



Geylang Methodist School (Secondary) Preliminary Examination 2018

SCIENCE (CHEMISTRY/BIOLOGY)
Paper 1

5078/1
Sec 4E/5N

Additional materials : Optical Answer sheet (OAS)

1 hour

Setter : Iskandar
Ms Lam Yuit Kwai

18 Aug 2018

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid on the Optical Answer Sheet.

Write your name, class and index number on the Optical Answer Sheet provided.

There are **forty** questions in this paper. Answer all the 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.

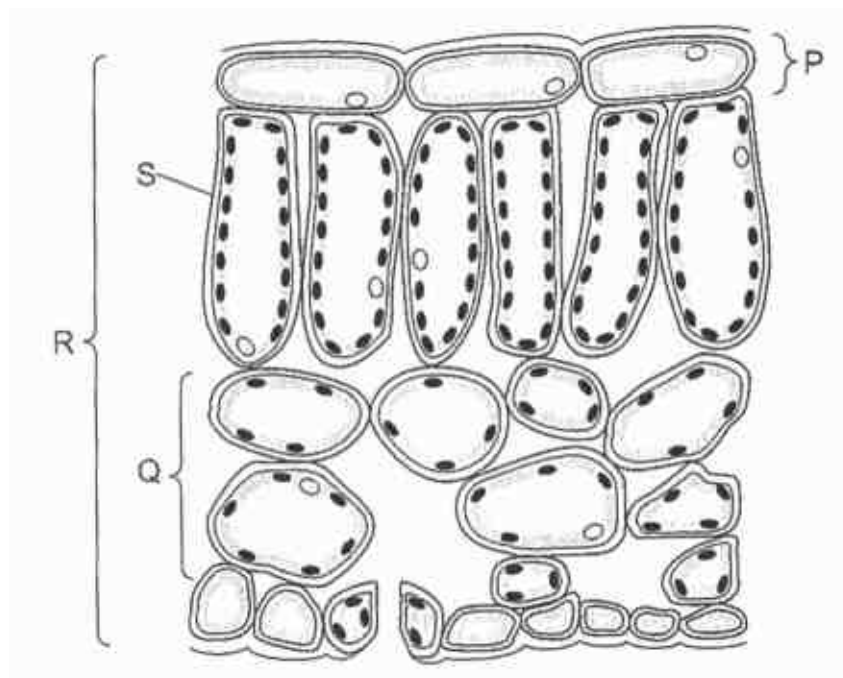
Each correct answer will score one mark. No mark will be deducted for a wrong answer.

Any rough work should be done in this booklet.

A copy of the periodic table is printed on page 24.

Section A

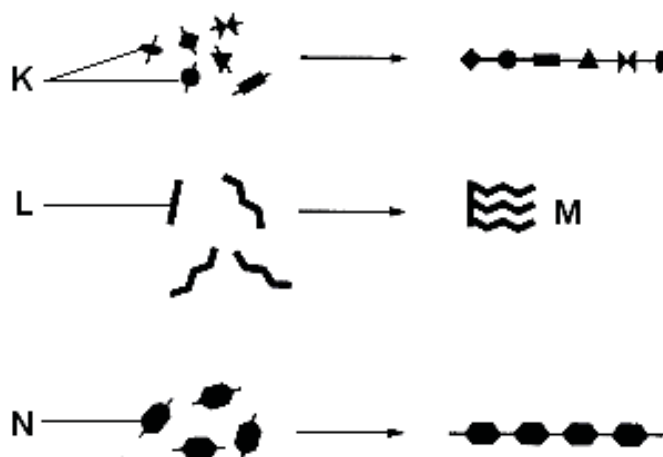
- 21 The diagram shows a section through a leaf.



Which of the following correctly identifies an organ and a tissue?

	organ	tissue
A	P	R
B	Q	S
C	R	P
D	S	Q

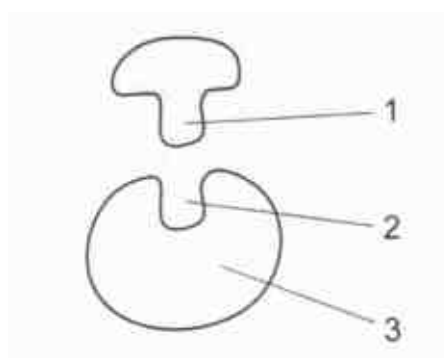
- 22** The diagram shows some chemical molecules found in the human body and how they join to form larger molecules.



Which of the following correctly identifies molecules **K**, **L**, **M** and **N**?

	K	L	M	N
A	amino acid	glycerol	fat	glucose
B	protein	glycerol	fatty acid	starch
C	maltose	fat	glycerol	cellulose
D	fatty acid	amino acid	starch	glucose

- 23** The diagram illustrates the 'lock and key' hypothesis of enzyme action.

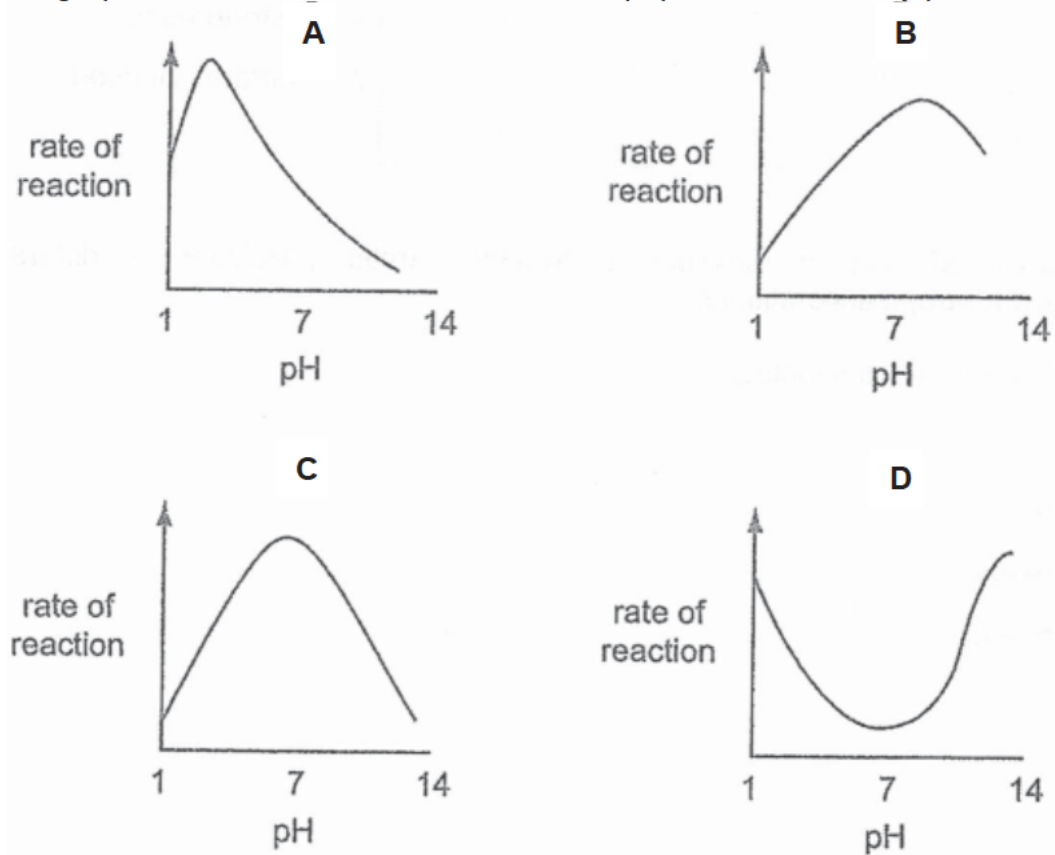


Which of the following correctly identifies the enzyme, the active site and the substrate?

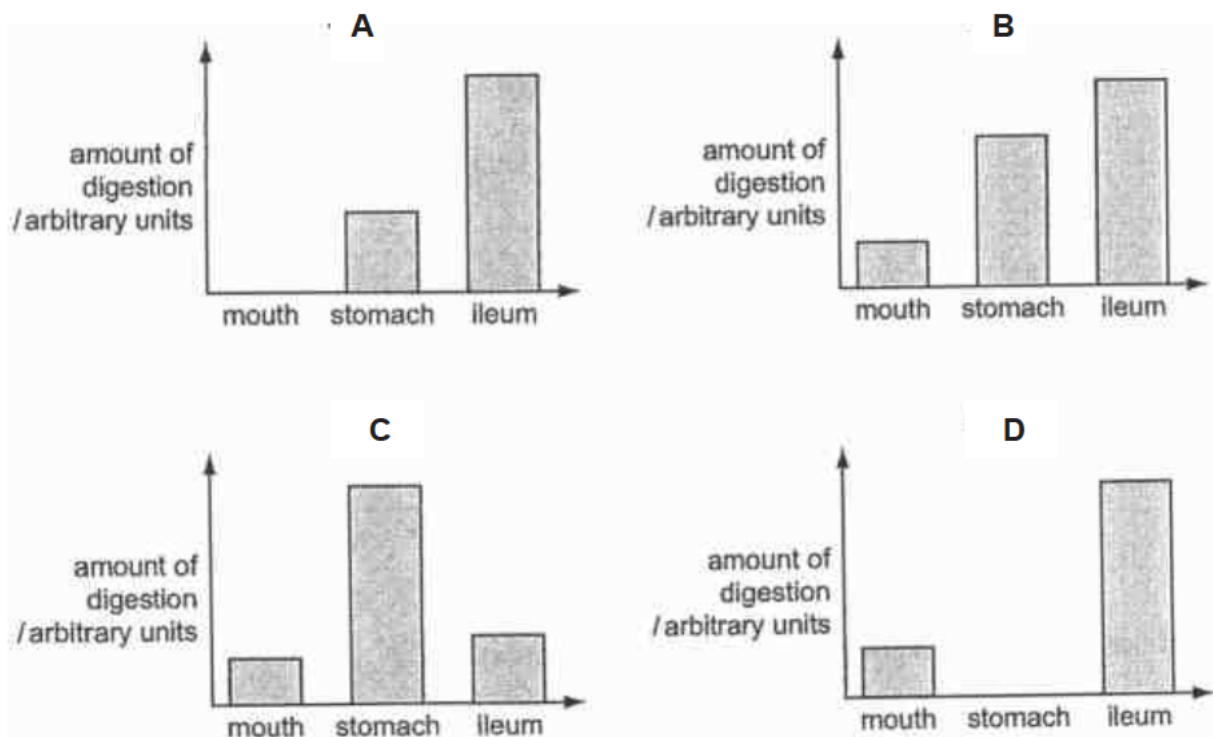
	enzyme	active site	substrate
A	1	2	3
B	1	3	2
C	3	1	2
D	3	2	1

- 24 Pepsin is an enzyme that is active in the human stomach.

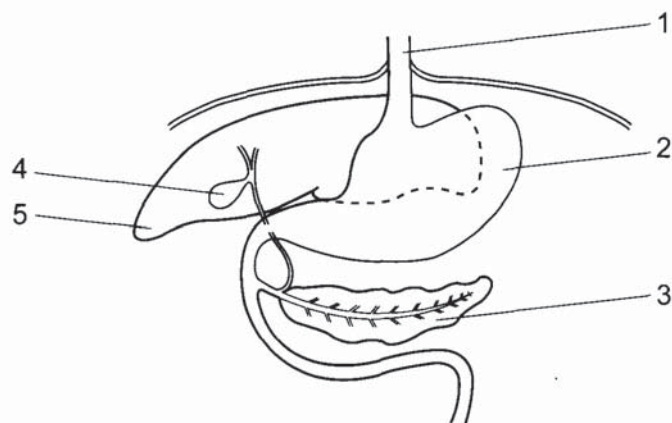
Which graph shows how the rate of reaction of pepsin is affected by pH?



- 25 Which bar chart represents the amount of starch digested in the mouth, stomach and ileum of a human?



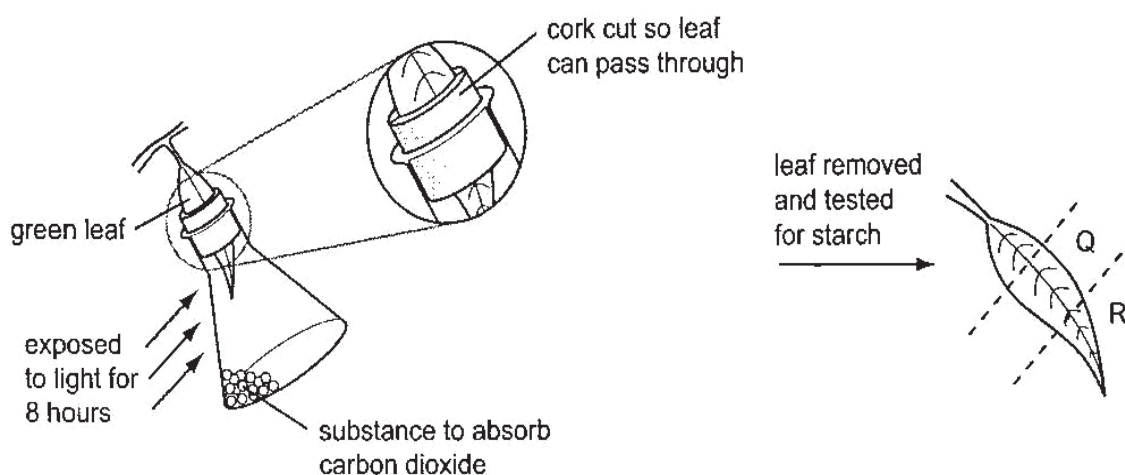
- 26 The diagram shows part of the human alimentary canal.



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

- A** 1 and 4
B 3 and 5
C 2 and 3
D 4 and 5
- 27 A plant is kept in the dark for two days.

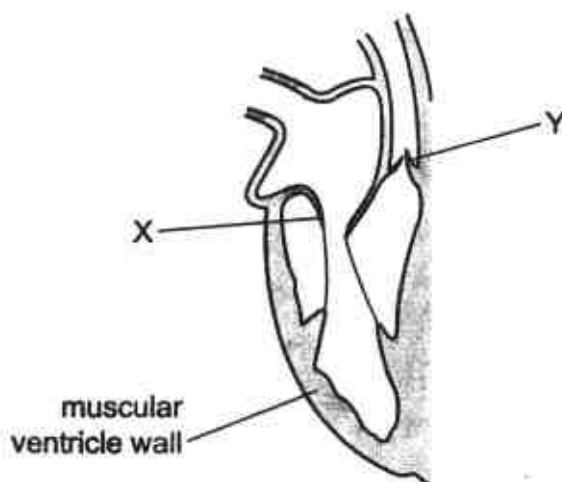
A leaf is used in an experiment to investigate the effect of two factors on photosynthesis, as shown in the diagram.



What are the colours of **Q** and **R**, when the leaf is tested for starch?

	Q	R
A	brown	brown
B	brown	blue-black
C	blue-black	brown
D	blue-black	blue-black

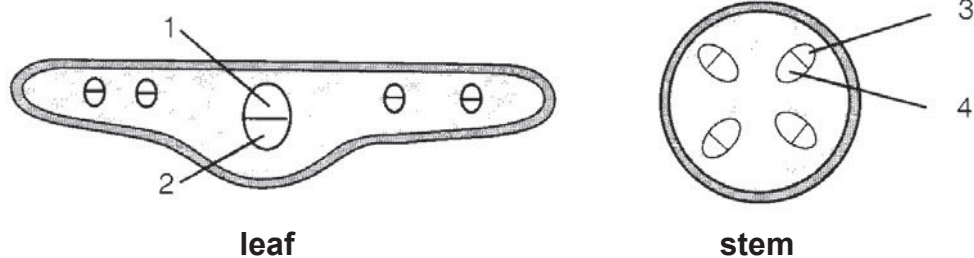
- 28** The diagram shows the right-hand side of the human heart when the ventricle is relaxed.



Which row correctly describes the position of the valves X and Y when the ventricle contracts?

	valve at X	valve at Y
A	closed	closed
B	closed	open
C	open	closed
D	open	open

- 29** A shoot is placed in a beaker of red coloured water for 3 hours.
The diagrams show transverse sections of a leaf and stem of the shoot.

