

Secondary Four Express Examination Papers

2014

Biology

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Anglo-Chinese School
(Barker Road)

PRELIMINARY EXAMINATION 2014

SECONDARY FOUR EXPRESS

BIOLOGY PAPER 1

5158/1

TIME: 1 HOUR

INSTRUCTIONS TO CANDIDATES:

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name and index number on the answer sheet in the spaces provided.

There are forty questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D.

Choose the one you consider correct and record your choice in soft pencil on the separate answer sheet.

Read the Instructions on the Answer Sheet very carefully.

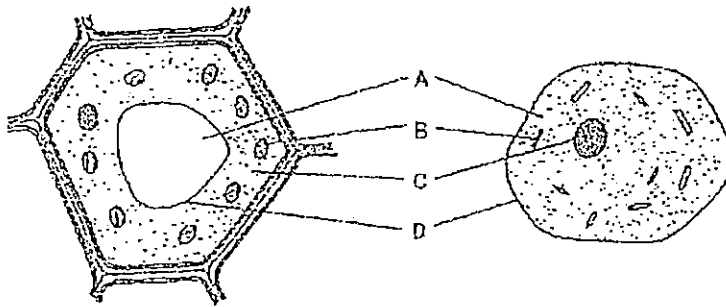
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

Additional Materials provided by the School:

Answer Sheet

This question paper consists of 16 printed pages.

1. The diagrams below show two cells as seen under a light microscope.

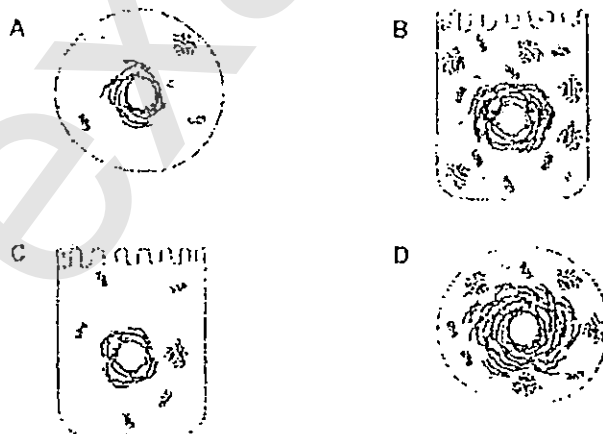


Which label is correct for both cells?

- A cell sap
B cytoplasm
C golgi apparatus
D membrane
2. Which line in the table correctly identifies these body components?
1. brain, spinal cord and nerves
 2. blood
 3. neurone
 4. stomach

	cell	tissue	organ	system
A	2	3	1	4
B	2	4	3	1
C	3	2	1	4
D	3	2	4	1

3. Which of the following cells of equal volume would be most efficient at absorbing nutrients as well as synthesizing and secreting a product?

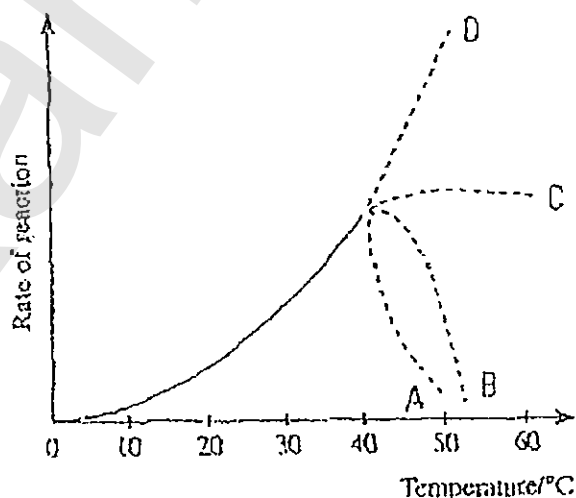


4. A student observes that a human liver cell placed in fresh water for 30 minutes eventually lyses but a leaf epidermal cell remains intact when subjected to the same treatment.

Which of the following explains his observations?

- A The liver cell has a more concentrated cytoplasm than the leaf epidermal cell.
 - B The liver cell is smaller and can therefore take in less water.
 - C The liver cell lacks a cell wall that would resist excessive intake of water.
 - D The liver cell lacks a large central vacuole that can accommodate large amounts of water.
5. Which is an example of active transport?
- A movement of glucose molecules into the cells of the villi
 - B movement of ions in blood plasma
 - C movement of mineral salts into root hair cells
 - D movement of water in the transpiration stream
6. A student is investigating the activity of enzyme Q which is typically found in organisms that live in the vent of hot springs (about 120 °C). The graph shows how activity of the enzyme changes with temperature.

Which line correctly shows the activity of the enzyme above 40 °C?



7. A sample of food mixed with water was tested to find out its contents. The results are shown in the table below.

test	results
Benedict's test	brick red precipitate formed
Iodine test	Iodine solution remained brown
Ethanol emulsion test	white emulsion formed
Biuret test	violet solution formed

What were present in the food sample?

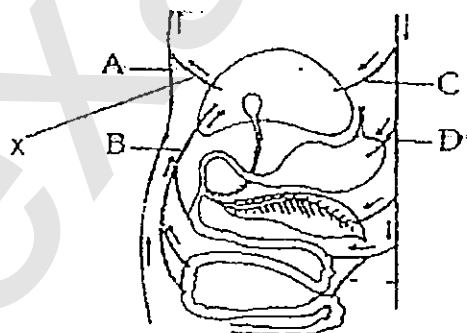
- A amino acids, fats and reducing sugars
 B amino acids, fats and starch
 C reducing sugars, fats and proteins
 D starch, fats and proteins
8. Lipase solution was added to milk. After 30 minutes, the milk when tested with a pH meter, shows a low pH value.

What were the substrate and product in this reaction?

	substrate	products
A	fats	amino acids
B	fats	fatty acids
C	proteins	amino acids
D	proteins	fatty acids

For questions 9 and 10, refer to the diagram below.

The diagram shows part of the digestive system and associated blood vessels.

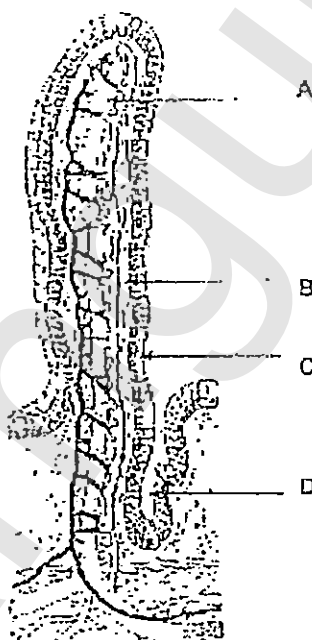


9. Which blood vessel would contain the highest concentration of amino acids after a meal?

10. Which of the following correctly compares the concentration of dissolved substances in blood vessel X with blood vessel B?

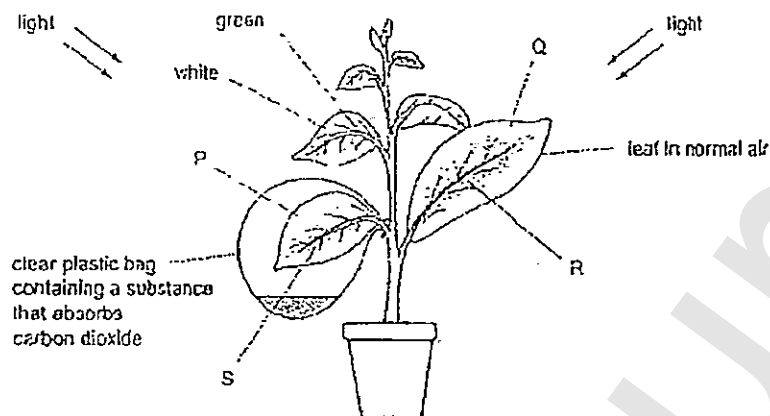
	glucose concentration	amino acids concentration	fats concentration
A	higher	higher	equal
B	higher	lower	higher
C	lower	lower	equal
D	lower	lower	lower

11. Which letter indicates the area from which the products of lipids digestion are transported throughout the body?



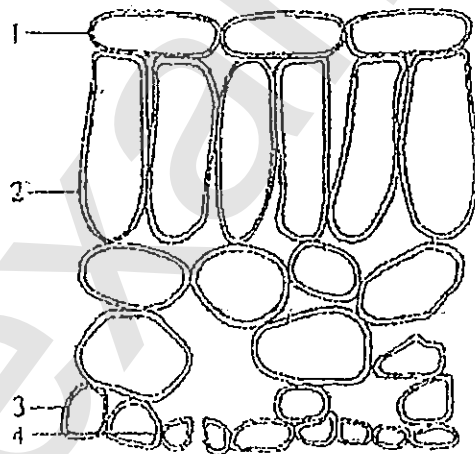
12. The diagram below shows an experiment on photosynthesis. The plant has leaves that are green in the middle and white round the edges.

Which two leaf areas each lack only one factor needed for photosynthesis?



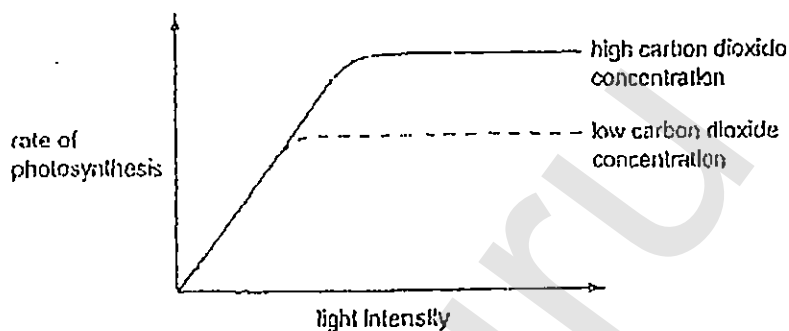
- A P and Q
 B P and R
 C Q and S
 D R and S
13. The diagram shows the arrangement of cells inside the leaf of a green plant, without any cell content.

Which two cells contain chloroplasts?



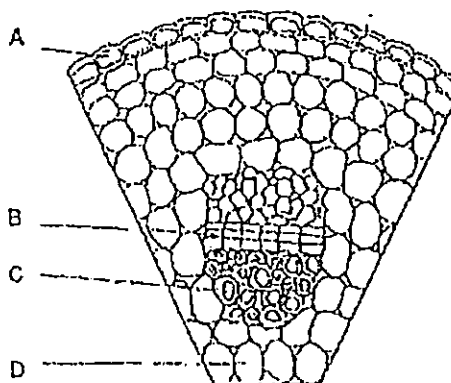
- A 1 and 2
 B 1 and 4
 C 2 and 3
 D 2 and 4

14. The graph shows the effect of changing light intensity on the rate of photosynthesis in a plant at two different carbon dioxide concentrations.



Which conclusion can be drawn from the graph?

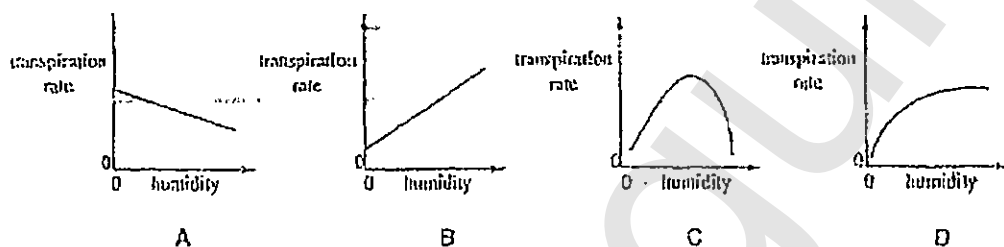
- A At high light intensity, carbon dioxide limits the rate of photosynthesis.
 - B At low light intensity, light intensity has no effect on photosynthesis.
 - C Light intensity limits the rate of photosynthesis.
 - D When carbon dioxide concentration is low, plants cannot photosynthesize.
15. How does most carbon dioxide reach the photosynthesising cells of leaf?
- A diffusion through the epidermis of the leaf
 - B diffusion through the stomata of the leaf
 - C movement through the phloem vessels
 - D movement through the xylem vessels
16. A leafy shoot is placed in a beaker containing a solution of coloured dye. The diagram shows part of the section of the stem after two days.



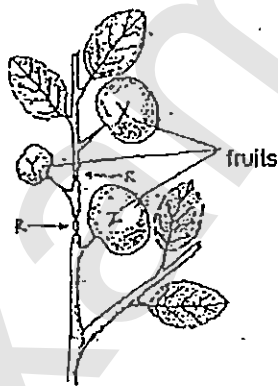
17. What causes root pressure, capillary action and transpiration pull to occur?

	root pressure	capillary action	transpiration pull
A	cohesion and adhesion of water molecules	evaporation of water	water entering xylem by osmosis
B	evaporation of water	water entering xylem by osmosis	cohesion and adhesion of water molecules
C	water entering xylem by osmosis	cohesion and adhesion of water molecules	evaporation of water
D	water entering xylem by osmosis	evaporation of water	cohesion and adhesion of water molecules

18. Which graph shows the effect of increased humidity on the rate of transpiration of a plant?



19. The diagram below shows part of the shoot system of a fruit tree.



At the two places marked R, all the tissues external to the xylem were removed at the flowering stage.

What is the most likely explanation of the difference in size of fruits?

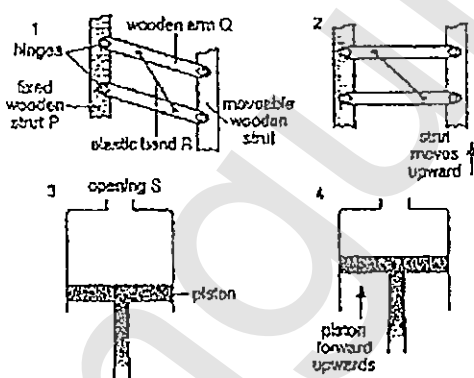
- A Food is transported downwards in the phloem, and water upwards in the xylem.
- B Food is transported both upwards and downwards in phloem.
- C Fruit Y is not getting enough water.
- D Fruits X and Z received more light than Y.

20. The table below shows the blood groups of four people and the type of blood received in a transfusion.

Which person is at risk from agglutination?

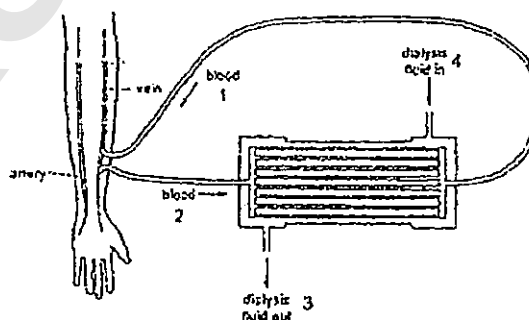
	recipient blood group	donor blood group
A	A	B
B	A	O
C	AB	A
D	O	O

21. The figure below shows models which demonstrate the action of two different sets of muscles used during breathing.



Which two diagrams represent the thorax after breathing in?

- A 1 and 3
B 1 and 4
C 2 and 3
D 2 and 4
22. The diagram shows the flow of blood and dialysis fluid through a dialysis machine.

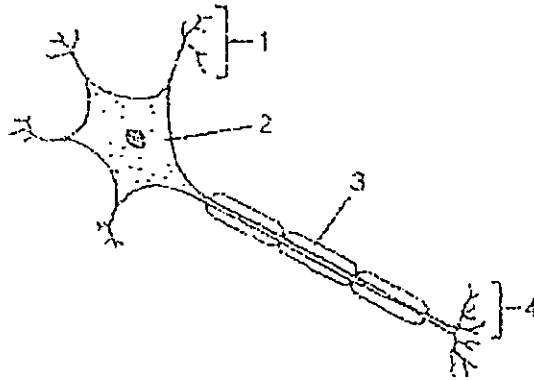


Where would the concentration of urea be the lowest or absent?

- A 1 and 2
B 1 and 4
C 2 and 3
D 3 and 4

For questions 23 and 24, refer to the diagram below.

The diagram below shows a neurone.



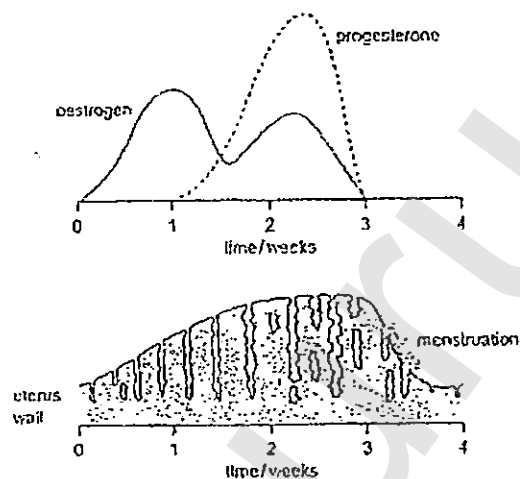
23. Which correctly identifies part 2 and the functions of parts 1 and 3?

	2	function of 1	function of 3
A	axon	transmits impulses	speeds up transmission
B	cell body	insulation	receives impulses
C	cell body	receives impulses	insulation
D	dendron	receives impulses	speeds up transmission

24. Which statement about part 4 is false?

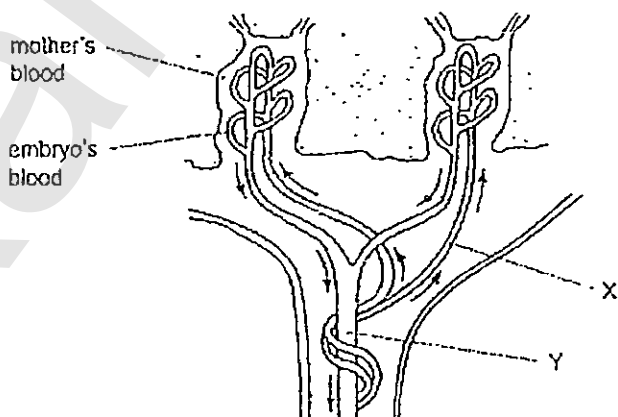
- A It transmits impulses.
- B It contains a nucleus which is not shown in the diagram.
- C It is not connected to another neurone.
- D There is a higher surface area to volume ratio in part 4 compared to parts 2 and 3.

25. The diagram shows the changes that take place during a woman's menstrual cycle.



What is occurring during the woman's fertile phase?

- A a fall in the level of progesterone only
 - B a fall in the levels of oestrogen and progesterone
 - C a rise in the level of oestrogen only
 - D a rise in the levels of oestrogen and progesterone
26. The diagram shows how the blood of a human embryo flows close to the mother's blood in the placenta.

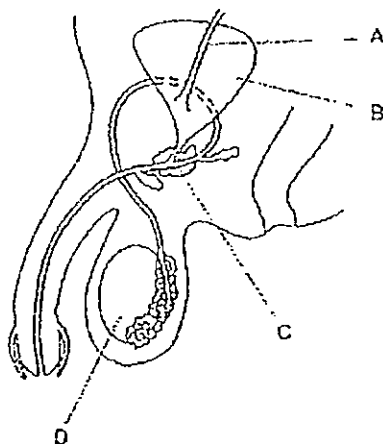


Which substances are present at X in higher concentrations than at Y?

- A carbon dioxide and glucose
- B carbon dioxide and urea
- C glucose and oxygen
- D glucose and urea

27. The diagram shows the male reproductive system.

Which structure produces testosterone?

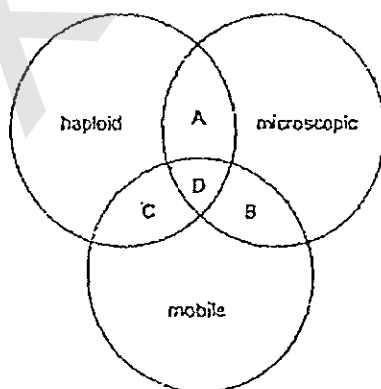


28. The table lists some processes that take place during reproduction in flowering plants and humans. Which row is correct?

	fertilisation needed	implantation needed	pollination needed
A	flowering plants and humans	flowering plants and humans	humans only
B	flowering plants and humans	humans only	flowering plants only
C	flowering plants and humans	humans only	flowering plants and humans
D	humans only	humans only	flowering plants only

29. The diagram represents three properties of gametes.

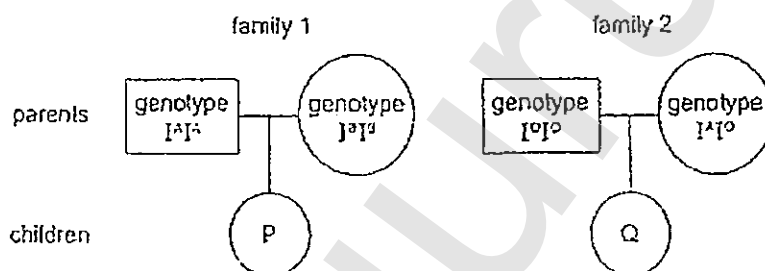
Which area describes the male gametes of humans and flowering plants?



30. Albinism in humans is caused by a recessive allele. Parents who do not suffer from the condition produce an albino child. If they already have 2 other children who are normal, what is the probability that their fourth child will be born albino?

A 0%
B 25%
C 50%
D 75%

31. The diagram shows inheritance of blood groups in two different families.



For each of P and Q, what is the probability that they have a co-dominant genotype?

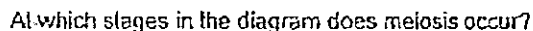
	P	Q
A	0	1
B	0.5	1
C	1	0
D	1	0.5

32. A person with Down's syndrome is born with 47 chromosomes in each of his / her cells, instead of 46.

What could cause this?

A A mutation happened during the production of the egg cell.
B More than one sperm fused with the egg at fertilisation.
C Radiation caused a change in structure of a gene in the father's sperm.
D The mother was exposed to harmful chemicals while she was pregnant.

34. Rice is a type of grass that has been grown by humans for about 5000 years. Over hundreds of years, farmers have improved the yield of rice crops. They kept grains from the highest yielding stalks to grow the next crop.

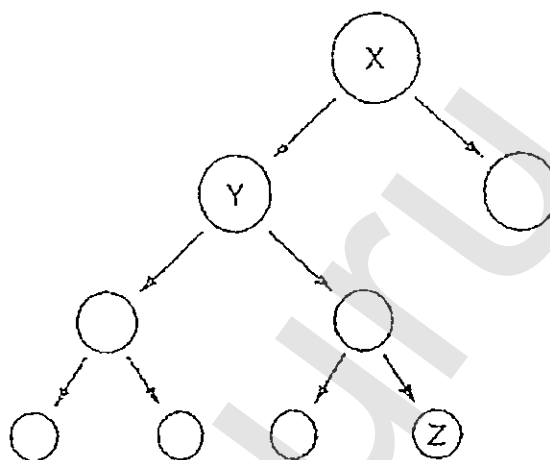


- What is this farming practice?
- A genetic engineering
 - B natural selection
 - C outbreeding
 - D selective breeding
35. Which of the following combinations correctly matches the words to the blanks?

These nuclei are found in (IV) _____.

Preliminary Examination 2014

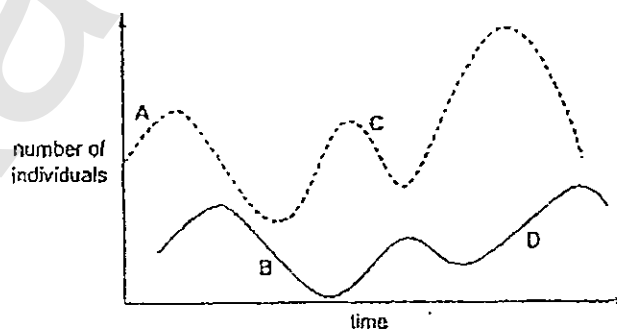
36. Cell X first divides by mitosis and then cell Y divides by meiosis.



How does cell Z compare to cell X?

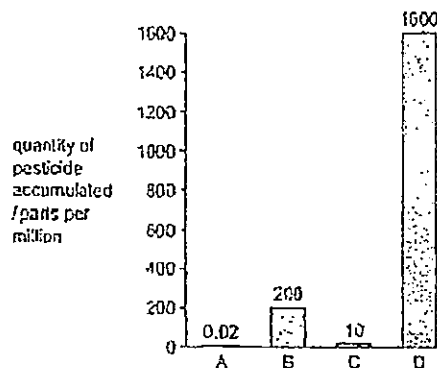
	same number of chromosomes as cell X	genetically identical to cell X	
A	✓	✓	key ✓ = true x = false
B	✓	x	
C	x	✓	
D	x	x	

37. The graphs show the changes in the populations of predator and prey over a period of time.



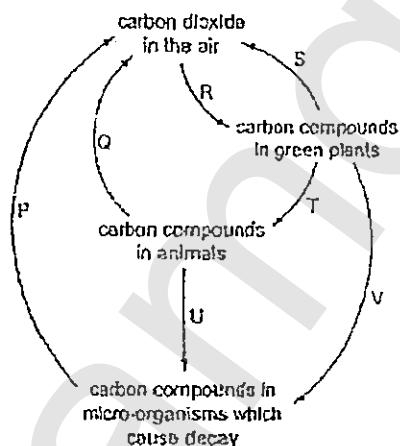
Which point on the graph shows a decrease in predator population?

38. The graph shows the quantities of pesticides that accumulate in four populations, each at different trophic levels in a food chain.



Which population is most likely to be herbivores?

39. The diagram shows the carbon cycle.



Which letters represent respiration?

- A. P and Q
 B. P, Q and S
 C. T, S and V
 D. T, U and V
40. The presence of high concentrations of nitrogen-containing fertilisers in a pond can lead to the death of fish. What is the sequence of events leading to the death of the fish?
- A. increase in algae → algae die → increase in bacteria → drop in oxygen
 B. increase in algae → drop in oxygen → increase in bacteria → algae die
 C. increase in bacteria → drop in oxygen → increase in algae → algae die
 D. increase in bacteria → increase in algae → algae die → drop in oxygen

End of Paper

INDEX NO.



Anglo-Chinese School
(Parker Road)

PRELIMINARY EXAMINATION 2014

SECONDARY FOUR EXPRESS

BIOLOGY PAPER 2

5158/2

TIME: 1 Hour 45 Minutes

READ THESE INSTRUCTIONS FIRST

Write your index number on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer all questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer all the questions.

Write your answers in the spaces provided on the Question Paper.

The use of an approved scientific calculator is expected, where appropriate.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

At the end of examination fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

		Marks
Section A		
Section B		
8		
9		
10		
TOTAL		

This question paper consists of 19 printed pages.

SECTION A (50 marks)

Answer all questions in the spaces provided.

1. Fig 1.1 shows an experiment where two potato cylinders A and B, of identical mass are balanced on each end of a pivoted wooden ruler.

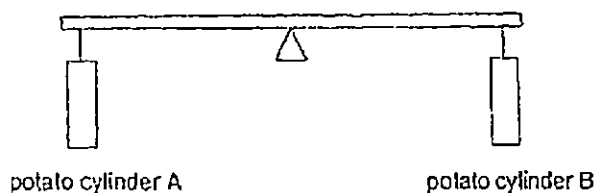


Fig 1.1

Fig 1.2 shows the two potato cylinders being placed in different solutions for half an hour and then removed.

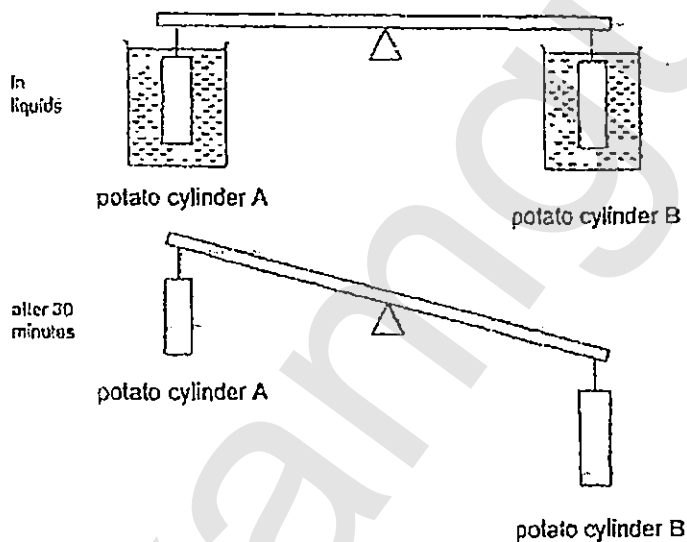


Fig 1.2

- (a) Concentrated sucrose solution and distilled water were used in this experiment. In the table below, state the potato cylinder that has been immersed in each of these solutions.

	Type of solution	Potato cylinder immersed in solution
(i)	Concentrated sucrose solution	
(ii)	Distilled water	

[1]

- (b) State and give the definition of the process involved in this experiment that caused the results shown in Fig 1.2.

.....

.....

.....

[2]

- (c) Explain the results obtained in Fig 1.2.

.....

.....

.....

.....

.....

[4]

[Total: 7]

2. Fig 2 shows the results of an experiment. Four starch agar plates were prepared and treated. The experimental set-ups were left for 30 minutes at 40 °C before iodine solution was added to each agar plate at the end of 30 minutes.

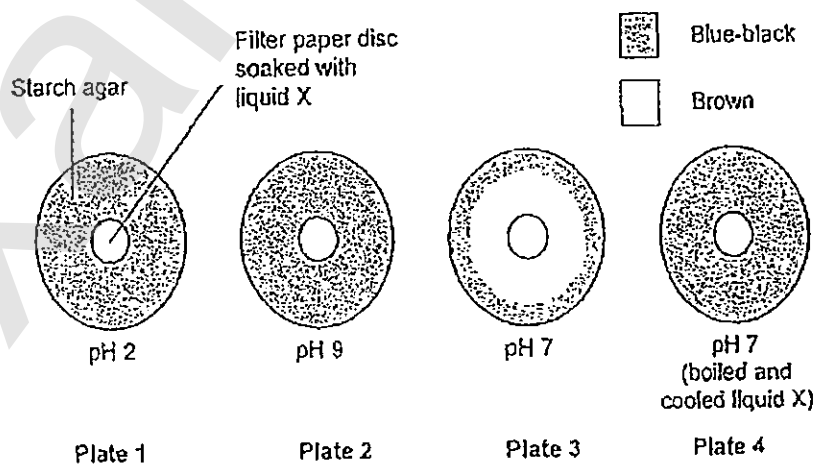


Fig 2

- (a) Using the results of this experiment to support, list two conclusions that can be drawn.

Conclusion 1.....

Evidence from results

.....

.....

.....

Conclusion 2.....

Evidence from results

.....

.....

.....

[4]

- (b) State the part of the human body that naturally produces the substance in liquid X.

.....

[1]

- (c) Briefly explain what is meant by the 'lock and key' hypothesis.

.....

.....

.....

[3]

[Total: 8]..

3. A small tube called a catheter can be inserted into the blood system through a vein. It can be threaded through the vein and into and through the heart until its tip is in the pulmonary artery. A tiny balloon at the tip can then be used to measure the pressure changes in the pulmonary artery.

Fig 3.1 shows a section through the heart with the catheter in place. Fig 3.2 shows the pressure changes recorded in the pulmonary artery.

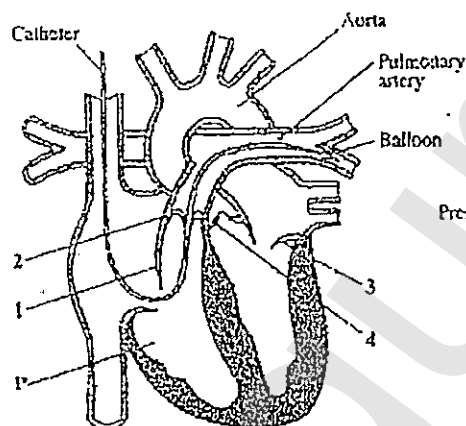


Fig 3.1

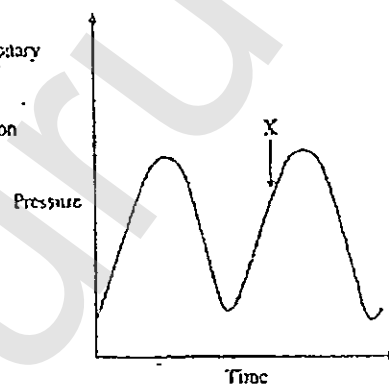


Fig 3.2

- (a) Name the chamber of the heart labelled P.

[1]

- (b) Complete the table below by placing ticks (✓) in the appropriate boxes to show which of the structures 1 – 4 will be open and which will be closed at time X as shown in Fig 3.2.

Structure	Open	Closed
1		
2		
3		
4		

[2]

- (c) On Fig 3.2, sketch and label a graph to show the pressure changes that would be expected if the pressure in the aorta is measured at the same time.

[1]

- (d) Arteries may become blocked by the formation of fatty materials on the walls. An operation called balloon angioplasty may be used to correct this. The procedure is shown in Fig 3.3.

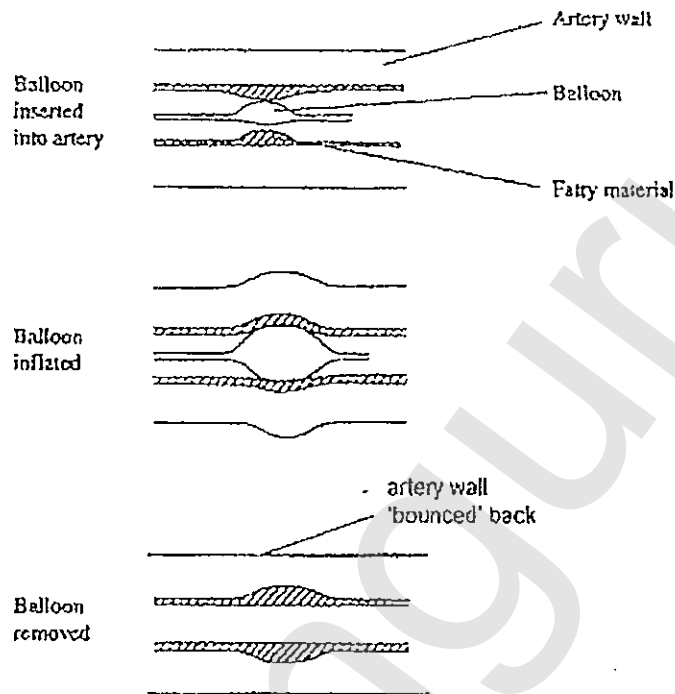


Fig 3.3

- (i) Explain why the artery wall 'bounces back' when the balloon is removed.

.....

.....

.....

[2]

- (ii) Explain why the ability of the artery wall to 'bounce back' is important in maintaining blood circulation.

.....

.....

.....

.....

[3]

[Total: 9]

4. Fig 4 shows a transverse section of a nephron in the region of the medulla of a person.

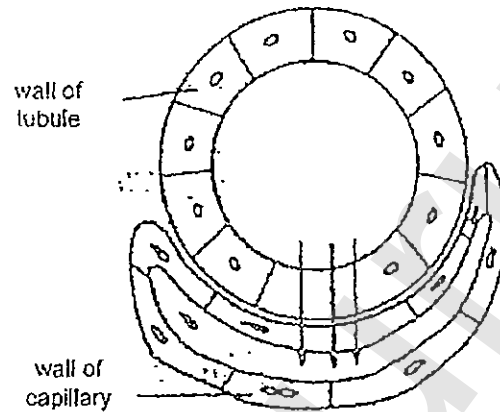


Fig 4

- (a) (i) Name the liquid present in the lumen of this tubule.
 [1]
- (ii) Name the process that caused the liquid in part (a)(i) to be present.
 [1]
- (iii) Plasma proteins and amino acids are both detected in the lumen. Deduce, with explanation, whether the nephron is functioning properly in this person.
 [2]
- (b) Name the parts of the nephron that are found in the medulla.
 [2]

[Total: 6]

5. Species D of a rodent lives in the highlands of a mountain range. Fig 5 shows what can happen over the same period of time, if some members of species D migrate from the highlands to the lowlands.

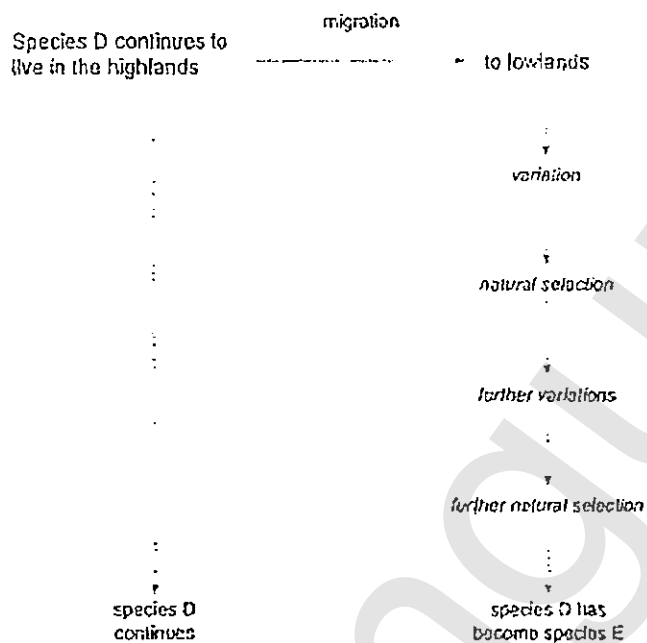


Fig 5

- (a) Name the two factors that may act as selective forces on the rodent.
1.
2. [2]
- (b) Name the process involving variation and natural selection that has led to the development of species E.
- [1]

- (d) Explain the roles of meiosis and sexual reproduction in producing variation in a species.

[4]

[Total: 11]

6. Haemophilia A is caused by a mutation to the gene responsible for the formation of factor VIII, a protein involved in blood clotting.
- (a) In the past, people with haemophilia depended upon blood or plasma donations as a source of factor VIII. Nowadays, biotechnology provides a better source of the protein.

Suggest why factor VIII produced by biotechnology is a better source of the protein than blood or plasma donations.

.....

.....

[1]

- (b) Fig 6 is a diagram showing the sequence of events in the production of defective factor VIII in a cell of a patient with Haemophilia A.

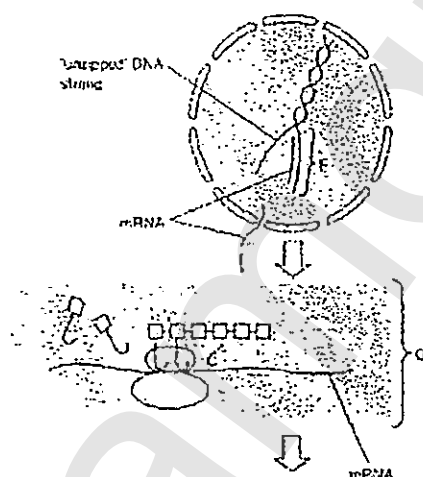


Fig 6

- (i) State the process represented by G.

.....

[1]

- (ii) Describe the relationship between the DNA strand marked F and factor VIII.

.....

.....

.....

[1]

- (c) Part of the DNA sequence on the coding strand is shown below.



State the corresponding sequence on the non-coding strand.

	triplet 1	triplet 2	triplet 3
non-coding strand			

[1]

- (d) Factor VIII is made up of 191 amino acids. The DNA sequence of a patient with Haemophilia A is 500 base pairs long. Showing your working clearly, deduce the effect of the mutation on the gene for factor VIII in this patient.

Conclusion

[2]
[Total: 6]

7. Fig 7.1 and Fig 7.2 are light micrographs of onion cells in various stages of mitosis.



Fig 7.1

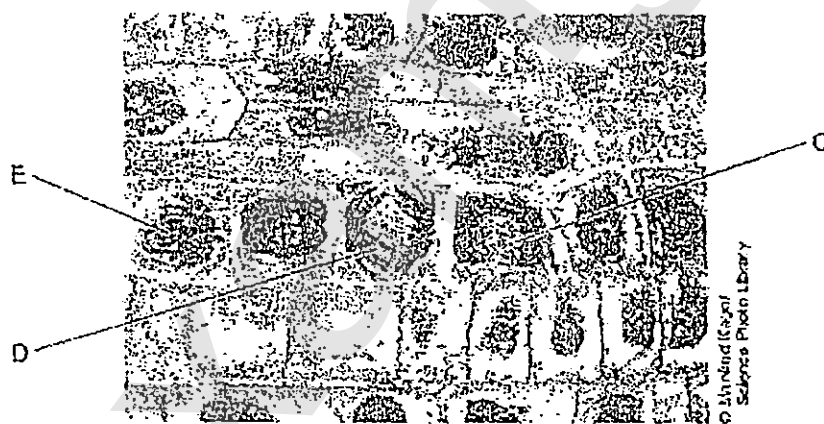


Fig 7.2

Using the letters A, B, C, D or E, identify one cell that is in:

anaphase

metaphase

telophase

[3]
[Total: 3]

SECTION B (30 marks)

Answer three questions.

Question 10 is in the form of Either/Or question.

Only one part should be answered.

8. (a) A group of scientists observed the animals in a forest ecosystem. Table 8.1 shows the average number of each type of animal in one mahogany tree.

animal	trophic level	number of animals
hawk owl	4	2
tanager	3	4
warbler	3	5
aphid	2	36
caterpillar	2	42
weevil	2	13
wasp	2	7
forest mouse	2	2

Table 8.1

- (i) Use information from Table 8.1 to calculate the total number of animals at each trophic level. Write your answers in Table 8.2.

trophic level	number of animals
2	
3	
4	

Table 8.2

[2]

- (ii) Use information from Tables 8.1 and 8.2 to draw an overall pyramid of numbers for this food web.

- (iii) Many scientists believe that a pyramid of biomass is more useful than a pyramid of numbers. State what extra information would be needed to draw a pyramid of biomass.

[1]

- (b) Fig 8.3 shows the same information in part (a) being presented in another form.

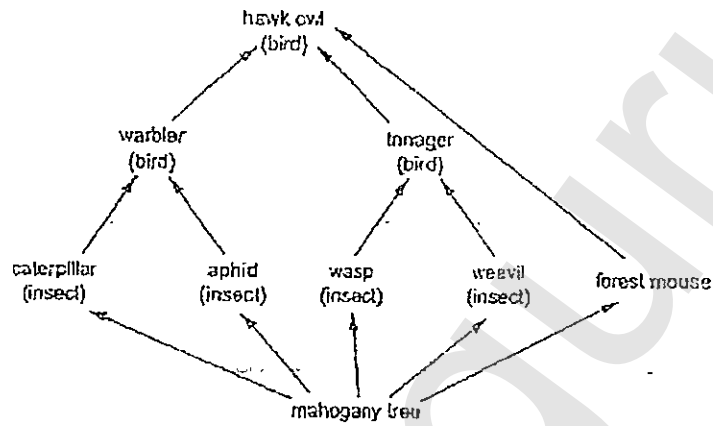


Fig 8.3

- (i) What do the arrows in Fig 8.3 represent?

[1]

- (ii) Identify the energy source and the tertiary consumer.

energy source

tertiary consumer

[2]

- (c) Describe how the information presented in Table 8.1 and Fig 8.3 differ.

[1]

- Predict the effect on tanagers and forest mice if all of the warblers were removed from the forest. Explain briefly.

[2]

- Explain how the mahogany tree plays the role of a carbon sink.

[2]

[Total: 12]

- (i) the exchange surface of the alveolus.

[3]

(ii) the lining of the trachea.

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[3]

(b) Describe two effects of nicotine, which is found in cigarette smoke, on the human body.

.....

.....

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[2]

[Total: 8]

[3]

[7]

[Total: 10]

10. Or

- (a) A person is sitting in the shade reading a book when he looks at the bright sky to see an aeroplane flying past. Describe and explain the changes in

(i) the lens, and

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[4]

(ii) the pupil.

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[4]

- (b) State the two functions of the choroid.

.....

.....

.....

[2]
[Total: 10]

End of Paper

examsguru

35



ACS (Barker Road)
Sec 4 Biology (5158)
Preliminary Examination Paper 1
Answer Scheme

Qn No.	Ans	Qn No.	Ans	Qn No.	Ans	Qn No.	Ans
1	D	11	A	21	C	31	C
2	D	12	C	22	B	32	A
3	B	13	D	23	C	33	A
4	C	14	A	24	B	34	D
5	C	15	B	25	D	35	B
6	D	16	C	26	B	36	D
7	C	17	C	27	D	37	B
8	B	18	A	28	B	38	C
9	B	19	B	29	D	39	B
10	C	20	A	30	B	40	A

1ai) A ii) B

*Must have both answers correct = [1]

b) - Osmosis [1]

- Net / overall movement of water molecules from a region of higher water potential (higher water concentration) to a region of lower water potential (lower water concentration), through a partially permeable membrane. [1] *Reject semi-permeable membrane

c) - For A, higher water potential in the potato cells compared to the concentrated sucrose solution. [1]

- Movement of water molecules out of the potato cells to make the potato cylinder lighter / lower in mass. [1]

- For B, lower water potential in the potato cells as compared to the distilled water. [1]

- Movement of water into the potato cells to make the potato cylinder heavier / increased in mass. [1]

2a) Conclusion 1: X works best / better at pH 7 or Optimum pH is pH 7. [1]

Evidence from results: Starch has disappeared in Plate 3 while starch remains in all other plates. [1]

Conclusion 2: X contains enzymes / amylase. [1]

Evidence from results: X no longer acts on starch when it is boiled and cooled. [1]

b) Salivary glands (reject mouth) / Pancreas [1]

c) A proposed model that explains the specificity of enzyme action through the binding of substrate with enzyme [1] via active sites [1] as substrate and enzyme have complementary surfaces that fit with each other. [1]

3a) Right ventricle [1]

b) 1: closed 2: open 3: closed 4: open

c) *Graph is of same shape and above the current curve. [1]

di) - Artery wall contains elastic tissues / muscles / fibres. [1]

- Wall stretches as the balloon pushes against the wall. [1]

- Wall recoils when the balloon is removed. [1]

*Any 2 correct answers = [2]

ii) - Heartbeat causes a surge of blood into the artery. [1]

- Elastic tissues allow artery to withstand the rise in pressure and prevents the artery from rupturing. [1]

- Elastic recoil maintains a high energy / velocity / momentum of blood flowing through. [1]

4ai) Glomerular filtrate [1]

ii) Ultrafiltration [1]

iii) - Plasma proteins are normally retained in the glomerulus. [1]

- Its presence indicates the Bowman's capsule may be damaged / ruptured / leaking. [1]

b) Loop of Henle [1] and Collecting duct [1]

5a) Answers: Change in: Temperature / Food supply / Water supply / pH of environment / Condition of soil minerals / Light intensity etc

*Any 2 of the above biotic and/or abiotic factors of the ecosystem = [2]

b) Evolution [1]

c) - Genetic variation / Phenotypic variation [1]

- Organisms with traits that make them more adapted, survive better and reproduce more. [1]

- Over time, the proportion of individuals with genes for the adaptations in the population increases. [1]

- The differences accumulated eventually lead to the formation of a new species. [1]

d) Meiosis creates genetic variation by (Max [2] for any 2 correct answers)

- creation of haploid gametes [1]

- selection of one out of each homologous pair to be passed to the next generation. [1]

- different combination of chromosomes amongst the gametes. [1]

- crossing over of alleles between homologous chromosomes during prophase I. [1]

- random assortment / arrangement of chromosomes. [1]

Sexual reproduction creates genetic variation by (need both answers)

- random fusion of gametes. [1]

- creates new homologous pairs / new allele combinations / new genetic combinations. [1]

6a) - No risk of blood-borne infections. [1]

- Easier to ensure steady supply of factor VIII. [1]

- Injections are more convenient than blood transfusions. [1]

- No risk of incompatible blood type / rejection as wrong blood type. [1]

*Any 1 of the answers = [1]

bi) Translation [1]

ii) - Sequence of bases / Nucleotides determines / Corresponds to / Codes for the sequence of amino acids of the protein formed. [1]

c) Triplet 1: CTC

Triplet 2: GAG

Triplet 3: GCT

d) $191 \times 3 = 573$ coding bases [1]

Part of the gene is removed / deleted / truncated. [1]

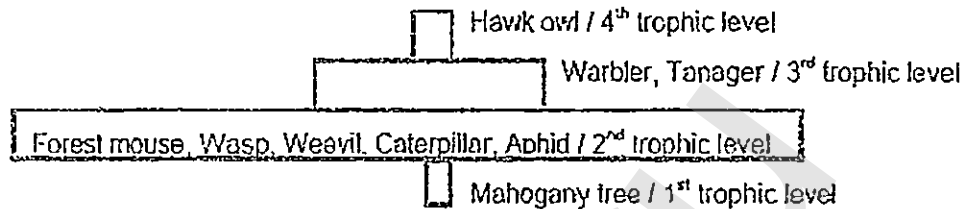
7. anaphase: B / D [1]

metaphase: A [1]

telophase: C [1]

8ai) 100; 9; 2

ii)



iii) Dry mass of organisms in each trophic level at any one time. [1]

bi) Energy flow / Transfer of energy [1]

ii) Sun [1]. Hawk owl [1].

c) Table 8.1 shows the quantitative abundance of each organism while Fig 8.3 shows the feeding relationships of organisms / directions of energy flow. [1]

d) - Population size will decrease. [1]

- Less prey / food for hawk owl causes increased predation of tanagers and forest mice. OR

- When warbler population decreases, the populations of caterpillar and aphid will increase and therefore there is not sufficient food (mahogany tree for wasp and weevil and therefore not sufficient food for tanager, which will decrease in population. There is insufficient food (mahogany tree) for forest mouse so population of forest mouse will decrease. [1]

e) - Photosynthesis removes carbon dioxide from the air. [1]

- Storage of carbon in cell walls / Formation and storage of carbon compounds in cells OR Reference to longevity of mahogany trees. [1]

9ai) - Wall is one-cell thick, minimizes distances of travel of gases which enhances diffusion. [1]

- A thin film of moisture covers the surface of the air-facing surface of the alveolus which dissolves oxygen and enhance its movement into the capillaries. [1]

- The wall / surface of the alveolus is richly surrounded with blood capillaries which facilitates absorption, release and transportation of gases. [1]

ii) - The gland cells secrete mucus to trap dust and bacteria. [1]

- The cilia sweeps these trapped particles upwards towards the pharynx. [1]

- Combined action of cilia and gland cells help filter the air passing through the trachea towards the alveolus. [1]

b) - Increases heartbeat and blood pressure. [1]

- Increases risk of blood clots in blood vessels. [1]

10 Either

a) A hormone is a chemical substance / complex protein [1] secreted in minute amounts by endocrine gland / ductless gland [1] into bloodstream, carried to target organ(s) to exert its effects. [1]

b) - Increases blood glucose levels by speeding up the breakdown of glycogen to glucose in the liver and muscles. [1]

- Increases metabolic rate, more energy is released via respiration. [1]

- Increases rate of heartbeat and causes a rise in blood pressure so oxygen and glucose are carried faster to the muscles. [1]

- Increases the rate and depth of ventilation. [1]

- Constricts arterioles in skin / vasoconstriction of arterioles in skin to cause paleness, channelling more blood to the muscles. [1]

- Increases rate of blood coagulation. [1]

- Causes pupils to dilate to enhance vision. [1]

- Contracts hair erector muscles, producing 'goose pimples'. [1]

*Any 7 correct answers = [7]

10 Or

ai) - Contracted ciliary muscles will now relax. [1]

- Relaxed / slackened suspensory ligaments now contract. [1]

- Lens will change from thick and more convex to become thin and less convex. [1]

- This is to increase the focal length of the eye to allow the distant plane to be focused sharply on the retina. [1]

ii) - Contracted radial muscles of the iris will now relax. [1]

- Relaxed circular muscles of the iris will now contract. [1]

- Dilated / enlarged pupil will now constrict / become smaller. [1]

- This is to decrease the amount of light entering the eyes. [1]

b) - Prevents internal reflection of light. [1]

- Brings oxygen and nutrients to the eyeball and remove metabolic waste products.

[1]

ANDERSON

Name: _____ ()

2

- 1 The table gives descriptions of four membranous structures in a cell. Which structure is correctly matched with its function?

	Structure	Function
A	An extensive network of tubes and sacs; each tube and sac bounded by a single membrane	Lipid synthesis
B	A spherical sac bounded by a single membrane	Protein synthesis
C	A sac bounded by two membranes, the inner highly folded	Packaging of proteins
D	A stack of elongated, curved sacs; each sac bounded by a single membrane	Photosynthesis

- 2 What is the adaptation of the xylem vessel that allows it to carry out its function?

- A large surface area
- B presence of many chloroplasts
- C absence of cross walls
- D biconcave shape

- 3 Which of the following is an example of diffusion in plants?

- A Water moving from the soil into the root hair cells.
- B Ions moving into root hair cells against a concentration gradient.
- C Carbon dioxide moving into leaves during photosynthesis.
- D Water moving from vascular bundles into mesophyll cells in the leaves.

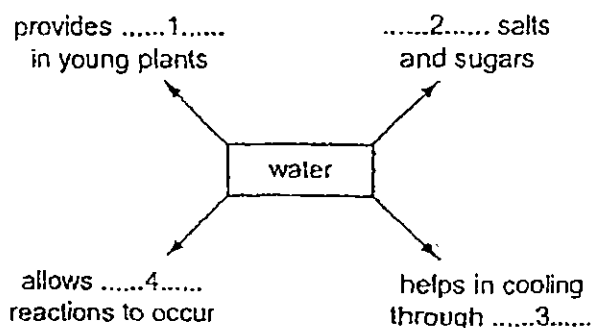
- 4 Which of the following does not affect the rate of diffusion?

- A concentration gradient of diffusing substances
- B size of diffusing substances
- C temperature
- D concentration of adenosine triphosphate (ATP) molecules

- 5 Which of the following is required for the Biuret test to give a positive result?

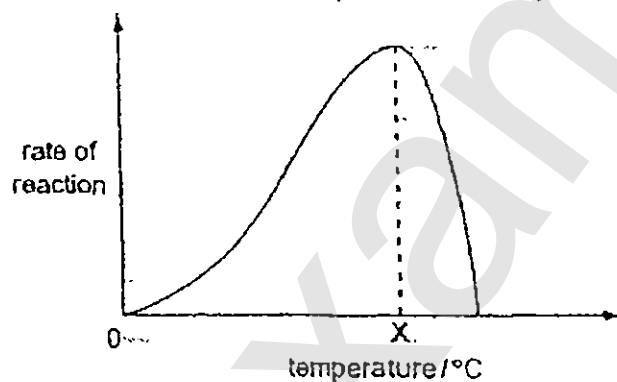
- A reducing sugars
- B iodine
- C copper (II) sulfate
- D lipids

- 6 What is the adaptation of the xylem vessel that allows it to carry out its function?



- | | | | | |
|---|-------------|-------------|-------------|-------------|
| | 1 | 2 | 3 | 4 |
| A | chemical | evaporation | transports | support |
| B | evaporation | support | chemical | transports |
| C | support | transports | evaporation | chemical |
| D | transports | chemical | support | evaporation |

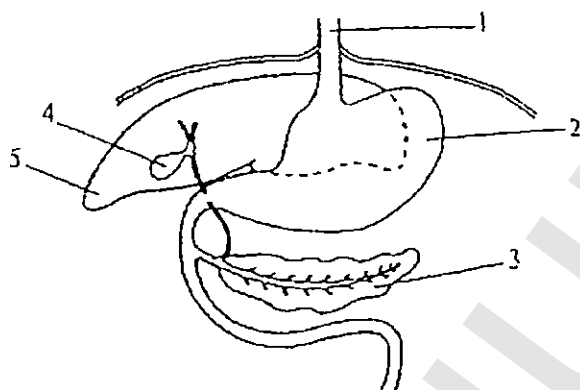
- 7 The graph shows the effect of temperature on an enzyme-catalyzed reaction.



What is the correct explanation of events at temperature X°C?

- A The activation energy of the reaction has been raised to a maximum.
- B The kinetic energy of substrate molecules has reached a maximum.
- C The number of denatured enzyme molecules is at a minimum.
- D The number of enzyme-substrate complexes has reached a maximum.

- 8 The diagram shows part of the human alimentary canal.



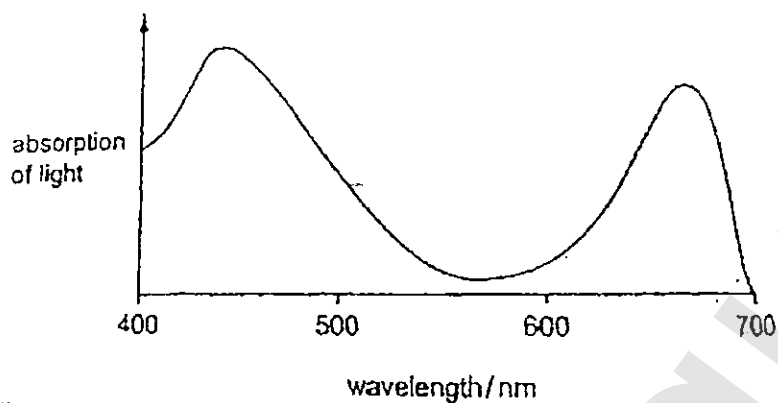
Which two structures produce substances involved in the digestion of fat?

- A 1 and 4
B 2 and 3
C 3 and 5
D 4 and 5
- 9 Which function of the liver is correctly paired with the chemical involved?

	Function	Chemical
A	Deamination	Glycogen
B	Detoxification	Alcohol
C	Excretion	Urea
D	Storage	Amino acids

- 10 Some organisms live in the dark at the bottom of the seas and, to synthesize glucose, use energy from chemicals in the very hot water that comes out of volcanoes. What is a distinguishing feature of these organisms?
- A Their enzymes are easily denatured by heat.
B They do not need carbon dioxide.
C They do not need to be green.
D They all obtain energy only by being carnivores.

- 11 The graph shows the absorption of light at different wavelengths by intact chloroplasts from a pond weed.



A sample of the same pond weed was exposed to four different wavelengths of light of the same intensity for the same time. The table shows the number of bubbles produced by the pond weed at each wavelength of light.

Experiment	Number of bubbles			Mean number of bubbles
1	15	14	16	15
2	3	4	2	3
3	1	2	0	1
4	12	11	13	12

Which row shows the number of bubbles produced by the different wavelengths of light investigated?

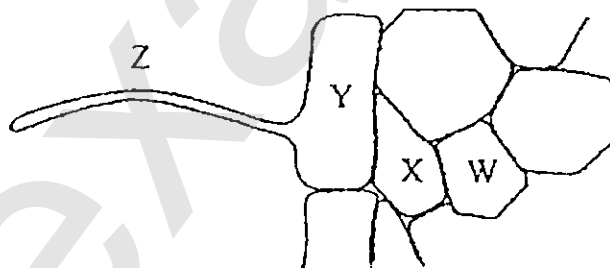
	Mean number of bubbles			
	440nm	520nm	560nm	650nm
A	1	12	15	3
B	3	1	12	15
C	12	15	3	1
D	15	3	1	12

- 12 The table shows the characteristics of the blood in one blood vessel in the body.

oxygen concentration	carbon dioxide concentration	pressure
High	Low	High

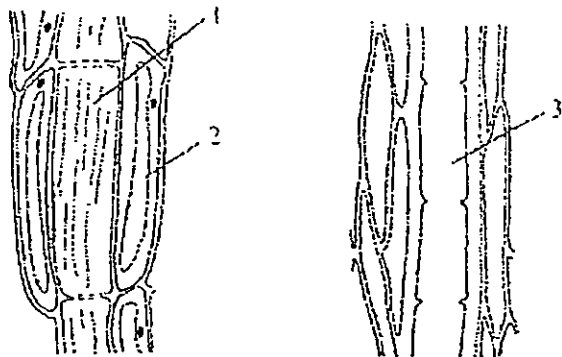
Which blood vessel contains blood with these characteristics?

- A Aorta
 B Pulmonary vein
 C Pulmonary artery
 D Vena cava
- 13 Which substance will pass from muscle cells into the capillary via the tissue fluid?
- A Adrenaline
 B Carbon dioxide
 C Glycogen
 D Urea
- 14 Which of the following can cause a heart attack?
- A Hardening of the hepatic portal vein
 B Blood clot in the brain
 C Rupture of the renal artery
 D Blocked coronary artery
- 15 The diagram shows some plant root cells. Which statement is correct?



- A The water potential of the soil water Z is zero.
 B The water potential of cell W is the lowest.
 C The water potential of cell X is higher than cell Y.
 D The water potential of cell W is higher than cell Y.

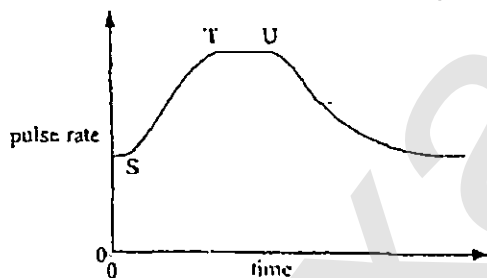
- 16 The diagrams represent some plant cells seen in a section of a stem.



Which cells have the functions shown?

	1	2	3
A	Support of young stem	Transport of water	Transport of sucrose
B	Transport of amino acids	Supply of energy to surrounding cells	Transport of minerals
C	Transport of sucrose	Transport of water	Transport of amino acids
D	Transport of water	Supply of energy to surrounding cells	Support of young stem

- 17 The pulse rate of a girl was measured every two minutes and plotted on the graph.



Her exercise started at S and finished at T but her pulse rate did not start to drop until U. Which process(es) would occur during the T-U interval?

1. accumulation of lactic acid from muscle cells
2. increased supply of oxygen to the muscle cells
3. increased transport of carbon dioxide to the lungs

- A 1, 2 and 3
 B 1 and 3 only
 C 2 only
 D 2 and 3 only

18 Some effects of smoking tobacco are listed

1. bronchitis
2. increase in alertness
3. increase in blood pressure
4. increase in heart rate
5. increase in mucus production
6. uncontrolled cell division

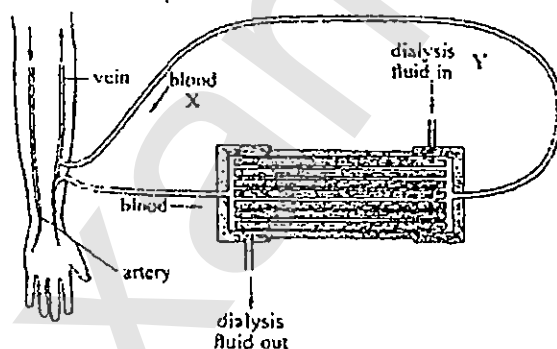
Which effects are caused by tar?

- A 1, 2, and 3
 B 1, 5 and 6
 C 2, 4 and 6
 D 3, 4 and 5

19 What is an example of excretion?

- A Release of adrenalin from the adrenal glands
 B Release of sweat from the sweat glands
 C Removal of carbon dioxide from the lungs
 D Removal of faeces from the alimentary canal

20 The diagram shows the flow of blood and dialysis fluid through a kidney machine.



Which substances have the lowest concentration at X and the highest concentration at Y?

	Lowest at X	Highest at Y
A	Glucose	Salts
B	Salts	Glucose
C	Urea	Water
D	Water	Urea

- 21 On a hot day how would these skin structures respond to help maintain a constant body temperature?

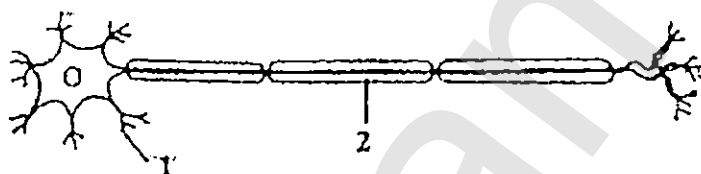
	Sweat gland	Arterioles
A	Decreased sweat production	Contract
B	Decreased sweat production	Dilate (get wider)
C	Increased sweat production	Contract
D	Increased sweat production	Dilate (get wider)

- 22 Four processes that take place in the human body are listed

1. absorption of amino acids through the villi
2. maintenance of constant body temperature
3. production of lactic acid in muscles
4. regulation of blood glucose concentration

Which two processes are directly controlled by negative feedback?

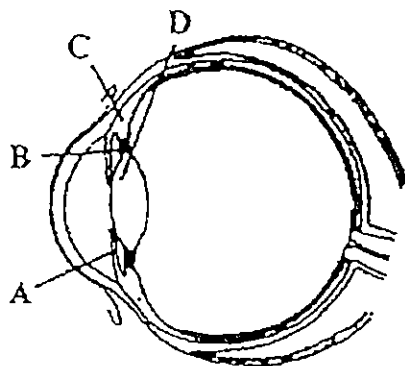
- A 2 and 4
 B 1 and 4
 C 1 and 3
 D 2 and 3
- 23 The diagram below shows a motor neuron.



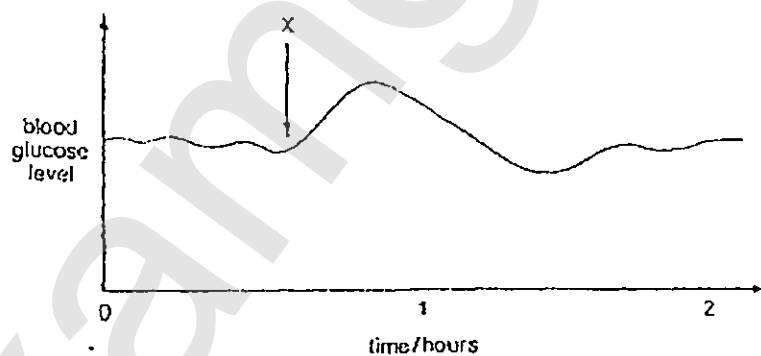
Which one of the lines, A, B, C or D in the table belows names the labeled parts correctly?

	1	2
A	Dendrite	Myelin sheath
B	Axon	Dendrite
C	Cell body	Axon
D	Synapse	Dendrite

- 24 The diagram below shows the mammalian eye in section. Which part of the eye, A, B, C or D controls the quantity of light falling on the retina?



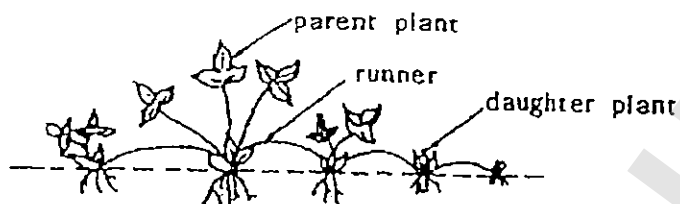
- 25 The graph shows changes in the glucose concentration in the blood of a person during two hours.



What explains the shape of the graph after X?

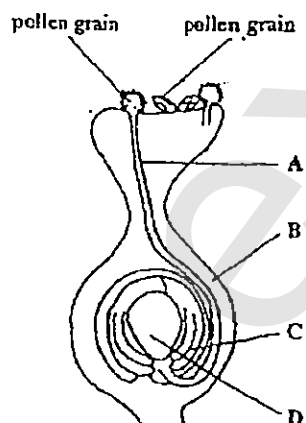
- A The person has eaten a sugary sweet meal.
- B The person has had an insulin injection.
- C The person is suffering from diabetes mellitus.
- D The person starts some hard physical exercise.

- 26 Some species of plant reproduce vegetatively by producing slender side-shoots called runners, which grow along the ground surface and which root at the nodes as shown in the diagram below. Eventually, the runner decays, leaving the rooted parts to develop as independent individuals.

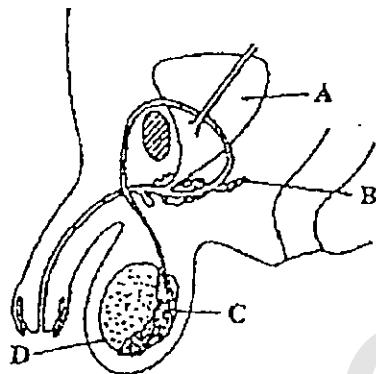


In which one of the following ways may this method of reproduction have an advantage over reproduction by seed?

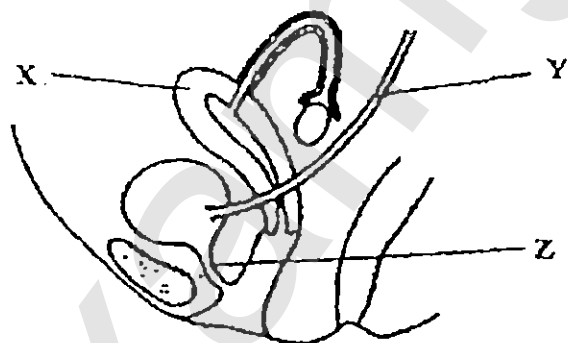
- A The offspring are identical to the parent and are therefore bound to be healthy.
 - B Faster growth of daughter plants to become mature plants.
 - C There is no possibility of a mutation occurring to give offspring of a different genotype.
 - D Those plants, which compete with this species will have less chance of becoming established nearby.
- 27 Many wind-pollinated flowers have _____.
- A feathery stigmas and light pollen
 - B short stigmas and sticky pollen
 - C feathery stigmas and sticky pollen
 - D short stigmas and light pollen
- 28 The diagram shows the development of a pollen tube and its entry into the ovule. Which part usually develops into the fruit after fertilization?



- 29 The diagram shows the reproductive system and associated structures of a male mammal. Which labeled structure stores sperm cells in an inactive form?

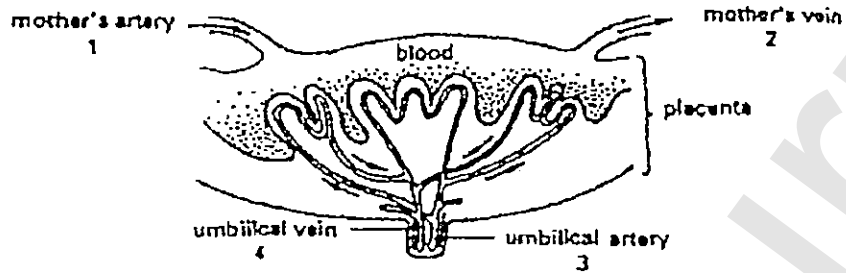


- 30 The diagram shows some of the structures present in the lower abdomen of a female mammal. What are the structures labeled X, Y and Z?

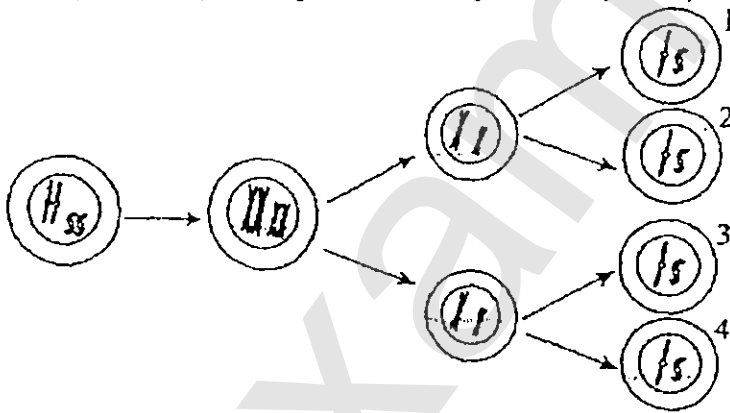


	Uterus	Urethra	Ureter
A	X	Y	Z
B	X	Z	Y
C	Y	X	Z
D	Y	Z	X

- 31 The diagram shows part of the placenta. In which numbered parts does the blood contain the most oxygen and nutrients?

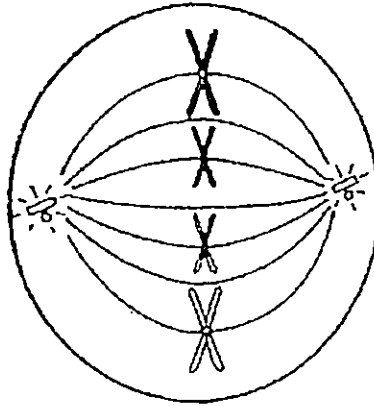


- A 1 and 4
 B 1 and 3
 C 1 and 2
 D 2 and 3
- 32 The diagram shows a cell undergoing meiosis. Which of the labeled daughter cells are genetically identical? (Assuming there is crossing over in Prophase 1)



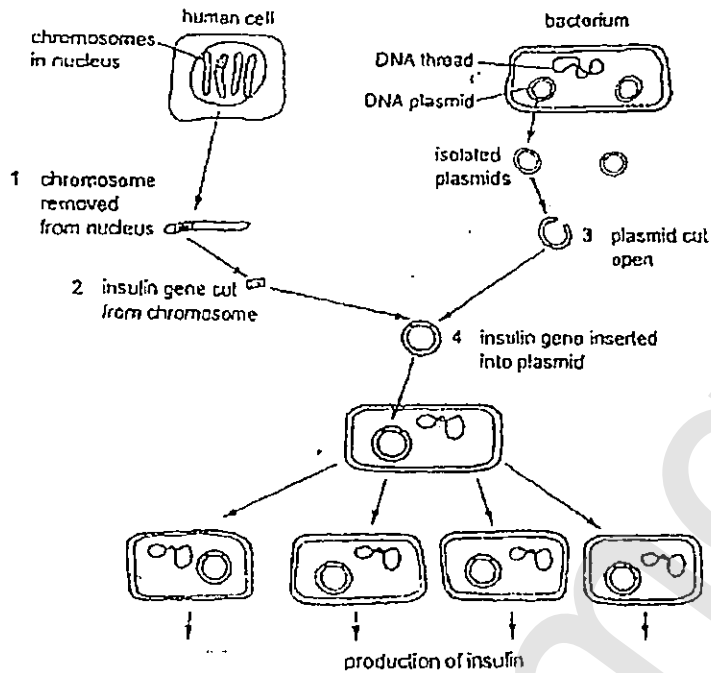
- A 1 and 2
 B 3 and 4
 C 1 and 3; 2 and 4
 D None of the above

- 33 The diagram shows a cell undergoing cell division. Which phase of the cell division is it at?



- A Prophase
 B Metaphase
 C Anaphase
 D Telophase
- 34 Which of the following is false?
- A Each chromosome contains one gene.
 B Each nucleotide consists of a base, a sugar and a phosphate group.
 C Genes encode information to make proteins.
 D Cytosine pairs with guanine.

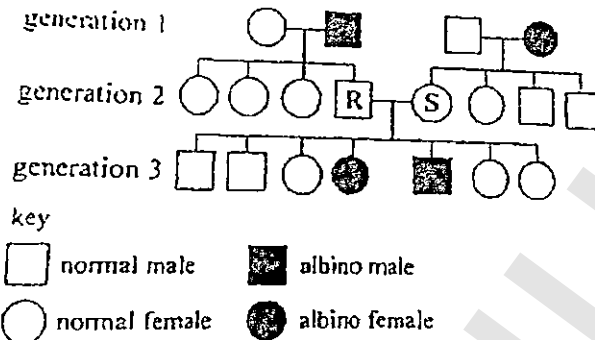
- 35 The diagram shows a process by which a human insulin gene can be inserted into bacterial DNA to produce human insulin.



Which stages use a restriction enzyme?

- A 1 and 3
 B 2 and 3
 C 1 and 4
 D 2 and 4
- 36 In goats, the allele for black hair is dominant to the allele for red hair. Two black-haired goats mated and produced twelve offspring. Of the first eleven, eight had black hair and three had red hair. What is the probability of the twelfth offspring having red hair?
- A 0.75
 B 0.50
 C 0.33
 D 0.25

- 37 Albinism is an inherited condition caused by a recessive allele a . A is the dominant allele for the normal condition.



What are the genotypes of individuals R and S?

	R	S
A	AA	AA
B	AA	Aa
C	Aa	Aa
D	aa	aa

- 38 Which two statements about continuous variation are correct?

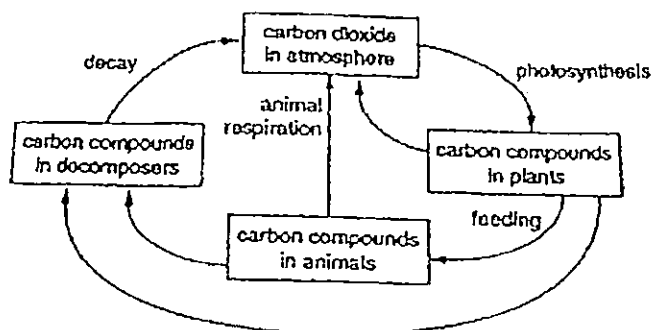
1. The heights of adult humans will partly depend on the quality of their diets when young.
2. The faster period of growth in humans is in the embryo.
3. A group of adult males had heights ranging from 155 cm to 220 cm.
4. Humans have stopped growing by the time they are 22 years old.
5. Humans grow taller during babyhood and childhood.

- A 1 and 2
B 1 and 3
C 2 and 4
D 3 and 5

- 39 Only one hundredth of the light energy trapped by green plants is passed to herbivore tissues and only one thousandth reaches primary carnivore tissues. Which one of the following is the main reason for this?

- A Energy is lost as heat to the environment.
B Energy is lost as carbon dioxide to the environment.
C Energy is used in photosynthesis of green plants.
D Energy is used in transpiration of green plants.

40 The diagram shows part of the carbon cycle.



Which process converts most carbon from one form to another?

- A Animal respiration
- B Decay
- C Feeding
- D Photosynthesis

--- End of paper ---



ANDERSON SECONDARY SCHOOL
SCIENCE DEPARTMENT
PRELIMINARY EXAMINATION 2014

CANDIDATE
NAME

CLASS

4	/	
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INDEX NUMBER

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BIOLOGY (SPA)

Paper 2

5158/02

September 2014
1 hr 45 min

READ THESE INSTRUCTIONS FIRST:

Write your index number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer all questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer questions 9 and 10. Choose Either [E], Or [O] for question 11.

You are advised to spend no longer than 1 hour on Section A and 45 minutes on Section B.
The number of marks is given in brackets [] at the end of each question or part question.

Section A	
Section B	
9	
10	
11 [E] [O]	
Total	

This question paper consists of 18 printed pages, inclusive of this cover page.

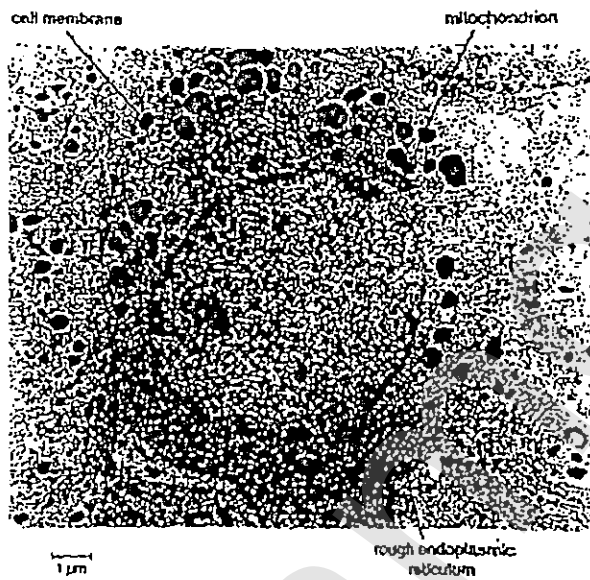
[Turn over]

Section A [50 marks]

Answer all the questions in this section.

Write your answers in the spaces provided.

The diagram below shows an electron micrograph of a secretory cell from the hypothalamus of the brain. This cell synthesizes and releases ADH. ADH is a peptide made of nine amino acids.



(a) Explain the role of the following structures in the synthesis of ADH.

mitochondrion

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nucleolus

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chromatin threads

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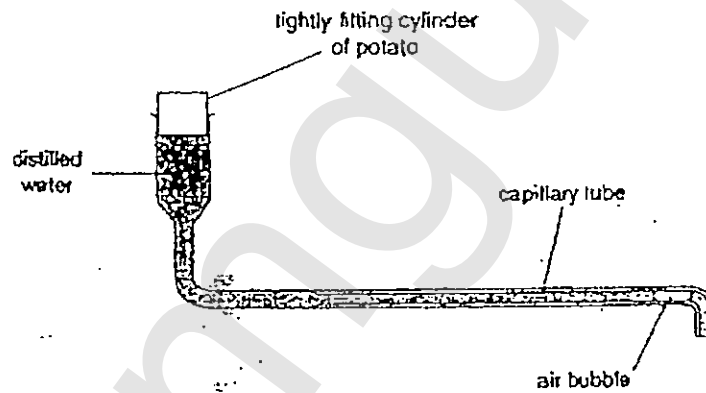
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[3]

- (b) Describe what happens to peptides, such as ADH, before they are secreted out of the cell.

[2]

2. An experiment was carried out to investigate the effect of solutions of different concentrations on potato tissue. The apparatus was set up as shown below.



- (a) (i) Name the process which will occur where the potato is in contact with the distilled water.
- (ii) In which direction will the air bubble move along the capillary tube? Explain your answer.

Direction

Explanation

[4]

- (b) Suggest how and why the experimental results would differ (if at all) if a cooked potato is used instead.

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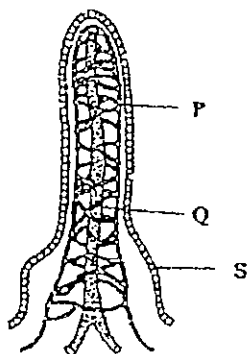
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[1]

3. The figure shows a villus, in longitudinal section, from the ileum of a mammal.

0.2 mm



- (a) What are the names and functions of P and Q.

P

.....

.....

Q

.....

.....

[2]

- (b) Explain how S is adapted to carry out its respective specific functions.

.....

.....

.....

[2]

Alcohol is a small molecule that is easily absorbed through the small intestine.

(c) State how alcohol travels to the liver

..... [1]

(d) State what prolonged excessive consumption of alcohol can do to the liver.

..... [2]

4. Fig 1 and 2 below shows two different views of a leaf.

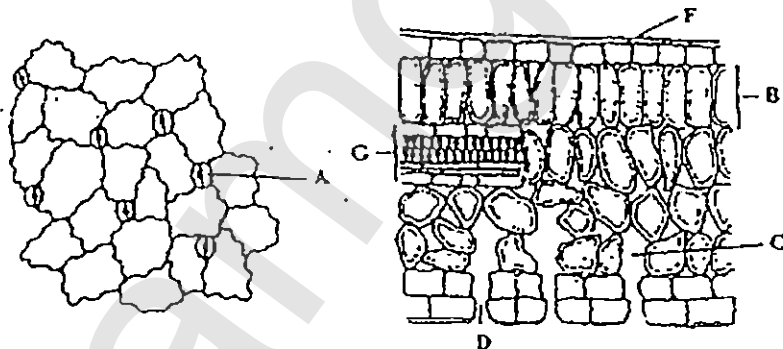


Fig. 1

Fig. 2

(a) By means of a line labelled E, indicate the layer of cells in Fig 2 that corresponds to the cells represented in Fig. 1. [1]

(b) Name the parts labelled A and B, and describe their function.

..... [2]

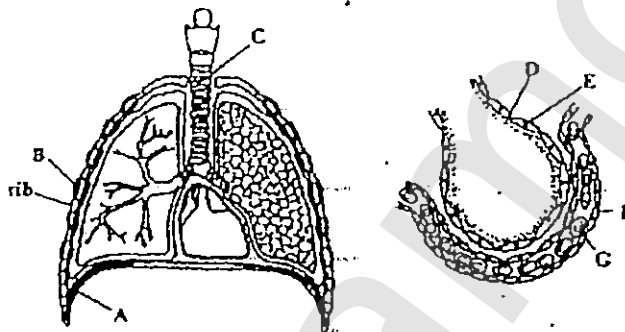
- (c) Name two substances carried to the leaf cells by region G.

[1]

- (d) Explain how these substances enter the plant and reach the leaf.

[3]

5. The diagram shows structures associated with breathing and gaseous exchange.



- (a) Name the structures A, B, C and E

A:

B:

C:

E:

[2]

- (b) Describe using the diagram above the characteristics of the alveoli that enables efficient gaseous exchange.

[2]

(c) Describe how blood flows from the lungs to the liver cells.

.....

.....