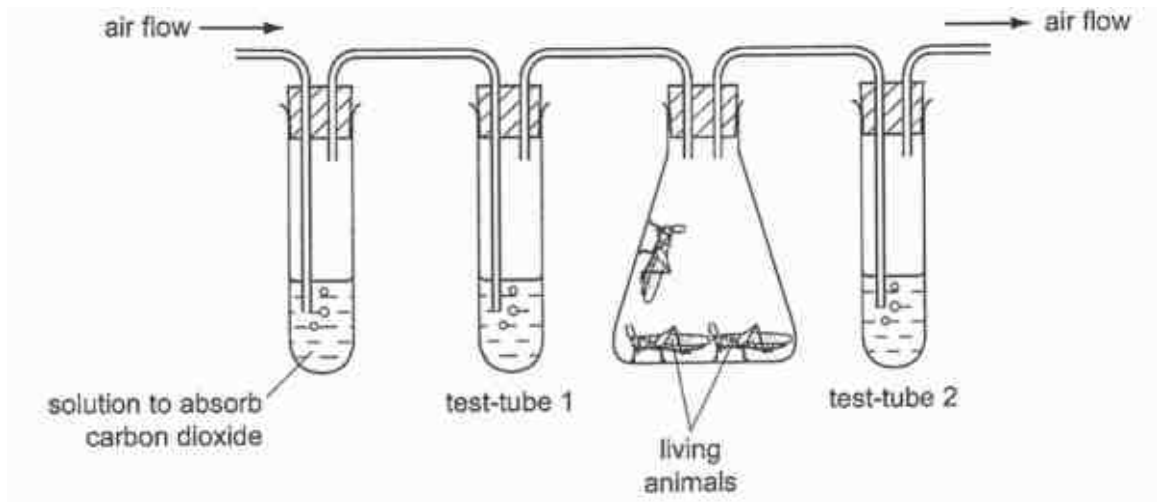


Which regions, 1 – 4, will be stained red after three hours?

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

- 30** An experiment is set up as shown.

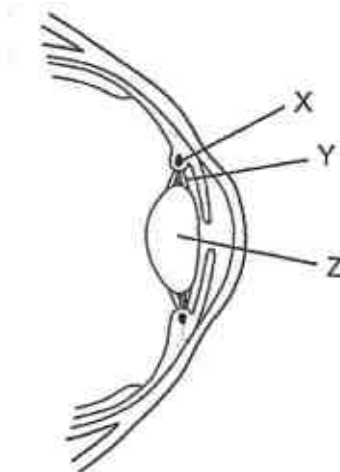
Test-tubes 1 and 2 contain limewater. Limewater is a clear solution that turns cloudy in the presence of carbon dioxide. Air is pumped through the apparatus.



What is the appearance of the limewater in test-tubes 1 and 2 after a period of ten minutes?

	test-tube 1	test-tube 2
A	clear	clear
B	clear	cloudy
C	cloudy	clear
D	cloudy	cloudy

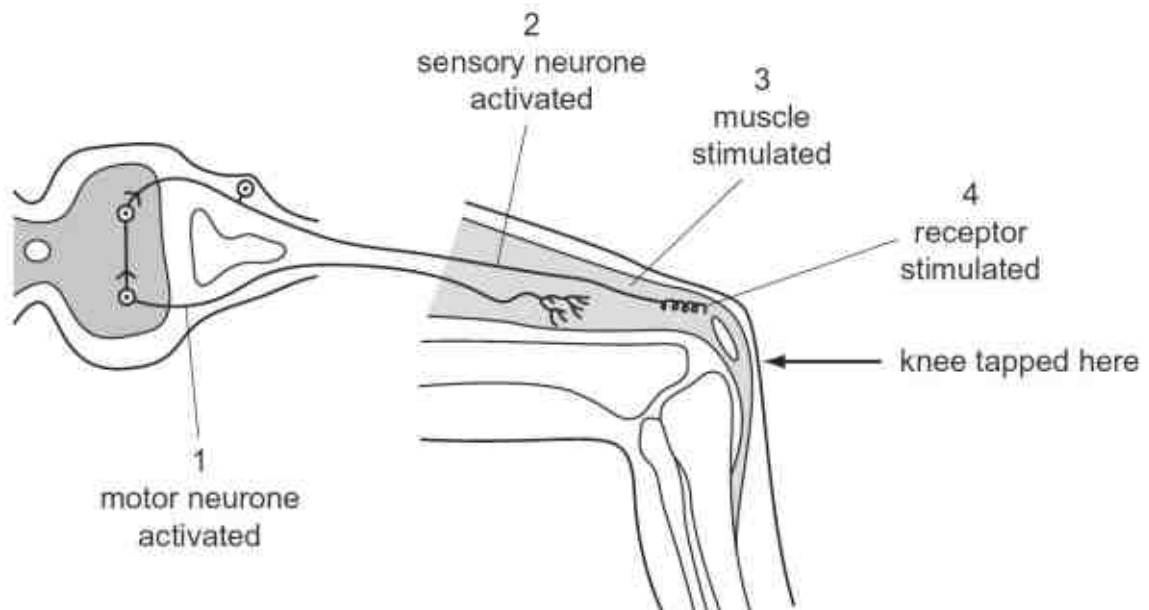
- 31** The diagram shows a section through part of the eye.



What happens to parts X, Y and Z when the eye focuses on a near object?

	X	Y	Z
A	contracts	tight	less convex
B	contracts	slack	more convex
C	relaxes	tight	less convex
D	relaxes	slack	more convex

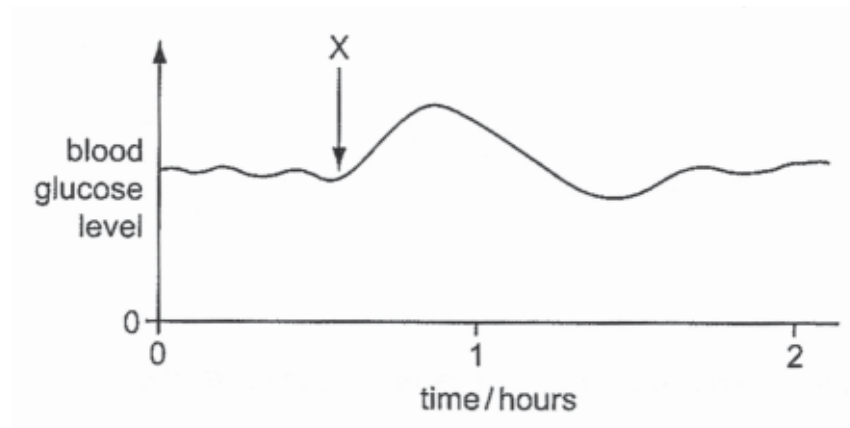
- 32 The diagram shows a simple knee-jerk reflex.



What is the correct order of events after the knee is tapped?

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

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

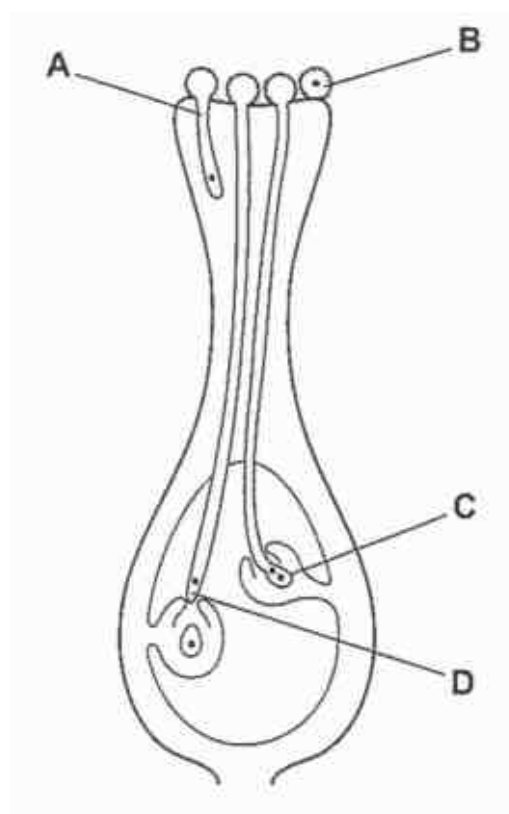


What explains the shape of the graph after X?

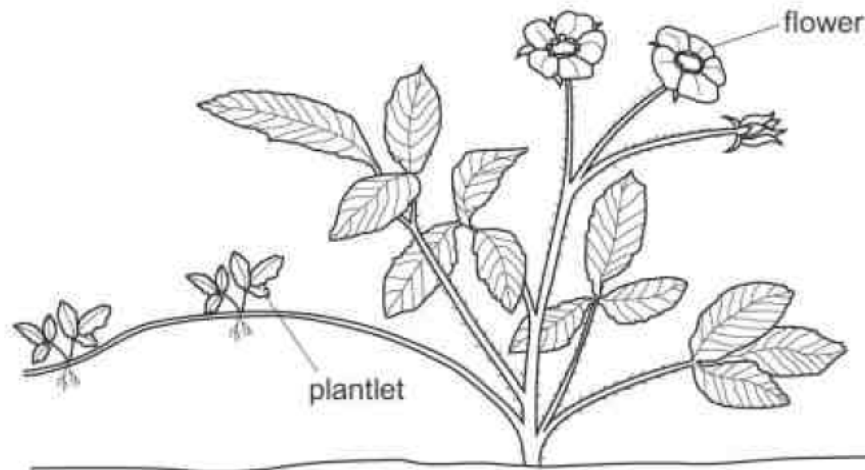
- A** The person has eaten a jam sandwich.
- B** The person has had an insulin injection.
- C** The person is running a marathon.
- D** The person is suffering from a condition in which insulin is lacking.

- 34** The diagram shows the stigma, style and ovary of a flower.

Where does fertilisation take place?

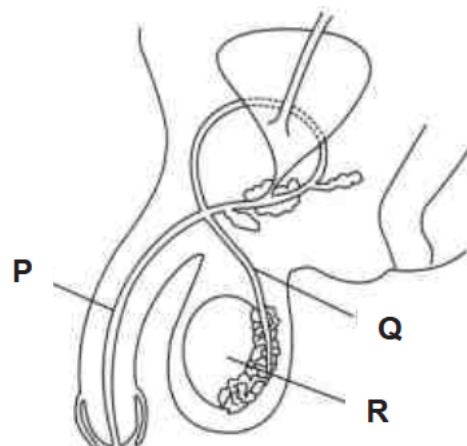


- 35 The diagram shows a plant that is producing small plantlets.



Which statement about the plantlets is correct?

- A They are genetically identical to the parent plant.
 - B They are genetically different from the parent plant.
 - C They are produced by seeds formed in the fruit while attached to the plant.
 - D They are produced as a result of the fusion of nuclei.
- 36 The diagram shows part of the human male reproductive system.

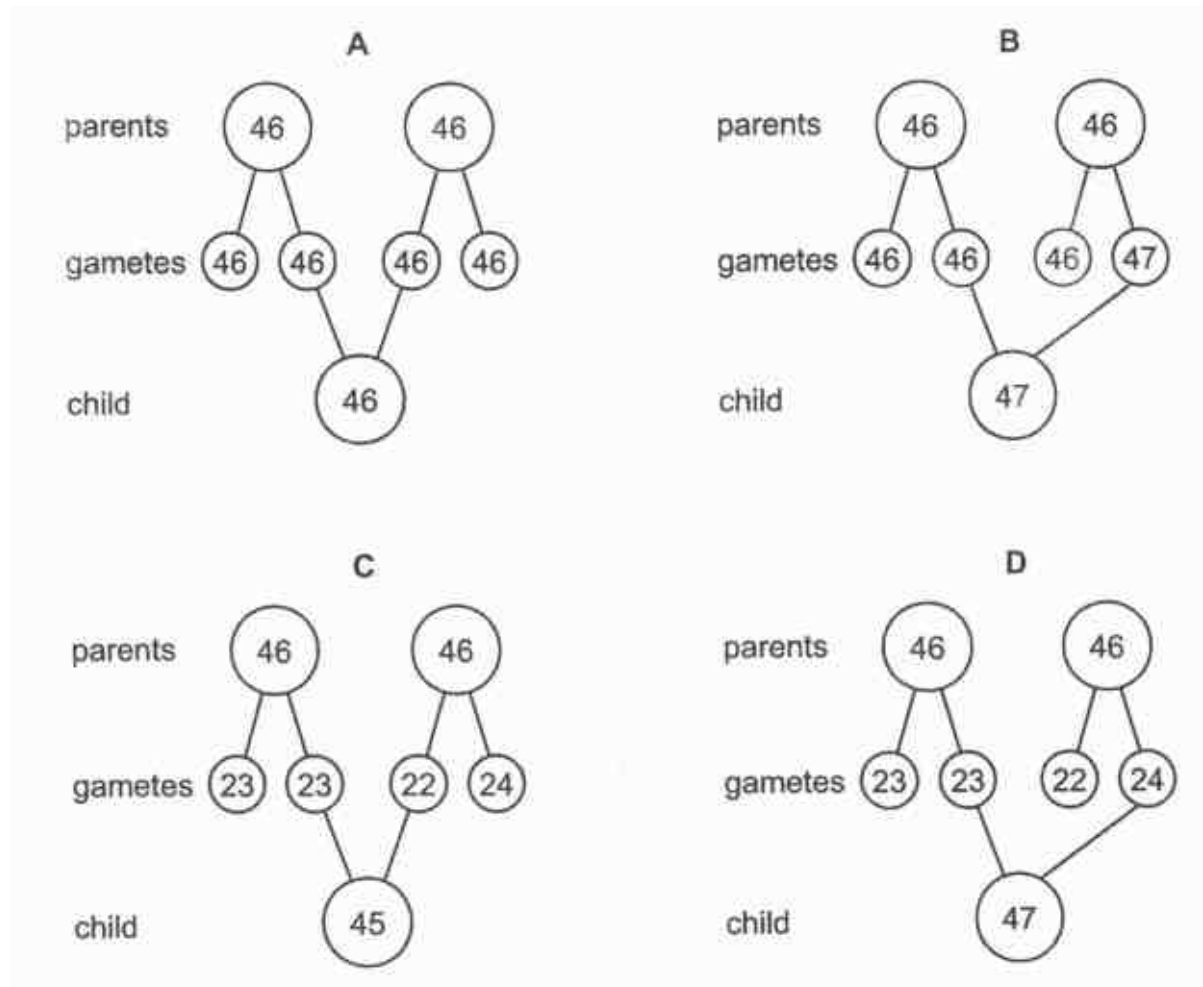


What are the structures **P**, **Q** and **R**?

	P	Q	R
A	sperm duct	urethra	testis
B	sperm duct	testis	urethra
C	urethra	testis	sperm duct
D	urethra	sperm duct	testis

- 37 A Down's Syndrome child is born.

Which diagram shows the correct number of chromosomes in the cells of the parents, in their gametes and in the cells of their child with Down's Syndrome?



- 38 In mice, the allele for long fur is dominant and the allele for short fur is recessive.

Several heterozygous mice with long fur were mated with several mice with short fur. For every 100 offspring, how many should be predicted to have short fur?

- A 25
- B 50
- C 75
- D 100

Group									
I	II		III	IV	V	VI	VII	0	
		1 H Hydrogen 1						4 He Helium 2	

7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	86 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	209 Po Polonium 84	209 At Astatine 85	209 Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89	+														

*58-71 Lanthanoid series
+90-103 Actinoid series

Key

a	X	b
---	---	---

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

140	Ce Cerium	141	Pr Praseodymium	144	Nd Neodymium	150	Sm Samarium	152	Eu Europium	157	Gd Gadolinium	159	Tb Terbium	162	Dy Dysprosium	165	Ho Holmium	167	Er Erbium	169	Tm Thulium	173	Yb Ytterbium	175	Lu Lutetium
232	Th Thorium		Pa Protactinium	238	U Uranium		Pu Plutonium		Am Americium		Cm Curium		Bk Berkelium		Cf Californium		Es Einsteinium		Fm Fermium		Md Mendelevium		No Nobelium		Lr Lawrencium
58		59		60		61		62		63		64		65		66		67		68		69		70	71
90		91		92		93		94		95		96		97		98		99		100		101		102	103

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).



Geylang Methodist School (Secondary) Preliminary Examination 2018

Candidate
Name

Class

Index Number

SCIENCE

5078/04

Paper 4 Biology

Sec 4 Express
Sec 5 Normal (A)

Additional materials : Writing paper

1 hour 15 minutes

Setter : Ms Lam Yuit Kwai

20 Aug 2018

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 on both sides of the paper.

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

Section A (45 marks)

Answer **all** the questions.

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

Section B (20 marks)

Answer any **two** questions.

Write your answers in the spaces provided on the question paper and the question no. you have attempted in the box on the right side of this page.

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

For Markers' Use	
Section A	45
Section B	
	10
	10
TOTAL	65

This question paper consists of **16** printed pages.

[[Turn over

Section A

Answer **all** the questions in the spaces provided.

- 1 A student cut six pieces of potato and weighed each one.
 He placed each piece of potato in a different concentration of sugar solution for 60 minutes.
 He then re-weighed each piece of potato.
 He worked out the change in mass for each piece as a percentage of the original mass.
 His results are shown in Table 1.1.

Table 1.1

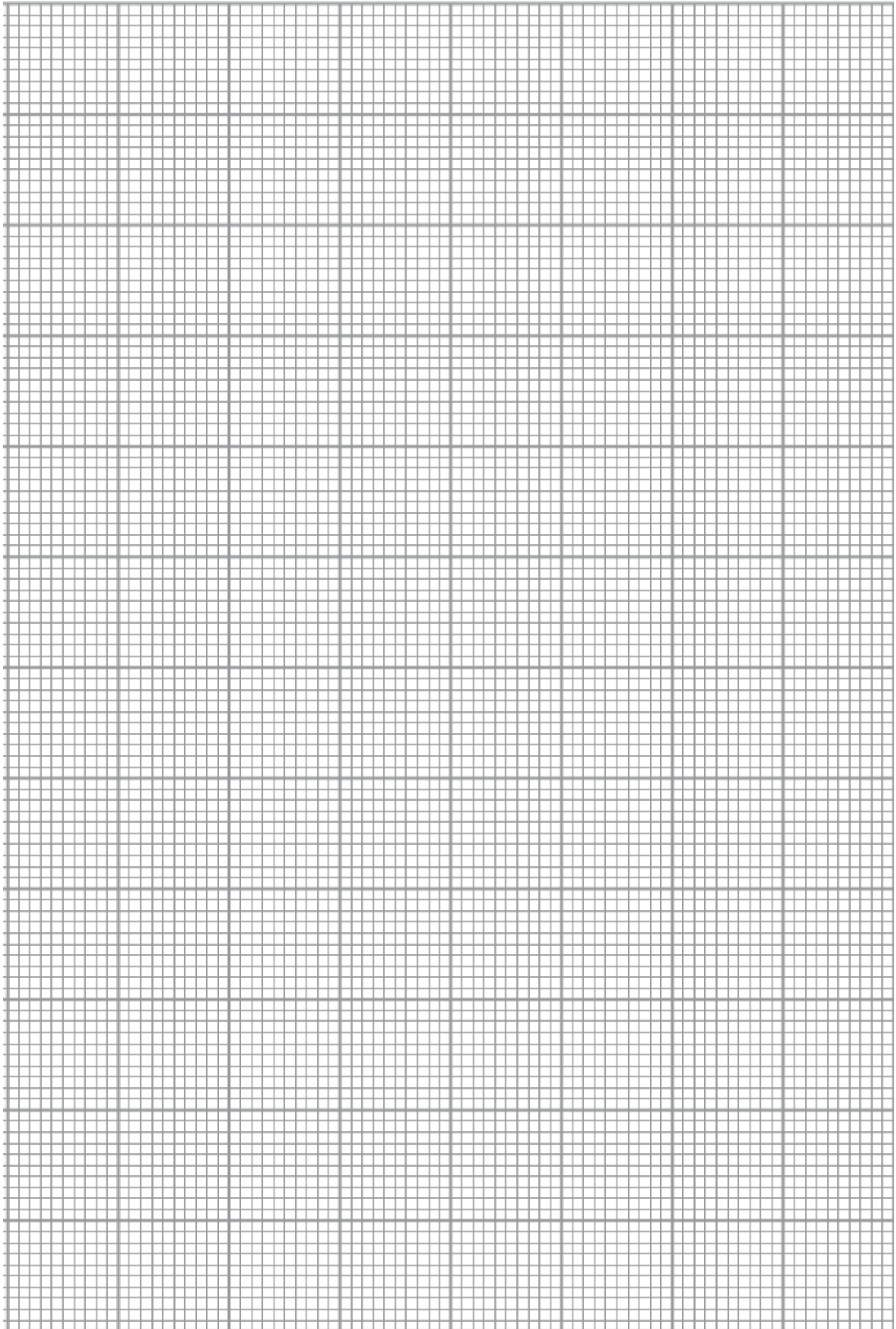
concentration of sugar solution / mol per dm ³	mass of potato / g		percentage change in mass / %
	start	finish	
0.20	8.42	9.18	+9.0
0.30	8.15	8.68	+6.5
0.40	8.30	8.48	+2.2
0.50	8.62	8.31	-3.6
0.60	8.38	7.83	-6.6
0.70	8.22	7.53	

- (a) Calculate the percentage change in mass for the sugar concentration of 0.70 mol per dm³.

percentage change in mass = _____ % [2]

- (b) On the grid provided on the next page, plot the graph of percentage change in mass against concentration of sugar solution. Use the results in **Table 1.1** and your answer to (a).

On your graph, use appropriate scales, label the axes and draw a line of best-fit. [4]



- (c) (i) Use your graph to suggest a concentration for the cell sap in the potato.

_____ mol per dm³ [1]

- (ii) Explain your answer to (c)(i).

[2]

- 2 Fig. 2.1 shows the human respiratory system.

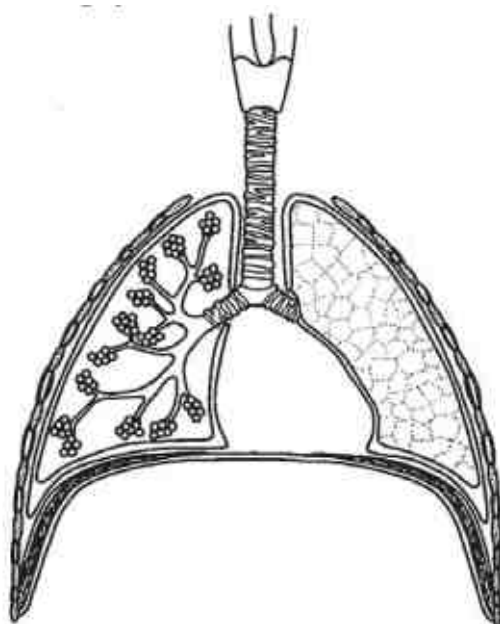


Fig. 2.1

- (a) Add labels to the diagram to show the trachea, a bronchiole and some alveoli.

[3]

- (b) At the exchange surface of the alveoli, oxygen travels from the air to the blood.

Explain how the structure of the alveoli aids the rapid transfer of oxygen at this surface.

[3]

- (c) Smoking cigarettes can have serious effects on health.

- (i) Name **three** major toxic compounds of tobacco smoke.

1. _____

2. _____

3. _____

[3]

- (ii) Suggest **two** ways that smoking cigarettes may affect the health of the lungs.

[2]

- 3 Fig. 3.1 and F3.2 show two frontal views of an eye under different lighting conditions.



Fig. 3.1



Fig. 3.2

- (a) On Fig. 3.1, use label lines to identify the following structures

(i) iris [1]

(ii) pupil [1]

- (b) Suggest how the change in the eye from Fig. 3.1 to Fig. 3.2 is brought about.

[3]

- 4 Haemochromatosis is an inherited disorder that results in an accumulation (build up) of iron in the liver. It is inherited as a recessive allele.

Fig. 4.1 shows how haemochromatosis was inherited in one family.

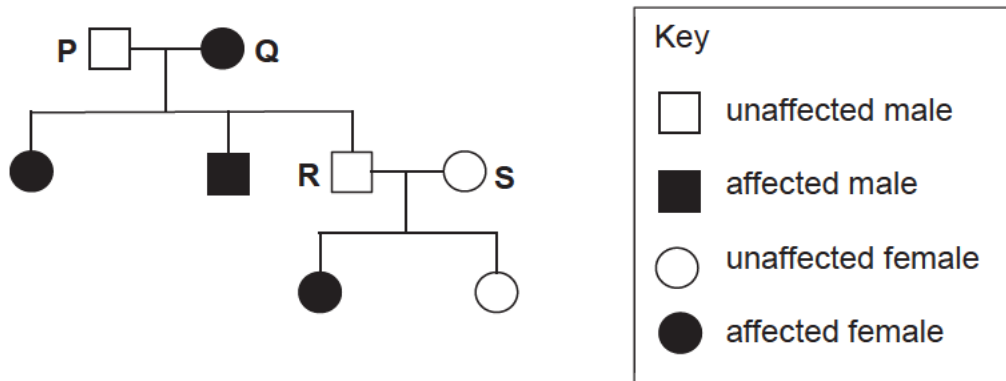


Fig. 4.1

In answers to this question, use **H** to represent the normal allele and **h** to represent the recessive allele.

- (a) (i) What is the genotype of parent **P**? _____ [1]
- (ii) What is the genotype of parent **Q**? _____ [1]
- (b) Parents **R** and **S** have a third child. What is the chance that this child has haemochromatosis?

Use the Punnett square to work out your answer.

		father R	
mother S			

Chance of the child having the disorder = _____ [3]

5 Fig. 5.1 below shows a section of a DNA molecule.

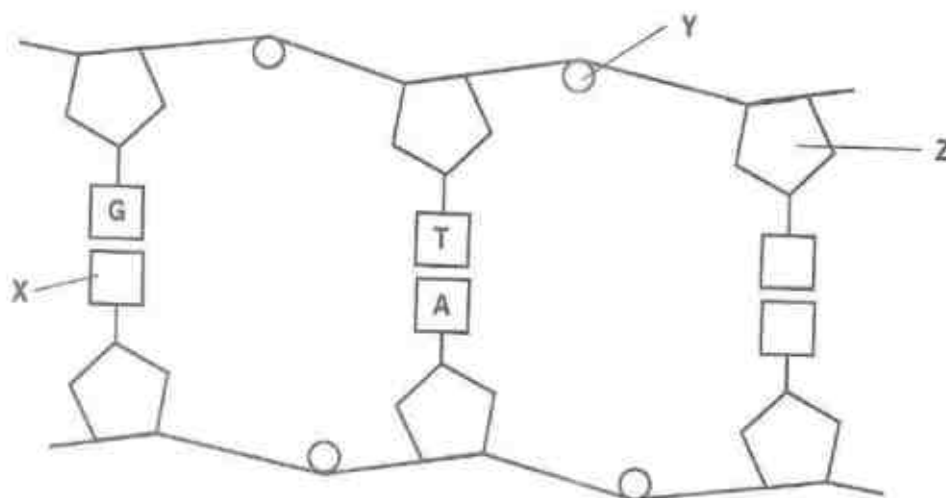


Fig. 5.1

(a) (i) Name the parts labelled **X**, **Y** and **Z**.

X : _____

Y : _____

Z : _____

[3]

(ii) Draw a circle around the components which make up **one** nucleotide on Fig. 5.1.

[1]

(b) Table 5.1 shows the percentage composition of bases in the DNA of rat. Complete the table.

Table 5.1

organism	% A	% C	% G	% T
rat	28			

[2]

6 Fig 6.1 shows a food web in a habitat.

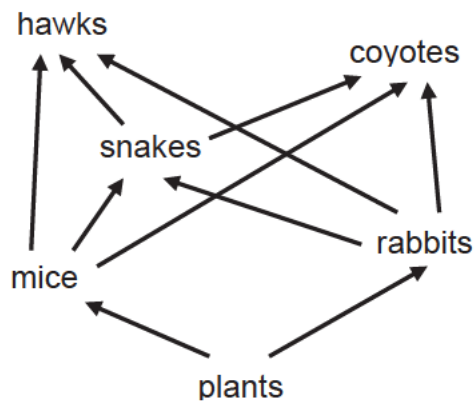


Fig. 6.1

(a) From this food web, name

(i) a herbivore,

_____ [1]

(ii) a carnivore

_____ [1]

(b) The disease myxomatosis kills most of the rabbits in this habitat. Predict and explain **one** significant impact this has on the food web.

 _____ [2]

(c) (i) From the food web in Fig. 6.1, construct a food chain with four trophic levels.

[1]

- (ii) Sketch a fully labelled pyramid of number for the food chain you have constructed in (i)

[2]

- (d) Suggest why food chains generally do not have more than four trophic levels.

[2]

Section B

Answer **two** questions from this section.
Write your answers in the spaces provided.

- 7 Fig. 7.1 shows the carbon cycle.

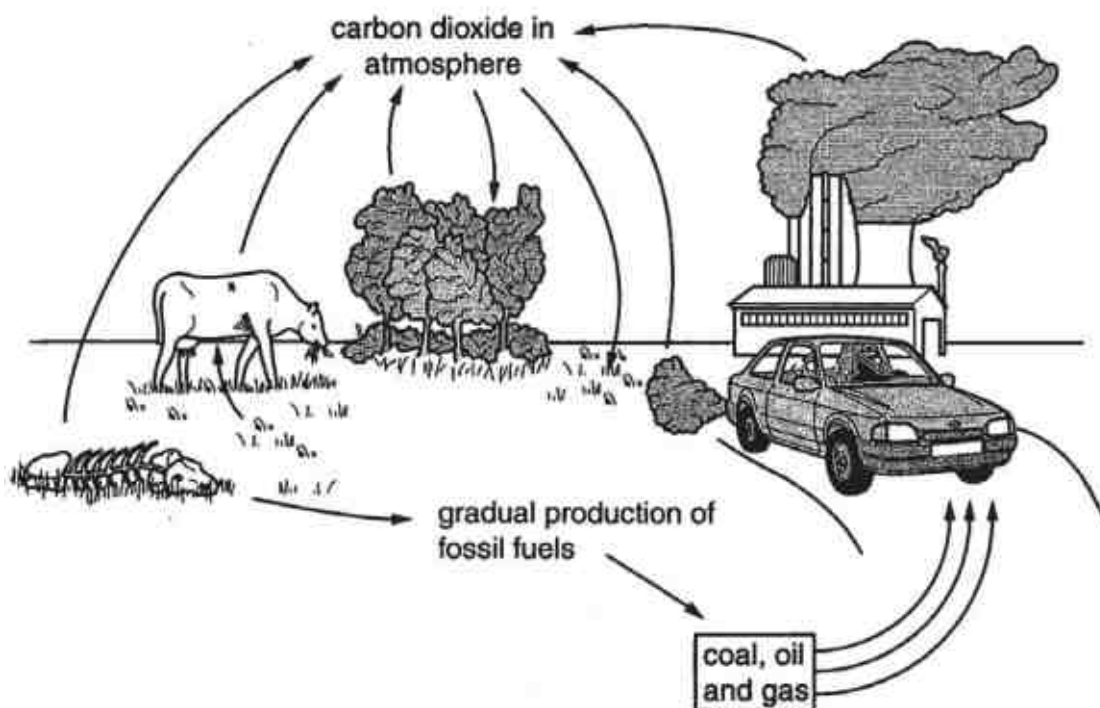


Fig. 7.1

- (a) With reference to Fig. 7.1, explain how photosynthesis, respiration and animal nutrition are involved in the carbon cycle.

[6]

- (b)** Burning of fossil fuels and destruction of the world's forests are both increasing.

Predict and explain what effect these increases will have on the carbon cycle.

[4]

- 8 Fig. 8.1 shows the thickness of the uterus lining changes during a woman's menstrual cycle. Fig. 8.2 shows how concentrations of the hormones oestrogen and progesterone change during the same cycle.