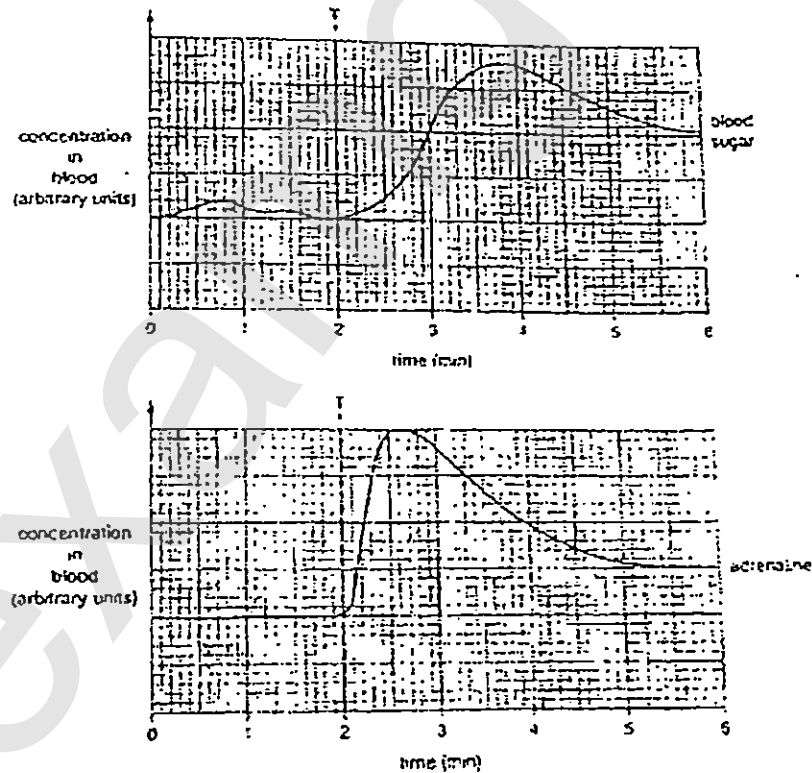
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[3]

6. The levels of sugar and adrenaline in a person's blood were measured at the same time over a period of six minutes. The figure below shows these measurements.



- (a) Suggest what may have happened at time T.

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..... [1]

- (b) Explain why the concentration of blood sugar changed after time T.

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..... [1]

- (c) Explain how the concentrations of blood sugar are returned to their original levels.

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..... [3]

- (d) Explain how the nephrons in the kidneys also aid in returning the water potential of blood to normal levels.

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..... [2]

7. Fig 2.1 and Fig 2.2 show diagrammatically chromosomes from two cells from the same organism undergoing different types of nuclear division.

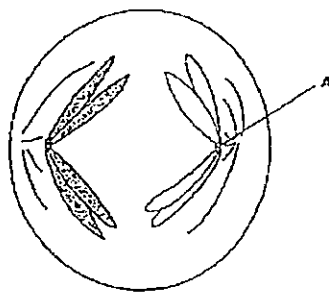


Fig. 2.1



Fig. 2.2

- (a) State the type of nuclear division and name the stage shown for:

- (i) Fig 2.1

type of nuclear division

stage [1]

- (ii) Fig 2.2

type of nuclear division

stage [1]

- (b) Describe the main difference between the two stages visible in Fig 2.1 and Fig 2.2.

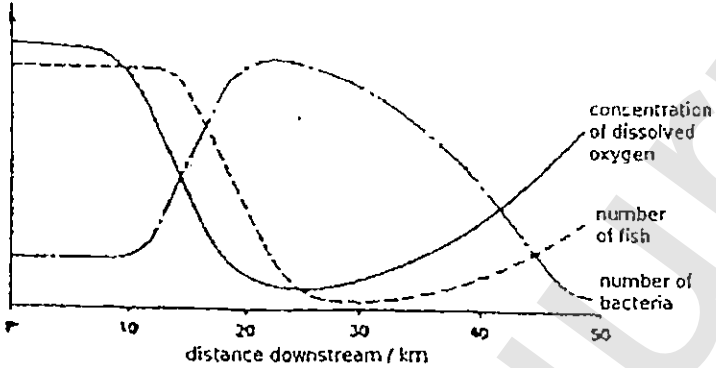
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 [2]

- (c) Explain how meiosis and fertilization can lead to variation.

.....

 [2]



- (a) With reference to the three curves on the graph, describe the effect of pollution downstream 10 to 30 km from Point P.

[3]

- (b) Describe how sewage should be treated before it is safe to be released to water bodies.

{3}

Write your answers in the spaces provided.

- Eight test tubes of equal concentrations of a short peptide are incubated with an equal amount of short peptide-protease, extracted from the stomach of a mammal, at 37°C at the same time. At every twenty minutes after the start of the reaction, a test tube was selected and the reaction was stopped with an inhibitor. A Biuret test was carried out using the contents of the test tube and the intensity of the violet solution was measured and recorded below.

Tube	A	B	C	D	E	F	G	H
Time stopped/ min	20	40	60	80	100	120	140	160
Intensity / AU	1170	700	530	502	500	500	500	500

- (b) Describe and explain the graph you have plotted.

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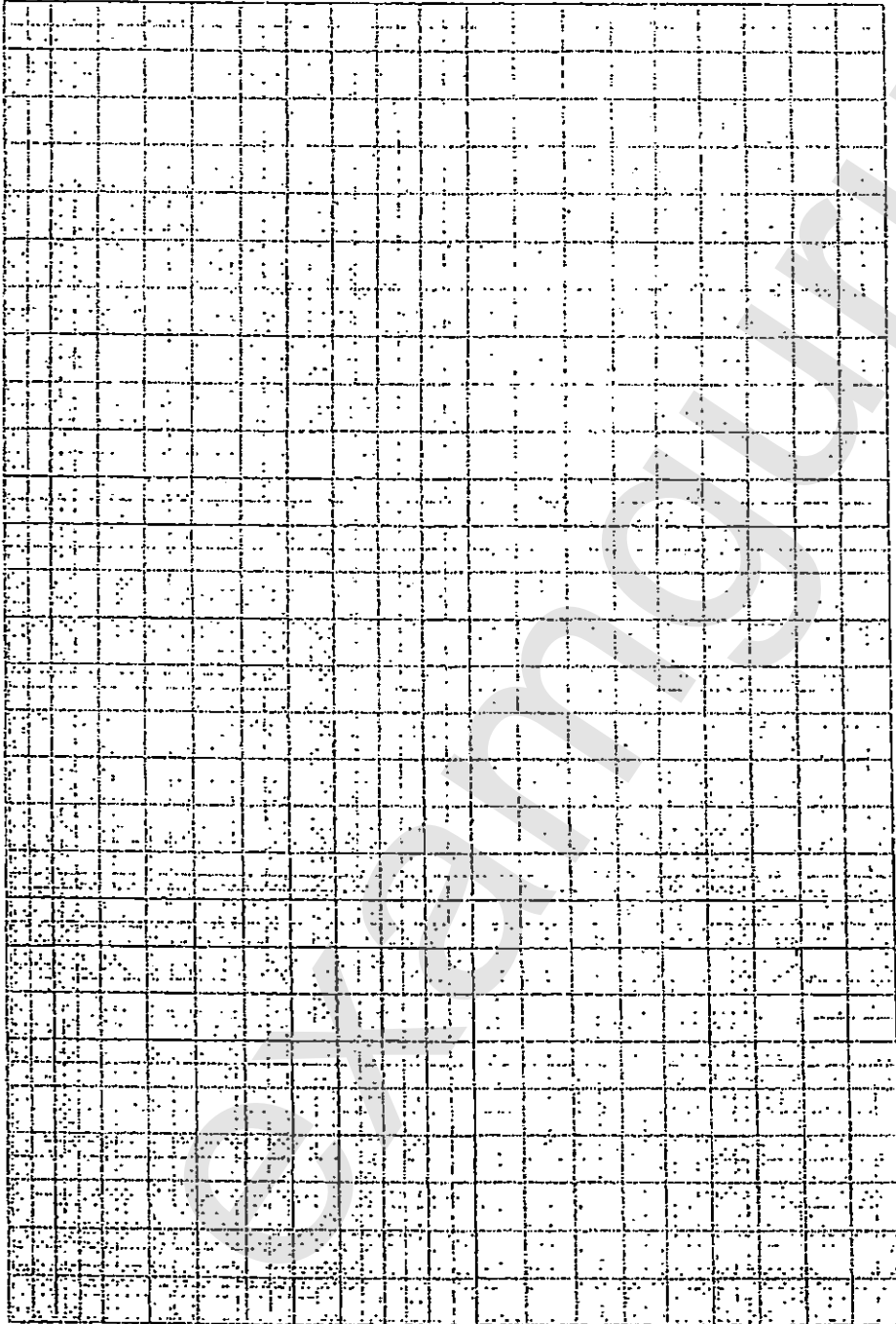
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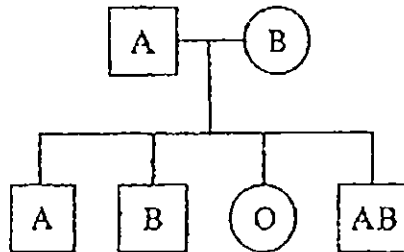
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- (c) The same reaction was repeated at an incubation temperature of 27°C .
- (i) If the data were collected and a graph plotted, sketch this new graph on the same graph paper on the next page and label it " 60°C ". [2]
- (ii) Explain the differences you see in the new graph compared to that from the original graph you plotted.

[2]



10. The diagram below shows the blood groups of the members in a family.



- (a) Draw a genetic diagram to show how it is possible that the parents have children of all four different blood groups.

[3]

A flu epidemic is suddenly upon the population of an Asian country that is caused by a mutated form of the avian flu virus. However, it seems humans with blood group AB are more likely to survive than the rest.

- (b) Suggest what factors may have increased the rate of mutation of the avian flu virus.

[1]

- (c) Suggest and explain what would happen to the population if there is no cure for the flu epidemic over hundreds of years.

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[3]

- (d) If scientists discovered the gene that produces a protein that gives people of blood group AB higher resistance to the flu virus. Suggest how bacteria can be used to manufacture this protein in large quantities.

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[3]

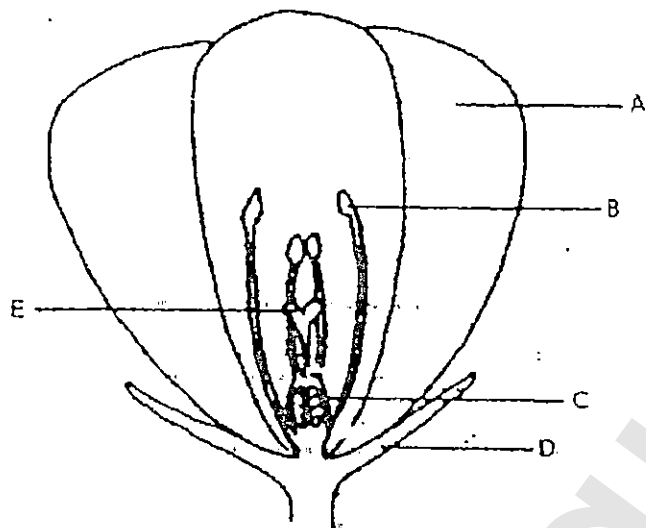
A detailed anatomical diagram of the human eye, showing internal structures. The diagram is labeled with letters A through F. A is the cornea, B is the iris, C is the lens, D is the retina, E is the optic nerve, and F is the ciliary muscle.

- (a) Explain how the skin is involved in returning the body temperature to normal when the body overheats. In your answer, you should refer to, and identify, structures A to E.

[5]

The diagram below shows the main parts of a flower.



(b) Name the parts A to E and describe their functions.

[5]

- [3]

- [5]

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 104

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Paper 1

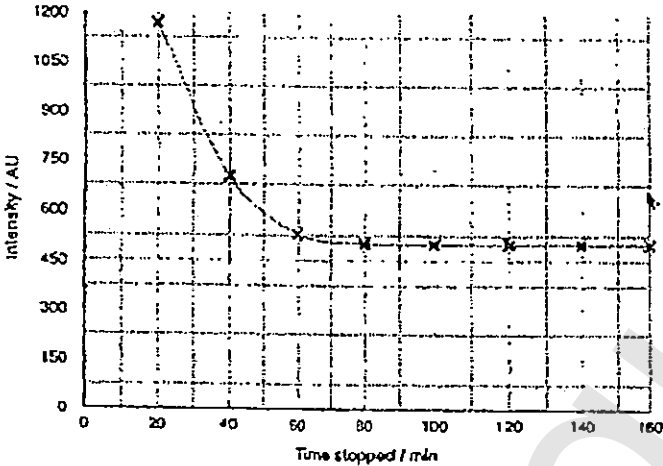
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11	12	13	14	15	16	17	18	19	20
D	A	B	D	B	B	D	B	C	C
21	22	23	24	25	26	27	28	29	30
D	A	A	A	A	B	A	B	C	B
31	32	33	34	35	36	37	38	39	40
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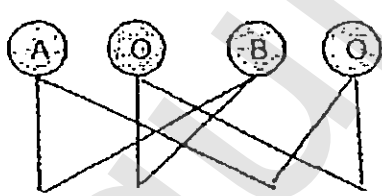
Paper 2 Section A

1a	mitochondrion - provide energy through respiration for synthesis of ADH nucleolus - produce ribosomes for synthesis of proteins chromatin threads - DNA that contains the gene / genetic code that encodes for the protein		
1b	sent to the <u>golgi apparatus</u> for; <u>modification</u> and <u>repackaging</u> before it leaves the cell;		
2ai 2aaii	osmosis [1] direction - from right to left [1] explanation - distilled water has a <u>higher water potential</u> and have a <u>net movement into the potato</u> through osmosis.		
2b	there will be <u>no net movement</u> (remained in position) of water as membrane will be destroyed and become <u>fully permeable</u> .		
3a	P - blood capillaries, carry amino acids and monosaccharides Q - lacteal, carry fatty acids and glycerol to the liver		
3b	<u>one cell thick epithelium</u> - faster diffusion of digested nutrients presence of <u>microvilli</u> - increase surface area to volume ratio for faster diffusion		
3c	travels through the <u>hepatic portal vein</u> from the small intestine to the liver		

3d	damage liver, replacement of <u>functional liver tissue with scar tissue</u> ; resulting in <u>cirrhosis</u> ;		
4a	lower epidermal layer		
4b	A - guard cell - controls the size of the stoma so as to allow gaseous exchange and transpiration B - palisade mesophyll layer - contains the highest concentration of chloroplasts, site of photosynthesis		
4c 4d	water and mineral salts root pressure - root hair cells have lower water potential compared to the soil, water enters through osmosis; mineral salts enter through active transport; capillary action - helps to pull water up the xylem vessels; transpiration pull - water vapour leaves through the stomata creating a force that pulls water up the xylem vessels;	4d - any 3	
5a	A - diaphragm B - external intercostal muscles C - trachea E - alveolar wall		
5b	thin alveolar wall moist layer to dissolve gases numerous alveoli to increase surface area to volume ratio (any 2)		
5c	blood leaves lungs via <u>pulmonary vein</u> and enters the <u>left atrium</u> , past the <u>bicuspid valve</u> then to the <u>left ventricle</u> and out via the <u>aorta</u> to the <u>hepatic artery</u> and into the liver (0.5 mark each)		
6a	any reasonable response - a scare, panic attack		
6b	adrenaline causes the conversion of fat and glycogen to glucose in the liver, increasing the blood sugar concentration		
6c	once stimulus over, adrenaline production will stop, excess <u>adrenaline will be broken in the liver</u> , glycogen no longer convert to <u>glucose</u> ; pancreas will detect high levels of glucose; and <u>secrete insulin</u> to convert <u>glucose to glycogen</u> to be stored in the liver;		
6d	ultrafiltration - all small molecules enter the nephron from the glomerulus selective reabsorption - molecules needed by the body like glucose, amino acids and water will be reabsorbed into the capillaries <u>Alternate Answer:</u>		

	Noticed many students interpret the question as a continuation of the scenario where blood glucose level increases. So they answered based on osmoregulation. I will accept this alternate answer: - water potential of blood decreases below normal due to high blood glucose, hypothalamus stimulated and trigger pituitary gland to secrete <u>more ADH</u> [1]; <u>more water reabsorbed</u> by kidney tubules thereby raising water potential of the blood to normal levels [1].		
7ai	meiosis		
7aii	anaphase 1		
	mitosis		
	anaphase		
7b	2.1 shows the splitting of homologous chromosomes, while in 2.2 the centromere has divided and the sister chromatids of each chromosome separate from each other		
7c	meiosis produce genetically dissimilar gametes due to formation of <u>chiasma</u> and the <u>independent assortment of alleles</u> . Fertilisation brings together gametes from 2 genetically distinct individuals - both serve to increase variation		
8a	Oxygen decrease due to usage by reproducing bacteria; Bacteria increase due to sewage providing organic matter / food for reproduction; Fish decrease due to lack of oxygen in water. As the amount of bacteria rapidly increased after 10km away from P the amount of <u>dissolved oxygen correspondingly decreased</u> due to <u>increased respiration of bacteria leading to bacteria reproduction</u>. This caused the fish to start dying due to lack of oxygen and their number decreased shortly after 15km away from P.		
8b	- raw sewage is filtered to remove solids and insoluble substances - liquid phase of sewage is treated with microorganisms to break down complex biomolecules - chemically modify toxins and neutralise poisons		

9a	 Intensity / AU Time stopped / min	[1] scale [1] correct line and points [1] correct labeling of axis	
9b	from 20min to 80min the intensity dropped exponentially from 1170AU to 502AU as the concentration of short peptide decreases because the protease catalyzed the breaking down of the short peptide to amino acids. from 80min to 160min the intensity did not change because all the short peptides would have been broken down by then thus 500AU is the baseline colour intensity for the absence of short peptides	data used in description [1] correct explanation in part 1 [1] and part 2 [1]	
9ci 9cii	new line should be less steep and reaches 500AU later higher temperature means slower reaction rates because - - enzymes denatured - enzyme active site 3D configuration might be slightly changed, thus lower chance of forming enzyme-substrate complex <u>Errata:</u> - The temp corrected to 27C, so the explanation corrected to: Enzyme action at lower temp is less active[1] as the kinetic energy of the enzyme and substrate molecules are lowered thereby decreasing the frequency of collision between enzyme and substrate molecules in forming the enzyme-substrate complex [1].		

10a	parental phenotype A B parental genotype AO BO gametes  F1 genotype AB BO AO OO F1 phenotype AB B A O	[1] parental genotype [1] correct gametes and crossing [1] correct F1 genotype no marks for parental phenotype and F1 phenotype	
10b	radiation from the sun or cosmic rays or chemicals like carcinogens		
10c	1) blood group AB has higher chance of survival so greater chance of mating and reproducing 2) more chance of passing the AB gene to the next generation 3) increase in the number of people having blood group AB		
10d	1) gene is isolated and amplified using PCR technology 2) copies of the gene and antibiotic resistant plasmids are cut using the same restriction enzyme 3) gene and plasmid joined together using ligase 4) plasmid introduced into bacteria using heat or electric shock treatment 5) bacteria grown in broth with antibiotics to select only those bacteria with plasmid 6) transformed bacteria are grown in large fermenters and protein is collected and purified		too little marks
11Ea	A - <u>shunt vessels</u> at the surface <u>constrict</u> to allow more blood to carry heat to the surface and cooled by conduction, convection and radiation D - sweat glands become more active <u>producing more sweat</u> that is <u>secreted through sweat pores</u> B. <u>Sweat evaporates carrying away latent heat of vaporization</u> C - thermoreceptors / nerve ending <u>register the increase in temperature</u> at the surface of the skin triggering other homeostatic processes	0.5 mark for naming A to E, 0.5 mark for explanation	

	E - <u>arterioles</u> also <u>dilate</u> allowing more blood to flow towards the skin to bring away the heat		
11Eb	A - petals - large and coloured for insect pollinated flowers to attract insects B - stamen / anther - produces pollen grains C - ovary or ovules - contains the egg cells D - sepals - protects the flower during the bud stage E - stigma - receives mature pollen grains during pollination	0.5 for name, 0.5 for explanation	
11Oa	<u>hypothalamus detects increase</u> in water potential in blood, <u>pituitary gland releases less ADH</u> ; Less ADH means less water reabsorbed in the kidneys tubules / nephrons; Water potential of the blood decreases		
11Ob	- during menstruation lower levels of progesterone and oestrogen causes the uterine wall to break down and expelled through the vagina - estrogen is produced by the ovaries and causes the repair of the uterine wall - high levels of estrogen will eventually cause the ovulation which marks the middle of the fertile periods of the woman. A mature egg is released by a mature follicle cell, this marks the start of the fertile phase - the follicle cell then becomes the graafian follicle and corpus luteum after ovulation which produces progesterone - progesterone thickens the uterine lining in preparation of the implantation of a fertilized egg - if there is no fertilized egg, the graafian follicle eventually degenerates and the concentration of progesterone will drop causing the breaking down of the uterine lining again starting the cycle		
11Oc	amniotic fluid protects the fetus from external impact and allows the fetus to move freely inside the uterus; amniotic sac contains the fetus and the fluid;		

Name of Candidate: _____ () Class: _____ Calculator Model:



BUKIT PANJANG GOVERNMENT HIGH SCHOOL

Preliminary Examinations 2014

SECONDARY FOUR EXPRESS

BIOLOGY

Paper 1

5158/01

Date: 20 August, 2014

Duration: 1h

Time: 1100 – 1200h

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and register number on this question paper and the Optical Answer Sheet (OAS).

There are forty questions in this paper.

Answer all questions.

For each question there are four possible answers A, B, C and D.

Choose the one you consider correct and record your choice in soft pencil on the OAS.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this question paper.

For Examiner's Use	
Total	/ 40

Sellers: Ms Jessie Lee & Ms Ding Ying Jye

[Turn over

This paper consists of 20 printed pages.

1. A list of functions in cells is listed below. Match the functions with the structures stated in the table.

- (i) where carbon dioxide is reduced to carbohydrate
- (ii) where glucose is oxidized and energy is released
- (iii) a fully permeable outer layer
- (iv) a selectively permeable outer layer
- (v) the centre of protein synthesis

	(i)	(ii)	(iii)	(iv)	(v)
A.	mitochondrion	chloroplast	cell membrane	cell wall	nucleus
B.	ribosome	mitochondrion	cell membrane	cell wall	nucleus
C.	chloroplast	ribosome	cell wall	cell membrane	mitochondrion
D.	chloroplast	mitochondrion	cell wall	cell membrane	ribosome

2. Which of these activities cannot be performed by an erythrocyte?

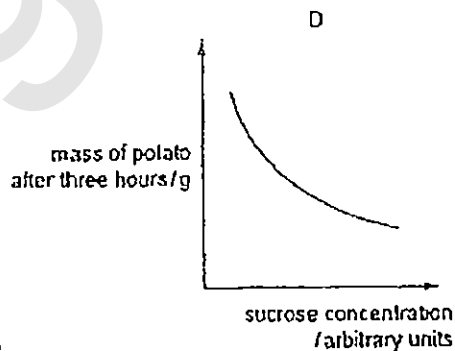
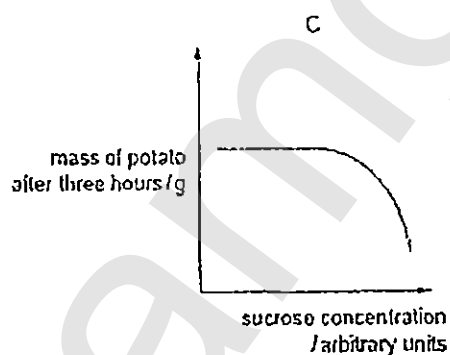
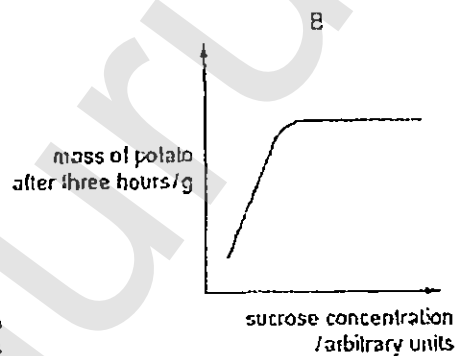
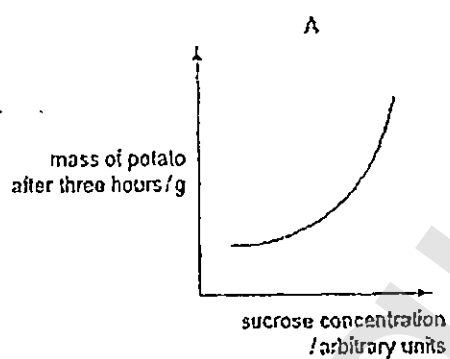
- A. release of oxygen
- B. release of energy
- C. replication of DNA
- D. uptake of glucose

3. What is the main disadvantage of a spherical cell doubling its diameter without dividing?

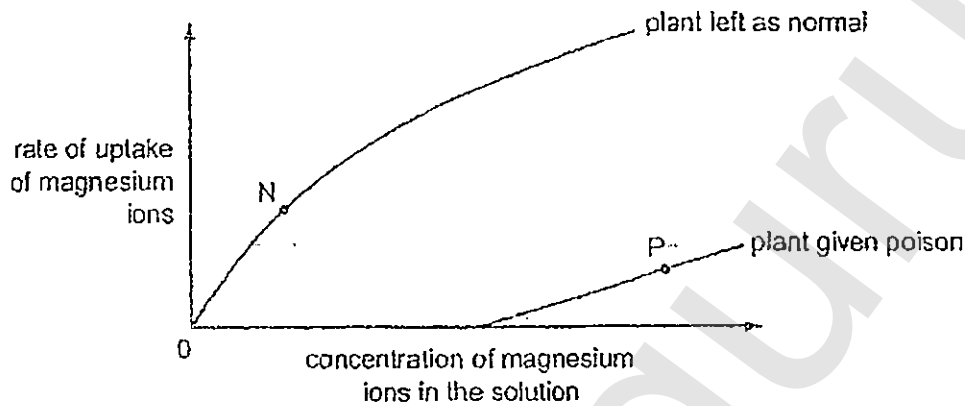
- A. The amount of food diffusing into the cell is increased.
- B. The effectiveness of diffusion is reduced.
- C. The nucleus is not able to fully control the cellular activities.
- D. There is an increase in volume for stored food.

4. Identical pieces of potato are placed in sucrose solutions of different concentrations. After three hours, the mass of each potato piece is measured.

Which graph shows the results of the experiment?



5. An experiment measured the rate at which plants take up magnesium ions from solution. One plant was given a poison that stops respiration. Another plant was left as normal. The graph shows the results.



How are magnesium ions being absorbed by the plants at points N and P?

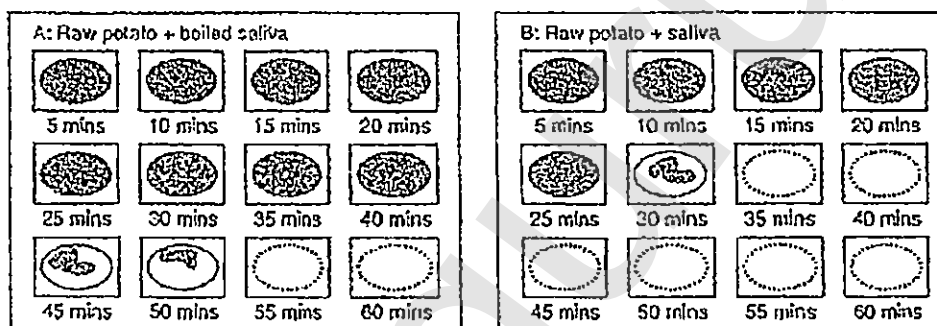
	N	P
A.	active transport	active transport
B.	active transport	diffusion
C.	diffusion	active transport
D.	diffusion	diffusion

6. Trypsinogen is added to a sample of protein in a test tube and incubated at 37°C for 25 minutes at pH 2. What substance(s) is/are left at the end of the experiment?

- A. protein only
- B. protein and polypeptide
- C. protein and lipids
- D. protein and monosaccharide

7. An investigation of the activity of amylase was set up below. Discs of similar sizes were removed from a potato and placed in two different solutions at 40°C. Solution A contained boiled saliva while solution B contained saliva. At every five minute intervals, a disc from each solution was removed and placed in iodine solution.

The results are shown below.



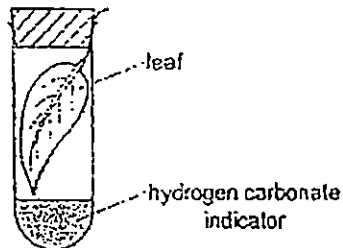
Which of the following is the best explanation for the results obtained in set-up A?

- Boiled saliva took a longer time to break down the starch.
- The starch in the potato reacted with the boiled saliva to form a new substance.
- The potato might contain some amylase, which was responsible for digesting the starch.
- The starch in the potato was decomposed by exposure to air after 55 minutes.

8. Which of the following best describes the carbohydrates cellulose and sucrose?

		It is a reducing sugar.	It is a polysaccharide.	It produces monosaccharides upon complete hydrolysis.
A.	cellulose	✓	✓	X
	sucrose	✓	✓	X
B.	cellulose	X	✓	✓
	sucrose	✓	X	✓
C.	cellulose	✓	✓	✓
	sucrose	X	X	X
D.	cellulose	X	✓	✓
	sucrose	X	X	✓

9. A green leaf is picked at time 0700h and immediately placed in a sealed test-tube containing hydrogen carbonate indicator solution. The tube is kept near a window for 24 hours. The table shows how the indicator changes in colour.

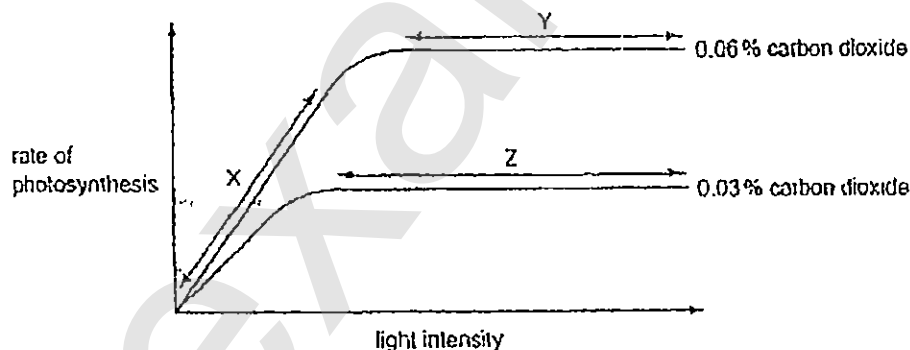


colour	amount of carbon dioxide compared to average atmospheric concentration
purple	less than normal
red	normal
yellow	more than normal

Which colour will the hydrogen carbonate indicator be at times 1200h and 2400h?

	1200h	2400h
A.	purple	yellow
B.	red	purple
C.	yellow	purple
D.	yellow	red

10. The graph shows the rate of photosynthesis of a plant with increasing light intensities at two different carbon dioxide concentrations. The temperature is kept constant.



Which of the following may be the limiting factors of photosynthesis at X, Y and Z?

	X	Y	Z
A.	carbon dioxide	light intensity	carbon dioxide
B.	carbon dioxide	light intensity	light intensity
C.	light intensity	carbon dioxide	carbon dioxide
D.	light intensity	carbon dioxide	light intensity

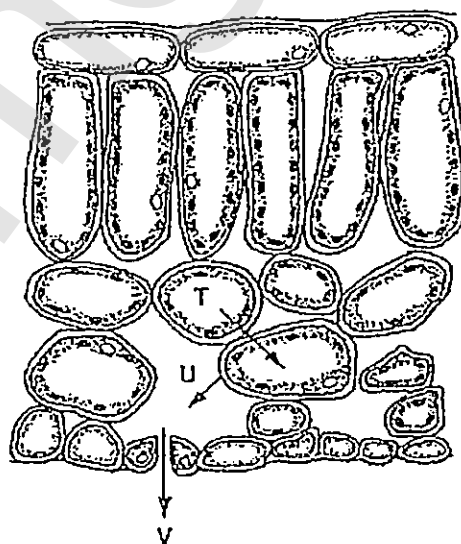
11. Different features of various vascular bundle components are listed below.

- (i) presence of sieve plates
- (ii) presence of companion cells
- (iii) absence of cross walls
- (iv) hollow lumen

Which of the above are not adaptations for the maintenance of transpiration streams in plants?

- A. i and ii
- B. i and iii
- C. ii and iv
- D. iii and iv

12. The diagram shows a transverse section of part of a leaf.



→ movement of water

The arrows represent the movement of water vapour.

Which of the following correctly identifies the processes involved?

	T	U	V
A.	diffusion	diffusion	osmosis
B.	diffusion	evaporation	transpiration
C.	osmosis	evaporation	diffusion
D.	osmosis	transpiration	evaporation

13. Fitness training increases the concentration of lactic acid that runners can build up in their muscles before pain stops them from running.

What is a consequence of this increase?

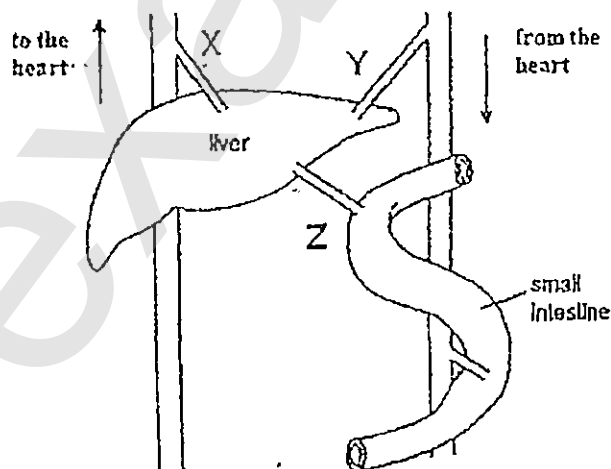
- A. Aerobic respiration in muscles can be more rapid.
- B. Blood flow to the muscles is increased.
- C. More anaerobic respiration can take place in the muscles.
- D. More energy is needed by the muscles.

14. In the human respiratory system, which features maintain the carbon dioxide gradient between the alveoli and the outside air?

- (i) blood continually pumped to the alveoli
- (ii) breathing in and out
- (iii) moist alveolar surfaces
- (iv) thin alveolar walls

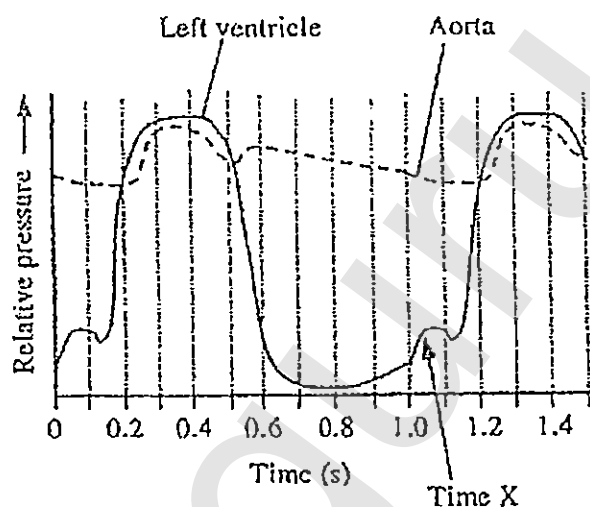
- A. i and ii
- B. i and iv
- C. ii and iii
- D. iii and iv

15. The diagram below represents the liver and the associated blood vessels X, Y and Z. Arrange the following vessels in descending sugar concentrations.



- A. X, Y, Z
- B. Y, X, Z
- C. Z, X, Y
- D. Z, Y, X

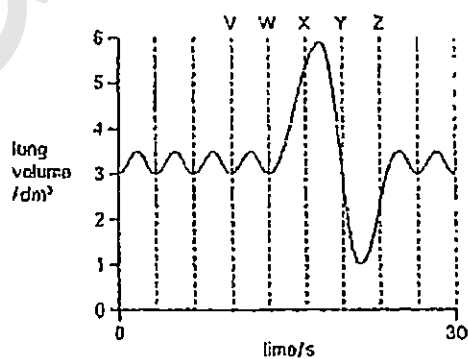
16. The diagram below shows the change of pressure in the left ventricle and in the aorta of a person during the beating of his heart.



Which of the following does not occur at time X?

- A. The bicuspid valve is opened.
- B. The atria are contracting.
- C. The ventricles are being filled with blood.
- D. The ventricles are forcing blood out.

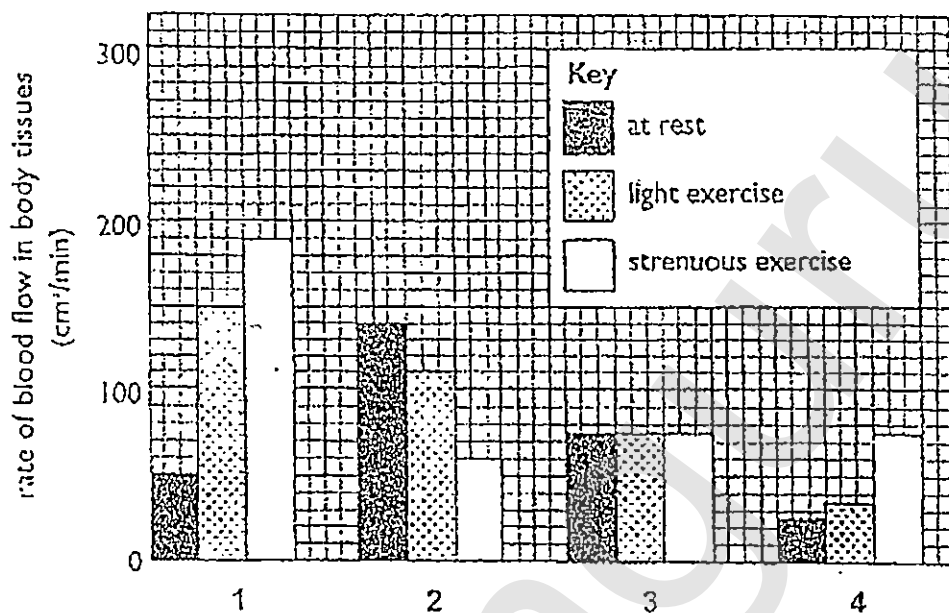
17. The graph shows the changes in the amount of air in a person's lungs over a period of 30 seconds.



Between which time periods is the rate of breathing fastest?

- A. V to W
- B. W to X
- C. X to Y
- D. Y to Z

18. The bar graph below shows the rate of blood flow in four various parts of the body when the body is in different states of activity.



Which of the following correctly represents blood flow in the following organs?

	small intestine	heart	pancreas
A.	1	4	2
B.	2	1	4
C.	4	1	3
D.	3	4	2

19. Which reaction(s) is catalyzed by carbonic anhydrase when red blood cells pass through the lungs?

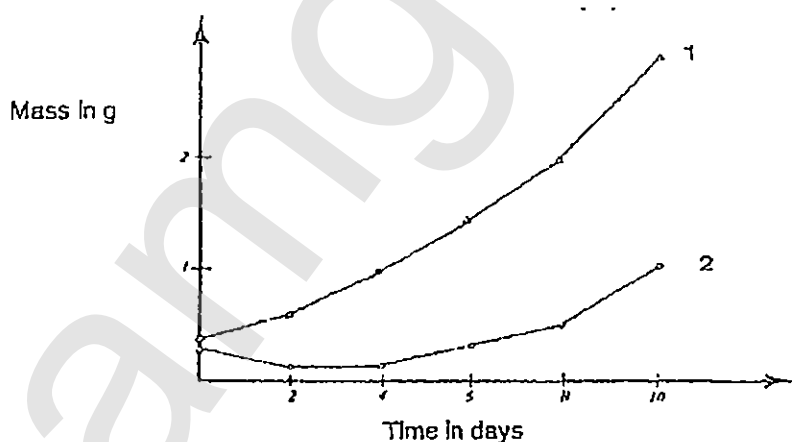
- (i) $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$
- (ii) $\text{HCO}_3^- + \text{H}^+ \rightarrow \text{H}_2\text{CO}_3$
- (iii) $\text{H}_2\text{CO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- (iv) $\text{H}_2\text{CO}_3 \rightarrow \text{H}^+ + \text{HCO}_3^-$

- A. i and ii
- B. i and iii
- C. ii and iv
- D. iii and iv

20. A man, whose heart rate was 80 beats per minute, took up vigorous training in an attempt to become fitter. After 6 weeks, his heart rate had dropped to 68 beats per minute. Which of the following is the most likely explanation for this?

- A. The blood vessels had enlarged thus aiding blood flow.
- B. The heart improves its capacity to pump more blood per minute.
- C. As he trained he lost weight, so there was less tissue to supply blood.
- D. His cellular respiration had become more efficient so that the blood was more oxygenated.

21. Sixty mung beans were grown in identical conditions. Ten plants were removed from the sample and the average dry mass determined every two days and the results were shown in the graph below.



Which of the following graphs correctly represents
(i) the change in dry mass, and
(ii) the reason for the change?

	(i) graph	(ii) reason
A.	1	Photosynthesis exceeded respiration.
B.	2	A slight decrease in mass for the first few days because food storage is used for respiration.
C.	1	Respiration exceeded photosynthesis.
D.	2	A slight decrease in mass for the first few days because leaves has not developed.

22. Which of the following is an example of excretion?

- A. release of adrenaline from the adrenal glands
- B. release of sweat from the sweat glands
- C. removal of carbon dioxide from the lungs
- D. removal of faeces from the alimentary canal

23. Samples of blood from the renal artery and the renal vein were analysed.

The blood in the renal artery contains _____.

- A. less carbon dioxide and more urea than the renal vein
- B. more carbon dioxide and less urea than the renal vein
- C. less oxygen and more urea than the renal vein
- D. more oxygen and less urea than the renal vein

24. The following statements describe parts P and Q of the nervous system.

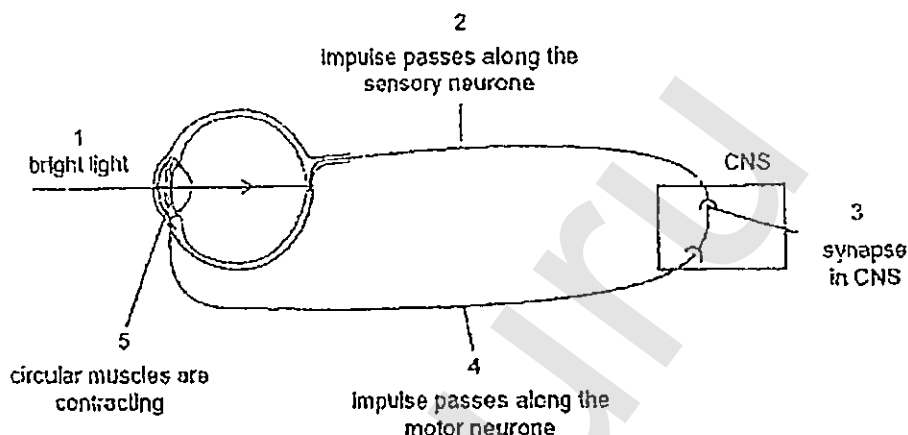
Part P: Site where the cell bodies of the motor neurones gather together.

Part Q: Site where axons of motor neurones are found.

Identify parts P and Q.

	P	Q
A.	white matter	ventral root
B.	grey matter	ventral root
C.	grey matter	dorsal root ganglion
D.	white matter	dorsal root

25. The flow diagram shows the pupil reflex.



Which of the following correctly names the receptor, central nervous system (CNS) and effector?

	receptor	CNS	effector
A.	nerve endings in iris muscles	brain	ciliary body
B.	nerve endings in cornea	spinal cord	iris muscles
C.	nerve endings in retina	spinal cord	ciliary body
D.	nerve endings in retina	brain	iris muscles

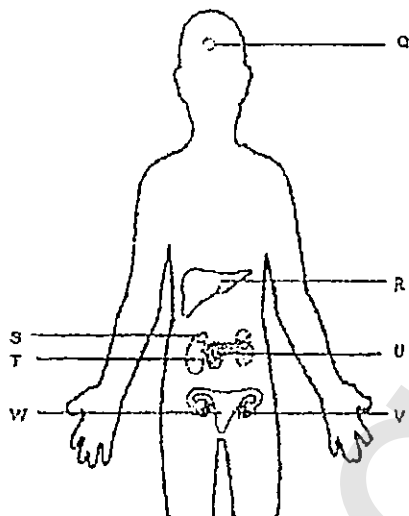
26. Which of the following statements best describe the cones present in the retina?

- A. Cones are more sensitive to light than rods.
- B. Cones contain visual purple which is bleached in bright light.
- C. Cones absorb different wavelengths of light, primarily red, blue and green.
- D. Cones are thermoreceptors which are sensitive to light.

27. Which of these statements describes control by negative feedback?

- A. An injury to body tissue activates platelets in the blood and these activated platelets release chemicals which activate more platelets.
- B. During the menstrual cycle, luteinising hormone stimulates the release of oestrogen which in turn stimulates the release of more luteinising hormone.
- C. The onset of contractions during childbirth causes the release of a hormone which stimulates further contractions.
- D. When blood pressure is high, nerve impulses from the brain cause the blood vessels to dilate and blood pressure is reduced.

28. Structures Q to W are either endocrine glands or target organs in the body. Which of the following incorrectly matches the endocrine gland to its associated target organ?



	endocrine gland	target organ
A.	Q	T
B.	R	U
C.	S	R
D.	V	W

29. The following investigation was carried out using flower buds growing on three plants on the same species.

- Plant 1 → The anthers were carefully removed and the buds left open to air.
 Plant 2 → The anthers were left untouched and a paper bag was tied tightly around each bud.
 Plant 3 → The anthers were carefully removed and a paper bag was tied tightly around each bud.

Although all flowers later opened normally, only those on Plant 1 produced seeds. What does the result show about this species?

- A. only cross-pollination can take place
 B. only wind-pollination can take place
 C. only insect-pollination can take place
 D. both self and cross-pollination can take place

30. A new life form is discovered. It has a genetic code much like those of organisms on earth except that there are three different DNA bases instead of four, and the base sequences are translated as quadruplets (sets of four) instead of triplets (sets of three). How many different amino acids could be accommodated by this genetic code?

- A. 9
- B. 12
- C. 64
- D. 81

31. A student obtained a sample of DNA. mRNA was transcribed from this DNA and the two samples were subsequently purified. He then separated the two strands of the DNA sample. The base compositions of each strand and that of the mRNA were analysed.

The results of the analysis are shown in the table below.

	A	G	C	T	U
DNA strand 1	19.1	28.0	31.0	23.9	0.0
DNA strand 2	24.2	30.8	25.7	19.3	0.0
mRNA	19.0	25.9	30.8	0.0	24.3

Which of the following statements correctly show the relationship between DNA strand 1, DNA strand 2 and mRNA?

- A. Strand 1 is the coding strand for mRNA synthesis.
- B. Strand 2 is the coding strand for mRNA synthesis.
- C. mRNA is complementary to DNA strand 1.
- D. mRNA is the template for DNA synthesis.

32. A strand of DNA which codes for part of a polypeptide has the following base sequence.

Start CAATCTGGTTCTGGTTCTTCT End

Hydrolysis of the polypeptide (coded for by the base sequence above) yields different amino acids in the numbers as shown in the table below.

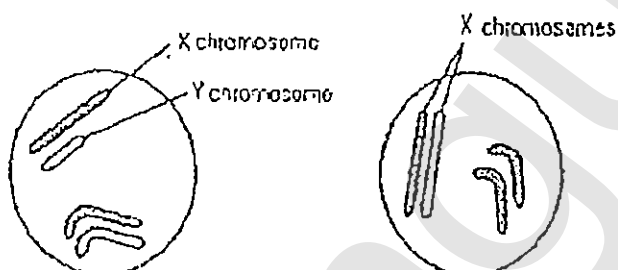
Amino acid	Symbol	Number found in polypeptide
Valine	Val	1
Proline	Pro	2
Arginine	Arg	4

[Turn over

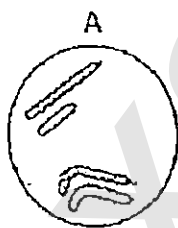
Which of the following correctly shows the sequence of amino acids in the polypeptide?

- A. Pro-Arg-Val-Arg-Pro-Arg-Arg
- B. Val-Arg-Pro-Arg-Pro-Arg-Arg
- C. Val-Arg-Pro-Arg-Pro-Arg-Val
- D. Val-Pro-Arg-Pro-Arg-Pro-Pro

33. The diagram shows two pairs of chromosomes in the nuclei of body cells of a male and female animal.



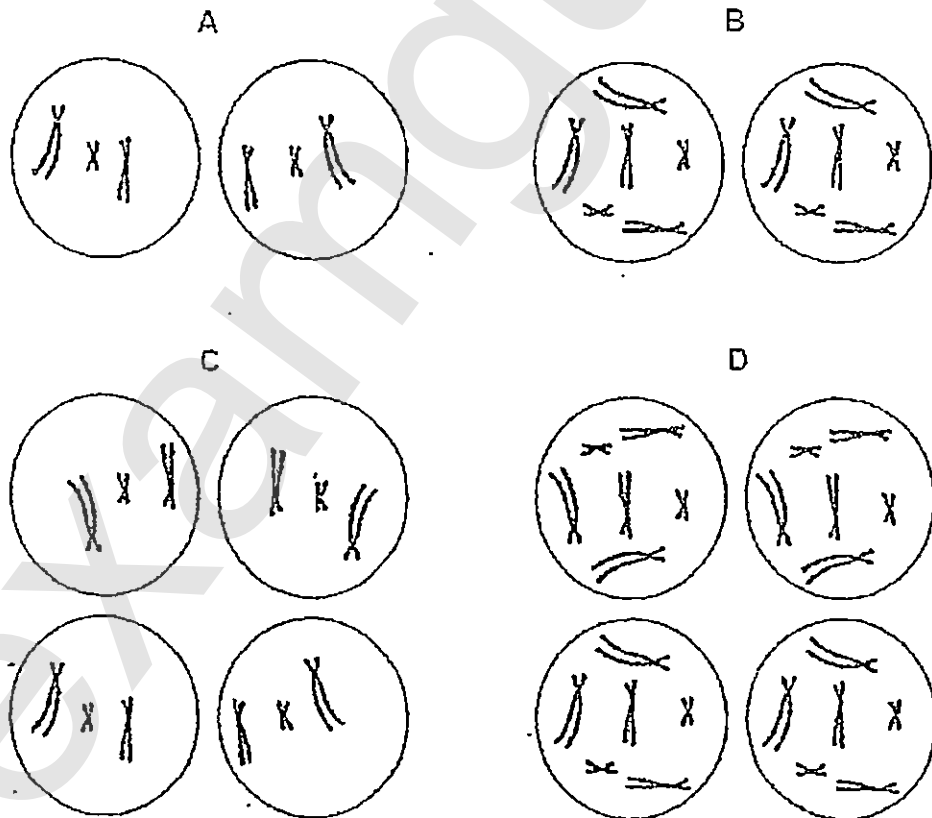
Which of the following shows a combination of chromosomes that cannot possibly occur in a zygote formed from the gametes of the male and female animal?



34. The diagram shows the chromosomes in a cell at the beginning of meiosis.



Which diagram shows the likely product of one division of the cell at end of meiosis I?

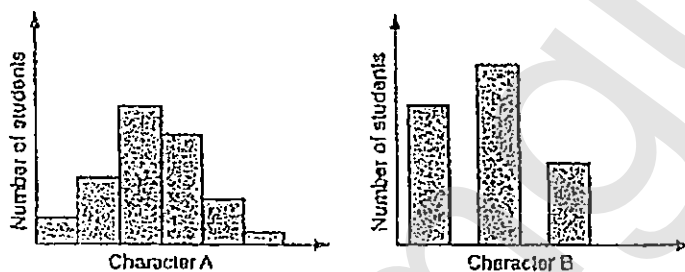


35. Mammalian skin cells in tissue culture were supplied with a source of radioactive thymine.

At which stage of the cell cycle will the radioactive thymine be incorporated into the nuclei?

- A. anaphase
- B. interphase
- C. metaphase
- D. prophase

36. Two phenotypes of a class of students were measured. The results obtained were recorded in the graphs below.



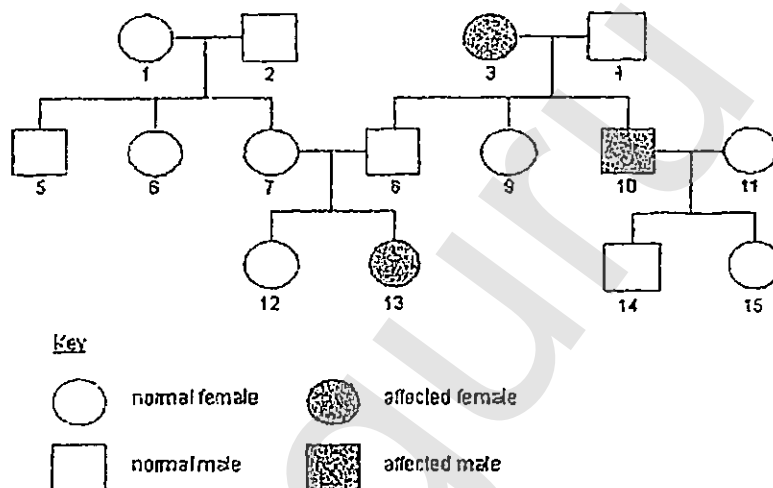
Which of the following statements is true?

- A. Character A is determined by dominant alleles while character B is determined by recessive alleles.
- B. Character A is not influenced by environmental factors while character B is.
- C. Character A is determined by the additive effect of many pairs of alleles while character B is determined by one or a few pairs of alleles.
- D. Ability to roll the tongue is an example of character A while blood group is an example of character B.

37. Which statement describes an example of artificial selection?

- A. It has been found that some strains of bacteria produce antibiotics.
- B. It is common practice to mate bulls with cows that produce the most milk.
- C. It is possible to control caterpillars on food crops by releasing small wasps which lay their eggs in caterpillars and kill them.
- D. Mosquitoes have developed strains that are resistant to insecticides.

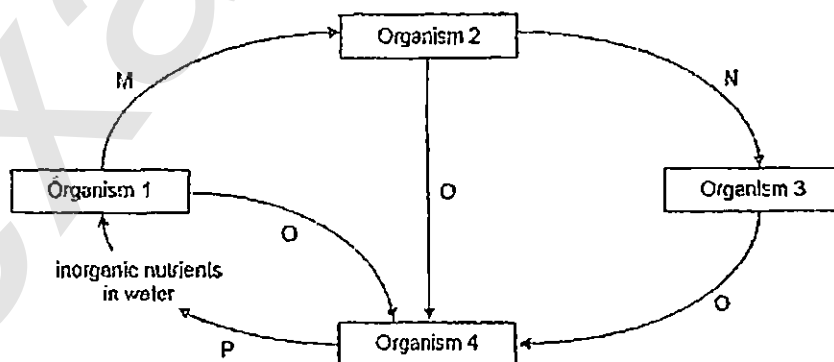
38. The diagram below shows the inheritance of phenylketonuria (PKU), a condition caused by a recessive allele r in the family.



Which of the females are certain to have the genotype Rr ?

- A. 1, 7 and 9
- B. 1, 9 and 12
- C. 7, 9 and 15
- D. 9, 12 and 15

39. The diagram shows how nutrients can be recycled in an aquatic environment.



Which of the following matches of processes is correct?

	M	N	O	P
A.	photosynthesis	predation	feeding	decomposition
B.	feeding	excretion	predation	death
C.	feeding	predation	death	decomposition
D.	predation	feeding	respiration	photosynthesis

40. The oxygen requirements of water from a particular site are measured by taking a sample of the water and measuring its oxygen content with an electronic meter.

After keeping it sealed in the dark for 5 days at 20°C, the oxygen content is measured again. The rate at which the oxygen has been used up is known as the biological oxygen demand (BOD).

The BOD of an unpolluted river is about 3mg O₂ per litre of water while that of raw sewage is about 325mg O₂ per litre of water.

Which of the following reasons below explain the relatively high BOD of raw sewage?

- (i) increased population of decomposing bacteria in raw sewage
- (ii) decreased levels of carbon dioxide in raw sewage
- (iii) increased levels of organic wastes in raw sewage
- (iv) decreased amounts of dissolved oxygen in raw sewage

- A. i and ii
- B. i and iii
- C. ii and iii
- D. i and iv

~ This is the end of the paper. ☺ ~

Name of Candidate: _____ () Class: _____ Calculator Model: _____



BUKIT PANJANG GOVERNMENT HIGH SCHOOL

Preliminary Examinations 2014

SECONDARY FOUR EXPRESS

BIOLOGY

5158/02

Paper 2

Date: 20 August, 2014

Duration: 1h 45min

Time: 0800 – 0945h

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A [50 marks]

Answer all questions.

Write your answers in the spaces provided on the question paper.

Section B [30 marks]

Write your answers on the graph and writing paper provided.

Write an E (for Either) or an O (for Or) next to the number 10 in the grid on the right hand side of this cover page to indicate which question you have answered.

You are advised to spend no longer than an hour on Section A and no longer than 45 minutes on Section B.

At the end of the examination, hand in Section A & B separately.

The number of marks is provided in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	/50
Q8	/10
Q9	/10
Q10	/10
Section B	/30
Paper 2	/80

[Turn over

This paper consists of 13 printed pages.

Section A [50 marks]

Answer all questions.
Write your answers in the spaces provided.

For
Examiner's
Use

1. A study was performed on osmoregulation in saltwater (marine) and freshwater fish. The salt concentration in the circulatory fluid of fish is generally higher than that of freshwater and lower than that of seawater. Both water and salts can move freely through the plasma membranes of fish cells.

Use the information below in the table to answer the following questions.

	marine fish	freshwater fish
rate of water uptake (ml/h)	-3.5	4.0
rate of salt uptake (mg/h)	1.2	-2.3
rate of urine production (ml/h)	3.2	12.2
concentration of salt in circulatory fluid (mg/l)	2.0	2.0
concentration of salts in urine (mg/l)	5.0	2.0

- (a) Explain the difference in water uptake between the marine fish and the freshwater fish.

[2]

- (b) With reference to the function of the kidney nephron, explain how marine fish maintains the water potential of its circulatory fluid.

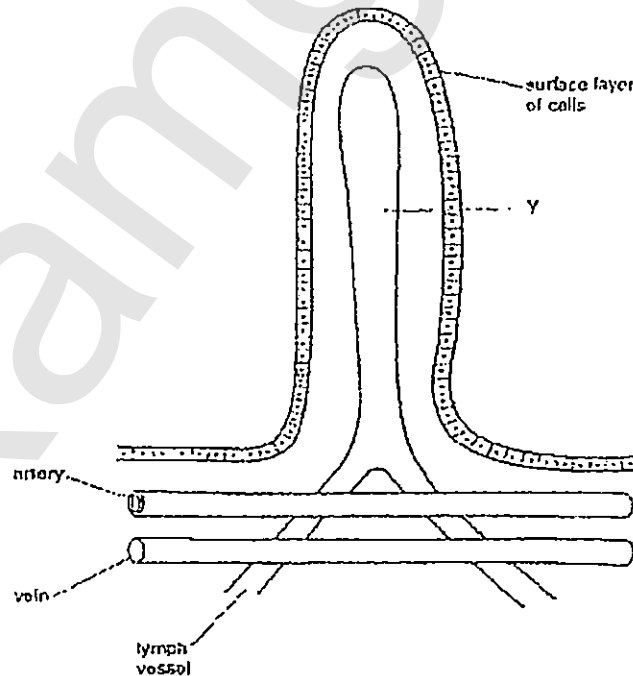
[2]

- (c) Freshwater fish actively absorb salts from their surroundings through their gills to maintain a constant water potential in their circulatory fluid. With reference to osmoregulation, explain why maintaining a constant water potential is important to the health and survival of the fish. [2]

For
Examiner's
Use

[Total: 6 marks]

2. The figure below shows a section through a villus in the small intestine. The blood capillaries are not shown.



- (a) (i) On the figure above, draw the blood capillaries inside the villus and link it with the appropriate blood vessels. Draw arrows to show the direction of the blood flow in the capillary. [1]

(ii) Name the first organ to which blood flows from the small intestine and the vessel that transports this blood. [1]

For
Examiner's
Use

Organ:

Vessel:

(b) The surface layer of cells on the villus possesses projections known as microvilli. Microvilli aid in the absorption of food substances. State and explain one other feature of the cells that aids in the absorption of food substances. [2]

.....
.....
.....

(c) Name structure Y. Describe the role of structure Y in the absorption of materials from the small intestine. [2]

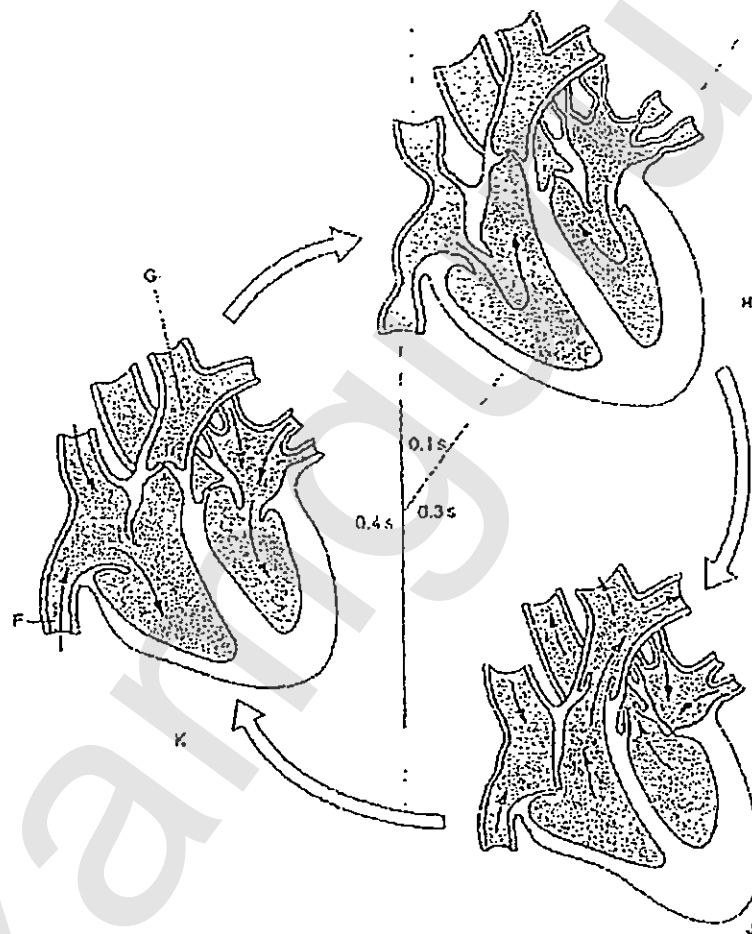
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(d) Describe the role of the liver in digestion. [2]

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.....
.....

[Total: 8 marks]

3. The figure below shows three stages in the cardiac cycle.



(a) Name blood vessels F and G.

[1]

F:

G:

(b) Explain why the walls of the atria have a thinner muscular wall compared to those of the ventricles.

[1]

.....

.....

.....

(c) Complete the table below, naming stages J and K, and show what is happening to the following parts of the left side of the heart at each of the stages, H, J and K as shown in the previous diagram: [6]

- Left atrium
- Left ventricle

Stage	Left atrium	Left ventricle
H: Atrial systole	contracts to force blood into left ventricle	
J:		
K:		relaxes and fills with blood from left atrium

(d) The valves of the heart open and close during the cardiac cycle. Explain the states of the aortic valve at stages J and K. [2]

Stage J:

.....

Stage K:

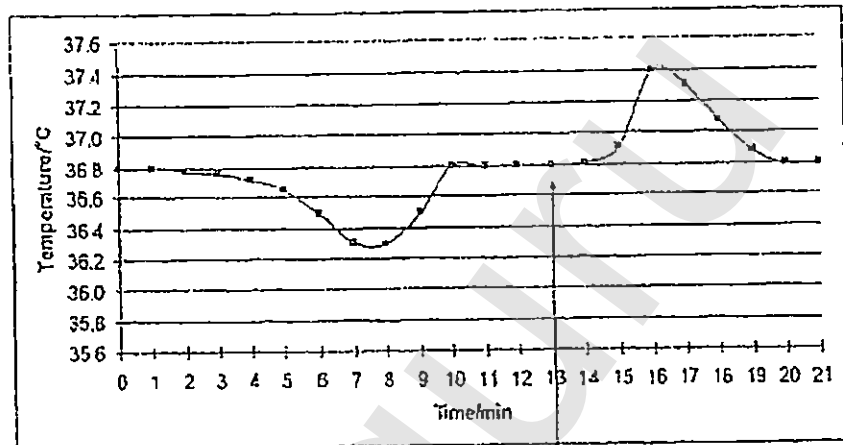
.....

[Total: 10 marks]

For
Examiner's
Use

4. The graph below shows how the temperature of a person varies with time as he was driving.

For
Examiner's
Use



- (a) At the 1st minute, the person switched on the air-conditioning in the car. Describe the mechanism that led to the change in temperature between the 8th and 10th minute. [2]

- (b) At point X, the car in front suddenly stopped, nearly causing an accident. This resulted in a change in temperature between the 14th and 16th minute. Using your knowledge of the endocrine and nervous systems, describe the mechanisms that led to this change. [3]

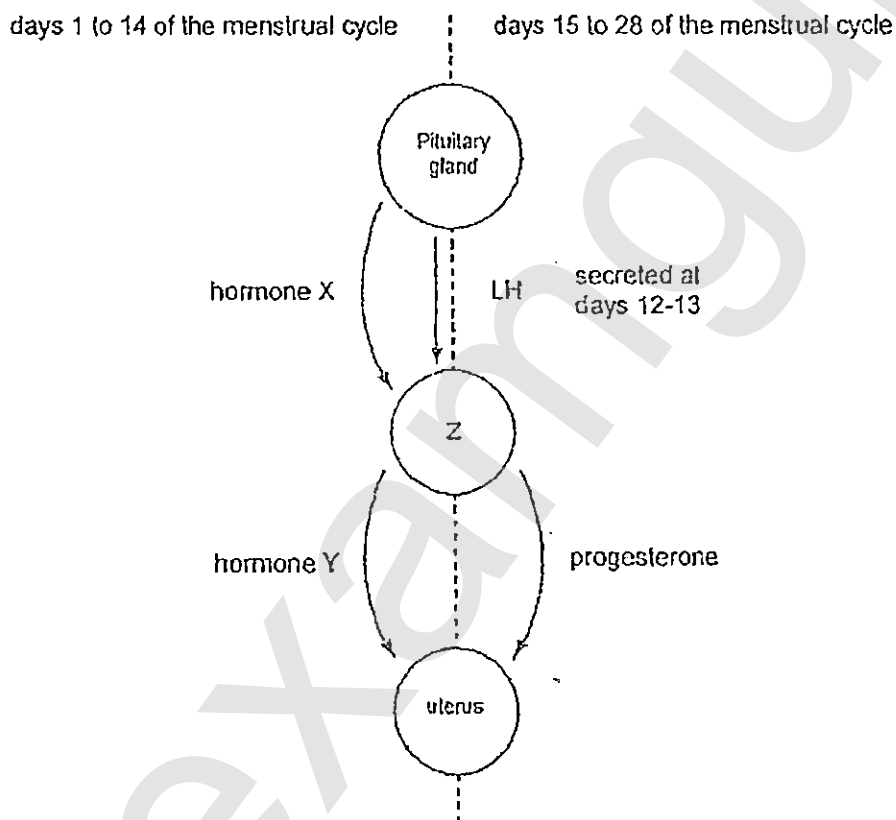
- (c) Explain how the negative feedback mechanism prevents the body temperature from rising further once the danger is past.

[2]

For
Examiner's
Use

[Total: 7 marks]

5. The human menstrual cycle is controlled by four hormones. The figure below is a diagram that shows the site of production and the target organs of these hormones.



- (a) Name hormones X and Y and organ Z.

[3]

Hormone X:

Hormone Y:

Organ Z:

(b) What is the role of progesterone in the menstrual cycle?

[1]

For
Examiner
Use

(c) Day 1 of the menstrual cycle is the first day of menstruation. Suggest the cause of menstruation.

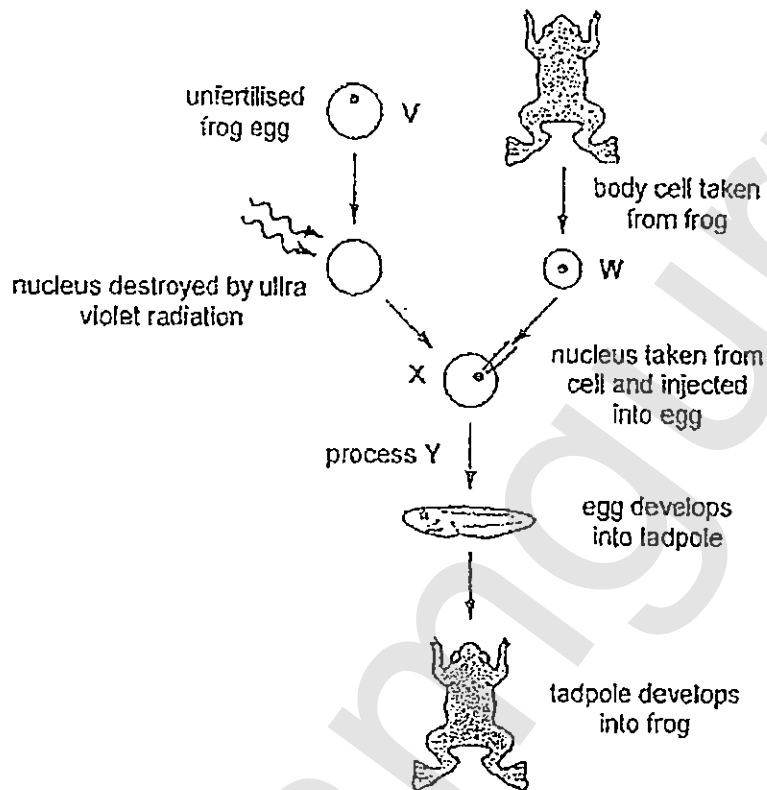
[1]

(d) Explain the process of the secretion of progesterone in a pregnant woman. [2]

[Total: 7 marks]

6. The diagram shows how genetically identical frogs can be developed from unfertilized frog eggs. The diploid number ($2n$) for frogs is 26.

For
Examiner's
Use

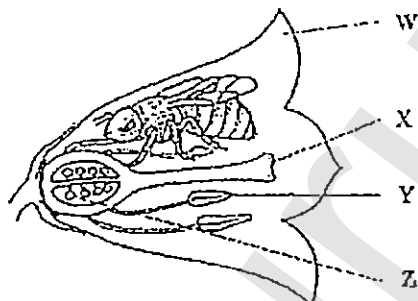


- (a) State the number of chromosomes found in cell V. [1]
-
- (b) State the number of chromosomes found in cell X. [1]
-
- (c) Name process Y. [1]
-
- (d) Would the phenotype of the final frog be identical to that of the frog that produced cell V or the frog that produced cell W? Explain your answer. [2]
-
-

[Total: 5 marks]

7. The diagram below shows a bee visiting a flower of genotype Rr after leaving another flower of the same plant. Assume no other flowers have been visited by this bee.

For
Examiner's
Use



- (a) Name the parts of the flower. [2]

W: X:

Y: Z:

- (b) What is the maximum number of offspring that could be produced from this flower based on the illustrated diagram? [1]

.....

- (c) With the aid of a genetic diagram, determine the ratio of phenotypes in the offspring that could result from this bee's visit. [3]

- (d) It was found that the offspring produced from this flower later bore flowers that all showed the dominant phenotype. Explain why this varies from the answer in (c). [1]

..... [Total: 7 marks]

~End of Section A~

Section B [30 marks]

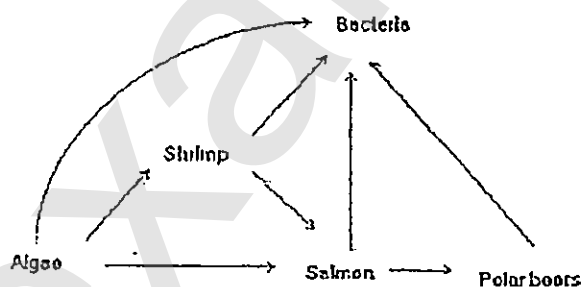
Answer three questions only.

Question 10 is in the form of an Either/Or question. Only one part should be answered.

8. In an experimental set-up, a plant is watered with water radioactively labelled with isotope ^{18}O . The plant is then placed in a sealed chamber and the radioactivity of the air in the chamber is measured over time. The table below shows the data that was obtained from the experiment.

Time/h	0	1	2	3	4	5	6	7
Radioactivity/Bq	0.0	10.0	20.0	35.0	48.0	55.0	58.0	60.0

- (a) Using the data above, draw a graph on the graph paper provided to show how radioactivity of the air changes with time. [4]
- (b) For this experiment, describe the passage of a radioactively-labelled oxygen atom in water that is used in a plant. Your answer should begin from the point the atom is taken up at the roots to the point where it is released into the atmosphere. [6]
9. Energy is transferred along food chains from one level to the next.
- (a) Explain why it is more efficient for a secondary consumer to feed on a producer instead of a primary consumer. [2]
- (b) A simple food web is shown below.



- (i) In the event of a nuclear explosion, many dust particles will be thrown into the atmosphere, thus reducing the amount of light reaching the earth. With reference to the given food web, state and explain how this decrease in the amount of light will affect the population of each organism. [5]
- (ii) Explain how DDT can build up in large quantities in polar bears, which live in the North Pole. [3]

10. EITHER

- (a) Explain the differences between mitosis and meiosis. Your explanation should include references to where the processes occur and why they occur. [5]
- (b) Explain how it is possible that parents with different blood groups are able to produce only children with blood groups different from themselves, giving specific examples. [5]

OR

- (a) State the differences between male and female human gametes in terms of size, numbers and motility. [3]
- (b) Explain the disadvantages of self-fertilisation to a flowering plant. [3]
- (c) State the differences between the reproductive parts of flowers of a wind-pollinated and an insect-pollinated plant. [4]

~This is the end of the paper. ☺~



Answers

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
D	C	B	D	B	A	C	D	A	C
11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
A	C	C	A	C	D	A	B	B	B
21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
B	C	A	B	D	C	D	B	A	D
31.	32.	33.	34.	35.	36.	37.	38.	39.	40.
A	B	D	A	B	C	B	C	C	B

Answers

	Answers	Mark
1a	- The freshwater fish cells have a <u>lower water potential</u> than the surrounding water, while the marine fish cells have a <u>higher water potential</u> than the surrounding water. - Water <u>molecules diffuse</u> into the freshwater fish <u>cells</u> by <u>osmosis</u> (gain) - Water <u>molecules diffuse</u> out of the marine fish <u>cells</u> by <u>osmosis</u> (lose)	1 ½ ½
1b	- The marine fish <u>selectively reabsorbs more water</u> - But <u>does not selectively reabsorb more/reabsorbs less</u> salts to remove the excess salts in the urine.	1 1
1c	- If circulatory fluid becomes <u>too dilute/water potential is too high</u>, water molecules will diffuse into the cells by osmosis and cells will <u>swell and lyse/burst</u>. - If circulatory fluid becomes <u>too concentrated/water potential too low</u>, water molecules will diffuse out of the cells by osmosis and cause cells to <u>shrink/dehydrate/crenate</u>.	1 1
2a	- Capillary with correct links to artery and vein (no direction 0 marks)	1
2a	- Organ: Liver - Vessel: Hepatic portal vein	½ ½
2b	- Presence of numerous mitochondria in cells - Site of respiration - Releasing of energy - Active transport	½ ½ ½ ½
2c	- Lacteal / lymphatic capillary - (Absorption of) fatty acids + glycerol / Fat globules - Ref. to (absorption into) lymphatic system/lymph vessel - Fat-soluble vitamins (bonus)	1 1 1 1 [max 2]
2d	- Secretion/production of <u>bile</u> to be stored temporarily in the gall bladder - Involved in fat emulsification OR physical digestion of large fats globules into smaller fat droplets (R: digestion of fat molecules)	1 1
3a	F: vena cava G: pulmonary artery	½ ½
3b	- Ventricles pump blood to lungs and whole body (longer distance) - Blood needs to be pumped at a higher pressure	½ ½
3c	Stages J: Ventricular systole K: Atrial & ventricular diastole Left atrium J: Relaxes, fills with blood from the pulmonary veins K: Relaxes, fills with blood from the pulmonary veins Left ventricle H: Relaxes, fills with blood from the left atrium J: Contracts, forcing blood into the aorta	1 1 1 1 1 1
3d	Stage J: Aortic valve opens Pressure in left ventricle higher than that of aorta Stage K: Aortic valve closed Pressure in aorta higher than that of left ventricle	1 1
4a	- Signal sent to <u>arterioles to constrict</u> - <u>reducing blood flow to blood capillaries at skin surface</u>	1 1

	- sweat glands less active - hair erector muscle contracts (R: increase in metabolic rate/shivering as a slight decrease in body temperature will not be enough to trigger these)	1 1
4b	- the sight of the other car sent impulses to be sent to the brain - the hypothalamus sends signals - to the adrenal gland - adrenaline secreted - increase in metabolic rates	
4c	- hypothalamus stimulated - adrenaline production ceases - existing adrenaline destroyed in the liver	1 1 1
5a	X: follicle-stimulating hormone (R:FSH) Y: oestrogen Z: ovary (R: ovaries)	1 1 1
5b	- thickens/maintains the endometrium/uterine lining of the uterus/womb - prepares endometrium for implantation of embryo - prevents menstruation/stops menstrual cycle - promotes development/maintenance of blood vessels in endometrium - prevents FSH secretion/prevents follicle development/inhibits LH	1
5c	Low levels of oestrogen and progesterone (both hormones must be mentioned)	1
5d	- progesterone will be secreted by the corpus luteum of the ovary - hormone (hCG – human chorionic gonadotropin) secreted by zygote maintains the corpus luteum for about 2-3 months - after 2-3 months, corpus luteum breaks down - placenta formed and takes over the progesterone production	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
6a	13	1
6b	28	1
6c	Mitosis / Differentiation	1
6d	Frog that produced cell W Cell X contains entire nucleus of cell W Same DNA (genetically identical) as cell W	1 $\frac{1}{2}$ $\frac{1}{2}$
7a	W: standard petal R: keel petal / wing petals X: stigma (R: style) Y: anther (R: filament) Z: ovule R: ovum	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
7b	8	1
7c	Parental phenotype Parental genotype Gametes Offspring genotype Offspring phenotype Ratio (3:1 dominant:recessive)	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
7d	Small sample size of 8 only	1
8a	- correctly plotted points - correctly labeled axis w units (x-axis: time/h, y-axis: radioactivity/Bq) - appropriate scale - best fit curve	1 1 1 1
8b	- Oxygen atom enters as water through root hair cells - via osmosis - diffuses from one cell to the adjacent cell - travels up xylem - drawn up by capillary action/ root pressure - transpiration pull - enters the mesophyll cells from xylem via osmosis	$\frac{1}{2}$ each [max 6]

	- photosynthesis equation - photolysis in the presence of light - H_2O molecule broken down - 24 hydrogen atoms and 6 oxygen molecules formed - oxygen diffuses from cell to cell - dissolves in moisture lining the spongy cells - diffuses through stomata into external environment													
9a	- energy is lost at each trophic level/more energy is available at lower trophic levels - energy is lost through heat/respiration, uneaten body parts, egested material, excreted material	1 1												
9bi	- reduces the rate of photosynthesis - reduces population of algae (producer) - reduces population of shrimp, salmon and polar bears - bacteria population will increase as first as other organisms die (less competition for food) - but will eventually decrease	1 1 1 1 1												
9bii	- DDT is insoluble and non-biodegradable/cannot be broken down by microorganisms - accumulate in the algae/shrimp/salmon (bioaccumulation) - concentrated in the fatty tissues of the final consumers (polar bears) when they feed on organisms lower down in food chain (bioamplification)	1 1 1												
Either 10a	<table border="1"> <thead> <tr> <th>Mitosis</th><th>Meiosis</th></tr> </thead> <tbody> <tr> <td>Chromosome number maintained/diploid</td><td>Chromosome number halved/haploid</td></tr> <tr> <td>Genetically identical offspring/clones</td><td>Genetically non-identical daughter cells</td></tr> <tr> <td>2 offspring from 1 parent</td><td>4 offspring from 1 parent</td></tr> <tr> <td>Growth/repair of worn out cells</td><td>To produce gametes</td></tr> <tr> <td>Eg of where: Animals/humans/normal (somatic) body cells/bacteria</td><td>Eg of where: In gonads/testes/ovaries/anthers</td></tr> </tbody> </table>	Mitosis	Meiosis	Chromosome number maintained/diploid	Chromosome number halved/haploid	Genetically identical offspring/clones	Genetically non-identical daughter cells	2 offspring from 1 parent	4 offspring from 1 parent	Growth/repair of worn out cells	To produce gametes	Eg of where: Animals/humans/normal (somatic) body cells/bacteria	Eg of where: In gonads/testes/ovaries/anthers	[max 5]
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10b	- Correct parental blood groups identified (AB and O, OR A and B) - (in text or diagram) parents' genotypes identified as $I^A I^O$ and $I^O I^O$, OR $I^A I^A$ and $I^O I^O$ - *Correct gametes identified for both parents - *the word <u>gametes</u> correctly used - *Genotype of offspring ($I^A I^O$ + $I^O I^O$ OR $I^A I^A$) shown - Blood groups of offspring identified as Group A and B OR AB *available with wrong genotypes as long as they match	[max 5]												
Or 10ai	<table border="1"> <thead> <tr> <th></th><th>Male gamete</th><th>Female gamete</th></tr> </thead> <tbody> <tr> <td>Size</td><td>5 μm Small in comparison to female gamete / egg / ovum</td><td>120 μm Large and spherical</td></tr> <tr> <td>Numbers</td><td>Millions produced upon ejaculation / upon puberty</td><td>A few thousand available at birth, one egg released (R: produced) every month upon start of puberty</td></tr> <tr> <td>Motility</td><td>Motile</td><td>Non-motile, swept</td></tr> </tbody> </table>		Male gamete	Female gamete	Size	5 μm Small in comparison to female gamete / egg / ovum	120 μm Large and spherical	Numbers	Millions produced upon ejaculation / upon puberty	A few thousand available at birth, one egg released (R: produced) every month upon start of puberty	Motility	Motile	Non-motile, swept	
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Motility	Motile	Non-motile, swept												

		(R; mobile), movement propelled by flagella	along fallopian tubes by sweeping action of cilia and peristaltic movement													
10b	- fewer or no new alleles/genes - limited genetic variation - limited evolution/less likely to adapt to/limited resistance to <u>changes in environment</u> - likelihood of appearance of in-bred weaknesses AW / no hybrid vigour / decreased fertility AW - increased likelihood of expressing harmful recessive traits to the offspring			1 1 1 1 1 [max 3]												
10b	Insect stigma – small compact, do not protrude out of flower stamen – non pendulous, do not protrude out of flower pollen – fairly abundant, usually larger with rough surfaces Wind Stigma – large feathery, protrude out of flower Stamen – long pendulous filament, protruding anthers Pollen – more abundant, usually smaller and lighter and smooth surfaces <table border="1"> <thead> <tr> <th></th> <th>Insect pollination</th> <th>Wind pollination</th> </tr> </thead> <tbody> <tr> <td>Stigma</td> <td>Small and compact Enclosed within flower</td> <td>Large and feathery Protrude out of flower</td> </tr> <tr> <td>Stamen</td> <td>Non-pendulous</td> <td>Long and pendulous</td> </tr> <tr> <td>Pollen grains</td> <td>Larger, with rough / spikey surfaces Abundant numbers</td> <td>Smaller, with smooth surfaces More abundant</td> </tr> </tbody> </table>				Insect pollination	Wind pollination	Stigma	Small and compact Enclosed within flower	Large and feathery Protrude out of flower	Stamen	Non-pendulous	Long and pendulous	Pollen grains	Larger, with rough / spikey surfaces Abundant numbers	Smaller, with smooth surfaces More abundant	4
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Name:		Index Number:		Class:	
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CATHOLIC HIGH SCHOOL
Preliminary Examination 3
Secondary 4

BIOLOGY

5158/1

Thursday 18 September 2014

1 hour

Additional Materials: Optical Answer Sheet (OAS)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, index number and class on the OAS in the spaces provided.