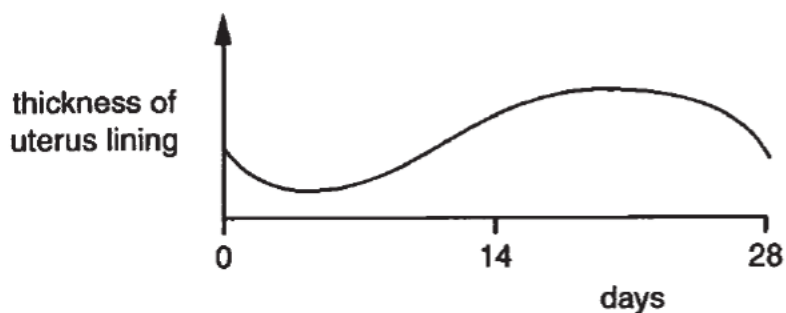


Fig. 8.1

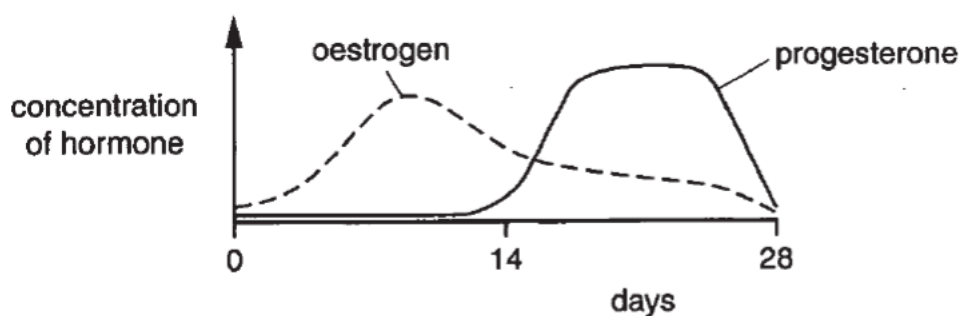


Fig. 8.2

- (a) Describe how the lining of the uterus changes from day 0 to day 28 of the menstrual cycle. Include in your description how the hormones oestrogen and progesterone affect the uterus lining during the menstrual cycle.

[6]

[6]

- (b) (i) Suggest and explain what differences you would expect in Fig. 8.1 and Fig. 8.2 if an egg is fertilised during the cycle.

[2]

- (ii) Explain why the woman's whole menstrual cycle is made up of fertile and non-fertile phases. Include which days are the fertile phase for this woman's cycle in your answer.

[2]

- 9 (a)** Describe **three** differences between a typical plant cell and a typical animal cell. Suggest how each difference is essential to the survival of the plant.

[illegible]

- (b)** Suggest how the differences between a red blood cell and a typical animal cell are related to the function of the red blood cell.

[4]

End of Paper

Geylang Methodist School Secondary
Preliminary Exam 2018
Science (Biology) Papers 1 and 4
Sec 4E/5NA

MARKING SCHEME

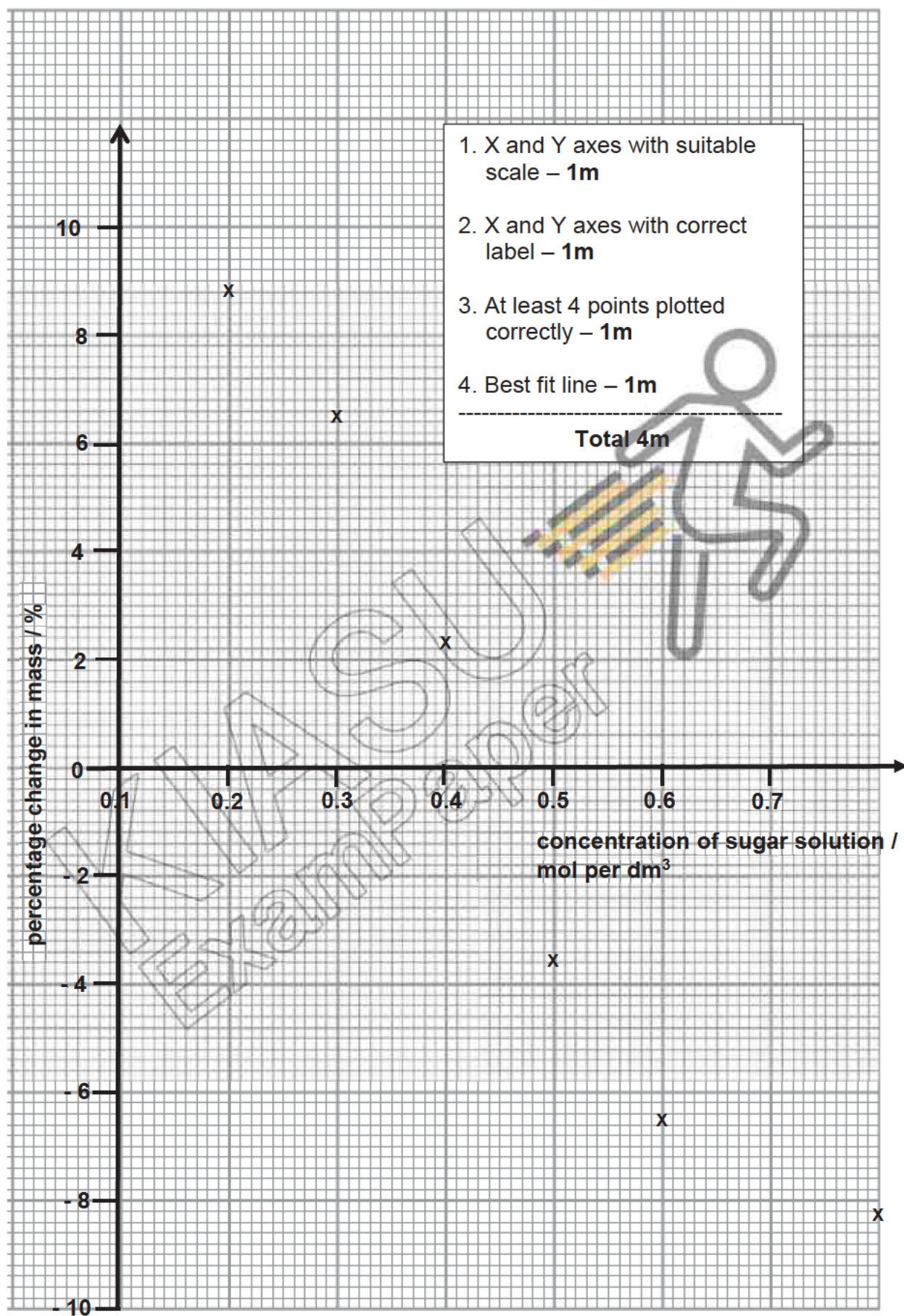
Paper 1 (Biology Section – Q21 to Q40))

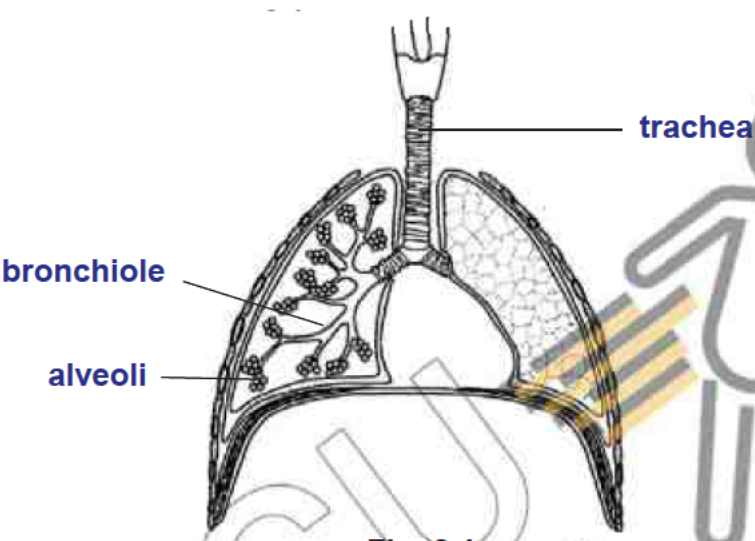
Qn No.	21	22	23	24	25	26	27	28	29	30
<u>Ans</u>	C	A	D	A	D	B	A	B	C	B

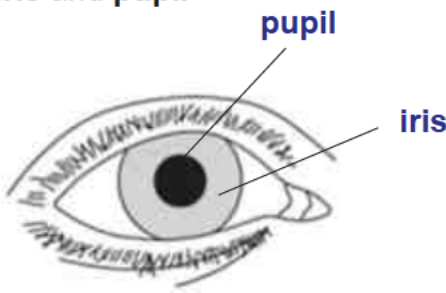
Qn No.	31	32	33	34	35	36	37	38	39	40
Ans	B	C	A	C	A	D	D	B	A	A

Paper 4 (Biology)

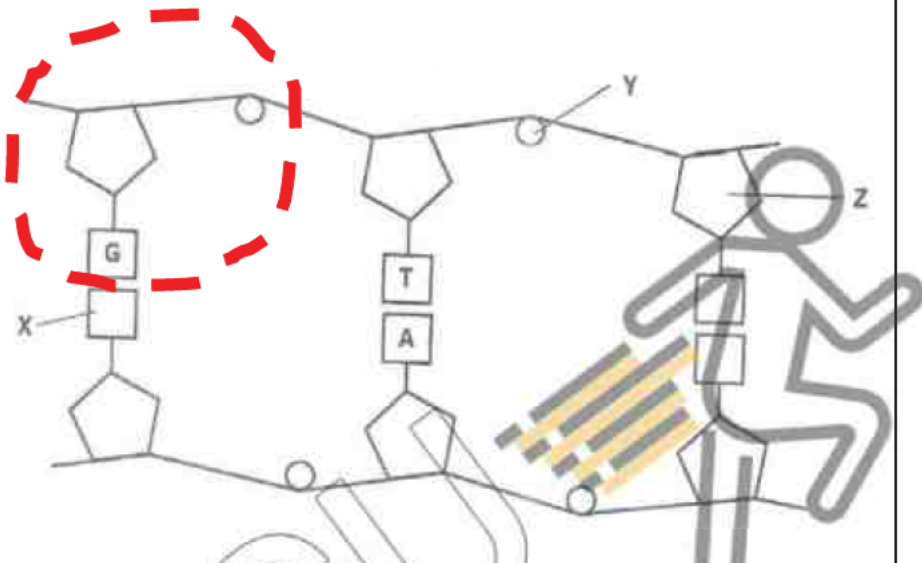
<u>Section A</u>		
Qn. No	Answers	Marks
1 (a)	$\frac{(7.53 - 8.22)}{8.22} \times 100\%$ % change in mass = - 8.4%	1m
1 (b)	See graph on next page. Correctly labelled X-axis and scale Correctly labelled Y-axis and scale At least 4 out of 6 correctly marked plots Best fit line	1m each Total 4m
1 (c)(i)	From the graph, concentration of cell sap is 4.4 mol per dm ³	1m
1 (c)(ii)	The sugar solution which results in no % change in mass of the potato indicates that there is no net movement of water. This can only happen if the water potential of the sugar solution is the same as that of the cell sap of the potato cells.	1m 1m



2 (a)	Correctly labelled trachea, bronchiole and alveoli  Fig. 2.1	1m each correctly identified and labelled part ----- Total 3m
2 (b)	1. <u>Spherical shape of the alveoli</u> provides a large surface area to volume ratio which increases the rate of oxygen transfer. 2. <u>Thin / one-cell thick alveolar wall</u> which reduces the distance oxygen has to diffuse through to get to the capillaries. 3. <u>Presence of a thin film of moisture</u> in the inner surface of the alveolus enables oxygen to dissolve in which facilitates the diffusion of the oxygen across the alveolus. Note: question is about “structure of alveoli”, hence any reference to features other than this is not accepted, e.g. proximity of blood capillaries	1m 1m 1m ----- Total 3m
2 (c)(i)	1. Nicotine 2. Tar 3. Carbon monoxide	1m each ----- Total 3m
2 (c)(ii)	Any TWO of the 3 ways: 1. Irritants and tar in the cigarette smoke causes <u>inflammation of the bronchioles (bronchitis)</u>, a condition in which the passage of air in the bronchial tubes is blocked due to the secretion of large amounts of mucus. 2. Prolonged smoking causes <u>emphysema</u> where the <u>alveolar walls breakdown</u> resulting in a reduced surface area for oxygen absorption. 3. Carcinogens in cigarette smoke cause the cells in the lungs to grow uncontrollably leading to <u>cancer</u>.	1m for each correct answer. ----- Total 2m

3 (a)	Correctly labelled iris and pupil  Fig. 3.1	1m each correctly identified and labelled part ----- Total 2m
3 (b)	When the eye is exposed to bright light, the pupil automatically becomes smaller / constricts. This is due to the circular muscles of the iris which contract while radial muscles (of the iris) relax (max 1m if 'iris' is omitted)	1m 1m 1m ----- Total 3m

4 (a)(i)	Hh	1m															
4 (a)(ii)	hh	1m															
4 (b)	<table><tr><td colspan="2"></td><th colspan="2">father R</th></tr><tr><td colspan="2"></td><th>H</th><th>h</th></tr><tr><th rowspan="2">mother S</th><th>H</th><td>HH unaffected</td><td>Hh unaffected</td></tr><tr><th>h</th><td>Hh unaffected</td><td>hh affected</td></tr></table>			father R				H	h	mother S	H	HH unaffected	Hh unaffected	h	Hh unaffected	hh affected	1m for correct parental gametes 1m for correct offspring genotype and phenotype
		father R															
		H	h														
mother S	H	HH unaffected	Hh unaffected														
	h	Hh unaffected	hh affected														
	Chance of the child having the disorder = 25% or 1/4	1m															

5 (a)(i)	 Fig. 5.1											
	X: cytosine	1m										
	Y: phosphate	1m										
	Z: deoxyribose sugar Reject 'sugar'	1m										
5 (a)(ii)	ANY correctly circled nucleotide consisting of a pentose sugar, phosphate and nitrogenous base.	1m										
5 (b)	Table 5.1 <table><tr><th>organism</th><th>% A</th><th>% C</th><th>% G</th><th>% T</th></tr><tr><td>rat</td><td>28</td><td>22</td><td>22</td><td>28</td></tr></table>	organism	% A	% C	% G	% T	rat	28	22	22	28	1m for correct %T 1m for correct %C or %G ----- Total 2m
organism	% A	% C	% G	% T								
rat	28	22	22	28								

6 (a)(i)	mouse / rabbit	1m
6 (a)(ii)	snake / hawk / coyote	1m
6 (b)	Population of mice will increase.	1m
	More plants available for mice to feed on.	1m
6 (c)(i)	ANY ONE of the following food chains: plants → mice → snakes → hawks plants → mice → snakes → coyotes plants → rabbits → snakes → hawks plants → rabbits → snakes → coyotes	1m

6 (c)(ii)	Pyramid of number	1m for correct relative size of trophic levels 1m for regular height
6 (d)	About 90% of energy is lost to the environment during energy transfer from one trophic level to the next in the food chain. Hence an organism beyond the 4th trophic level would not be able to obtain sufficient energy to sustain life.	1m 1m Total 2m

Section B

7 (a)	<u>CO₂ in the atmosphere</u> is constantly removed by all green plants for the process of <u>photosynthesis</u>. During this process, carbon is used to make <u>carbohydrate/ glucose molecules</u> which the plants use for <u>tissue respiration</u> to release energy for their cellular activities. <u>Excess glucose</u> made is either <u>stored up</u> in the plant as <u>starch</u> / converted to other organic compounds within the plant body When herbivorous <u>animals feed on the green plants</u> (animal nutrition), the carbon locked in the plant body is <u>transferred into and becomes part of the animal</u>. When the animal uses the carbon compound glucose for tissue respiration, CO₂ is produced which is returned back into the atmosphere.	1m 1m 1m 1m 1m Total 6m
7 (b)	The burning of fossil fuels (such as coal, oil and gas) releases the locked-up carbon in the fossil fuels as CO₂ into the atmosphere. An increase in the burning of fossil fuels therefore will result in <u>more CO₂ being released into the atmosphere</u>. Forests comprise green plants/trees which play a major role in removing CO₂ from the atmosphere for the process of photosynthesis.	1m 1m 1m

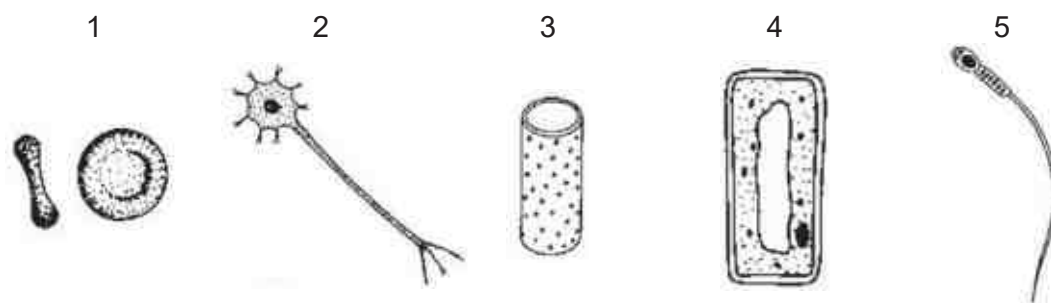
	Increasing destruction of the world's forests will mean that less CO ₂ in the atmosphere will be removed, causing CO ₂ levels to remain high.	1m
		Total 4m

8 (a)	From <u>day 0 to day 5</u> , <u>menstruation occurs</u> during which the <u>uterine lining breaks down</u> and its thickness decreases.	1m
	From day <u>6 to day 10</u> , increasing oestrogen level promotes the repair and growth of the uterine lining.	1m
	As the concentration of oestrogen increases further, the uterine starts to thicken from day 11 to day 17.	1m
	From day 18 onwards, under the influence of increasing progesterone level, the uterine lining <u>continues to thicken further</u> and is <u>maintained</u> .	1m 1m
	At day 28 when the level of progesterone has decreased sharply, the uterine lining can no longer be maintained and it starts to break down, marking the end of the menstrual cycle (and the beginning of the next cycle).	1m Total 6m
8 (b)(i)	If an egg is fertilised during the cycle, The level of <u>progesterone in Fig. 8.2 will continue to remain high in order to maintain the uterine lining / prevents the uterine lining from breaking down</u>	1m
	<u>The thickness of the uterine lining in Fig. 8.1 will remain high to enable the fertilised egg/zygote to be implanted so that it can continue to grow and develop into a foetus</u>	1m Total 2m
8 (b)(ii)	A ripe/mature egg is released from the ovary between day 11 and day 17 of the menstrual cycle which represents the fertile phase of the cycle as the chance of egg being fertilised by a sperm is very high.	1m
	Hence outside of day 11 to day 17, the chance of fertilisation is very low or non-existent, representing the non-fertile period of the menstrual cycle.	1m Total 2m

9 (a)	1. A typical plant cell has <u>chloroplasts containing chlorophyll</u> while a typical animal cell does not have.	1m
	Chlorophyll in the chloroplasts of plant cells enables the plant to <u>absorb sunlight</u> for the process of <u>photosynthesis to make food</u> which is essential for the survival of the plant.	1m
	2. A typical plant cell has a <u>cell wall</u> which is absent in a typical animal cell.	1m
	Cell wall provides <u>protection against mechanical damage</u> and gives shape to the cell, both essential for the survival of the plant.	1m
	3. A typical plant cell has a <u>large central vacuole</u> whereas a typical animal cell has <u>numerous small vacuoles</u> .	1m
	A large central vacuole allows the cell to store water and nutrients and keep the cell turgid, which enables soft tissues in the plant to stay erect.	1m
	Total 6m	
9 (b)	<u>Any TWO</u> of the following:	
	1. A red blood cell (RBC) has <u>haemoglobin</u> which is absent in a typical animal cell.	1m
	Haemoglobin <u>binds reversibly to oxygen</u> which enables the RBC to transport oxygen <u>from the lungs to all parts of the body</u> .	1m
	2. <u>Nucleus</u> is present in a typical animal cell but absent in a RBC. Absence of a nucleus enables the RBC to <u>pack in more haemoglobin</u> and thus it can <u>carry more oxygen</u> .	1m
		1m
	3. A RBC has a <u>biconcave disc shape</u> , unlike the irregular shape of a typical animal cell.	1m
	The biconcave shape of the RBC <u>increases its surface area to volume ratio</u> , allowing oxygen to <u>diffuse</u> into and out of the RBC at a <u>faster rate</u> .	1m
	Total 4m	

End of Paper

21 The diagram below shows **five** different types of cells.



Which row identifies the functions of the cells shown?

	transmits nerve impulses	manufacture sugar	carry genetic information	conducts water and mineral salts	transports oxygen
A	5	3	2	4	1
B	2	3	5	1	4
C	3	4	2	5	1
D	2	4	5	3	1

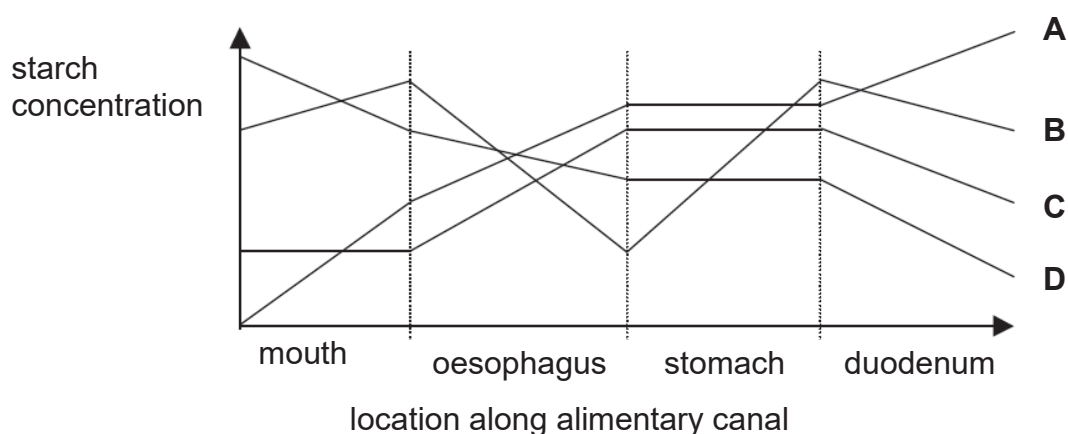
22 A type of mammalian red blood cell is found to contain cytoplasm that is isotonic to 1% salt solution. If these red blood cells were immersed in 0.5% salt solution they would

- A** gain water by active transport and burst.
- B** gain water by osmosis and burst.
- C** lose water by active transport and shrink.
- D** lose water by osmosis and shrink.

23 According to the lock and key hypothesis, which is the lock and key for fat digestion?

	key	lock
A	fatty acids	glycerol
B	lipase	lipids
C	lipase	glycerol
D	lipids	lipase

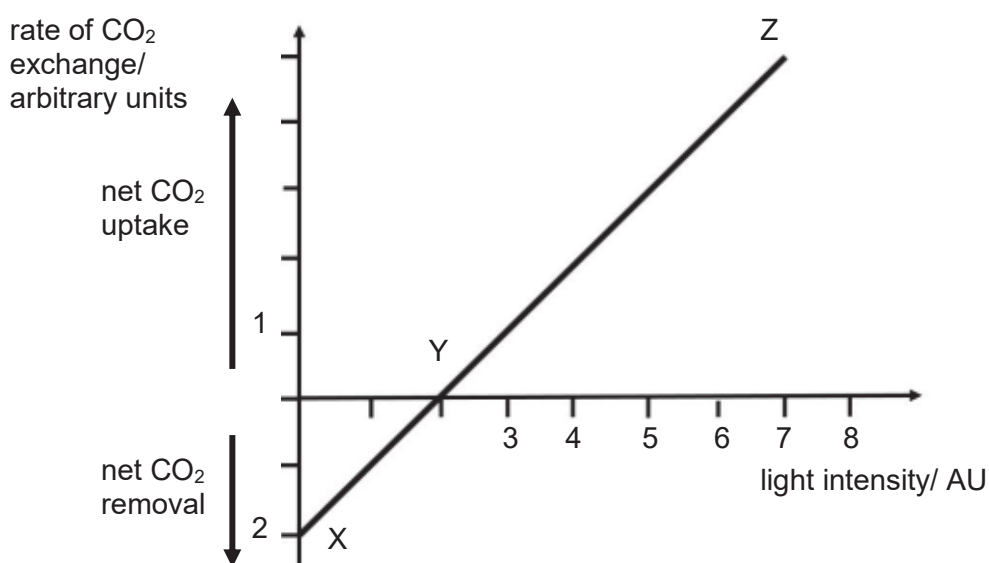
24 Which of the lines represents the activity of amylase in starch digestion?



25 What would happen if a person's bile duct became blocked?

- A Carbohydrate digestion would stop.
- B Fat digestion would be reduced.
- C Fat digestion would stop.
- D Manufacture of bile would stop.

26 The graph shows the effect of changing light intensity on the amount of carbon dioxide (CO_2) absorbed or released by green plants.

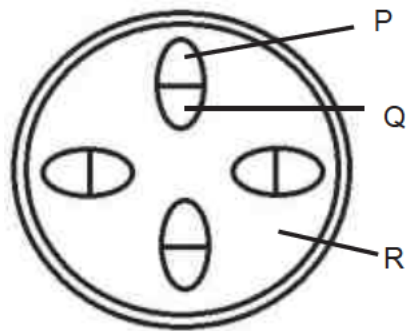


Which of the following statements is/are **not** true?

- I The photosynthetic rate is greater than the respiratory rate between X and Y.
- II The respiratory rate is greater than the photosynthetic rate between Y and Z.
- III There is no respiration occurring at Z.

- A I only
- B III only
- C I and II only
- D I, II and III

- 27 The diagram shows sections from the stem of a plant which had been standing in coloured solution for one day.



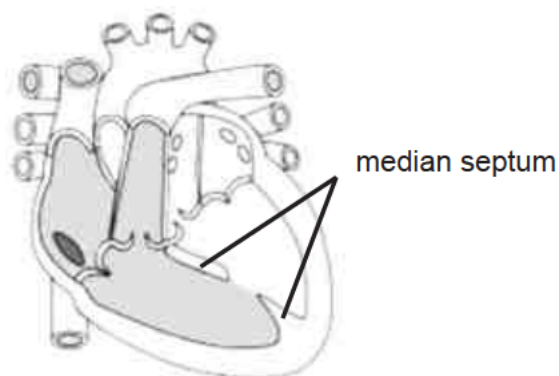
Which tissues would be most heavily stained?

- A Q only
 - B R only
 - C P and Q
 - D P and R
- 28 Translocation occurs in the phloem and aphids feed on the contents of phloem tubes.

What type of food would be lacking in their diet?

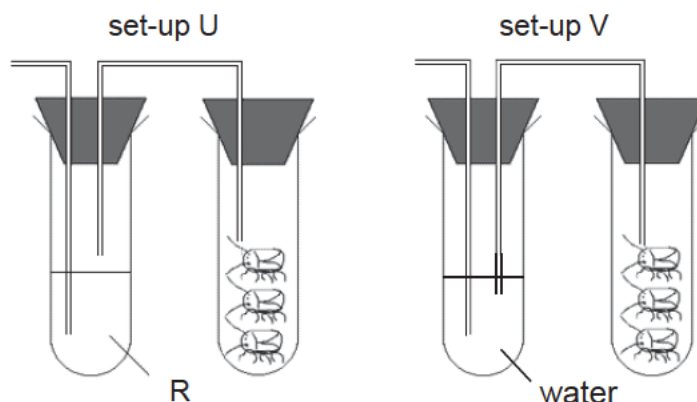
- A amino acid.
- B glucose.
- C lipids.
- D sucrose.

- 29 The diagram shows a congenital defect in which the median septum of the heart fails to fully form resulting in a “hole in the heart”.



Which of the following would **not** be a likely consequence of the disease?

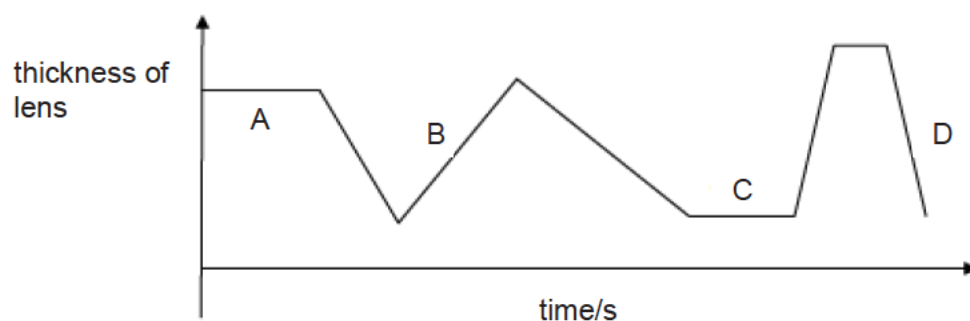
- A There would be a reduction in the pressure of blood entering the lungs.
 - B There would be a reduction in the amount of oxygen brought to body cells.
 - C The heart will become weaker and contract less.
 - D There would be a reduction in the pressure of blood leaving through the aorta.
- 30 The figure shows a setup to investigate respiration. Three live cockroaches are placed in set-up U and set-up V. R is a solution which absorbs oxygen.



What results would you expect to observe after 24 hours?

- A The cockroaches in setup U will die.
- B The cockroaches in setup V will die.
- C The cockroaches in both setups will die.
- D The cockroaches in both setups will live.

For questions 31 and 32, refer to the graph below. The graph shows the thickness of the lens of a woman as she looked at the movement of a mosquito.



31 During which period was she looking at a mosquito biting her hand?

32 During which period was she looking at the mosquito flying away from her?

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

Plant X – The anthers were carefully removed and the buds left open to the air.

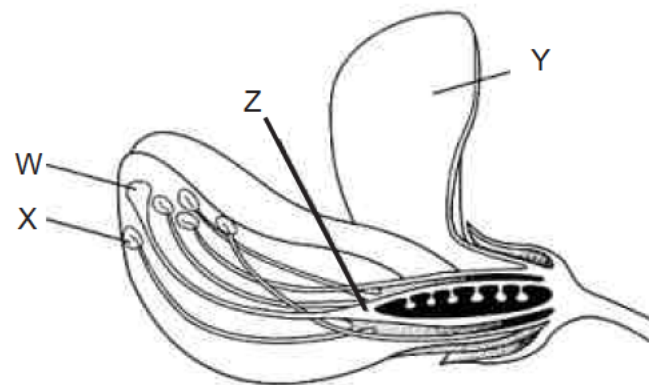
Plant Y – The anthers were left untouched and a paper bag was tied tightly around each bud.

Plant Z – The anthers were carefully removed and a paper bag was tied tightly around each bud.

Although all flowers later opened normally, only those in Plant X produced seeds. This result shows that in this species,

- A only cross-pollination can be successful.
- B only wind-pollination can be successful.
- C only insect-pollination can be successful.
- D both self-pollination and cross-pollination can be successful.

34 The diagram shows the structure of a flower.



The functions of the four labelled parts are:

- 1 attracts insects
- 2 develops into a fruit
- 3 produces pollen
- 4 receives pollen

Which of the following rows is **correct**?

	W	X	Y	Z
A	3	4	1	2
B	3	4	2	1
C	4	3	1	2
D	4	3	2	1

35 The following events occur after fertilization in humans.

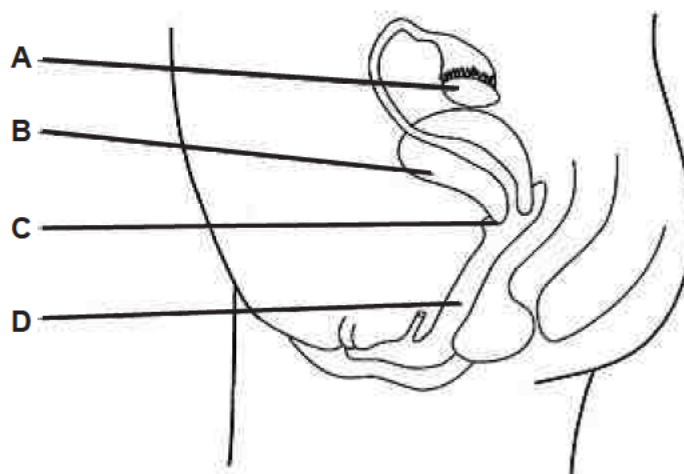
- P: A zygote is formed in the fallopian tube.
- Q: Cell division occurs to form a ball of cells.
- R: The embryo implants into the uterine lining.
- S: The ball of cells travels down the fallopian tube.