DO NOT WRITE ON ANY BARCODES.

There are forty questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D.

Choose the one you consider correct and record your choice by shading in pencil on the OAS. Erase all incorrect answers cleanly.

Each correct answer will score one mark.

Any rough working should be done in this booklet.

Electronic calculators may be used.

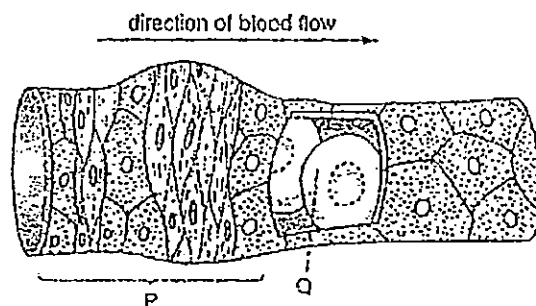
For examiner's use only:

Total	/ 40
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This paper consists of 15 printed pages.

[Turn over

- 1 The diagram shows blood passing through an arteriole into a capillary. Part of the capillary wall has been cut away to show the blood.



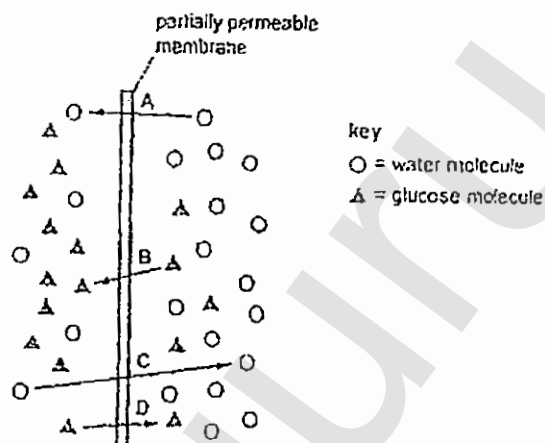
What is the level of organisation of the structures labelled P and Q?

	P	Q
A	organ	cell
B	organ	tissue
C	tissue	cell
D	tissue	tissue

- 2 An amino acid enters a cell and is then used to synthesise an enzyme secreted by the cell. What is the sequence of cell structures involved in the synthesis of the enzyme?

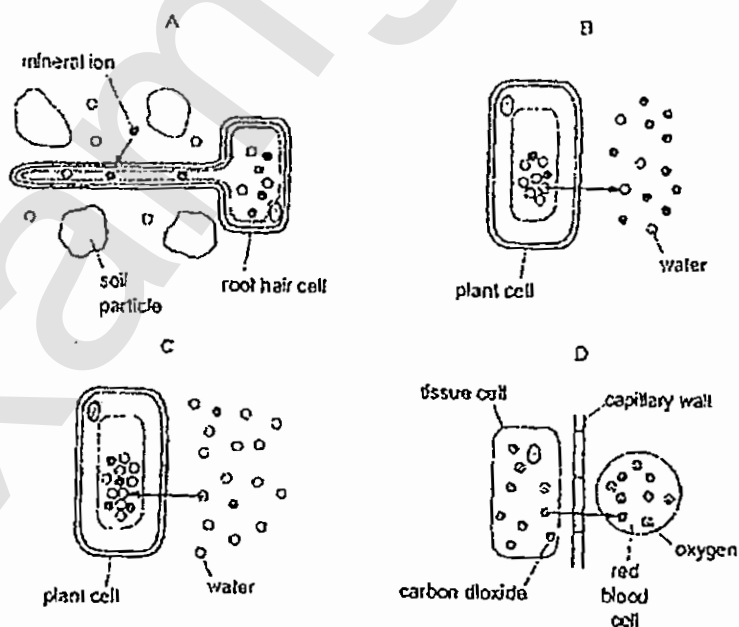
	first	→ last		
A	endoplasmic reticulum	Golgi apparatus	ribosome	exocytotic vesicle
B	endoplasmic reticulum	ribosome	Golgi apparatus	cell surface membrane
C	ribosome	endoplasmic reticulum	Golgi apparatus	exocytotic vesicle
D	ribosome	Golgi apparatus	endoplasmic reticulum	cell surface membrane

- 3 The diagram represents the passage of water molecules and glucose molecules across a partially permeable cell surface membrane.



Which arrow indicates osmosis?

- 4 Which diagram illustrates the process of active transport?



- 5 Which molecule contains peptide bonds?

A cholesterol
 B deoxyribonucleic acid
 C glycogen
 D haemoglobin

6 What is a role of essential fatty acids in the body?

- A as part of cell membranes
- B as part of cell walls
- C to use for DNA formation
- D to use for enzyme formation.

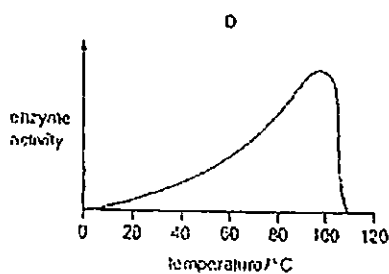
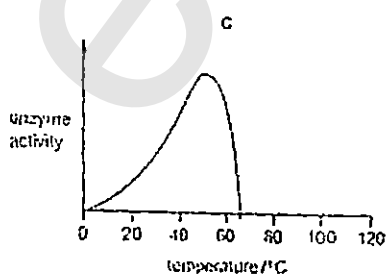
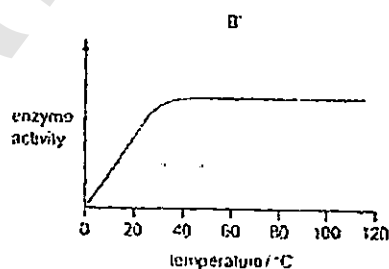
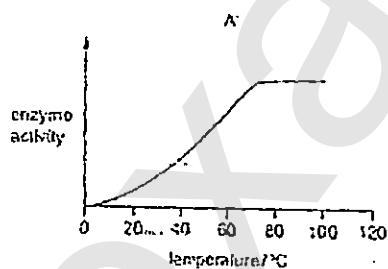
7 A student carried out four tests for biological molecules on a solution. The results are shown in the table.

test for biological molecules	observation
iodine solution	orange-brown
biuret	purple
Benedict's	orange
emulsion	clear

Which three molecules may be originally present in this solution?

- A amylase, starch, oil
- B amylase, starch, water
- C egg white, glucose, oil
- D egg white, sucrose, water

8 A bacterium lives in hot springs at temperatures of 75°C to 85°C. Which graph represents the activity of enzymes found in these bacteria?



- 9 The table shows the rates of absorption of two different sugars, arabinose and glucose, in living and dead intestines. The concentrations of the sugars inside the intestines were the same in each case.

	rate of absorption (arbitrary units)	
	arabinose	glucose
living intestine	31	102
dead intestine	31	34

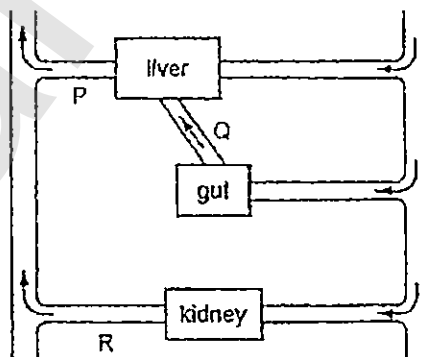
What are the main methods of absorption of arabinose and glucose in living intestine?

	arabinose	glucose
A	active transport	active transport
B	active transport	diffusion
C	diffusion	active transport
D	diffusion	diffusion

- 10 The small intestines of cows are similar in general structure and function to the small intestines of humans. A disease in cows reduces the number of villi in their small intestines. The cows lose weight and become weak. What explains this?

- A less amylase produced
B less peristalsis
C slower absorption of nutrients
D slower digestion of proteins

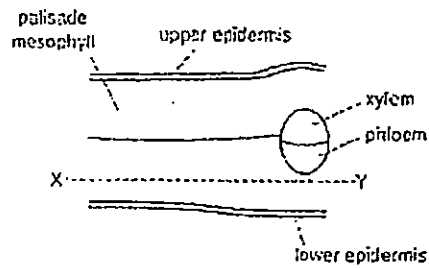
- 11 The diagram represents some human organs and their blood vessels.



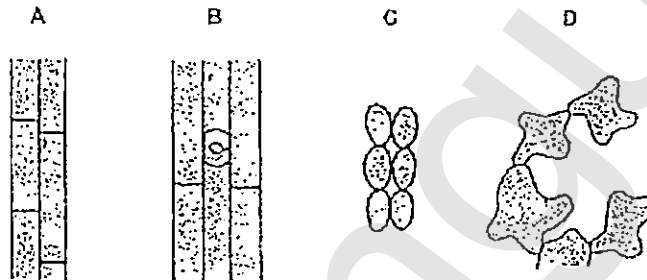
Immediately after taking an alcoholic drink, how would the levels of alcohol compare in blood vessels P, Q and R?

	P	Q	R
A	high	medium	high
B	medium	high	low
C	low	low	medium
D	high	low	low

- 12 The diagram shows the arrangement of the tissues of a leaf as seen in cross-section under the microscope.



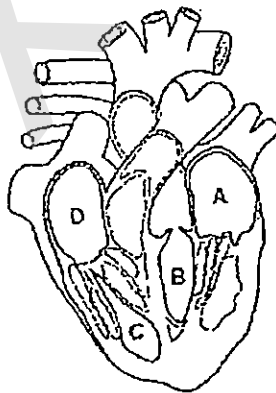
What is the arrangement of the cells in the section X-Y?



- 13 What is the main source of the energy that causes water to rise up a plant stem?

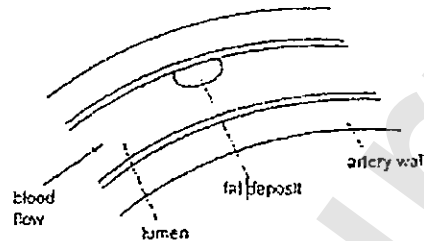
- A. difference in water potential between cell sap and soil water
- B. heat from the Sun
- C. light absorbed by chlorophyll
- D. respiration of sugars made in photosynthesis

- 14 In a medical investigation, a dye was injected into the renal artery of a patient. The dye was not filtered out of the blood in the kidneys.



Which chamber of the heart would be the first to receive blood with this dye in it?

- 15 The diagram shows a section of the coronary artery with damage that may result in a heart attack.



What best describes the events that could lead to a heart attack?

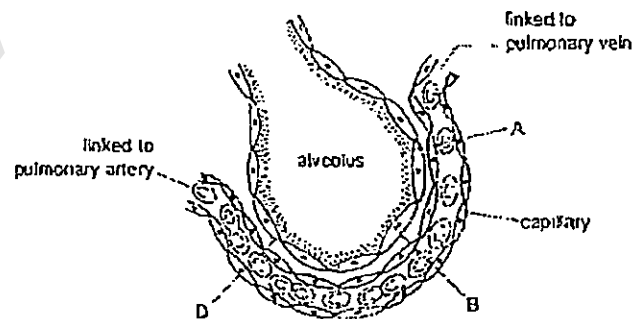
- A further fat deposits followed by platelet and red blood cell destruction
 - B further fat deposits followed by platelets forming a fibrin mesh restricting blood flow
 - C hardening the artery wall preventing diffusion across the wall
 - D restriction of the artery lumen by a clot causing less oxygen per cm^3 of blood
- 16 The diagram shows a section through part of a vein.



What could be the first organs found in the directions 1 and 2?

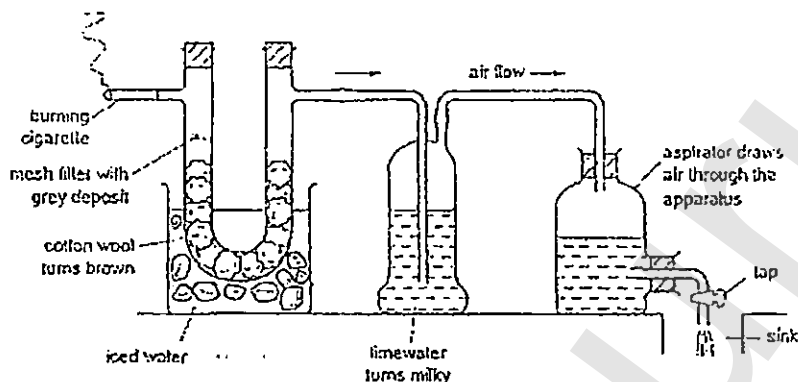
	1	2
A	heart	brain
B	intestine	liver
C	kidney	heart
D	lung	heart

- 17 The diagram shows an alveolus and an associated blood capillary.



At which point will the greatest rate of diffusion of carbon dioxide occur?

- 18 The diagram shows the apparatus used to show some of the materials in cigarette smoke. The labels indicate the results after five minutes.



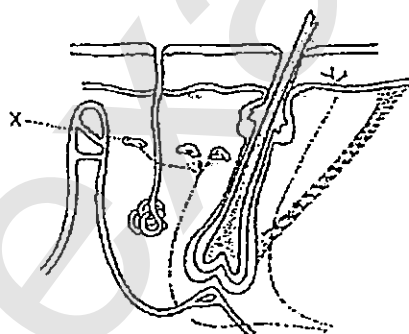
Which materials that are in cigarette smoke did this apparatus detect?

	grey deposit on mesh filter	cotton wool turns brown	limewater turns milky
A	nitrites	nicotine	carbon dioxide
B	nitrites	tar	carbon monoxide
C	particles	nicotine	carbon monoxide
D	particles	tar	carbon dioxide

- 19 What would be normally absent from the glomerular filtrate in the kidney?

A glucose B protein C salts D urea

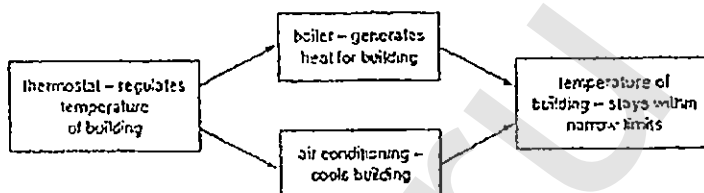
- 20 The diagram shows some of the structures seen in a section through human skin.



What is the function of structure X?

- A to cause capillaries to constrict
 B to detect changes in temperature
 C to receive impulses from the central nervous system
 D to stimulate sweat glands to release sweat

- 21 The diagram shows a way of regulating the temperature of a building.



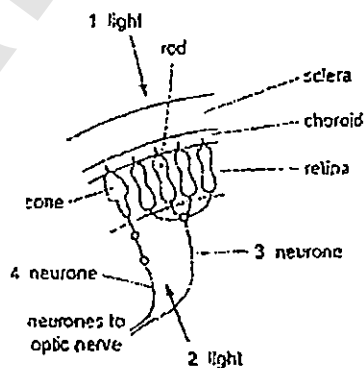
Which shows the equivalent organs that regulate the temperature of the human body?

	air conditioning	boiler	thermostat
A	brain	lungs	skin
B	lungs	brain	muscles
C	skin	liver	brain
D	stomach	skin	heart

- 22 What is the role of motor neurones in reflex action?

- A carrying nerve impulses from the central nervous system to an effector
- B connecting a receptor to the central nervous system
- C forming a synapse with a sensory neurone
- D transferring energy from the stimulus to a nerve impulse

- 23 The diagram shows a very small section of the retina with microscopic detail of four rods and a cone.



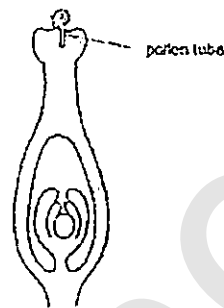
Which arrow shows the direction that the light passes to stimulate the retinal cells, and, at low level light intensity, which of the two neurones will fire impulses?

	direction of light	neurone fired
A	1	3
B	1	4
C	2	3
D	2	4

- 24 How does adrenaline affect glucose uptake by muscle cells and carbohydrate conversion by liver cells?

	glucose uptake	carbohydrate conversion
A	decreases	glucose to glycogen
B	decreases	glycogen to glucose
C	increases	glucose to glycogen
D	increases	glycogen to glucose

- 25 The diagram shows a vertical section through the carpel of a flower that has been pollinated.



What is the correct order of structures through which the pollen tube must grow in order to bring about fertilisation?

	first			last
A	micropyle	stigma	style	ovary wall
B	ovary wall	micropyle	stigma	style
C	stigma	style	ovary wall	micropyle
D	style	ovary wall	micropyle	stigma

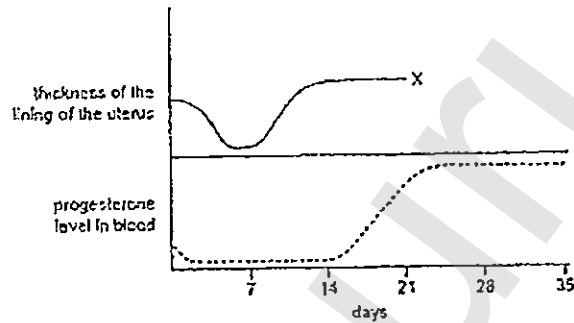
- 26 What are involved in reproduction in both animals and plants?

- A ovary and embryo
- B ovary and testes
- C ovule and stigma
- D uterus and embryo

- 27 What is the result of cutting both the sperm ducts in a man?

- A He is unable to develop sperms.
- B He is unable to pass urine.
- C Male sex hormones no longer circulate in his blood.
- D Sperms are not emitted from the urethra.

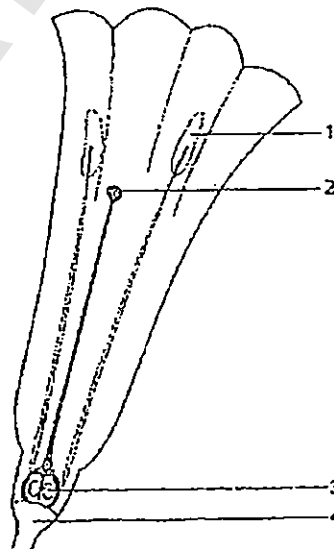
- 28 The diagram shows the relationship between progesterone levels and the thickness of the lining of the uterus.



Which segment needs to be added at X to complete the diagram?



- 29 The diagram shows a section through a flower.



In which structures are haploid nuclei formed by reduction division?

- A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4

- 30 If the mass of DNA in a normal body cell is Z , how much DNA will be present in a cell after the completion of mitosis, after completion of meiosis and in an egg after completion of fertilisation?

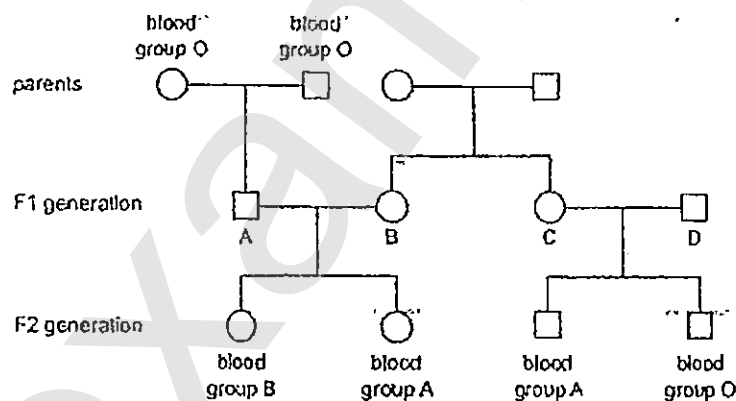
	after completion of mitosis	after completion of meiosis	after completion of fertilisation
A	Z	$\frac{1}{2}Z$	Z
B	Z	$2Z$	$2Z$
C	$\frac{1}{2}Z$	$2Z$	$2Z$
D	$2Z$	$\frac{1}{2}Z$	Z

- 31 Which statement is true of both chromosomes and genes?

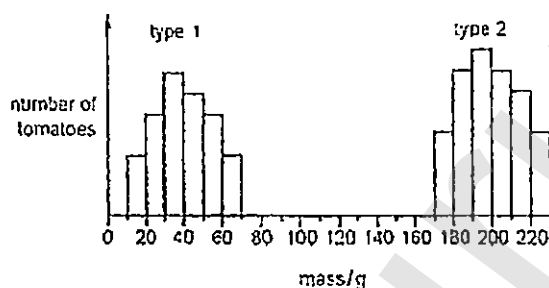
- A Each codes for a specific protein.
- B Each may be copied and passed on in mitosis.
- C Each may be either dominant or recessive.
- D Each may exist as two or more alleles.

- 32 The diagram shows the blood group phenotypes of some members of a family.

Which member of the F1 generation must be heterozygous, with the codominant alleles?



33 The graph shows the masses of two different types of tomato.



What can be concluded from the graph?

- A Genes do not affect the mass of tomatoes.
- B Type 1 tomatoes show continuous variation.
- C Type 2 tomatoes are sometimes smaller than type 1 tomatoes.
- D Type 2 tomatoes show discontinuous variation.

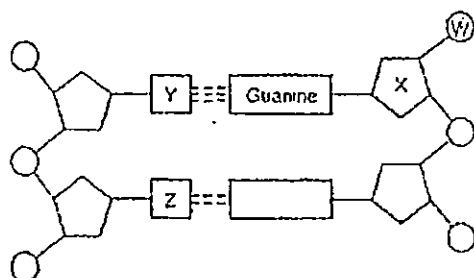
34 Which outcomes might farmers want to achieve by using artificial selection?

	increased	decreased
A	fertiliser use	pesticide use
B	growth rate	yield
C	pesticide use	growth rate
D	yield	fertiliser use

35 Which statement about chromosomes is correct?

- A Chromosomes are long DNA molecules called genes which are divided into sections.
- B Chromosomes include a long molecule of DNA divided into sections called genes.
- C Chromosomes include genes which are divided into sections called DNA molecules.
- D Genes include long DNA molecules called chromosomes.

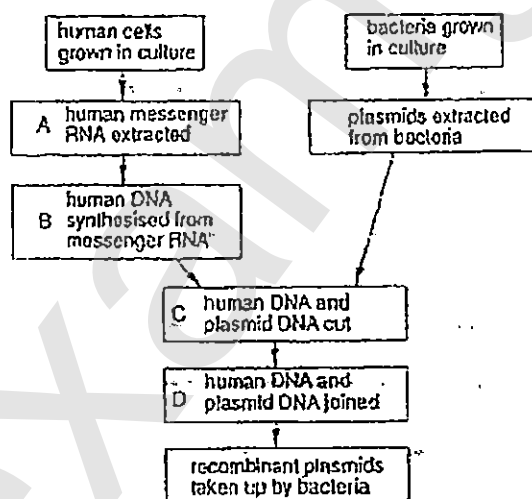
- 36 The diagram shows part of a DNA molecule.



Which letters indicate cytosine, pentose, phosphate and thymine?

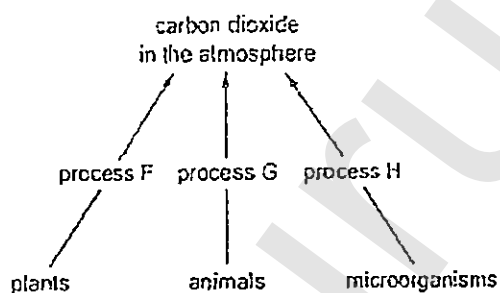
	cytosine	pentose	phosphate	thymine
A	W	X	Y	Z
B	Y	X	W	Z
C	Z	W	X	Y
D	Y	Z	X	W

- 37 The following diagram shows some of the events in the synthesis of a human hormone by genetic engineering.



At which stage in the process is a restriction enzyme used?

38 The diagram shows some of the stages in the carbon cycle.



What are processes F, G and H?

	process F	process G	process H
A	photosynthesis	respiration	photosynthesis
B	photosynthesis	respiration	respiration
C	respiration	respiration	respiration
D	respiration	photosynthesis	photosynthesis

39 Which pollutants of water can lead to eutrophication?

	fertilisers	herbicides	insecticides	sewage
A	✓	✓	x	x
B	✓	x	x	✓
C	x	✓	✓	x
D	x	x	✓	✓

40 Cutting down tropical rain forest trees has many consequences.

Which of these consequences could lead to global warming?

- | | | | |
|---|-----------------------------|---|------------------------------|
| A | fewer organisms decomposing | C | less carbon dioxide absorbed |
| B | fewer roots in ground | D | soil erosion |

- End of Paper -

Name:	Index Number:	Class:
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CATHOLIC HIGH SCHOOL
Preliminary Examination 3
Secondary 4

A1

BIOLOGY

5158/2

18 Sep 2014

1 hr 45 minutes

Additional Materials: **NIL**

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

DO NOT WRITE ON THE MARGINS

Answer all questions in the space provided.

For examiner's use only:

Question 1	/ 9
Question 2	/ 7
Question 3	/ 9
Total	/ 25

At the end of the examination, fasten all your work for each section securely together.

Hand in each section separately.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of 20 printed pages.

[Turn over

Section A: Answer all questions in this section in the spaces provided.

1

Fig. 1.1 shows a vertical section of the stomach, together with the parts of the alimentary canal leading into and out of it.

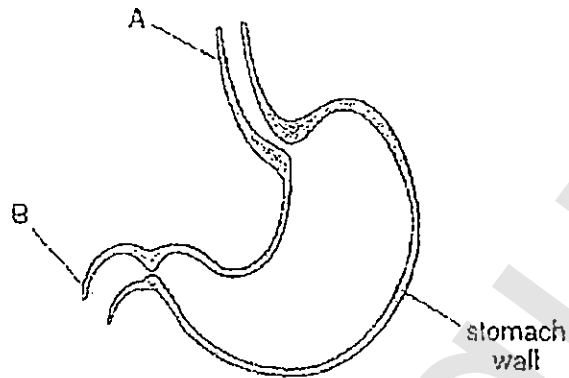


Fig. 1.1

(a) Name the parts A and B.

A

B[2]

The stomach is a bag-like structure with very muscular walls.

(b) Explain the role of the muscles in the stomach wall.

.....
.....
.....
.....
.....
.....[3]

- 10 cm³ of a cloudy egg white suspension, the protein, was placed into each of four test-tubes. Other substances were added as shown in Table 1.1.

Table 1.1

test-tube	volume / cm ³			
	egg white suspension	hydrochloric acid	pepsin	water
1	10	2	3	0
2	10	0	3	2
3	10	2	0	3
4	10	0	0	5

Describe and explain the processes and conditions that cause the change in appearance of test-tube 1.

4

[Total: 9]

2

- (a) Fig. 2.1 shows a section through a leaf. A leaf is designed for photosynthesis and this process provides a supply of simple sugars for a plant.

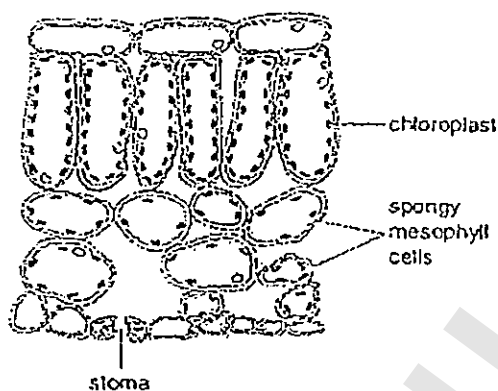


Fig. 2.1

- (i) State the function of the chloroplasts in photosynthesis.

.....
[1]

- (ii) Describe and explain the advantage of the distribution of the chloroplasts as shown in Fig. 2.1.

.....

[2]

- (iii) Suggest the function of the stomata and the spaces between the spongy mesophyll cells in the process of photosynthesis.

.....

[3]

- (b) Name the tissue that transports amino acids around the plant.

.....[1]

[Total: 7]

3

Fig. 3.1 shows an incomplete diagram of the female urinary system.

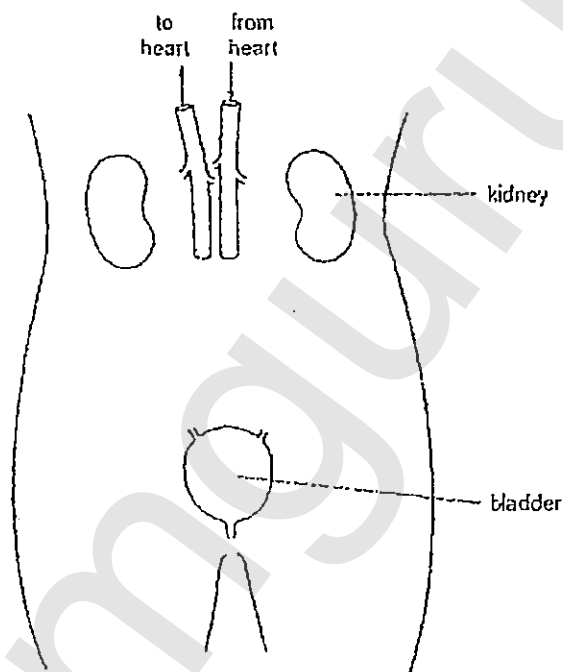


Fig. 3.1

- (a) On Fig. 3.1, draw and label the following parts:
renal artery, urethra and ureter.

[3]

- (b) If the kidneys fail, the patient may be put on a kidney machine. Explain how a kidney machine works.

4

- (c) Outline the role of the kidneys in homeostasis.

.....

.....

.....

.....[2]

[Total: 9]

Name:		Index Number:		Class:	
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CATHOLIC HIGH SCHOOL
Preliminary Examination 3
Secondary 4

A2

BIOLOGY

5158/2

18 Sep 2014

1 hr 45 minutes

Additional Materials: NIL

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DO NOT WRITE ON THE MARGINS

Answer all questions in the space provided.

For examiner's use only:

Question 4	/ 7
Question 5	/ 5
Question 6	/ 7
Question 7	/ 6
Total	/ 25

At the end of the examination, fasten all your work for each section securely together.

Hand in each section separately.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of 20 printed pages.

[Turn over

Section A: Answer all questions in this section in the spaces provided.

4

Fig. 4.1 shows part of the internal structure of the human eye.

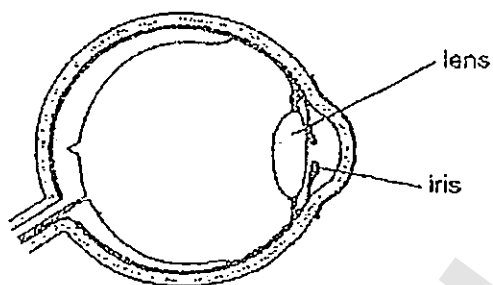


Fig. 4.1

- (a) On the following two diagrams, the lens and the iris are missing.
 (i) On Fig. 4.1a below, draw the iris to show how it would appear when the eye is receiving less light than the eye in Fig. 4.1.

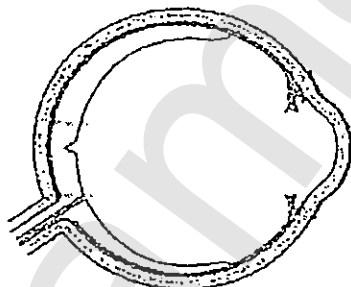


Fig. 4.1a

- (ii) On Fig. 4.1b, draw the lens to show how it would appear when the eye is focused on an object closer to the eye than in Fig. 4.1. [1]

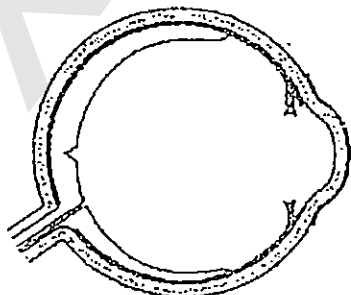


Fig. 4.1b

[1]

A line graph showing the relationship between light intensity and pupil diameter. The y-axis is labeled 'diameter of pupil / mm' and ranges from 0 to 10. The x-axis is labeled 'light intensity / arbitrary units' and ranges from 0 to 10. The curve starts at a diameter of about 8 mm at zero light intensity and decreases as light intensity increases, leveling off at approximately 1.2 mm for intensities above 8 units.

light intensity / arbitrary units	diameter of pupil / mm
0	8.0
1	7.5
2	6.5
3	4.5
4	3.5
5	2.8
6	2.2
7	1.8
8	1.5
9	1.3
10	1.2

(b) Explain how the response is brought about as the light intensity is increased from 2 to 4 arbitrary units.

15

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5

The production of chlorophyll in a variety of tomato plant is controlled by a gene. The dominant allele causes normal chlorophyll production and the recessive allele causes a lack of chlorophyll in the leaves.

- (a)(i) Using the symbols, G to represent the dominant allele and g to represent the recessive allele, explain, using a genetic diagram, the expected outcome of crossing two heterozygous tomato plants.

[4]

- (ii) If 500 seeds from the heterozygous cross were germinated, how many seedlings would you expect to have green leaves and how many white leaves?

green leaves white leaves [1]

[Total: 5]

6

Fig. 6.1 shows a cell of a female fruit fly, *Drosophila melanogaster*, during 2 stage of mitosis.

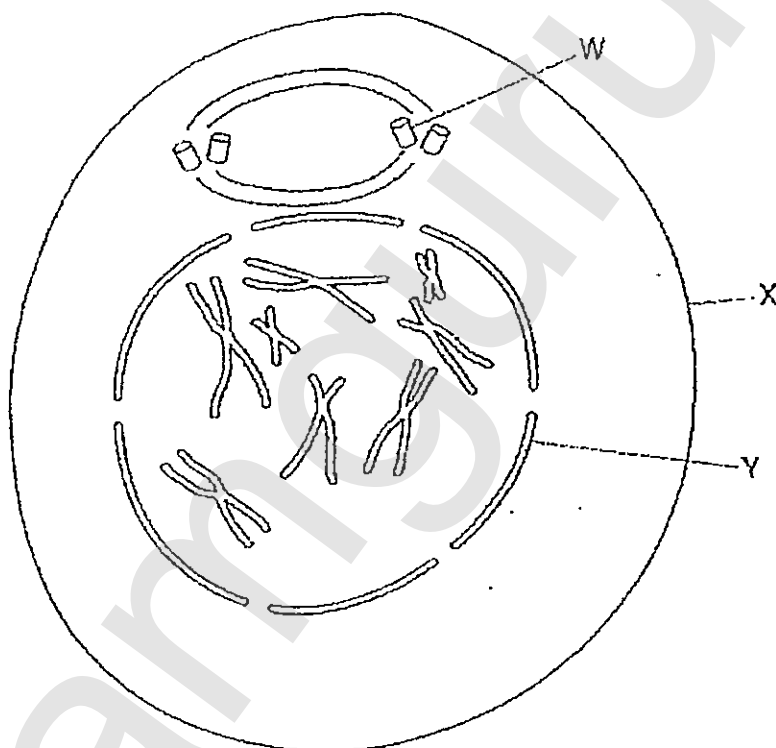


Fig. 6.1

(a)(i) Name the stage of mitosis shown in Fig. 6.1.

.....[1]

(ii) Shade a pair of homologous chromosomes.

[1]

(iii) Name the structure labelled W and state its function.

.....

[2]

- 3

7

energy contained within food

3% of this energy stored in tissue

60% of this energy passes through the ox

licks

(a) State the source of the energy in the food eaten by the ox.

.....[1]

1.
2. [2]

The bird on the ox's back is an oxpecker that feeds both on blood-sucking parasites (ticks) living on the ox, and on blood from the ox's wounds.

- (c) Explain why there must always be fewer oxpeckers than ticks in this food web.

.....

.....

.....

.....

.....[3]

[Total: 6]

Name:	Index Number:	Class:
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CATHOLIC HIGH SCHOOL
Preliminary Examination 3
Secondary 4

B

BIOLOGY

5158/2

18 Sep 2014

1 hr 45 minutes

Additional Materials: **NIL**

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

DO NOT WRITE ON THE MARGINS

Answer all questions in the space provided.

Question 10 is in an Either/OR form. Write an E (for Either) or an O (for Or) next to the number 10 in the grid below to indicate which question you have answered.

Additional lines are provided at the end of booklet B (on page 20) to continue answers for parts of the essay question.

You must indicate the question number and the relevant part that is continued.

For examiner's use only:

Question 8	/ 10
Question 9	/ 10
Question 10	/ 10
Total	/ 30

At the end of the examination, fasten all your work for each section securely together.

Hand in each section separately.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of 20 printed pages.

[Turn over

Section B: Answer all questions in this section in the spaces provided.

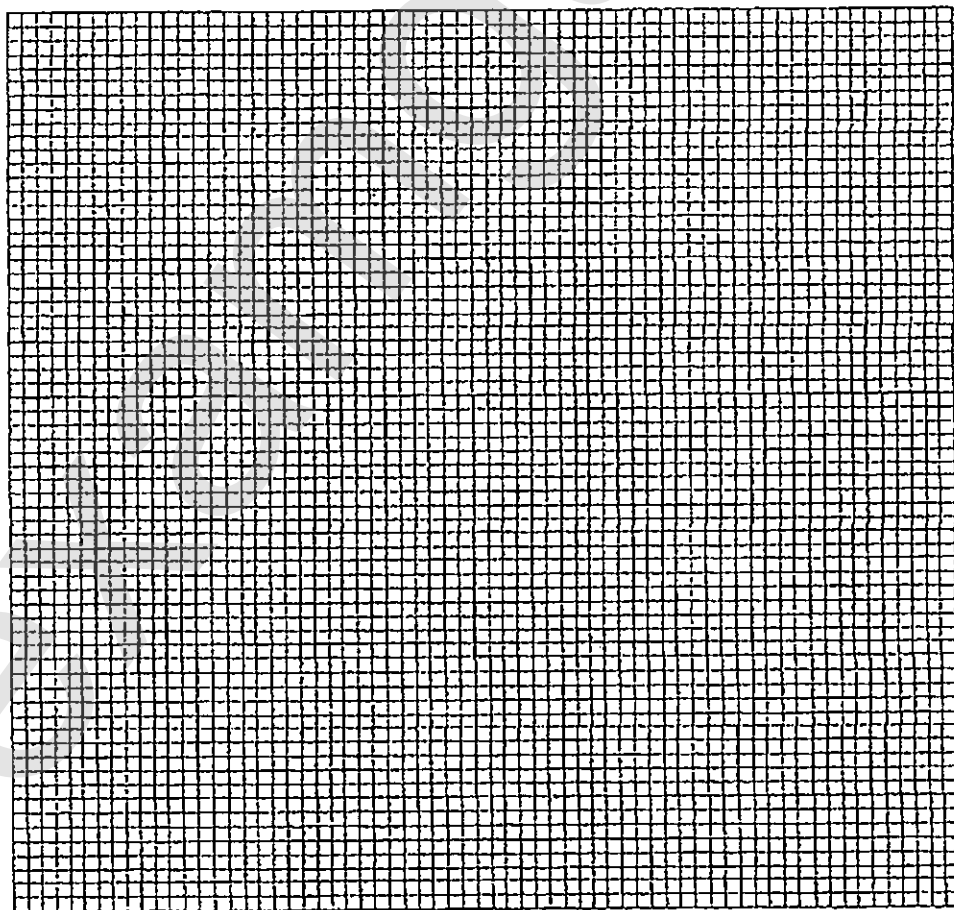
Table 8.1 shows the rate of water loss by a plant over a period of 15 hours.

Table 8.1

time /hours	rate of water loss /grams per hour
0600	12
0900	18
1200	24
1500	24
1800	20
2100	10

- (a) Plot the data in Table 8.1 on the graph paper below.

[4]



- (b) State two environmental factors, apart from humidity, that can cause a change in water loss and explain how each of these has its effect.

1 factor

explanation

.....

.....

.....

.....

.....

2 factor

explanation

.....

.....

.....

.....

.....[6]

[Total: 10]

9

(a) State the equation for anaerobic respiration in yeast.

[1]

(b)(i) Describe and explain the changes that occur in breathing and heartbeat as a person climbs a mountain.

[4]

(ii) Explain how these changes affect the working of the leg muscles during the climb.

[5]

[Total: 10]

10 EITHER

(a) State the products of an ovary in a woman and describe the roles of each of these products.

- (E)

- [Faint background watermark text: "Exam" and "Q&A"]*

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(a) Explain what is meant by the terms
(i) gene;

.....

.....

.....

.....

.....

.....

.....

.....

[4]

[6]

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Additional Lines for answers
Please indicate Question number and part of question that is continued here.

Example question



CATHOLIC HIGH SCHOOL

SECONDARY 4 BIOLOGY

Mark Scheme of 2014 Preliminary Examination 3

Paper 1 (40 marks)

1	2	3	4	5	6	7	8	9	10
A	C	A	A	D	A	B	D	C	C
11	12	13	14	15	16	17	18	19	20
B	D	B	D	B	A	D	D	B	B
21	22	23	24	25	26	27	28	29	30
C	A	C	D	C	A	D	A	A	A
31	32	33	34	35	36	37	38	39	40
B	B	B	D	B	B	C	C	B	C

Catholic

2014 Biology Preliminary 3 Paper 2
Answer Scheme

Section A

- 1 (a) {A} oesophagus/gullet [1]
{B} duodenum [1] I: small intestines
- 1 (b) - contract + mix food [1] I: squeeze
- and gastric/digestive juices/(named) enzymes/HCl [1]
- (mechanical) break down food/increase surface area [1]
- moving food along/emptying/peristalsis [1]
- sphincters [1]
- control the entry and exit (to and from the stomach) [1]
- gastric glands secrete mucus [1]
[max 3]
- 1 (c) - protein/egg white has been, digested/broken down + (converted) into, (poly)peptides/amino acids [1] which are soluble [1]
- (caused) an enzyme/protease/pepsin [1]
- acid/lower pH (as environmental factor) [1] I: acid acting alone
- 37°C/body temperature + ref to optimum temp [1]
[max 4]
- [Total: 9]
- 2 (a) (i) To trap/capture/absorb light/convert light energy to chemical energy [1]
A: take in light I: refs. to catch light/hold chlorophyll/make starch/food etc
- 2 (a) (ii) - more in upper part of mesophyll/palisade layer/palisade mesophyll [1]
- to get maximum absorption of light/nearer the light/closer to light [1]
A: Increase amount of light taken in
- arranged in cells to avoid overlap/orientated at right angles to light [1] (refers to chloroplasts)
[max 2]
- 2 (a) (iii) - (open) stomata allow diffusion/entry [1] of carbon dioxide [1]
(CO₂ into leaf – 2 marks
CO₂ and oxygen moving in and out – 2 marks
oxygen and CO₂ moving in and out – 1 mark)
- stomata open in the light/during day [1]
- spaces allow circulation/diffusion of gas/carbon dioxide [1]
- distribution/availability to all mesophyll cells/reach all mesophyll cells [1]
I: refs. to oxygen/water/transpiration
[max 3]
- 2 (b) Phloem/sieve tubes/phloem tubes [1]
- [Total: 7]

- 3 (a) one mark for each part (drawn) and labelled correctly:
 renal artery [1]
 urethra [1]
 ureter [1]
 Max 2 for only labels without drawings
- 3 (b) - ref. to blood enters machine from patient AW [1] (ONLY CREDIT ONCE)
 - blood passes along + dialysis tubing AW / visking tubing / cellulose or cellophane tubing [1]
 - ref. to tubing AW being semi-permeable / selectively permeable/ acting as a filter AW [1]
 - ref. to surrounding fluid containing + some salts / glucose/ no urea [1]
 - waste materials/excess materials + pass from blood [1]
 - ref. to diffusion [1]
 - ref. to pump/bubble trap/counter flow [1]
 - 'cleaned' blood returns + to patient's circulation/body AW [1] (CREDIT ONCE)
 [max 4]
- 3 (c) - ref. to maintaining level of named substance in blood [1]
 - method outlined, e.g. filtration/reabsorption/osmosis/diffusion [1]

[Total: 9]

- 4 (a) (i) Iris drawn with wider gap [1]
- 4 (a) (iii) Lens drawn with greater bulge [1]
- 4 (b) - light sensitive/receptor (cells) or named/retina [1]
 - neurones/nerve cells or fibres [1] A: optic nerve
 - impulses [1]
 - contraction + circular muscles [1] R: if reference ciliary.
 - relaxation + radial muscles [1] R: if reference ciliary
 - correct reference iris [1]
 [max 5]

[Total: 7]

5 (a) (i)

Parents:	phenotype	green	x	green	
	genotype	Gg	x	Gg	[1]
	gametes	G	g	G	g
					[1]
Offspring:	genotype	GG	Gg	Gg	gg
	phenotype	green	green	green	white
					[1]

Accept – normal chlorophyll/normal for green, lacks chlorophyll for white
 Reject – lacks/affected/abnormal for white

- 5 (a) (ii) green – 375 white – 125 [1]

[Total: 5]

- 6 (a) (i) prophase [1] R: prophase I
- 6 (a) (ii) two homologous chromosomes shaded [1]
- 6 (a) (iii) - centriole [1] A: centrosome/microtubule organising centre
one from
 - produces spindle/produces spindle fibres [1]
 - produce/organises, microtubules [1]
 - disassembles/AW, spindle/spindle fibres/microtubules [1]
 [max 2]
 A: one e.g. of role of, spindle fibres/microtubules if a link to centriole has been made
 allow if centriole incorrectly named or if not given

6 (b) *max 2 if no attempt made at both X and Y*

X/cell surface membrane

- forms a (cleavage) furrow [1] A: 'pinches in' / constricts / AW
- ref. fusion [1]
- to divide cell into two [1] A: idea of formation of two (separate) cells linked to behaviour of (cell surface) membrane
- ref. to cytokinesis [1]

Y/nuclear envelope

- disassembles/breaks down/AW [1]
- during prophase/by end of prophase/before metaphase [1]
- re-forms/AW, during telophase (from ER) [1]

[max 3]

[Total: 7]

7 (a) Sun/light [1]

7 (b) *any two from*

- muscle contraction/movement [1]
- impulses [1]
- temperature maintenance/(body) heat [1]
- cell division / growth / cell repair [1]
- metabolic or anabolic reactions/building up molecules [1]
- active transport/ATP production [1]

R: excretion/digestion/reproduction/respiration

- 7 (c)
- energy loss along the chain [1]
 - last organism receives least energy [1]
 - need large number of ticks + to supply required energy [1]
 - ticks would be in danger of extinction/effect on ecosystem if ticks removed [1]
 - ref. to tick size or mass smaller/very small ticks/large oxpeckers [1]

[max 3]

[Total: 6]

Section B

- S (a) A labelling of axes (x-axis labelled time/hours + y-axis labelled rate of water loss / grams per hour) [1] R: if wrong orientation
S scale (graph needs to be more than half of the graph paper) [1]
P all points plotted correctly [1]
L line (a best-fit curve + no extrapolation) [1]

- S (b) - light/sunlight [1]
- affects opening of stomata [1]
- brighter light (→ wider opening) increases water loss [1]

- temperature/heat [1]
- affects humidity of air/concentration gradient/higher temp particles/molecules move quicker [1]
- higher temperature (→ lower humidity) increases water loss/rate of transpiration rises [1]

- wind/air movement [1]
- moves humid air/water molecules/particles away from stomata/alters concentration gradient [1]
- more wind (→ more dispersal of water vapour) increases water loss [1]

Any two factors plus explanation – 3 marks each [6]

[Total: 10]

- 9 (a) $C_6H_{12}O_6$ /glucose → $2C_2H_5OH$ + $2CO_2$ / alcohol or ethanol + carbon dioxide [1]

- 9 (b) (i) - (breathing) fast(er) [1] and deep(er) [1]: 'breathe more'
- (heart beat) fast(er) [1] and more powerfully/ref. higher blood pressure [1]
! beat 'more'
- faster circulation of blood [1]
- supplying more oxygen/compensation for lower O_2 concentration [1]
- removing more carbon dioxide* [1]
[max 4]
[* or in (ii)]

- 9 (b) (ii) - (muscles) increased + supplies of glucose (to muscles) [1]
- increased + work-rate (person)/contraction (muscle) [1]
- faster + respiration (in muscle cells) [1]
- more + energy [1] A: ATP
- increased supply of O_2 [* or in (i)] [1]
- increased removal of CO_2 [* or in (i)] [1]
- delays lactic acid production/removes lactic acid [1]
[max 5]

[Total: 10]

- 10
Either (a)
- produces haploid + ovum/egg [1]
 - fertilization + ref. zygote/embryo [1]
 - oestrogen [1]
 - progesterone [1]
 - any two functions of oestrogen (e.g. development of sex organs / secondary sexual characteristics / thickening of uterus lining / stimulates production of LH / inhibits follicle stimulating hormones) [2]
 - any two function of progesterone (maintains uterus lining / inhibits FSH / inhibits LH AW) [2]
- [max 5]

- 10
Either (b)
- prevent mixing of maternal and fetal blood [1]
 - allow exchange AW of substances between maternal and fetal blood [1]
 - dissolved [1]
 - named nutrient [1]
 - named gas [1]
 - named excretory product [1] : nitrogenous waste
 - antibodies/hormones [1]
- [max 5]

[Total: 10]

- 10
Or (a)
- (gene)
- a section of DNA/chromosome [1]
 - controls production of a protein/or a characteristic or e.g. [1]
- A: feature/phenotype
- can be copied [1]
 - passed on/(unit of) inheritance [1]
- [max 3 for gene]
- (allele)
- a form of a gene/ref. upper + lower case letters, or e.g./pair of phenotypic examples [1] A: sort/type
 - on homologous AW chromosomes/at same locus AW [1]
- A: a pair of
- the idea of dominance/recessiveness/codominance/can have different effects [1]
- [max 4 for (a)]

- 10
Or (b)
- are inherited/ref. reproduction [1]
 - ref. mutation/change in gene [1]
 - producing variation/differences/changes in appearance or in behaviour or in phenotype [1]
 - advantageous/useful/better adaptation [1]
 - survival [1]
 - change in environment [1]
 - long period of time [1]
 - change in phenotype [1]

- ref; competition [1]
 - ref, natural selection [1]
- [max 6]

N.B. Accept and apply scheme as appropriate to specific examples.

[Total: 10]

END OF ANSWERS



CEDAR GIRLS' SECONDARY SCHOOL
Preliminary Examination Two 2014
Secondary Four

BIOLOGY

5158/01

Paper 1 Multiple Choice

25 August 2014

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, Centre number and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are forty questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D.

Choose the one you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Read the Instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

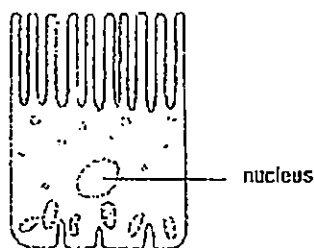
This document consists of 16 printed pages.

[Turn over

1 Which of the following is not a function of a cell nucleus?

- A protection of genetic material
- B regulation of protein synthesis
- C replication of genetic material
- D synthesis of enzymes

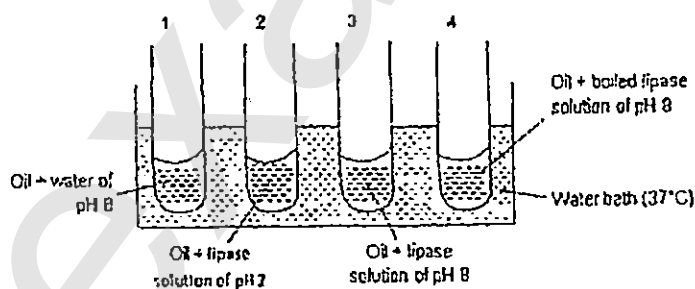
2 The diagram shows a cell found in an organism.



Identify the type of cell and the function it is mostly likely adapted to perform.

	type of cell	function
A	animal	absorption of substances
B	animal	storage of substances
C	plant	absorption of water
D	plant	photosynthesis

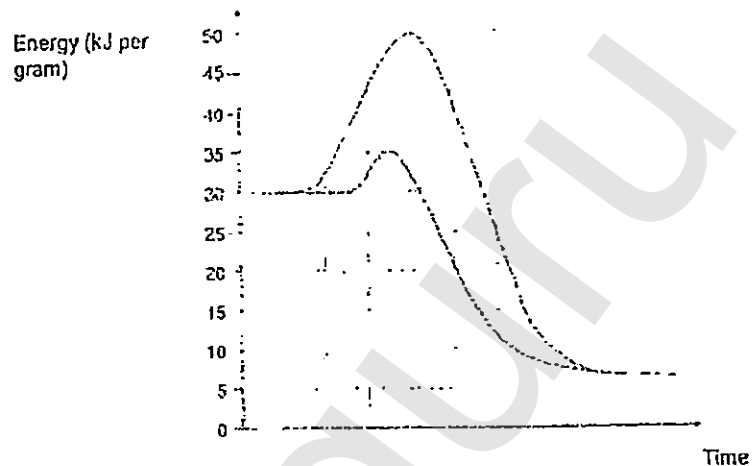
3 Four test tubes, labelled 1, 2, 3 and 4, were set up in an experiment. 1 cm³ of oil and 1 cm³ of solution are added to each test tube. The test tubes were incubated for one hour.



Which of the following shows the expected results when the test tubes are subjected to the ethanol emulsion test?

	1	2	3	4
A	Cloudy	Cloudy	Clear	Cloudy
B	Cloudy	Cloudy	Cloudy	Clear
C	Clear	Clear	Clear	Cloudy
D	Clear	Clear	Cloudy	Clear

- 4 The graph shows the energy levels of an enzyme-catalysed reaction and a reaction without the enzyme.



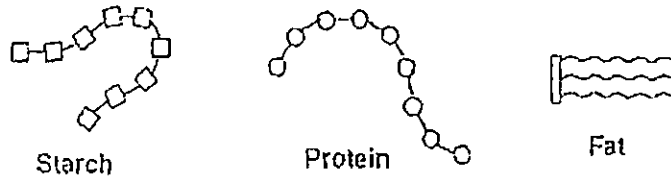
How much has the activation energy been lowered due to enzyme action?

- A 15 kJ per gram
 B 20 kJ per gram
 C 35 kJ per gram
 D 50 kJ per gram
- 5 A Benedict's test and a Biuret test were carried out on a sample of saliva from the salivary glands of a human. Which of these accurately shows the expected observations of the two tests?

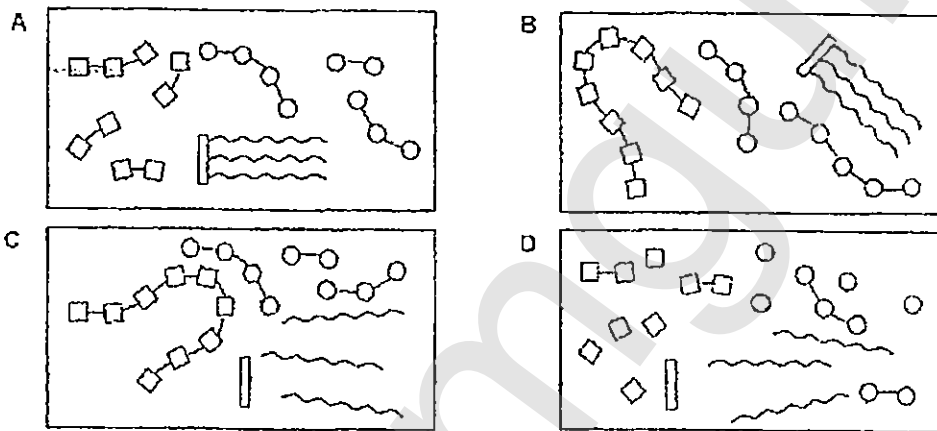
	Benedict's test	Biuret test
A	blue solution	blue solution
B	blue solution	violet colouration
C	red precipitate	blue solution
D	red precipitate	violet colouration

- 6 Which blood vessel contains the highest concentration of glucose after a period of fasting?
- A hepatic artery
 B hepatic portal vein
 C hepatic vein
 D renal artery

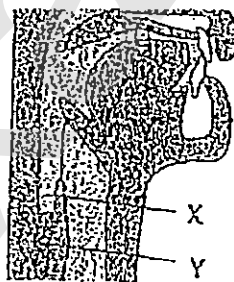
- 7 The diagrams represent molecules of starch, protein and fat at the beginning of the human alimentary canal.



A sample of food that has been in a person's stomach for 3 hours was removed and mixed with bile. The mixture was left to stand for an hour. Which diagram correctly represents the final products of this procedure?



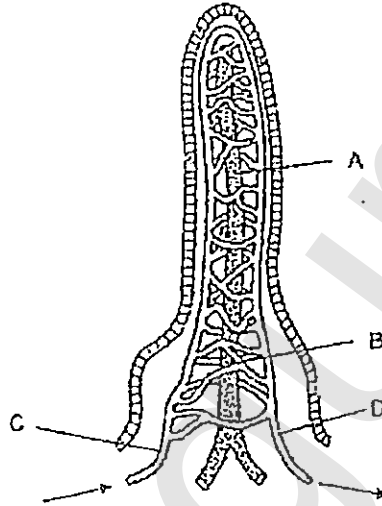
- 8 The diagram shows food after it has been swallowed into the human alimentary canal.



Which of the following is true about the muscles in the oesophagus at points X and Y?

	circular muscles at X	longitudinal muscles at Y
A	contract	contract
B	contract	relax
C	relax	contract
D	relax	relax

- 9 The diagram shows a section through a villus in a small intestine. The arrows indicate the direction of flow in the vessels. Which labelled part contains the highest concentration of glucose?



- 10 Which substance/s is not able to pass from a capillary into muscle tissue via tissue fluid?

- 1 adrenaline
- 2 carbon dioxide
- 3 glycogen
- 4 red blood cells

- A 1 only
 B 1 and 2
 C 2 and 3
 D 3 and 4

- 11 The following table shows the results of blood transfusions between four individuals, P, Q, R and S.

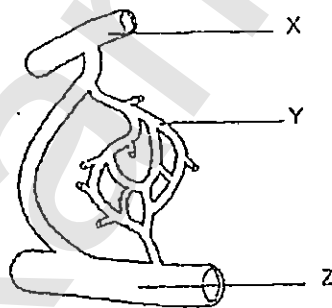
		Recipients			
		P	Q	R	S
Donors	P		✓	✓	✓
	Q	X		✓	✓
	R	X	X		X
	S	X	✓	✓	

✓	Successful transfusion
X	Unsuccessful transfusion

What are the possible blood groups of the four individuals?

	P	Q	R	S
A	AB	A or B	O	A or B
B	AB	A	O	B
C	O	A or B	AB	A or B
D	O	B	AB	A

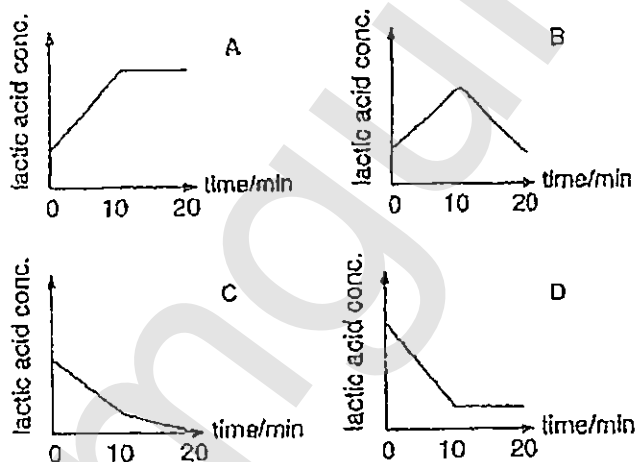
- 12 The diagram shows some blood vessels found within a human being.



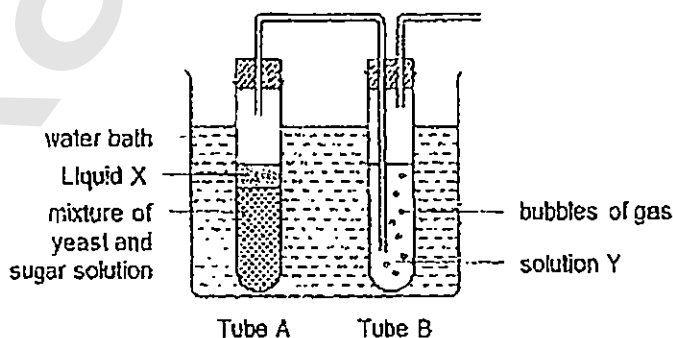
Which of the following accurately identifies the vessels in which blood flows at the highest and lowest pressure?

	highest pressure	lowest pressure
A	X	Y
B	X	Z
C	Z	Y
D	Z	X

- 13 Which of the following statements about the clotting of blood is not true?
- A a blood clot helps to prevent the entry of foreign particles
 - B an enzyme is required for the process of blood clotting
 - C blood clots can only form at the surface of the skin
 - D the clotting of blood prevents excessive loss of blood
- 14 Which of the graphs shows the change in lactic acid concentration in the muscles of a man if he runs for 10 minutes and then rests for another 10 minutes?



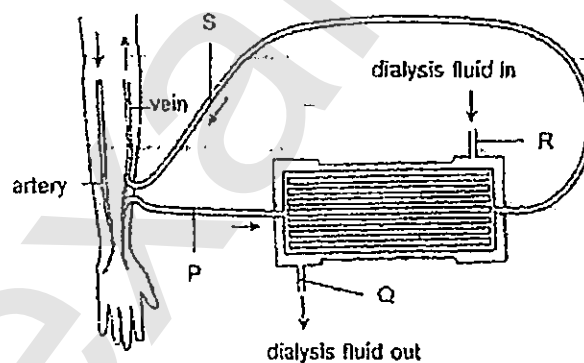
- 15 A student conducted an investigation on the products of anaerobic respiration in yeast cells as seen in the diagram.



What are the identities of Liquid X and Solution Y?

	liquid X	solution Y
A	ethanol	calcium hydroxide solution
B	oil	calcium hydroxide solution
C	lactic acid	ethanol
D	water	ethanol

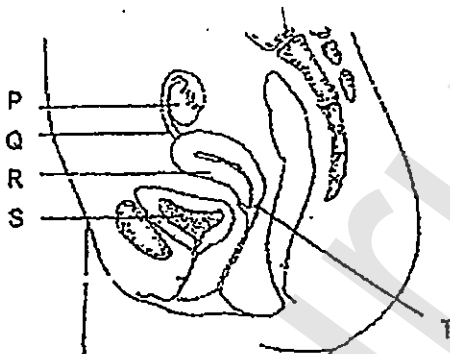
- 16 Which of the following substances is/are not found in the glomerular filtrate which enters the Bowman's capsule of a kidney tubule?
- 1 urea
 - 2 proteins
 - 3 glucose
 - 4 red blood cells
- A 1, 2, 3 and 4
 B 1, 2 and 4
 C 2 and 4
 D 4 only
- 17 A healthy person has decided to modify his diet by increasing his intake of proteins and lowering his intake of carbohydrates. What is a possible consequence of this change?
- A Less glucose will be present in his urine
 B More amino acids will be present in his urine
 C More proteins will be present in his urine
 D More urea will be present in his urine
- 18 The diagram shows the flow of blood and dialysis fluid through a kidney machine.



Arrange P, Q, R and S in the increasing order of concentrations of urea present in the fluids at the different points.

	concentration of urea (in increasing order)
A	$R \rightarrow S \rightarrow Q \rightarrow P$
B	$R \rightarrow S \rightarrow P \rightarrow Q$
C	$S \rightarrow R \rightarrow Q \rightarrow P$
D	$S \rightarrow Q \rightarrow R \rightarrow P$

19 The diagram below shows a female reproductive system.



Which correctly shows the regions where the following events are likely to occur?

	Implantation	fertilisation	meiosis
A	R	Q	P
B	R	P	Q
C	S	Q	R
D	T	R	P

20 Which of the following statements is true about a woman's fertile period?

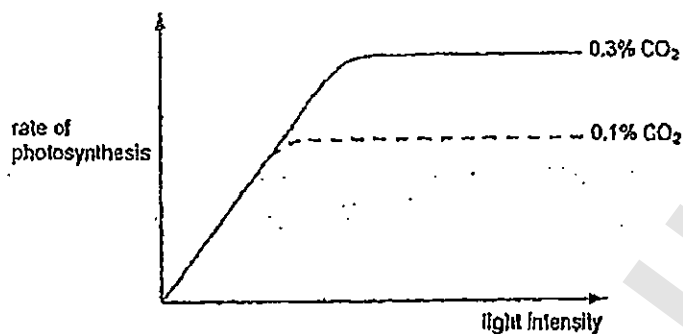
- A Her fertile period starts only after ovulation has taken place as an ovum has to be present for fertilisation to take place.
- B Her fertile period starts a few days before ovulation as sperms are able to survive for a few days.
- C Her fertile period starts immediately after menstruation has taken place as a new ovum will start to develop.
- D Her fertile period starts few days before ovulation as the ovum released from the previous cycle will still be intact.

21 Which of the following substances are able to cross the placenta?

- 1 amino acids
- 2 urea
- 3 red blood cells

- A 1 only
- B 1 and 2
- C 1, 2 and 3
- D 2 and 3.

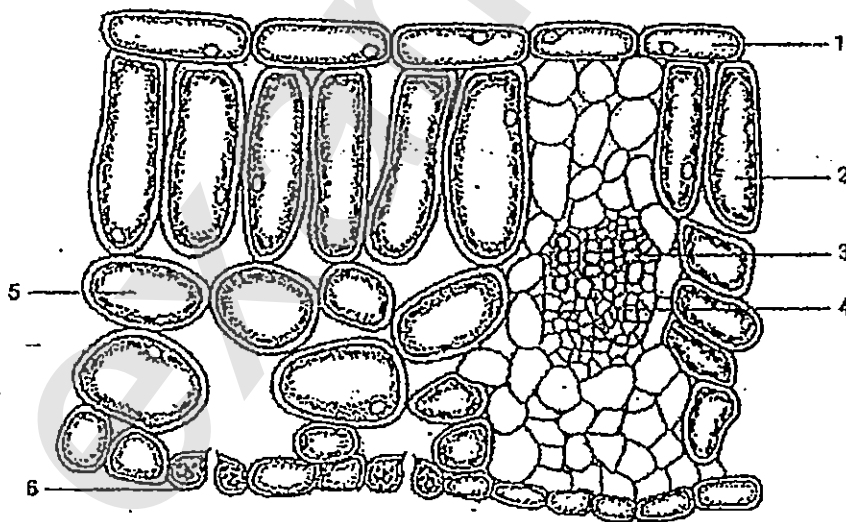
- 22 The graph shows the effect of changing light intensity on the rate of photosynthesis in a plant at two different carbon dioxide concentrations.



Which statement can be best concluded from the graph?

- A Light intensity does not limit the rate of photosynthesis.
- B Light intensity limits the rate of photosynthesis.
- C Carbon dioxide limits the rate of photosynthesis at high light intensity.
- D Carbon dioxide limits the rate of photosynthesis at low light intensity.

The diagram shows part of a leaf. Use the diagram to answer questions 23 and 24.



- 23 Which cells are involved in photosynthesis?

- A 1, 2 and 5
- B 2, 4 and 5
- C 2, 5 and 6
- D 4, 5 and 6

24 Which cell uses the least amount of sugar?

- A 1
- B 3
- C 4
- D 6

25 Which of the following is an advantage of wilting?

- A leaves fold downwards to decrease surface area exposed to sunlight
- B leaves fold downwards to protect the plant from physical harm
- C stomata close to prevent carbon dioxide from diffusing into the leaves
- D stomata close to prevent diffusion of water vapour out of the leaves

26 Which of the following is correct with regards to translocation in the phloem?

	cell with pores in its cross walls	cell releasing energy	translocated substance
A	companion cell	sieve tube element	sucrose
B	sieve plate	companion cell	sucrose
C	sieve plate	sieve tube element	amino acid
D	sieve tube element	companion cell	amino acid

27 A boy accidentally cuts his finger with a kitchen knife. He grabbed his injured finger, cried out in pain and ran to look for his mother.

Which row correctly identifies the parts of the nervous system involved in this reflex action?

	transmission of signal from cutting his finger	transmission of signal towards muscles and larynx	response coordinator
A	motor neurone	relay neurone	spinal cord
B	motor neurone	relay neurone	brain
C	sensory neurone	motor neurone	spinal cord
D	sensory neurone	motor neurone	brain

Use the information to answer questions 28 and 29.

A group of research scientists conducted an experiment to test the reaction timing in 10 volunteers. Each volunteer was blindfolded and touched on the left foot by an object. They were instructed to press a button as soon as they felt the touch. Each person did the test 30 times, and an average reaction time was calculated. The results are shown in the table.

individual	average reaction time / s
1	0.8
2	0.5
3	0.3
4	0.4
5	0.5
6	0.6
7	0.8
8	0.7
9	0.7
10	0.5

28 What was the stimulus in this experiment?

- A pressing the button
- B reacting immediately
- C the skin on the toe
- D the touch on the toe

29 Is the response a reflex action, and why?

	reflex action?	why?
A	no	touch was not painful
B	no	response was voluntary
C	yes	presence of stimulus
D	yes	quick and immediate

30 Which of the following parts of the eye matches the correct description?

	part of the eye	description
A	choroid	contains rods and cones
B	ciliary body	connects the suspensory ligaments to the lens
C	fovea	found on retina
D	iris	highest refraction index

31 What happens to the eye when accommodation takes place?

- A change in refraction of the cornea and lens to focus light rays on retina
- B focal length changes to focus light rays on retina
- C pupil dilates to allow more light to enter
- D rectus muscles contract and relax to move the eyeball for a focussed image

32 Which of the following is not a consequence of an increase in adrenaline?

- A increase glucose uptake through villi
- B increase heart rate
- C increase metabolism
- D increase ventilation

33 Jack has diabetes mellitus. After collecting a few pieces of information from him, a biology student concluded that he is down with Type 1 and not Type 2 diabetes mellitus. The information is as follows:

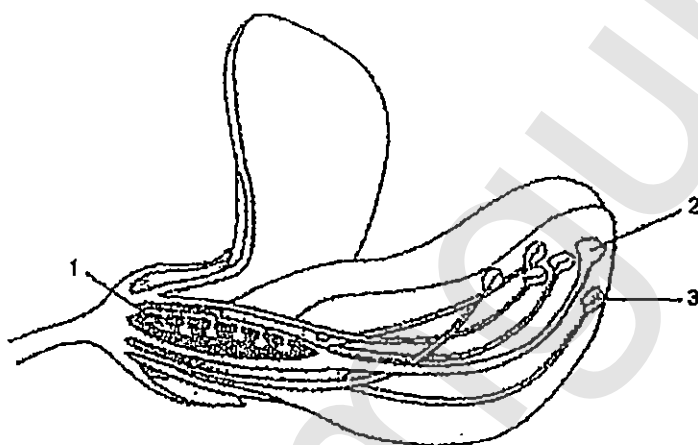
- 1 He is overweight.
- 2 He suffers from a hereditary condition that affects his pancreas
- 3 He contracted diabetes mellitus when he was six years old.
- 4 He carries a supply of insulin injections all the time.

Which of the following pieces of information are evidences that Jack has Type 1 diabetes mellitus?

- A 1 and 2 only
- B 3 and 4 only
- C 2, 3 and 4 only
- D 1, 2, 3 and 4

- 34 Which one of the following is a disadvantage of cross-pollination compared with self-pollination in flowering plants?
- A adaptation of offspring to new surroundings is low
 - B fertility of offspring is low
 - C genetic variation is low
 - D probability of occurrence is low

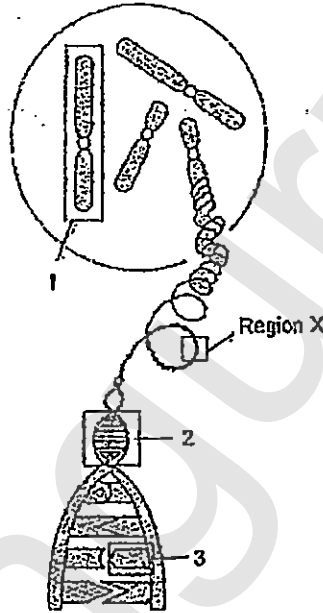
- 35 The diagram shows a flower.



Where do fusion and production of gametes take place?

	Fusion of gametes	Production of gametes
A	1	1 and 2
B	1	1 and 3
C	2	2 and 3
D	3	1, 2 and 3

Use the diagram to answer questions 36 and 37.



36 Which of the options identify 1, 2 and 3 correctly?

	1	2	3
A	chromatin	DNA	sugar
B	chromatin	gene	base
C	chromosome	DNA	base
D	chromosome	gene	phosphate

37 What will not be found at X?

- A centromere
- B codon
- C hydrogen bond
- D nucleotide

- 38 Bacterial transformation is a technique used to produce insulin to treat patients suffering from diabetes mellitus.

Which of the following is not required for insulin production through bacterial transformation?

- A bacteria
 - B DNA ligase
 - C plant host
 - D plasmid
- 39 What is an advantage of producing transgenic plants?
- A allow plants to occupy only one niche in their ecosystem
 - B create less variation in the same plant species
 - C increase the nutrient content in the plants
 - D lower the plants' resistance to pesticides

- 40 Which of the following characteristics shows the correct type of variation?

	continuous variation	discontinuous variation
A	gender	ability to roll tongue
B	presence of lobed ears	hair colour
C	intelligence quotient	blood groups
D	eye colour	skin colour

Section A

Answer all the questions.

Write your answers in the spaces provided.

- 1 Fig. 1.1 shows an animal cell during cell division.

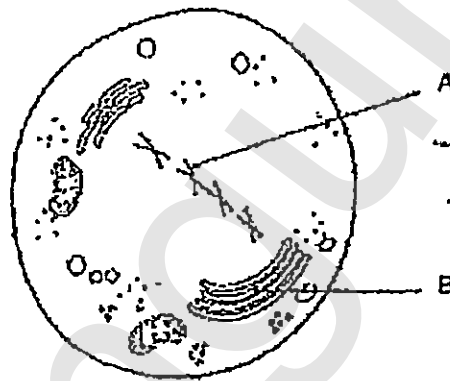


Fig. 1.1

- (a) Name the structures labelled A and B. [2]

A _____

B _____

- (b) (i) Identify the stage of cell division that the cell will undergo after the stage it is currently at. [1]

- (ii) Describe the events that happen in the stage of cell division named in (b)(i). [2]

- (c) The mass of DNA in the cell in Fig. 1.1 was found to be n units.

- (i) State the mass of DNA in a non-dividing cell from the same animal. [1]

[Turn over]

For
Examiner's
Use

- (ii) Name the process that leads to the change in DNA mass between that of a non-dividing cell and that of the cell in Fig. 1.1.

[1]

[Total: 7marks]

- 2 In an experiment, a student suspended several rat liver cells in water and left the suspension in a test tube for 5 hours. It was found after the experiment that the test tube no longer contained intact cells. Explain what has happened to the cells during the course of the experiment

[3]

[Total: 3marks]

- 3 Fig. 3.1 shows the cross-section of a stem from atypical flowering plant.

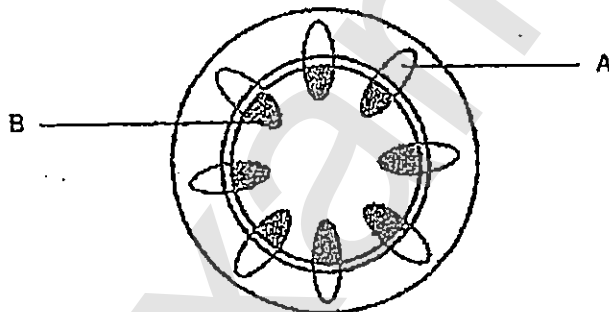


Fig. 3.1

- (a) Identify structure B and explain how it is adapted for its function.

[3]

[Turn over]

Fig. 3.2 shows a set-up that measures the rate of water uptake from a twig.

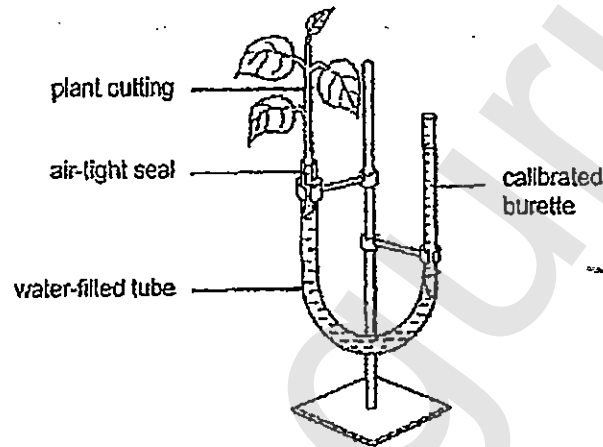


Fig. 3.2

- (b) Explain how the leaves in the twig obtain water from the set-up and how the rate of water uptake is measured.

[3]

An experiment was conducted to investigate the effect of sunlight on the rate of water uptake by the twig and the results are shown in Table 3.3.

In sunlight	In darkness
2cm ³ /hr	0.1cm ³ /hr

- (c) State and explain the effect of sunlight on water uptake by the twig.

[2]

[Total: 8marks]

Turn over

- 4 The fig 4.1 shows the thoracic section of the human body.

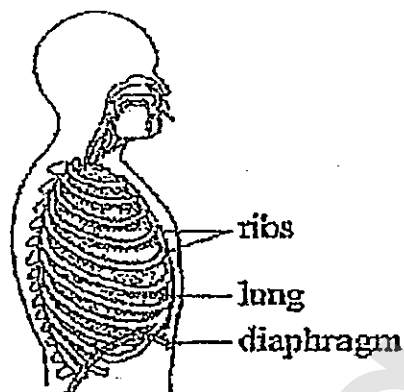


Fig. 4.1

- (a) Draw and label two arrows on Fig. 4.1 to indicate the direction of movement during inhalation for the ribs and diaphragm respectively. [2]
- (b) Table 4.2 shows the volume of air inhaled per breath and the breathing rate of a normal person during resting conditions.

Volume of air inhaled/cm ³	Breathing rate/min ⁻¹
515	13

Table 4.2

Calculate the volume of oxygen entering the lungs per minute, given that atmosphere air contains 20% oxygen. Show your working. [2]

- (c) During strenuous exercise, the volume of oxygen obtained by breathing is often insufficient to meet the energy demands of the body. State how the body copes during strenuous exercise and the consequence of oxygen insufficiency on the body. [3]

[Total: 7marks]

[Turn over

- 5 In *Drosophila* flies, the wing shape is controlled by a gene found on chromosome 2 and has 2 alleles. Curly wings were found to be dominant over normal wings. Fig. 5.1 and Fig. 5.2 show the normal wing and curly wing phenotype respectively.

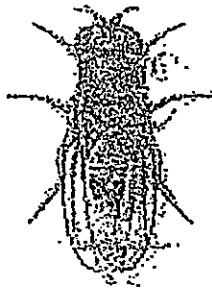


Fig 5.1 Normal Wing



Fig. 5.2 Curly Wing

- (a) Distinguish between an allele and gene

[2]

The gene controlling eye colour is found on the X chromosome and has two alleles. It was observed that red eye trait is dominant over white eye trait.

- (b) Explain what is meant by the term 'dominant'.

[1]

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- (c) A curly winged male was crossed with normal winged female. They produced 20 curly winged and 22 normal winged offspring. Determine the genotype of the male parent using a genetic diagram. [5]

[Total: 8marks]

[Turn over]

- 6 The takahē, *Porphyrio hochstetteri*, is a flightless bird that is restricted to a small area of the South Island of New Zealand. It is one of only two remaining species of large, flightless, herbivorous birds from New Zealand. Their flighted ancestor came over from Australia millions of years ago.
- The takahē as shown in Fig. 6.1 was thought to be extinct but a small population with low genetic variation was discovered in 1948 among the grassland mountains of the South Island.



Fig. 6.1

- (a) Explain why it has been possible for flightless birds, such as the takahē, to evolve. [4]

- (b) Suggest why low genetic variation in the population of takahē is undesirable. [1]

- (c) To increase genetic variation in the population, conservationists selected some birds with more variation in their alleles and allowed them to interbreed. This is an example of artificial selection.

- (i) Suggest one difference between artificial selection and natural selection. [2]

- (ii) State two processes that led to increased genetic variation in the population. [2]

[Total : 9marks]

- 7 Fig. 7.1 shows a town and surrounding countryside.

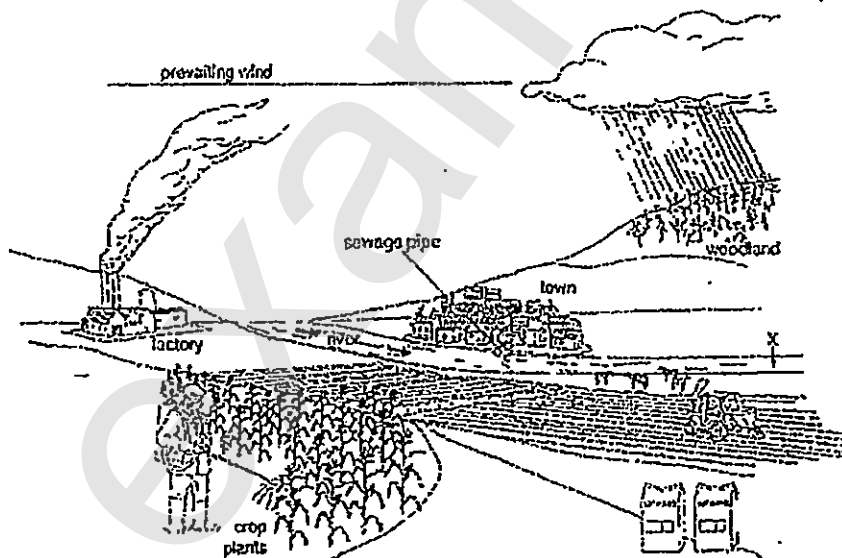


Fig. 7.1

- (a) State the term for the effects on the environment of the activities shown in Fig. 7.1. [1]

[Turn over]

- (b) (i) Name a harmful gas released into the air by the factory. [1]

- (ii) Describe a harmful effect of this gas. [1]

- (c) (i) Downstream from point X in Fig. 7.1, plants in the river grow rapidly and in large numbers. State two possible reasons for this. [2]

1

2

- (ii) Explain why, between the town and point X, there are large numbers of bacteria but very few plants and animals in the water. [4]

[Total: 9marks]

End of Section A

[Turn over]

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CLASS

4

Section B

Answer all the questions.

Answer Q 8(bi) on the graph paper inserted behind this cover page.

Question 10 is in the form of an Either/Or question.
Only one part should be answered.
Write your answers on the lines provided.

For Examiner's Use	
Section B	
8	
9	
10	
Total	

- 8 The rate of a drug exiting the body via the kidneys was measured by injecting a radioactively labelled drug into a vein in the arm of a volunteer and measuring the radioactivity of urine samples collected in 1-hr intervals.

(a) Outline the shortest path a molecule can take from a vein in a person's arm to his kidneys, listing the major blood vessels and organs that the molecule will pass through.

[3]

(b) The results are shown in table 8.1.

Time/h	0	1	2	3	4	5	6
Radioactivity/ arbitrary unit	0	0	10	5	2.5	1.2	0.6

(i) Plot the data on the graph paper provided.

[4]

[Turn over]

- (ii) Calculate the time for the radiation intensity to drop from its peak to half of the peak value.

[1]

- (iii) The analysis of the radioactive molecules in the urine samples showed that the radioactive molecule is a fragment of the original drug molecule, and none of the original drug molecules are present. Explain what could have occurred to lead to this observation and name the organ in the body that could have been involved in this process. [2]

- 9 (a) Describe the events that occur after the body temperature falls that will return the body temperature to its normal level. [7]
- (b) Explain what is meant by control by 'negative feedback'. [3]

Example

191

10 Either

(a) Describe the path taken by a molecule of oxygen as it passes from air in the lungs to a muscle cell in the body.

[6]

(b) Explain how the difference in the pressure of the blood in the pulmonary artery and in the aorta is related to

(i) the structure of the ventricles and

(ii) where the blood is going.