Which is the correct order of events after fertilization in humans?

- A** P → Q → S → R
- B** Q → S → R → P
- C** Q → R → P → S
- D** R → P → Q → S

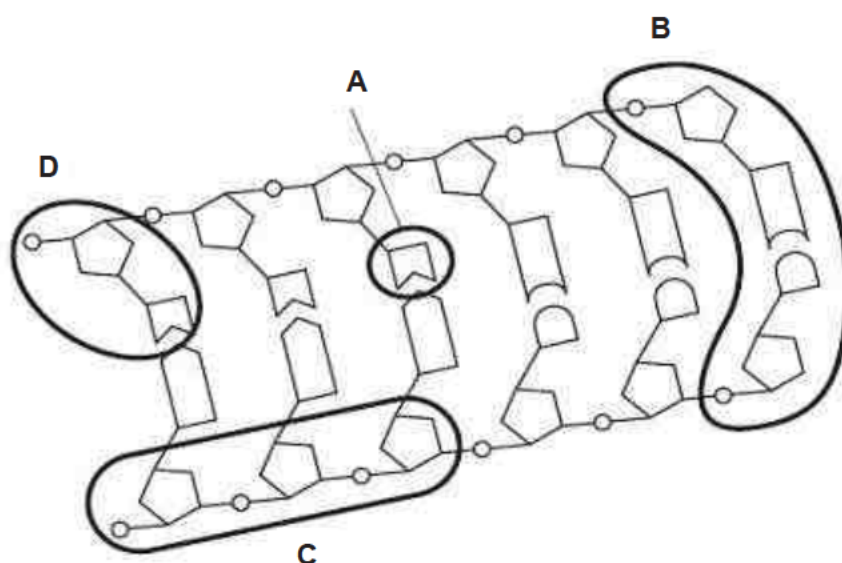
36 The diagram shows a side-view of the reproductive system of a woman.

Where does maturation of the ova occur?



37 The diagram shows part of a strand of deoxyribonucleic acid.

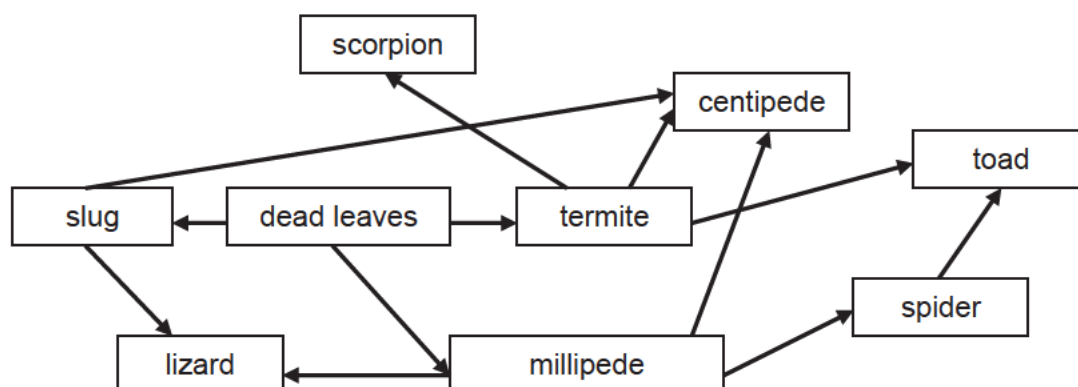
Which part represents a nitrogenous base?



38 How does continuous variation differ from discontinuous variation?

	continuous variation has two or more distinct types of traits	continuous variation is controlled by
A	no	few genes
B	no	many genes
C	yes	few genes
D	yes	many genes

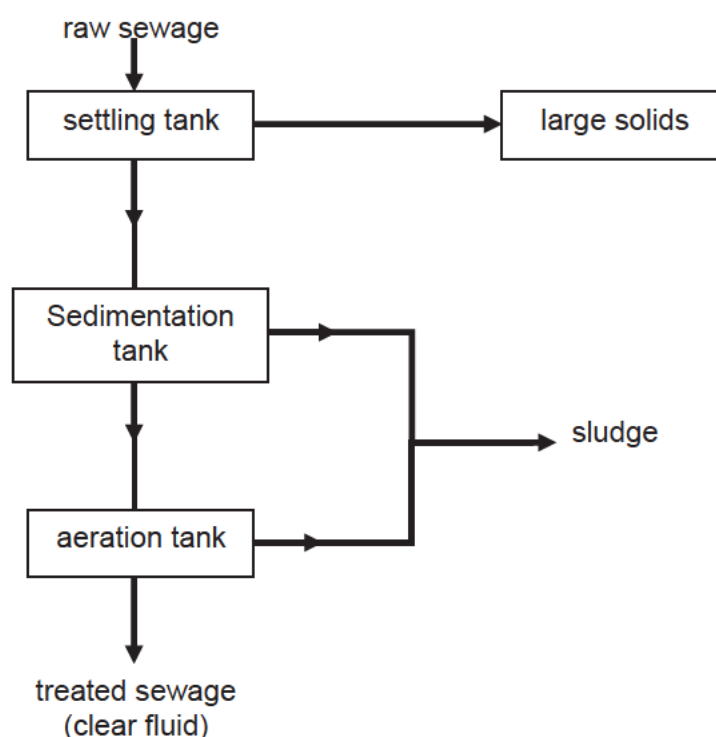
39 This shows the food web of an urban park habitat.



Which is a tertiary consumer?

- A centipede
- B slug
- C spider
- D toad

40 The diagram shows a simplified sewage treatment system.



Which of the following explains why air is continuously pumped into the sewage in the aeration tank?

- A to increase the oxygen content of treated sewage before discharge
- B to kill aerobic bacteria
- C to provide enough oxygen for bacteria to decompose sewage
- D to remove harmful gases such as hydrogen sulphide

- End of Paper -

Name: _____ () Class: _____

4E/ 5NA

Centre Number: _____ Index Number: _____

KRANJI SECONDARY SCHOOL
Preliminary Examination
**Secondary 4 Express/
5 Normal (Academic)**

SCIENCE (BIOLOGY)
PAPER 4



5078/4

Tuesday

14 Aug 2018

1 hour 15 minutes

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READ THESE INSTRUCTIONS FIRST

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

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your name, class and register number in the spaces provided on the cover page.

Section A

Answer **all** questions.

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

Section B

Answer any **two** questions.

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

INFORMATION FOR CANDIDATES

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	
9	
10	
11	
Total	/ 65

This question paper consists of **17** printed pages (including cover page).

[Turn over]

Section A (45 marks)

Answer **all** the questions in the space provided.

- 1 Fig. 1.1 shows a single-celled organism, amoeba, that survive in an aquatic environment.

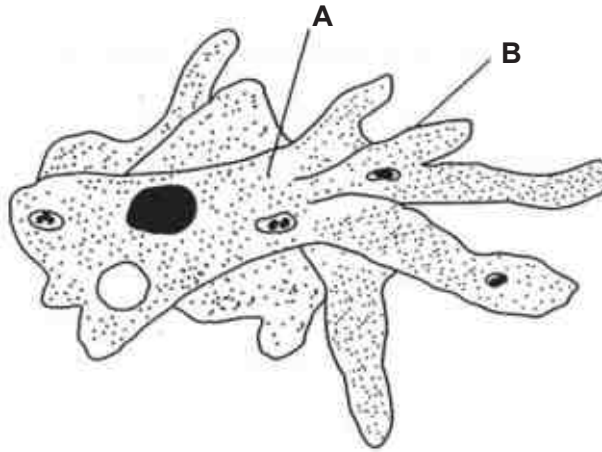


Fig. 1.1

- (a) Identify the cell structures **A** and **B**.

A : _____

B : _____ [1]

- (b) State the function of structure **B**.

_____ [1]

- (c) Suggest how the amoeba take in water and nutrients from its surroundings.

_____ [3]

- 2** A student conducted an experiment with amylase to study its digestion of starch in the human alimentary canal.

Some amylase was added to a starch suspension in a test tube. The mixture was incubated at 40°C for 1 hour.

- (a)** A small sample, **X**, was removed and some food test were conducted.

- (i)** Describe how you would carry out a Benedict's Test on sample **X** and what you would expect to observe.

[2]

- (ii)** In which part of the alimentary canal does this digestion take place?

[1]

- (b)** The experiment was repeated with the addition of concentrated hydrochloric acid.

A small sample, **Y**, was removed and Benedict's Test was conducted.

- (i)** What results would the student obtain for sample **Y**?

[1]

- (ii)** Explain your answer for Sample **Y**.

[2]

- 3 An experiment was conducted to investigate the loss of water vapour from plant leaves under different wind conditions. Forty similar leaves were removed from a plant and the end of each leaf stalk was covered and sealed with wax. The leaves were then divided into eight groups of five. Each of these groups of leaves were weighed and then suspended in a current of air moving at different speeds. After two hours, each group of leaves were weighed again. The results are recorded in table 3.1.

Table 3.1

group	air speed / ms^{-1}	initial total mass/ g	final total mass/ g	change in mass/ g
1	0	3.00	2.95	- 0.05
2	2	3.00	2.90	- 0.10
3	4	3.00	2.87	
4	6	3.00	2.84	
5	8	3.00	2.82	
6	10	3.00	2.81	
7	12	3.00	2.80	
8	14	3.00	2.80	

- (a) Besides the mass of leaves, state one other variable that must be kept constant in this experiment.

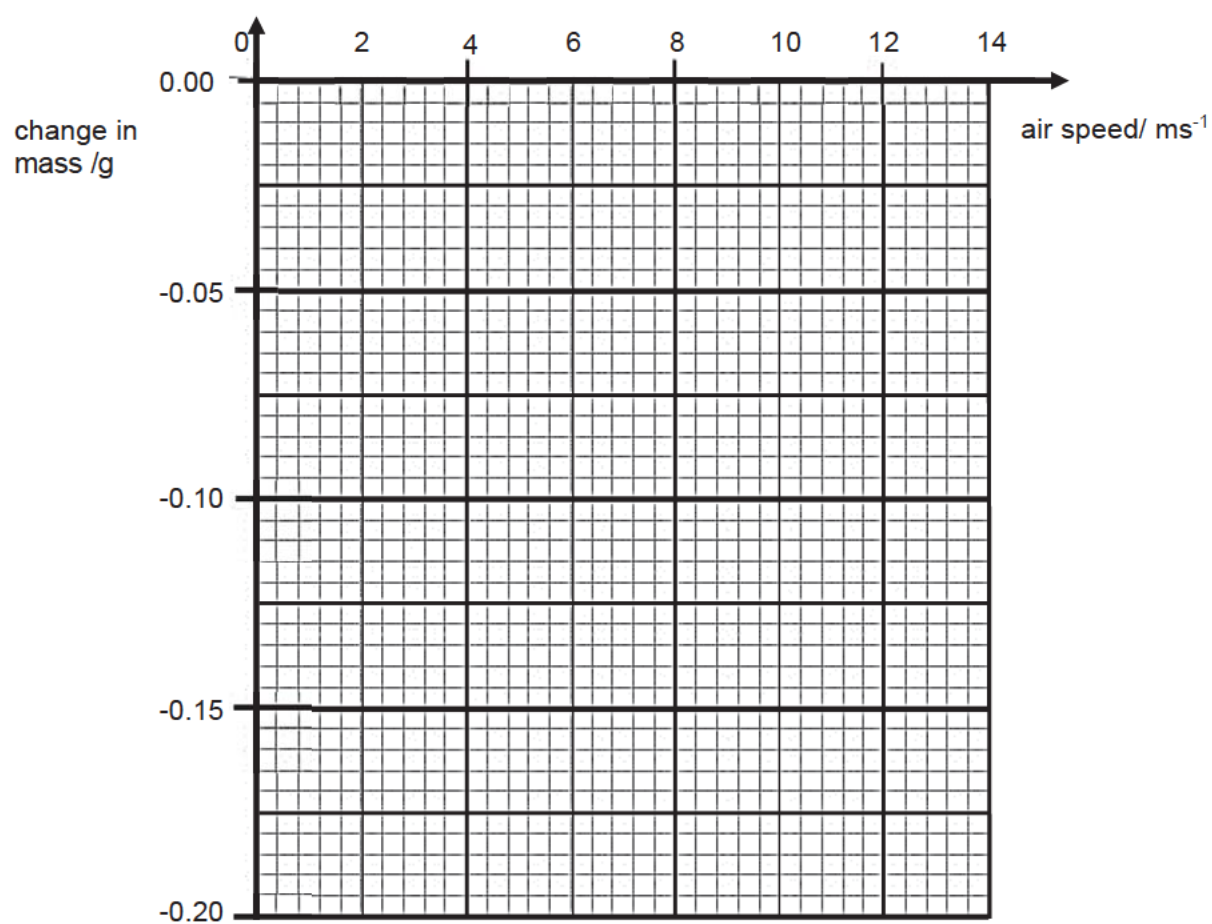
[1]

- (b) (i) Complete Table 3.1 by calculating the change in mass.

[1]

- (ii) On the grid, plot the points and draw a best-fit curve.

[2]



- (c) (i) Using the graph, describe the relationship between air speed and the change in mass.

[1]

- (ii) Find the change in mass at 7 ms^{-1} and explain why it is different from 0 ms^{-1} .

[4]

- 4 Fig. 4.1 represents the circulatory system, the lungs and body cells.

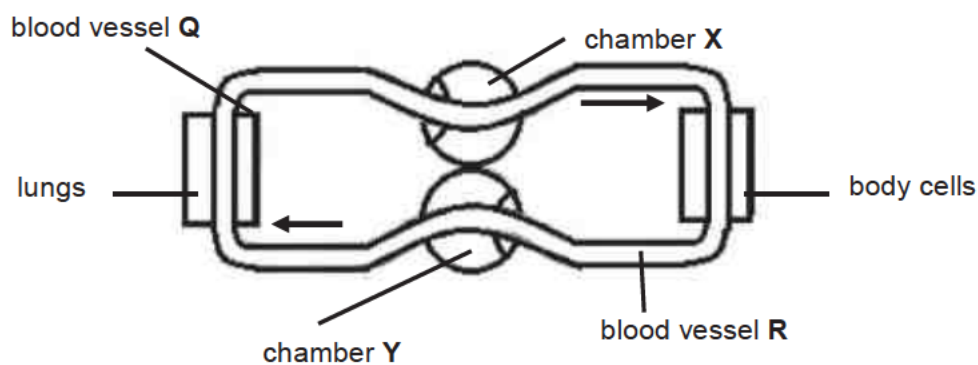


Fig. 4.1

Key:

→ direction of blood flow

- (a) Identify

- (i) blood vessels:

Q: _____

R: _____ [1]

- (ii) chambers

X: _____

Y: _____ [1]

- (b) The cells in the body, example muscle cells, undergo anaerobic respiration under vigorous exercise.

(i) Define anaerobic respiration in humans.

.....
..... [1]

(ii) State the word equation for anaerobic respiration in humans.

.....
..... [1]

- (c) Table 4.1 shows the amount of lactic acid in the muscle cells of an athlete at a 400m sprint event.

Table 4.1

position	amount of lactic acid / mgdm⁻³
resting	0.0
immediately after sprint	20.0

Using information in Table 4.1, describe the effects of lactic acid observed in the body cells during the sprint.

.....
.....
.....
..... [2]

- 5** The maintenance of the blood glucose at normal levels is brought about by an efficient regulatory mechanism controlled by the endocrine system.

(a) Identify the various components of the regulatory mechanism that lowers blood glucose levels back to the norm after a carbohydrate-rich meal.

stimulus	rise in concentration of glucose in the blood
receptor of stimulus	
endocrine gland	
hormone	insulin
transport medium of hormone	
target cells	liver / muscles
chemical response in target cells	

[2]

- (b) Fig 5.1 shows the changes in blood glucose and insulin levels in the blood over a 12 hour period.

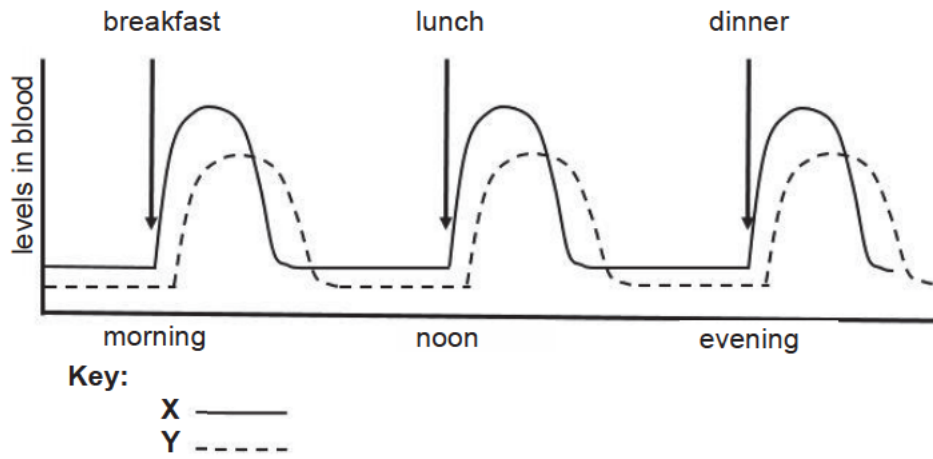


Fig 5.1

Which line (X or Y) represents the changes in levels of insulin?

Explain your answer.

[2]

- 6 Fig 6.1 shows the carpel of a flower after pollination as occurred.

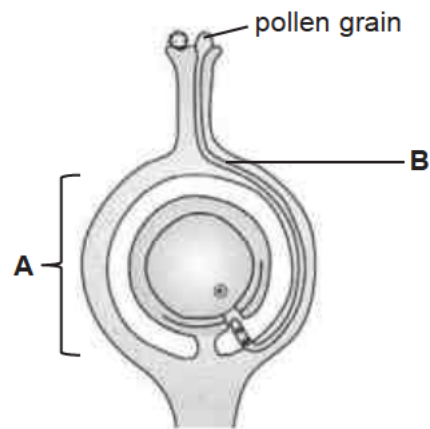


Fig. 6.1

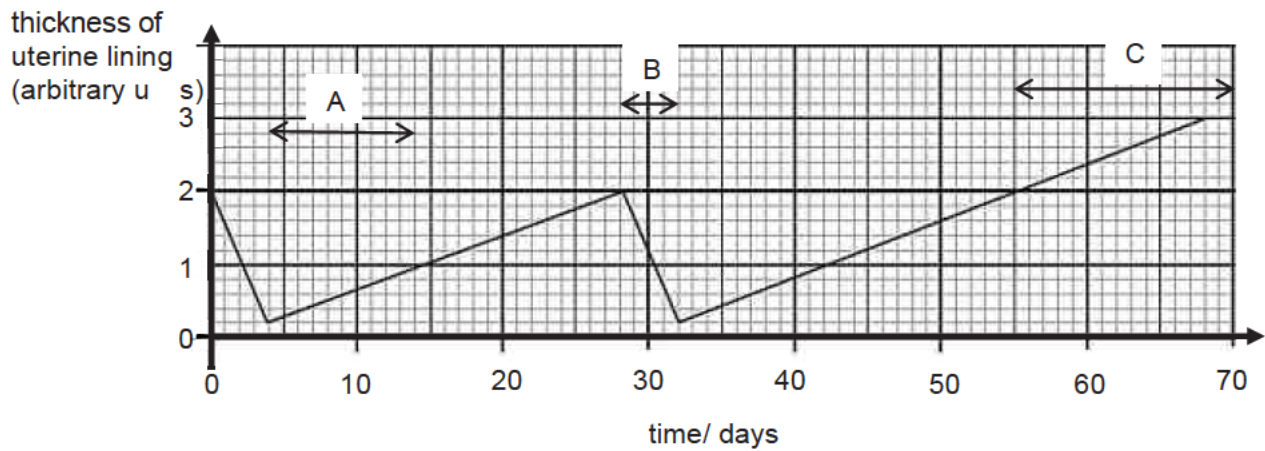
- (a) Explain how structure **B** reaches the female gamete of a flower.

[3]

- (b) State one difference between the carpel shown in Fig 6.1 and the carpel of a wind-pollinated flower.

[1]

7 Fig. 7.1 shows the changes in the uterine lining of a woman over a period of time.



(a) With reference to Fig. 7.1,

(i) What is the event that is occurring in period **B**?

_____ [1]

(ii) What are the day(s) on which ovulation occurs?

_____ [1]

(b) (i) Identify the hormone responsible for the change in thickness of the uterine lining in period **A**.

_____ [1]

(ii) Explain the change in thickness of the uterine lining in period **A**.

 _____ [2]

(c) State the most likely day during which fertilization has taken place.

_____ [1]

- 8 Warfarin is a poison used to kill rats. A mutation caused some rats to become resistant. These rats are not killed by the poison. This resistance is controlled by a dominant allele.

(a) Explain what is meant by the terms

(i) allele

..... [1]

(ii) mutation

..... [1]

(b) Warfarin is still used to kill rats, since not all rats are resistant to the poison.

In Fig. 8.1 provided, show how a male rat and a female rat, both not affected by the poison, can produce offspring that are killed by the poison.

Use 'R' to represent the dominant allele and 'r' the recessive allele.

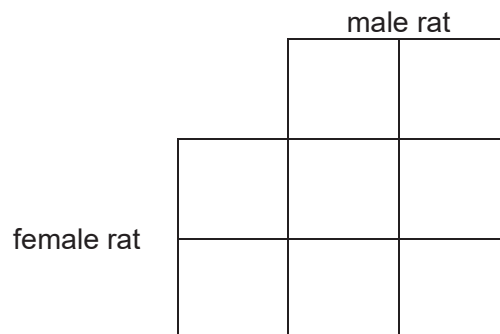


Fig. 8.1 [1]

Determine the chance in which the offspring is not resistant to the poison.

Chance in which offspring is not resistant to poison = [1]

(c) The DNA sequence of rats is 95% similar to humans.

Suggest why warfarin is not harmful to humans.

..... [1]

Section B (20 marks)

Answer any **two** questions from this section.

Write your answers in the spaces provided.

- 9 Fig. 9.1 shows a transverse section of a part of a leaf.

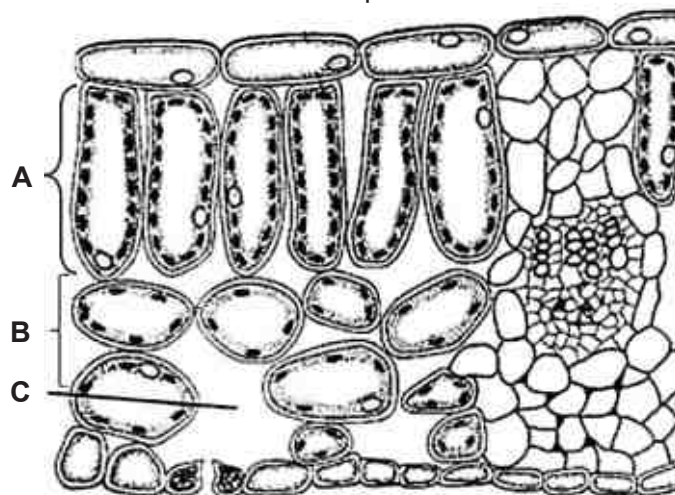


Fig. 9.1

- (a) (i) Write a word equation for photosynthesis.

..... [1]

- (ii) State one factor that affects the rate of photosynthesis.

..... [1]

- (b) Describe how products of photosynthesis are removed from the leaf.

.....
.....
.....
..... [2]

-
- This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

10 (a) Fig. 10.1 shows the concentration of oxygen, the number of bacteria and the number of fishes in a river over a distance of 50 km, measured from point **P** which is upstream from a pollution source from untreated sewage.



- [1]

- (ii) With reference to the three curves on Fig. 10.1, describe and explain the effects of the pollution.

.....

.....

.....

.....

.....

..... [3]

- (b) Explain how carbon in dead animal tissue is made available for photosynthesis.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (c) Discuss **two** ways in which biodiversity of either forests or oceans is maintained.

.....

.....

.....

..... [2]

- During the liver transplant, a section of the liver was cut from a donor and transplanted into the man.

[4]

[3]

- (b) There are roughly 23.8 million human immunodeficiency virus (HIV) infected persons in all of Africa.

Discuss **one** way HIV is spread and **two** methods by which it can be controlled.

[3]

End of Paper

Answers for Section A (20 marks)

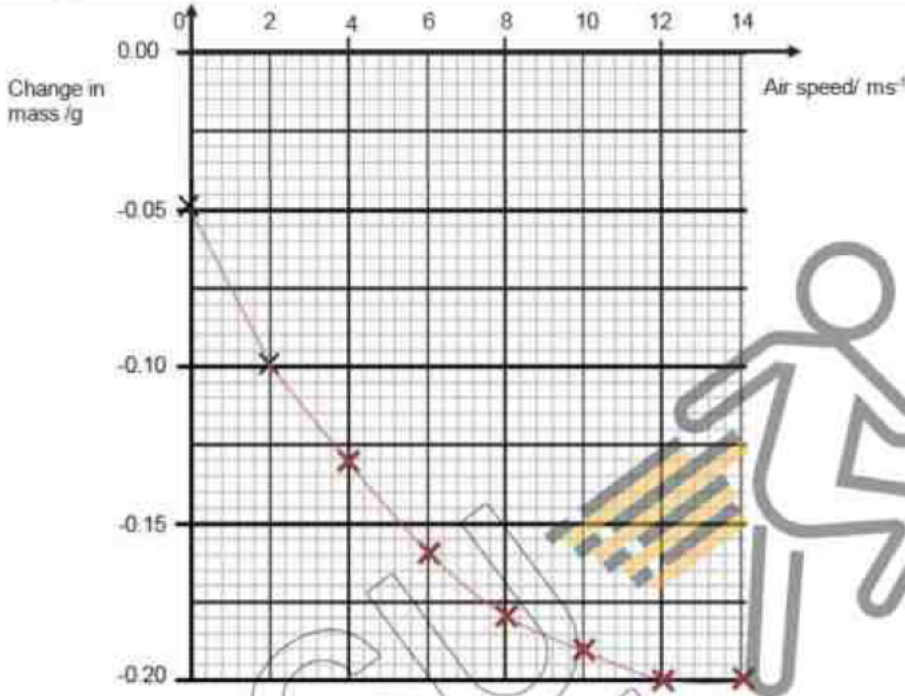
Q 21	Q 22	Q 23	Q 24	Q 25	Q 26	Q 27	Q 28	Q 29	Q 30
D	B	D	D	B	D	A	B	C	C

Q 31	Q 32	Q 33	Q 34	Q 35	Q 36	Q 37	Q 38	Q 39	Q 40
A	D	A	C	A	A	A	B	D	C

Section B: Structured Questions (45 marks)

	Marks scheme	Total Marks
1 a	2 correct – 1m Structure A: cytoplasm Structure B: cell membrane	[1]
b	<u>Controls</u> the movement of substances entering and leaving the cell. [1]	[1]
c	For nutrient absorption, By active transport, against a concentration gradient. [1] By diffusion, down a concentration gradient. [1] For water absorption, By osmosis, down a water potential gradient. [1]	[3]

	Marks scheme	Total Marks																																													
2	ai To 2cm³ of sample X, add 2cm³ of Benedict's solution. Place in boiling water for 3 mins. [1] Brick red precipitate is observed [1] ii Mouth/ small intestine/ duodenum [1] bi Benedict's solution <u>remains blue</u>. [1] ii Amylase is <u>denatured</u>, [1] <u>no digestion of starch into maltose</u> which is a reducing sugar occurs. [1]	[2] [1] [1] [2]																																													
3	a Temperature/ light intensity [1] bi <table><tr><th>Group</th><th>Air speed / ms⁻¹</th><th>Initial total mass/ g</th><th>Final total mass/ g</th><th>Change in mass/ g</th></tr><tr><td>1</td><td>0</td><td>3.00</td><td>2.95</td><td>- 0.05</td></tr><tr><td>2</td><td>2</td><td>3.00</td><td>2.90</td><td>- 0.10</td></tr><tr><td>3</td><td>4</td><td>3.00</td><td>2.87</td><td>- 0.13</td></tr><tr><td>4</td><td>6</td><td>3.00</td><td>2.84</td><td>- 0.16</td></tr><tr><td>5</td><td>8</td><td>3.00</td><td>2.82</td><td>- 0.18</td></tr><tr><td>6</td><td>10</td><td>3.00</td><td>2.81</td><td>- 0.19</td></tr><tr><td>7</td><td>12</td><td>3.00</td><td>2.80</td><td>- 0.20</td></tr><tr><td>8</td><td>14</td><td>3.00</td><td>2.80</td><td>- 0.20</td></tr></table> Must have negative sign, all 2 d.p.	Group	Air speed / ms ⁻¹	Initial total mass/ g	Final total mass/ g	Change in mass/ g	1	0	3.00	2.95	- 0.05	2	2	3.00	2.90	- 0.10	3	4	3.00	2.87	- 0.13	4	6	3.00	2.84	- 0.16	5	8	3.00	2.82	- 0.18	6	10	3.00	2.81	- 0.19	7	12	3.00	2.80	- 0.20	8	14	3.00	2.80	- 0.20	[1] [1]
Group	Air speed / ms ⁻¹	Initial total mass/ g	Final total mass/ g	Change in mass/ g																																											
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2	2	3.00	2.90	- 0.10																																											
3	4	3.00	2.87	- 0.13																																											
4	6	3.00	2.84	- 0.16																																											
5	8	3.00	2.82	- 0.18																																											
6	10	3.00	2.81	- 0.19																																											
7	12	3.00	2.80	- 0.20																																											
8	14	3.00	2.80	- 0.20																																											

	Marks scheme	Total Marks
ii	 Plots – [1]; line - [1] ci Units required. As air speed <u>increases from 0 to 14 m/s</u>, <u>mass decreases from 0.05 to 0.20g</u>. [1] ii Change in mass = <u>-0.17g</u>. [1] Units required. <u>Increase air speed removes the water vapour around the stomata of the leaves</u> [1] <u>faster</u>, <u>increasing the concentration gradient between the inside of the leaf and outside of the leaf</u> [1], <u>more transpiration occurs</u>. [1] 4 ai 2 correct – [1] Q: pulmonary vein R: vena cava	[2] [1] [4] [1]

	Marks scheme	Total Marks														
ii	2 correct – [1] X: Left ventricle Y: Right ventricle	[1]														
bi	It is the <u>breakdown</u> of food substances in the <u>absence</u> of oxygen. [1]	[1]														
ii	Glucose → lactic acid + small amount of energy [1]	[1]														
c	During the sprint, there is an <u>increase</u> in lactic acid by <u>20mgdm⁻³</u> . [1] High amounts of lactic acid cause muscle <u>fatigue</u> . [1]	[2]														
5 a	Any 1 correct – [0] Any 2 - 3 correct – [1] Any 4 correct – [2] <table border="1"><tr><td>Stimulus</td><td>Rise in concentration of glucose in the blood</td></tr><tr><td>Receptor of stimulus</td><td>Pancreas</td></tr><tr><td>Endocrine gland</td><td>Islets of Langerhans</td></tr><tr><td>Hormone</td><td>Insulin</td></tr><tr><td>Transport medium of hormone</td><td>blood</td></tr><tr><td>Target cells</td><td>Liver / muscles</td></tr><tr><td>Chemical response in target cells</td><td>Excess glucose converted into glycogen</td></tr></table>	Stimulus	Rise in concentration of glucose in the blood	Receptor of stimulus	Pancreas	Endocrine gland	Islets of Langerhans	Hormone	Insulin	Transport medium of hormone	blood	Target cells	Liver / muscles	Chemical response in target cells	Excess glucose converted into glycogen	[2]
Stimulus	Rise in concentration of glucose in the blood															
Receptor of stimulus	Pancreas															
Endocrine gland	Islets of Langerhans															
Hormone	Insulin															
Transport medium of hormone	blood															
Target cells	Liver / muscles															
Chemical response in target cells	Excess glucose converted into glycogen															
b	Y [1]. Insulin levels rise and fall after blood sugar. [1]	[2]														