[4]

[Turn over]

10 OR

(a) Describe how the action of enzymes can be explained by the 'lock and key' hypothesis.

[5]

(b) Describe and explain the effect of a gradual increase in temperature on an enzyme-controlled reaction. You should refer to the 'lock and key' hypothesis.

[5]

(Turn over



CEDAR GIRLS' SECONDARY SCHOOL
Preliminary Examination Two 2014
Secondary Four

Paper 1: MCQ

1	D	11	C	21	B	31	B
2	A	12	B	22	C	32	A
3	A	13	C	23	C	33	C
4	A	14	B	24	B	34	D
5	B	15	B	25	D	35	B
6	C	16	C	26	D	36	C
7	A	17	D	27	D	37	A
8	A	18	A	28	D	38	C
9	D	19	A	29	B	39	C
10	D	20	B	30	C	40	C

Paper 2

Section A

	Marking Scheme/Answers	Marker's Comment
1	(a) A: Chromosome [1] B: Golgi body [1] (b) (i) Anaphase [1] (ii) • The sister chromatids [$\frac{1}{2}$] • separate [$\frac{1}{2}$]. • Spindle fibre will shorten [$\frac{1}{2}$] • Chromosomes pulled towards the poles [$\frac{1}{2}$]. (c) (i) $\frac{1}{2}n$ [1] (ii) DNA replication [1] [Total : 7 marks]	
2	Water molecules + osmosis [1]. Water potential inside the cells is lower than that of pure water which is outside the cells. [1] an increase in the volume + cells lyse.[1] [Total : 3 marks]	

3	(a) • The xylem vessels - long + hollow tube [$\frac{1}{2}$]. • able to conduct water and mineral salts + direction [$\frac{1}{2}$] • no cross walls or cytoplasm [$\frac{1}{2}$] • continuous hollow columns + efficient water transport. [$\frac{1}{2}$] • lignin deposition [$\frac{1}{2}$] • prevents the collapse of the structures. [$\frac{1}{2}$] • When bundled together [$\frac{1}{2}$]. • provide mechanical support to the plant. [$\frac{1}{2}$] (max 3 marks) (b) • mesophyll cells surrounded by a thin film of water [$\frac{1}{2}$]. • water evaporates [$\frac{1}{2}$] • lost as water vapour when the stomata of the leaves are open [$\frac{1}{2}$] • This lowers [$\frac{1}{2}$] the water potential of the mesophyll cells. • Water moves from the neighbouring cells + osmosis [$\frac{1}{2}$] • a suction force [$\frac{1}{2}$] was created • results in water uptake [$\frac{1}{2}$] of the twig from the photometer. • water level at the calibrated pipette will decrease, indicating the amount of water that is absorbed. [$\frac{1}{2}$] (c) • presence of sunlight increases [$\frac{1}{2}$] the rate of water uptake by the twig. • In darkness guard cells at the leaves are flaccid + stomata are closed [$\frac{1}{2}$]. • little transpiration + little water uptake [$\frac{1}{2}$] • stomata open + increase the rate of transpiration. [$\frac{1}{2}$] [Total : 8 marks]	
4	(a) (b) $515 \times 13 \times 0.2 \approx 139 \text{ cm}^3$ (c) • anaerobic respiration [$\frac{1}{2}$] • additional energy [$\frac{1}{2}$]. • lactic acid [1] produced • muscle fatigue [$\frac{1}{2}$]. • breathing rate continues to be fast [$\frac{1}{2}$] [Total : 7 marks]	

5

(a)

- Gene - a segment of a chromosome [$\frac{1}{2}$] +
- a sequence of nucleotides and it codes for a single protein [$\frac{1}{2}$].
- An allele is one of the alternate forms of a gene [1]

(b)

- Dominant refers to the gene that is able to express itself [$\frac{1}{2}$]
- same phenotype in both homozygous and heterozygous dominant. [$\frac{1}{2}$]

(c) Let N represent the allele for the Normal wing
n represent the allele for the curly wing

For the female parent to have normal wing, it has to be Nn or NN.

Cross one : if the female parent is NN

Parents: Phenotype	Curly winged	X	Normal Winged
Genotype	nn		NN

Alleles	n, n		N, N
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Fertilisation

F1 Generation: Genotype Nn
Phenotype normal
Ratio All Normal Winged

Cross two : if the female parent is Nn

Parents: Phenotype	Curly winged	X	Normal Winged
Genotype	nn		Nn

Alleles	n, n		N, n
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Fertilisation

F1 Generation: Genotype Nn, Nn, nn, nn
Phenotype Normal Curly Winged
Ratio 1 Normal Winged : 1 Curly Winged

As shown in this cross 2, the female parent has to be heterozygous (Nn) if she was to contribute a recessive allele (n) to produce a curly winged offspring which has genotype of nn.

6	(a) Explain why it has been possible for flightless birds, such as the takahē, to evolve in New Zealand. • <u>Variations + (e.g. flightless birds) + mutation.</u> [1] • <u>Adapted to the environment + e.g. by being a specialist in grassland</u> [1] • <u>Nature selection occurs</u> [1] • <u>Survival of fittest (or explain this term e.g. able to compete and survive and reproduced their own kind.)</u> [1] (b) Suggest why low genetic variation in the population of takahē is undesirable. <u>May result in extinction</u> [1/2] <u>because population may not have resistance to diseases</u> [1/2] (c) (i) Suggest one difference between artificial selection and natural selection. <u>Artificial Selection is when the selection of a trait (in plants for animals) is carried out by Man while Natural Selection occurs when environmental Conditions determine which combination of alleles (genotypes) will survive and reproduce.</u> [2] (ii) State two processes that led to increased genetic variation in the population. 1. Environmental Conditions 2. Meiosis (Independent assortment and crossing over) 3. Mutation 4. Fertilisation (any two) Total : 9 marks]	
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7	(a) pollution ; [1] (b) (i) carbon dioxide/carbon monoxide/sulphur dioxide/various oxides of nitrogen (R symbols) ; [1] (ii) global warming /carboxyhaemoglobin/acid rain (effect must be related to named gas) ; [1] (c) (i) Any two from: drainage from land, ion/salt/nutrients or named, sewage, dung, warmer water;; [2] (ii) bacteria in sewage/cow dung ; decomposition ; oxygen used up ; bacteria + respiration ; animals/plants + unable to respire [max 3] [Total : 8 marks]	
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Section B

8	(a) The shortest pathway for the molecule to take is to travel from the vein in the arm to the right atrium and ventricle of the heart, [$\frac{1}{2}$] enter the lungs via the pulmonary artery [$\frac{1}{2}$] and return to the left atrium [$\frac{1}{2}$] and ventricle of the heart via the pulmonary vein, [$\frac{1}{2}$] The molecule then exits the heart via the aorta [$\frac{1}{2}$] and travels to the kidneys via the renal artery, [$\frac{1}{2}$] [max 3]	
	(b) (i) Graph Labels [1] Plotting [1] Shape [1] Appropriate axes/more than $\frac{1}{2}$ of graph paper [1] [max 4]	
	(ii) 1 hour (iii) The drug molecule travelled to the liver [1] where it is metabolised [$\frac{1}{2}$] into smaller molecules [$\frac{1}{2}$]. [max 3]	

9	(a) ref. hypothalamus nervous control/impulses/brain less active sweat glands/sweating stops (A inactive) less evaporation (of sweat) (R no evaporation) vasoconstriction of arteries/-rioles/blood vessels (R capillaries/veins) less blood to capillaries (A ref. heat loss from) less heat lost shivering generates heat/hair erection decreases heat loss (or insulates)/adrenaline release/higher metabolic rate one behavioural reference (e.g. moving/putting clothes on) [max 7] (b) • a change (e.g. in level); • is responsible for/ triggering/ causing/ • with ref to receptors; • a response/reaction occurs; • (which leads to) restoration of original level; [max 3]	
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10	Either (a) Describe the path taken by a molecule of oxygen as it passes from air in the lungs to a muscle cell in the body. • Enters the nostrils + (air is warmed and moistened); • Pharynx + larynx; • Trachea; • Bronchus (must be singular); • Bronchiole (must be singular); • Alveolus (must be singular); • Dissolve in thin film of moisture; • Passes through the single celled alveolar wall; • <u>Diffuses</u> into the capillaries; • Diffuses into RBC + binds with haemoglobin; • RBC will be carried to left ventricle of heart + by the pulmonary vein; • Left ventricle contracts + RBC will be sent to all parts of the body including muscles. [max 6] (b) right (ventricle) wall thinner/left (ventricle) wall thicker OR reference less/ more muscle OR weaker/stronger contractions ; (A smaller—Larger) (pulmonary) shorter distance to travel (A only to the lungs); little work (or effort) to do against gravity; avoidance of damage to lung capillaries/low pressure required in lungs ; (body) high pressure for kidney filtration ; oxygen/glucose to brain ; [max. 3]	
10	OR (a) active site ; of specific shape; substrate ; fit/are complementary ; any ref. enzyme/substrate complex being like lock and key ; stress on substrate molecule ; product formed ; also works in reverse ; [max 5] (b) reaction rate increases ; similar to key turning more often ; more energy/faster movement of molecules ; active site changes shape ; proteins are denatured by heat; permanently ; reaction stops ; substrate no longer fits active site ; key no longer fits lock ; [max 5]	

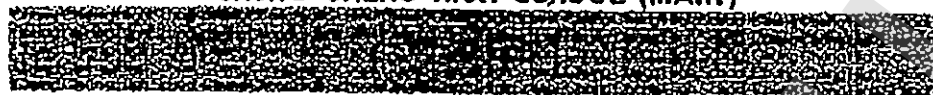
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Name:	Class	Class Register Number/ Centre No./Index No.
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中正中學

CHUNG CHENG HIGH SCHOOL (MAIN)



PRELIMINARY EXAMINATION 2014
SECONDARY 4

BIOLOGY

Paper 1

5158/01

3rd September 2014

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are forty questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D.

Choose the one you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of 16 printed pages, including the cover page

[Turn over]

1 Which series progresses in complexity?

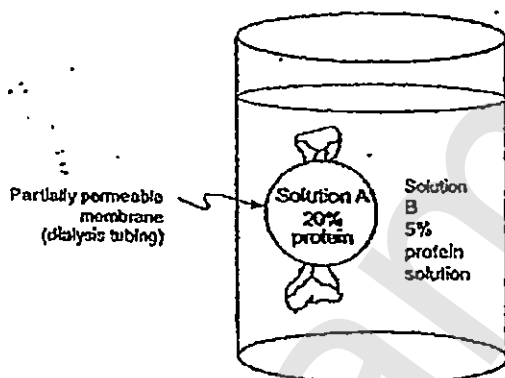
- A chromosome, DNA, mRNA, nucleus
- B DNA, chromosome, ribosome, mRNA
- C mRNA, DNA, chromosome, nucleus
- D nucleus, chromosome, DNA, mRNA

2 Which line in the table correctly identifies these body components?

- 1. Brain, spinal cord and nerves
- 2. Blood
- 3. Neurone
- 4. Stomach

	Cell	Tissue	Organ	System
A	2	3	1	4
B	2	4	3	1
C	3	2	1	4
D	3	2	4	1

3 In the situation shown in the diagram below,



- A Water will enter solution A and the concentration of solution A will increase.
- B Water will enter solution A and the concentration of solution A will decrease.
- C Water will enter solution B and the concentration of solution B will increase.
- D Water will enter solution B and the concentration of solution B will decrease.

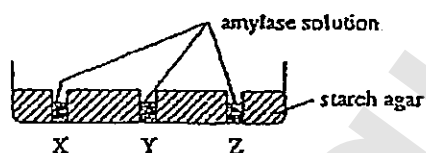
4 The table shows the concentration of a substance inside and outside four different cells. Which cell would need the most energy to absorb the substance by active transport?

cell	concentration (arbitrary units) inside cell	concentration (arbitrary units) outside cell
A	3	6
B	3	9
C	6	3
D	9	3

5 Three different intestinal amylase solutions are prepared as follows.

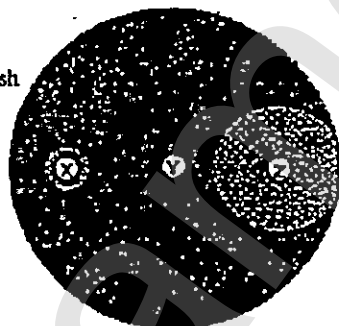
1. Amylase solution
2. Amylase solution of pH 8
3. Amylase solution of pH 2

A shallow dish which holds agar jelly containing starch was prepared. Three similar wells, X, Y and Z are cut in the jelly and each well has a different intestinal amylase solution added to it as shown in the diagram below.



24 hours later the jelly is covered with iodine solution.

top view of dish
after 24 hours



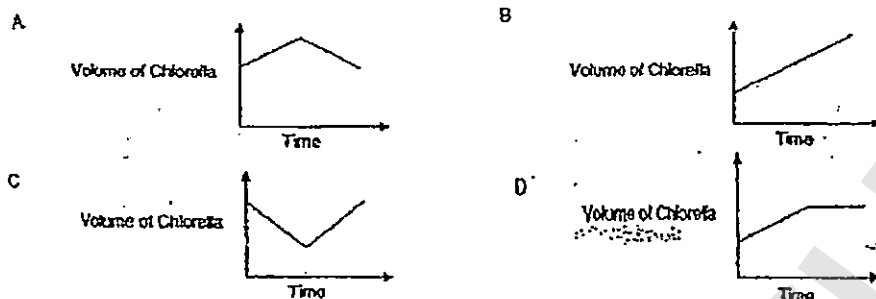
key

-  jelly stained light brown
-  jelly stained blue-black

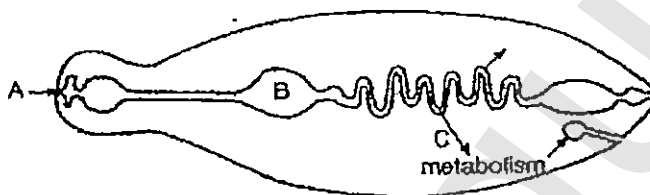
Which amylase solution was placed into each well?

	Well X	Well Y	Well Z
A	1	2	3
B	1	3	2
C	2	1	3
D	3	2	1

A *Chlorella* cell (a unicellular alga) is put in a beaker of distilled water. Which of the following graphs currently shows the change in volume of *Chlorella*?



The figure below shows the structures in an animal.



The processes which would occur in a living animal at A, B and C are

	A	B	C
A	Egestion	Absorption	Assimilation
B	Ingestion	Digestion	Absorption
C	Ingestion	Digestion	Excretion
D	Chewing	Excretion	Egestion

Which characteristic activities of living organisms are similar to the burning of petrol and the release of exhaust fumes by a car?

	Burning of petrol	Release of exhaust fumes
A	Excretion	Movement
B	Movement	Nutrition
C	Nutrition	Respiration
D	Respiration	Excretion

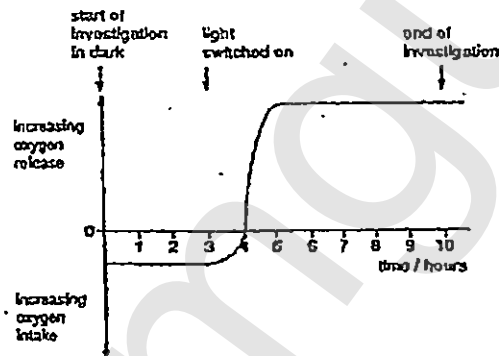
- 9 The table below shows an experiment carried out by a student.

Step	Food substance under test	Substance added	Results
1	X	Iodine solution	Blue-black
2	X	Benedict's solution	Blue
3	X	Y	Z formed
4	X	Y (boiled)	A mixture W is formed
5	Z	Benedict's solution	Orange-red precipitate
6	W	Benedict's solution	Blue

Which of the following correctly identifies W, X, Y and Z

	W	X	Y	Z
A	Reducing sugar	Starch	Saliva	Starch
B	Starch	Starch	Saliva	Reducing sugar
C	Starch	Saliva	Reducing sugar	Reducing sugar
D	Reducing sugar	Reducing sugar	Saliva	Starch

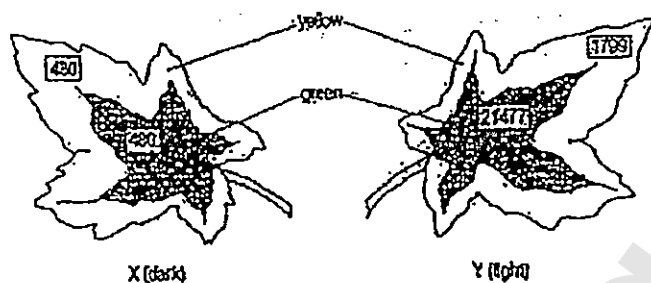
- 10 The graph shows the results of an investigation into oxygen release and oxygen intake by a green plant in different light conditions.



For how many hours did respiration and photosynthesis take place during the investigation?

	Respiration / hr	Photosynthesis / hr
A	3	5
B	3	6
C	4	7
D	10	7

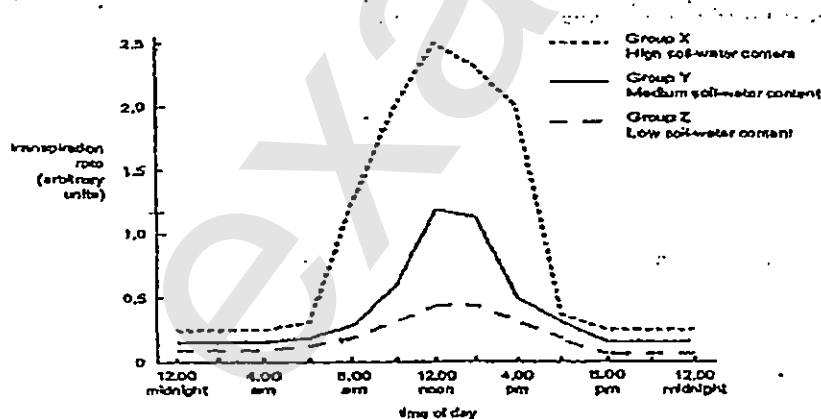
- 11 Variegated leaves of a plant were supplied with radioactive carbon dioxide ($^{14}\text{CO}_2$) during an experiment. Leaf X was kept in the dark and leaf Y was kept in the light. At the end of the experiment, the radioactivity in the leaves was measured. The results in arbitrary units are shown in the boxes in the diagrams.



What is the most likely explanation for the level of radioactivity found in the yellow zone of leaf Y?

- A Photosynthesis occurs but no storage of starch occurs in this zone.
 B Photosynthesis proceeds slowly in the absence of chlorophyll.
 C Products of photosynthesis are transported into the yellow zone.
 D Radioactive carbon dioxide diffuses into the leaf and accumulates there.
- 12 Transpiration rate was measured in the bean, *Phaseolus vulgaris*. Three identical groups were tested. In group X the soil moisture was high, in group Y it was medium and in group Z it was low.

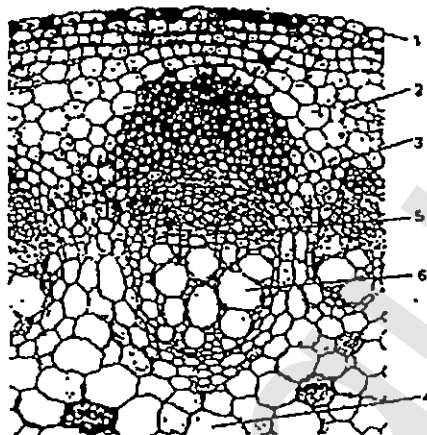
The graph below shows the results of the experiment.



From the graph, we can conclude that:

- A stomata were closed between 8:00 am and 4:00 pm in group Z.
 B no water was lost between 8:00 pm and midnight in group Z.
 C the rate of water loss through stomata was greatest in group X.
 D at 12:00 noon, water loss in group X was four times greater than water loss in group Y.

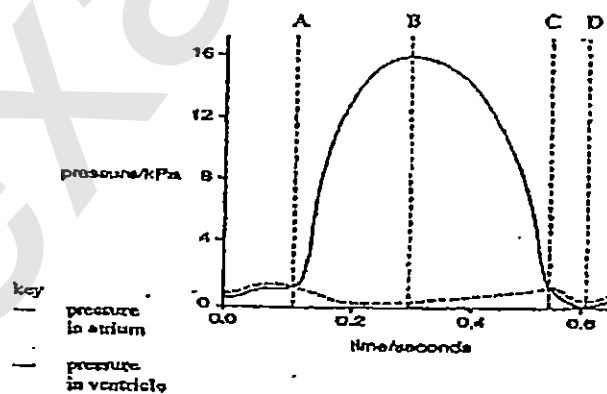
- 13 The photomicrograph below shows the transverse section of a dicotyledonous stem.



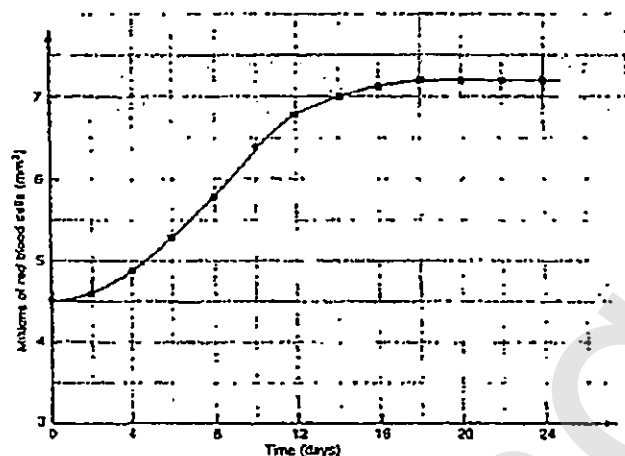
Which of the following combinations is correct?

	Reduction of water loss	Storage of food	Transport of water & mineral salts	Production of new cells	Transport of food
A	2	4	1	3	6
B	1	3	5	6	4
C	1	4	6	5	3
D	2	5	4	3	6

- 14 The graph shows pressure changes in the left side of the heart, during a single heartbeat. At which point does the bicuspid (mitral) valve open, allowing blood to flow from the atrium to the ventricle?

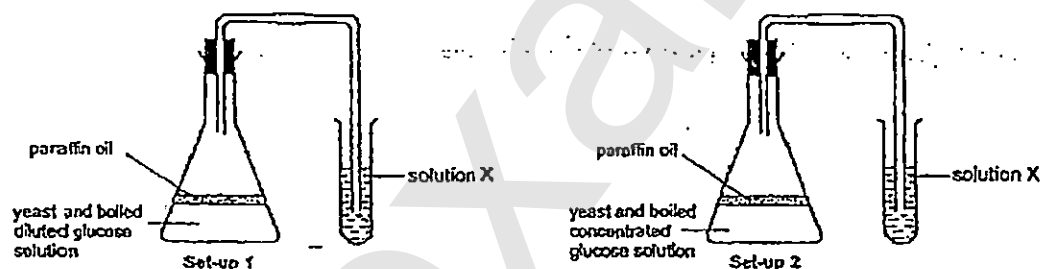


- 15 The graph below shows how moving from sea level to the mountains will affect red blood cells. Based on the graph, which of the following conclusion cannot be made?



- A A person who has just arrived at this altitude will feel breathless.
- B It takes at least 20 days to get used to the 'thinner' air.
- C The percentage increase in the number of red blood cells is 60 %.
- D Exercising at high altitude helps a person develop stronger lung muscles.

Questions 16 to 18 refer to the diagram below which shows two set-ups used to study anaerobic respiration in yeast:



The table below shows the results obtained:

Set - up	Result
1	Alcohol produced
2	No alcohol produced

- 16 What conclusion can be drawn from the results?
- A Yeast respire aerobically at high glucose concentration.
 - B Yeast breaks down food completely at high glucose concentration.
 - C Yeast is killed by dehydration at high glucose concentration.
 - D Yeast cannot respire anaerobically at high glucose concentration.

17 Which of the following is not essential for creating an anaerobic condition in the set-ups?

1. stopper the flask
2. vaseline the joints
3. add paraffin oil
4. boil the glucose solution

- A 1 and 2 only
B 2 and 3 only
C 3 and 4 only
D 1 and 4 only

18 Solution X is used to test the gas produced in the flask. Solution X can be

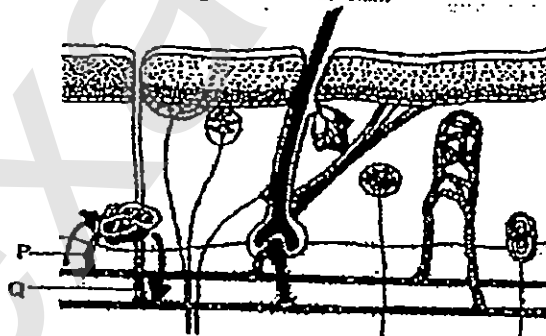
1. lime water.
2. sodium hydroxide solution.
3. sodium hydrogencarbonate solution.
4. hydrogencarbonate indicator solution

- A 1 and 2
B 2 and 3
C 3 and 4
D 1 and 4

19 In a dialysis machine, all the following would take place except

- A diffusion of solutes into the surrounding fluids.
B blood cells are prevented from leaving the tubing.
C selective reabsorption of salts.
D blood flows through a tube with partially permeable walls.

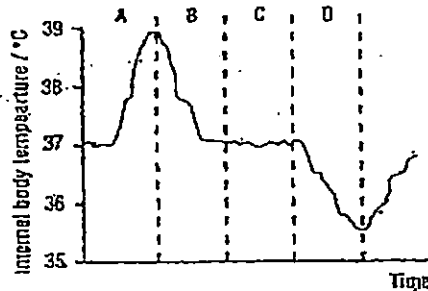
20 The diagram shows a section through mammalian skin.



Which of the following changes in concentrations of carbon dioxide, salt and urea take place as blood passes from P to Q?

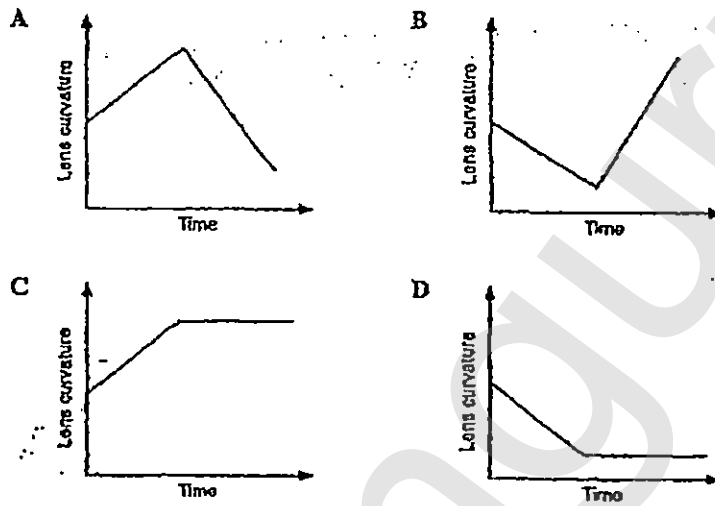
	Carbon dioxide	Salt	Urea
A	Decrease	Decrease	Increase
B	Decrease	Increase	Decrease
C	Increase	Decrease	Decrease
D	Increase	Decrease	Increase

- 21 The graph shows changes in a person's internal body temperature over a period of time. During which period would the arterioles supplying blood to surface capillaries first become constricted?

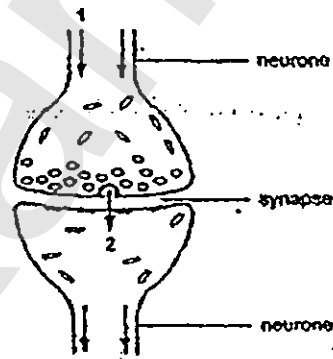


- 22 When a rabbit was shown to a classroom of kindergarten kids, it was very frightened, resulting in an increase in its blood sugar. Which substance is responsible for this increase?
- A Adrenaline
 - B Amylase
 - C Glycogen
 - D Insulin
- 23 Which of the following takes place when a person moves from bright to dim light?
- A The circular muscles contract and the pupil enlarges.
 - B The circular muscles contract and the pupil becomes smaller.
 - C The radial muscles contract and the pupil enlarges.
 - D The radial muscles contract and the pupil becomes smaller.
- 24 Which of the following involves both the nervous and endocrine systems?
- A A young boy developing a deeper voice at puberty.
 - B Feeling "pins and needles" in the legs after sitting cross-legged.
 - C Hearing a buzzing sound at the ear and trying to kill a mosquito.
 - D Running after a snatch thief.

- 25 A boy standing on a station platform watches a distant train approaching the platform until it comes to a standstill. Which of the following graphs correctly shows the change in the curvature of the lens of his eye?



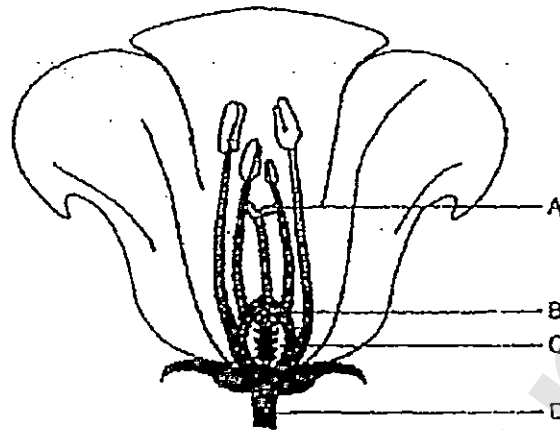
- 26 The diagram below shows the working of a synapse between two neurones.



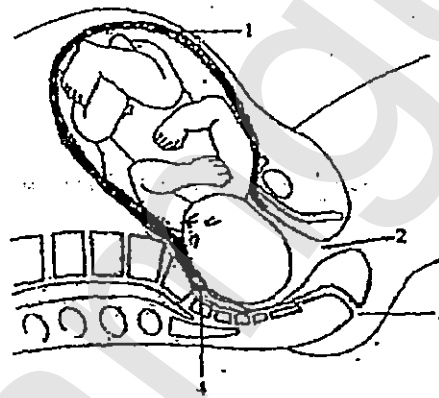
What do arrows 1 and 2 represent?

	1	2
A	Chemical transmitter	Slow acting hormone
B	Chemical transmitter	Chemical transmitter
C	Nerve impulse	Chemical transmitter
D	Nerve impulse	Slow acting hormone

- 27 The diagram shows the main parts of a flower. Which labelled part shows that this flower is insect-pollinated?



- 28 The diagram shows a stage during the birth of a baby.



Identify the numbered structures.

	1	2	3	4
A	Amniotic sac	Cervix	Vagina	Uterus
B	Uterus	Vagina	Anus	Cervix
C	Uterus	Vagina	Cervix	Amniotic sac
D	Amniotic sac	Cervix	Anus	uterus

29 Which of the following are genetically identical?

- A Kittens born in the same litter.
- B Fraternal (non-identical) twins in the same family.
- C Seeds produced from the same plant.
- D Plants produced by tissue culture from different parts of a leaf.

30 If X units of DNA are present in the nucleus of a cell during Interphase before DNA replication, what is the relative amount of DNA present in this cell during anaphase of the first meiosis?

- A $X/4$
- B $X/2$
- C X
- D $2X$

31 In order to produce large quantities of human insulin, genetic engineering can be carried out. The following shows the processes involved in the procedure.

1. Remove plasmid DNA from bacteria
2. Grow bacteria in fermenter tanks
3. Insert insulin gene into plasmid DNA
4. Use of detergents to break nuclear membrane
5. Cut plasmid DNA using enzymes
6. Isolate human insulin gene from chromosome using enzymes

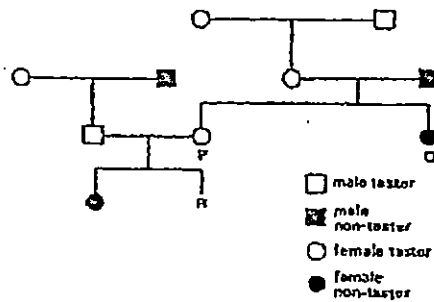
Which represents the most logical sequence in which these processes are carried out?

- A 6, 4, 1, 5, 3, 2
- B 4, 1, 6, 5, 3, 2
- C 2, 1, 5, 4, 6, 3
- D 4, 6, 1, 5, 3, 2

32 Pollen grains are usually produced in large numbers so that

- A the species can explore new environments.
- B competition among the new plants can be reduced.
- C they can help the dispersal of new plants.
- D they can have a greater chance of reaching other flowers.

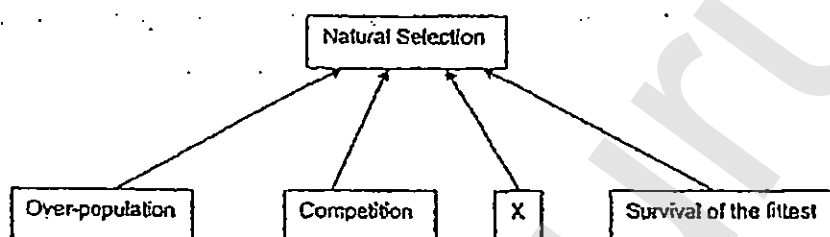
- 33 Only people who have the dominant allele, T, have the ability to taste certain chemicals. The pedigree chart shows the transmission of this gene in a family.



What is the chance that child R is a male taster?

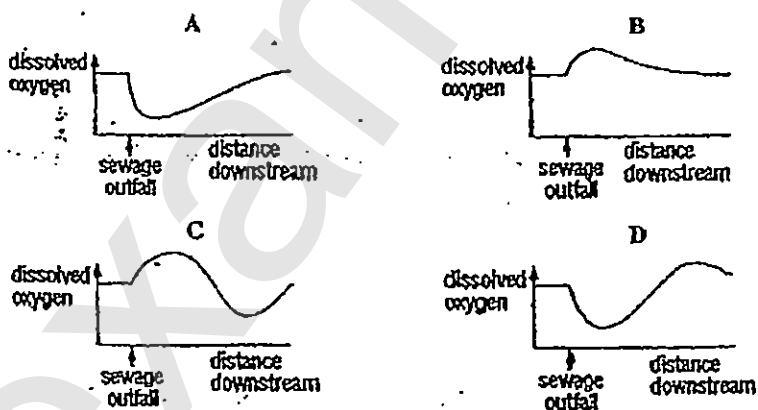
- A 0.13
B 0.25
C 0.38
D 0.75
- 34 A farmer saves the seeds from his best maize crop plants to sow for next year's crop.
This is an example of
- A Artificial selection.
B Genetic engineering.
C Natural selection.
D Genetic variation.
- 35 Which two statements about continuous variation are correct?
1. The heights of adult humans will partly depend on the quality on their diets when young.
 2. During puberty there is a dramatic growth spurts.
 3. A group of adult males had heights ranging from 155 cm to 220 cm.
 4. During old age, people tend to shrink in height.
 5. Humans grow taller during infancy and childhood.
- A 1 and 2
B 1 and 3
C 2 and 4
D 3 and 5

- 36 Some of the concepts included in Darwin's Theory of Natural Selection are represented in the diagram below.

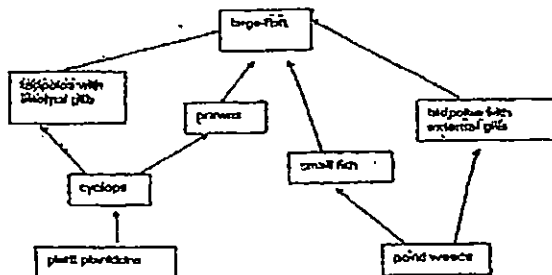


Which concept could be correctly represented by X?

- A Meiosis
 - B Mutation
 - C Genetic variation
 - D Transmission of acquired traits
- 37 Which graph shows the most likely effect of pollution by sewage on the amount of oxygen dissolved in a river?



For Questions 38 and 39, refer to the diagram below which shows the relationship between some organisms living in a freshwater lake.



38 Which of the following organisms is/are primary consumers?

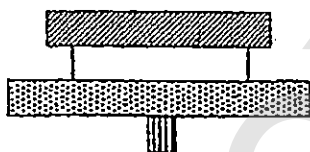
1. plant planktons
2. Cyclops
3. Prawns
4. Tadpoles with internal gills

- A 1 only
 B 2 only
 C 1 and 2 only
 D 2 and 4 only

39 Which of the following statements about this food web is true?

- A There are three herbivores in this food web.
 B Only two food chains are present in this food web.
 C All the tadpoles present on the food web are primary consumers.
 D The ultimate source of energy is the plant planktons and pond weeds.

40 Which are the two factors that contribute to the shape of the pyramid of numbers shown below?



1. a large number of small carnivores
2. a large number of small producers
3. a small number of large carnivores
4. a small number of large producers

- A 1 and 2
 B 1 and 4
 C 2 and 3
 D 3 and 4

END OF PAPER

Name: _____ () _____

SECTION A [50 marks]

Answer all questions in this section.

Write your answers in the spaces provided.

- 1 (a) Outline how smoking leads to
(i) Chronic bronchitis

.....
.....
.....[2]

- (ii) Emphysema

.....
.....
.....[2]

- (b) Briefly explain how these two diseases lead to difficulties in breathing.

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.....[2]

[Total: 6]

- 2 Fig. 2 are two graphs showing oxygen uptake (Graph A) and lactic acid concentration (Graph B) in the blood of a man before, during and after a short-period of physical exercise.

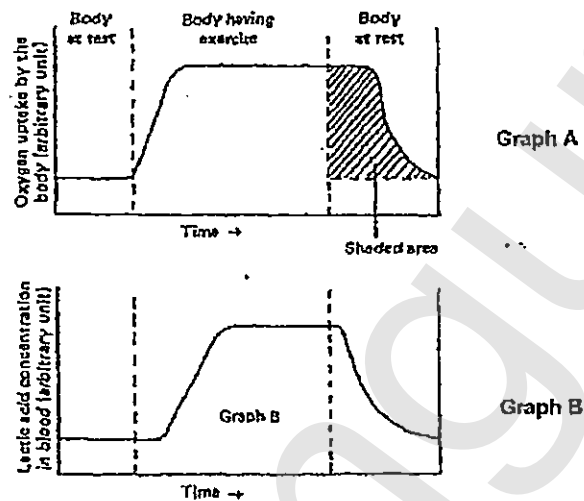


Fig. 2

- (a) Explain the increase in lactic concentration in the blood at the beginning of exercise.

.....

 [3]

- (b) State the biological term used to represent the shaded area on Graph A.
 Explain how the volume of oxygen in the shaded region is related to the amount of lactic acid in the blood.

.....

 [3]

(c) Describe the effect of lactic acid during exercise.

[1]

[Total: 7]

3 Fig. 3 shows animal cells in different stages of mitosis.

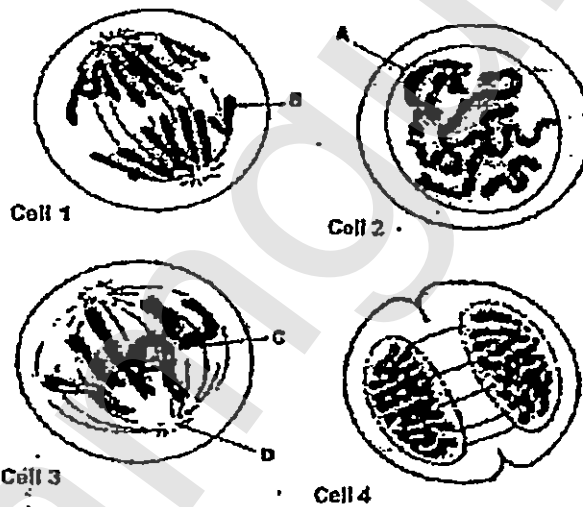


Fig. 3

(a) Using the number given to each cell above, arrange the stages in the correct mitotic sequence.

[1]

(b) What is the diploid number of chromosomes in Cell 3?

[1]

(c) Complete the table using letters A, B, C and D from the diagrams in Fig. 3.

[1]

1. Attaches a chromatid to a spindle fibre	
2. Breaks down at the beginning of mitosis	
3. Formed by longitudinal division of a chromosome	
4. Produces spindle fibres	

[Total: 3]

Fig. 4 shows the inheritance of sickle-cell anaemia in two families. A person who is a carrier of this disease usually shows no ill effects.

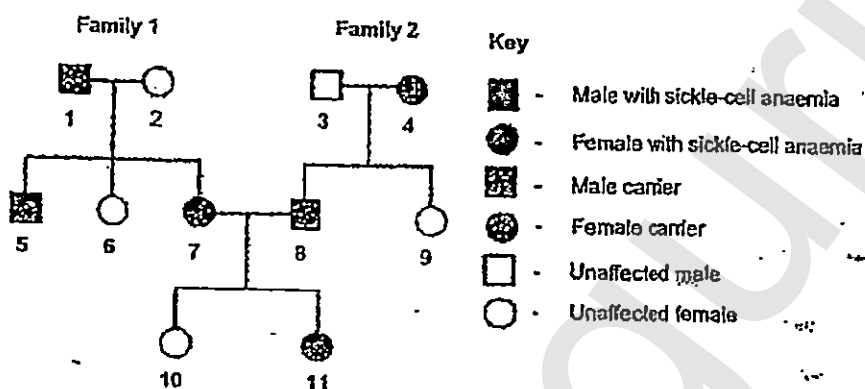


Fig. 4

- (a) Sickle-cell anaemia is a genetic disorder that results in the red blood cells having a 'sickle' shape and a reduced ability to carry oxygen. What is the cause of sickle-cell anaemia?

.....

..... [1]

- (b) Person 7 is pregnant with her third child. Use a genetic diagram to show how it is possible for this child to have sickle-cell anaemia.

[4]

[Total: 5]



- [2]

- 14

- (c) Fig. 5.2 shows the relationship between the pressure in the veins returning blood into the heart and stroke volume (the volume of blood pumped by the left ventricles of the heart in one contraction).

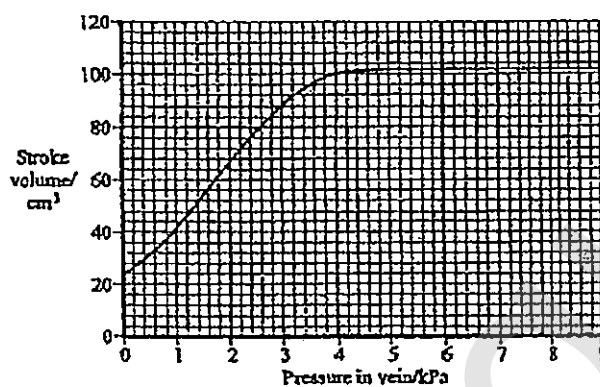


Fig. 5.2

- (i) From the graph, describe the relationship between stroke volume and pressure in the veins.

.....
[1]

- (ii) What information would you need, other than that in the graph, to calculate this person's cardiac output (the volume of blood pumped out by the heart per minute)?

.....
[1]

[Total: 8]

- 6 (a) Fig. 6 shows the energy flow through a food chain.

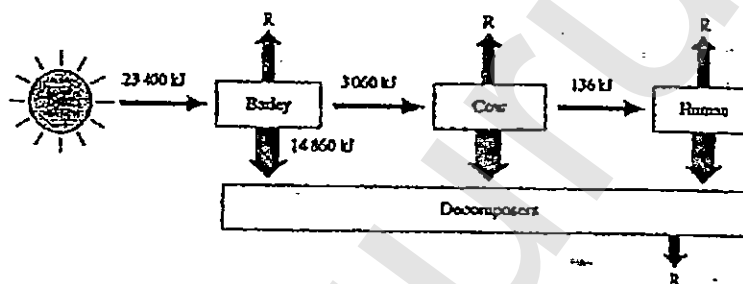


Fig. 6

- (i) Calculate the percentage of the energy received by the cow which is available to the human. Show your working.

Answer = _____ [2]

- (ii) Explain, in terms of energy, why it would be better for humans to eat barley directly.

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[3]

- (iii) The herbivores are mammals. Suggest why they lose to the environment about 80% of the energy they receive, but the plants lose only about 50% of their energy.

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.....

[2]

- (b) (i) With reference to Fig. 6, draw a labelled pyramid of energy for the food chain.

[1]

- (ii) State two advantages of using pyramids of energy instead of pyramids of biomass to represent the feeding relationships in a food chain.

[2]

[Total: 10]

Fig. 7.1 shows the menstrual cycle of a human female, with changes in the thickness of the uterus wall and the levels of two female sex hormones.

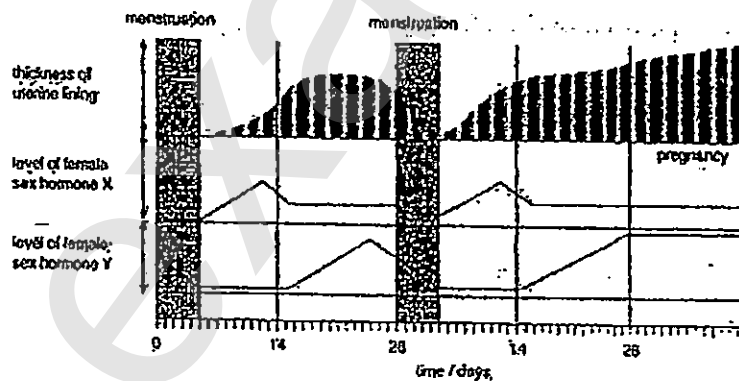


Fig. 7.1

- (a) How long is the duration of the menstrual cycle of this woman?

[1]

- (b) With reference to Fig. 7.1,
(i) When does ovulation occur?

[1]

- (ii) State the days which sexual intercourse is most likely to result in pregnancy. Explain your answer.

[2]

- (iii) With reference to Fig. 7.1, state the changes when this woman becomes pregnant.

[2]

- (c) Using the information from Fig. 7.1, complete Table 7.2 for hormones, X and Y.

[5]

Hormone	Name of Hormone	Functions	Explanation
X			
Y			

Table 7.2.

[Total: 11]

SECTION B [30 marks]

Answer all questions in this section.

Question 8 is an Either/Or Question.

There are two types of plants, C3 and C4 plants, which differ in the kind of photosynthetic mechanism they have, and this has a direct effect on how efficiently they photosynthesize.

Rice is an example of a C3 plant while maize is an example of a C4 plant.

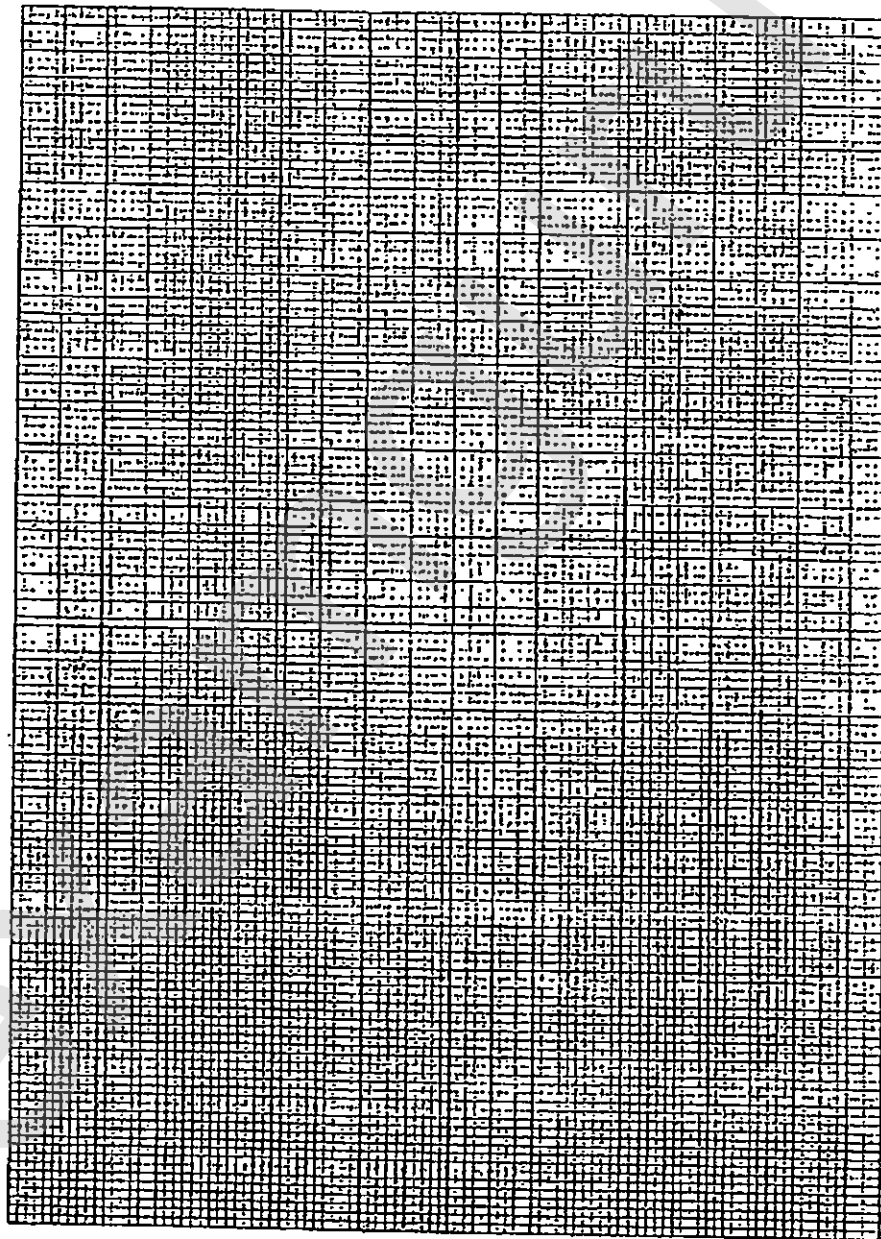
C4 plants use a different enzyme, called PEP carboxylase, which allows CO₂ to be taken into the plant much more quickly compared to C3 plants.

- (a) Use the data in Table 8 below to plot a graph of rate of photosynthesis against water uptake.

Water uptake / mm ³ per min	Photosynthetic rate / mg carbohydrate produced per unit area per min	
	Rice (C3)	Maize (C4)
2	1	4
4	3	10
6	7	29
8	16	46
10	20	49
12	32	54
14	42	58
16	55	60
18	72	60
20	72	60

Table 8

[4]



- (b) Describe the relationship between water uptake and the rate of photosynthesis using curve for maize from your graph.

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- (c) Explain which plant will grow better in desert areas.

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- (d) Scientist aims to create rice plants with this C4 mechanism through genetic engineering. Outline in detail how the above process can be carried out using biotechnology and genetic engineering tools.

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- 9 Fig. 9 shows changes in the rate of secretion of two pancreatic hormones, A and B at different blood glucose levels in humans

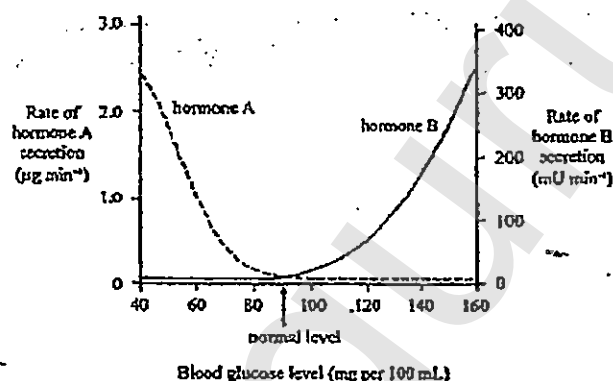


Fig. 9

- (a) Define a hormone.

.....
[2]

- (b) Which hormone will play an active role in the control of blood glucose level from the normal level to 40mg per 100mL? Give evidence from the graph to support your answer.

.....

[3]

- (c) Identify hormone A and state how this hormone contributes to the homeostatic control of blood glucose level.

.....

[2]

- (d) State one way in which a hormone is different from an enzyme.

.....[1]

[Total: 8]

10 Ether

- (a) Describe and explain in what ways does a plant use water?

Figure 1. Schematic diagram of the experimental setup. The setup includes a laser source, a beam splitter, a lens, a mirror, and a detector. The laser beam is split into two paths: one path goes through a lens and a mirror, and the other path goes through a beam splitter and a detector. The two paths are recombined at the beam splitter, and the resulting beam is detected by the detector.

- (b) With reference to the vascular tissues in roots, stems and leaves, describe the movement of essential materials within a plant.

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[Total: 10]

- (c) (i) Using the graph, state the temperature at which the rate of carbon dioxide uptake is equal to the rate of rate carbon dioxide release.

[1]

- (ii) Suggest the effect of growing crop plant seedlings for an extended period of time at this temperature.

[1]

- (d) Explain how the plant may avoid overheating on a hot sunny day given that the soil is well-watered.

[2]

[Total: 10]

End of Paper



**2014 BIOLOGY PRELIMINARY EXAMINATION
MARK SCHEME
(updated 28 Aug 2014)**

Paper 1

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9	B	19	C	29	D	39	A
10	D	20	C	30	C	40	D

Paper 2

Question	Answers	Marks
1 (a) (i)	- Tar paralyse cilia + accumulation of mucus / mucus not swept up the trachea / pharynx; - Inflammation of airways / air passages / epithelium; R: lungs are inflamed Prolonged exposure to irritants + excessive / increase secretion of mucus R: ciliated cell / ciliary cells	any 2 points
(ii)	- Smoking causes violent and persistent / constant coughing; - Partition walls of alveoli weaken / break down (and sacs lose their elasticity);	1 1
(b)	(accumulation of) mucus block / narrow airways + less air enters lungs; - Decrease / reduced surface area + lesser/slower gaseous exchange;	1 1
2 (a)	- Oxygen cannot be delivered to the muscles fast enough to keep pace with the need / insufficient oxygen supply to muscle cells; R: energy supplied for aerobic respiration is not sufficient - muscle cells respire anaerobically producing lactic acid; - which (accumulates) diffuse into the blood stream; (max 2 marks if no mention of muscle cells)	1 1 1
(b)	- Oxygen debt; - The shaded area refers to the amount of oxygen required to oxidise lactic acid; - The greater the shaded region/oxygen debt, the greater the amount of lactic acid produced/oxidised; R: As the volume of oxygen in the shaded region decreases, the amount of lactic acid in the blood decreases. (cause and effect is wrong)	1 1 1
(c)	It causes muscle fatigue R: muscle ache / pain	1
3 (a)	2, 3, 1, 4;	1

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2014 BIOLOGY PRELIMINARY EXAMINATION MARK SCHEME (updated 28 Aug 2014)

Paper 1

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10	D	20	C	30	C	40	D

Paper 2

Question	Answers	Marks
(b)	• <u>6</u> ;	1
(c)	• <u>CABD</u> ;	1
4 (a)	• Mutation in the gene / change in structure of the gene / mutation of allele; R: genetic mutation	1
(b)	• Parental Genotype – Aa, Aa • Gametes should be circled • Offspring genotype – AA, Aa, Aa, aa • Offspring phenotype – 1 normal, 2 carrier, 1 Anaemia (ratio not required) (minus 1 mark – if the description is wrong) (minus 1 mark – if no key, R: if not mention of alleles in key)	4
5 (a)	• Increase pressure causes valve A to shut and valve B to open; • Blood squeezed in one direction / prevent backflow of blood + flows through valve B;	1 1
(b)	• Materials transferred are <u>glucose / amino acids / oxygen / other named suitable material</u> ; (A): fatty acids/inorganic minerals, ions/hormones/vitamins/CO ₂ /urea at least 2 R: nutrients / dissolved food substances / nitrogenous waste <u>Max 3</u> : • walls are <u>one-cell thick to decrease distance of diffusion</u> ; • <u>lumen is small / capillaries are narrow to decrease the flow rate</u> ; • dense / large network of capillaries to <u>increase Surface Area</u> ; • walls of capillaries are partially permeable; • capillaries are microscopic/relative smaller than other blood vessels + close proximity to cells; • network/branching of capillaries + slow down blood flow + sufficient	4

CCH Prelims 2014 5158/2



2014 BIOLOGY PRELIMINARY EXAMINATION
MARK SCHEME
(updated 28 Aug 2014)

Paper 1

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(b)	- Oxygen debt; - The shaded area refers to the amount of oxygen required to oxidise lactic acid; - The greater the shaded region/oxygen debt, the greater the amount of lactic acid produced/oxidised; R: As the volume of oxygen in the shaded region decreases, the amount of lactic acid in the blood decreases. (cause and effect is wrong)	1 1 1
(c)	It causes muscle fatigue R: muscle ache / pain	1
3 (a)	2, 3, 1, 4;	1

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Paper 2

Question	Answers	Marks
(b)	• <u>5</u> ;	1
(c)	• <u>CABD</u> ;	1
4 (a)	• Mutation in the gene / change in structure of the gene / mutation of allele; R: genetic mutation	1
(b)	• Parental Genotype – Aa, Aa • Gametes should be circled • Offspring genotype – AA, Aa, Aa, aa • Offspring phenotype – 1 normal, 2 carrier, 1 Anaemia (ratio not required) (minus 1 mark – if the description is wrong) (minus 1 mark – if no key, R: if not mention of alleles in key)	4
5 (a)	• Increase pressure causes valve A to shut and valve B to open; • Blood squeezed in one direction / prevent backflow of blood + flows through valve B;	1 1
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CCH Prelims 2014 5158/2



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9	B	19	C	29	D	39	A
10	D	20	C	30	C	40	D

Paper 2

Question	Answers	Marks
	time for diffusion;	
(c) (i)	- As pressure in vein increases, stroke volume increases until 4 to 5 kPa; - R: As stroke volume increases, pressure in vein increases. (cause & effect)	1
(ii)	Heart rate/ pulse rate / pulse beat per min / heartbeat per min / no. of contractions by left/right ventricles per min;	1
6 (a) (i)	$136/3060 \times 100 = 4.44\%$ (must be at least 1 dp) (A) answer in fraction 1 mark for working, 1 mark for final answer	2
(ii)	- A lot of energy/90% of energy lost from one trophic level to the next; - Through respiration/excretion; (at least 1) - Fewer links in food chain if humans eat barley / barley is the producers / barley is the 1st trophic level + so more energy available/less energy lost;	1 1 1
(iii)	- animals are mobile + need energy to move around; - respiration is much more rapid; - have higher metabolic rate; - greater heat loss to environment; - need more energy to keep constant body temperature ;	any 2
(b) (i)	Accept any possible answer, Base should be the largest;	1
(ii)	- Pyramids of energy take in account the energy level in each trophic level over a period of time, while pyramids of biomass only represent energy at a certain point in time. - Pyramid of energy take into account rate of reproduction while pyramid of biomass does not.	1 1

CCH Prelims 2014 5158/2



**2014 BIOLOGY PRELIMINARY EXAMINATION
MARK SCHEME
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Paper 1

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9	B	19	C	29	D	39	A
10	D	20	C	30	C	40	D

Paper 2

Question	Answers	Marks									
7 (a)	• 28 days ;	1									
(b) (i)	• Day 12;	1									
(ii)	• Day 10 – 14;	1									
	• Sperm and egg can survive for at least 2-3 days + ovulation takes place on day 12;	1									
(iii)	• Sex hormone Y (increases and) remains at high levels; • uterine lining increases in thickness/remains thick;	1 1									
(c)	<table border="1"> <thead> <tr> <th>Hormones</th><th>Function</th><th>Explanation</th></tr> </thead> <tbody> <tr> <td>Oestrogen</td><td>• To repair/thicken uterine lining</td><td>• after menstruation, thickness of uterine lining increased with increasing hormone X/ oestrogen.</td></tr> <tr> <td>Progesterone</td><td>• To maintain thickness of the uterine lining</td><td></td></tr> </tbody> </table>	Hormones	Function	Explanation	Oestrogen	• To repair/thicken uterine lining	• after menstruation, thickness of uterine lining increased with increasing hormone X/ oestrogen.	Progesterone	• To maintain thickness of the uterine lining		5
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8	D	18	D	28	B	38	B
9	B	19	C	29	D	39	A
10	D	20	C	30	C	40	D

Paper 2

Question	Answers	Marks
Section B		
8 (a)	Rate of PS in C3 and C4 plant agst water uptake - Labels + graph; - Scale + Axes; - Axes; - Plot;	4
(b)	- rate of photosynthesis increases rapidly/sharply from 2cm³ to 8cm³ - from 8cm³ to 16cm³ of water uptake rate of photosynthesis increases gradually	



2014 BIOLOGY PRELIMINARY EXAMINATION
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8	D	18	D	28	B	38	B
9	B	19	C	29	D	39	A
10	D	20	C	30	C	40	D

Paper 2

Question	Answers	Marks
	Beyond 16cm² of water uptake, photosynthesis rate remains the same/constant at (60mg carbohydrate produced per unit area per min).	
(c)	maize + has a faster rate of photosynthesis at lesser amounts of water absorbed/at lower water uptake	1
(d)	- Cut the gene for <u>PEP carboxylase (enzyme)</u> + a bacterial plasmid + using the same restriction enzyme; - R: plasmid from plant - Mix the plasmid with the gene of interest/cut out gene (OWTTE) + DNA ligase (to join the gene to the plasmid); - Mix the <u>recombinant</u> plasmid with bacteria + heat or electric shock + to introduce recombinant plasmid into bacteria; - infect plant cells with transgenic bacteria;	4
9 (a)	- chemical substance + produced in minute quantities/by endocrine gland; - carried by the blood/secreted into bloodstream; - which alters the activity of one or more specific target organs and is then destroyed by the liver;	any 2
(b)	<u>Hormone A/glucagon</u>; - as blood glucose decreases from normal concentration to 40mg/100ml, hormone A increases/from 40mg/100ml to normal concentration of blood glucose, hormone A decreases; - Hormone B remains at low levels;	3
(c)	<u>Glucagon</u> - facilitates the conversion of glycogen to glucose + to raise blood glucose level back to normal - R: converts glycogen to glucose - ecf if hormone A is identified wrongly	2



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Paper 2

Question	Answers	Marks										
(d)	<table border="1"> <thead> <tr> <th>Hormones</th><th>Enzymes</th></tr> </thead> <tbody> <tr> <td>Hormones are destroyed by liver after use</td><td>Not destroyed, can be reused</td></tr> <tr> <td>Endocrine secretion</td><td>exocrine secretion</td></tr> <tr> <td>transported by blood</td><td>transported by ducts</td></tr> <tr> <td>Can be proteins or steroids</td><td>Proteins</td></tr> </tbody> </table>	Hormones	Enzymes	Hormones are destroyed by liver after use	Not destroyed, can be reused	Endocrine secretion	exocrine secretion	transported by blood	transported by ducts	Can be proteins or steroids	Proteins	1
Hormones	Enzymes											
Hormones are destroyed by liver after use	Not destroyed, can be reused											
Endocrine secretion	exocrine secretion											
transported by blood	transported by ducts											
Can be proteins or steroids	Proteins											
10. (a) E	- used in <u>photosynthesis</u> + provides the hydrogen necessary for the reduction of carbon dioxide to glucose; - turgidity in plant cells + provide support to seedlings/plants with soft stems; - turgidity in leaf cells + keep leaves spread out + absorb maximum sunlight for photosynthesis; - medium for chemical reactions in plant cells; - solvent + transport of materials/translocation; - evaporation from leaves + takes away latent heat/cool down plant;	any 4										
(b)	<u>With reference to xylem</u> - transports water and mineral salts; - from roots to leaves; - capillary action/transpiration pull/root pressure; (any 2) <u>With reference to phloem</u> - transports sucrose/amino acids; - from leaves to all parts of plants; - translocation/active transport; NB : if no mention of xylem or phloem, max 4	6										
10 (a) O	- as temperature increases from -10°C to 35°C rate of carbon dioxide uptake increase from 0 to 11 arbitrary units; - the highest rate of carbon dioxide uptake at 11 arbitrary units takes place at 35°C; - from 35°C to 47°C rate of carbon dioxide uptake decreases from 11 to 0 arbitrary units;	3										



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9	B	19	C	29	D	39	A
10	D	20	C	30	C	40	D

Paper 2

Question	Answers	Marks
(b)	• biomass decreases + carbon dioxide uptake is (two times) lower than carbon dioxide release at 45°C; • Rate of respiration exceeds rate of photosynthesis or vice versa; • Depletes food reserves/using up food store;	3
(c) (i)	• 43°C (+/-1°C);	1
(ii)	• just enough energy released for sustenance /no cell growth/no increase in biomass/seedling does not grow;	1
(d)	• guard cell turgid + stomata opened • excess heat is removed by increased transpiration	2

Class:	Register No:	Name:
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CRESCENT GIRLS' SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION

BIOLOGY
Paper 1 Multiple Choice

Additional Materials: Multiple Choice Answer Sheet

5158

1 September 2014

1 hour

READ THESE INSTRUCTIONS FIRST

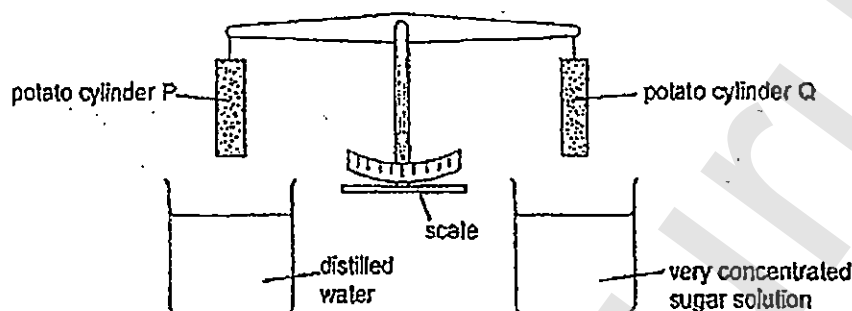
Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided.

There are forty questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D.
Choose the one you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

This paper consists of 16 printed pages, including the cover page.

- 1 A student investigated osmosis in potatoes. He set up the apparatus shown.



At the beginning, the potato cylinders were exactly balanced on the scale. He immersed the cylinders into the liquids for 4 hours, after which the cylinders were lifted out of the liquids. Cylinder P was then heavier than cylinder Q.

Which statement explains what happened?

- A Water molecules moved into both cylinders.
 - B Water molecules moved out of both cylinders.
 - C Water molecules moved into the cylinder in the distilled water and out of the cylinder in the sugar solution.
 - D Water molecules moved out of the cylinder in the distilled water and into the cylinder in the sugar solution.
- 2 Which kind of molecule could be an enzyme?
- A fat
 - B glucose
 - C protein
 - D starch
- 3 Small molecules are used as the basic units in the synthesis of large food molecules.

Which statement is correct?

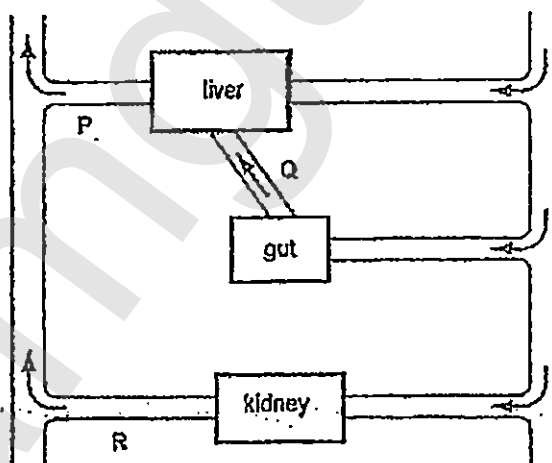
- A Amino acid is a basic unit of DNA.
- B Fatty acid is a basic unit of glycogen.
- C Glycerol is a basic unit of oils.
- D Simple sugar is a basic unit of protein.

- 4 The table shows the conditions in four test-tubes containing equal quantities of starch and salivary amylase.

In which test-tube is the starch broken down the fastest?

	pH	Temperature / °C
A	2	27.0
B	2	37.0
C	7	27.0
D	7	37.0

- 5 The diagram represents some human organs and the associated blood vessels.



Which row represents the levels of alcohol found in blood vessels P, Q and R immediately after taking an alcoholic drink?

	P	Q	R
A	low	low	medium
B	medium	high	low
C	high	low	low
D	high	medium	high

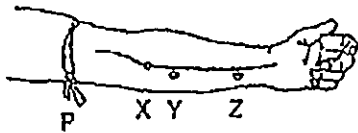
- 6 Which statement explains double circulation of the blood?

- A Atria and ventricles contract alternately.
- B Blood flows through atria and ventricles.
- C Blood flows through the arteries and veins.
- D Blood flows twice through the heart.

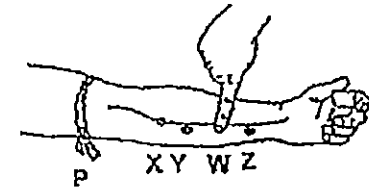
- 7 The diagram shows how to demonstrate the flow of blood in the veins of the lower arm.



Bandage arm at P to slow return of blood to the heart.



Veins become visible, and valves show as swelling at X, Y and Z.



Press one finger down at W.

Use another finger to stroke the vein as far as position X and then remove this finger.

Vein 'disappears' between W and Y.

Some possible reasons why the vein 'disappears' are listed.

1. The bandage at P prevents backflow.
2. The finger pressed at W prevents more blood entering.
3. The valve at Y prevents backflow.
4. The valve at Z prevents more blood entering.

Which are the correct reasons?

- A 1 and 2
 B 1 and 4
 C 2 and 3
 D 2 and 4
- 8 Aphids feed on the contents of phloem tubes.

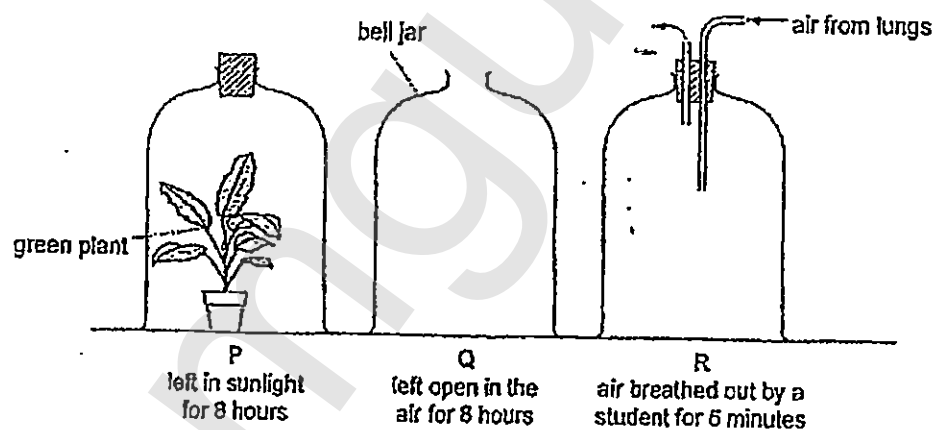
What type of food would be lacking in their diet?

- A amino acid
 B fat
 C sucrose
 D water

9 Which method could increase the rate of water uptake by a shoot?

- A covering the shoot with a black plastic bag
- B covering the shoot with a clear plastic bag
- C removing the leaves from the shoot
- D shining a bright light onto the shoot

10 In an experiment, three glass bell jars were set up.



At the end of the experiment, which bell jar has the most oxygen and which has the least?

	Most oxygen	Least oxygen
A	P	Q
B	P	R
C	Q	P
D	R	P

11 Why does anaerobic respiration by yeast release less energy than aerobic respiration?

- A Energy is lost in oxygen.
- B Energy is lost in carbon dioxide.
- C Energy remains trapped in ethanol.
- D Energy remains trapped in lactic acid.

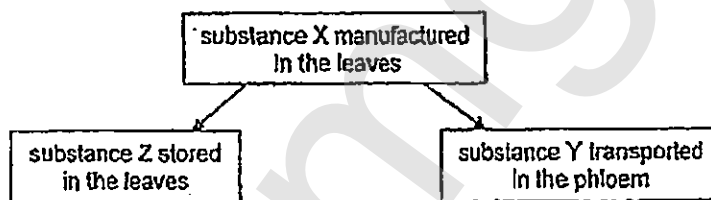
- 12 In which organ is urea formed and through which tube does it leave the body?

	organ	tube
A	kidney	ureter
B	kidney	urethra
C	liver	ureter
D	liver	urethra

- 13 Which process is used during dialysis?

- A active transport
- B passive diffusion
- C translocation
- D ultrafiltration

- 14 The diagram shows some stages occurring in the leaves.



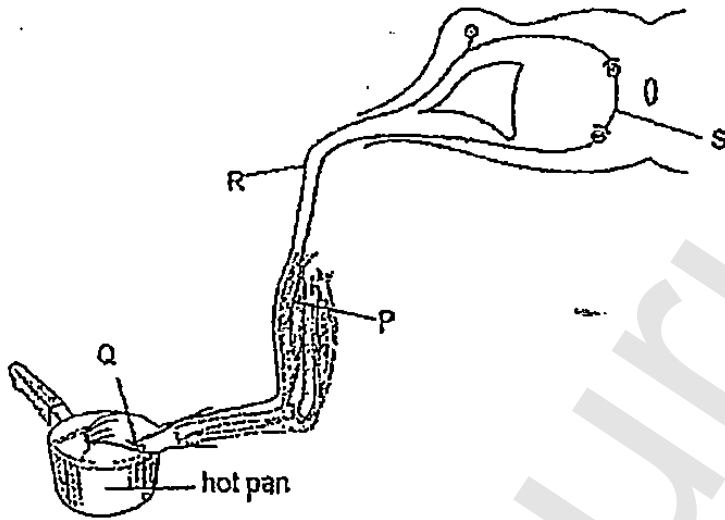
What are substances X, Y and Z?

	X	Y	Z
A	glucose	sucrose	glucose
B	glucose	sucrose	starch
C	starch	glucose	glucose
D	starch	glucose	starch

- 15 What are the two active enzymes involved in the blood clotting process?

- A fibrinogen and prothrombin
- B fibrinogen and thrombin
- C thrombokinase and prothrombin
- D thrombokinase and thrombin

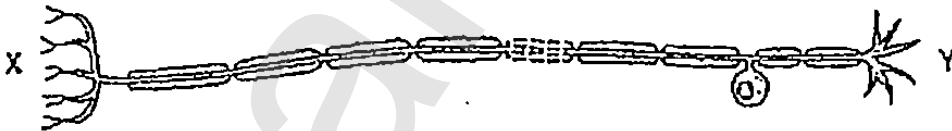
- 16 The diagram shows the structures involved in a reflex action.



What is the correct sequence showing a reflex action?

- A $P \rightarrow Q \rightarrow R \rightarrow S$
- B $P \rightarrow S \rightarrow R \rightarrow Q$
- C $Q \rightarrow R \rightarrow S \rightarrow P$
- D $Q \rightarrow S \rightarrow P \rightarrow R$

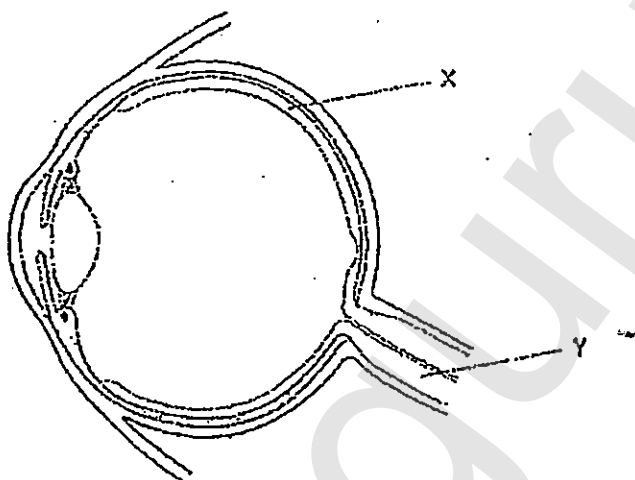
- 17 The diagram shows a neurone.



Which structures could be found at X and Y?

	X	Y
A	brain	intestine
B	brain	leg
C	eye	hand
D	skin	spinal cord

- 18 The diagram shows a section through an eye.



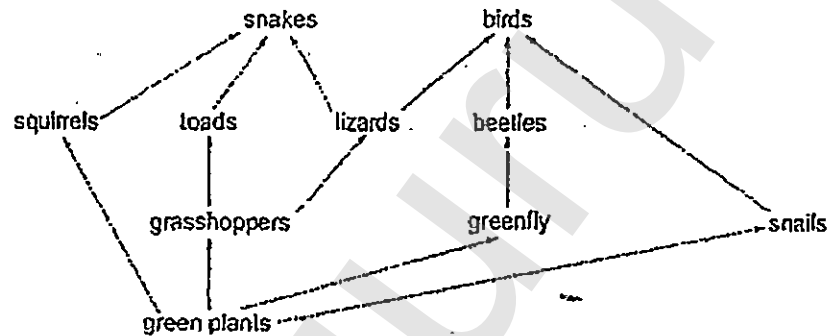
What are structures X and Y?

- A organs in an organ system
 B organs in a tissue
 C organ systems in an organ
 D tissues in an organ
- 19 Which part of the eyeball produces the greatest degree of refraction of light?
- A aqueous humour
 B cornea
 C lens
 D vitreous humour
- 20 When a person is frightened, adrenaline is released by the adrenal glands.

What are the effects of the adrenaline?

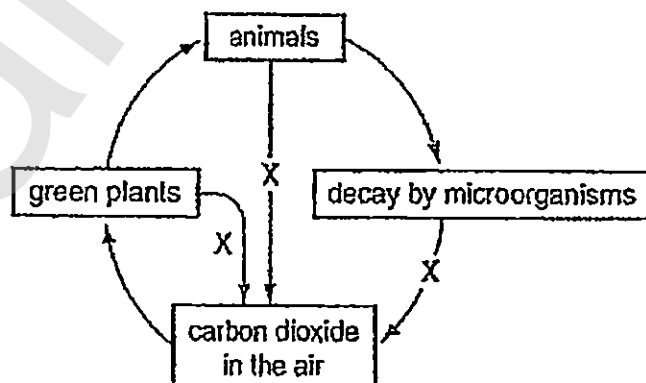
	breathing rate	heart beat rate
A	decreased	decreased
B	decreased	increased
C	increased	decreased
D	increased	increased

- 21 The diagram shows a food web.



Which organism population will increase when the population of snakes increases?

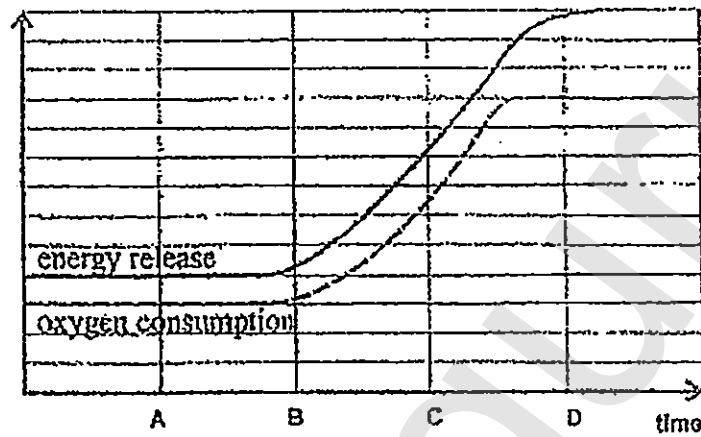
- A birds
 - B grasshoppers
 - C lizards
 - D squirrels
- 22 The diagram shows part of the carbon cycle.



What does X represent?

- A death
- B digestion
- C photosynthesis
- D respiration

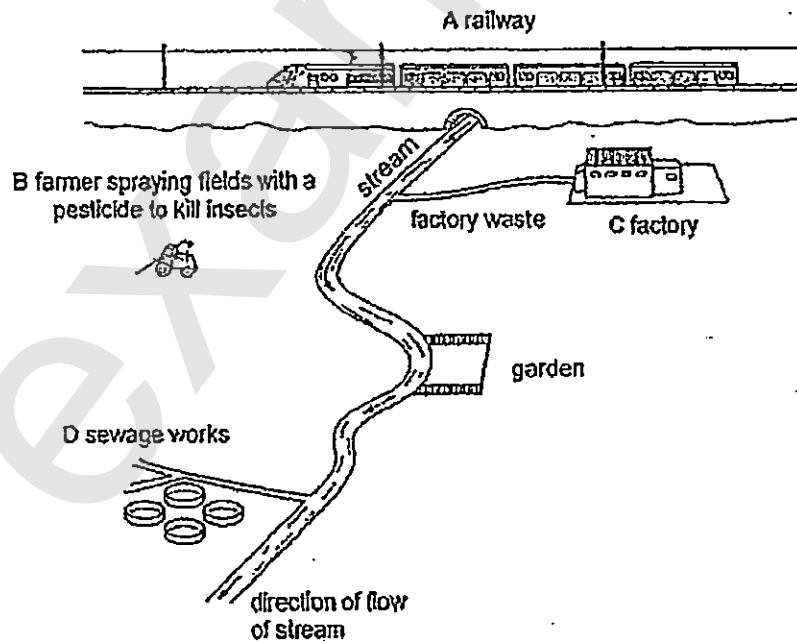
- 23 The graph shows the oxygen consumption and energy released during a period of exercise.



At which point in time is an oxygen debt incurred?

- 24 A gardener planted some water plants in the stream at the bottom of the garden shown on the diagram. At first, the plants grew well but after a while, they died.

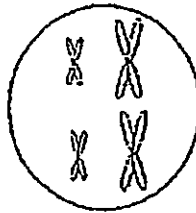
Which source of pollution is most likely to have caused the death of the plants?



- 25 The zygote produced by sexual reproduction in mice (*mus musculus*) contains 40 chromosomes. How many chromosomes are there in cells produced by the first division of meiosis in mice?

A 10
B 20
C 40
D 80

- 26 The diagram represents the nucleus of a cell $2n=4$ in late prophase of meiosis.

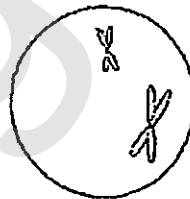


Which diagram represents a cell of the same species in anaphase II of meiosis?

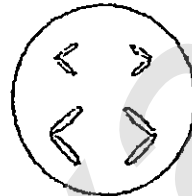
A



B



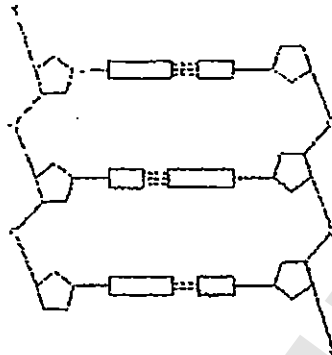
C



D



- 27 The diagram shows the structure of a small section of DNA.

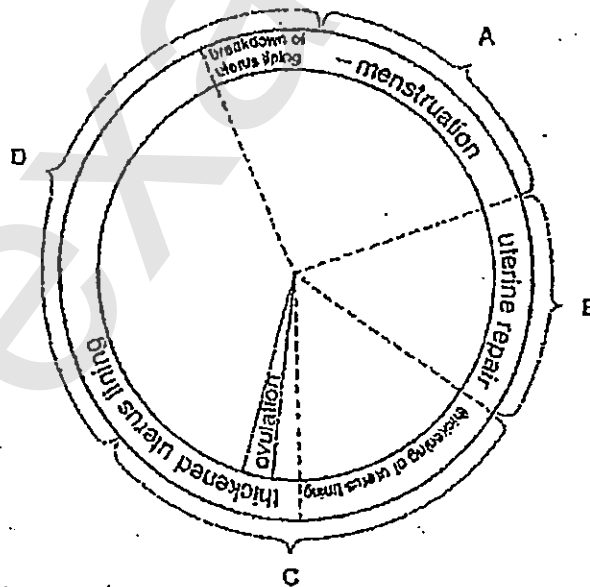


What is represented by the shapes in the diagram?

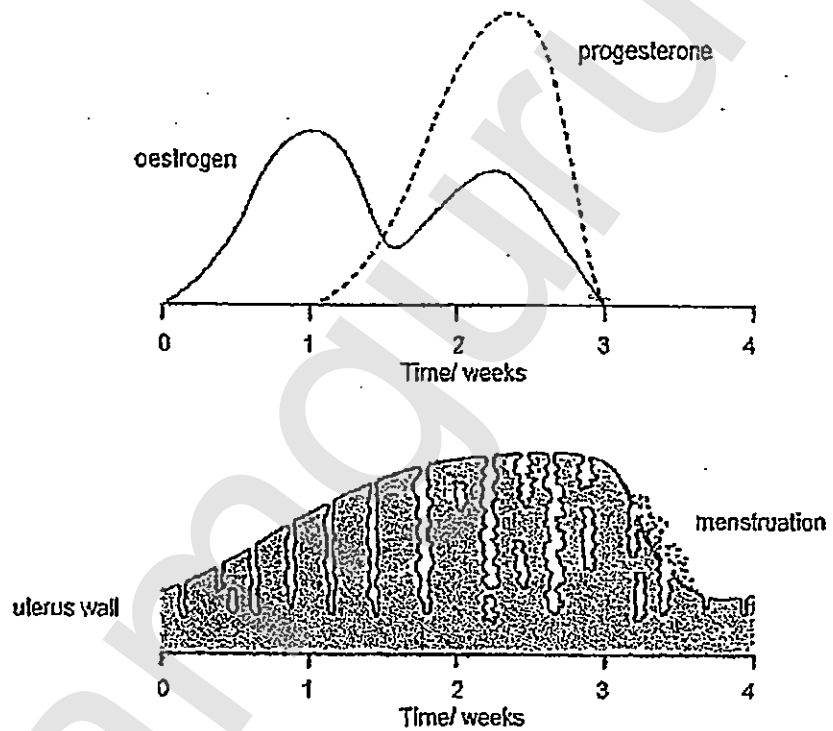
	O		
A	base	phosphate	deoxyribose
B	base	ribose	phosphate
C	deoxyribose	phosphate	base
D	phosphate	deoxyribose	base

- 28 The diagram shows stages of a menstrual cycle.

Which is the most fertile stage?



29 The diagram shows the changes which take place during a woman's menstrual cycle.



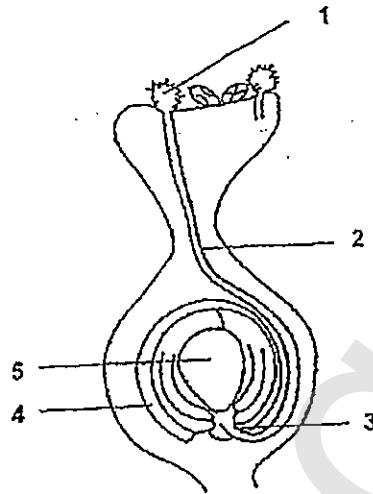
What is occurring at the time of ovulation?

- A a fall in the levels of oestrogen and progesterone
- B a fall in the level of oestrogen and a rise in progesterone
- C a rise in the levels of oestrogen and progesterone
- D a rise in the level of oestrogen only

30 AIDS is not transmitted _____.

- A during sexual intercourse with an infected person
- B from an infected mother to foetus during birth
- C through the sharing of infected needles
- D through mosquitoes which bit an infected person previously

- 31 The diagram shows a cross-section through the carpel of a flower just before fertilisation.



Which parts would develop further after fertilisation?

- A 1 & 5
 B 4 & 5
 C 1, 2 & 3
 D 2, 4 & 5
- 32 The chart provides information about the flowers of three different plants.

Flower characteristic	Flowers		
	Plant A	Plant B	Plant C
Petal colour	white	purple	bright, yellow
Aroma	none	rotting meal, strong	sweet, strong
Petal size	0,3 cm	10,0 cm	4,0 cm
Nectar size	none	medium amount	large amount

Which inference is valid concerning the method of pollination for plants A, B and C?

- A All three plants are wind pollinated.
 B All three plants are insect pollinated.
 C Plant A is wind pollinated, but plants B and C are insect pollinated.
 D Plants A and B are insect pollinated, but plant C is wind pollinated.

- 33 In humans, which types of variation are shown by blood group and height?

	blood group	height
A	continuous	continuous
B	continuous	discontinuous
C	discontinuous	continuous
D	discontinuous	discontinuous

- 34 A family has three daughters. The mother is pregnant for the fourth time. What is the chance of the fourth child being a son?

- A 25%
- B 50%
- C 75%
- D 100%

- 35 What is a mutation?

- A a change in a gene or chromosome
- B a condition caused by a recessive allele
- C a process used in genetic engineering
- D a type of discontinuous variation

- 36 Which is genetically identical?

- A brothers and sisters in the same family
- B cuttings taken from the same plant
- C mammals in the same litter
- D seeds produced by the same tree

- 37 A person has the blood group O with genotype $i^O i^O$. What determines this blood group?

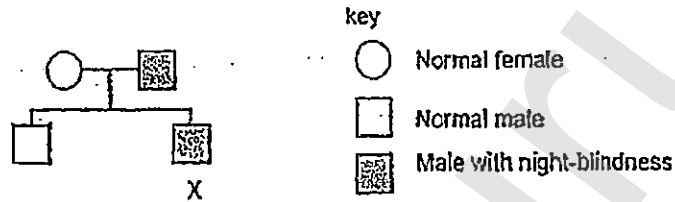
- A different alleles on different chromosomes
- B different alleles on the same chromosomes
- C the same alleles on different chromosomes
- D the same alleles on the same chromosomes

- 38 Why does a young boy lose more heat than a man in identical condition?

- A The boy is more active.
- B The boy sweats less than a man.
- C The boy eats more carbohydrates.
- D The boy has a larger surface area to mass ratio.

- 39 Night-blindness is an inherited condition, caused by a dominant allele.

The chart shows how this condition was passed on in a family.

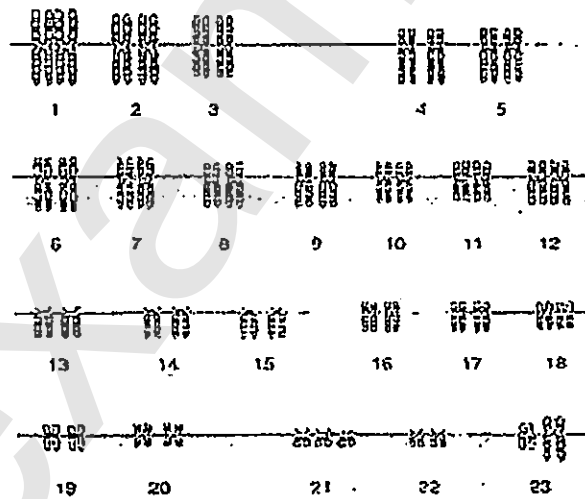


Person X marries someone with normal sight.

What is the chance that their first child will have night-blindness?

- A 0%
- B 50%
- C 75%
- D 100%

- 40 The diagram shows chromosomes from a human cell.



This person is _____

- A a normal female
- B a normal male
- C a female with Down's syndrome
- D a male with Down's syndrome

.....The End

Class:	Register No:	Name:
 CRESCENT GIRLS' SCHOOL SECONDARY FOUR PRELIMINARY EXAMINATION BIOLOGY Paper 2 No additional materials are required		
		5158/02 25 August 2014 1 hour 45 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided above.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer all questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer three questions.

Write your answers in the spaces provided on the Question Paper.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	50
Section B	30
Total	80

This paper consists of 18 printed pages, including the cover page.

SECTION A (50 marks)

Answer all questions.

Write your answers in the spaces provided.

- 1 Fig. 1 shows a single-celled organism called *Euglena*.

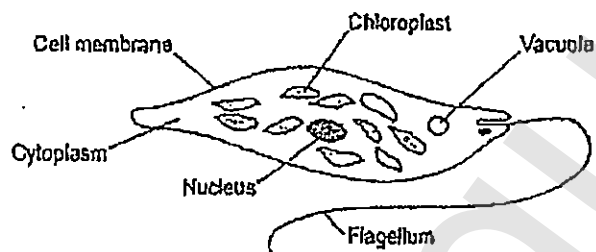


Fig. 1

- (a) In the 19th century, scientists could not decide whether *Euglena* should be described as a plant or an animal.

Use your knowledge of plant and animal cells to answer these questions.

- (i) Suggest two reasons why some scientists thought *Euglena* was a plant cell and not an animal cell. [2]

1

2

- (ii) Suggest one reason why some scientists thought *Euglena* was an animal cell and not a plant cell. [1]

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- (b) The *Euglena* in Fig. 1 lives in fresh water. Explain what happens to the *Euglena* if it is put into salt water. [3]

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[Total: 6]

- 2 A patient has a disease which damages his pancreas. His doctor prescribes a course of treatment for him. He was advised to take one capsule of medicine (shown in Fig. 2 below) with each meal. Each capsule contains hundreds of small, dry beads. The beads are made of enzymes. The pancreas normally produces these enzymes. The outer coating of the capsule is made of lipid.

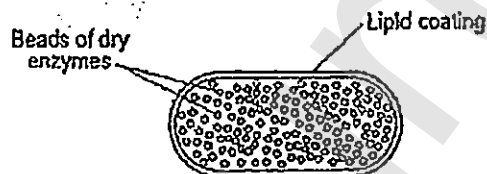


Fig. 2

- (a) One of the enzymes in the beads is lipase.
Name two other enzymes made in the pancreas of a healthy person. [2]
-
- (b) Explain how the lipid coating on the capsule makes sure that the enzymes are not released until the capsule reaches the small intestine. [2]
-
-
-
- (c) Suggest why the lipase in the beads does not digest the lipid coating around the capsule. [1]
-
- (d) State another medical condition that this patient is likely to have and suggest 2 ways to treat it. [3]
-
-
-
-

[Total: 8]

- 3 Fig. 3.1 below shows a developing human fetus and part of the mother's reproductive system.

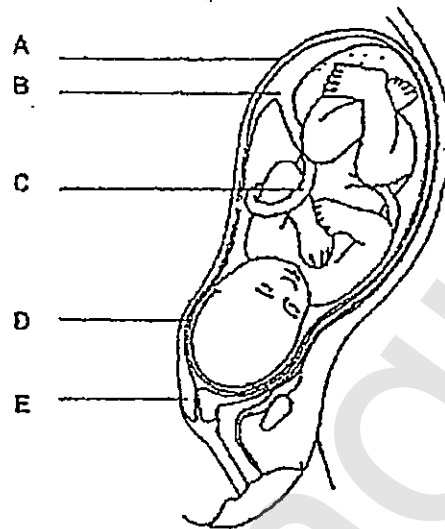


Fig. 3.1

- (a) State two functions of the fluid enclosed by structure D. [2]

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- (b) Name the structure B. Suggest two fetal organs which functions have been taken over by B during pregnancy. [3]

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- (c) State the role played by structure A during the birth of the fetus. [1]

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- (d) One of the structures (A – E) secretes a hormone. State the structure and name the hormone that it produces. [1]

- (e) Fig. 3.2 shows the cross section of structure C.

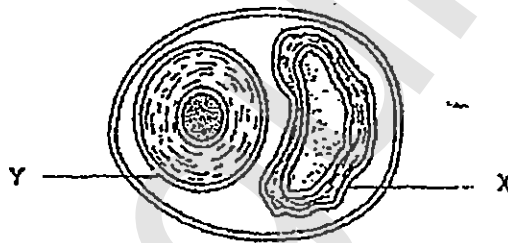


Fig. 3.2

- (i) X and Y are blood vessels. State which one (X or Y) is an artery. Give one reason for your answer. [1]

- (ii) State two differences in the composition of the blood in X and in Y. [2]

Blood in X	Blood in Y

[Total: 10]

- 4 Fig. 4 is a diagram representing a stage of mitosis in an animal cell.

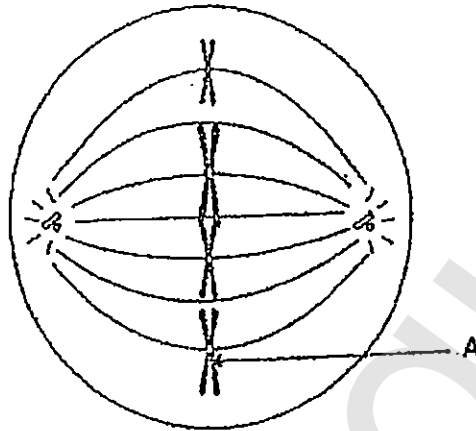


Fig. 4

- (a)(i) Name this stage of mitosis. [1]

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- (ii) Structure A is a chromosome. Describe what happens to A in the stage immediately following that shown in Fig. 4. [2]

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- (b) The table shows the mean mass of DNA in the nuclei of different cells in cattle.

Cell	Mean mass of DNA / arbitrary units
Sperm cell	3.42
Red blood cell	0.00
Liver cell	7.05

- (i) Explain why there is a difference in DNA content between sperm and liver cells. [2]

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- (ii) Explain why there is no DNA in the red blood cell. [1]

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- (iii) The amount of DNA in cells from the liver tissue was analysed. Explain why some cells were found to have 7 units of DNA while others had 14 units of DNA. [2]

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[Total: 8]

- 5 Fig. 5 shows two different species of butterfly.

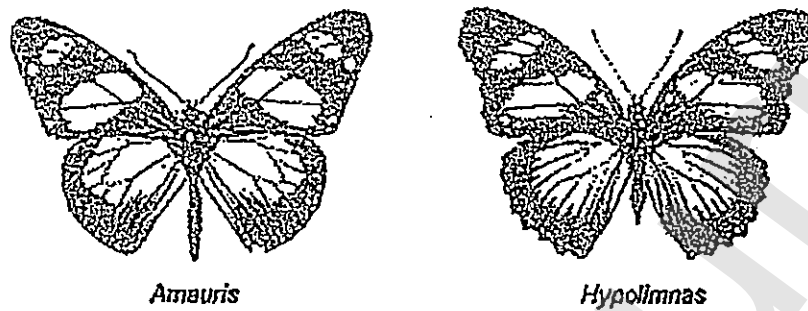


Fig. 5

Both species can be eaten by most birds.

Amauris has an unpleasant taste which birds do not like, so birds have learned not to prey on it.

Hypolimnas does not have an unpleasant taste but most birds also do not prey on it.

- (a) With reference to Fig. 5, suggest why most birds do not prey on *Hypolimnas*. [2]

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- (b) Suggest an explanation, in terms of natural selection, for the markings on the wings of *Hypolimnas*. [3]

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[Total: 5]

- 6 Fig. 6 shows the annual energy flow through 1 m^2 of a habitat. The unit, in each case, is $\text{kJ per m}^2 \text{ per year}$.

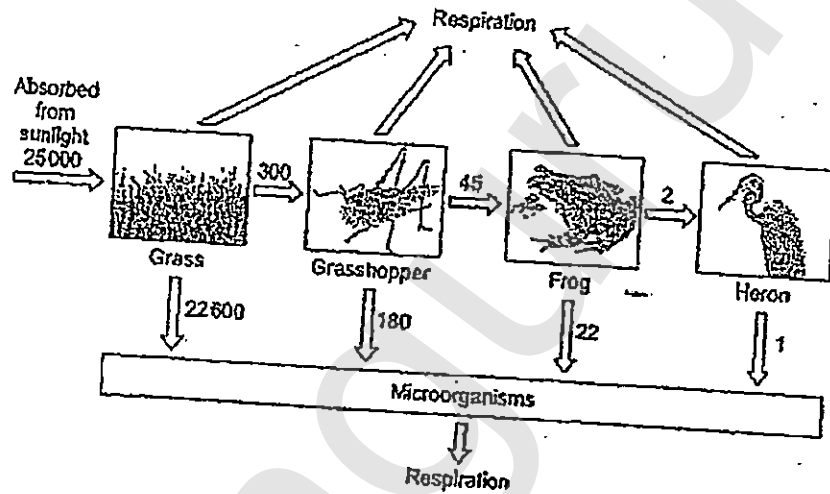


Fig. 6

- (a) Calculate the percentage of the energy absorbed by the grass from sunlight that is transferred to the frog. Show clearly how you work out your answer. [1]
- (b) All of the energy the grass absorbs from the sun is eventually lost to the surroundings. State the form in which this energy is lost. [1]
- (c) Explain how microorganisms help to recycle materials in this habitat. [3]

[Total: 5]

- 7 Students investigated the effect of changing the carbon dioxide concentration on the rate of photosynthesis in pieces of leaf.

Fig. 7.1 shows the type of leaf used by the students.



Fig. 7.1

The students:

- cut pieces of leaf from the green region
- put the pieces into test tubes
- added different concentrations of carbon dioxide to each tube
- shone lights with either high or low light intensity on the tubes
- recorded the concentration of oxygen in the tubes after 5 hours

Fig. 7.2 shows how each experiment was set up.

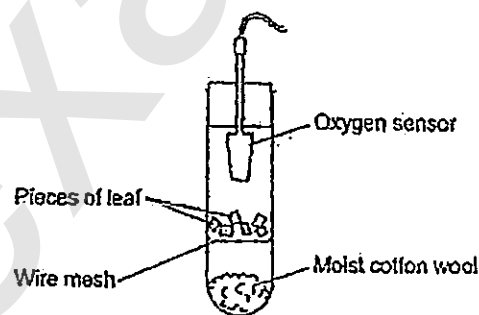
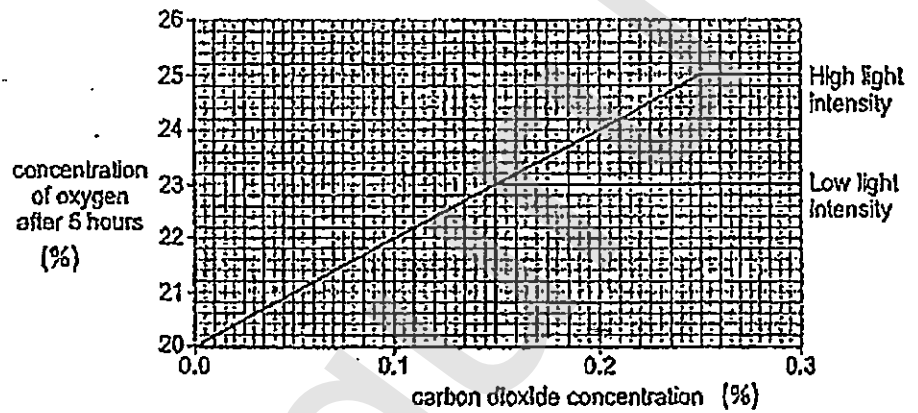


Fig. 7.2

The graph shows the results of the investigation.



- (a)(i) With reference to the graph, describe the effect of increasing carbon dioxide concentration on the rate of photosynthesis at low light intensity. [2]

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- (ii) Based on the concept of limiting factors, explain the effect that you have described in (i). [2]

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- (b) Explain the effect on oxygen concentration over the five-hour period if a white region of the leaf had been used, instead of a green region. [2]

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- (c) Some people keep indoor plants which have variegated leaves (leaves with green and white regions).

If plants with variegated leaves are kept in dim light conditions, the white areas of the leaves start to turn green. Suggest why this is an advantage to the plant. [2]

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[Total: 8]

SECTION B (30 marks)

Answer three questions.

Question 10 is in the form of an Either/Or question.

Only one part should be answered.

Write your answers in the spaces provided.

- 8 The seeds of a certain plant species have either red or orange seed coats. This trait is controlled by a pair of alleles. A red seed is germinated and developed into a mature plant. This plant is then self-pollinated and 200 seeds were produced. The colour and mass of the seeds were recorded in Table 8.1 and 8.2.

Table 8.1

Colour of seed	Red	Orange	White
Number of seeds	148	51	1

Table 8.2

Mass of seeds / g	0.4	0.6	0.8	1.0	1.2	1.4
Number of seeds	18	27	49	60	26	20

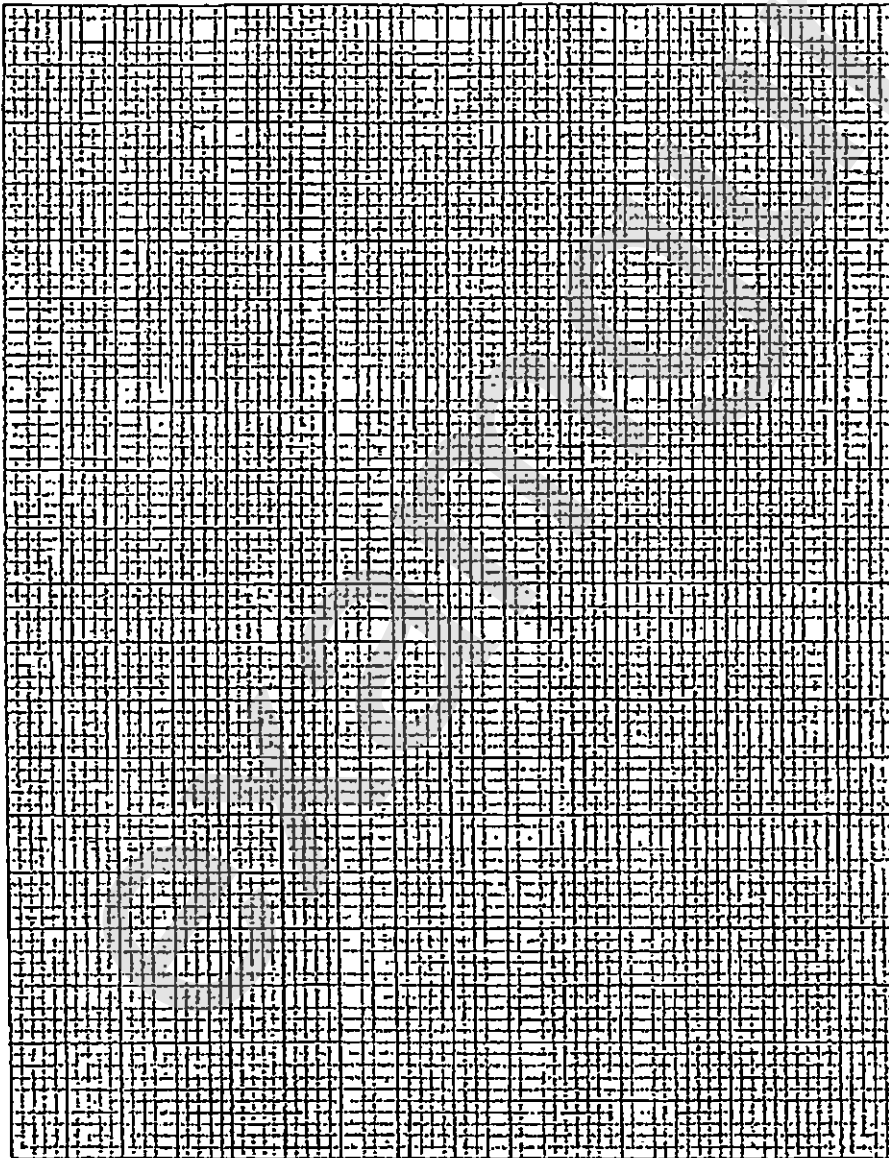
- (a) State the dominant allele for the colour of seed coat. [1]
-
- (b) With the help of a genetic diagram, show how self-pollination of the original red seed plant can produce orange seeds. [3]

- (c) Suggest a possible reason for the presence of the single white seed.

[1]

- (d)(i) Plot a graph of the number of seeds against the mass of seeds.

[3]



- (ii) Calculate the percentage of seeds which have mass of at least 1.2 g. [1]

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- (e) The mass of seeds can be affected by both environmental and genetic factors. Suggest one environmental factor that may result in the difference in the mass of the seed. [1]

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[Total: 10]

9

- (a) Explain why a plant species in which self-pollination occurs can become adapted to new surrounding better than one that reproduces asexually, but less well adapted than a species that is always cross-pollinated. [4]

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes the need for transparency and accountability in financial reporting.

2. The second part of the document outlines the various methods and techniques used to collect and analyze data. It includes a detailed description of the experimental setup and the procedures followed during the study.

3. The third part of the document presents the results of the study, showing the data collected and the analysis performed. It includes tables and graphs to illustrate the findings.

4. The fourth part of the document discusses the implications of the study and the conclusions drawn from the results. It highlights the significance of the findings and their potential applications.

5. The fifth part of the document provides a summary of the study and a list of references. It also includes a list of figures and tables used in the document.

- (b) Describe how sperms and pollen grains are specialised for their respective roles in the life cycles of mammal and flowering plants. [6]

[illegible]

[Total: 10]

10 Either

(a) Explain why more urine is produced on a cold rainy day. [3]

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(b) Explain how bacteria can be genetically modified to produce human insulin. [4]

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(c) Explain how eutrophication can lead to the death of fish in the river. [3]

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[Total: 10]

10 Or

- (a) Explain the importance of the structure of each of the following in relation to their functions: [4]

- (i) the exchange surface of the alveoli
(ii) the lining of the trachea

- (b) People who have regularly smoked cigarettes for many years may become short of breath when they exercise. They may also have a persistent cough. Explain how smoking cigarettes could have contributed to these two effects. [6]

[Total: 10]

..... End of Paper



17

MCQ:

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
C	C	C	D	B	D	C	B	D	B

11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
C	D	B	B	D	C	D	D	B	D

21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
B	D	D	C	B	C	D	C	B	D

31.	32.	33.	34.	35.	36.	37.	38.	39.	40.
B	C	C	B	A	B	C	D	B	D

criscent girls

19

Biology Prelim 2014 Paper 2

Marking scheme

Section A

question	answers	extra information	mark
1ai	(has) chloroplast(s)	(A) chlorophyll	1
	vacuole		1
aii	any one from: - no cell wall - can move / has flagellum	R. counter arguments that are listed in 1a(i)	1
b	water molecules leave / move out through partially permeable membrane + by osmosis because water potential inside the cell is greater than that of solution outside Euglena shrinks in size	1 1 1 1 Any 3 accept explanations in terms of concentration (of salt) is greater outside than inside	Max 3

2a	trypsin	(A) protease (R) pepsin	1
	amylase	do not allow sucrase / maltase / lactase	1
b	no lipase produced / found In stomach / mouth / before small intestine OR accept lipase only produced / found (1) in small intestine (1)	if no other mark is awarded, lipid is not broken down in the stomach or lipid is digested in small intestine, gains 1 mark	1 1
c	enzymes only work in solution / when dissolved or because enzyme / lipase / it is dry	allow enzymes only work in presence of water or enzymes do not work / inactive when dry Ignore other physical conditions	1
d	Diabetes / high blood glucose/ Insulin injection Diet low in carbohydrates/ sugars		1 1 1

3a	Supports/ cushions the fetus before birth / Acts as shock absorber/ Protects fetus against physical injury/ Allows fetus some degree of movement/ Lubricates birth canal during childbirth	Any 2 functions	2										
b	Placenta Lungs / Kidneys / Stomach / small intestines	Reject uterine lining / uterus 1 } 1 } Any 2 1 }	1 2										
c	Contracts to push out the baby		1										
d	B + progesterone	(R) placenta 1 mark given only when both are correct	1										
e(i)	Y It has thicker muscle wall / smaller lumen	1 mark given only when both are correct	1										
(ii)	<table border="1"> <thead> <tr> <th>X</th> <th>Y</th> </tr> </thead> <tbody> <tr> <td>More oxygen</td> <td>Less oxygen</td> </tr> <tr> <td>Less carbon dioxide</td> <td>More carbon dioxide</td> </tr> <tr> <td>More glucose</td> <td>Less glucose</td> </tr> <tr> <td>Less urea</td> <td>More urea</td> </tr> </tbody> </table>	X	Y	More oxygen	Less oxygen	Less carbon dioxide	More carbon dioxide	More glucose	Less glucose	Less urea	More urea	Reject oxygenated/ deoxygenated blood Any 2	2
X	Y												
More oxygen	Less oxygen												
Less carbon dioxide	More carbon dioxide												
More glucose	Less glucose												
Less urea	More urea												

4a(i)	metaphase		1
(ii)	centromere splits/ divides into two; sister chromatids separates / pull apart by spindle fibres to opposite poles,		1 1
b(i)	sperm produced by <u>meiosis</u> + haploid/ only one set of chromosomes; liver cell produced by <u>mitosis</u> + diploid/ two sets of chromosomes/	Do not award any marks if candidate simply mentions that mass of DNA in liver cell is twice that of the sperm cell	1 1
(ii)	Red blood cell has no nucleus	Accept red blood cell has no chromosome	1

(iii)	cell with 14 units of DNA has replicated its DNA / is at interphase / prophase / metaphase / before cytokinesis;		1
	cell with 7 units of DNA has not undergone DNA replication or has just completed cytokinesis;		1

5a	wing pattern similar to <i>Amauris</i>	allow looks similar to <i>Amauris</i>	1
	birds assume it will have an unpleasant taste		1
b	mutation / variation produced wing pattern similar to <i>Amauris</i>	do not accept breeds with <i>Amauris</i>	1
	(these butterflies not eaten (by birds))	do not accept idea of intentional adaptation	1
	these butterflies breed or their genes are passed to the next generation		1

6a	$45 \times 100 / 25000$ $= 0.18\%$	award mark for correct answer with working	1
b	Heat	Allow heat <u>from</u> respiration	1
c	any three from: (microorganisms) decay / decompose / digest / breakdown dead organic matter (breakdown) releases minerals / nutrients / ions / into soil + plants absorb these for growth (microorganisms / respiration) release carbon dioxide into the air + plants use the carbon dioxide for photosynthesis	accept marking points if candidate uses other terms for microorganisms ignore eat ignore food	3

7ai	Rate of photosynthesis increases when CO ₂ conc. increases from 0 to 0.15 %		1
	Above 0.15% CO ₂ , rate of photosynthesis levels off / becomes constant / reaches a maximum		1
aii	at CO ₂ conc. below 0.15%, CO ₂ concentration is a limiting factor + hence		1

	increase in CO₂ conc. leads to an increase in the rate of PS at CO₂ conc. above 0.15%, light is a limiting factor + hence further increase in CO₂ conc. does not result in any increase in the rate of PS		1
b	effect: oxygen concentration falls explanation: oxygen is used for respiration no photosynthesis, hence no oxygen is released from the leaves		1 $\frac{1}{2} + \frac{1}{2}$
c	more chlorophyll / chloroplasts allows more photosynthesis / description	for both marks must refer to more at least once	1 1

Section B

8a	Allele for red seed coat	(A) red	1
b	Legend for the alleles Parents' phenotype: Red X Red Parents' genotype: Rr Rr Gametes: R, r R, r Offspring's genotype: RR, Rr, Rr, rr Offspring's phenotype: red, red, red, orange Ratio 3 red : 1 orange		$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
c	mutation		1
d(i)	Axes are labelled with units All points plotted correctly and smooth curve/ best fit curve Suitable scale		1 1 1
(ii)	$\frac{46}{200} \times 100$ = 23%	No mark given if working not shown	1
(iii)	Amount of water available / Amount of nutrients in the soil / Light intensity		1

9(a)	Asexual reproduction does not involve fusion of gametes/ produces genetically identical offspring	1	Max. 4
	Self and cross pollination both involve sexual reproduction / fusion of gametes	1	
	Gametes are produced through meiosis / genetically varied	1	
	Self-pollination results in offspring with some genetic variation as the gametes come from the same parent	1	
	Cross-pollination results in offspring with greater genetic variation as gametes come from / traits are inherited from 2 parents	1	
	The more genetically varied the offspring, the better they are at adapting to changing environmental conditions	1	
(b)	<u>For adaptation of sperm cell</u>		1
	• Flagellum for movement of cell to oviduct		1
	• Acrosome for digestion of follicle cells of the ovum		
	• Large number of mitochondria for release of energy from respiration for movement of sperm		1
	<u>For adaptation of pollen grain</u>		
	• Pollen tube produces enzymes to digest through style		1
	• Rough surface for insect pollinated flowers + cling to body of insects		1
	• Light/small pollen grains for wind pollinated flowers + to be easily carried by the wind		1

10 Either (a)	Less sweat produced	Max 3 marks	1
	Water potential of blood increases		1
	Less ADH released		1
	less water reabsorbed from kidney tubules back to blood capillaries		1

(b)	Insulin gene cut from Human DNA + use of restriction enzyme	$\frac{1}{2} + \frac{1}{2}$	1
	Plasmid is isolated and cut + use of <u>same</u> restriction enzyme	$\frac{1}{2} + \frac{1}{2}$	1
	Insulin gene inserted into cut plasmid + use of DNA ligase	$\frac{1}{2} + \frac{1}{2}$	1
	Plasmid with the inserted insulin gene is introduced into bacteria + treating bacteria with heat / electric shock	$\frac{1}{2} + \frac{1}{2}$	1
(c)	Profuse growth of algae in the water blocks sunlight from reaching the submerged plants	Max 3 marks	1
	Submerged plants fail to photosynthesise and die		1
	Bacteria decompose the dead plants and increase in numbers		1
	Bacteria use up the oxygen in the water causing fish to die due to lack of oxygen		1

10 OR	Inner wall covered with a thin film of moisture + to dissolve oxygen before it diffuses in solution into blood;		1
(a)(i)	- wall is very thin/ only one-cell thick + to enable faster diffusion of oxygen and carbon dioxide during gaseous exchange		1
(ii)	Gland cells in the epithelium secrete mucus + traps dust and germs in inhaled air;		1
	Cilia sweep the mucus towards the pharynx to be swallowed ;		1
(b)	Tar & irritants in tobacco smoke		1
	Paralyse cilia lining trachea & bronchi		1
	Mucus & dust cannot be removed / accumulate		1
	Violent coughing to expel mucus & clear air passage		1
	Partition walls of alveoli breakdown & form large empty spaces, causing emphysema.		1
	Surface area for gaseous exchange is reduced results in breathlessness during exercise		1

examguru



Paya Lebar Methodist Girls' School (Secondary)
Preliminary Examination (2) 2014
Secondary 4 Express

CANDIDATE
NAME

CLASS

4	A
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INDEX NUMBER

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BIOLOGY (SPA)

5158

Paper 1 Multiple Choice

6 August 2014

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name and index number on all the work you hand in.

There are forty multiple choice questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D. Choose the one you consider correct and record your choice in soft pencil on the separate Answer Sheet

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

This paper consists of 23 pages including this cover page

1 Which structures are present in a root hair cell?

	nucleus	chloroplast
A	✓	✓
B	✓	x
C	x	✓
D	x	x

key

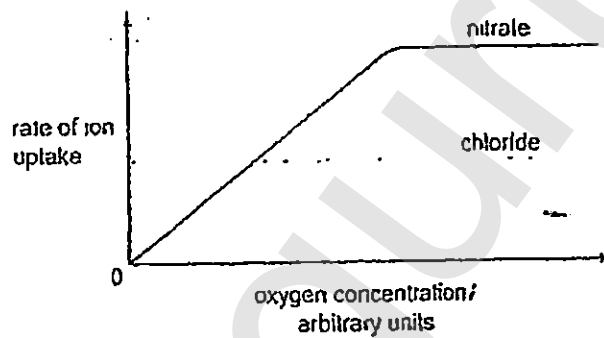
✓ = present

x = absent

2 What is an example of active transport?

- A movement of glucose molecules into the cells of the villi
- B movement of glucose molecules down a concentration gradient
- C movement of ions in blood plasma
- D movement of water in the transpiration stream

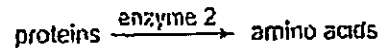
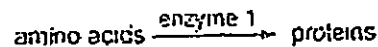
- 3 The roots of a plant are placed in a dilute solution containing chloride and nitrate ions. The graph shows how the rate of uptake of chloride and nitrate ions by the roots of the plant varies with oxygen concentration.



What can be concluded about how chloride and nitrate ions enter the roots?

	chloride	nitrate
A	active transport	active transport
B	active transport	diffusion
C	diffusion	active transport
D	diffusion	diffusion

- 4 Two enzyme-controlled reactions are shown.



From these reactions, what deduction can be made about enzymes?

- A Enzyme 1 has been changed to enzyme 2.
- B Enzyme 2 slows down the production of amino acids.
- C Enzymes only break down large molecules.
- D Enzymes can build up large molecules.

Turn over

5 Four test tubes, each containing 2cm^3 of amylase solution are treated as follows:

- 1 boiled, then cooled to 1°C
- 2 boiled, then cooled to 25°C
- 3 frozen, then warmed to 1°C
- 4 frozen, then warmed to 25°C

10cm^3 of starch solution was then added to each tube and after 5 minutes, 2 drops of iodine solution was added to each tube.

Which row shows the results?

	1	2	3	4
A	black	black	black	yellow
B	black	yellow	black	yellow
C	yellow	black	yellow	black
D	yellow	yellow	yellow	black

6 Which statements are correct for all enzymes?

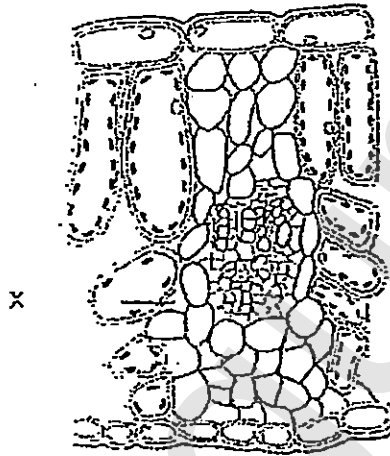
- 1 They are proteins.
- 2 They are secreted into the alimentary canal
- 3 They speed up biochemical reactions.
- 4 None of them work at low pH.

A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4

7 Which-listed substances are all broken down by the liver?

- A alcohol, drugs and progesterone
- B drugs, adrenaline and urea
- C oestrogen, water and adrenaline
- D urea, alcohol and drugs

5 The diagram represents a cross section of part of a leaf.

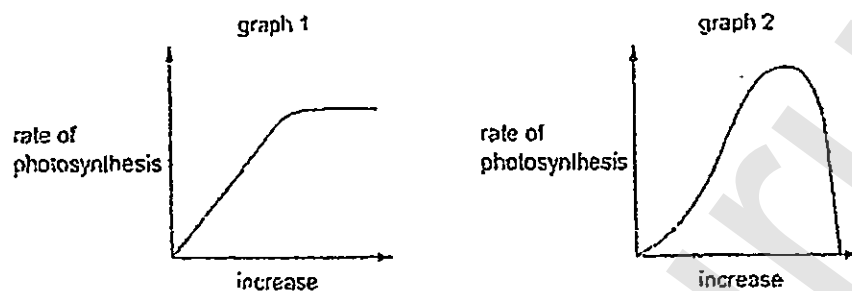


How does the oxygen content of the air at X compare to normal atmospheric air, when the leaf is in the light and when it is in the dark?

	in the light	in the dark
A	lower	the same
B	lower	higher
C	higher	the same
D	higher	lower

[Turn over]

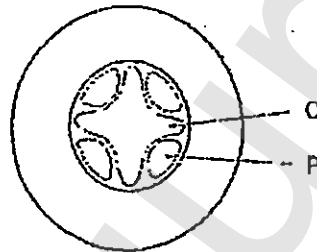
9 The graphs show how two different conditions affect the rate of photosynthesis.



Which conditions are being altered in graphs 1 and 2?

	graph 1	graph 2
A	carbon dioxide concentration	light intensity
B	carbon dioxide concentration	temperature
C	temperature	carbon dioxide concentration
D	temperature	light intensity

- 10 A herbaceous plant, growing in a nutrient solution, is placed in a well-lit experimental chamber through which humid air is being passed slowly. The diagram below shows a section through a part of the plant.



The speeds of movement of the fluids in tissues P and Q are measured. The humid air is then replaced by dry air and the speeds of movement of the fluids change.

What are these changes?

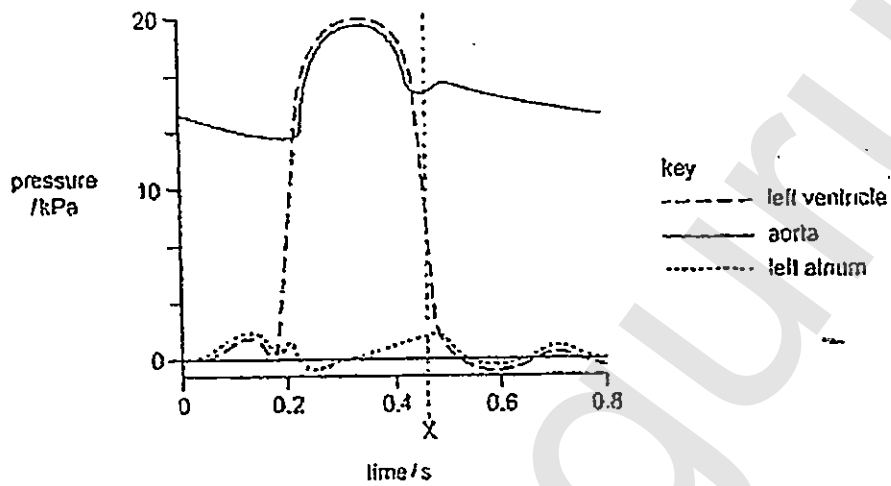
	tissue P	tissue Q
A	greatly increased upward movement	greatly increased downward movement
B	greatly increased downward movement	little change
C	little change	greatly increased downward movement
D	little change	greatly increased upward movement

- 11 What contributes to the wilting of plant leaves?

- A the mesophyll cells lose turgor
- B the phloem stops translocating
- C the stomata close
- D the xylem fills with air

[Turn over]

12 The diagram shows the pressures in the left side of the heart during one heart beat.



Which valves are open and which are closed at the time marked X?

	bicuspid	semi-lunar
A	closed	closed
B	closed	open
C	open	closed
D	open	open

13 The table refers to blood vessels in the human body

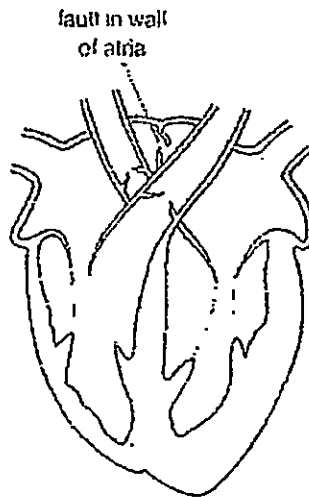
vessel	blood carried		oxygenated / deoxygenated
	from	to	
aorta	P	all organs except lungs	oxygenated
pulmonary vein	lungs	heart	Q
hepatic artery	aorta	R	oxygenated
hepatic portal vein	alimentary canal	liver	S

What are P, Q, R and S?

	P	Q	R	S
A	left ventricle	deoxygenated	kidney	deoxygenated
B	left ventricle	oxygenated	liver	deoxygenated
C	right ventricle	deoxygenated	kidney	oxygenated
D	right ventricle	oxygenated	liver	oxygenated

[Turn over]

14 The diagram shows a defect in the walls between the atria.



What effect would this defect have on the blood circulatory system?

- A increased pressure in the pulmonary artery
- B irregular heart beat
- C reduced oxygen saturation of haemoglobin
- D ventricular systole is delayed

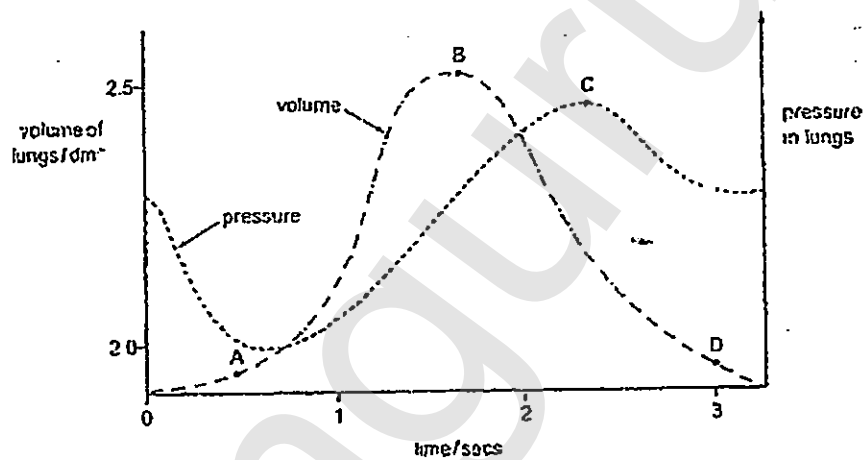
15 In the human breathing system, which features maintain the carbon dioxide gradient between the alveoli and the outside air?

- 1 blood continually pumped to the alveoli
- 2 breathing in and out
- 3 moist alveolar surfaces
- 4 thin alveolar walls

- A 1 and 2
- B 1 and 4
- C 2 and 3
- D 3 and 4

- 16 The graph shows how the pressure and volume inside the lungs change during one complete breath.

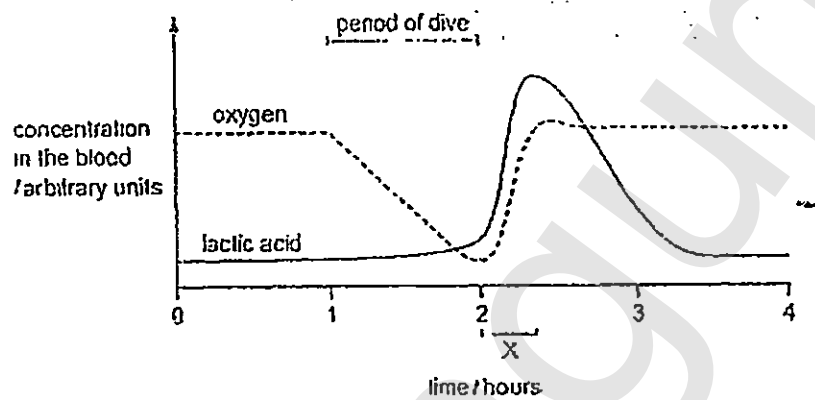
At which point are the muscles of the diaphragm starting to contract?



- 17 Which substance is lost from the body by the kidneys, lungs and skin?

- A carbon dioxide
- B excess ions
- C urea
- D water

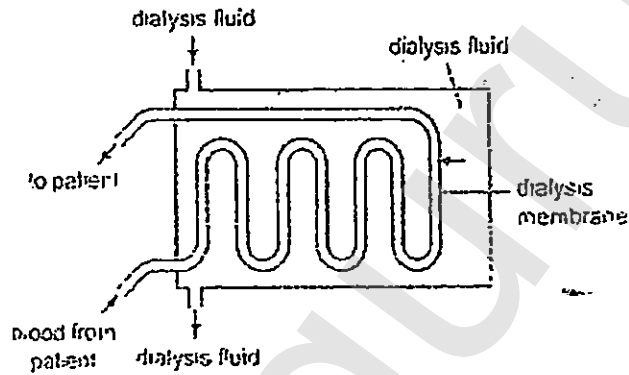
- 18 Seals are marine mammals. When they dive under water, they are capable of respiring anaerobically for long periods. During this time, blood flow to the muscles is greatly reduced but the muscles are able to tolerate high concentrations of lactic acid. The graph shows the concentrations of lactic acid and oxygen in the blood of a seal before, during and after a dive



What explains the change in lactic acid concentration during time X?

- A increased lactic acid production
- B increased blood flow to the muscles
- C increased rate of aerobic respiration
- D reduced rate of anaerobic respiration

19 In a kidney dialysis machine, which substance cannot diffuse through the dialysis membrane?



- A glucose
- B insulin
- C sodium
- D urea

20 Which of these statements correctly describe control by negative feedback?

- A An injury to body tissue activates platelets in the blood and these activated platelets release chemicals which activate more platelets.
- B During the menstrual cycle, luteinising hormone stimulates the release of oestrogen which in turn stimulates the release of more luteinising hormone.
- C The onset of contractions during childbirth causes the release of a hormone, which stimulates further contractions.
- D When blood pressure is high, nerve impulses from the brain cause the blood vessels to dilate and blood pressure is reduced.

- 21 If the air temperature is higher than the core body temperature, which processes can increase heat loss from the body?

	shivering by muscles	evaporation of sweat	vasodilation in the skin
A	✓	X	✓
B	✓	X	X
C	X	✓	✓
D	X	✓	X

key

✓ = can increase heat loss

X = cannot increase heat loss

- 22 Insulin is a hormone synthesised in the pancreas and distributed around the body by the blood

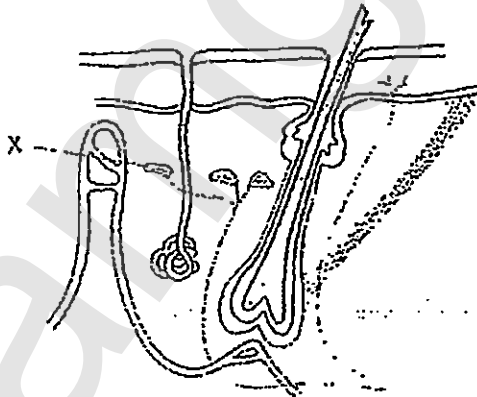
What describes its rate of secretion and concentration in the blood?

	rate of secretion	concentration in the blood
A	constant	constant
B	constant	varied
C	varied	constant
D	varied	varied

23 Which changes occur in the body when a person is shocked?

	increase in	decrease in
A	the diameter of the pupils in the eye	the speed of peristalsis
B	the rate of conversion of glycogen to glucose	the diameter of the pupils in the eye
C	the rate of urine formation	the rate of conversion of glycogen to glucose
D	the speed of peristalsis	the rate of urine formation

24 The diagram shows some of the structures seen in a section through human skin.

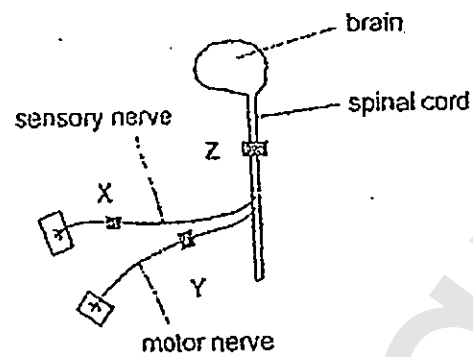


What is the function of structure X?

- A to cause capillaries to constrict
- B to detect changes in temperature
- C to receive impulses from the central nervous system
- D to stimulate sweat glands to release sweat

[Turn over

25 The diagram represents a central nervous system. X, Y, and Z show possible sites where the system can be blocked by a focal anaesthetic.



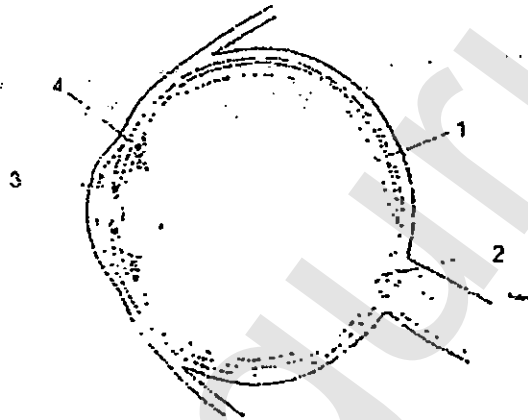
Of four men, one had no anaesthetic block and the other three had only one anaesthetic block at X, Y or Z.

One of the men can feel a pinprick on his leg but cannot move it.

Where is the anaesthetic block?

- A block is at X
- B block is at Y
- C block is at Z
- D no block

26 The diagram shows a section through an eye.

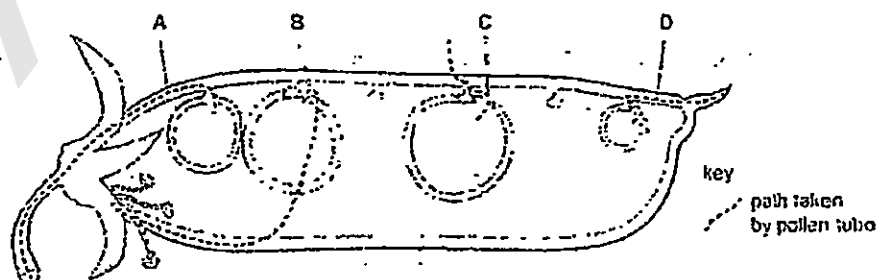


In the pupil reflex, which row gives the sites of the effectors and receptors involved?

	effectors	receptors
A	3	1
B	3	2
C	4	1
D	4	2

27 The diagram shows a pod from a pea plant.

Which line correctly shows the path that was taken by a pollen tube to an ovule?



[Turn over

28 Which plants are most likely to adapt successfully to a climatic change in their environment?

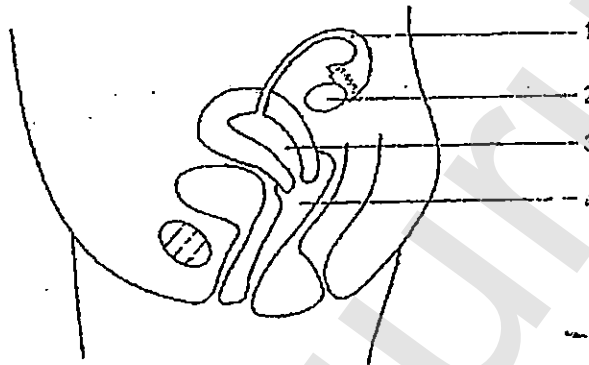
- A plants that are cross-pollinated
- B plants that do not rely on wind-pollination
- C plants that grow rapidly
- D plants that reproduce asexually

29 A natural method of birth control assumes that sperms live for three days after sexual intercourse, ovulation occurs between days 13-15 of the menstrual cycle and released ova live for 36 hours.

On which day of the cycle should sexual intercourse not result in pregnancy?

- A day 7
- B day 11
- C day 12
- D day 16

30 The diagram shows a side view of the female reproductive system.



In which region are sperms released during sexual intercourse and where does fertilisation usually take place?

	sperms released	fertilisation
A	3	1
B	3	2
C	4	1
D	4	2

Turn over

31 A couple has three children. The table shows some of the children's characteristics.

child	sex	blood group	sickle-cell / normal
1	male	B	sickle-cell
2	female	AB	normal
3	male	O	normal

What do the characteristics show?

- A continuous variation only
- B discontinuous variation only
- C both continuous and discontinuous variation
- D neither continuous nor discontinuous variation

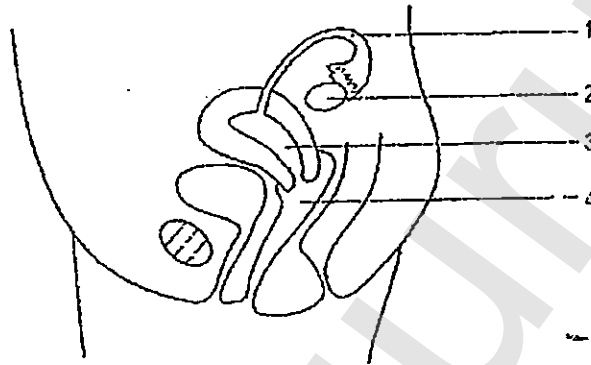
32 What is a result of natural selection?

- A dogs that are friendly to humans
- B grapes that contain no seeds
- C mosquitoes that are resistant to insecticides
- D onion crops that have a pleasant taste

33 The genotype for the height of an organism is written as Tt. What conclusion may be drawn?

- A The allele for height has at least two different genes
- B There are at least two different alleles of the gene for height
- C There are two different genes for height, each having a single allele
- D There is one allele for height with two different forms.

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34 A scientist takes 4 pairs of samples from a wild cherry tree. In which pair of samples could there be cells with different genotypes?

- A two fruits
- B two leaves
- C two petals
- D two root cuttings

35 Six processes in genetic engineering are listed

- 1 The bacterium is cloned
- 2 The gene is copied.
- 3 The gene is switched on.
- 4 The gene is transferred into a bacterium.
- 5 The human gene is isolated
- 6 The protein, insulin, is synthesised.

Which four processes, in the correct order, show the production of human insulin by bacteria?

- A 2→3→5→6
- B 3→1→4→6
- C 5→3→2→6
- D 5→4→1→6

36 Which type of molecule is the end product of translation?

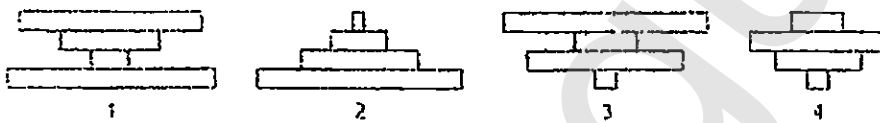
- A amino acid
- B mRNA
- C polypeptide
- D tRNA

Turn over

37 Which statement about chromosomes is correct?

- A Chromosomes are long DNA molecules called genes, which are divided, into sections
- B Chromosomes include a long molecule of DNA divided into sections called genes.
- C Chromosomes include genes, which are divided into sections called DNA molecules.
- D Genes include long DNA molecules called chromosomes.

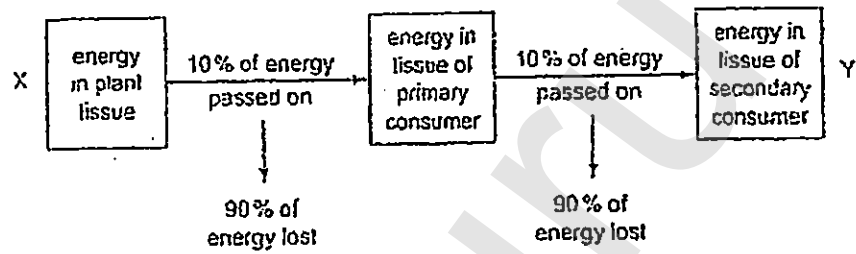
38 A tree has insect larvae burrowing in its leaves. The emerging insects are eaten by birds and the birds have parasitic fleas living amongst their feathers.



Which is a pyramid of biomass and which is a pyramid of numbers for this food chain?

	pyramid of biomass	pyramid of numbers
A	1	3
B	1	4
C	2	3
D	2	4

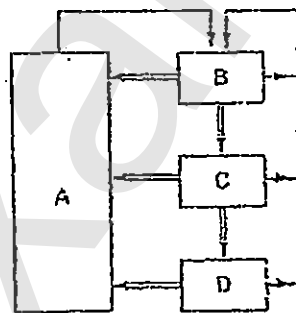
39 The diagram shows energy flow through a food chain from X to Y.



By which processes is energy lost between X and Y?

- A excretion and respiration
- B growth and excretion
- C growth and photosynthesis
- D photosynthesis and respiration

40 The diagram represents the flow of substances within a balanced ecosystem. The boxes are various trophic levels. Which box represents producers?



key

— shows flow of organic substances

→ shows flow of carbon dioxide

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Paya Lebar Methodist Girls' School (Secondary)
Preliminary Examination (2) 2014
Secondary 4 Express

CANDIDATE
NAME

CLASS

4 A

INDEX NUMBER

BIOLOGY (SPA)

5158

Paper 2

1 August 2014

1 hour 45 mins

READ THESE INSTRUCTIONS FIRST

Write your name and index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A (50 marks)

Answer all questions in the spaces provided in the question paper.

Section B (30 marks)

Answer all three questions, the last question is in the form either/or.
Write your answers on the lined paper in this booklet and, if necessary, continue on separate answer paper.

At the end of the examination, fasten all your work securely together, if applicable.
The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
7	
8	
9	
Total	

This paper consists of 19 printed pages including the cover page.

Section A

[50 marks]

Answer all questions in this section.

Write your answers in the spaces provided.

- 1 A student was asked to make a model of a plant cell. She took a length of tubing made from a substance that allows only water molecules to pass through and enclosed it in a flexible permeable membrane as shown in Fig. 1.1.

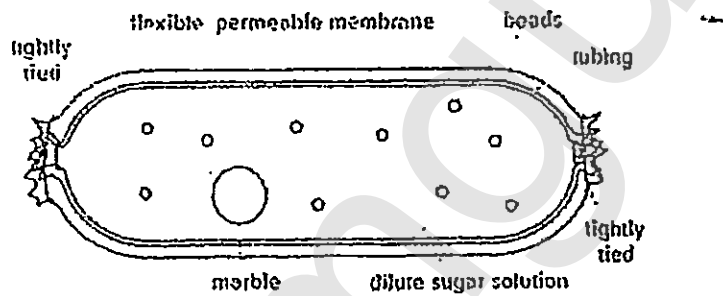


Fig. 1.1

- (a) Name the structures found in a plant mesophyll cell that are best represented by the following items used in the model of the plant cell.

Marble
 Beads
 Tubing [3]

- (b) State a structure of a plant cell that is not represented in the student's model.

..... [1]

- (c) The student then placed her model into a concentrated sugar solution for 10 minutes. State and explain the similarities between what might happen to her model time and what would happen to a plant cell placed in the same solution.

[Total: 10m]

The diagram illustrates the traditional process of preparing cassava drink in four steps:

- Step 1:** A cassava plant is shown with its root tubers. Labels indicate "cassava plant" and "root tubers crushed and boiled".
- Step 2:** A person is shown chewing the root tubers. A label indicates "crushed and boiled tubers chewed for several minutes".
- Step 3:** The person spits the material into a container. Labels indicate "then spit into a container" and "water added".
- Step 4:** The mixture is left in an open container for several days. Labels indicate "left in open air for several days" and "sediment". The final product is labeled "drink ready for consumption".

Fig. 2.1.

- [2]

[2]

-

.. [3]

[Total: 5m]

- 3 Fig 3.1(a) and Fig 3.1(b) each shows cells from the lining of a trachea. One is from a smoker and one is from a non-smoker.

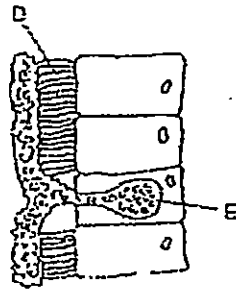


Fig 3.1(a)

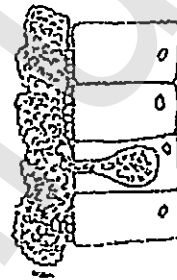


Fig 3.1(b)

- (a) (i) Identify structures D and E.

D

E

[2]

- (ii) Describe the function of D.

[2]

Fig. 3.2(a) and Fig. 3.2(b) show the cross-sections through the alveoli of a smoker and a non-smoker.

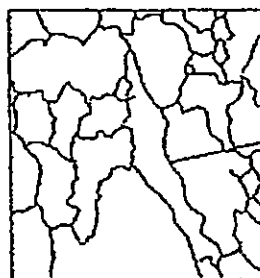


Fig. 3.2(a)

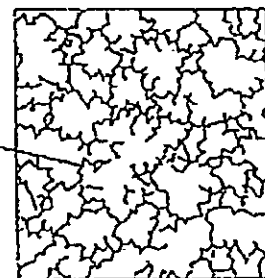


Fig. 3.2(b)

walls of
alveoli

ea : Fig. ... Alveoli : Fig... [2]

on how the effect of smoking on the alveoli can affect the respiratory system of a
er.

[4]

[Total: 10m]

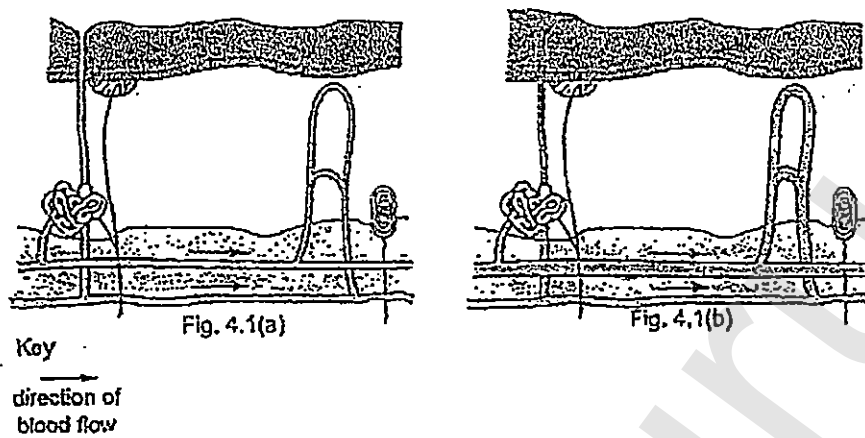
Alveoli : Fig....

[4]
[Total: 10m]

[4]

{Total: 10m}

- 4 Fig. 4.1(a) and Fig 4.1(b) shows a section through the skin of a person at two different temperatures.



- (a) On Fig 4.1(a), identify and label the sweat gland and temperature receptor. [2]
- (b) State what happened to the body temperature to cause the changes shown in Fig. 4.1(b) compared with Fig. 4.1(a). Explain your answer

Item	Unit	Quantity	Unit Price	Total Price
1. Material				
2. Labor				
3. Overhead				
4. Profit				
Total				500.00

- 5 Fig. 5.1 shows the average sweating rates of a person over a 4-hour period under different conditions.

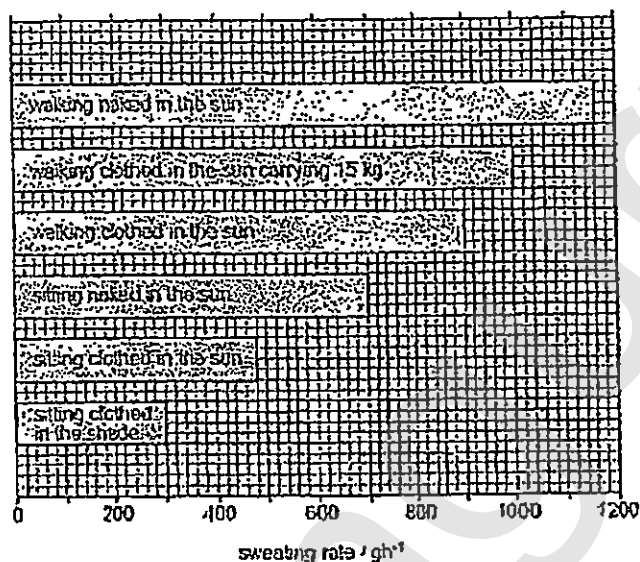


Fig. 5.1

- (a) State one way other than by sweating and urination in which a person might lose water.

[1]

- (b) (i) Suggest how the rates of sweating shown in Fig. 5.1 are different for the person when they are walking clothed in the sun with and without the 15 kg weight

[3]

- (b) (ii) Suggest why the person who is sitting clothed in the shade has the lowest sweating rate.

[2]

(c) Fig 5.2 shows the water gain and loss of a person over 24 hours.

daily water gains		daily water losses	
drinks	1500 cm ³	exhaled air	400 cm ³
water in food	700 cm ³	faeces	100 cm ³
water formed within body	200 cm ³	sweat	500 cm ³
urine	?	urine	? cm ³
total	2400 cm ³	total	2400 cm ³



Fig 5.2

(i) Name a reaction in the body that produces water.

[1]

(ii) Using the information in Fig. 5.2, calculate the volume of water a person must lose in the urine over 24 hours in order to maintain the volume of water in the body. Show your working in the space below.

Volume of water:

[1]

(iii) On a hot day, the volume of water loss as sweat will change. Suggest how sweating could affect the urine that a person produces.

[2]

(Total 10m)

- 6 Cultivated banana plants produce fruits with seeds that are infertile (unable to develop) while wild banana plants produce fruits with large, fertile seeds.

- (a) State the type of reproduction usually found in cultivated bananas and wild bananas

Cultivated bananas:

Wild bananas:

[2]

- (b) State one commercial advantage that results from the type of reproduction found in cultivated bananas

"Black sigatoka" is a fungal disease of banana leaves. The hyphae of the fungus spread through the intercellular spaces as shown in Fig 6.1

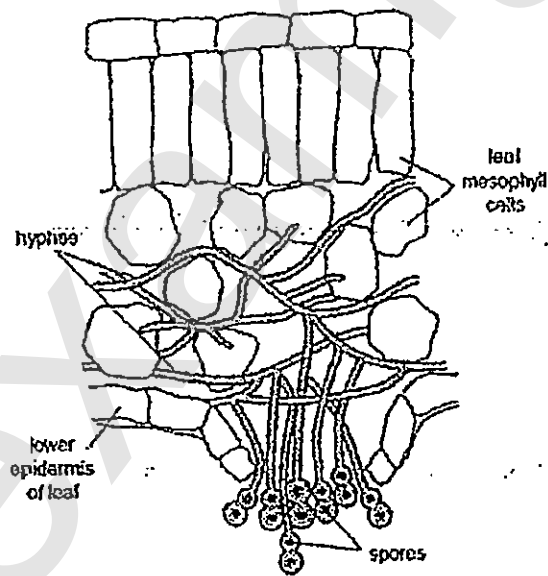


Fig. 6.1

(c) Suggest ways by which the fungus would eventually cause the leaf to die.

(ii) Explain why fungal diseases tend to kill a higher percentage of cultivated bananas.

{3}

11

Section B

[30 marks]

Answer three questions

Question 9 is in the form of an Either / Or question. Only one part should be answered.

- 7 Over a period of several months, a student recorded some activities of the wild life in a particular habitat. The following observations appeared in her notebook as seen in Fig.

7.1.

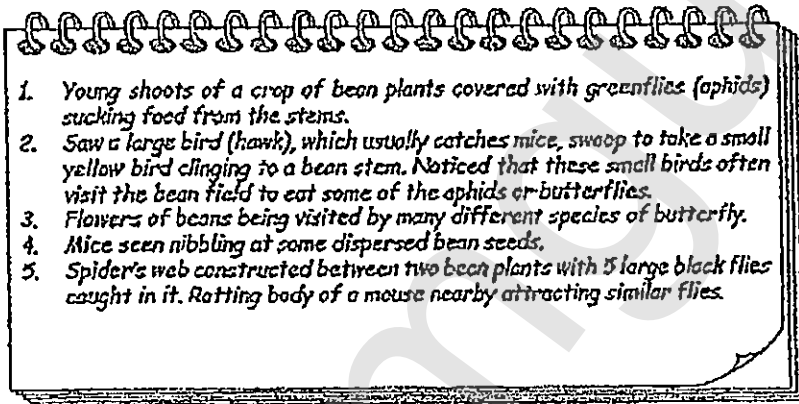


Fig. 7.1

- (a) In the space below, draw and label a pyramid of biomass for the hawks, mice and bean plants in this habitat

[2]

- [3]



- [3]

- [2]

13

- 8 Fig. 8.1 shows how genetic engineering with the use of yeast cells can be used to manufacture an enzyme (chymosin) that clots milk in the stomach of young mammals

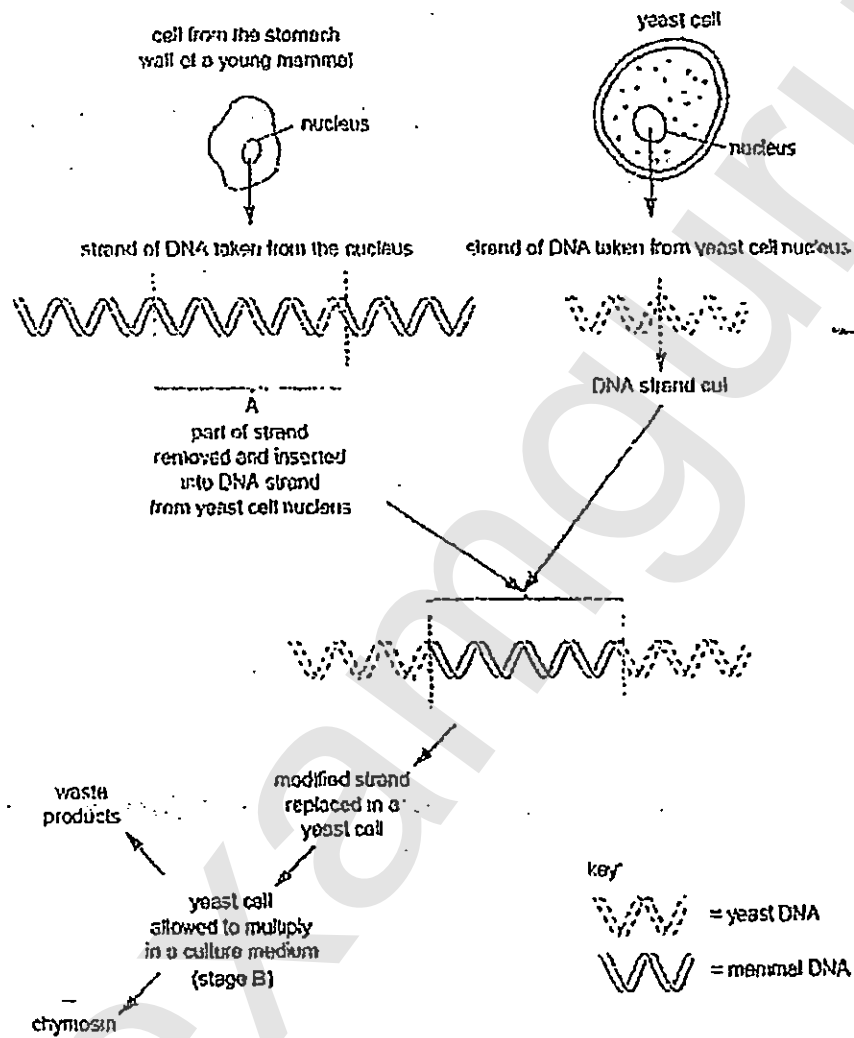


Fig. 8.1

- (a) Name the part labelled A in the diagram above.

[1]

9 EITHER

- (a) Fig. 9.1 shows a horizontal section of the human eye and the pathway taken by light rays as they leave a distant object.

Complete the diagram by continuing the lines from the object to show how the light rays produce a focused image on the retina. [3]

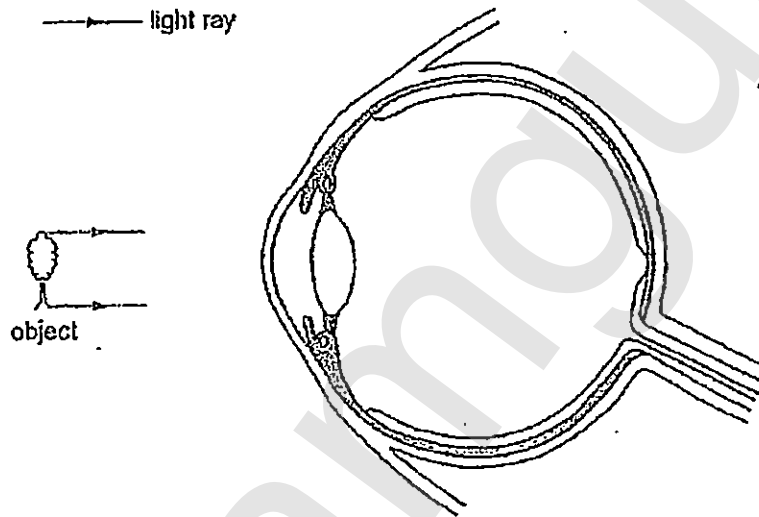


Fig. 9.1

(b) Fig. 9.2 shows two front views, S and T, of a human eye in two different light intensities.

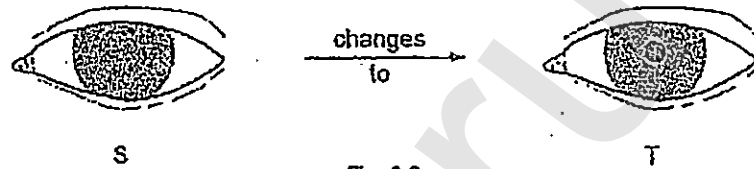


Fig 9 2

(f) Suggest how the light intensity changes from S to ∞ explaining how the changes shown in Fig 9.2 is brought about

(ii) Define pupil reflex and suggest why drug that prevents this reflex action from occurring should be avoided.

[Total: 10m]

9 OR

- (a) In the inheritance of the colour of mouse fur, the allele for yellow fur (D) is dominant to the allele for grey fur (d).
- (i) Two heterozygous yellow-coloured mice produce offspring. Use a fully labelled genetic diagram to show how the colour of mouse fur is inherited by the offspring. State the expected genotypes and phenotypes in the offspring. (5)

- 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1

- ... [2]

End of Paper

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Sec 4 Biology Prelim 2 2014 Ans

Paper 1

1	B	21	C
2	A	22	D
3	C	23	A
4	D	24	B
5	A	25	B
6	A	26	A
7	A	27	D
8	D	28	A
9	B	29	A
10	D	30	C
11	A	31	B
12	A	32	C
13	B	33	B
14	C	34	A
15	A	35	D
16	A	36	C
17	D	37	B
18	B	38	C
19	B	39	A
20	D	40	B

Answers

1 (a) nucleus, chloroplasts, (cell) membrane. [3]

1 (b) vacuole / ribosomes / mitochondria / tonoplast. [1]

1 (c) water leaves;

by osmosis;

ref. water potential (A any ref. to differential in concentration);

cell / cytoplasm / protoplasm / model shrinks (R ref. vacuole);

ref. decreased pressure / turgidity / firmness / flaccidity;

tubing pulls away from permeable membrane OR cytoplasm or cell membrane pulls away from (cell) wall;

ref. plasmolysis;

selective permeability of tubing

no sugar leaves cell by diffusion/ enters space between tubing and permeable membrane

OR between

cell membrane and wall. [max 6]

2 (a) damage / breaks AW (cells / tissue)

ref. cell wall / membrane;

releasing (cell) contents / starch;

kills cells / denatures enzymes / stops metabolic reactions. [max 2]

2 (b) salivary amylase / carbohydrase.

digests / breaks down / hydrolyses + starch

(to) maltose: [3]

3. (a) (i) D cilia, E goblet (cell) / mucus (-producing cell) / gland (cell) ; [2]

3 (a) (ii) ref. beating / AW ;

moving mucus + towards throat / upwards / away from lungs .

containing germs / dirt ; [2]

3 (b) (i) Fig. 3.1(b) + Fig. 3.2(a) [2]

3 (b) (ii) carcinogenic / AW :

tar + impervious to gases ;

emphysema / break down of alveoli walls ;

reduced surface area ;

less O₂ absorption / to red blood cells / body cells ;

irritants paralyse cilia lining the air passage;

dust particles trapped in the mucus lining the air passage cannot be removed;

increase the risks of chronic bronchitis [max 4]

4 (a). label line must touch the sweat gland; label line must touch some part of receptor under Malpighian layer; [2]

4 (b). (body temperature increases / rises: [1] R cooler / decreases

In either order. Activation of sweat glands to produce sweat;

dilation blood vessels / vasodilation/capillaries; increase blood flow near the surface of the body; to radiate heat away from the body. [2] R veins

to allow the body to cool down. [1] (max 3 points)

5. (a) exhaling or breathing out/faeces/bleeding or crying or vomiting [1]

5 (b) (i) the rate of sweating is higher for a person who is carrying a weight of 15 kg at 1000gh^{-1} as compared to a person who is not at 900gh^{-1}

The person who is carrying 15kg has more energy released/higher rate of respiration;
More heat produced;

Increase in rate of sweating to cool the body [max 4]

5(b) (ii). For a person who is sitting in the shade, there is less work done from sitting; and less exposure to heat; hence, the person does not need to produce as much sweat to allow cooling of the body [max 2]

5 (c) (i). Respiration [1]

5 (c) (ii) 1400 cm^3

5 (c) (iii) volume of sweat produce will increase
the volume of urine will decrease / less water;
the concentration will increase / colour will be darker. [3 max]

6 (a) asexual/vegetative;
sexual (ignore asexual); [2]

6 (b) any from;
more certain, known quality/quantity of fruit or described*,
favourable conditions, greater % of fruit is flesh, faster,
greater profit/higher yield, (*allow ecf if wrong type of reproduction); [1]

6 (c) interferes with movement of gases/blocks stomata,
interference with transpiration;
digests cell contents/ref. enzymes/separates cells;
takes nutrients from the plant;
kills cells/protective toxins released by cells;
no/less photosynthesis;
blocks veins/vascular bundles/phloem/xylem; [max 4]

6 (d) (A reverse argument) cultivated plants are planted close together in a smaller area/designated farm; easier spread of fungal spores;
genetically identical;
little variation/mutation;
all/very large numbers lack resistance; [max 3]

Section B

7 (a) correct shape (A smooth-sided or stepped pyramid).
all three levels correctly labelled : [2]
(upside-down pyramid with producer at top = 1 mark)

7 (b) large bird / hawk + spider :
small / yellow bird + (black) flies ;
greenflies / aphids + butterflies + mouse / mice ; [1 mark per trophic level]

7 (c) ref. Sun.
light (energy) to chemical energy;
absorbed by / inside plants or producers / photosynthesis;
named photosynthetic product;
food for / eaten by + animals / herbivores / consumers / decomposers.
lost as heat;
(from) respiration / ref ATP;
Energy does not pass back to producers / plants / Sun; [max 3]

7(d) This is due to bioaccumulation;
When the mice feeds on the bean plants, the insecticide is not broken down in the mice and is accumulated in the mice that the hawk feeds on. Hence, the concentration of the insecticides increases up the trophic level and will affect the animals higher up in the trophic level more. [max 2]

8 (a) gene / allele : [1]

8 (b) sugar (or named) / nitrates (A amino acids) ;
solution / broth / water ;
suitable temperature / pH ;
ref. oxygen / air (A ref. [an]aerobic) ;
(since respiration in yeast may be aerobic or anaerobic)
fermenter / stirring / ref. sterility (i.e. the mechanics of the process) ; [3 max]
(A large / suitable container)

8 (c) excess glucose to glycogen
correct ref. liver / muscles .
enhanced glucose uptake by cells / increased cell permeability .
ref. constant blood composition / concentration/reduction of blood glucose [2 max]

8 (c) (iv). Instead of using yeast, bacteria is used in the production of human insulin gene:
unlike bacteria which is single-stranded, yeast is double stranded.
both need the plasmid to be taken up by either the yeast or bacteria before they are placed in fermenter.
Bacteria and yeast are both put into a nutrient broth that allows them to multiply and produce the insulin or chymosin;
Any other reasonable answers. (max 4)

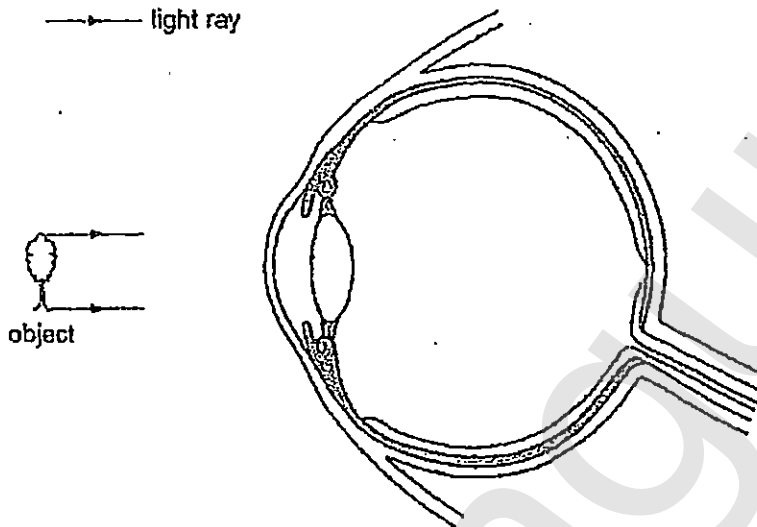
9 either

(a) rays continue parallel until hit cornea;

rays converge at cornea;

rays converge at lens;

meet before retina + continue to hit retina; [3]



9 (b) (i). light intensity increases at F / gets brighter at F; [1]

1 increase in light intensity detected by retina;

2 impulses to iris (via brain) to result in an involuntary action where

3 (iris) circular muscles contract;

4 (iris) radial muscles relax;

5 making pupil smaller/constricted

6 and therefore less light will enter the eyes.

any three 1 mark each

(max 4)

9 (b) (ii)

Pupil reflex is a

fast / rapid / quick.

reaction / response + (to) stimulus;

automatic / involuntary / no involvement of conscious thought AW: / cannot be controlled [1]

R no involvement of brain, too much light allowed to enter AW:

damage to retina / rods / cones / light-sensitive cells; [2]

9 or

(a) (i)

Parental Phenotype

Heterozygous

x

Heterozygous

Parental Genotype

Dd

x

Dd

Gamete

D

d

D

d

Random fertilisation

Offspring genotype

DD

Dd

Dd

dd

Genotypic ratio

1

2

1

Phenotypic ratio

3

Yellow

1

Grey

1 mark for correct labels, 1 mark for each step | max 5 marks|
R if wrong symbols used

(a) (ii) DD (A e.c.f. for incorrect symbols)

ref. 1 in 4 would be DD

leaves ratio 2 yellow : 1 grey, [3]

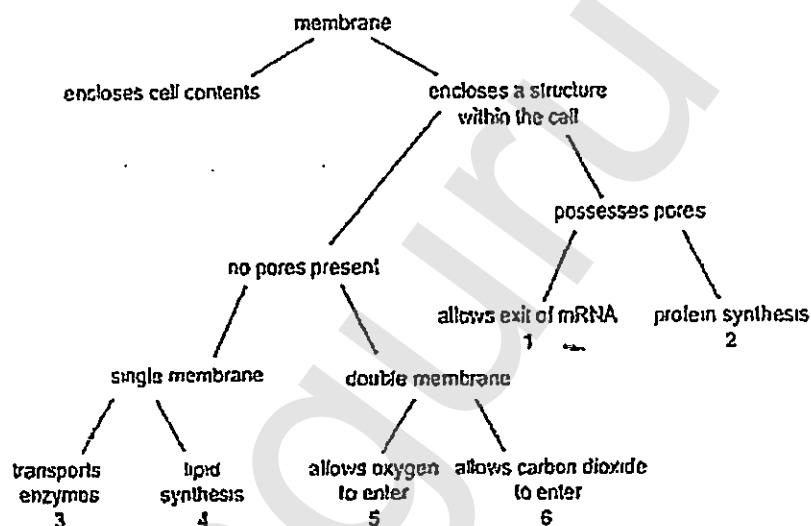
(A explanation on diagram .. accept on (ai) so long as linked)

9 (b) Any two of the following

Mustard gas/formaldehyde/ ultra violet radiation/ exposure to alpha, beta and gamma rays

1 Membranes within and at the surface of cells have different roles

The diagram allows the identification of the various organelles within the cell, by describing the membrane structure and function.



Which of the outcomes shown below correctly identifies the organelles that possess the membrane and function concerned?

	1	2	3	4	5	6
A	chloroplast	vesicle	smooth ER	rough ER	nucleolus	mitochondrion
B	nucleus	rough ER	vesicle	smooth ER	nucleolus	mitochondrion
C	nucleus	rough ER	vesicle	smooth ER	mitochondrion	chloroplast
D	nucleus	smooth ER	mitochondrion	rough ER	vesicle	chloroplast

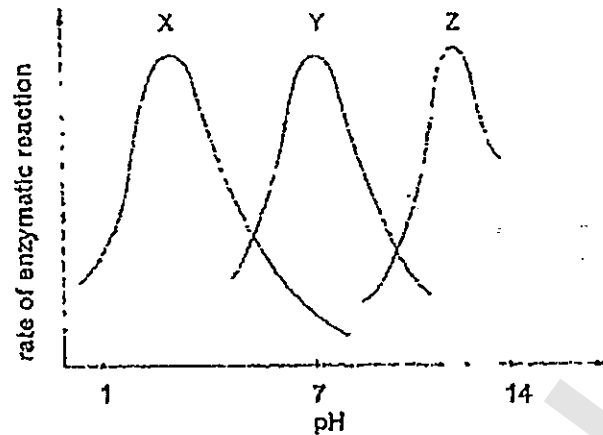
2 The table below shows the chemical elements present in four substances.

Which substance, A, B, C or D could be cellulose?

√ = present X = absent

substance	carbon	hydrogen	nitrogen	oxygen
A	√	√	√	X
B	√	√	X	√
C	√	√	√	√
D	√	X	√	√

- 7 The following graph shows the effect of pH on the rate of reaction of three enzymes, X, Y and Z.



Each of these enzymes was extracted from a region of the alimentary canal of a mammal. Which of the following combinations states the correct area where each enzyme was extracted?

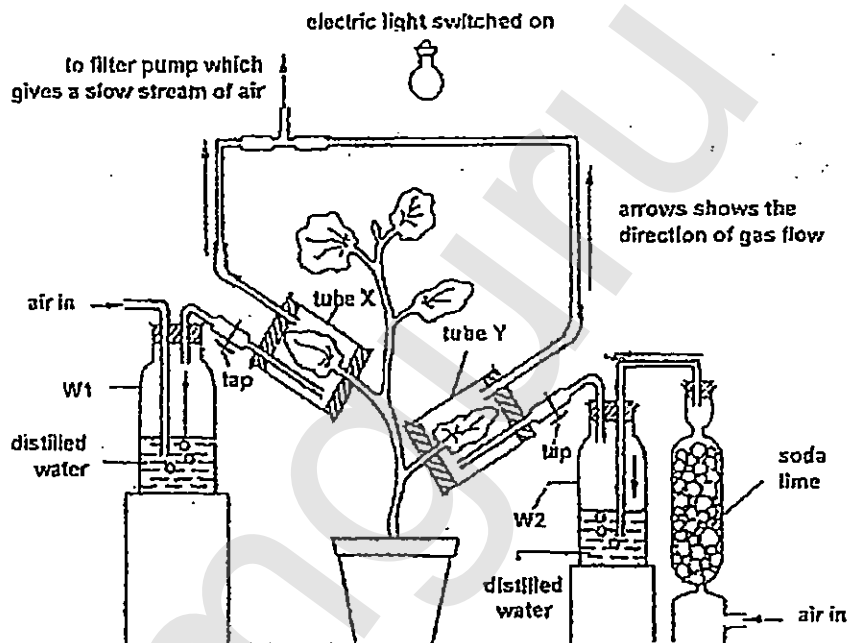
	X	Y	Z
A	small intestine	salivary gland	stomach
B	stomach	salivary gland	small intestine
C	small intestine	stomach	salivary gland
D	liver	stomach	gall bladder

- 8 Which of the following statements is correct?

- A Carbohydrates makes up the main component in cell membranes.
- B Fats are the main energy source.
- C Proteins are important in the production of antibodies.
- D Water is not an essential nutrient.

Refer to the information and diagram below for Questions 9 and 10

An experiment is set up as shown in the diagram below to investigate factors essential for photosynthesis



The taps can be used to regulate the flow of gas through tubes X and Y. W1 and W2 both contain distilled water. The plant is continuously illuminated and regularly watered. Prior to setting up the experiment, the plant has been kept in a dark cupboard for three days.

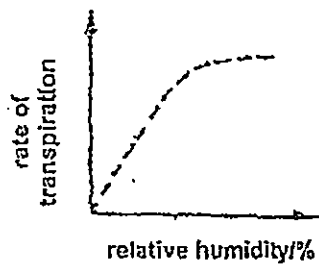
9 Which factor essential for photosynthesis is being investigated in this experiment?

- A light only
- B carbon dioxide only
- C carbon dioxide and light
- D carbon dioxide and water

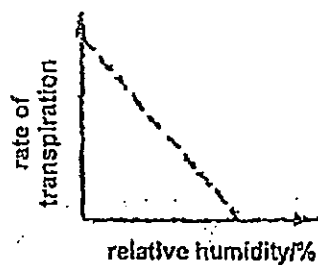
10 What modifications would you make to the experimental set up to investigate the effect of light on the process of photosynthesis?

- A black out tube X
- B black out tube X and Y
- C remove soda lime tower and black out tube X or Y
- D remove soda lime tower and black out tube X and Y

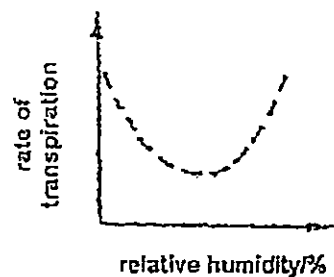
- 11 Which one of the following graphs most closely represents the relationship between the rate of transpiration of a leaf and relative humidity?



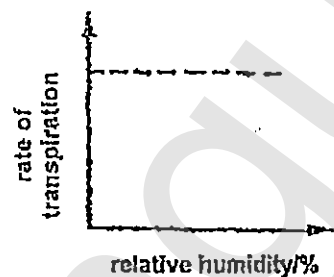
A



B

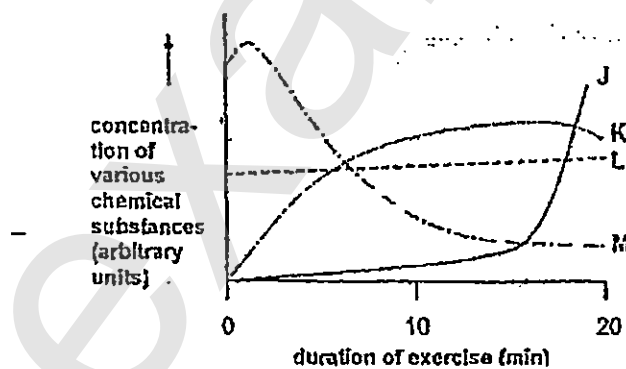


C



D

- 12 The graph below shows the changes in concentrations of various chemical substances in the thigh muscles of a person exercising vigorously.



Which of the following statements is correct?

- A Line J represents glycogen.
- B Line M represents lactic acid.
- C Line L represents oxygen.
- D Line K represents carbon dioxide.

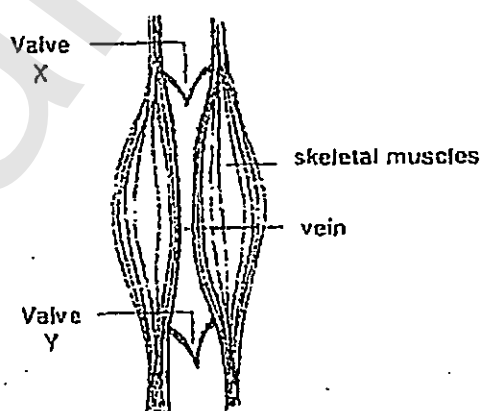
- 13 Which of the following correctly describes the state of the muscles and the relative pressure when breathing in?

	<i>external intercostal muscles</i>	<i>diaphragm</i>	<i>pressure inside lung compared to atmospheric pressure</i>
A	contracted	contracted	lower
B	contracted	contracted	higher
C	relaxed	contracted	higher
D	relaxed	relaxed	higher

- 14 The table shows the blood groups of four people and the type of blood each received in a transfusion.
Which person is at risk from agglutination?

	<i>blood group</i>	<i>blood type received in transfusion</i>
A	A	O
B	B	AB
C	AB	B
D	O	O

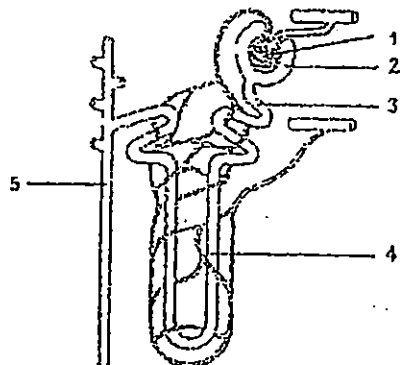
- 15 The diagram below illustrates a small portion of a vein and its neighbouring skeletal muscles.



Which of the following combinations shows the state of the muscle with the corresponding situations of valves X and Y?

	<i>Skeletal muscle</i>	<i>Valve X</i>	<i>Valve Y</i>
A	contraction	open	closed
B	contraction	closed	open
C	relaxation	open	closed
D	relaxation	open	open

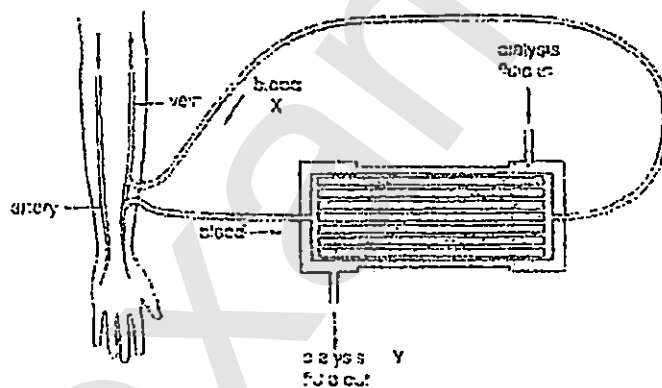
16 The diagram below shows the internal structure of a kidney



Which of the following statements is correct?

- A Ultrafiltration takes place at regions 1, 2 and 5.
B The liquid found in region 2 contains water, amino acids, urea, mineral salts and red blood cells.
C Reabsorption of glucose takes place mainly at regions 3 and 4
D Movement of substances in region 4 depends mainly on osmosis.

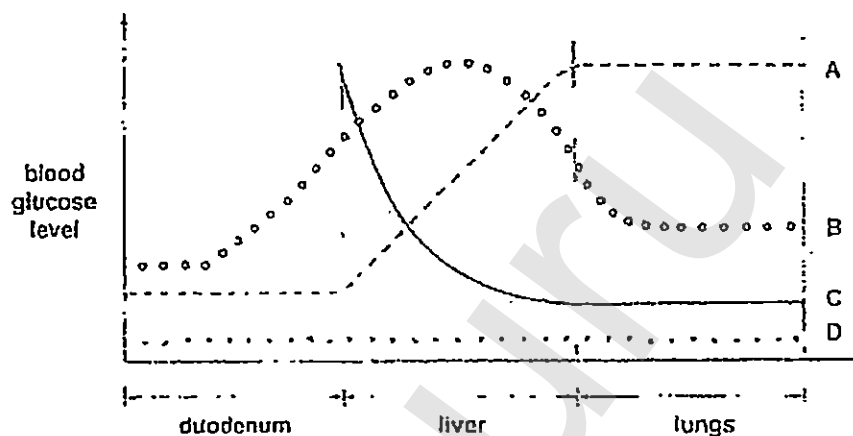
17 The diagram shows the flow of blood and dialysis fluid through a kidney machine.



Which substance will show the greatest difference in concentration between X and Y?

- A urea
B glucose
C water
D salts

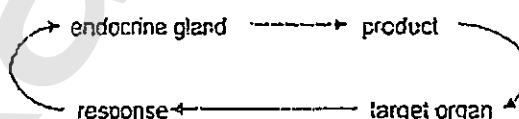
- 18 Which of the following curves best represents the change in the glucose level of blood flowing through the following organs of a man who has starved for eight hours?



- 19 Which organ controls the secretion of the hormone insulin and what is the target organ?

	organ that controls secretion	target organ
A	hypothalamus	pancreas
B	pancreas	ileum
C	hypothalamus	skeletal muscles
D	pancreas	liver

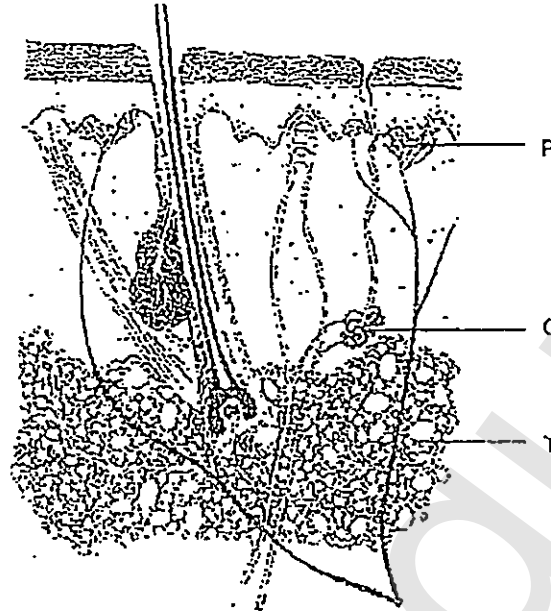
- 20 The diagram below shows the relationship between two organs and the changes/responses they bring about in the body



If the response of the target organ is controlled by negative feedback, then the product (of the endocrine gland)

- A inhibits the response (of the target organ).
- B stimulates a greater response (of the target organ).
- C stimulates a greater response (of the target organ) while the response inhibits the secretion of the product
- D inhibits the response (of the target organ) while the response (of the target organ) stimulates greater secretion of the product.

21 The diagram below shows a longitudinal section of the skin of a boy



Select the best combination that indicates one function of P, Q and T respectively

	P	Q	T
A	absorbs UV light	reduces evaporation	reduce heat loss
B	detects changes in air temperature	produces sweat	acts as an insulator of heat
C	detects changes in air temperature	reduces evaporation	stores food
D	absorbs UV light	releases water vapour	supplies nutrients to the skin

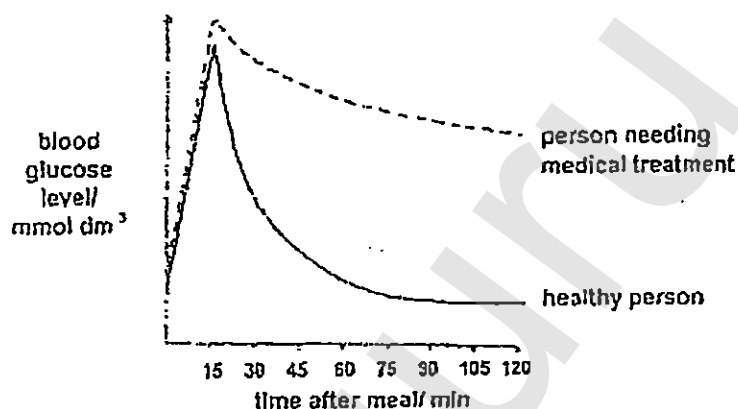
22 Adrenaline is secreted in response to feelings of fear or anger.

Which of the following are effects of the secretion of adrenaline?

- i Increased heart rate
- ii Constriction of arterioles in the skin.
- iii Constriction of arterioles in gut (intestines).
- iv Increased conversion of glucose to glycogen

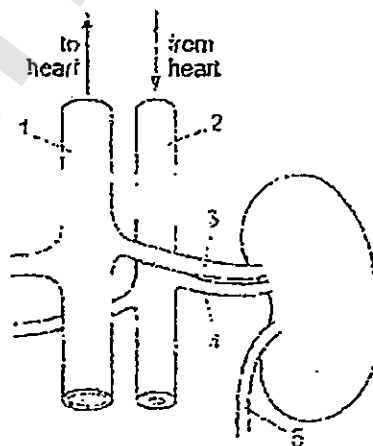
- A i and ii only.
- B i, ii and iii only
- C i, ii and iv only
- D i, ii, iii and iv

- 23 The graph shows changes in the blood glucose levels of two people after eating identical meals



What should be the correct medical treatment for person X?

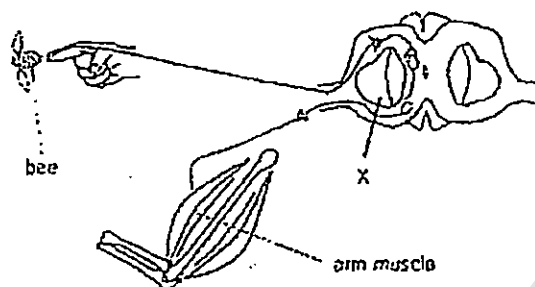
- A insulin injections
 - B blood transfusion
 - C dialysis by a kidney machine
 - D increase proteins taken in the diet
- 24 The diagram shows a kidney and its associated vessels



Which structures contain liquids with the least and the most concentrations of urea solution?

	least	most
A	1	4
B	2	1
C	3	4
D	3	5

- 25 The diagram below shows part of the nervous system including a reflex arc. A cut has been made at X.

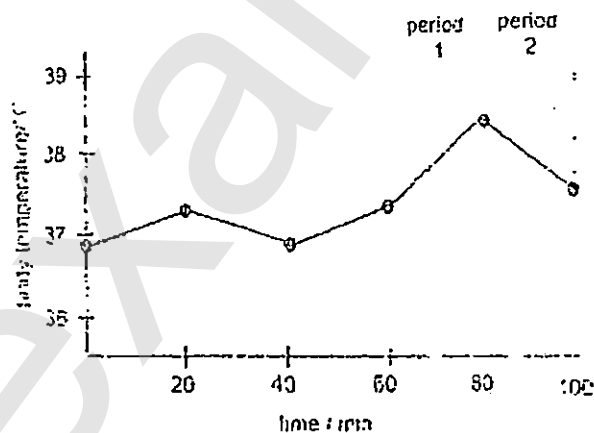


A bee stings the finger as shown.

What are the effects of the sting?

	pain felt	arm moves
A	yes	yes
B	yes	no
C	no	yes
D	no	no

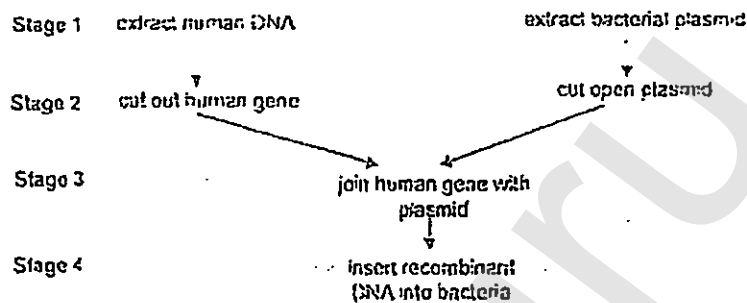
- 26 The graph below shows the changes in a person's body temperature plotted against time.



What could cause the changes in body temperature in periods 1 and 2?

	period 1	period 2
A	vigorous exercise	increased sweating
B	reduced air temperature	shivering
C	vigorous exercise	increased air temperature
D	reduced air temperature	increased sweating

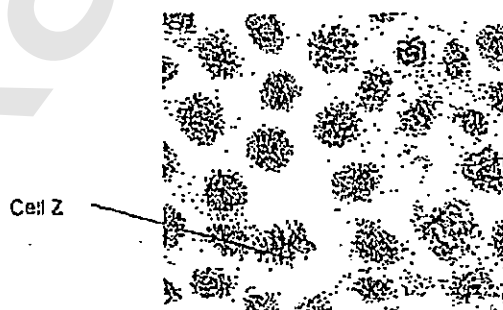
- 27 The diagram below outlines part of the process to produce a recombinant DNA containing a human gene



Which of the following correctly identifies the enzymes involved at the different stages?

- | | <i>restriction enzyme</i> | <i>ligase</i> |
|---|---------------------------|---------------------|
| A | Stage 1 and Stage 2 | Stage 3 and Stage 4 |
| B | Stage 2 and Stage 4 | Stage 3 |
| C | Stage 1 | Stage 4 |
| D | Stage 2 | Stage 3 |
- 28 A gene
- A is a DNA molecule
 - B is a sequence of nucleotides
 - C is a chain of amino acids
 - D consists of a sugar molecule a phosphate group and a base

- 29 The photomicrograph shows the cells in a onion root tip undergoing cell division



Which of the following statements correctly describes what is occurring in Cell Z?

- A DNA is replicating
- B Homologous chromosomes are pairing up
- C Sister chromatids are separating
- D Chromosomes are lining up at the equator

- 30 Which of the following correctly identifies the type/s of cell division that occur/s in the liver and the testes?

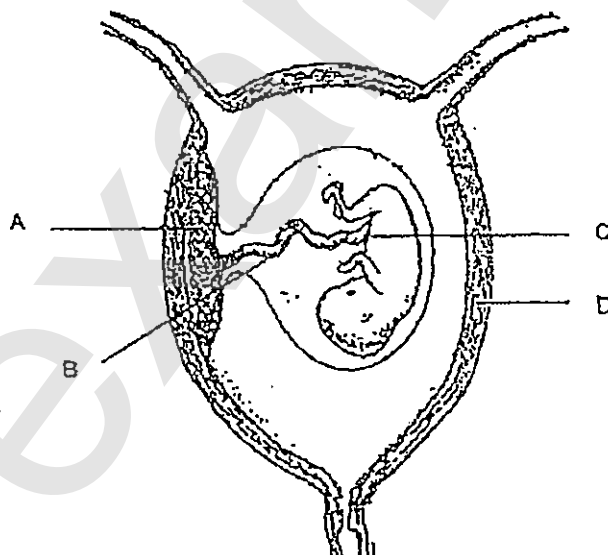
	liver	testes
A	mitosis	mitosis
B	mitosis	mitosis and meiosis
C	meiosis	meiosis
D	meiosis	mitosis and meiosis

- 31 An experiment was set up using four groups of insect-pollinated flowers in a field. In each group, different parts of the flower were removed as shown below and insects were allowed to visit all the flowers.

Which group would produce most seeds?

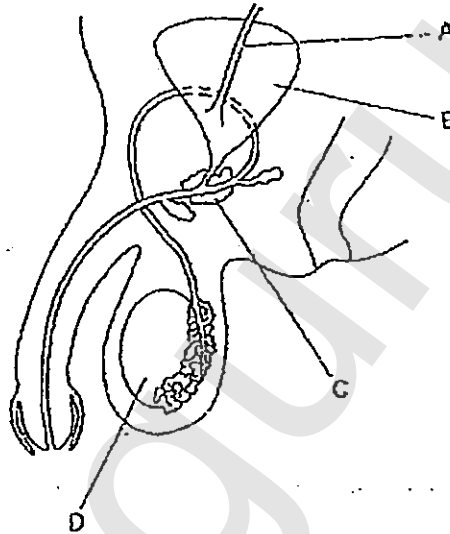
group of flowers	petals	stigmas	anthers
A	left behind	left behind	removed
B	left behind	removed	left behind
C	removed	left behind	left behind
D	removed	removed	left behind

- 32 The diagram below shows a fetus in a uterus.



Where does exchange of maternal and fetal materials take place?

- 33 The diagram shows the male reproductive and urinary systems. Which structure produces the fluid part of semen?



- 34 Fig. 1 shows the side view of the female reproductive system while Fig. 2 shows the early stages of reproduction in humans.

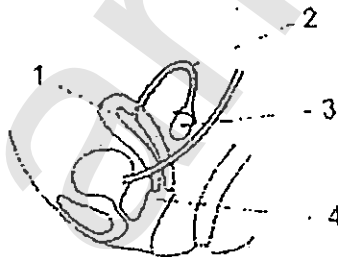


Fig. 1

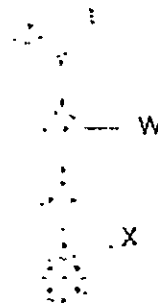


Fig. 2

In which numbered parts of the female reproductive system will the stages W and X be found?

	W	X
A	1	2
B	2	1
C	3	2
D	1	4

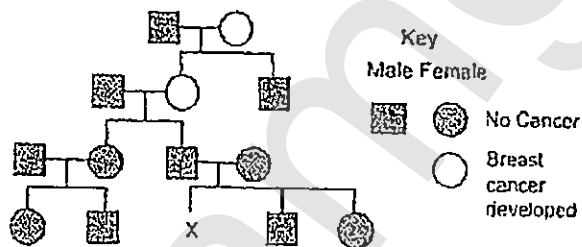
- 35 A girl has blood group A and her brother has blood group B. Which combination of genotypes cannot belong to their parents?

	mother	father
A	$I^A I^O$	$I^B I^O$
B	$I^A I^A$	$I^B I^O$
C	$I^O I^O$	$I^A I^B$
D	$I^A I^B$	$I^A I^B$

- 36 Which of the following consists of human traits that display discontinuous variation only?

- A tongue rolling, ABO blood group, ear lobe (detached)
- B height, widow's peak hairline, eye colour
- C weight, intelligence, earlobe (detached).
- D intelligence, haemophilia (blood unable to clot), ABO blood group

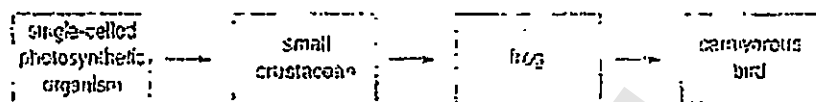
- 37 The diagram below shows the inheritance of a form of breast cancer associated with the presence of just one allele of the BRCA 1 gene.



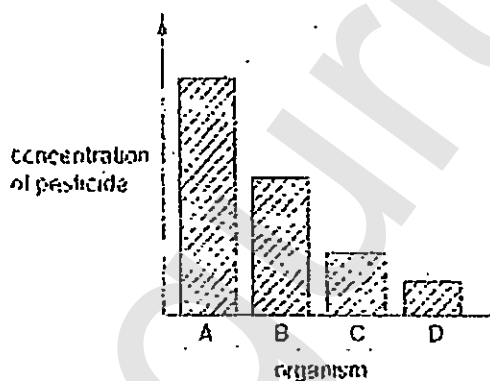
What is the probability that the woman X inherits the BRCA 1 allele that is associated with breast cancer?

- A 0.00
- B 0.25
- C 0.75
- D 1.00

- 38 The diagram shows part of a food chain in a lake

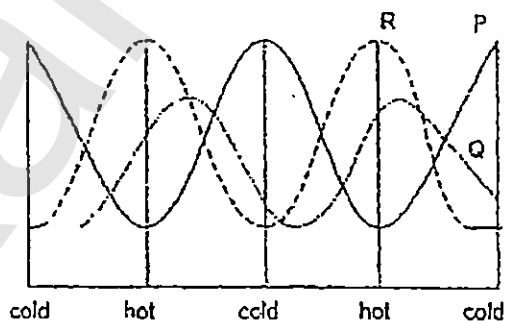


The chart shows the concentration of a pesticide in the bodies of each organism in the chain



Which organism on the chart is the crustacean?

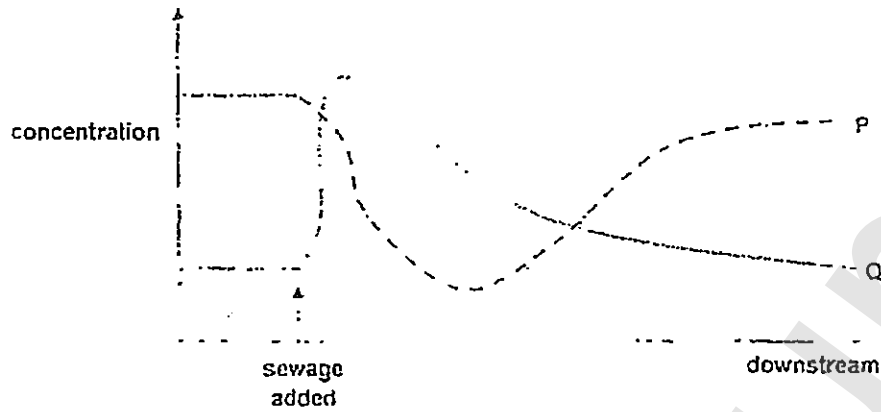
- 39 In a pond variations in the population of consumers and producers and the amount of mineral salts were measured over a few years. The diagram below shows the results



Which statement is not true of the results?

- A The amount of mineral salts is represented by graph Q.
- B The producer and consumer population show a difference in size.
- C The producer population increases after mineral salts content increases.
- D The consumer graph pattern follows closely behind that of the producer graph pattern.

- 40 The graph below shows the changes in the concentration of two substances P and Q in the river. Identify P and Q



- | | P | Q |
|---|-------------------|-------------------|
| A | carbon dioxide | nitrogen compound |
| B | nitrogen compound | carbon dioxide |
| C | oxygen | nitrogen compound |
| D | nitrogen compound | oxygen |

END OF PAPER

Section A [50 marks]

Answer all the questions in the space provided.

- 1 Fig. 1.1 is a diagrammatic representation of the small intestine containing three types of food molecule: a fat, a carbohydrate and a protein. before they have been digested. Fig. 1.1 also shows a lacteal and a capillary.

The different features in Fig. 1.1 have not been drawn to the same scale.

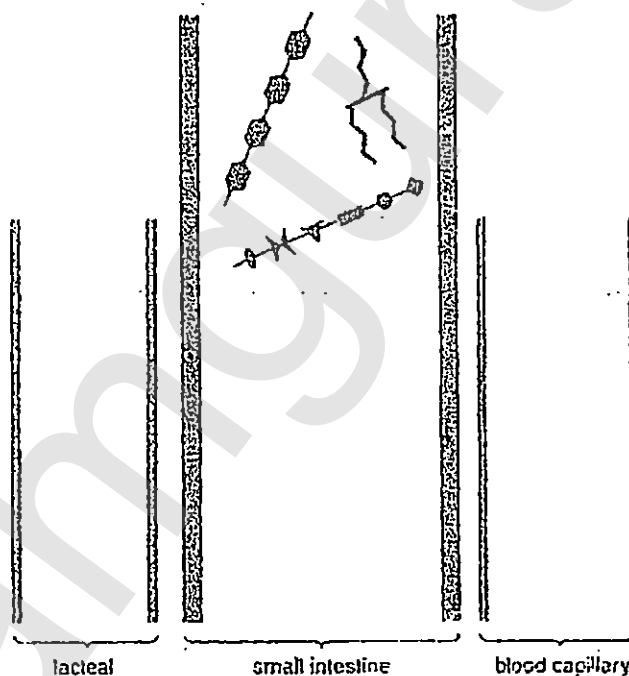


Fig. 1.1

- (a) On Fig. 1.1, draw and label the molecules as they would appear after they have been digested and then absorbed by the lacteal and by the capillary [3]
- (b) Explain how these molecules are carried to the liver [2]

[Total: 5m]

- 2 Fig 2.1 shows an experiment to investigate the uptake of ions by a plant.

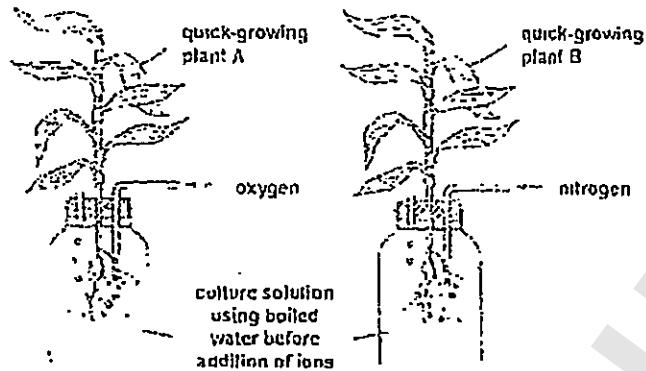


Fig. 2.1

The culture solutions contained measured quantities of all the ions necessary for plant growth which had been boiled to remove dissolved gases

- (a) Identify the process characteristic of all plant cells which the roots of plant B will be unable to carry out

(1)

Using the radioactive form of an ion, the rate at which it is absorbed from culture solutions can be measured. Fig. 2.2 shows the rate of uptake of one particular ion from the two solutions in Fig. 2.1.

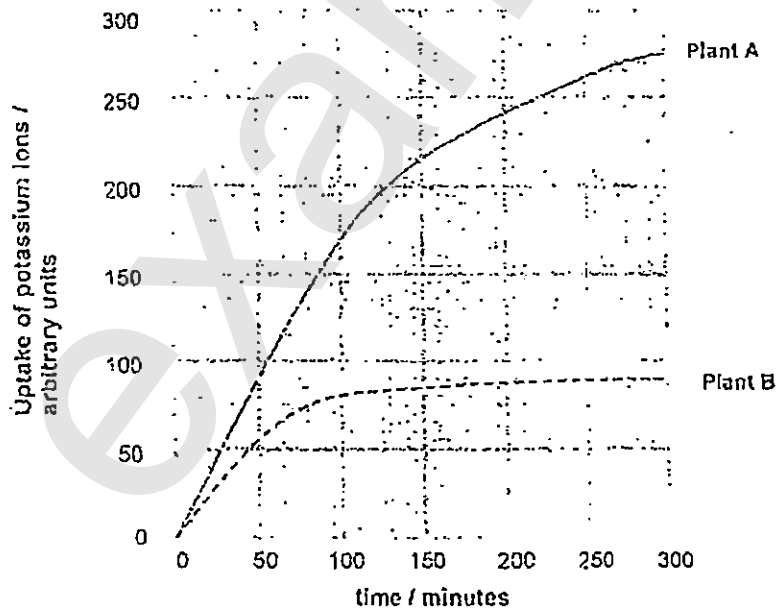


Fig. 2.2

- (b) Calculate the difference in uptake of the ion between the two plants after 2.5 hours

[2]

- (c) Describe and explain the difference in the uptake between the two plants.

[3]

[Total: 6m]

- 3 (a) Fig. 3.1 shows the pressure of the blood as it completes one circulation of the body (excluding the lungs)

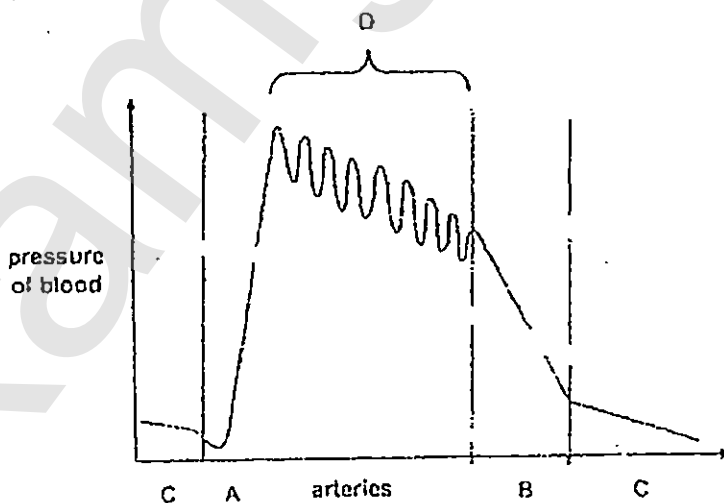


Fig. 3.1

- (i) State which labelled section of the above graph shows the pressure of the blood as it passes through

(1) veins: _____ (2) capillaries _____ (3) the heart: _____ [2]

- (ii) Suggest a reason to support why section D of graph represents the arteries.

[1]

- (b) (i) The blood pressure in the pulmonary circulation is taken. Describe how the blood pressure in the arteries of the pulmonary circulation would differ from that in Fig 3.1.

[1]

- (ii) Explain your answer to (c) (i).

[1]

- (c) Explain how blood pressure might be affected by eating food rich in animal fats and cholesterol.

[2]

[Total: 7m]

- 4 (a) Fig. 4.1 shows the changes in the tension of the suspensory ligaments of a girl. She carries out 2 activities during 10 seconds

A: she writes an essay

B: she looks at an aeroplane flying past a window

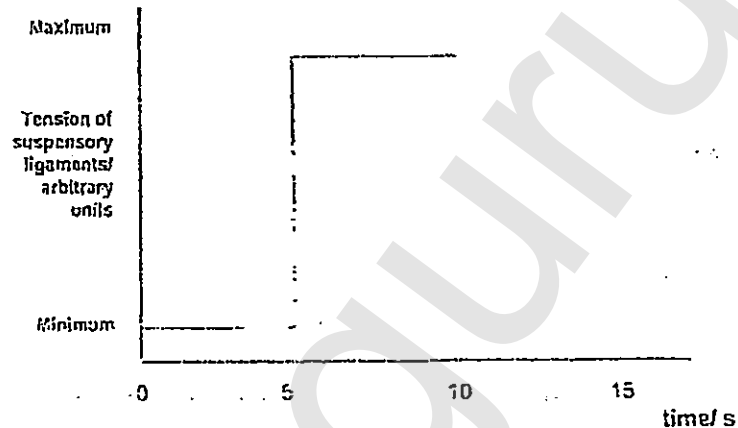


Fig. 4.1

- (i) Using the letters A and B identify which activity is being carried out:
 From 0 to 5 s: _____ From 5 to 10 s: _____ [1]
- (ii) Her pet puppy runs into her room through the door towards her between 10 s and 15 s. On Fig 4.1, show on the same axes the change that occurs to her suspensory ligaments from 10 s to 15 s. [1]
- (b) Before an eye test can be conducted to observe the retina, eye drops containing muscle relaxants are often applied to a person's eye. Often after the eye test, a person's eyesight is blurred and it takes a few hours until his eyesight returns to normal
- (i) State two groups of muscles that are present in the eye. [2]
- (ii) Suggest why the person's eyesight is blurred after applying the muscle relaxant [2]

[Total: 6m]

5 The process of meiosis increases variation in gametes

- (a) Describe how meiosis increases variation in gametes.

.....

.....

.....

.....

.....

[2]

- (b) Sickle cell anaemia is an example of a condition that can arise when this type of mutation occurs. Fig. 5.1 below illustrates this mutation. In sickle cell anaemia the mutation leads to a different haemoglobin S molecule being formed.

section of gene for
normal haemoglobin

A C T C C T G A G G A G A A G

section of gene for
haemoglobin S

A C T C C T G T G G A G A A G

Fig. 5.1

- (i) Identify the type of mutation illustrated in Fig. 5.1

[1]

- (ii) Explain how a change in the sequence of bases in a gene can lead to a different haemoglobin S being formed.

.....

.....

.....

.....

[2]

[Total: 5m]

- 6 Fig 6.1 shows the longitudinal section of an insect-pollinated flower and Fig. 6.2 shows the transverse section of the flower bud of the same species of insect-pollinated flower

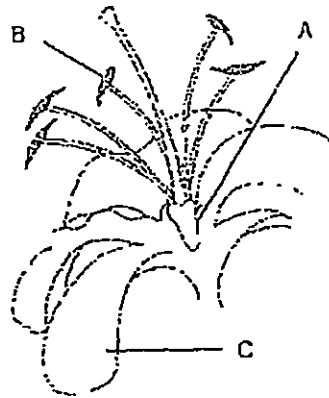


Fig. 6.1

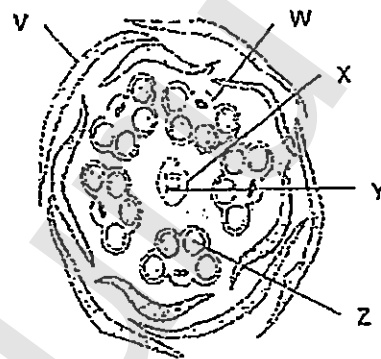


Fig. 6.2

- (a) Suggest two possible methods that may be used by this flower to avoid self-pollination.

[2]

- (b) With reference to Fig 6.2 only, state two features that indicate that the flower is pollinated by insects.

[2]

- (c) Identify the labelled parts in Fig. 6.2 which are equivalent to parts A, B and C in Fig 6.1 respectively

Fig 6.1	Fig 6.2
A	
B	
C	

[3]

- (d) Describe how the number of chromosomes in Y and Z differ from the number of chromosomes in cells in structure V

[1]

[Total: 8m]

- 7 The fur colour of mice is observed to be either yellow or grey. A heterozygous male mouse with grey fur was mated with a female mouse with yellow fur. They had a litter of 8 mice, 5 with grey fur and 3 with yellow fur.

- (a) By using suitable symbols and a genetic diagram, show the results of the cross between the grey and yellow mice

[3]

- (b) State the reason why the actual percentage of the offspring with different fur colour does not match that predicted in (a)

[1]

- (c) A group of equal number of yellow and grey mice were released into a field where yellow grains were grown. After a few years, the number of mice in the field had increased. However, the percentage of yellow furred mice was now more than double the percentage of grey furred mice.

Explain the changes that occurred in the population of mice.

[3]

[Total: 7m]

- 8 A flow chart representing energy flow through a food web in a pond during one year is shown in Fig. 8.1 below.

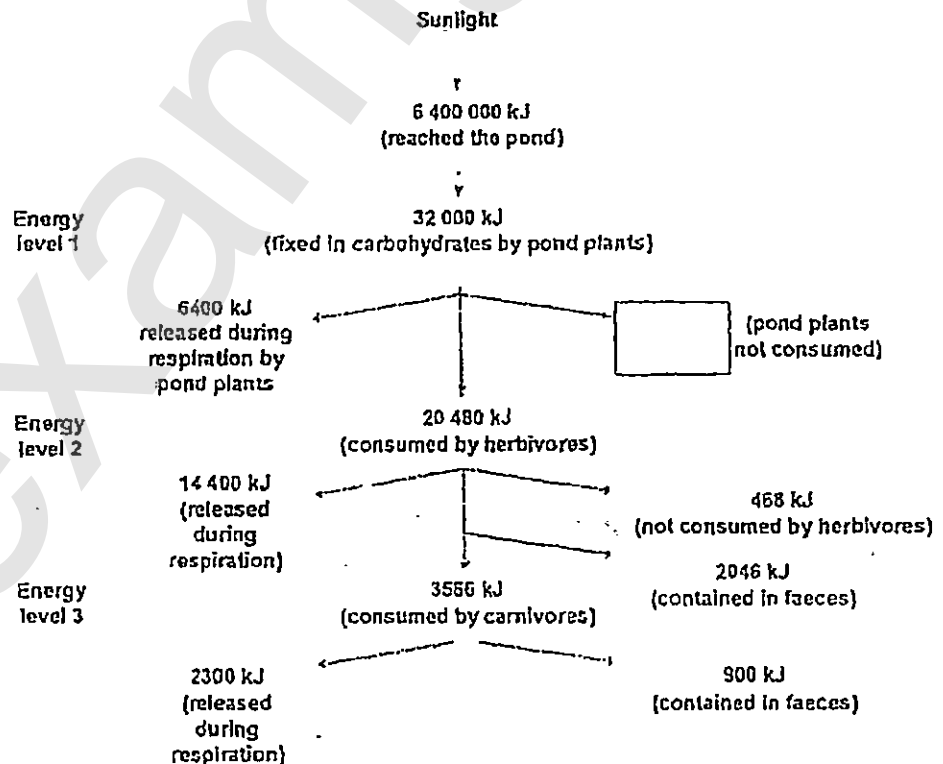


Fig. 8.1

- (a) (i) State the process that is responsible for fixing the energy from sunlight into carbohydrates

[1]

- (ii) Determine the percentage of the light energy (from the sunlight) that is fixed into carbohydrates by pond plants

[1]

- (iii) The remainder of the light energy which reached the pond was not fixed into carbohydrates in the pond plants. Suggest a reason why this energy did not enter the food web

[1]

- (b) Only 20 480 kJ per year reach the herbivores because the plants release energy from their carbohydrates during respiration and not all the plants are consumed. Calculate the amount of energy still contained in the pond plants which were not consumed.

[2]

- (c) Compare the amount of energy released during respiration by pond plants and by herbivore. Suggest one reason for the difference.

[1]

[Total: 6m]

Section B [30 marks]

Answer all the questions in this section on the space provided
Question 11 has a choice of parts to answer.

- 9 Fig 9.1 below shows the thickness of the uterine lining of a woman for the first 8 days of a 40-day assessment period

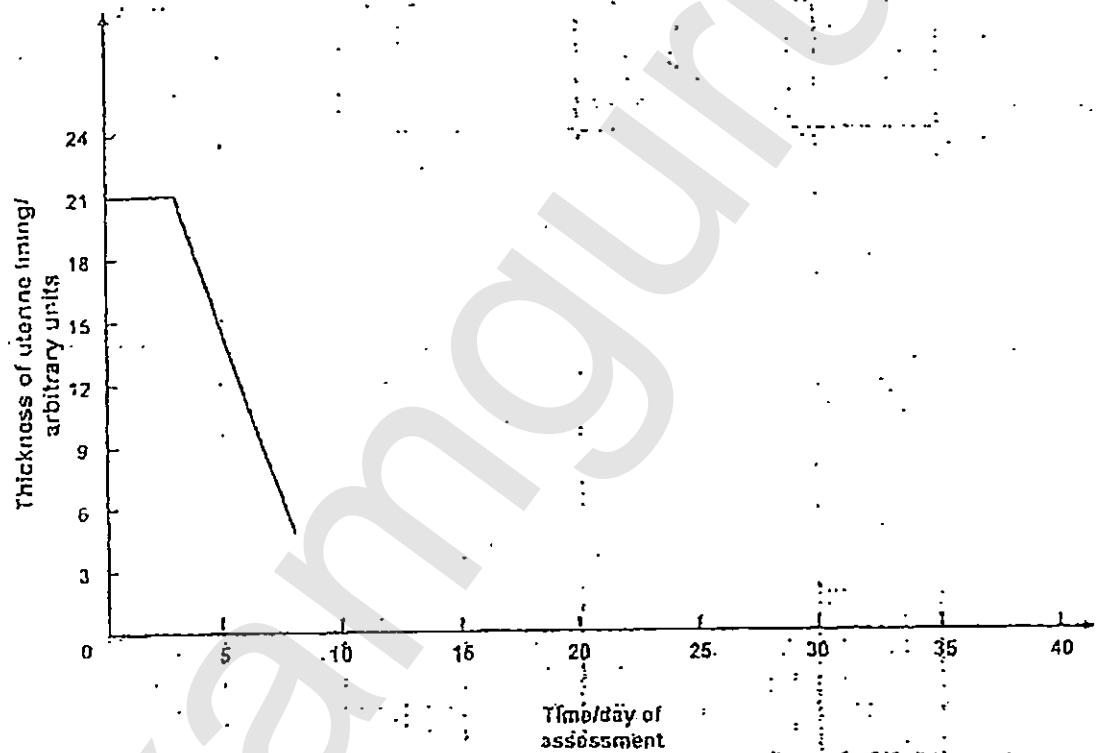


Fig 9.1

- (a) Using Table 9.2 below, complete the graph of the thickness of her uterine lining for the remaining period of the assessment. [2]

Time/day of assessment	Thickness of uterine lining/ arbitrary units
10	3
16	9
20	21
24	21
28	21
32	24
36	24
40	24

Table 9.2

- (b) The woman's menstrual cycle lasts an average of 28 days

With reference to the graph drawn in Fig 9.1, outline the key biological events that would have taken place in her female reproductive system (including ovaries, fallopian tubes and uterus) for the following period of time:

- (i) Day 10 to Day 16 of assessment

[2]

- (ii) Day 17 to Day 40 of the assessment

[4]

- (c) A foetus in a woman's womb is suspended in amniotic fluid.
Describe the functions of amniotic fluid.

[2]

- 10 (a) Differentiate between respiration and breathing.

[4]

- (b) In 1822, a man, Alexis Bidagan, suffered an injury from a gun fired at close range. The injury was in the form of a hole about 10 cm in diameter, penetrating both his chest and stomach walls, below his diaphragm. Fig. 10.1 shows the position of the opening that remained to Alexis's stomach until he died 58 years later.

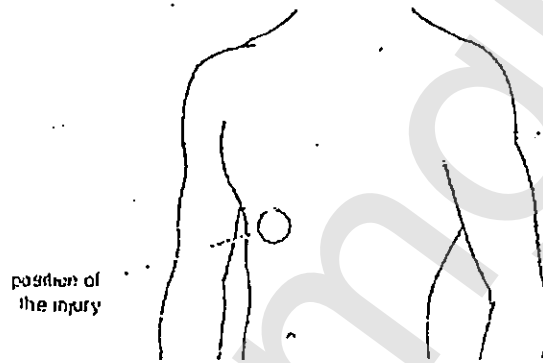


Fig. 10.1

If the wound had extended above his diaphragm, explain why Alexis would have experienced some breathing difficulties until the wound healed

[5]

- (c) Explain why smoking leads to emphysema

[1]

Either

11

- (a) With reference to named examples describe the differences between hormonal and nervous control in humans

[8]

- (b) A patient was admitted to a hospital accident and emergency ward and was diagnosed with Syndrome of Inappropriate Antidiuretic Hormone Secretion or SIADH. She was suffering from hyponatremia, a condition where the water potential of blood remains abnormally high.

Based on your knowledge of Antidiuretic Hormone (ADH) explain how hyponatremia comes about in a patient suffering from SIADH

[2]

Or

- 11 (a) With a named example of enzyme, substrate and product, explain how the effect of temperature affects the rate of enzymatic reaction.

[6]

- (b) (i) Describe the role of enzymes in blood clotting

[2]

- (ii) Blood clotting is an important process that prevents excessive bleeding when a blood vessel is injured. However, a blood clot can be a serious medical condition because clots that form in the veins or arteries can cause stroke or heart attack.

Describe how enzyme can be used for the removal of blood clot.

[2]

End of Paper



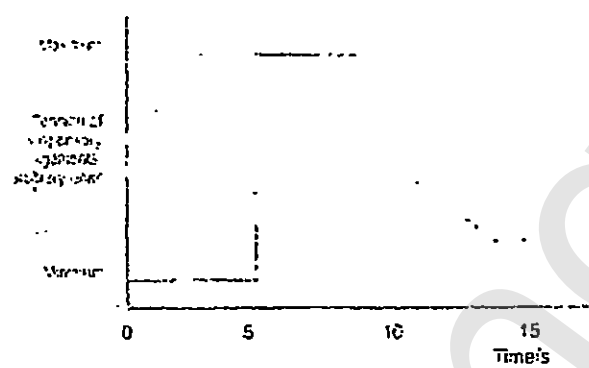
Answer Key

Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans
1		11	E	21		31	
2	B	12	D	22	B	32	A
3		13	A	23		33	C
4	D	14	S	24	D	34	D
5	C	15	B	25	E	35	B
6		16	D	26	A	36	A
7	D	17	A	27	D	37	A
8	C	18	A	28	E	38	C
9	A	19	D	29	D	39	C
10		20		30		40	

Answer Keys for 2014 Biology Preliminary Examinations Papers 2

Paper 2

Qn	Answer keys
1a	- In lacteal – draw the same molecule of fat [1] - In blood capillary – draw 4 molecules of glucose [1] - In blood capillary – draw 6 molecules of amino acids (must follow the shapes given in question) [1] No marks awarded if number or shape of molecules is wrong
1b	Any 2 of the 3 points. - Soluble in (blood) plasma [1] - Transported by plasma [1] - From small intestine to liver via hepatic portal vein [1] Max 2 marks
2a	Aerobic respiration [1] Reject: Respiration/ active transport
2b	$215 - 85 = 130$ arbitrary units Correct working [1] Correct answer with correct units [1]
2c	Speed of absorption of ions by plant A is twice as fast as that of plant B/ The amount of ions absorbed by plant A is twice that absorbed by plant B [1]. This is because plant A can absorb ions by both diffusion and active transport. [1] In the presence of oxygen, aerobic respiration can be carried out by the root hair cells to produce energy required to transport ions into the plant against a concentration gradient. [1]
3a	Veins: C Capillaries: B The heart: A 1 mark for each correct answer. Max: 2 marks
3a(i)	Any of the following: Pulsating blood pressure because of the contraction and relaxation of artery muscles [1] Arteries being nearer to heart hence highest blood pressure compared to the other blood vessels [1]
3b(i)	Blood pressure in pulmonary arteries higher than the other arteries [1]
3b(ii)	Pulmonary artery carries (deoxygenated) blood from the heart to the lungs which is

Qn	Answer keys
	very close to the heart [1].
3c	Diet rich in animal fats and cholesterol which are saturated fats results in deposition of fats on the walls of the blood vessels [1]. The fatty deposits narrow blood vessels hence increasing blood pressure [1]
4a	From 0 – 5 s: A [1] From 5 – 10 s: B [1]
4a:	 1 mark
4b	muscles of iris [1] ciliary muscles [1]
4bii	- Ciliary muscles remains relaxed/ unable to contract, suspensory ligaments remain taut [1] - lens remains flat/ unable to bulge, cannot focus on near objects [1] OR - Iris muscles cannot contract/remain relaxed, pupil remains dilated [1] - Allows a lot of light into eye, causing blur image [1]
5a	- Crossing over occurs where sections of <u>homologous chromosomes</u> are exchanged during prophase 1 [1] - Random assortment of homologous pairs of chromosomes occurs during metaphase 1 [1]
5b	- The sequence of bases determines the sequence of amino acids in a protein [1] - Wrong sequence of amino acid leads to different protein formed [1] - folds differently/different physical structure/different 3D structure from normal haemoglobin [1]

Qn	Answer keys								
6a	Pollen grains from the same flower landing on stigma do not germinate [1] Anthers and stigma matures at different times. [1]								
6b	Any two: Large petals, stigma not feathery, stamen not pendulous/short and compact Max. 2 marks								
6c	<table border="1"> <thead> <tr> <th>Fig 3.1</th><th>Fig 3.2</th></tr> </thead> <tbody> <tr> <td>B</td><td>X [1]</td></tr> <tr> <td>E</td><td>Y [1]</td></tr> <tr> <td>F</td><td>W [1]</td></tr> </tbody> </table>	Fig 3.1	Fig 3.2	B	X [1]	E	Y [1]	F	W [1]
Fig 3.1	Fig 3.2								
B	X [1]								
E	Y [1]								
F	W [1]								
6d	They contain half the number of chromosomes of W [1]								
7a	Diagram illustrating a monohybrid cross: - Parental Genotypes: Gg (grey) and gg (yellow) - Gametes: G and g - F1 Genotypes: Gg (grey), Gg (grey), gg (yellow), gg (yellow) - Phenotypes: grey, grey, yellow, yellow • Legend (symbols used etc) [1] • Correct Genotypes of parents and gametes formed [1] • Correct crosses (lines drawn) and genotypes and phenotypes of F₁ generation [1] Deduct 1 mark if did not circle the gametes [1]								
7b	The number of offsprings/progeny is too small or sample size of progeny/offsprings is too small. [1]								
7c	• yellow fur mice <u>better adapted</u> to survive in environment (<u>reasonable explanation</u>) [1] • <u>survive longer</u>, more likely to mate and <u>pass on the allele for yellow fur</u> to their offspring [1] • <u>over many generations</u>, <u>greater percentage of population</u> has the <u>advantageous</u>								

Qn	Answer keys
	allele for them to survive [1]
8ai	Photosynthesis [1]
8aiv	Total energy reaching the pond = 6400 000 kJ Energy fixed = 32 000 kJ % energy fixed = $(32\ 000/6400\ 000) \times 100 = 0.5\%$ [1]
8aiv	Any one of the following: Reflected off the pond water/ fall on a part of the pond where there are no plants/ wrong wavelength to be absorbed by plant [1]
8b	32 000 kJ fixed by pond plant, of this, 6400 kJ used for respiration 20 8000 kJ consumed by herbivores So amount not consumed = $32\ 000 - (20\ 480 + 6400) = 5120\text{ kJ}$ 1m for correct answer+unit, 1 m for correct working
8c	Herbivores released much more energy by respiration (about twice as much) because they use energy to move around [1]
9a	Correct plots [1] Line of best fit [1]
9bi	Repair and thicken of uterus lining + development of follicle/primary follicle develop into Graafian follicle + secretion of oestrogen [1] Ovulation/ release of mature egg cell [1]
9bi	Fertilization [1] Migration of zygote from fallopian tube to uterus, Mitosis of zygote to form embryo/ ball of cells, Implantation of embryo into uterine lining. [2] Corpus luteum stage + continue secretion of progesterone + thickening of uterus lining [1] Day 30/31 to 40 – no shredding of uterine lining/ endometrium continues to thicken [1] Max. 4m
9c	Amniotic fluid never enters lungs because foetus not breathing, the gaseous exchange does not occur via lungs. [1] but occurs via placenta [1]
10a	- Respiration is the oxidation of food substance to release energy [1] - Occurs in all living cells [1] - Breathing is the contraction and relaxation of muscles to bring about the

Qn	Answer keys																					
	movement of the ribs [1] • in order to cause air to move into and out of lungs. [1]																					
10b	• chest / thorax no longer airtight; [1] • rel. intercostal muscles (damage or action)/diaphragm (damage or action)/lungs / alveoli damaged or infected. [1] • air drawn in / out through hole [1] • correct volume / pressure reference. [1] • insufficient / less air or oxygen in lungs / not properly inflated [1]																					
10c	irritants in tobacco smoke cause <u>prolonged violent coughing</u> leading to <u>breakdown of partition walls between alveoli</u> [1]																					
11(D)	<table border="1"> <tr> <td>a</td> <td>hormonal</td> <td>Nervous</td> </tr> <tr> <td>response time</td> <td>generally slower</td> <td>very fast</td> </tr> <tr> <td>mode of transmission of signal</td> <td>by blood circulatory system</td> <td>by nerves</td> </tr> <tr> <td>voluntary/involuntary</td> <td>involuntary</td> <td>voluntary or involuntary</td> </tr> <tr> <td>length of effect</td> <td>can last very long</td> <td>short lived</td> </tr> <tr> <td>type of signal</td> <td>chemical</td> <td>chemical and electrical</td> </tr> <tr> <td>target organ</td> <td>can affect multiple organs</td> <td>localised</td> </tr> </table> Every correct comparison- 1m Every correct description (including named example) - 1m Max. 8 marks	a	hormonal	Nervous	response time	generally slower	very fast	mode of transmission of signal	by blood circulatory system	by nerves	voluntary/involuntary	involuntary	voluntary or involuntary	length of effect	can last very long	short lived	type of signal	chemical	chemical and electrical	target organ	can affect multiple organs	localised
a	hormonal	Nervous																				
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11(E) b	• <u>High secretion of ADH. increases permeability of collecting ducts</u> in the kidneys to water [1] • <u>Large amount of water reabsorbed</u> into blood stream [1]																					
11(O) a	<u>Essential marking point</u> Correct match of enzyme substrate and product [1] <u>Any 5 points below</u> Enzyme lowers the activation energy of the reaction [1] Lower temperature, enzymes and substrate has lower kinetic energy, enzymatic activity low/enzyme inactive [1] With every 10°C rise in temperature, enzyme activity doubles [1] Optimum temperature at 37 °C, enzymes works the fastest [1] Temperature above 37 °C, enzymes starts to denature, rate of reaction decreases [1] At 60 °C enzymes completely denatured rate of enzyme reaction is zero [1]																					

Qn	Answer keys
	Max. 6 marks
11(O) bi	Thrombokinase converts the prothrombin to thrombin (active enzymes) [1] Thrombin converts fibrinogen to fibrin [1]
11(O) bi	Protease [1] breaks down fibrin [1] in blood clot



SINGAPORE CHINESE GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2014
SECONDARY FOUR

BIOLOGY

5158/01

Paper 1 Multiple Choice

Tuesday

12 August 2014

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Shade your answers in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and index number on the Answer Sheet in the spaces provided.

There are forty questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D.

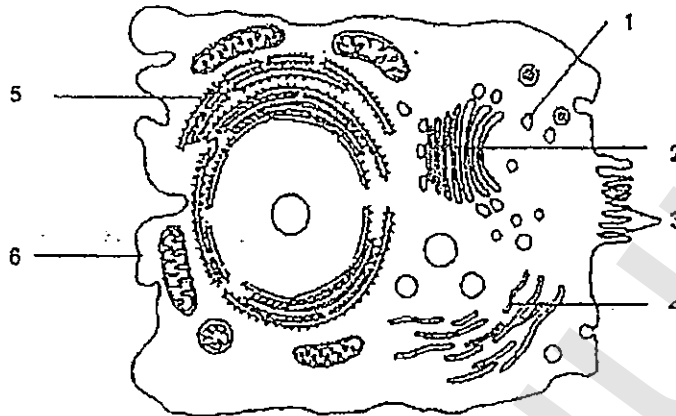
Choose the one you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this question paper.

- 1 The diagram shows a section of a generalized animal cell as seen under the electron microscope.



Where are the proteins and lipids synthesised and transported, packaged and secreted?

	synthesised and transported		packaged	secreted
	proteins	lipids	proteins and lipids	proteins and lipids
A	2	5	4	3
B	4	5	2	1
C	5	4	2	1
D	5	6	2	3

- 2 The statements describe some of the properties of water.

1. absorbs and retains a lot of heat
2. requires a lot of heat to evaporate
3. is able to form bonds with other water molecules
4. is able to form bonds with molecules of substances other than water

Which properties are important for the transport of water in xylem?

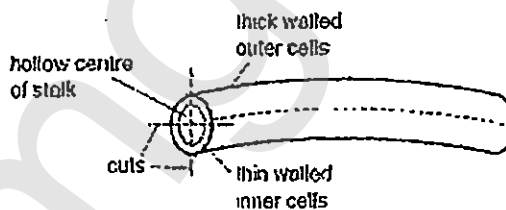
- A 1, 2 and 3
 B 1, 2 and 4
 C 2 and 3 only
 D 3 and 4 only
- 3 Which feature of xylem vessels allows them to have reduced resistance to water flow?
- A cellulose cell walls are thickened with lignin
 B empty lumen without cross walls or protoplasm
 C new vessels carry extra water as a plant grows
 D vessel elements join to form narrow tubes

4. A concentrated solution of sucrose and sucrase were mixed together and incubated at 30°C. Samples of the mixture were tested with two reagents at the start of the experiment and after 24 hours.

What colours would be expected?

	reagent added at the start		reagent added after 24 hours	
	Biuret solution	Benedict's solution and heated	Biuret solution	Benedict's solution and heated
A	blue	blue	blue	brick red
B	blue	brick red	blue	blue
C	violet	blue	violet	brick red
D	violet	brick red	blue	brick red

5. The stalk of wild garlic is a hollow tube. Pieces of the stalk are cut as shown and placed in sucrose solutions of different water potentials.



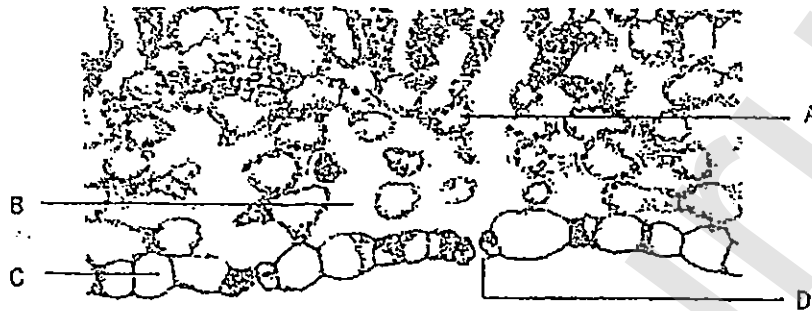
Which diagram shows the piece that is placed in the sucrose solution with the highest water potential?



6. What determines the rate of water movement from the roots to the leaves?

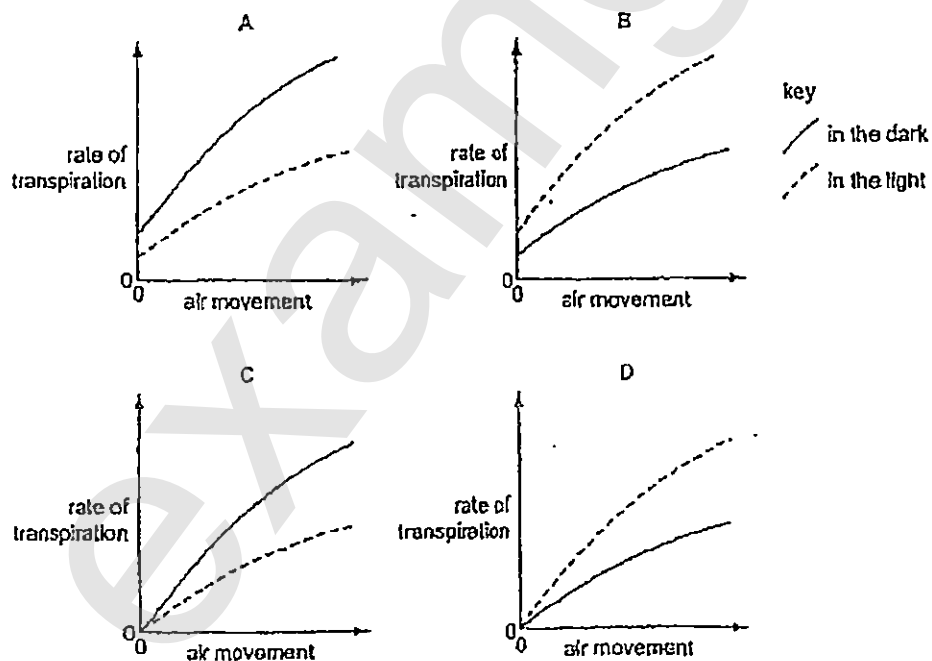
- A absorption of water through the root hairs
- B development of higher leaf water potential
- C evaporation of water from the mesophyll cell walls
- D osmosis of water through the stomata

- 7 The photomicrograph shows a section of the spongy mesophyll and the lower epidermal tissues of a leaf.

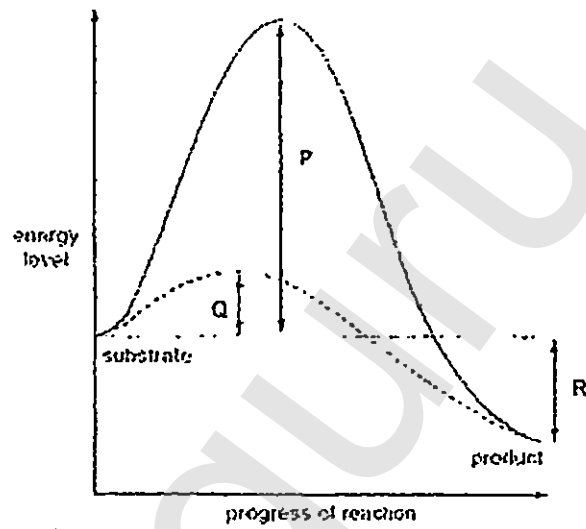


At which point will the concentration of carbon dioxide be lowest when the plant is exposed to a high light intensity?

- 8 Which graph shows the effect of increasing air movement on the rate of transpiration of a plant in light and in dark conditions?



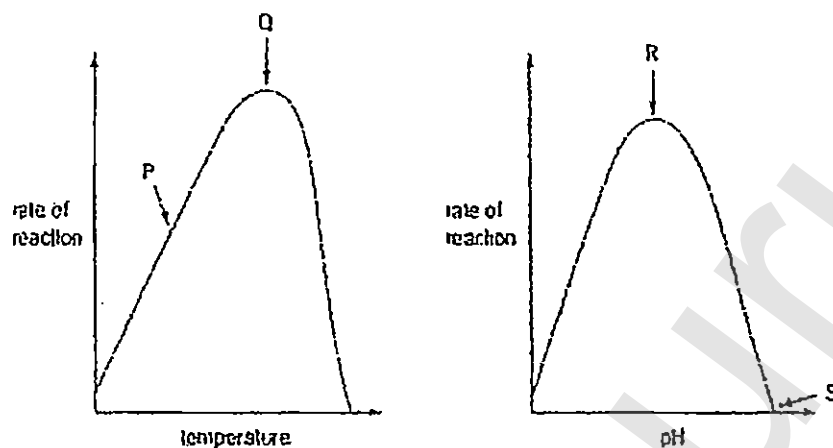
- 9 The graph shows the energy changes in an enzyme-controlled reaction.



Which option represents the activation energy of the reaction with and without the enzyme?

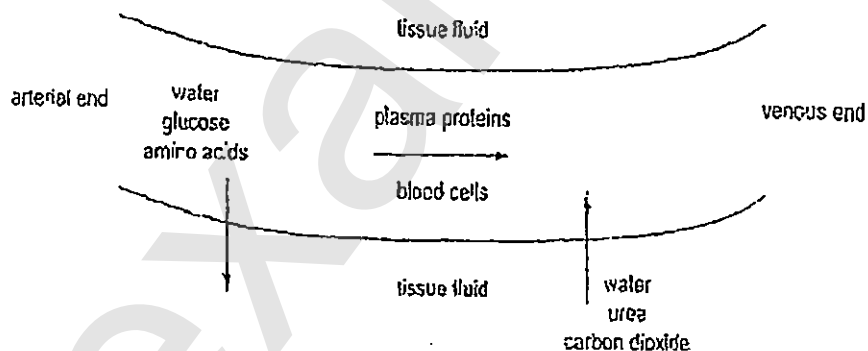
	with enzyme	without enzyme
A	Q	P
B	P + Q	Q
C	Q	P - Q
D	Q + R	P + R

- 10 The graphs show the effects of temperature and pH on enzyme activity.



Which statement correctly explains the enzyme activity at the point shown?

- A At P, bonds are formed between enzyme and substrate.
 - B At Q, enzyme activity is occurring at the highest temperature.
 - C At R, peptide bonds in the enzyme begin to break.
 - D At S, the substrate is completely denatured.
- 11 The arrows on the diagram show the direction of movement of some of the substances in plasma as they enter and leave a capillary.

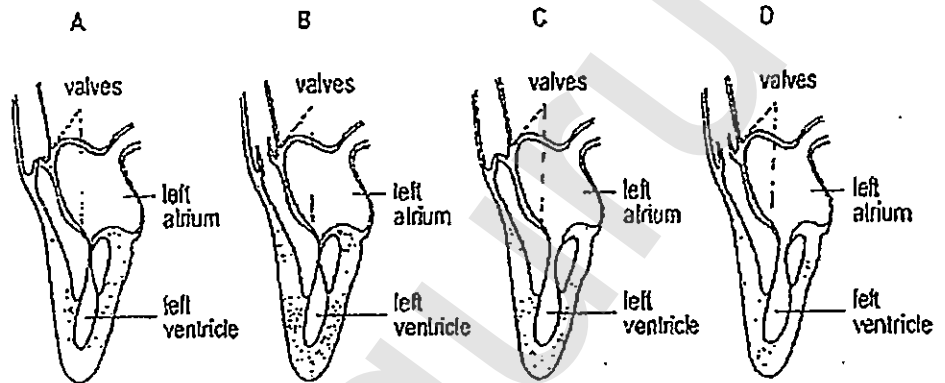


Which two factors help water to re-enter the capillary at the venous end?

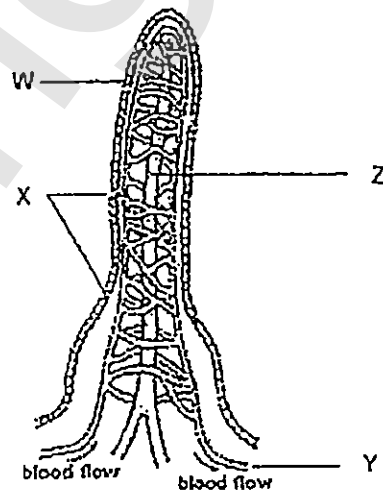
	plasma water potential	blood pressure in the capillary
A	decreased	decreased
B	decreased	increased
C	increased	decreased
D	increased	increased

12 The diagrams show sections through the left side of the heart.

Which diagram correctly shows the position of the atrioventricular and semilunar valves during a ventricular contraction?



13 The diagram shows a section through a villus in the small intestine.



Which of the following statements about the parts W, X, Y and Z is/are correct?

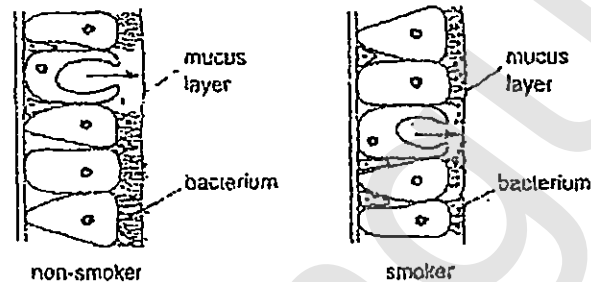
1. Cells similar to W have numerous microvilli and mitochondria.
2. Cells similar to X secrete mucus and digestive enzymes.
3. Vessel Y transports digested fats absorbed by diffusion.
4. Vessel Z transports digested food to the hepatic portal vein.

- A 1 only
 B 1 and 2 only
 C 3 and 4 only
 D 1, 2, 3 and 4

- 14 What are the changes to the concentration of the various substances in the red blood cells when carbon dioxide diffuses from respiring cells?

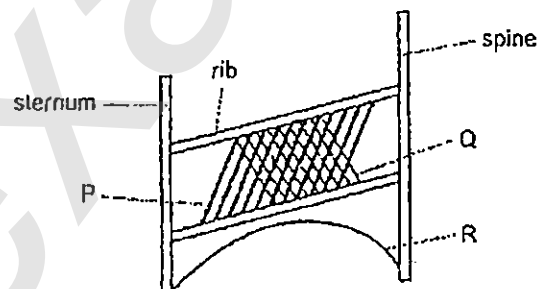
	carbonic anhydrase	hydrogen carbonate ions (HCO_3^-)
A	decreases	no change
B	increases	increases
C	no change	decreases
D	no change	increases

- 15 The diagrams show the epithelium lining the bronchioles in a non-smoker and a smoker.



As a result of the changes, what will the smoker experience?

- A more lung infections
 - B more mucus running down the nose
 - C the bronchioles become wider
 - D the cilia will beat more rapidly
- 16 The diagram represents some of the muscles involved with breathing.



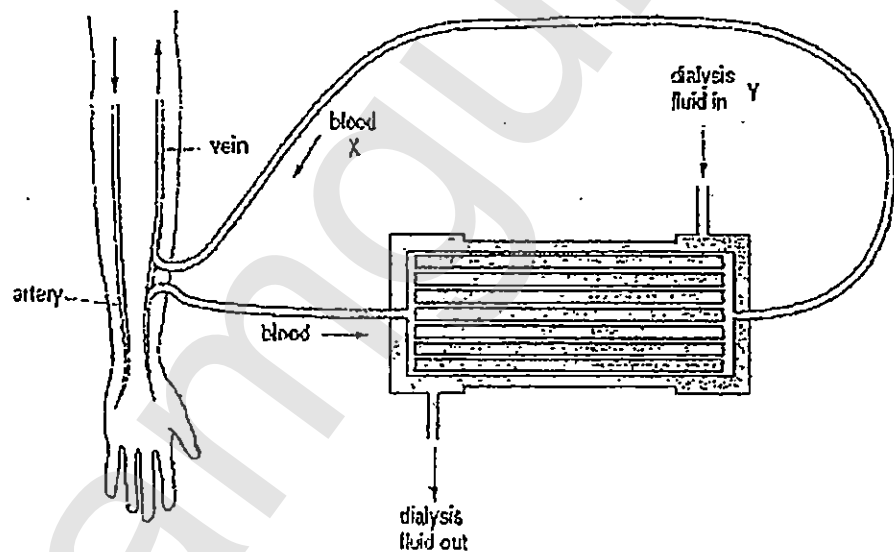
Which muscles are contracting during breathing in?

- A R only
- B P and Q
- C P and R
- D P, Q and R

- 17 Which option shows the substances ultra-filtered and selectively reabsorbed in the kidney tubules in a healthy human?

	ultra-filtered from blood	some selectively reabsorbed into blood	all selectively reabsorbed into blood
A	glucose	protein	water
B	protein	water	salt
C	salt	glucose	protein
D	water	salt	glucose

- 18 The diagram represents the flow of blood and dialysis fluid through a kidney machine.



Which substances have the lowest concentration at X and the highest concentration at Y?

	lowest at X	highest at Y
A	glucose	salts
B	salts	glucose
C	urea	water
D	water	urea

- 19 When a person is frightened in an emergency, which substance causes an increase in the blood sugar levels?

- A adrenaline
- B amylase
- C gastrin
- D glycogen

- 20 Which of the following changes occur when a person is immersed in a hot water bath for 15 minutes?

1. Dilation of skin arterioles
2. Increased metabolism of fat
3. Increased production of sweat

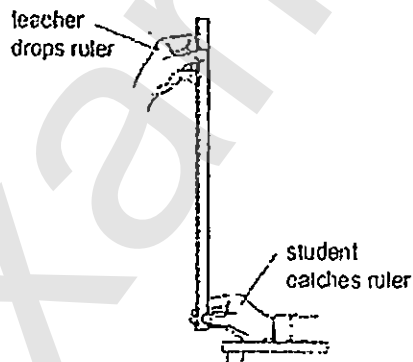
- A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

- 21 A man injures his hand in an accident. Afterwards, he can feel the objects touching his hand, but he cannot move his hand away from them.

What could cause this?

- A Receptors in his hand are damaged.
B Relay neurones in his hand no longer function.
C The nerve connection is cut only between the receptors in his hand and his central nervous system.
D The nerve connection is cut only between his central nervous system and the effectors in his arm.

- 22 The reaction time of a student is determined by measuring the distance a ruler falls before it is caught by the student. A teacher drops the ruler as shown.



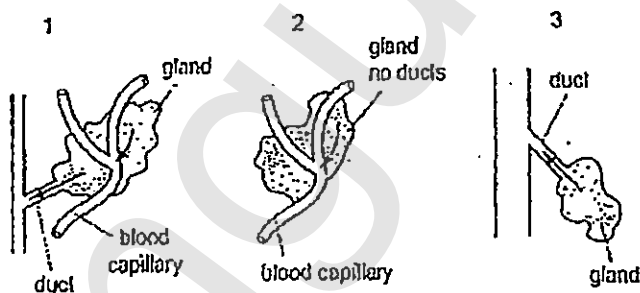
Which path is taken by nerve impulses from the student's eyes to the muscles of his hand?

- A optic nerve → retina → spinal cord → brain → spinal nerve
B optic nerve → retina → spinal cord → spinal nerve → brain
C retina → optic nerve → brain → spinal cord → spinal nerve
D retina → optic nerve → spinal nerve → brain → spinal cord

- 23 Which of the options shows the states of the circular and radial iris muscles and the ciliary muscles in the eye for the corresponding viewing action?

	viewing action	circular muscles	radial muscles	ciliary muscles
A	a distant object in bright light	relaxed	contracted	contracted
B	a distant object in dim light	contracted	relaxed	relaxed
C	a near object in bright light	contracted	relaxed	contracted
D	a near object in dim light	relaxed	contracted	relaxed

- 24 The diagram shows the basic plan of three types of glands. The arrows show how their secretions pass from them into other parts of the body.



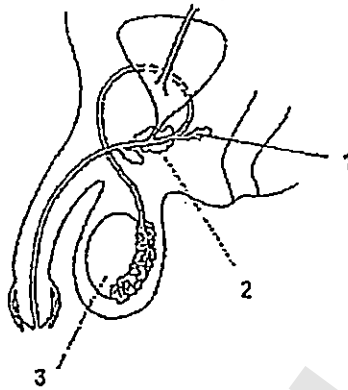
In which type of gland would secretions of sebum, insulin and oestrogen be produced?

	sebum	insulin	oestrogen
A	1	2	3
B	1	3	2
C	3	2	1
D	3	1	2

- 25 Which option shows the correct functions of both oestrogen and progesterone?

	oestrogen	progesterone
A	causes repair of uterus lining after menstruation	prevents release of eggs during pregnancy
B	maintains uterus lining	helps stimulate release of eggs from ovary
C	promotes menstruation	prevents menstruation
D	prevents release of eggs during pregnancy	promotes menstruation

- 26 The diagram shows part of the male urino-genital system.



What are the functions of the labelled parts?

	hormone production	seminal fluid production
A	1 and 2	3 only
B	1 and 3	2 only
C	2 only	1 and 3
D	3 only	1 and 2

- 27 What is the most important function of the amniotic fluid during pregnancy?

- A It allows space for the growth of the fetus.
- B It enables the fetus to get rid of waste products.
- C It protects the fetus by ensuring an even distribution of pressure.
- D It provides nourishment for the growth of the fetus.

- 28 Dioecious plant species are adapted to transfer pollen effectively to the stigma of another individual.

Which adaptations are used in wind pollination?

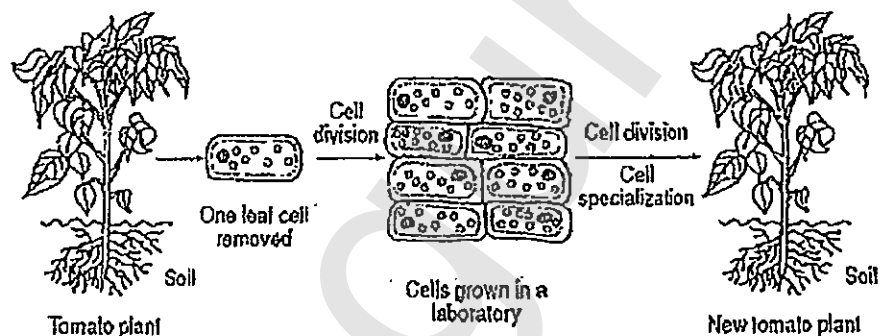
- 1. anther enclosed in petal
- 2. filament pendulous
- 3. feathery stigma
- 4. pollen rough
- 5. pollen small
- 6. stigma sticky knob

- A 1, 4 and 5 only
- B 1, 2, 3 and 6
- C 2, 3 and 5 only
- D 2, 4 and 6 only

29 Which characteristics of a population would most likely indicate the lowest potential for evolutionary change in that population?

- A asexual reproduction and few mutations
- B asexual reproduction and many mutations
- C sexual reproduction and few mutations
- D sexual reproduction and many mutations

30 The diagram represents a technique used to produce new plants.



Which statement is best supported by the information in the diagram?

- A The one leaf cell removed formed a zygote that developed into a new plant by mitotic cell division.
- B The cell taken from the leaf produced eight cells, each having one-half of the genetic material of the original leaf cell.
- C The new tomato plant will not be able to reproduce sexually because it was produced by mitotic cell division.
- D The procedure can be used to produce new tomato plants that are clones of the original tomato plant.

31 What are the similarities between traditional plant breeding and genetic engineering?

1. increase chance of mutation
2. involve selection of genetic traits
3. must involve closely related species
4. transfer genes

- A 1 and 3
- B 1 and 4
- C 2 and 3
- D 2 and 4

32 Some stages in the production of human insulin from genetically modified bacteria are listed.

1. A bacterial plasmid is cut open.
2. The bacterium is grown in a fermenter.
3. The insulin gene is cut out from human DNA.
4. The insulin gene is inserted into a plasmid.
5. The plasmid is inserted into a bacterium.

What is the correct sequence of these statements?

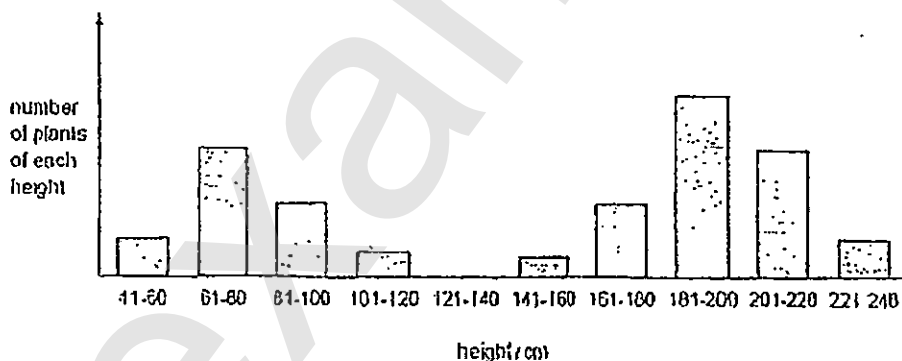
- A 2 → 3 → 5 → 4 → 1
- B 2 → 5 → 3 → 1 → 4
- C 3 → 1 → 4 → 5 → 2
- D 3 → 1 → 5 → 4 → 2

33 It has been found that some species of disease-causing bacteria that could previously be killed by antibiotics are now resistant to these drugs.

Which of the following statements best explains the origin of this resistance?

- A Antibiotics cause mutations in bacteria proteins, resulting in resistance.
- B Generations of bacteria adapt and become resistant to antibiotics.
- C Random changes in the sequence of bacterial DNA bases.
- D Resistant bacteria survive as a result of natural selection.

34 The heights of 500 pea plants of the same age were measured to the nearest 20 cm. The results are shown in the chart below.



Variation in height of these pea plants shows

- A continuous variation only.
- B discontinuous variation only.
- C both continuous and discontinuous variation.
- D neither continuous and discontinuous variation.

- 35 In which natural cycles do photosynthesis and respiration both play a part?

	carbon cycle	water cycle
A	✓	✓
B	✓	x
C	x	✓
D	x	x

Key
✓ = yes
x = no

- 36 The diagram shows a terrestrial food chain.

mahogany tree → caterpillar → small bird → owl

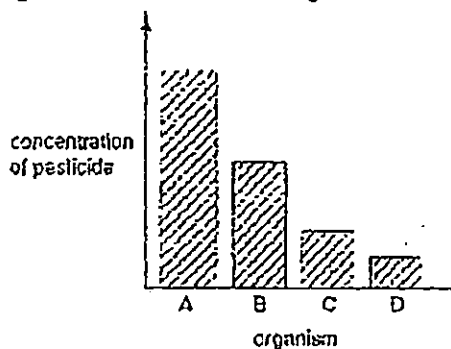
In this food chain, which population has the largest biomass and which has the largest population size?

	largest biomass	largest population size
A	owl	mahogany tree
B	owl	small bird
C	mahogany tree	caterpillar
D	mahogany tree	Owl

- 37 The diagram shows part of a food chain in a lake.

single-celled photosynthetic organisms → small shrimps → frog → carnivorous bird

The chart below shows the concentration of a pesticide in the bodies of each organism in the food chain. Which organism on the chart is the frog?



38 A student wrote the following statements about meiosis.

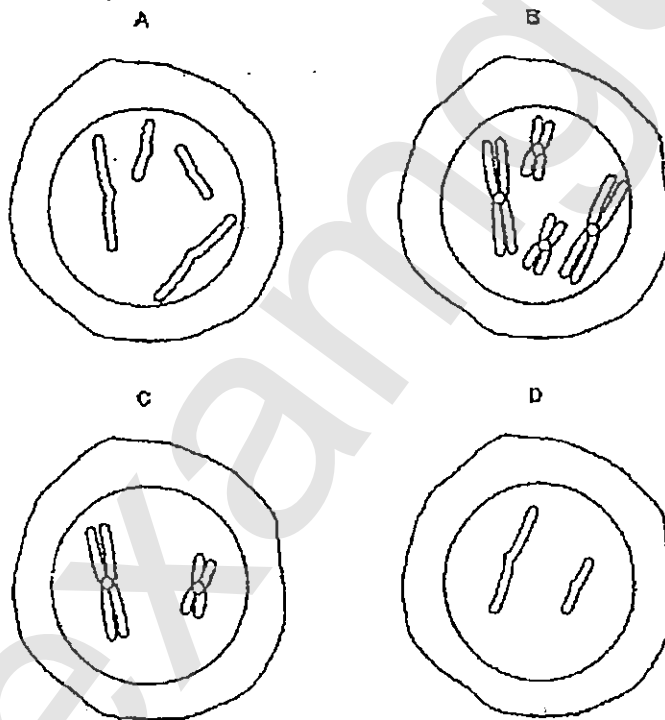
1. Homologous chromosomes pair up and cross-over.
2. Homologous chromosomes undergo Independent segregation
3. Crossing-over occurs between chromatids of non-homologous chromosomes

Which statements are features of meiosis which contribute to variation?

- A 1 and 2 only
- B 1 and 3 only
- C 2 and 3 only
- D 1, 2 and 3

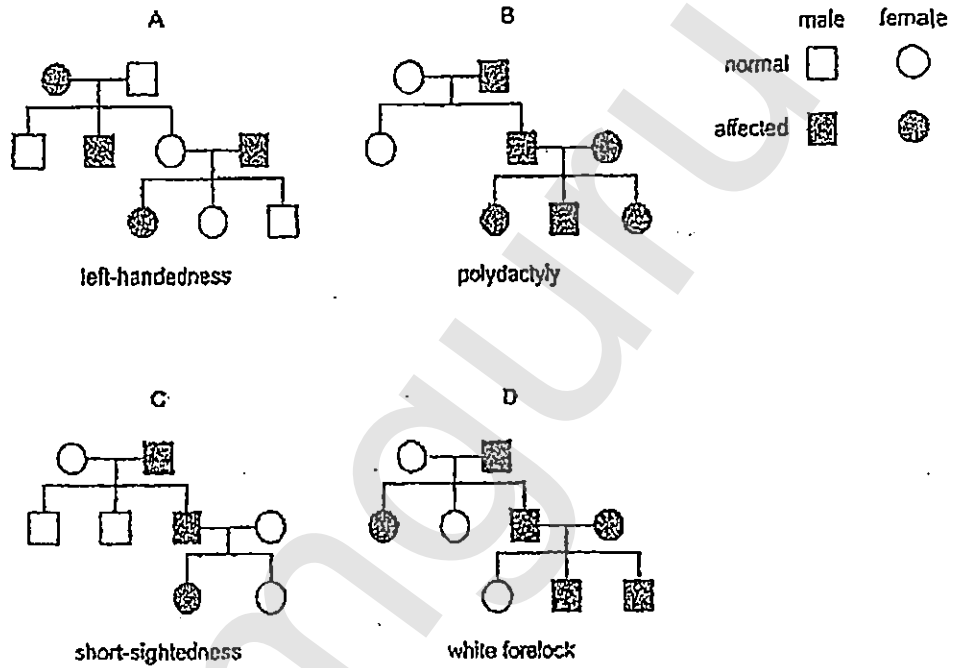
39 A cell containing two sets of chromosomes divides by meiosis.

Which diagram shows prophase II?



40 The inheritance patterns of four conditions are shown.

Which inheritance pattern proves that the condition is not caused by a recessive allele?



Index Number	Name	Class



**SINGAPORE CHINESE GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2014**

BIOLOGY

5158/02

Paper 2

Wednesday 30 July 2014

1 hour 45 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your index number, name and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction tape or fluid.

Section A

Answer all questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer all questions.

Write your answers in the spaces provided on the Question Paper.

Write an E (for Either) or an O (for Or) next to the number 10 in the grid below to indicate which question you have answered.

The use of an approved scientific calculator is expected, where appropriate.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

At the end of the examination fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	/ 50
Section B	
8	/ 9
9	/ 11
10	/ 10
Total	

This question paper consists of 20 printed pages, inclusive of this cover page.

Section A

Answer all questions.

Write your answers in the spaces provided.

1. Barley plants were grown in a culture solution that contained various ions. As the plants grew, they absorbed both ions and water from the solution. Fig. 1.1 shows the concentrations of some of these ions in the cell sap and culture solution.

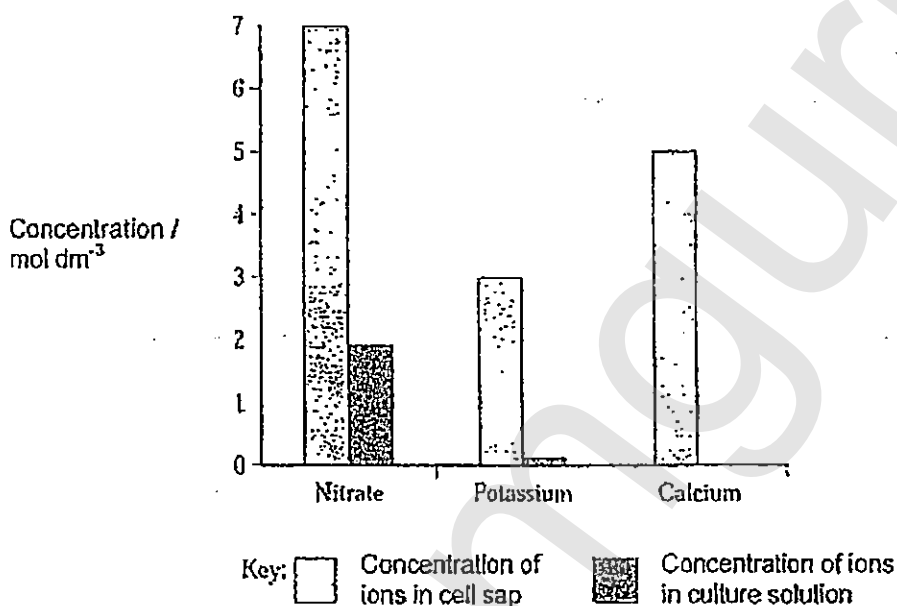


Fig. 1.1

- a) (i) With reference to Fig. 1.1, explain how the potassium ions were taken in by the plant cells. [2]

- (ii) Calcium ions are taken in via diffusion. Draw on Fig. 1.1, the expected initial concentration of calcium ions in the culture solution, which enables diffusion to take place. [1]

- b) Fig. 1.2 shows how blood and water flow through the gills of a fish. The numbers represent the concentration of oxygen, expressed in arbitrary units.

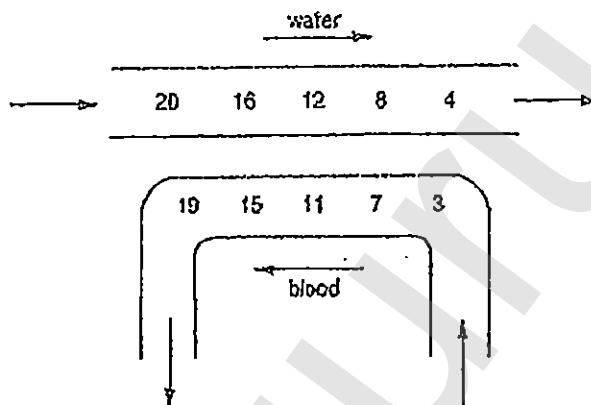


Fig. 1.2

- (I) With reference to Fig. 1.2, describe how the blood flows, relative to water. [1]

- (II) Explain how your answer to b (I) facilitates efficient gaseous exchange. [1]

[Total: 5]

2. The liver and the pancreas produce secretions involved in the processing of fats in the body.

a) Some scientists have developed a fat substitute that they called lipoleum, in response to consumer demands for low-fat and low-calorie foods.

Lipoleum has a similar structure to a natural fat, but it cannot be digested by enzymes in the body.

(i) Describe one physical change that would occur to both lipoleum and natural fats while they are in the duodenum and explain how this change is brought about.

[2]

(ii) State one chemical change that would occur to natural fats in the duodenum, but not lipoleum.

[1]

b) Chronic pancreatitis is a condition where the pancreas becomes permanently damaged due to inflammation. Signs and symptoms include repeated episodes of severe abdominal pain and production of greasy, foul-smelling faeces. Diabetes is a common complication.

Suggest why patients with the condition

(i) usually discharge oily faeces.

[2]

(ii) could also suffer from diabetes.

[2]

[Total: 7]

3. The two graphs in Fig. 3.1 show the oxygen uptake and the lactic acid concentration in the blood of a man before, during and after a short period of physical exercise.

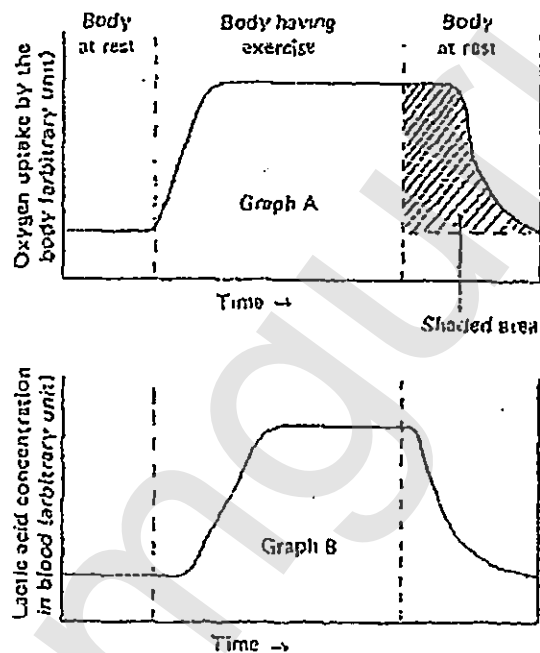


Fig. 3.1

- a) (i) Explain the increase in lactic acid concentration in the blood at the beginning of exercise. [2]

- (ii) Explain why the oxygen uptake remains high even when the body is at rest after exercise as shown by the shaded region for a period of time. [1]

- b) A patient suffers from asthma and is allergic to cigarette smoke. When the patient breathes in the cigarette smoke, it causes the muscles of his bronchi to contract, triggering an asthma attack. This is shown in Fig 3.2.

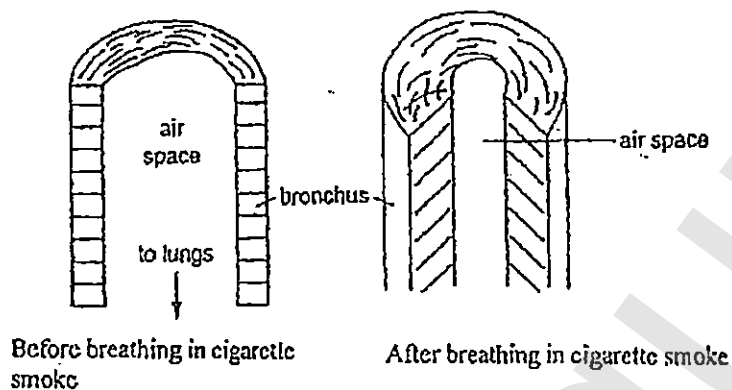


Fig. 3.2

- (i) Explain how the asthma attack would affect the patient's breathing. [2]

- (ii) The patient developed emphysema due to prolonged exposure to cigarette smoke. State one way in which the structure of the alveoli differs in the patient compared to a normal person. [2]

[Total: 7]

4. Fig. 4.1 shows two processes taking place in a cell.

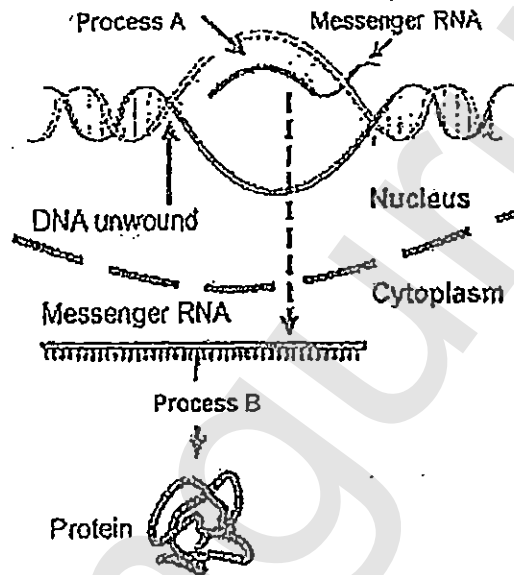


Fig. 4.1

- a) Name the two processes in Fig. 4.1. [1]

Process A _____

Process B _____

- b) Part of the unwound DNA has this nucleotide sequence:

~ AATCATGGTAGCATGCGCCATTA ~

Write the resulting sequence of the messenger RNA produced by process A. [1]

- c) Suggest why process A does not take place in the cytoplasm. [1]

- d) In the 1950s, Erwin Chargaff determined the relative quantities of the four bases in DNA in different organisms. His results provided important evidence for the model of DNA proposed by James Watson and Francis Crick in 1953. Some of Chargaff's data is shown in Table 4.1.

Organism	% Adenine	% Thymine	% Guanine	% Cytosine
Yeast	31.3	32.9	18.7	17.1
Wheat	27.3	27.2	22.7	22.8
Octopus	33.2	31.6	17.6	17.6

Table 4.1

- (i) With reference to Table 4.1, explain how the data suggest that nitrogenous bases form complementary pairs. [1]

- (ii) Suggest another conclusion that can be drawn from the Table 4.1. [1]

Table 4.2 shows Chargaff's data for a virus.

Organism	% Adenine	% Thymine	% Guanine	% Cytosine
Virus	24.0	31.2	23.3	21.5

Table 4.2

- (iii) Suggest the structure of the viral DNA based on the information given in Table 4.2. [1]

[Total: 6]

5. a) Distinguish between the terms

(i) genes and alleles

[2]

(ii) phenotype and genotype

[2]

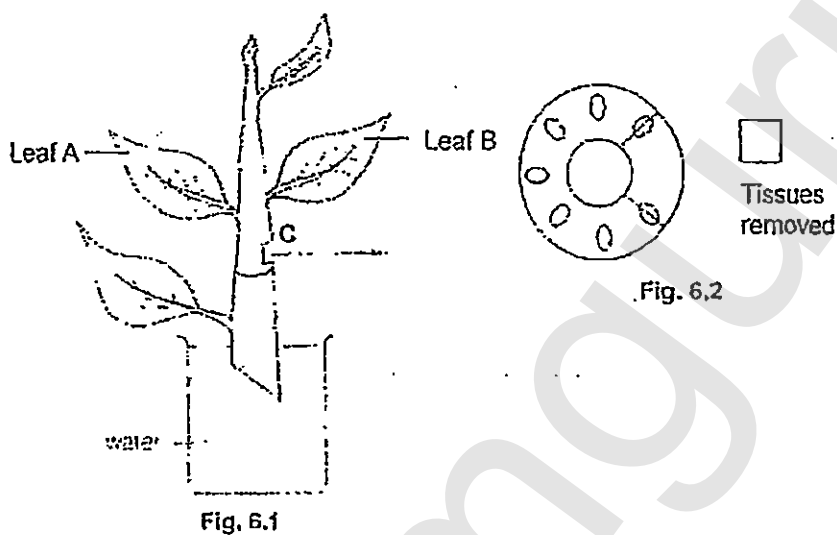
b) The presence of thorns on the stems of a species of rose plant is controlled by a single pair of alleles. A heterozygote of this species with thorny stem is crossed with homozygote with smooth stem. Draw a genetic diagram to show the phenotypic ratio of the F_1 generation. Using the letter 'T' to represent the dominant allele of thorny stem.

[4]

[Total: 8]

6. An experiment was conducted to investigate the movement of substances within a plant. Fig. 6.1 shows a shoot at the start of an experiment..

The stem was cut at C to remove some of the tissues as in the cross section shown in Fig. 6.2,



- a) (i) Suggest how the appearance of leaf A might differ from that of leaf B after a few hours. Explain your answer.

[2]

Appearance

explanation

- (ii) Describe what would be observed at the cut region just above C after a few days. Explain your answer. [2]

Appearance

explanation

- b) Fig. 6.3 shows a section through the ovary of a flower of the herbaceous plant.

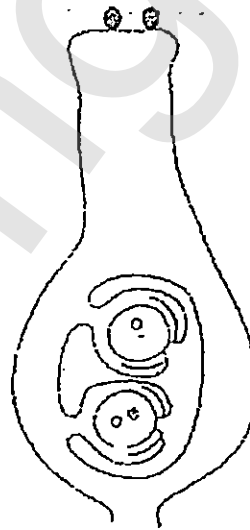


Fig. 6.3

- (i) Draw the pathway taken by the male gametes to one of the ovules, and indicate the position they would occupy just before they enter the ovule. [2]
- (ii) Label clearly, on Fig. 6.3, the following structures:
ovary wall, ovule, pollen tube, micropyle, male gametes. [2]
- (iii) State what happens to the ovum if it is not fertilised. [1]

[Total: 9]

7. Fig. 7.1 shows a food chain in an ocean. The energy content of each trophic level is shown in the boxes.

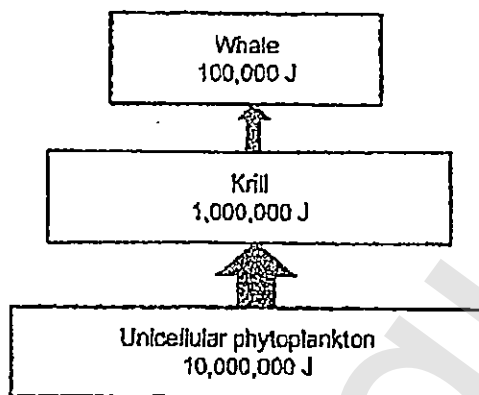


Fig. 7.1

- a) (i) Calculate the percentage decrease in energy content from unicellular phytoplankton to krill. Show your working in the space below. [1]

- (ii) Will the pyramid of energy shown in Fig. 7.1 achieve ecological stability? Explain your answer. [2]

- b) In shifting agriculture, plots of forests are cleared to grow crops. The trees are then burnt and the ash is dispersed throughout the field as fertilisers. When the soil loses its fertility after some years of crop-growing, the land will be abandoned and allowed to recover while the farmer moves on another plot of land.

- (i) "Forests are important carbon sinks." Explain this statement. [2]

- (ii) To prevent the land from becoming infertile, fertiliser was added to the soil. This resulted in fishes dying in the nearby rivers. Explain how this happened. [3]

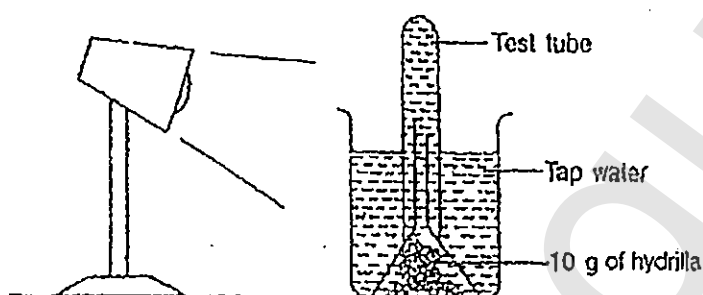
[Total: 8]

Section B
Answer three questions.

Question 10 is in the form of an Either/ Or question.
Only one part should be answered.

8. A student used the set-up below to investigate the effect of light intensity on the rate of photosynthesis. She counted the number of bubbles given off in one minute by the aquatic weed (*Hydrilla*) at different distances from the lamp.

The table shows the results of the investigation.



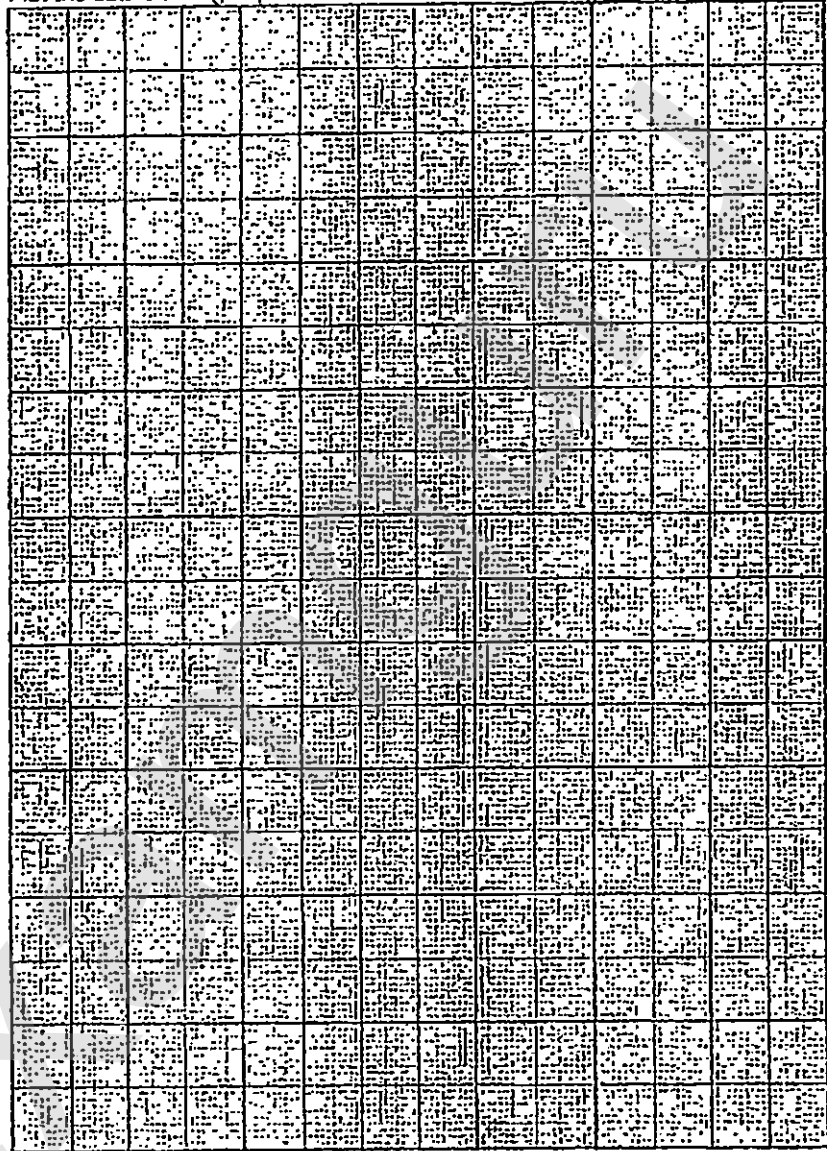
Distance between lamp and plant (cm)	0	10	20	30	40	50	60
Production of gas (number of bubbles collected per minute)	30	29	27	22	18	13	7

- a) State the word equation for photosynthesis.

[1]

b) Plot the data on the grid provided.

[3]



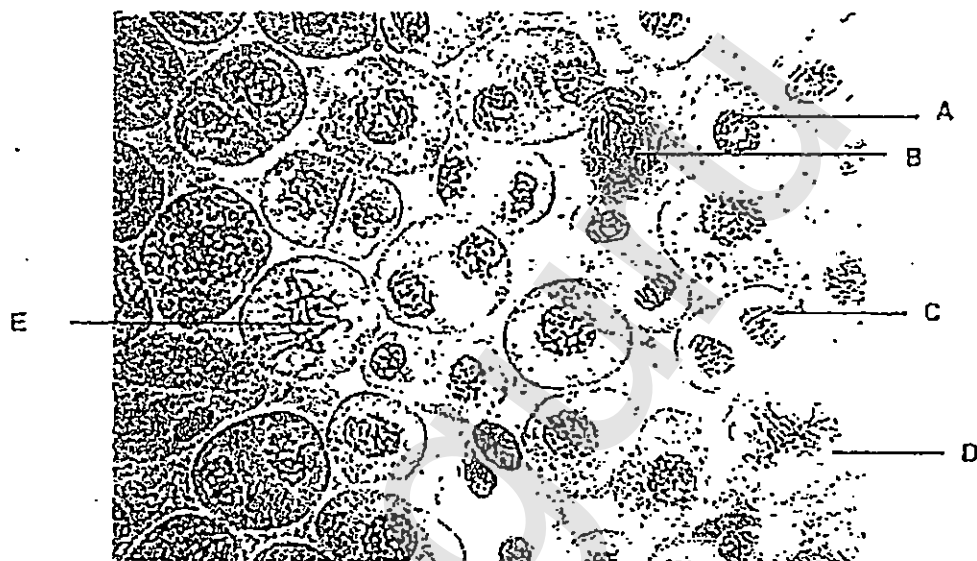
- c) Describe and explain the trend in the graph obtained. [3]

- d) Sketch an additional graph on the same grid to show the expected results if tap water containing hydrogencarbonate was used instead. [1]

- e) State one possible source of error in this experiment. [1]

[Total: 9]

9. The photomicrograph below shows onion root cells in different stages of the cell cycle.



- a) Complete the table below. Identify the stages in the cell cycle of cells A to E. Describe one characteristic feature shown that enabled you to identify each stage. (5)

Cell	Name of stage	Description of features
A		
B		
C		
D		Chromosomes align at the middle of cell/equator
E		

b) (i) Define the terms *haploid* and *diploid*.

[2]

(ii) State and describe one difference between prophase in mitosis and prophase I in meiosis.

[2]

(iii) Explain why gametes have to be haploid.

[2]

[Total: 11]

10 EITHER

Human blood consisting of blood cells, platelets and plasma is kept in circulation mainly by the pumping action of the heart.

- a) (i) Describe how blood flows through the circulatory system, starting from the blood vessels in the lungs until it reaches the kidneys. [4]

- (ii) Describe the part played by white blood cells in defending the body against diseases. [2]

- b) When transfusions are given, choice of blood type is crucial. For instance, if a patient of blood type A requires a blood transfusion, blood type AB is not suitable for the transfusion but blood type O is. Explain why. [4]

[Total: 10]

10 OR

- a) A student consumed a high-protein shake diluted with 600 cm³ of water over half an hour on a cool day.

Describe how the balance of water in her body is achieved, after consuming the shake. [6]

- b) Describe how amino acids in the protein shake are assimilated in the body. [4]

[Total: 10]

END OF PAPER



MS

1	C		21	D	
2	D		22	C	
3	B		23	C	
4	C		24	D	
5	A		25	A	
6	C		26	D	
7	A		27	C	
8	B		28	C	
9	A		29	A	
10	A		30	D	
11	A		31	D	
12	B		32	C	
13	B		33	D	
14	D		34	C	
15	A		35	B	
16	C		36	C	
17	D		37	B	
18	C		38	A	
19	A		39	C	
20	B		40	D	

☺ END ☺

365

1ai) K^+ enter cell sap via active transport against concentration gradient (AW from region of lower concentration to region of higher concentration);
This is because the concentration of potassium ions in the cell sap, 3 mol/dm^3 , is greater than the concentration of potassium ions in the culture solution by 10X (AW);
a) 6.5 mol/dm^3

bi) The direction of flow of oxygen in the water is opposite to that of its flow in the fish's blood;

bii) The concentration of the oxygen in the water is always higher in the water which ensures that a diffusion gradient is constantly maintained/ensured (OWTTE) between the water and the fish's blood;

2ai) Broken up into small droplets/emulsified by bile;

Lower the surface tension and reduce their attractive forces between the fat molecules;

a) Natural fats would be converted to glycerol and fatty acids by lipases.

bi) Fats in food not fully digested/partially digested;

as not enough lipases secreted by pancreas thus stools ended up more oily.

bii) Pancreas secrete lower levels of insulin;

and thus insulin is unable to stimulate liver cells to convert excess glucose to glycogen resulting in diabetes.

3ai) Oxygen cannot be delivered to the muscles fast enough and muscle cells respire anaerobically producing lactic acid;

which accumulates and diffuses into blood stream ;

a) Oxygen is required to oxidise/break down lactic acid is shown by the shaded region;

bi) Lumen of bronchus is narrowed / smaller air space;

Air flow to the lungs is reduced (OWTTE) and the patient has to breathe harder/difficulty breathing/gasping for air/wheeze

bii) Partition walls between the alveoli break down due to persistent , violent coughing;

Thus decrease surface area for gaseous exchange;

4a

A – Transcription

B – Translation

b) UUAGUUCCAUCGUACGCGUAAU

c) DNA does not exit / remains in the nucleus / too large to exit the nucleus during process A.

di) Percentage of A approximates percentage of T or

Percentage of C approximates percentage of G

dii) Any 1:

The A : T and C:G ratio (or complementary base pairing rule) is conserved (OWTTE) among species

The C+T and A+G percentages are always 50%;

Percentage of A & T greater than C & G;

Genetic code is universal;

diii) The virus is a single-stranded DNA virus as

A does not bind to T OR

C does not bind to G OR

Ratio of A and T/C and G is not the same.
Not a double Helix

5ai) Gene are hereditary factors /unit of inheritance found on a particular locus in a chromosome that controls a particular characteristics;

Alleles are alternate/different forms of a gene that occupy the same relative positions/locus on a pair of homologous chromosomes;

aii) Phenotype refers to the expressed trait in an organism/outward appearance of an organism;

Genotype is the genetic makeup of an organism/combination of alleles in an organism;

b)

Parental Phenotype
Parental Genotype

Thorny
Tt

x

Smooth
tt

Gametes



Random Fertilisation

F₁ genotype

F₁ phenotype

Thorny Thorny Smooth Smooth

Phenotypic ratio

Thorny: Smooth = 1:1

6ai) Leaf A remains firm while leaf B has wilted;

Leaf B loses water faster than can be replenished (AW: rate of transpiration faster than rate of water uptake);

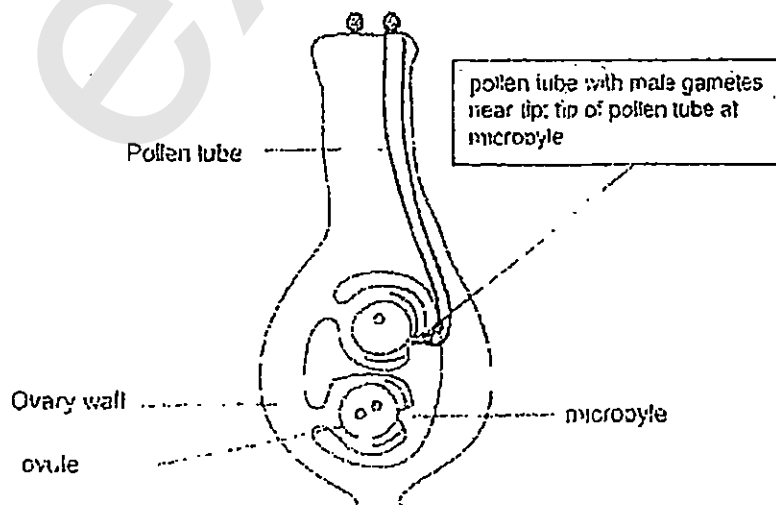
Flow of water along xylem from stem to leaf (B) is disrupted since tissue was removed;

Any one of 2

aii) Swelling above the girdled region;

sugars (/ photosynthates) made during photosynthesis unable to move down as the phloem tissue has been removed;

bi and ii)



biii) It will degenerate.

7ai) $(10\,000\,000 - 1000\,000) / 10\,000\,000 \times 100 = 90\%$

aii) Yes. In an ecosystem, energy flow is non-cyclic/linear; About 10% of energy is passed down to the next trophic level, thus, resources are sufficient for each trophic level/sustain the next level and biological balance is achieved.

bi) Atmospheric carbon dioxide is absorbed by the plants and use in photosynthesis; Large amount of carbon compounds are stored in trees, and when trees die, their remains form coal which are fossil fuels; OR store carbon for an indefinite amount of time;

Store more carbon than they release;

bii) Eutrophication leads to excessive algae bloom (OWTTE) at the nearby rivers; Overcrowding of algae prevent sunlight from reaching the submerged aquatic plants (OWTTE) and these submerged plants die;

Bacteria feed on decaying organic matter, which compete with fishes for oxygen (OWTTE), resulting in fishes dying due to lack of oxygen ;oxygen;

8a) Carbon dioxide + water $\rightarrow$ oxygen + glucose, in the presence of chlorophyll and light

b) Refer to graph behind

c) Increasing vol of oxygen produced with decreasing distance;

Increasing the distance decreases the light intensity. With lower light intensity, the rate of photosynthesis is lower and less oxygen is produced;

Light intensity is inversely proportional to distance (i.e relationship is not linear)

Volume of oxygen collected levels off when light intensity is no longer a limiting factor; when distance is 4cm or less;

(Any 3)

d) Steeper curve with higher max rate of oxygen produced.

e) As the lamp is placed nearer, the temperature is higher – can affect enzyme reactions.

The size of bubble varies;

Unable to determine if the bubble is made up of pure O₂.

Some of the gas / bubbles dissolved in the water;

Some bubbles may be hidden and thus not counted;

9a)

A: Interphase; No distinct chromosomes

B: Anaphase; Chromosomes attached to spindle / sister chromatids pulled towards opposite poles

C: Telophase; 2 distinct nuclei in one cell membrane

D: Metaphase

E: Prophase; DNA (coil and shorten) / condenses into chromosomes or, nuclear membrane not visible / disintegrated

bi) 1m – diploid (the state of having two copies of each chromosome)

1m – haploid (the state of having one copy of each chromosome, or having a single set of chromosomes, e.g. gametes (egg and sperm cells) are haploid.)

ii) Pairing of homologous chromosomes occurs in prophase I in meiosis but not prophase in mitosis;

or

Crossing over between homologous chromosomes occurs in prophase I in meiosis but not prophase in mitosis;

Exchange of genetic material between non-sister chromatids of homologous chromosomes (to give new combinations of genes / genetic variation);

iii) 2 haploid gametes will fuse during fertilisation, to form a diploid zygote;

Number of chromosomes in the species is conserved;

10 Either

ai) Capillaries in lungs → pulmonary veins → left atrium;

left atrium contracts → blood emptied into left ventricle;

left ventricle contracts → blood pumped out into aorta; →

renal artery; Back flow prevented by action of valves; [max. 4]

ii) The phagocyte enters the site of injury, ingest and engulf foreign body/bacteria;

The lymphocytes produce antibodies that bind to bacteria, clumping the bacteria, or destroying the bacteria

b) Plasma of patient of blood type A contains anti-B antibodies;

Anti-B antibodies will bind to antigen B in type AB blood;

Agglutination/Clumping of red blood cells occurs;

Blood group O has no antigens and so will not clump with patient's anti-B antibodies;

Note: student should express the meaning of agglutination correctly.

Correct notation for antigens and antibodies should be given.

10 Or

a) Water potential of blood plasma increases;

Detected by the hypothalamus;

Stimulates the pituitary gland to secrete less ADH;

Less water is reabsorbed from the kidney tubules into the bloodstream;

Resulting in a high volume of dilute urine;

Water potential of blood plasma returns to the norm;

This is a form of negative feedback as there is a corrective mechanism to restore the norm;

b) Amino acids are utilized for growth and building of protoplasm/synthesis of enzymes/hormones / antibodies (any 2 or any other specific examples);

Excess amino acids are deaminated to form urea;

In the liver;

Reject growth and repair



TEMASEK SECONDARY SCHOOL
O Level Preliminary Examination 2014
Secondary 4 Express

BIOLOGY

5158/01

Paper 1

1 hour

Question Booklet

Additional Material: Optical Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the Optical Answer Sheet.

You are not required to hand in this booklet.

There are forty questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D.
Choose the one you consider correct and record your choice in soft pencil on the separate Optical Answer Sheet.

Read the instructions on the Optical Answer Sheet very carefully.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

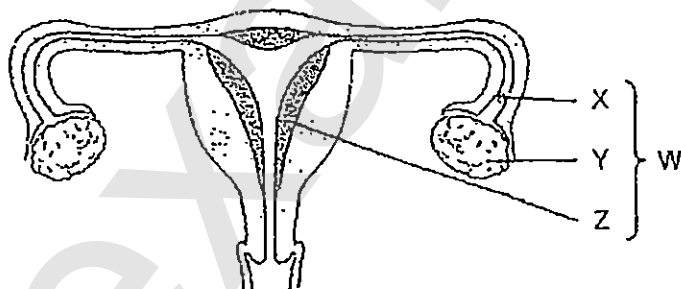
Attempt ALL questions in this section.

Choose the most appropriate answer and shade the corresponding letter on the separate answer sheet provided.

- 1 An actively growing cell is supplied with radioactive amino acids.
Which cell component would first show an increase in radioactivity?
 - A golgi body
 - B rough endoplasmic reticulum
 - C nucleus
 - D mitochondrion

- 2 A student suggests that plant cells do not require mitochondria since they have chloroplasts. Which of the following statements would you use to convince him otherwise?
 - A Having both chloroplasts and mitochondria would maximise the rate of photosynthesis.
 - B Having both chloroplasts and mitochondria would maximise the rate of energy production.
 - C Mitochondria would be necessary at night when chloroplasts are no longer able to photosynthesise.
 - D The chemical energy stored in glucose cannot be efficiently utilised in the cell without the mitochondria.

- 3 The diagram shows the female reproductive system.

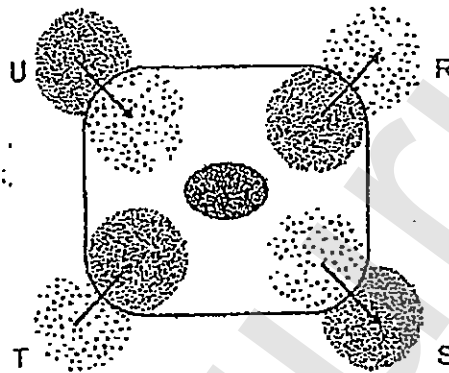


Which level of organisation are the structures W, X, Y and Z?

	Cell	Tissue	Organ	Organ system
A	W	X	Z	Y
B	X	Y	Z	W
C	X	Z	Y	W
D	Y	X	W	Z

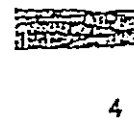
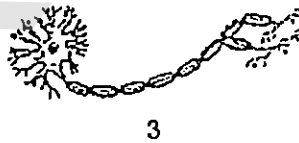
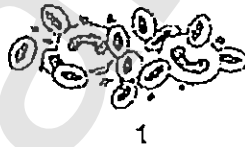
3

- 4 The diagram shows four ways in which molecules may move into a cell and out of a cell. The dots show the concentration of molecules.



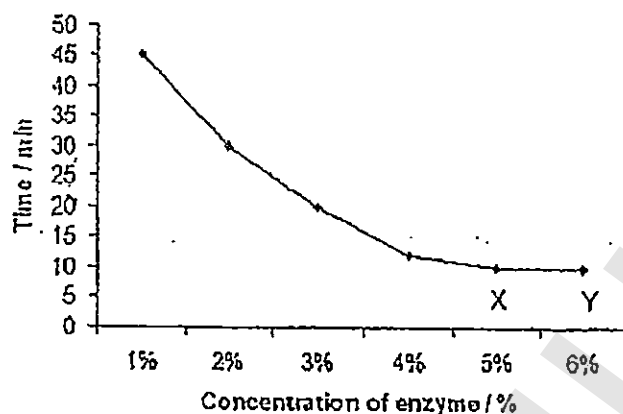
The cell is respiring aerobically.
Which process has correctly taken place in the cell?

- A R - The movement of carbon dioxide molecules
 - B S - The movement of carbon dioxide molecules
 - C T - The passive uptake of glucose molecules
 - D U - The active uptake of glucose molecules
- 5 Which statement describes the relationship between the human cells illustrated in the diagrams below?



- A 1 is produced by 4.
- B 2 transports oxygen to 1.
- C 3 is used to repair 2.
- D 3 causes 4 to contract.

- 6 The graph below shows the relationship between concentration of enzyme and time taken for reaction to complete.



Which of the following statements is true between point X and point Y?

- A Enzyme concentration is the limiting factor.
 - B pH of the environment is the limiting factor.
 - C Substrate concentration is the limiting factor.
 - D Temperature of the environment is the limiting factor.
- 7 A student was asked to identify the two food substances in each of these test-tubes. The table shows the results of the student's test.

Test tube	Reagent added to test-tube		
	Biuret solution	Benedict's solution	Iodine solution
X	Purple	Brick red precipitate	Brown
Y	Blue	Blue	Brown
Z	Purple	Blue	Blue-black

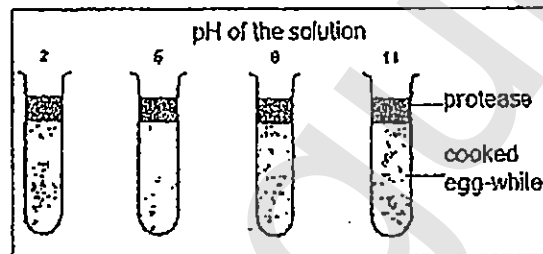
Which of the following is the correct description for the test-tube contents?

- A Egg white and glucose had been placed in tube X.
- B Starch and sucrose had been placed in tube Y.
- C Maltose and sucrose had been placed in tube X.
- D Maltose and starch had been placed in tube Z.

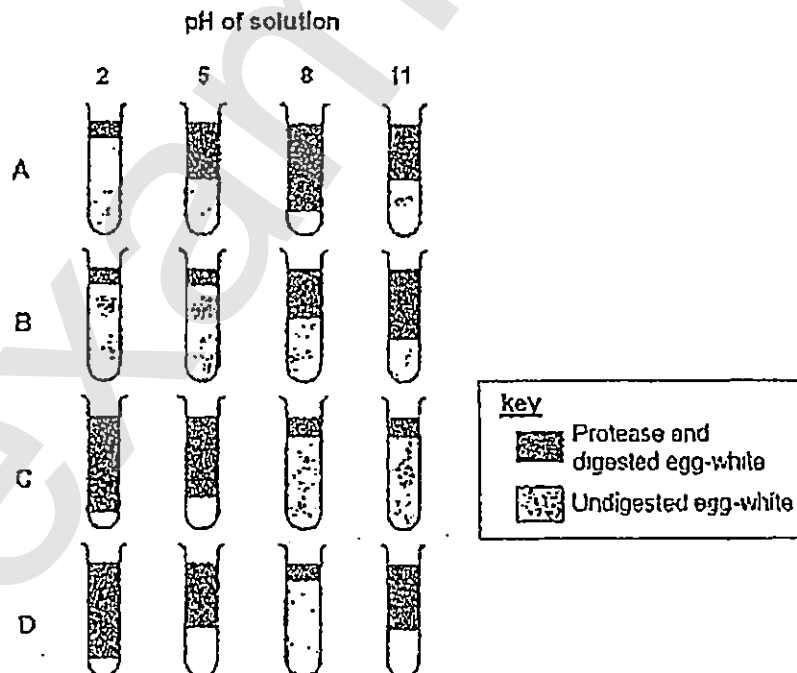
8 Which of the following fluids do not contain enzymes?

- A Blood plasma
- B Secretions from the liver
- C Secretions from the salivary gland
- D Secretions from germinating pollen grains

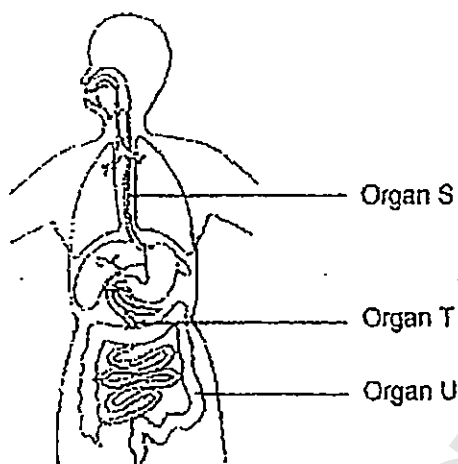
9 Four tubes containing cooked egg white were set up as shown. Protease solutions of different pH are added to each tube.



Which diagram shows the result of the experiment if the protease was pepsin?



- 10 The diagram below shows parts of the human digestive system.



What does each of the labelled organs (S, T and U) above have in common?

- A All the organs secrete digestive juices.
 - B Protein digestion occurs in all three labelled organs.
 - C Villi are present along the inner walls of all the organs.
 - D All the organs move its content using peristaltic movement.
- 11 Which of the following statements describe the uses of lipids?
- I It acts as a shock-absorber which protects blood vessels.
 - II It forms a heat insulating layer for mammals.
 - III It acts as a food reserve because it is miscible with water.
 - IV It is an essential component of a cell membrane.
- A I and II only
 - B II and III only
 - C II and IV only
 - D III and IV only
- 12 Which of the following is correct in the reaction catalyzed by carbonic anhydrase?

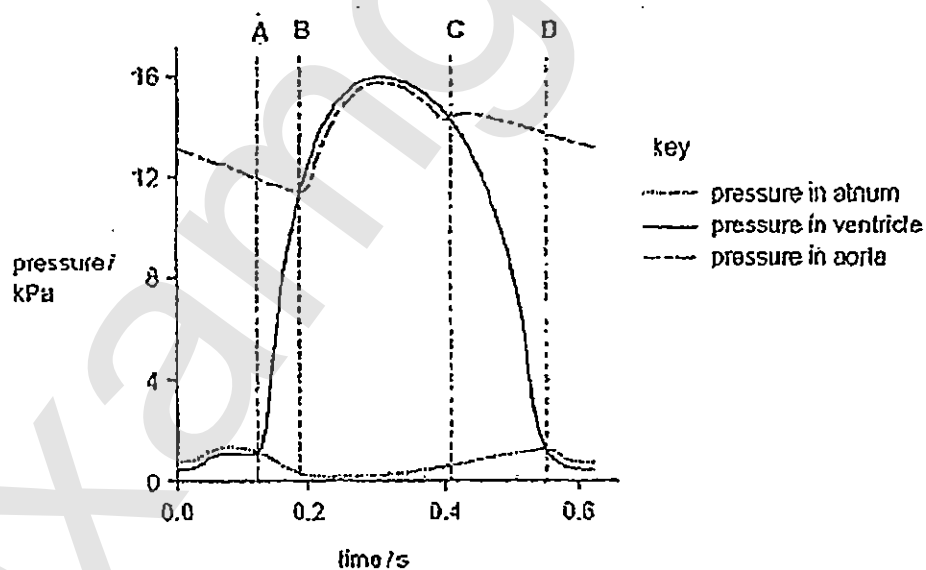
	Location	Reactant	Product
A	Plasma	H_2CO_3	$\text{H}_2\text{O} + \text{CO}_2$
B	Plasma	$\text{H}_2\text{O} + \text{CO}_2$	H_2CO_3
C	Red blood cell	H_2CO_3	$\text{H}_2\text{O} + \text{CO}_2$
D	Red blood cell	$\text{H}_2\text{O} + \text{CO}_2$	H_2CO_3

- 13 Due to an accident, Peter's gall bladder had to be removed. Which of the following is/are expected consequence(s) of this?

- I impaired fat digestion
- II lighter-coloured faeces
- III reduced absorption of amino acids
- IV reduced production of bile

- A I only
- B I and II only
- C I, II and IV only
- D I, II, III and IV

- 14 The graph shows pressure changes in the left side of the heart, during a single heartbeat.
At which point do the bicuspid valves close?



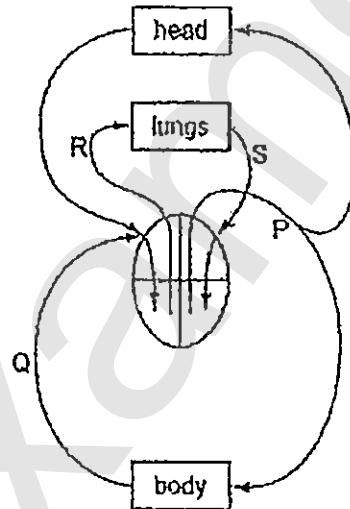
- 15 The diagram shows a section through part of a blood vessel.



- What could be the first organs found in the directions 1 and 2?

	1	2
A	Lung	Heart
B	Heart	Brain
C	Kidney	Heart
D	Intestine	Liver

- 16 The diagram represents the heart and some major blood vessels.



Which are possible blood pressures (in kPa) for the vessels shown in the diagram?

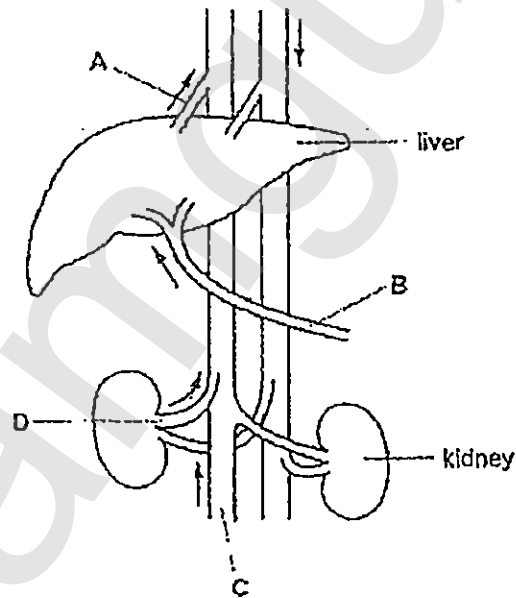
	P	Q	R	S
A	1	4	2	16
B	4	16	2	1
C	16	2	4	1
D	16	4	1	2

- 17 A person with blood group A needs a blood transfusion. Which option correctly shows the outcome of receiving blood from donors with other blood types?

	AB	B	O
A	+	—	+
B	+	+	—
C	—	—	+
D	—	+	—

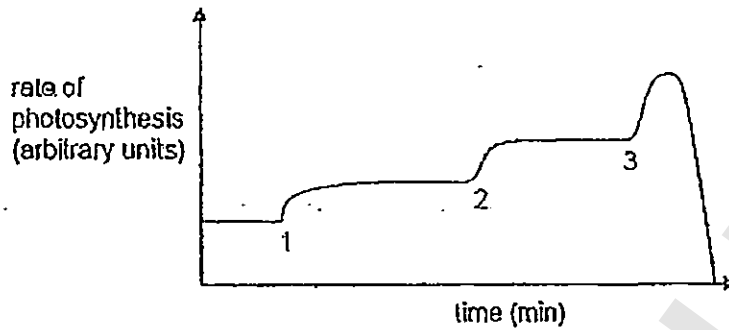
+ : compatible — : agglutination

- 18 The diagram shows the blood supply to various organs.



Which blood vessel carries blood with the highest concentration of urea?

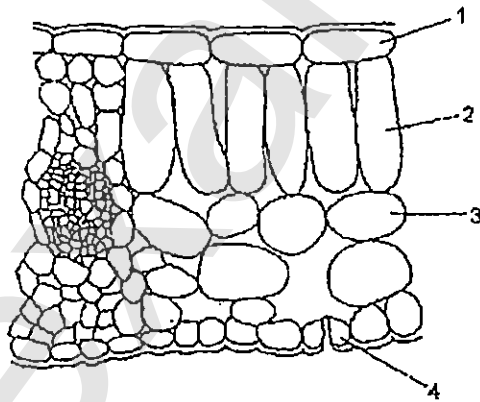
- 19 Temperature, light intensity and carbon dioxide concentration are three limiting factors in photosynthesis. In an experiment, each factor is increased in turn. The results are shown in the graph below.



Which numbered points represent the factors that were increased over a period of time?

	Light intensity	Carbon dioxide	Temperature
A	3	2	1
B	1	2	3
C	1	3	2
D	2	3	1

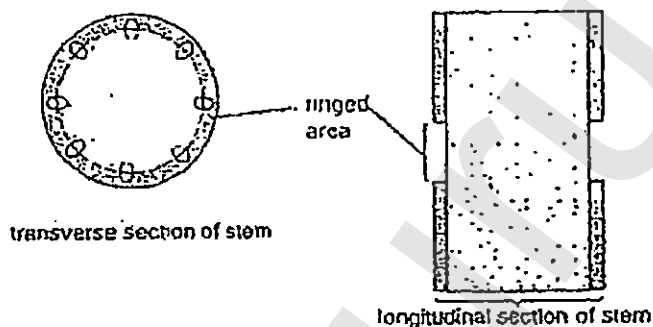
- 20 The diagram shows part of a transverse section of a leaf.



Where does photosynthesis take place?

- A 1 and 2 only
- B 1, 2 and 3 only
- C 2 and 3 only
- D 2, 3 and 4 only

- 21 In an experiment to demonstrate the movement of solutes in a plant, a complete ring of bark was removed from the stem, as shown in the figure below.



After 3 days, which of the following shows the correct concentration of sucrose found in the stem regions immediately above and below the ring?

	Concentration of sucrose in stem above ring / arbitrary units	Concentration of sucrose in stem below ring / arbitrary units
A	0.45	0.00
B	0.00	0.45
C	0.45	0.45
D	0.00	0.00

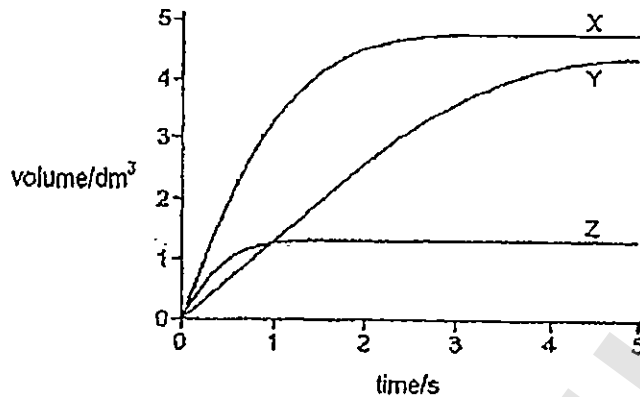
- 22 What would be the result of breathing in the same air that was expired?

	Blood pH	Breathing rate
A	Fall	Decrease
B	Fall	Increase
C	Rise	Increase
D	Rise	Decrease

- 23 Nicotine and carbon monoxide are present in tobacco smoke. What are their effects on health?

	Nicotine	Carbon monoxide
A	Causes addiction	Causes atherosclerosis
B	Causes addiction	Causes emphysema
C	Increases blood pressure	Causes addiction
D	Paralyses cilia	Causes lung cancer

- 24 The graph shows the volume of air breathed out quickly and with force, following a deep breath, for three different persons X, Y and Z.

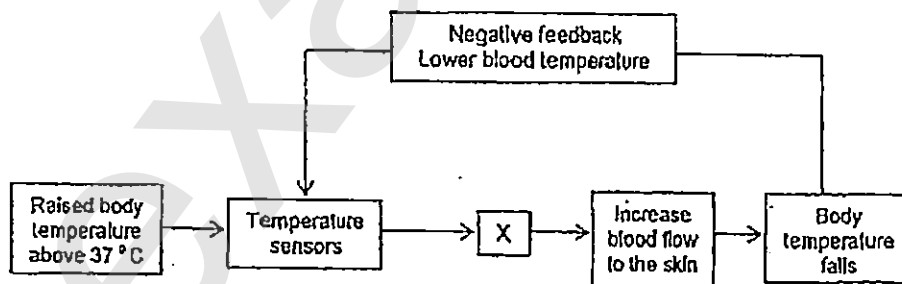


Of the three persons, one is suffering from chronic bronchitis, one is suffering from emphysema and the third person has normal lung function.

Which option correctly matches X, Y and Z to their condition?

	Chronic bronchitis	Emphysema	Normal lung function
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	Y	X

- 25 The diagram below shows the negative feedback loop to regulate our body temperature.



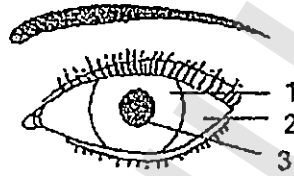
Which of the following structures constrict at point X?

- A Shunt vessels
- B Skin capillaries
- C Arterioles
- D Artery

- 26 A drug has been found to inhibit the effects of antidiuretic hormone (ADH). What would be the most expected consequence of administering this drug to a healthy person?

A A smaller volume of urine would be produced.
 B More proteins would be deaminated into urea.
 C The urine produced will be more concentrated.
 D The person will be dehydrated due to excess water loss.

- 27 The diagram below shows the external view of the human eye.



Which of the following statements regarding the diagram of the human eye is/are correct?

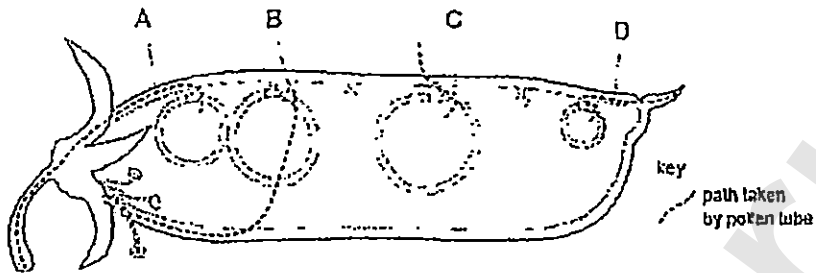
I Structure 1 is a group of muscles.
 II Structure 2 is a tough white coating around the eyeball.
 III Structure 3 is pigmented.

- A I only
 B I and II only
 C II and III only
 D I, II and III
- 28 The tri-germinal nerve in humans connects the brain with the teeth and with the skin of the face. When the dentist injects a local anaesthetic that targets this nerve, a person cannot feel pain or smile properly.

Which of the following conclusions can be best made?

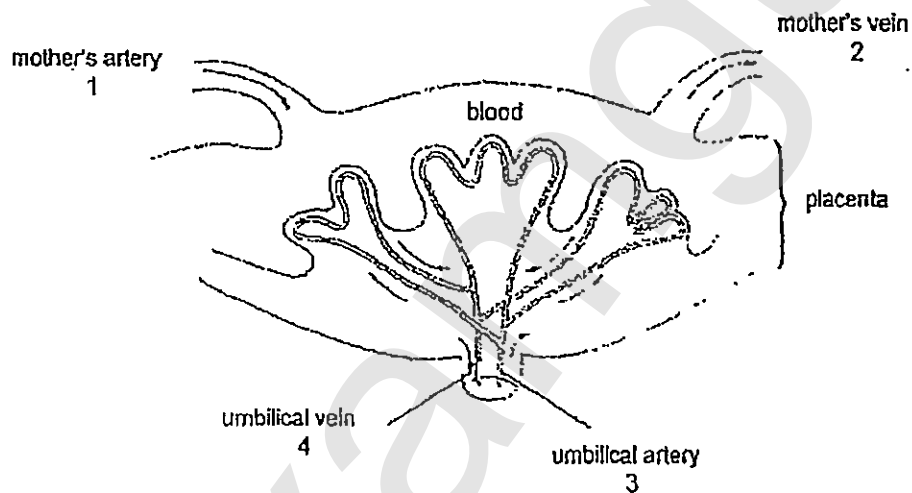
A The tri-germinal nerve contains only sensory neurones.
 B The tri-germinal nerve contains only motor neurones.
 C The tri-germinal nerve contains both sensory and motor neurones.
 D The tri-germinal nerve contains sensory, relay and motor neurones.

- 29 The diagram shows a pod from a pea plant.



Which line correctly shows the path that was taken by a pollen tube to an ovule?

- 30 The diagram shows part of the placenta.



In which numbered parts does the blood contain the most oxygen?

- A 1 and 3
- B 1 and 4
- C 2 and 4
- D 2 and 3

- 31 The nurses working at the maternity ward of a hospital suspected that they might have accidentally mixed up three babies at birth. Blood typing of the three couples and the three babies involved were carried out to match each baby to the right family.

The following results were obtained.

Baby 1: Type B

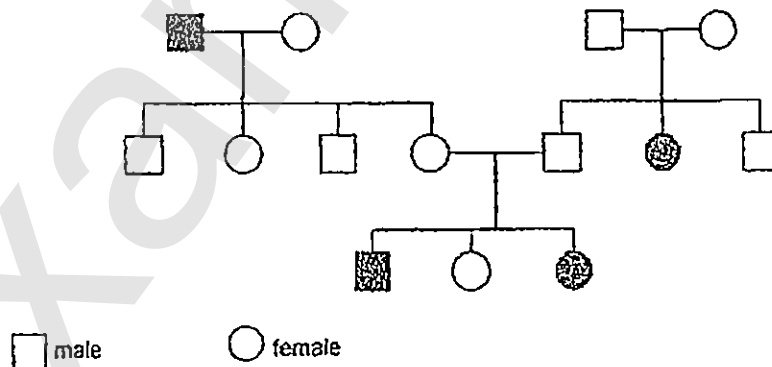
Baby 2: Type A

Baby 3: Type O

Family	Husband's blood type	Wife's blood type
Ang	O	AB
Tan	A	O
Chan	AB	B

What can be concluded from the above data?

- A Baby 1 belongs to the Ang family.
 B Baby 2 belongs to the Chan family.
 C Baby 3 belongs to the Tan family.
 D The families of all three babies cannot be determined from the above data.
- 32 The diagram below tracks the inheritance of fast twitch muscles (which are useful for sprinting) and slow twitch muscles (which are useful for long distance running) in three generations of horses.



White indicates a horse with fast twitch muscles.
 Black indicates a horse with slow twitch muscles.

What is the relationship between the two characteristics?

- A The allele for fast twitch muscles is dominant.
 B The allele for slow twitch muscles is dominant.
 C The characteristics exhibit co-dominance.
 D There is insufficient data to draw any conclusion.

- 33 Many people have an inherited condition that determines if they suffer from anaemia. H and h represents the alleles that determine this condition.

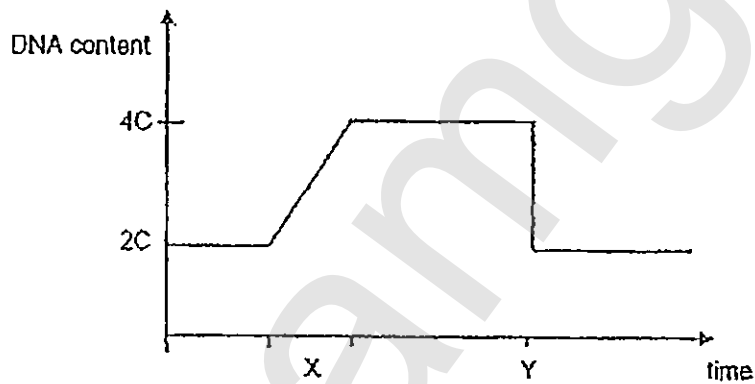
HH genotype: not anaemic

Hh genotype: mildly anaemic

hh genotype: severely anaemic, with high mortality rate

Two heterozygotes got married and planned to have children. What is the probability that a surviving offspring of the next generation is homozygous dominant?

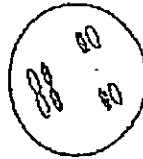
- A 0.00
B 0.25
C 0.33
D 0.50
- 34 The graph shows the changes in the amount of DNA present in the nuclei of the cells during cell division. A diploid cell has a $2C$ nuclear DNA content.



Which of the following conclusions can be deduced from the graph?

	Stage X	Stage Y
A	Uncoiling of DNA	Meiosis
B	Uncoiling of DNA	Mitosis
C	Replication of DNA	Meiosis
D	Replication of DNA	Mitosis

- 35 The nucleus below contains the chromosomes of a sea urchin zygote at the two-cell stage.



Which of the diagram below best represents the nucleus of an embryo at the 64-cell state grown from this cell?



A



B

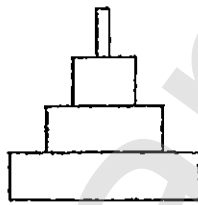


C

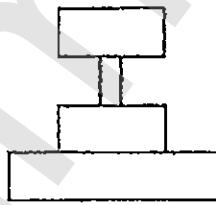


D

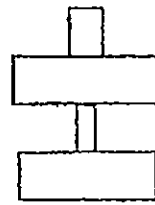
- 36 The diagram shows four ecological pyramids.



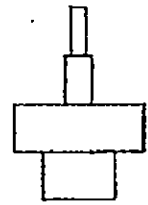
1



2



3



4

In a food chain, grass is eaten by cows. The cows have insects living on their skin. The insects are eaten by birds.

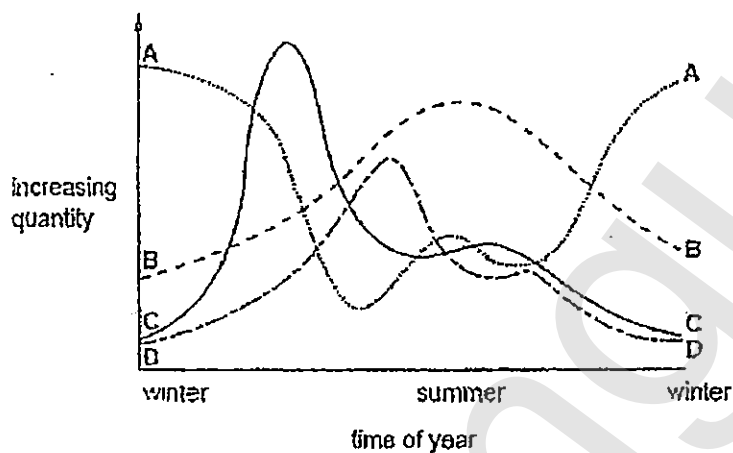
Which is the pyramid of mass and which is the pyramid of numbers in this food chain?

	Pyramid of mass	Pyramid of numbers
A	1	3
B	1	4
C	3	1
D	3	2

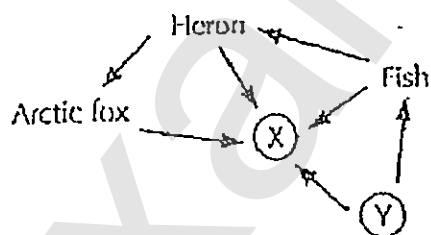
37 The graph shows the annual changes of the following factors in a lake.

- intensity of light per day
- numbers of producers
- numbers of primary consumers
- quantity of nutrients

Which curve represents the numbers of primary consumers?



38 The diagram below shows a food web on an Arctic island.

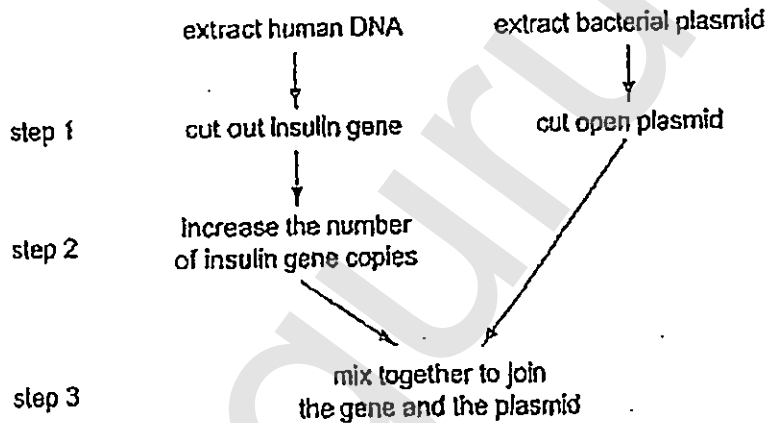


Which of the organisms can X and Y be?

	X	Y
A	Bacteria	Fungi
B	Bacteria	Algae
C	Fungi	Bacteria
D	Man	Bacteria

- 39 The diagram outlines part of the process to produce recombinant DNA that will synthesize human insulin.

At steps 1, 2 and 3, enzymes have to be used.



Which option correctly identifies the enzyme in each step?

	Step 1	Step 2	Step 3
A	Polymerase	Ligase	Restriction
B	Polymerase	Restriction	Ligase
C	Restriction	Ligase	Polymerase
D	Restriction	Polymerase	Ligase

- 40 DNA extracted from the nuclei of octopus cells is found to comprise 18% adenine in terms of base composition. What percentage of the bases is guanine?

- A 18
B 32
C 36
D 64

*****END OF PAPER*****

Name: _____ Index Number: _____ Class: _____



TEMASEK SECONDARY SCHOOL
O Level Preliminary Examination 2014
Secondary 4 Express

BIOLOGY

5158/02

**Paper 2
(SECTION A)**

**Total time for sections A & B:
1 hour 45 minutes**

Question and Answer Booklet

Additional Material: Nil

READ THESE INSTRUCTIONS FIRST

Do not open the booklet until you are told to do so.

You are required to submit this booklet at the end of the examination.

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Answer all questions in this section.

Write your answers in the spaces provided.

You are advised to spend no longer than one hour for Section A and no longer than 45 minutes for Section B. The number of marks is given in brackets [] at the end of each question or part question.

Submit Sections A and B separately.

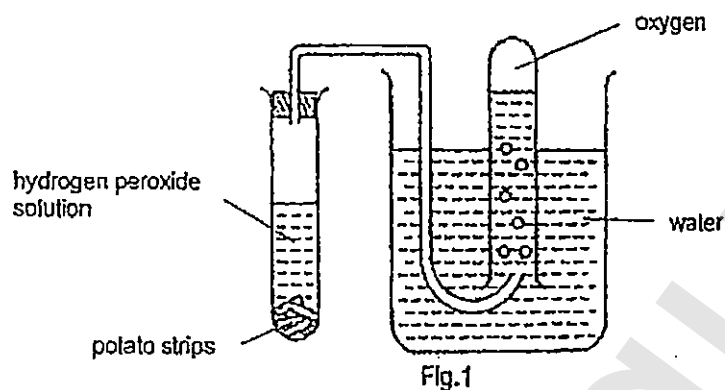
For Examiner's Use	
Section A	/50
Section B	/30
Total	/80

This document consists of 12 printed pages.

SECTION A (50 MARKS)

Answer ALL the questions in this section.

- 1 Fig.1 shows an experimental set-up using potato strips in a hydrogen peroxide solution at room temperature.



Potato cells contain an enzyme that breaks down hydrogen peroxide to release oxygen gas. The number of bubbles released per minute is counted, to measure the rate of enzyme activity in the potato cells.

- (a) The hydrogen peroxide solution was kept in the refrigerator for a day, before it was used in the experiment. Explain why there were no bubbles released initially when the potato strips were added to it. [2]

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- (b) Cells found in carrot strips too contain enzymes. However, when the carrot strips were used in place of the potato strips as shown in Fig.1, no bubbles of oxygen were released. Explain this observation. [2]

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- (c) Suggest and explain a change to the potato strips in this experiment so that the number of bubbles released per minute can be increased. [2]

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- 2 Fig.2.1 shows a *Stentor*, a freshwater unicellular animal that attaches itself to stationary objects when it feeds through its feeding funnel. It possesses two contractile vacuoles which fill up with water and empty their contents to the environment to expel excess water in the cell. Each filling and emptying of the contractile vacuole is called a pulsation.

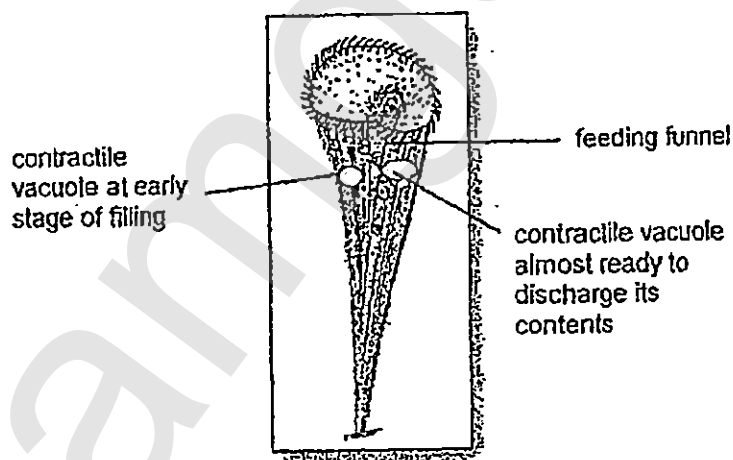


Fig.2.1

In an experiment, a specimen of a *Stentor* was placed in bathing solutions of different salt concentrations and the average time for each pulsation was recorded using a microscope.

Concentration of salt solution (mol/dm ³)	Average time for one pulsation (s)
0.1	95
0.3	156
0.5	201
0.7	378

Table 2.2

- (a) State and explain the process of how water enters the *Stentor*. [3]

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- (b) (i) Describe the trend obtained from the results in Table 2.2. [1]

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- (ii) Explain the trend that you have described in b(i) above. [3]

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- (c) Explain the significance of controlling the water level for *Stentor* living in a freshwater environment. [2]

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- 3 Fig.3.1 shows how blood pressure changes as blood travels through one circuit of the circulatory system.

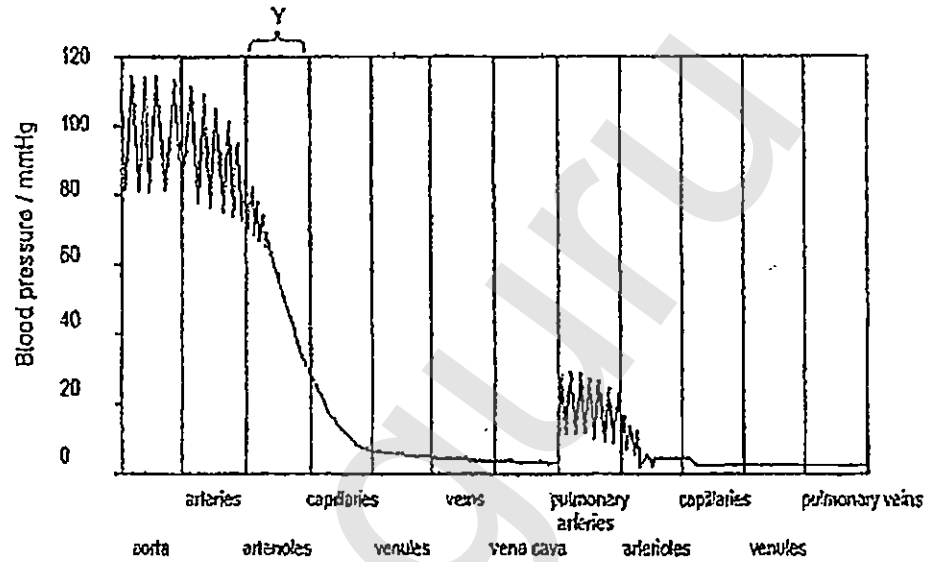


Fig.3.1

- (a) Explain why the blood pressure decreases so rapidly in region Y. [2]

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- (b) In the space below, draw a labelled diagram to show the cross-sectional view of a blood capillary. [1]

- (c) Give two reasons to explain how a return flow of blood to the heart is possible when the pressure in the veins is so low. [2]

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- (d) Fig.3.2 shows a blocked artery being treated with the use of a stent (small tube of stainless steel mesh). A balloon with the stent is inserted into the artery and inflated. The balloon is then removed and the stent remains inside the artery.

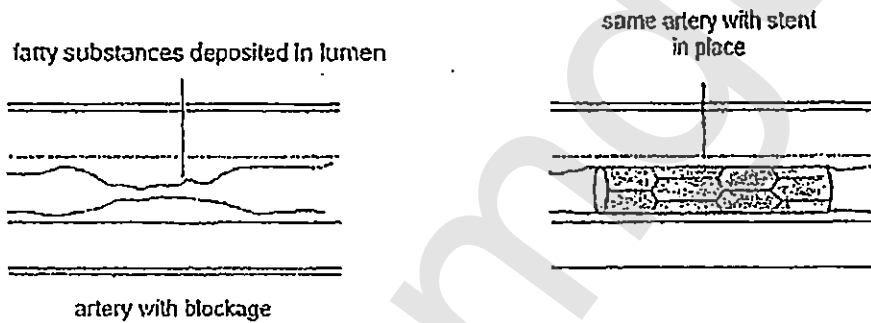


Fig.3.2

- (i) Suggest why the artery wall is able to 'bounce back' when the balloon is used to inflate the artery is removed. [1]

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- (ii) Explain why the ability of the artery wall to bounce back is important in a normal, healthy artery. [2]

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- 4 Gastric bypass surgery makes the stomach smaller and causes the food to bypass part of the small intestines.
In this surgery, a small part of the stomach is used to create a stomach pouch which is then connected to the middle part of the small intestines (jejunum) as shown in Fig. 4 below.

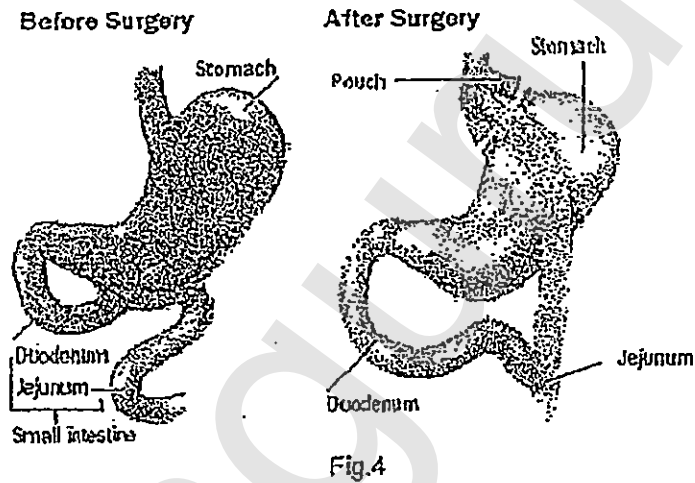


Fig.4

- (a) Describe the role played by the stomach in digestion. [4]

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- (b) Using Fig.4, state the difference in the route taken by the food after surgery. [1]

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- (c) Gastric bypass can be performed on people who are obese and wants to lose weight. Explain how it will help the person lose weight. [3]

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- (d) Suggest why this may not be the best way to lose weight. [1]

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- 5 Fig.5.1 shows two flowers belonging to the same plant species. Bees are known to assist in the reproductive processes of the flowers in this species.

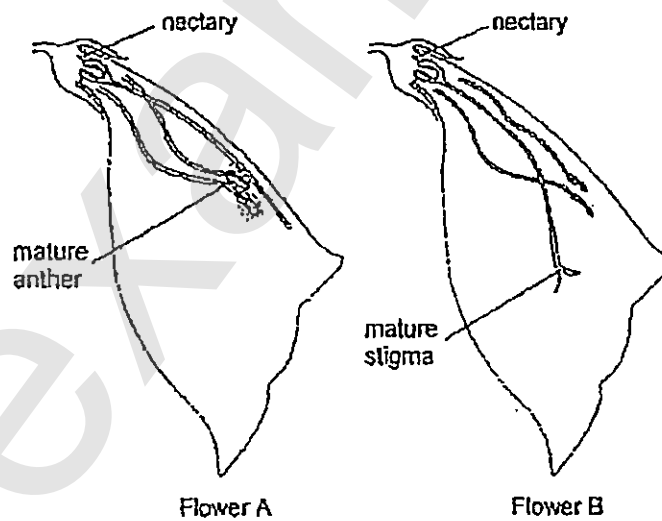


Fig.5.1

- (a) With reference to only the male and female parts of the flower given in Fig.5.1, suggest how cross pollination by the bee is guaranteed in this species. [2]

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- (b) Complete the table below on the movement of the male gamete in the female reproductive system of this plant species and that of humans. [4]

	Given plant species	Human
Structure(s) through which male gamete passes to reach female gamete.		
Adaptation for movement of male gamete.		

- (c) Table 5.2 shows a recording of the lengths of 5000 fully grown standard petals of this species growing in a certain area.

Standard petal length, x / mm	Frequency
$5 \leq x < 10$	2
$10 \leq x < 15$	0
$15 \leq x < 20$	0
$20 \leq x < 25$	0
$25 \leq x < 30$	1775
$30 \leq x < 35$	975
$35 \leq x < 40$	0
$40 \leq x < 45$	0
$45 \leq x < 50$	1075
$50 \leq x < 55$	1173
$55 \leq x < 60$	0

Table 5.2

(i) State the kind of variation seen in standard petal length in this species [1]

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(ii) Account for the frequency recorded for standard petal length of $5 \leq x < 10$. [1]

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6 Fig.6.1 shows an activity involving the DNA molecule.

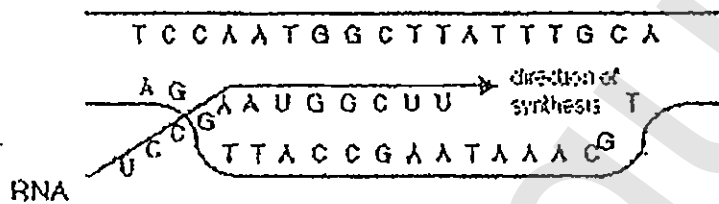


Fig.6.1

(a) In the cell, activities involving nucleotide chains could be replication, translation or transcription.

(i) Which of the following activities is depicted in Fig.6.1? [1]

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(ii) Explain which two features in Fig.6.1 give support to your answer. [2]

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- (b) Table 6.2 shows the RNA bases needed to code for particular amino acids.

Amino acid	mRNA code
Arginine	UCC
Glycine	CCA
Tryptophan	ACC
Serine	AGC

Table 6.2

Write in the DNA sequence needed to produce the following sequence:

serine – tryptophan – glycine – glycine – glycine – arginine – serine [1]

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- (c) Glutamic acid can be coded for by either CTC or CTT.
Valine can be coded for by either CAA or CAT.

In sickle cell haemoglobin, glutamic acid is replaced by valine. If this is the result of a change in single base, what was the original DNA code for glutamic acid? [1]

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- 7 It is thought that Darwin's finches evolved from one type of ancestral finch. Fig.7 shows examples of different species of Darwin's finches.

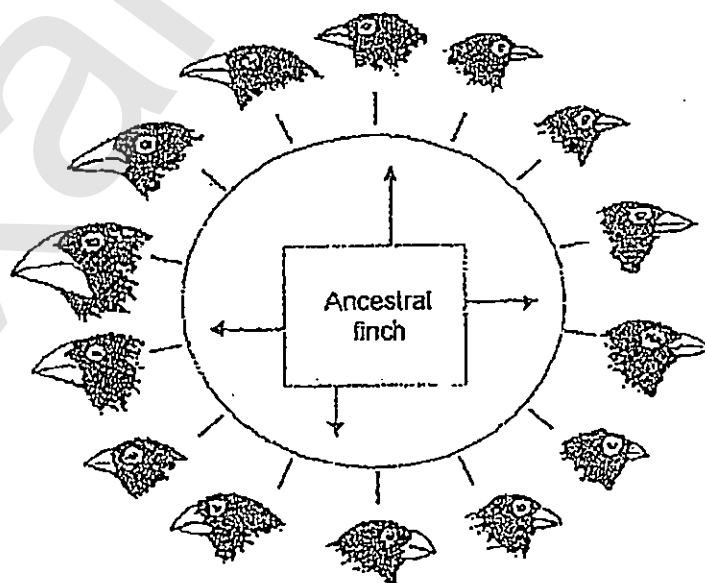


Fig.7

- (a) (i) What two observations can be made from the diagram about the structure of the finches' beaks? [2]

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- (ii) Name one environmental factor which has led to this variation. [1]

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- (b) The existence of Darwin's finches is under threat in the Galapagos Islands due to human activity.

- (i) Give an example of a human activity that could be affecting the finches [1]

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- (ii) What could be the effect of this human activity on finch biodiversity? [1]

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Name: _____ Index Number: _____ Class: _____



TEMASEK SECONDARY SCHOOL
O Level Preliminary Examination 2014
Secondary 4 Express

BIOLOGY

5158/02

Paper 2
(SECTION B)

Total time for sections A & B:
1 hour 45 minutes

Question and Answer Booklet

Additional Material: Nil

READ THESE INSTRUCTIONS FIRST

Do not open the booklet until you are told to do so.

You are required to submit this booklet at the end of the examination.

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Answer all the questions in this section.

Write your answers in the spaces provided

Write an E (for Either) or an O (Or) next to the number
10 in the grid below to indicate which question you
have answered.

You are advised to spend no longer than one hour for
Section A and no longer than 45 minutes for Section B.
The number of marks is given in brackets [] at the end
of each question or part question.

For Examiner's Use	
8	
9	
10	
Total	/30

Submit Sections A and B separately.

SECTION B (30 MARKS)

Answer THREE questions in this section.

Question 10 is in the format of an EITHER / OR question. Only one part should be answered.

- 8 Fig.8.1 shows a small, deep-rooted bush growing in a warm, dry climate.

Branches B and C have a similar number of leaves, but the leaves of branch B are enclosed in a transparent polythene bag that empties into a container.

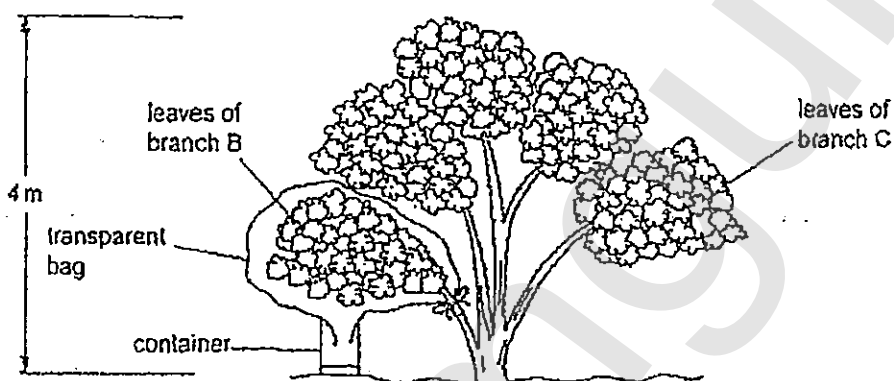


Fig.8.1

Fig.8.2 is a graph showing the total volume of water lost by the leaves of branch B from 0600 h to 1800 h.

Table 8.3 shows the total volume of water lost by the leaves of branch C during the same day.

Table 8.3

Time of day / h	0600	0800	1000	1200	1400	1600	1800
Total volume of water lost / cm ³	2.2	2.6	4.2	7.0	9.6	11.9	12.2

- (a) (i) Plot the graph for branch C on Fig.8.2 below.

[2]

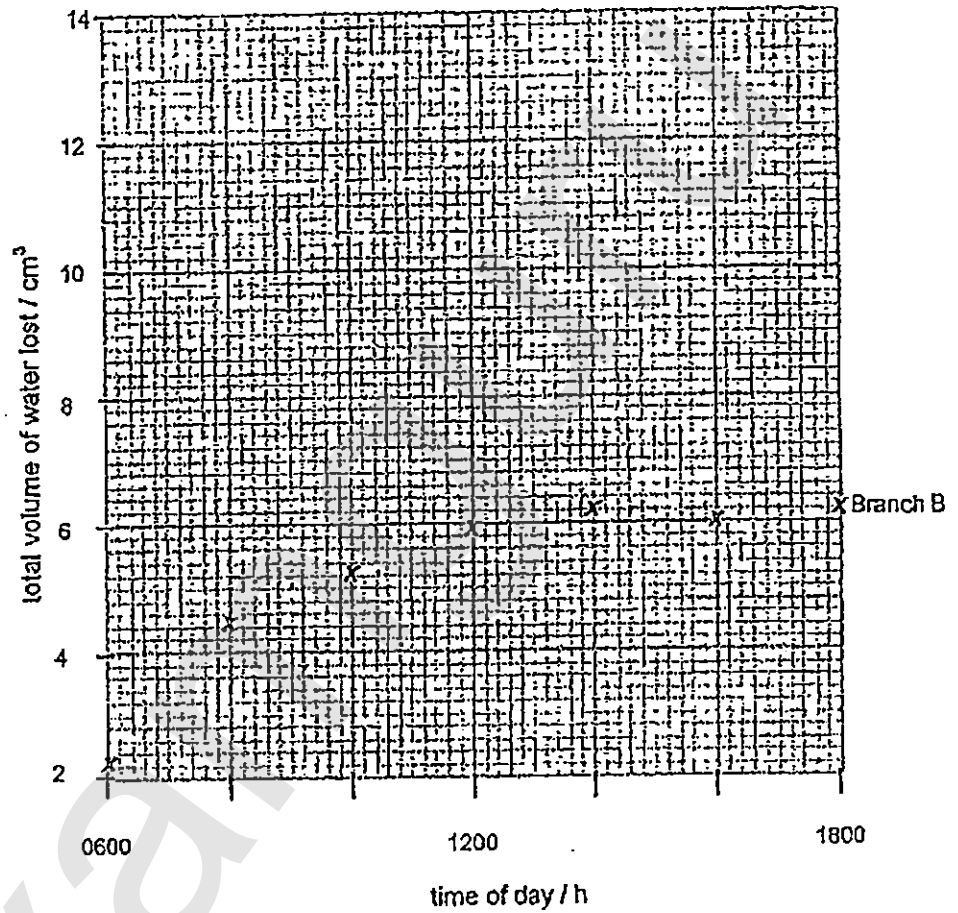


Fig.8.2

- (ii) State two environmental factors responsible for the water loss during the day by branch C.

[2]

- (III) Describe and explain the differences in the graph for the volume of water lost from leaves of branch B and branch C during the same day. [4]

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- (b) If branch B was enclosed in a black polythene bag, sketch a graph on Fig.8.2 to show the total volume of water that would be lost for the same period. [1]
- (c) Suggest why, even for certain plants that are poisonous to humans, the container in Fig.8.1 can supply travellers with safe drinking water. [3]

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[Total: 12 marks]

- 9 In a breeding experiment, a scientist investigates the body patterns of a particular species of moth. The life span of the moth is about three months. Three groups of moths K, L and M with different genotypes are crossed in an experiment and the results are shown in the table below.

Cross between;	Phenotype observed	
	 Striped	 Full bodied
L and L	268	84
K and M	417	0

- (a) Explain the advantage of using moths as a model to study inheritance. [1]

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- (b) Use the letter 'F' to represent the dominant allele and 'f' for the recessive allele.

- (i) Suggest which phenotype is dominant and explain your answer. [2]

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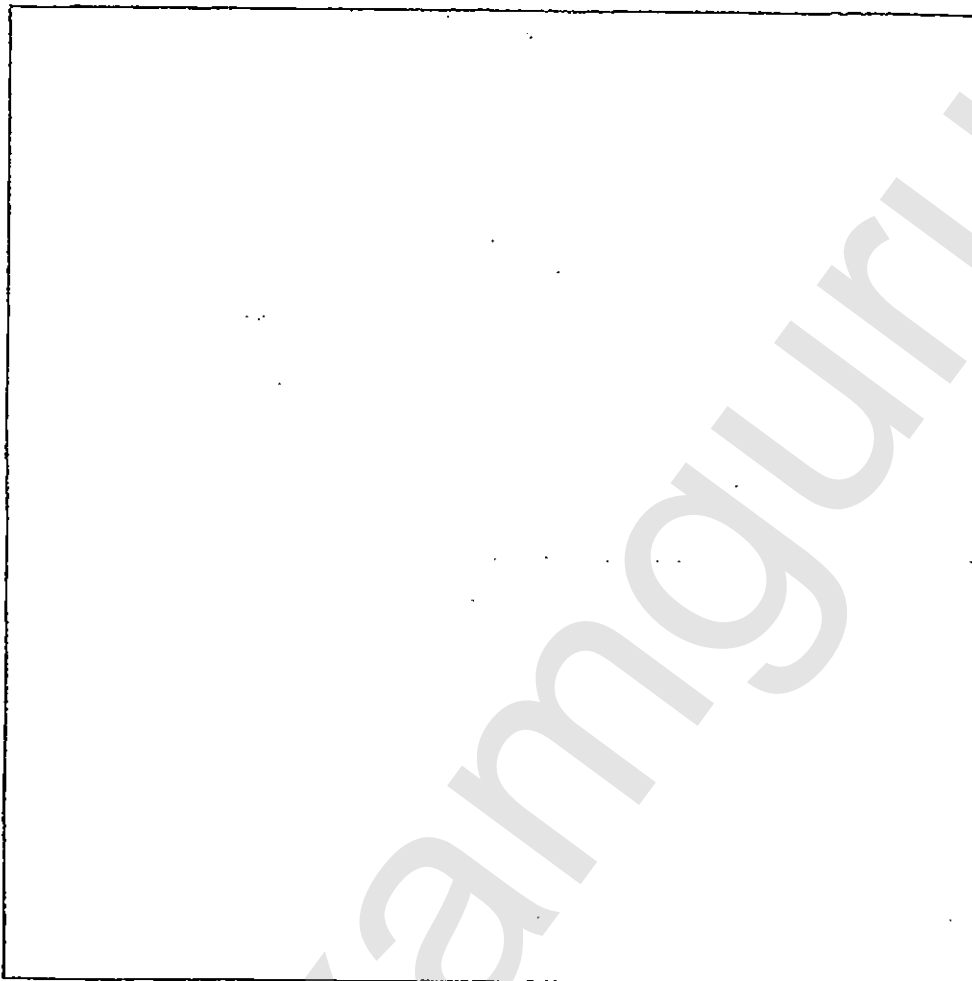
.....

- (ii) State the possible genotype of moth K, L and M. [2]

.....

.....

- (c) Use a genetic diagram to illustrate a possible cross between two groups of moths that will result in a phenotypic ratio of 1:1 in the offsprings. [3]



[Total: 8 marks]

- (a) How does the way in which oxygen molecules from the atmosphere reach the cells of a leaf differ from the way they reach the cells of the human body? [8]

(The page contains faint horizontal lines and a large diagonal watermark reading "Examplar".)

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes the need for transparency and accountability in financial reporting.
2. The second part outlines the various methods and techniques used to collect and analyze data. This includes both qualitative and quantitative approaches, ensuring a comprehensive understanding of the subject matter.
3. The third part focuses on the interpretation of results and the drawing of conclusions. It highlights the significance of critical thinking and the ability to identify patterns and trends in the data.
4. The final part discusses the implications of the findings and the potential for future research. It encourages ongoing monitoring and evaluation to ensure the relevance and effectiveness of the study.

10 OR

- Exam

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[Total: 10 marks]

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TEMASEK SECONDARY SCHOOL
Preliminary Examinations 2014
Secondary 4 Express Biology

Paper 1 Answers

1	B	11	C	21	A	31	C
2	D	12	D	22	B	32	A
3	C	13	A	23	A	33	C
4	A	14	A	24	D	34	D
5	D	15	B	25	A	35	D
6	C	16	C	26	D	36	A
7	A	17	C	27	B	37	D
8	B	18	A	28	C	38	B
9	C	19	B	29	D	39	D
10	D	20	D	30	B	40	B

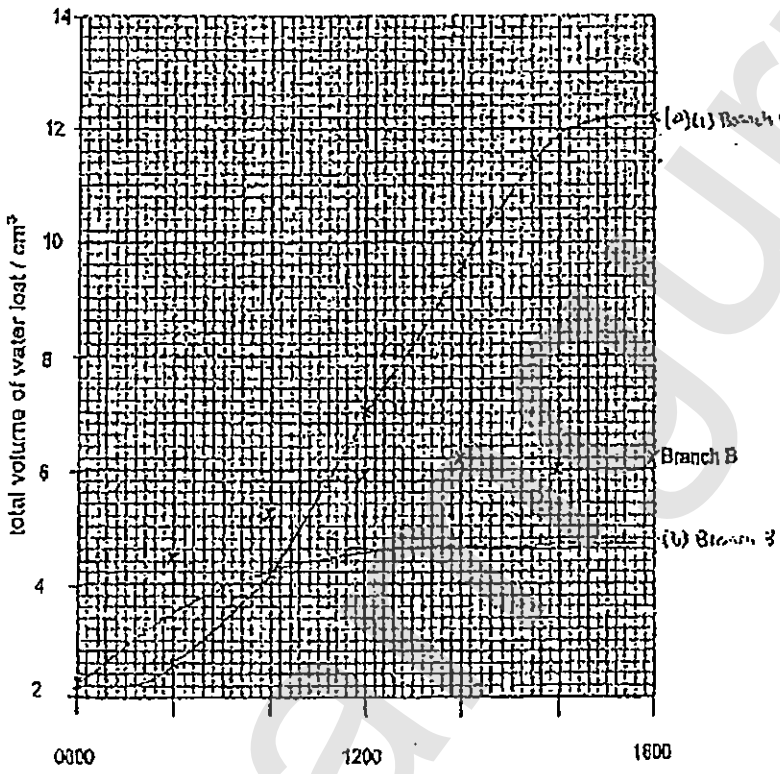
Paper 2 Section A (50 marks)

Qn		Marks
1(a)	At low temperature, the enzymes are less active due to lower level of kinetic energy so the rate of breaking down hydrogen peroxide is low due to decreased rate of effective collisions between enzymes and substrates	1 1 [2m]
(b)	The active sites of enzymes in carrot cells are not complementary to the shape of the binding site on hydrogen peroxide / substrate molecule to form the ES complex, so hydrogen peroxide cannot be broken down into oxygen	1 1 [2m]
(c)	Cut the potato strips into smaller pieces. This will increase the surface area to volume ratio for enzymes to break down the hydrogen peroxide.	1 1 [2m]
2(a)	As surrounding freshwater / dilute salt solution has a higher water potential than the cell cytoplasm, water will pass through the partially permeable cell membrane into the cell by osmosis	1 1 1 [3m]
(b)(i)	As water potential of surrounding salt solution decreases, time taken for pulsation increases. OR Time taken for pulsation increases as salt concentration increases	1m
(ii)	Rate of osmosis / water entering cell decreases as the water potential gradient between the cell and the surrounding salt solution decreases; it takes longer for the two vacuoles to fill up sufficiently with water before the excess water is expelled; therefore time taken for pulsation increases.	1 1 1 [3m]
(c)	Higher water potential of the freshwater can result in too much water entering the cell; Pressure exerted against cell wall membrane can result in lysing and death of the cell.	1 1 [2m]
3(a)	Arteries are dividing into many smaller arterioles; Blood flow slows down as blood enters the numerous smaller arterioles, pressure is greatly reduced / with a larger total cross-sectional area, pressure is greatly reduced	1 1 [2m]

3(b)		1m
(c)	Prevention of backflow by semi-lunar valves in the veins; Contraction and relaxation of skeletal muscles help push blood along the vein; Relaxing heart muscles cause pressure in heart to become lower than in veins, allowing blood to flow into atria (any 2)	1 each [2m]
(d)(i)	Presence of stretchable elastic tissue in walls of artery	1m
(ii)	Walls of artery can stretch and recoil; Helps to push blood along to maintain continuous blood flow / help to withstand high pressure of blood in the arteries	1 1 [2m]
4(a)	Churning action of stomach mixes food particles with gastric juice; breaks down food into smaller pieces to increase surface area of food for faster enzyme action; protease (pepsin) starts digestion of proteins to polypeptides; rennin coagulates soluble milk protein into insoluble casein for further digestion by pepsin / gastric juice contains hydrochloric acid which activates enzymes/provides suitable medium for action of enzymes	1 1 1 1 [4m]
(b)	After surgery, food passes from the stomach pouch directly into the jejunum, bypassing the rest of the stomach and the duodenum.	1m
(c)	Only a small stomach pouch is created, resulting in less food ingested, and the person is likely to feel full quickly; Less digestion taking place, as most of stomach is removed, and food does not pass into duodenum; Resulting in less absorption of digested food / body uses up food reserves (glycogen and fats), hence loss in weight	1 1 1 [3m]
(d)	Can result in malnutrition as less protein/fats/carbohydrate/nutrients is digested and absorbed; / Surgical complications can set in	1m

5(a)	Anther of all flowers on plant A will mature first, releasing pollen grains, before stigma of all flowers on plant B can mature; Pollen grains of flowers on one plant can only be accepted by mature stigmas of flowers on another plant	1 1 [2m]									
(b)	<table border="1"> <thead> <tr> <th></th><th>Given plant species</th><th>Human</th></tr> </thead> <tbody> <tr> <td>Structure(s) through which male gamete moves to reach female gamete.</td><td>Stigma → style ↓ ovary ↓ ovule</td><td>Vagina → Uterus ↓ oviduct</td></tr> <tr> <td>Adaptation for movement of male gamete.</td><td>Pollen tube transports male nuclei down the style, enzyme action allows growth of pollen tube to reach ovule</td><td>Sperm has numerous mitochondria to provide energy for moving the flagellum so that sperm can move towards ovum</td></tr> </tbody> </table>		Given plant species	Human	Structure(s) through which male gamete moves to reach female gamete.	Stigma → style ↓ ovary ↓ ovule	Vagina → Uterus ↓ oviduct	Adaptation for movement of male gamete.	Pollen tube transports male nuclei down the style, enzyme action allows growth of pollen tube to reach ovule	Sperm has numerous mitochondria to provide energy for moving the flagellum so that sperm can move towards ovum	1 for each box [4m]
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Adaptation for movement of male gamete.	Pollen tube transports male nuclei down the style, enzyme action allows growth of pollen tube to reach ovule	Sperm has numerous mitochondria to provide energy for moving the flagellum so that sperm can move towards ovum									
(c)	Discontinuous variation	1m									
(d)	Mutation took place, resulting in very short petals	1m									
6(a)(i)	Transcription	1m									
(ii)	When double helix separates, one of the DNA strand act as a template for making mRNA; A will pair with U on RNA, G will pair with C, T with A (message on DNA strand is copied onto the mRNA)	1 1 [2m]									
(b)	TCG TGG GGT GGT GGT AGG TCG	1m									
(c)	CTT	1m									

7(a)(i)	Beaks differ in thickness / sharpness / width / length / curvature (any 2)	1 each {2m}
(ii)	Type of food available / type of diet	1m
(b)(i)	Deforestation, resulting in destruction of their roosting places/availability of food; / environmental pollution eg of air (burning of garbage generated by humans), water (major oil spill), thus affecting their survival / introduction of other animals by humans, eg. wasps, which results in competition for food source (caterpillars) with finches, upset the equilibrium of the ecosystem (any one)	1m
(ii)	Decreases the biodiversity of finches / extinction of some varieties	1m

SECTION B (30 MARKS)		
8(a)(i)	All points correct; Smooth curve; 	1 1 [2m]
(ii)	Humidity of surrounding air / Wind speed / Light intensity / Availability of soil water / Temperature of surroundings (any 2)	2m
(iii)	The volume of water lost from branch B is greater than C up to about 1100h; after which much less water (less than 50%) was lost from branch B compared to C; air trapped in the transparent bag warms up quickly; heat speeds up the rate of evaporation of water from the leaf in branch B; hence more water lost from branch B; As humidity increases in the bag, rate of transpiration decreases as less water vapour can diffuse out of the leaves into the humid surroundings; hence less water lost.	1 1 1 1 [4m]

(b)	Lower than B, higher than C up to 1000h, then level off	1m
(c)	Water and dissolved mineral salts is absorbed from the soil (not manufactured by plant); and carried up to the leaves via xylem tissue; Metabolites/substances made by plant transported via phloem tissue; it is only water that evaporates during transpiration; poisonous substances remain in cells	1 1 1 [3m]
9(a)	Short reproductive cycle, able to reproduce faster; / Female moth able to lay many eggs at one time, able to produce a larger sample size of offsprings; / distinct phenotypes, able to easily differentiate between the different phenotypes (any 1)	1m
(b)(i)	Striped moth; In the cross between K and M, all offsprings displayed striped body. This suggests that the parents are pure bred and the offsprings are all heterozygous and display only the dominant phenotype / In the cross between L and L, the offsprings displayed striped to full bodied phenotype in the ratio of 3:1. This indicates that the parents are heterozygous and that striped phenotype is dominant as both homozygous recessive and heterozygous individuals can express the trait.	$\frac{1}{2}$ $\frac{1}{2}$ 1 [2m]
(ii)	Both K and M: FF or ff L: Ff (any 1 mistake, minus 1 mark)	[2m]
9(c)	Parent L x M/K Parental genotype Ff ff Gametes F f f f F1 genotype Ff Ff ff ff F1 phenotype Striped Striped Full Full F1 phenotypic ratio 1 Striped : 1 Full Correct parental genotype : 1m Headings: 1m Correct diagram and ratio : 1m Any 1 mistake: minus $\frac{1}{2}$ m	3m

10 Either		
(a)	In plants: Oxygen from atmosphere diffuses through the stomata into the intercellular spaces among spongy mesophyll cells in the leaf; Oxygen then dissolves in the moisture on the walls of the cells and diffuses into the cells; It diffuses from cell to cell to reach those tissues which are not directly connected to the air. In humans: Oxygen is breathed in through the nose, travels via respiratory passage (trachea, bronchus) into the lungs; Oxygen dissolves in the moisture lining the alveolar wall before diffusing into the blood in blood capillaries; gas then combines with haemoglobin in red blood cells to form oxyhaemoglobin, which is carried by blood to oxygen-poor tissues in other parts of the body, where oxygen is liberated and then diffuses through the walls of blood capillaries into the cells.	1 1 1 1 1 1 1 [8m]
(b)	Both the flattened expanded surface of leaves and the thousands of alveoli in the lungs of mammals provide a large surface area for increased diffusion of gases; Thin lamina of leaf and one cell thick alveolar wall of mammal allows gases to diffuse through easily.	1 1 [2m]
10 OR		
(a)	With the introduction of the new variety, Advantages - farmers are able to obtain higher yield since it has been genetically modified with a gene to boost photosynthesis / rate of photosynthesis is increased - Soya beans will be unaffected by herbicides used to kill the weeds, hence they can continue to grow well; - In addition, soya beans will be able to thrive better in the field since there will be lesser competition for nutrients and water as weeds can be removed easily with herbicides.	1 1 1

	Disadvantages • With the Introduction of gene that can resist herbicides, weeds that cross-breed with soya bean plants may inherit the gene and develop immunity to herbicides as well. • Formation of <u>superweeds</u>, weeds that are not easily removed in future by the same herbicide. This will create even greater competition for nutrients and space for growth with the soya bean crops. • Population of insects that feeds on weeds and help in pollination will be reduced since there will be drastic drop in weed population in the field / useful insects will be killed, links in food web are broken which will upset the ecological balance	1 1 1 [6m]
(b)	Sickle cell anaemia. • Mutation results in change in structure of gene controlling haemoglobin production • Mutated gene produces haemoglobin S, which causes red blood cells to become sickle-shaped • The shape interferes with the oxygen-carrying property of red blood cells and condition can be fatal OR Down's syndrome • Nondisjunction during ovum formation results in one ovum having an extra chromosome in the 21st pair • Fertilization between a normal sperm and a mutated ovum results in the zygote having one extra chromosome in the 21st pair; • Affected child has characteristic facial features and exhibits mental and physical difficulties OR Albinism • Mutation in the gene controlling production of pigment (melanin) • Results in absence of pigment in the skin, hair and eyes of animals • Individual has reddish white skin, white hair, iris appears red, very sensitive to light	1 1 1 1 [4m]

Name	Class	Register Number

5158/01

BIOLOGY (SPA)

Thursday

14 Aug 2014

1 hour

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VICTORIA SCHOOL

SECOND PRELIMINARY EXAMINATION (SECONDARY FOUR)

Additional Material:

Optical marksheet

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write your name, class and register number in the spaces provided at the top of this page and on the optical answer sheet.

There are forty questions in this paper.
Answer all questions.

For each question, there are four possible answers A, B, C and D. Choose the one you consider correct and shade your choice on the optical marksheet provided.

Each correct answer will score one mark. Marks will not be deducted for incorrect answers.

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This Question Paper consists of 16 printed pages (including this cover page).

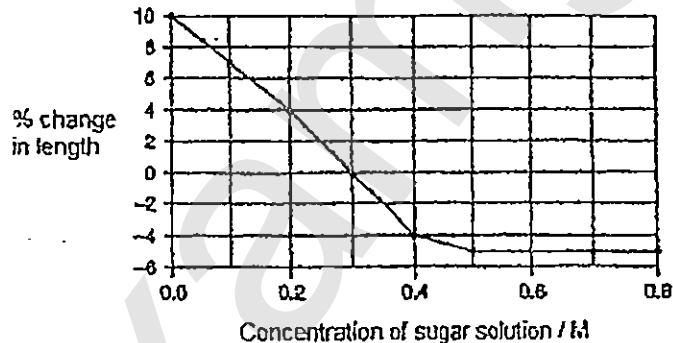
- 1 Which of the following options below correctly identifies a cell, a tissue and an organ?

	Cell	Tissue	Organ
A	stoma	xylem	leaf
B	sperm	testis	penis
C	ovum	muscle	uterus
D	ovule	epidermis	ovary

- 2 Which of the following organelles is not involved in the synthesis of lipases in an intestinal cell?

- A ribosomes
- B nucleus
- C golgi apparatus
- D smooth endoplasmic reticulum

- 3 Cylinders of potato tissue were placed in different concentrations of a sugar solution. The graph shows the percentage change in length of the tissues over a fixed period of time?



Assuming that the water potential of a red blood cell is similar to that of potato cells, which of the following statements is correct?

- A Red blood cells placed in 0.1M sugar solution will be crenated.
- B Red blood cells placed in 0.6M sugar solution will be crenated.
- C Red blood cells placed in 0.3M sugar solution will burst.
- D Red blood cells placed in 0.6M sugar solution will burst.

- 4 A sample of food mixed with water tested to determine its contents. The results of the test are shown in the table below.

Test	Results
Iodine solution added.	Solution remained brown.
Benedict's solution added and mixture heated.	Brick-red precipitate appeared.
Mixture shaken with ethanol and poured into water.	White emulsion formed
Dilute sodium hydroxide solution added, followed by a few drops of dilute copper sulfate solution.	Solution remained blue.

What is the most likely identity of the food sample?

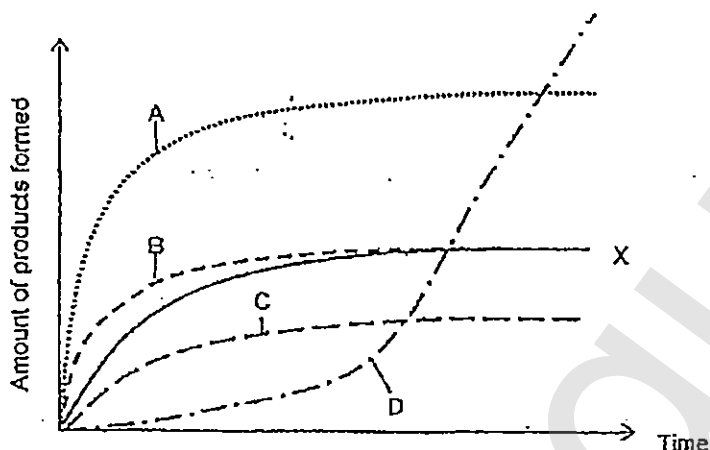
- A baked potato chips
 B cream topped muffin
 C fried fish fillet
 D strawberry flavoured sweets
- 5 The enzyme lysozyme secreted from tear glands forms deposits on contact with the lens surface.
- Which of the following ingredients would be effective in a lens cleaner for the removal these deposits?
- A proteases
 B antibodies
 C pH buffers
 D Bicarbonate solution
- 6 Enzyme action can be explained by the lock and key hypothesis. Which of the following options correctly shows the location of the active site and what the lock and key represent?

	Active site	Lock	Key
A	On the enzyme	Substrate	Enzyme
B	On the enzyme	Enzyme	Substrate
C	On the substrate	Substrate	Enzyme
D	On the substrate.	Enzyme	Substrate

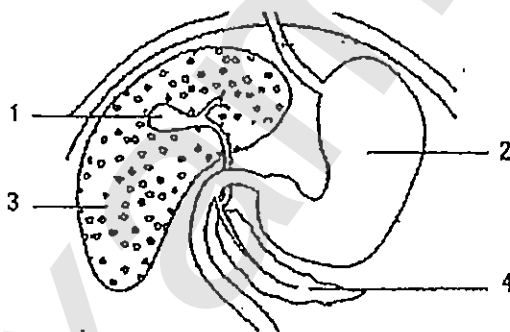
- 7 The anti-diuretic hormone (ADH) is produced by the _____ and its function is to _____.
- A pituitary gland; control the rate of sweat secretion.
 B kidney; control the rate of sweat secretion.
 C pituitary gland; maintain a balance in blood plasma water potential.
 D kidney; maintain a balance in blood plasma water potential.

- 8 The graph below shows curve X which represents the activity of an enzyme at 20°C.

Which curve represents the activity when the temperature is raised to 30°C and with more enzymes added?



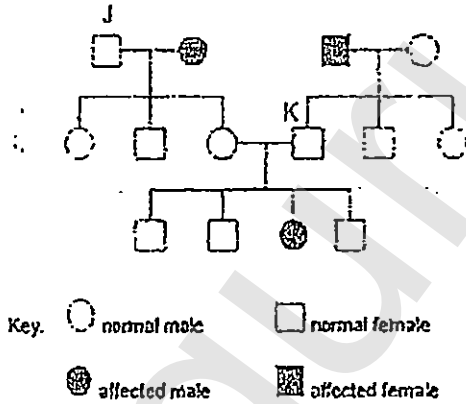
- 9 The diagram shows a part of the human alimentary canal.



Which two structures produce substances involved in fats digestion?

- A 1 and 3.
B 2 and 3.
C 1 and 4.
D 3 and 4.
- 10 Which of the following statements describes an example of artificial selection?
- A It has been found that some strains of bacteria produce antibiotics.
B It is common practice to mate bulls with cows that produce the most milk.
C It is possible to control caterpillars on food crops by releasing small wasps which lay their eggs inside caterpillars and kill them.
D Mosquitoes have developed strains that are resistant to insecticides.

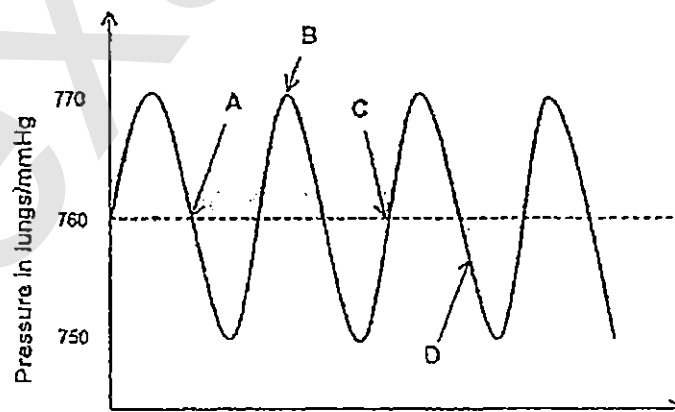
- 11 The pedigree chart below shows the inheritance of a recessive characteristic that is controlled by a single pair of alleles, G and g. G represents the dominant allele and g represents the recessive allele.



Which of the following options shows the most likely genotypes of individuals J and K?

	J	K
A	GG	GG
B	GG	gg
C	Gg	GG
D	Gg	Gg

- 12 The diagram below illustrates changes in air pressure taking place inside the lungs during complete cycles of breathing at atmospheric pressure of 760mmHg. At which point are the external intercostal muscles certainly contracted?



- 13 A plant is heterozygous for a single pair of alleles that are codominant. This plant is self-pollinated and the resulting seeds are germinated and allowed to grow.

Which of the following ratios are expected in the progeny?

	Ratio of phenotypes	Ratio of genotypes
A	1:2:1	1:2:1
B	1:2:1	3:1
C	3:1	1:2:1
D	3:1	3:1

- 14 A woman with blood group AB marries a man who is heterozygous for blood group B. What is the probability of the couple having a son with blood group A?

- A 6.25%
- B 12.5%
- C 25.0%
- D 50.0%

- 15 Which of the following options shows the correct stages of a cell cycle corresponding to the events shown?

	DNA replication	Breakdown of nuclear membrane	Division of centromere
A	interphase	prophase	metaphase
B	interphase	prophase	anaphase
C	prophase	interphase	anaphase
D	prophase	interphase	metaphase

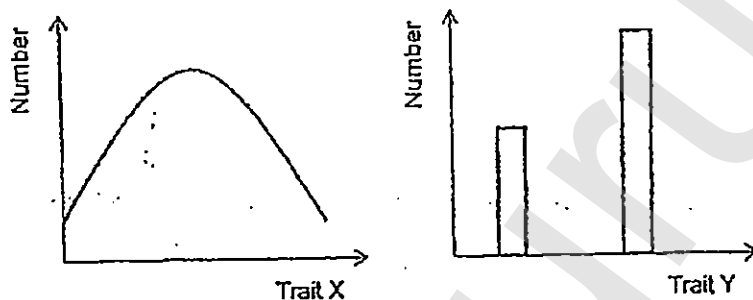
- 16 Which of the following statements correctly suggests a possible hazard of the practice of genetic engineering?

- A Genes for antibiotic resistance might be unknowingly incorporated into bacteria and cause human diseases.
- B GMOs might be able to produce human proteins on a large scale.
- C Transgenic crops might develop resistance to pests.
- D The nutritional content of certain crops might be enhanced.

- 17 Which of the following is an incorrect characteristic of adrenaline?

- A It increases breakdown of glycogen to glucose
- B It increases heart rate and blood pressure.
- C It is produced when a person is frightened.
- D It decreases the rate of breathing.

- 18 The diagrams below show the distribution of two inheritable traits in a human population.



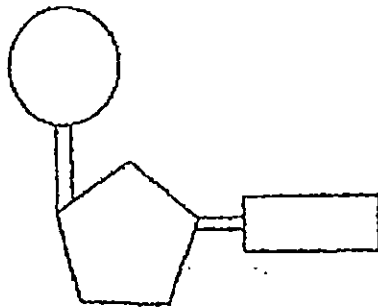
Which traits might best be represented by X and Y?

	X	Y
A	IQ	Height
B	Ability to roll tongue	Weight
C	Skin colour	Gender
D	Blood type	Shoe size

- 19 Independent assortment of chromosomes is one of the most important events in meiosis because it _____.
- A produces new combinations of the genetic information in gametes
 B limits variation in genetic information in the next generation.
 C halves the number of chromosomes in each cell during segregation
 D enables exchange of genetic information between random chromosomes
- 20 Which of the following options below correctly identifies the affinity between haemoglobin and the three gases?

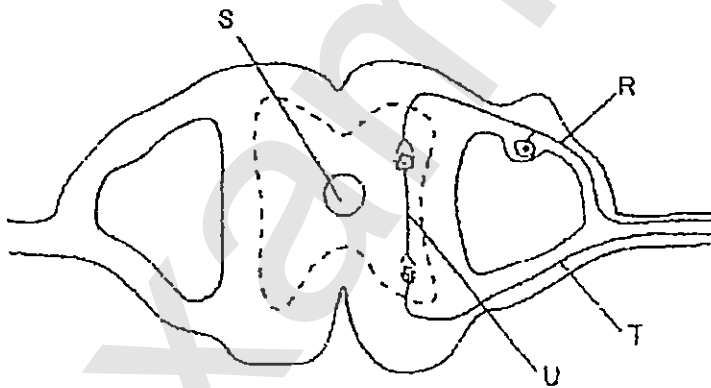
	highest affinity → lowest affinity		
A	carbon monoxide	carbon dioxide	oxygen
B	carbon monoxide	oxygen	carbon dioxide
C	oxygen	carbon dioxide	carbon monoxide
D	oxygen	carbon monoxide	carbon dioxide

- 21 The figure below shows the diagrammatic representation of a biological molecule.



What of the following is the correct identity of the molecule represented?

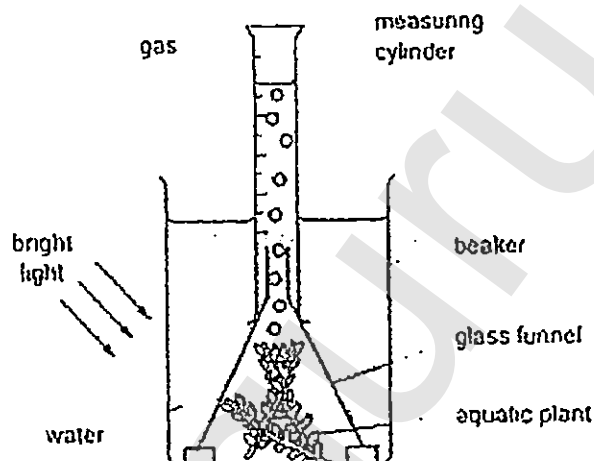
- A DNA molecule
 - B nucleotide
 - C tRNA
 - D sugar-phosphate backbone
- 22 The diagram shows a transverse cross-section of the spinal cord with spinal nerves.



Which of the following represents the correct pathway of a reflex action?

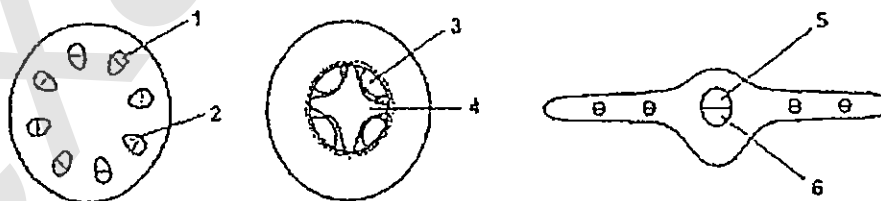
- A Effector → R → U → T → receptor
- B Effector → T → U → R → receptor
- C Receptor → T → U → R → effector
- D Receptor → R → U → T → effector

- 23 The figure shows an experiment carried out to investigate the effect of light intensity on the rate of oxygen production in aquatic plants.



Which two important factors must be kept constant during this investigation?

- A The amount of water in the beaker and the height of the measuring cylinder.
 - B The size of aquatic plant and the amount of gas in the measuring cylinder.
 - C Size of aquatic plant and the duration of exposure to light.
 - D The size of the beaker and the funnel.
- 24 The diagram below represent the cross section of the stem, root and leaf (respectively from the left) of a non-woody dicotyledonous plant. In each section the distribution of the structures is shown.



Which labelled numbers correctly identify the xylem and phloem in the stem, root and leaf?

	xylem			phloem		
A	1	3	5	2	4	6
B	1	3	6	2	4	5
C	2	4	5	1	3	6
D	2	4	6	1	3	5

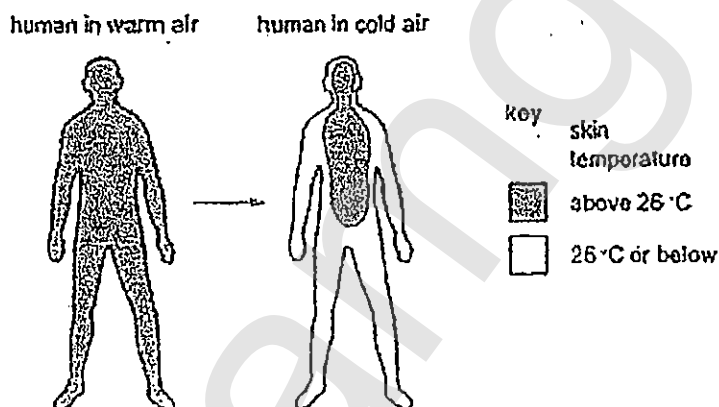
- 25 The table below shows the characteristics of the blood in a blood vessel in the body.

Oxygen concentration	carbon dioxide concentration	pressure
high	low	high

Which of the following is the likely identity of this blood vessel?

- A aorta
- B pulmonary artery
- C pulmonary vein
- D vena cava

- 26 The figure below shows skin temperature of a human when exposed to warm air and then exposed to cold air.



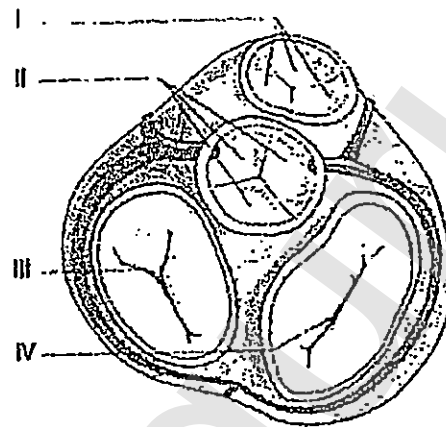
What causes the observed change in skin temperature on exposure to cold air?

- A Less blood flowing to the extremities.
- B Less blood going to the heart and lungs
- C More blood flowing just below the skin
- D More blood going to the heart and lungs

- 27 The hypothalamus detects a rise in blood temperature above normal. Which of the following options shows the appropriate response?

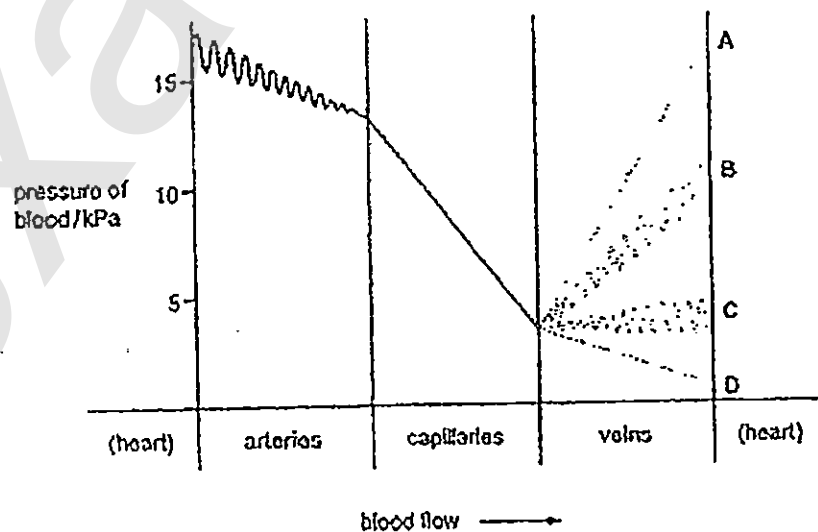
	arterioles in the skin	sweat glands	hair erector muscles
A	constrict	active	relax
B	constrict	inactive	contract
C	dilate	active	relax
D	dilate	inactive	contract

- 28 The figure below shows the valves in the human heart.



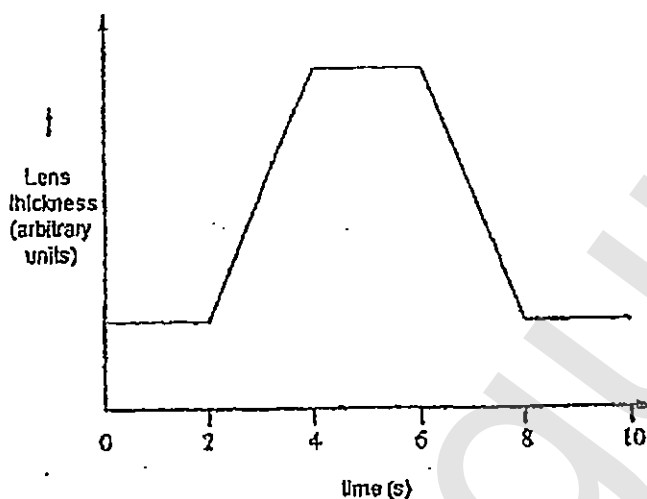
Which of the labelled valves close immediately after ventricular systole?

- A I and II.
 B II and III.
 C III and IV.
 D IV only.
- 29 The figure below shows the blood pressure of a person at rest as the blood leaves the heart and passes through arteries and then the capillaries.



Which of the labelled lines shows the pressure of blood as it flows through veins before returning to the heart?

For questions 30 and 31, refer to the graph below which shows the changes in the lens thickness in a boy's eye within a period of time.



30 What is happening to the boy's eye between the 2nd and 4th second?

- A The tension on the suspensory ligaments is decreasing
- B The tension on the suspensory ligaments is increasing
- C The ciliary muscles are relaxing
- D The radial muscles are contracting.

31 What is the boy looking at between the 4th to 6th second?

- A A distant object.
- B An object moving away from him.
- C A nearby object.
- D An object moving towards him.

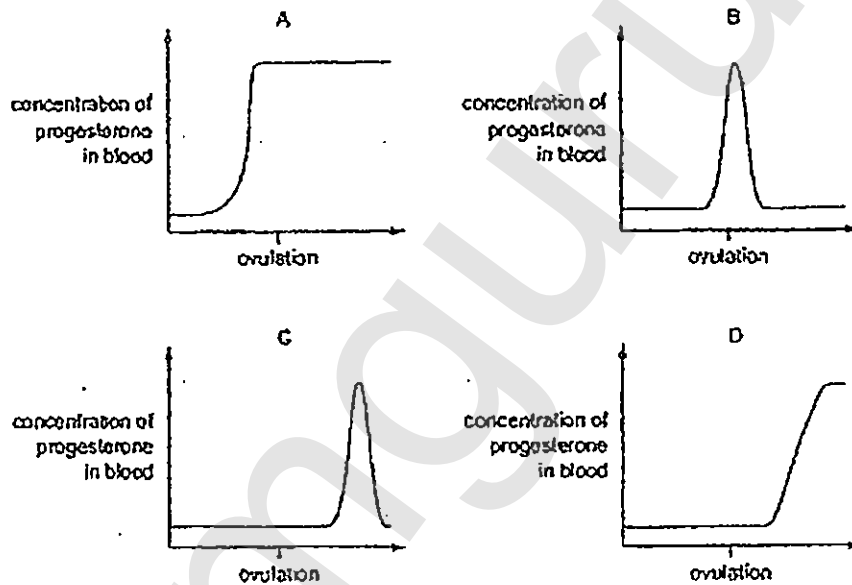
32 A pomegranate tree of variety X had its flowers pollinated by a distinctly different pomegranate tree of variety Y. However, the fruits produced strongly resembled those produced when variety X was self-pollinated.

Which of the following statements is the most reasonable explanation for this phenomenon?

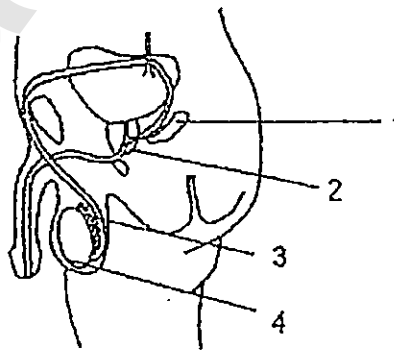
- A The fruit's flesh develop from tissues of the female parent plant.
- B Pollen contains very little genetic material.
- C Varieties X and Y are genetically identical.
- D Variety X is genetically more robust than variety Y.

- 33 The graphs below show the concentration of progesterone in the blood of a female during a 28 day cycle.

Which graph shows the changes in concentration of progesterone if pregnancy occurs after ovulation?



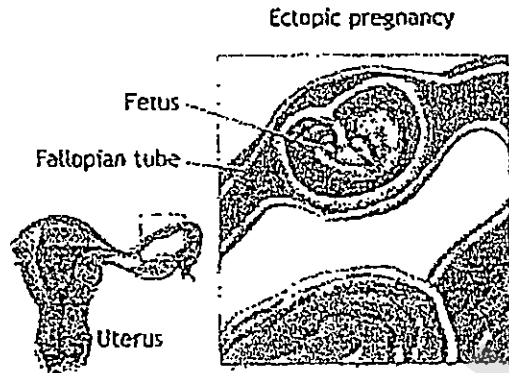
- 34 The figure below shows a section through the male reproductive system.



Which structure(s) produce(s) the fluid part of the semen that contains nutrients and enzymes?

- A 1 only.
- B 1 and 2.
- C 1, 2 and 3.
- D 2, 3 and 4.

- 35 An ectopic pregnancy refers to one in which the embryo implants in an area other than the womb, as illustrated in the figure below.



Which of the following statements would account for why the pregnancy could be dangerous for the mother?

- 1 Ectopic pregnancy would cause the uterine lining to shed.
- 2 Fetal and maternal blood systems are continuous.
- 3 The fallopian tube might rupture as the fetus enlarges.

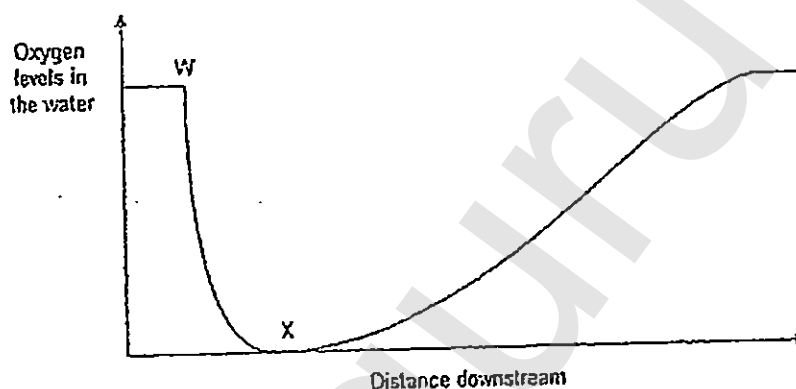
- A 2 only.
 B 3 only.
 C 1 and 3.
 D 1, 2 and 3.

- 36 Which of the following statements about eutrophication is true?

- 1 It increases the amount of sunlight reaching the bottom of the water body.
- 2 It occurs due to excessive amount of nitrates and phosphates in water.
- 3 It results in a decrease in water clarity, dissolved oxygen and aquatic life.

- A 2 only.
 B 1 and 3.
 C 2 and 3.
 D 1, 2 and 3.

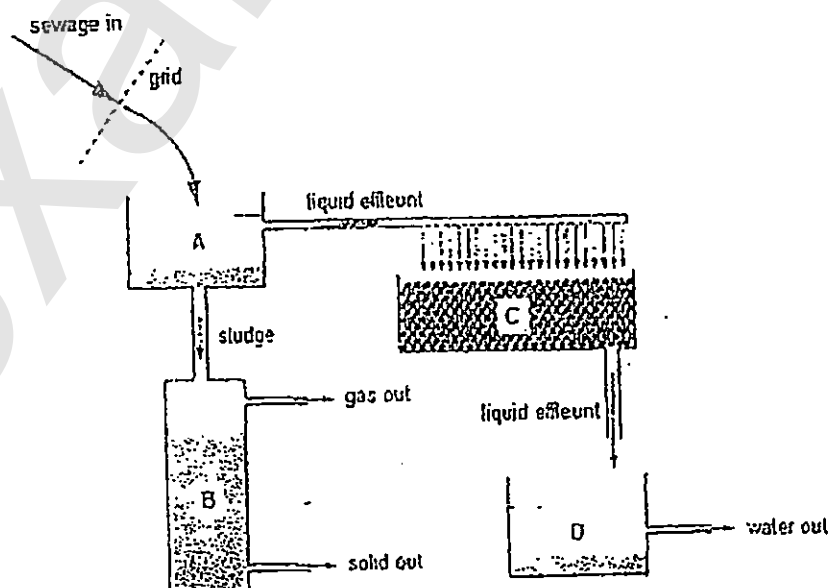
- 37 The graph below shows the oxygen levels in a slow-moving fresh water stream that has been contaminated by sewage.



The reason why the oxygen levels dropped rapidly between points W and X is because _____.

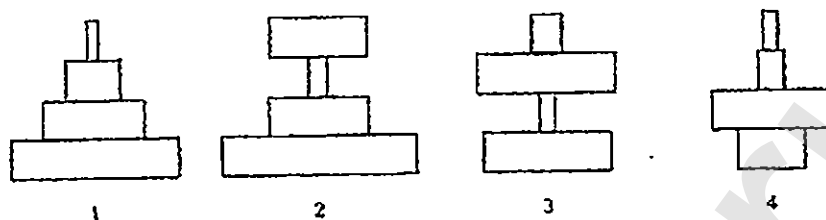
- A the fish took in all of the oxygen
- B there was an increase in the number of decomposers
- C there was a rapid increase in the numbers of green plants
- D there was a decrease in the dissolved nitrate concentration

- 38 The diagram shows a sewage treatment process.



Which of the labelled stages is likely to involve anaerobic bacteria?

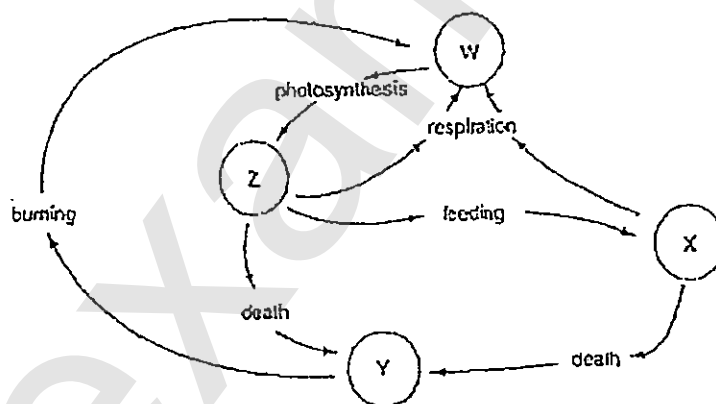
- 39 In a food chain, grass is eaten by cows. The cows have insects living on their hides. These insects are fed on by birds.



The diagram above shows four ecological pyramids. Which is the pyramid of biomass and which is the pyramid of numbers for this food chain?

	Pyramid of biomass	Pyramid of numbers
A	1	1
B	3	1
C	1	3
D	3	4

- 40 The diagram below shows some stages in the carbon cycle. W, X, Y and Z are carbon compounds.



Which of the following identifies Y?

- A Coal and natural gas.
- B Carbon dioxide in the air
- C Carbon compounds found in plants
- D Carbon compounds found in animals

- End of Paper -

Setters: Mr K. Tan
Mdm N. Kabir

Section A (50 marks)

Answer all questions.

Write your answers in the spaces provided.

- 1 Fig. 1.1 shows a large jar in which plants are growing.

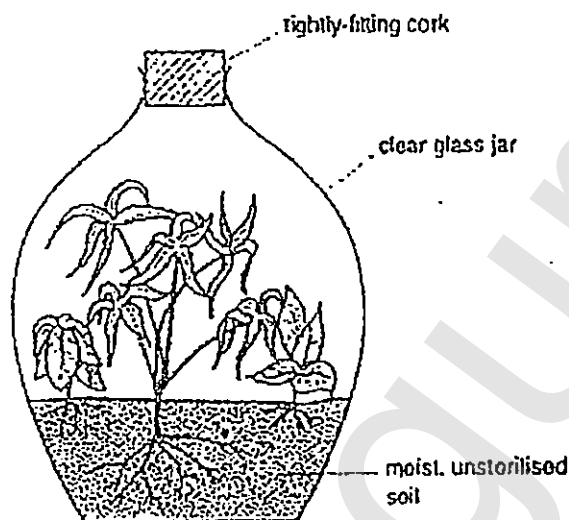


Fig 1.1

The jar provides an environment in which plants can survive for many months without the addition of water or air.

- (a) State the chemical equation of the process that occurs in the green plants in the presence of light.
 [1]
- (b) Name two likely limiting factors for the growth of the plants.
 1) 2) [2]
- (c) Explain how the plants are able to survive without a continuous supply of fresh air.

 [2]

- (d) Explain why water does not need to be added to the plants.

.....
[2]

[Total:7]

- 2 Fig. 2.1 shows a section through a small surface wound to the skin.

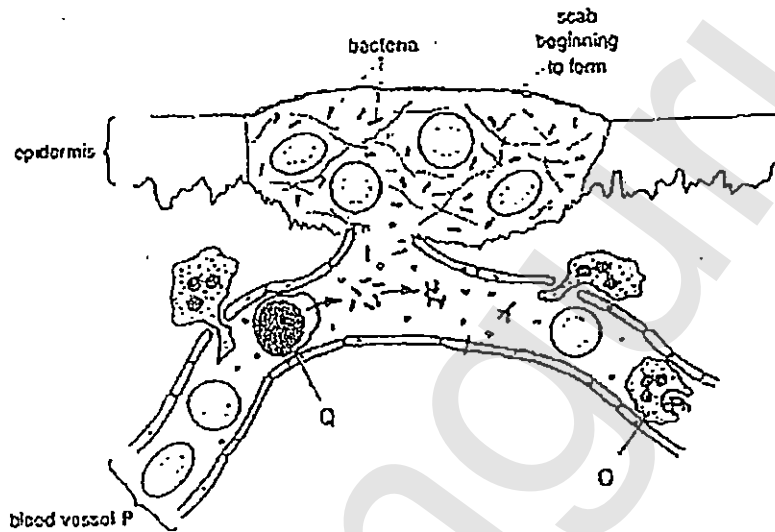


Fig 2.1

- (a) Name the cell O and blood vessel P.

O : P: [2]

- (b) Briefly describe the involvement of cells O and Q in defence.

.....

 [3]

- (c) Explain how further entry of bacteria is prevented during wound healing.

.....

 [2]

[Total:7]

- 3 A student completed his 2.4km run for his NAPFA test in 10 minutes and then rested for another 10 minutes. Fig 3.1 shows the lactic acid and muscle glycogen concentration in blood samples of the student taken at different time intervals.

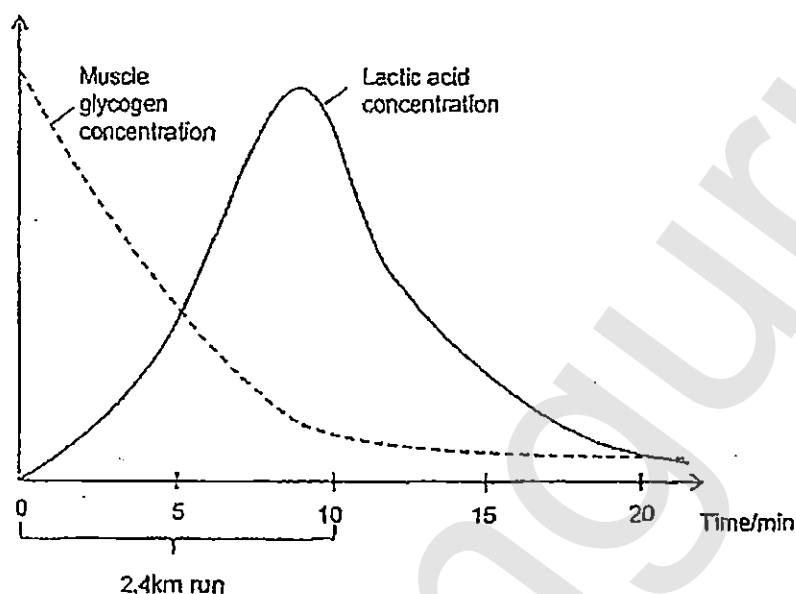


Fig 3.1

- (a) In Fig 3.1 above, draw a line representing the oxygen intake of the student. [1]

- (b) Define *anaerobic respiration*.

.....
[1]

- (c) Explain the decrease in muscle glycogen concentration during the 2.4km run.

.....

[2]

- (d) Explain the change observed in lactic acid concentration during rest.

.....

[3]

[Total:7]

- 4 Fig 4.1 shows two cells obtained from a flowering plant undergoing cell division. Cell A is obtained from the ovule while Cell B, from the style. The diploid number of chromosomes in this plant is 4.

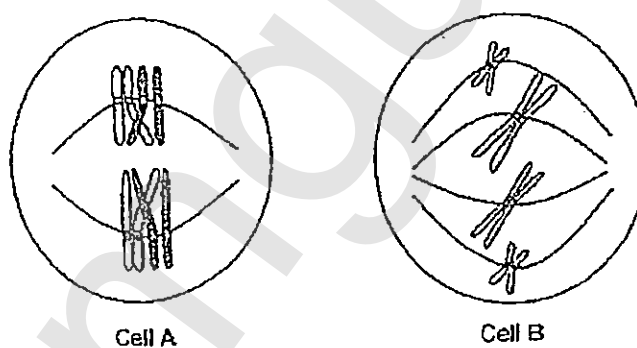


Fig 4.1

- (a) In the table below, state the type and stage of cell division that each of the cells are undergoing.

	Type of cell division	Stage of cell division
Cell A		
Cell B		

[2]

- (b) In the space provided below, illustrate the next stage of cell division that Cell A will undergo.

[2]

- (c) Explain why a gene mutation in Cell A is more likely to lead to the emergence of a new species compared to a gene mutation in Cell B.

[2]

[Total:6]

- 5 Fig 5.1 shows the initial stages involved in the insertion of the human insulin gene into a bacterium.

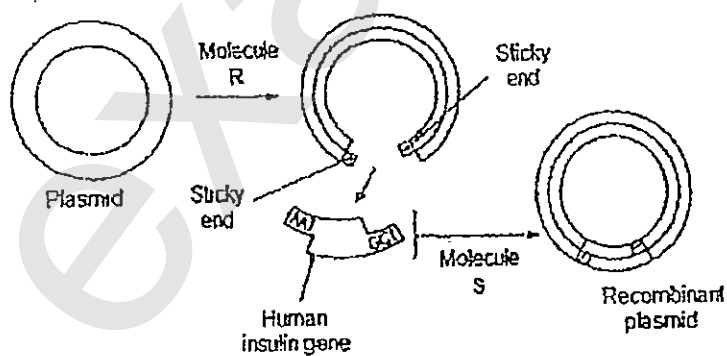


Fig 5.1

- (a) (i) Identify molecules R and S.

R: S:

[2]

- (ii) Explain why the same molecule R has to be used to obtain the gene that codes for human insulin.

.....
 [1]

- (iii) State the term used to describe the role of the plasmid in this procedure.

..... [1]

- (b) A section of the base sequence of the human insulin gene is given below.

ATG GCC CTG TGG ATG

- (i) State the base sequence of the mRNA that is produced from this sequence by the recombinant bacteria.

..... [1]

- (ii) Explain how fermenters can achieve large scale production of insulin to meet the demands of pharmaceutical companies.

.....

 [3]

- (c) Explain the significance of insulin in humans.

.....

 [3]

[Total:11]

6 Fig. 6.1 shows the energy flow through a food chain.

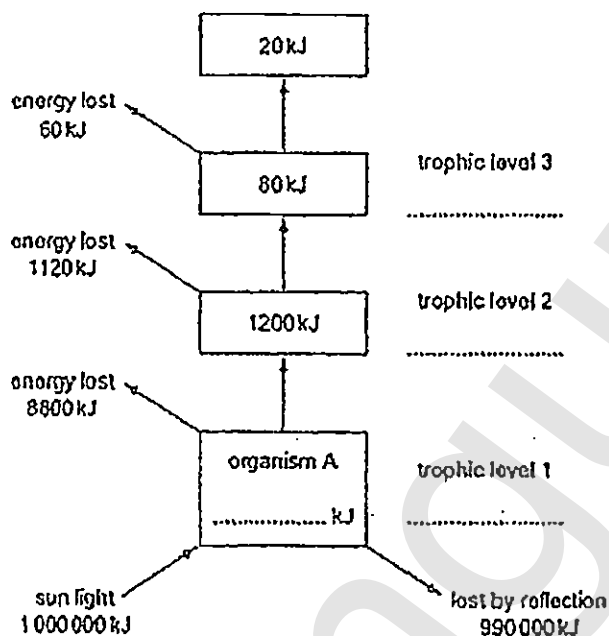


Fig 6.1

- (a) On Fig. 6.1, write carnivore, herbivore or producer at the correct trophic level. [1]
- (b) On Fig. 6.1, complete the energy value of organism A. [1]
- (c) Name the process by which organism A traps energy. [1]
- (d) With reference to Fig 6.1, explain why the food chain exhibits the non-cyclical nature of energy flow. [2]

[Total:5]

- 7 A 10-year study on a certain ecosystem was carried out to investigate the relationship between voles and owls.

Voles are small mouse-like mammals and owls are carnivorous birds.

The results are shown in Fig. 7.1 and Fig. 7.2.

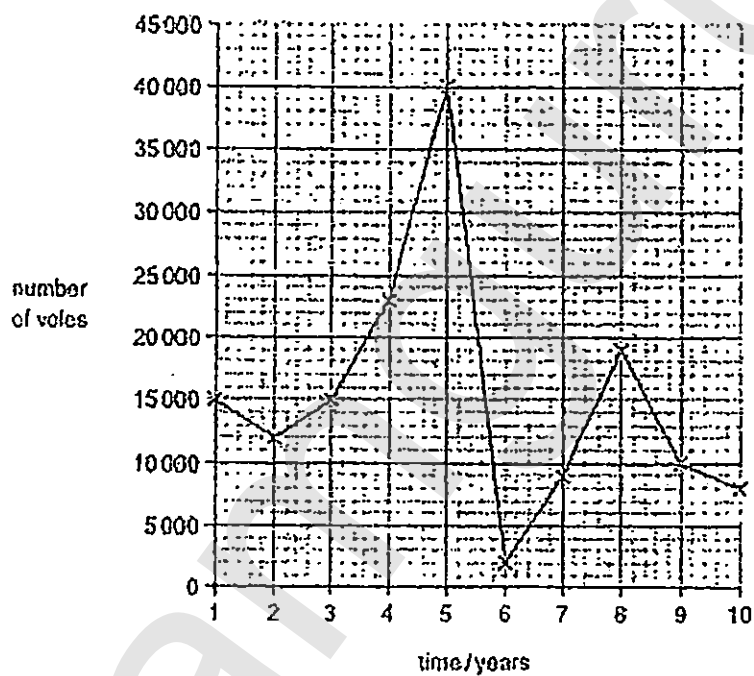


Fig 7.1

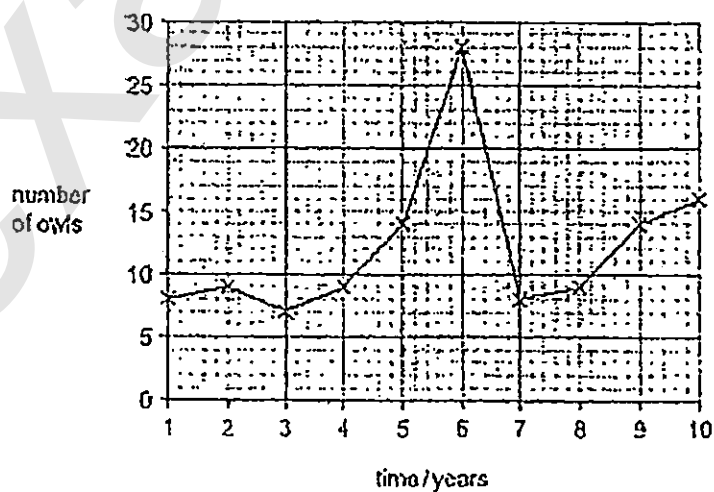


Fig 7.2

- (a) Explain the significance of the much larger population of voles compared to the owls.

.....

[2]

- (b) Suggest three reasons for the decrease in the voles population between years 5 and 6.

.....

[3]

- (c) State the evidence from Fig. 7.1 and Fig. 7.2 that supports the idea that voles form a large part of the owl's diet.

.....

[2]

[Total:7]

Section B (30 marks)

Answer three questions.

Question 10 is in the form of an Either/ Or question.

Only one part should be answered.

- 8 Clement carried out an experiment to investigate the effect of pepsin on egg whites.

6 test tubes were set up containing 10 cm^3 of egg white and 1 cm^3 of pepsin at a pH of 2. The 6 test tubes were then incubated in water baths of temperatures ranging from 10°C to 60°C . The time taken for the egg whites to turn clear was then recorded.

The experiment was repeated at a pH of 10.

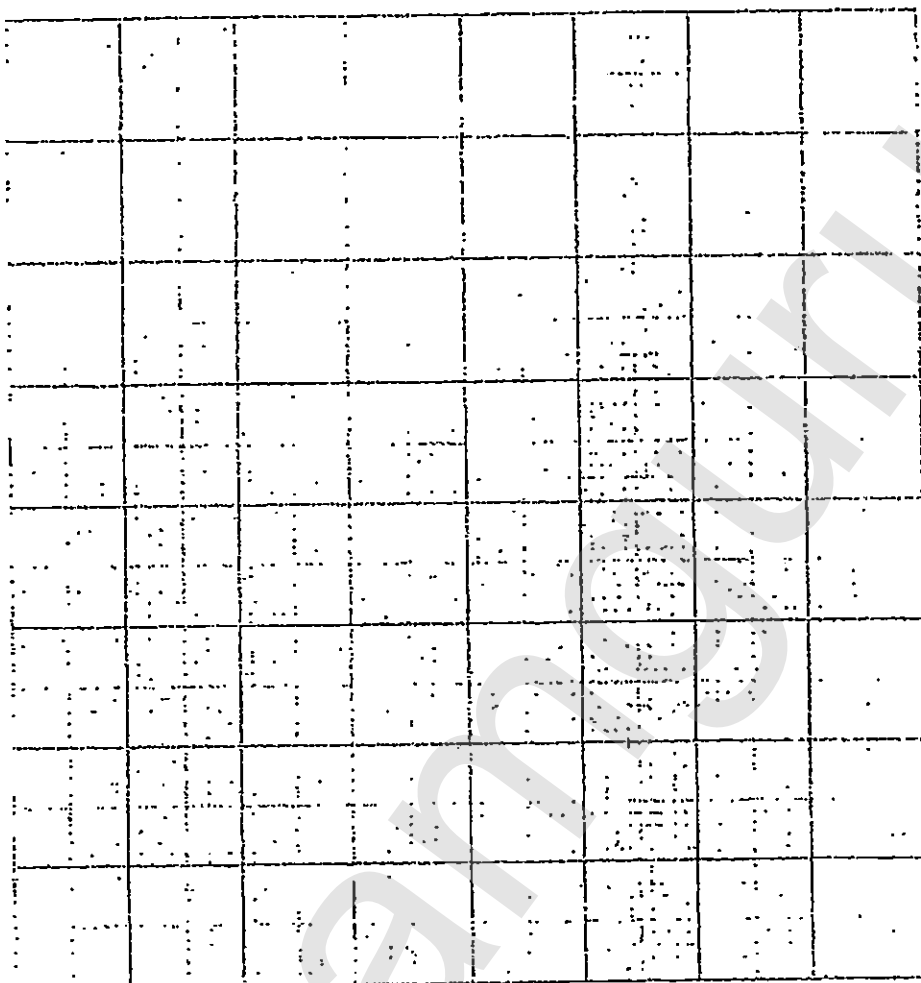
The results are shown in Table 8.1 below.

Temperature / $^\circ\text{C}$	Time taken for egg whites to clear / min	
	pH 2	pH 10
10	36	65
20	20	62
30	10	63
40	9	61
50	42	64
60	60	63

Table 8.1

- (a) Plot a graph of time taken for egg whites to clear against temperature at pH 2 and pH 10 on the grid provided.

[4]



(b) With reference to your graph, deduce the optimum temperature for pepsin.

[1]

(c) Explain the trends shown by the graphs at pH 2 and pH 10 between 10°C and 40°C.

[4]

- (d) Suggest how the results will differ if the experiment was repeated using intestinal protease instead of pepsin.

[1]

[Total:10]

- 9 Farmers have widely adopted the use of genetically modified (GM) crops in agriculture in recent years. Between 1996 and 2011, the total surface area of land cultivated with GM crops had increased hundredfold. GM crops offer many advantages over regular crops but there have been many concerns about the use of genetic engineering in food production.

- (a) Explain the term *Genetically Modified Organism*.

[2]

- (b) Describe two ethical and two social issues associated with genetic engineering with reference to a named example.

[4]

[The page contains several lines of faint, illegible text, likely bleed-through from the reverse side.]

10 Esther

- (a) Fig.10.1 shows a fetus developing inside the uterus.

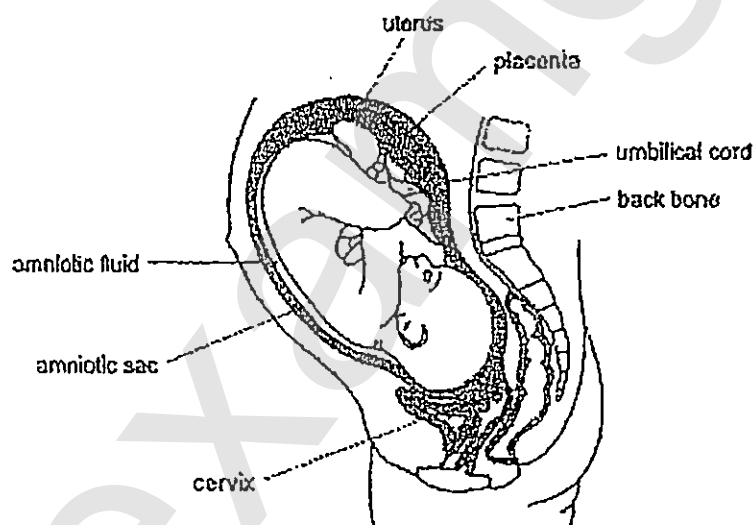


Fig 10.1

Describe how the structures named in Fig. 10.1 provide the following needs of the fetus.

Protection:

Excretion of metabolic waste:

 [3]

- (b) With reference to key structures and processes, describe what happens in the human body from the time of ovulation leading up to fertilisation.

.....

 [5]
 [Total:10]

10 OR

- (a) Describe two disadvantages of deforestation to the environment.

.....

 [4]

[3]

(c) Discuss reasons for the conservation of species in the management of fisheries.

[3]

(Total: 10)

- End of paper -

Settlers: Mr K Tan
Mdm N Kabir

Mark Scheme – Sec 4 Express Biology Prelim 2 2014

Paper 1: MCQs [40 marks]

Answer Key:

1	2	3	4	5
C	D	B	B	A

6	7	8	9	10
B	C	B	D	B

11	12	13	14	15
D	D	A	B	B

16	17	18	19	20
A	D	C	A	B

21	22	23	24	25
B	D	C	C	A

26	27	28	29	30
A	C	C	D	A

31	32	33	34	35
C	A	D	B	B

36	37	38	39	40
C	B	B	C	A

Answers to Paper 2

Section A [50 marks]

Q No.		
1(a)	$6\text{CO}_2 + 6\text{H}_2\text{O}$ (in the presence of light) $\rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$	[1]
(b)	Limited water; area; space; carbon dioxide	[2]
(c)	Both respiration + photosynthesis (occurring in jar); respiration releases CO_2 ; CO_2 released used for photosynthesis; photosynthesis, releases O_2 ; O_2 + used for respiration; ref. microorganisms / bacteria / fungi / decomposers + in soil	[2]
(d)	water from leaves/transpiration / water from soil evaporates; respiration + produces/releases water; returned to soil / condenses; absorbed / used by plants;	[2]
2(a)	O – phagocyte, P – capillary	[2]
(b)	Q releases antibodies in response to the bacteria; clumping Causes the bacteria to be harmless, O, has the ability to move to site of infection and engulf bacteria; phagocytosis	[3]
(c)	action of platelets and damaged cells release thrombin activates fibrin formation; traps red blood cell $\rightarrow$ stops bleeding scab formation, prevents further entry of bacteria	[2]
3(b)	Breakdown of food substances to release less energy in the absence of oxygen	[1]
(c)	Glycogen is broken down, increasing glucose concentration; To increase rate of respiration to meet increased energy demand	[2]
(d)	From 10 to 20 min, oxygen supply exceeds oxygen demand/surplus of oxygen/ oxygen debt is repaid; lactic acid is increasingly removed from cells and transported to the liver;	[3]

	and converted into glucose, decreasing lactic acid concentration			
4(a)	Cell	Type of cell division	Stage	[2]
	Cell A	Meiosis	Metaphase I	
	Cell B	Mitosis	Metaphase	
(b)	Separation of chromatids; Chromatids showed crossing over			[2]
(c)	Mutation in cell A results in variation in gametes and subsequently offspring; While mutations in cell B only affects that organism and do not affect future offspring			[2]
5(a)(i)	R: Restriction enzyme S: DNA ligase			[2]
(a)(ii)	Using the same restriction enzyme will produce sticky ends that are complementary to the sticky ends on the plasmid			[1]
(a)(iii)	It acts as a vector to carry the human insulin gene into the bacterium			[1]
(b)(i)	UAC CGG GAC ACC UAC			[1]
(b)(ii)	Bacterial strain used must be able to readily grow in a fermenter; Provide nutrients necessary for rapid cell growth : carbon & energy sources; Maintain optimum temperature and oxygen content			[3]
(b)(iii)	Insulin stimulates liver, to convert excess glucose to glycogen; Decreasing blood glucose levels back to normal levels			[3]
6(a)	Level 1 – producer, Level 2 - herbivore, Level 3 - carnivore			[1]
(b)	10 000kJ			[1]
(c)	photosynthesis			[1]
(d)	90 % of energy is lost up a food chain as heat; Only 10% of energy is transferred to the next consumer in the food chain/ made available; diminishing energy (AW) 1 000 000kJ available energy from the Sun, results in only 20kJ at the 4 th trophic level – eventually all energy is lost to the abiotic environment , hence cannot be re-enter the biotic environment			[2]

7(a)	Organisms lower in the food chain are larger in numbers to supply food for larger organism up the trophic level; Greater survival value	[2]
7(b)	greater predation by owls / more predators / more owls; lack of food / starvation / more competition for food ; adverse (named) weather condition (s) ; disease / sickness / illness; emigration	[3]
7(b)	1. owl population increases, after vole population increases ; 2. owl population decrease sharply (in year 7) ; 3.immediately after steep decrease in vole population ; 4.vole population decreases sharply (in year 6) ; 5.when there are most owls ; 6.if owls ate (much) other prey there would not be a close relationship / AW ; 7 ref to numbers of owls from the graph ;	[2]

Section B [30 marks]

Q No.	Answers	
8(c)	Pepsin works best in an acidic environment and is denatured at pH 10, temperature does not affect enzyme activity; At pH 2, as temperature increases below optimum, kinetic energy of molecules increase; substrate and enzyme molecules collide with each other more often; This increases the rate of formation of enzyme-substrate complex and an increased rate of reaction	[4]
8(d)	The results for pH 2 will show the results currently obtained for pH 10 while results for pH 10 will show the results currently obtained for pH 2	[1]
9(a)	Organism that had genes transferred from another organism; And which can express the transferred gene combinations of genes cannot occur in nature or in traditional crossbreeding	[2]
(b)	New proteins in GM food; might cause allergies in humans that consume them GM food may prove to be toxic or cancer-causing to people; Modifying a single gene in plants could result in the alteration of some metabolic processes within the plant. The resulting deaths of useful insects, like the honey bee, that feed on the nectar of GM crop plants;	

	may result in a loss of biodiversity Some biotechnology companies have engineered crop plants that produce seeds that cannot germinate; farmers have to buy special seeds from these companies every year There are objections to consuming animal genes in plants or vice versa; Vegetarians may object to the transfer to animal genes into crop plants Genes that code for antibiotic resistance may be used in genetic engineering; such genes might accidentally be incorporated into bacteria that cause diseases to humans	[4]
(c)	Analyse different plants and select plants that show the desirable traits; Let these plants self-fertilise or cross them with plants showing the same desired traits; select those with desirable traits and use them again as parents for the next few generations or cross different varieties of plants with different desirable qualities; Screen for plants with the desirable combination of genes from the two parental varieties; Propagate desired plant by vegetative means / repeat hybridisation process	[4]
Either		
10		
(a)	(amnion / uterus / amniotic fluid) 1. provides protection against, mechanical damage ; 2. provides sterile environment / no entry of pathogens ; 3. placenta provides a barrier to (named) pathogen(s) placenta prevents mixing of blood between fetus and mother excretion of metabolic waste across placenta / through placenta ; diffusion of, urea / carbon dioxide ; from fetal blood to mother's blood / into mother's blood ; nutrients / excretion umbilical cord transports, nutrients / excretory products ;	[5]
(b)	Position of ovum (fallopian tube); Time frame; Sperm swimming up through cervix to womb to fallopian tube Fusion of nuclei of ovum and sperm; Diploid zygote	[5]

OR		
10(a)	soil erosion / washed / blown ; loss of humus in soil ; desertification / ref. less rainfall / less transpiration ; leaching / flooding / loss of soil fertility ; loss of species / habitats / qualified effect on food chains ; loss of livelihood / resources / agricultural effects ; global warming / CO2 increase / climate change	[4]
(b)	insecticides + specific undesirable effect ; fertilisers / sewage / domestic or nitrogenous waste + specific undesirable effect ; heavy metal / inorganic, chemical or radioactive waste + specific undesirable effect ; gases from factories, car exhaust or fossil fuel / SO2 / + specific undesirable effect ; CFCs / CO2 / methane / CO + specific effect ; oil (spillage) + effect on wildlife ; litter / rubbish / noise / light + effect ;	[3]
(c)	Ensure livelihood of farmers (commercial value); Medical (research for drugs; Maintaining a stable and balance ecosystem; Maintenance of a large gene pool to increase variety	[3]