	Marks scheme	Total Marks									
6 a	The <u>growth</u> of structure B is controlled by the <u>pollen tube nucleus</u>. [1] As B grows, it <u>secretes enzymes to digest</u> the surrounding tissue of the <u>stigma and style</u>. [1] The pollen tube enters the ovule/ female gamete through the <u>micropyle</u>. [1]	[3]									
b	<u>Large and feathery stigma</u> [1]	[1]									
7 ai	Menstruation [1]	[1]									
ii	<u>Day 14 and 42.</u> [1]	[1]									
bi	A: oestrogen [1]	[1]									
ii	In period A, <u>increasing oestrogen</u> [1] cause <u>growth</u> and <u>increasing thickness of the uterine lining</u> . [1]	[2]									
c	Day 42. [1] (Accept a range of answers)	[1]									
8 ai	Different forms of a gene. [1]	[1]									
ii	Change in the structure of a gene/ in chromosome number [1].	[1]									
b	Male rat <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td><td style="text-align: center;">R</td><td style="text-align: center;">r</td></tr> <tr> <td style="text-align: center;">R</td><td>RR</td><td>RR</td></tr> <tr> <td style="text-align: center;">r</td><td>Rr</td><td>rr</td></tr> </table> Female rat [1]		R	r	R	RR	RR	r	Rr	rr	[2]
	R	r									
R	RR	RR									
r	Rr	rr									

	Marks scheme	Total Marks
	Chance = 0.25/ 25%/ ¼ [1]	
c	The 5% difference in DNA sequence, results in <u>different</u> proteins/ polypeptides that are made in humans which give warfarin resistance. [1]	[1]

Section C

	Marks scheme	Total Marks
9	ai <i>carbon dioxide + water</i> $\xrightarrow[\text{chlorophyll}]{\text{light energy}}$ <i>glucose + oxygen + water</i> [1] ii Light intensity/ carbon dioxide concentration/ temperature [1] b Glucose is converted to <u>sucrose</u> to be transported in <u>phloem</u> to other parts of the plant. [1] Oxygen <u>diffuses</u> out of the leaf through the <u>stomata</u>. [1] c Chloroplasts in <u>mesophyll</u> cells. [1] Mesophyll tissue is the main site for <u>photosynthesis</u>. [1] <u>More chloroplasts</u> in palisade mesophyll cells (A) than in spongy mesophyll cells (B). [1] More light energy absorbed by palisade mesophyll at <u>leaf surface</u> than by spongy mesophyll cells. [1] Large intercellular <u>air spaces</u>/ (C) in spongy mesophyll tissue. [1] Allow <u>fast diffusion</u> of carbon dioxide and oxygen into and out of mesophyll cells. [1]	[1] [1] [2] [6]
10	ai 10 km [1] ii Increase in bacteria growth due to organic waste. [1] Increase decomposition, bacteria multiply quickly cause drop in oxygen concentration. [1] Leading to fishes to die/ reduce number of fishes. [1] b <u>Decomposers</u> [1] digest dead animal tissue and <u>release carbon dioxide via respiration into the atmosphere</u>. [1]	[1] [3] [4]

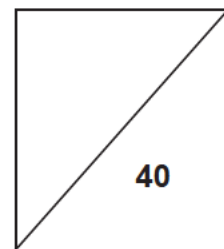
	Marks scheme	Total Marks
	Fossil fuels such as <u>oil</u> from long dead animal tissue is <u>burnt/ combustion</u> and <u>released as carbon dioxide</u>. [1] Carbon dioxide taken up plants via <u>stomata</u> during <u>photosynthesis</u>. [1]	
c	2 correct points from Either Conservation of forest by: • Selective tree felling, where young trees are not felled/ • New seedlings are planted in reforestation/ • Designate land as forest reserves/ • Prohibit tree felling, check trees regularly to control insects and diseases that harm them. Or Conservation of fishing grounds by: • Banning the use of drift-nets/ • Use nets with a certain mesh size so that young fish are not caught/ • Regulating the entry of ships into fishing grounds/ • Banning the harvesting of endangered species/ • Encouraging the raising of endangered species of fish in hatcheries.	[2]
11 ai	<u>Damaged tissues/blood platelets</u> release <u>thrombokinas</u>. [1] <u>Thrombokinas</u> converts <u>prothrombin into thrombin</u> in the presence of <u>calcium</u>. [1] <u>Thrombin</u> catalyse the conversion of <u>soluble fibrinogen</u> to <u>insoluble fibrin threads</u>. [1] To form a <u>mesh to trap blood cells that form a clot</u>. [1]	[4]
ii	Clotting will cause blood vessels of the liver to become <u>blocked</u>. [1] This will cause a <u>lack of oxygen and nutrients to the organ</u>. [1] Leading to <u>organ failure</u>. [1]	[3]
b	Any one way + 2 methods HIV is transmitted by: • Sexual intercourse with an <u>infected person</u>/ sharing hypodermic needles (tattoo, acupuncture, ear-piercing)/ blood transfusion from an <u>infected person</u>/ during pregnancy, from <u>infected</u> mother to fetus/ through breast milk from <u>infected</u> mother to infant Methods for control:	[3]

	Marks scheme	Total Marks
	• Keep to one sex partner or do not have sex/ • Wear condom/ • Do not abuse drugs/ • Do not share razors or toothbrushes/ • Make sure that needles are sterilized.	

KIASU
ExamPaper



NORTH VISTA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018



NAME: _____ ()

CLASS: _____

SUBJECT: SCIENCE(CHEMISTRY/BIOLOGY) (PAPER 1)

DATE: 12 SEPTEMBER 2018

LEVEL / STREAM: SECONDARY 4 EXPRESS

TIME: 1 HOUR

CODE : 5078/01

INSTRUCTIONS TO CANDIDATES

Write in soft pencil.

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

Write your full name, register number and class on the cover page of the question paper and OTAS sheet provided.

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 separate OTAS sheet.

Read the instructions on the OTAS 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.

Any rough working should be done in this booklet.

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

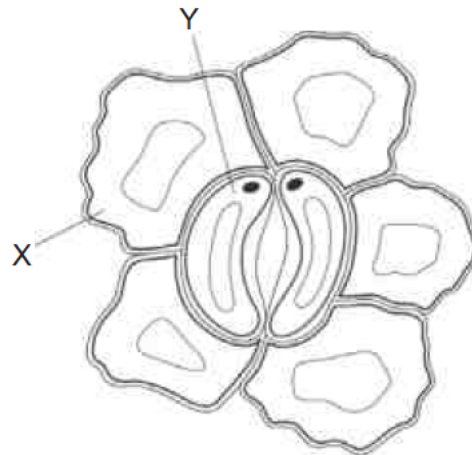
A copy of the Data Sheet is printed on page 19.

A copy of the Periodic Table is printed on page 20.

This question paper consists of 20 printed pages.

[Turn over

21 The diagram shows cells in the epidermis of a leaf.



Which structural features should also be added to cells in X and Y to complete the diagram?

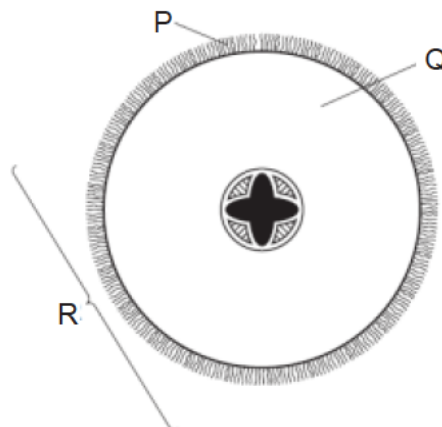
	cell X		cell Y	
	chloroplasts	nucleus	chloroplasts	nucleus
A	✓	✓	✗	✗
B	✓	✗	✓	✓
C	✗	✓	✓	✗
D	✗	✗	✗	✓

key

✓ = yes

✗ = no

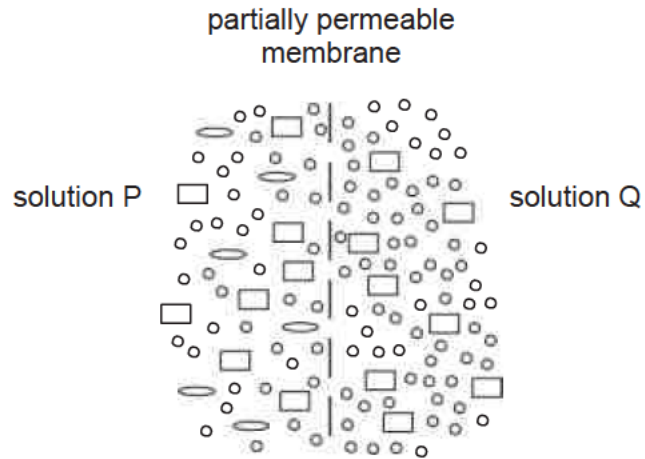
22 The diagram shows a section through a root.



What are the levels of organisation of the labelled structures?

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

- 23 The diagram represents an experiment where two solutions, P and Q, are separated by a partially permeable membrane.



What is the initial movement of the three different molecules between the two solutions, P and Q?

	net movement from Q to P	net movement from P to Q	no net movement
A	○	□	◐
B	○	◐	□
C	□	◐	○
D	◐	○	□

- 24 The table shows the results of some food tests.

Which row shows a food containing both protein and starch?

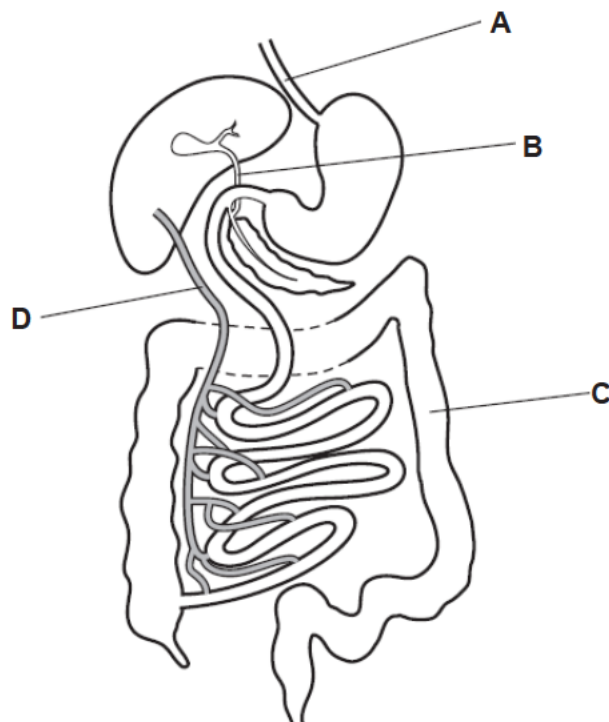
	Benedict's solution	biuret test	ethanol	iodine solution
A	blue	blue	clear	blue-black
B	blue	purple	clear	blue-black
C	red	blue	cloudy	brown
D	red	purple	cloudy	brown

- 25 According to the lock and key hypothesis, what represents the lock and key for the enzyme lipase?

	lock	key
A	glycerol	lipase
B	lipase	lipids
C	lipids	fatty acids
D	lipids	lipase

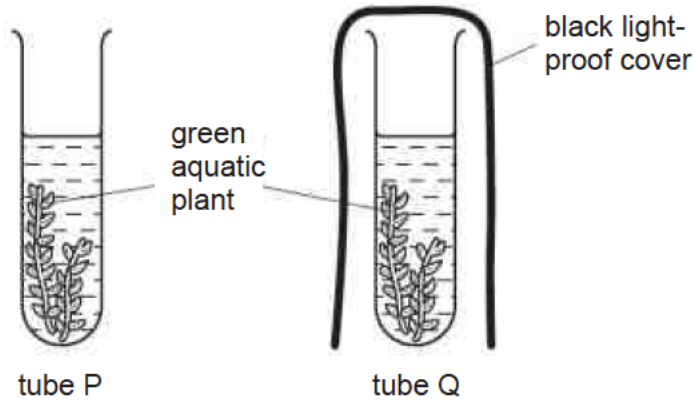
- 26 The diagram shows part of the alimentary canal and associated organs.

Which part would contain high concentrations of glucose and amino acids, four hours after eating a meal?



- 27 Two test-tubes, P and Q, were set up, each containing a solution of red hydrogencarbonate indicator. Hydrogencarbonate indicator turns yellow when the carbon dioxide concentration increases and turns purple when the carbon dioxide concentration decreases.

Similar pieces of the same aquatic plant were placed into tubes P and Q. Tube P was uncovered and tube Q had a black light-proof cover. The tubes were left in a warm room in sunlight for four hours.

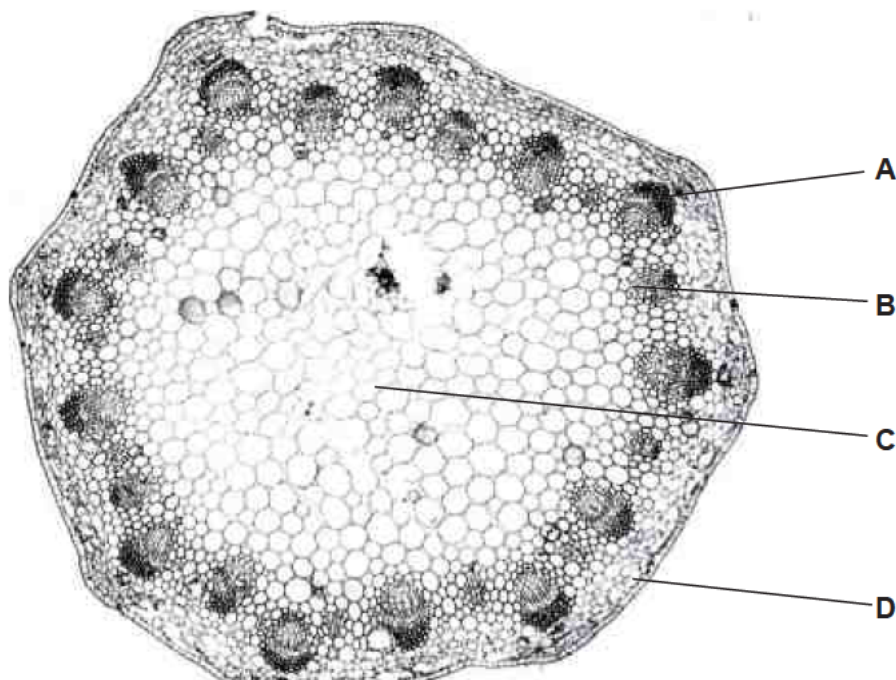


What would be the colour of the hydrogencarbonate indicator in the two tubes after four hours?

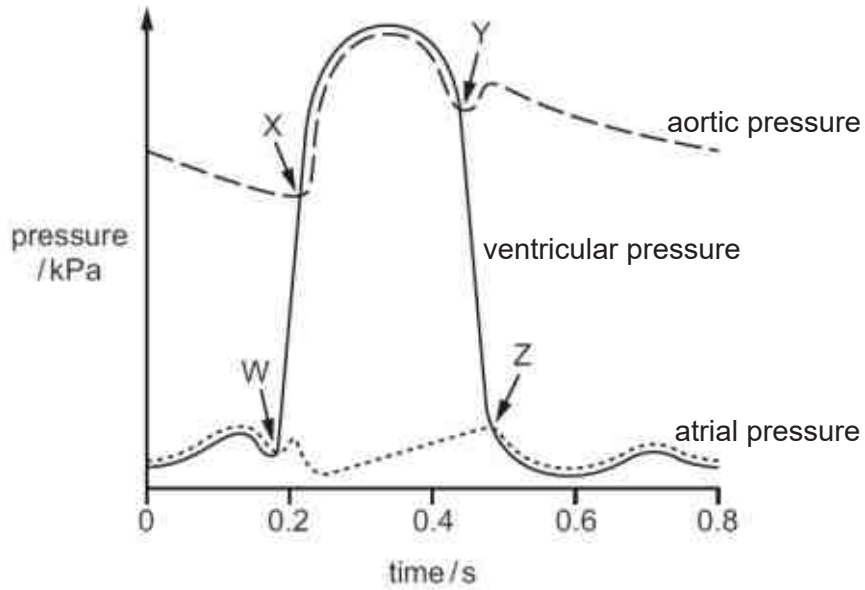
	tube P	tube Q
A	purple	red
B	purple	yellow
C	red	yellow
D	yellow	red

- 28 The photomicrograph is a section through a plant organ.

Which label identifies the xylem vessels?



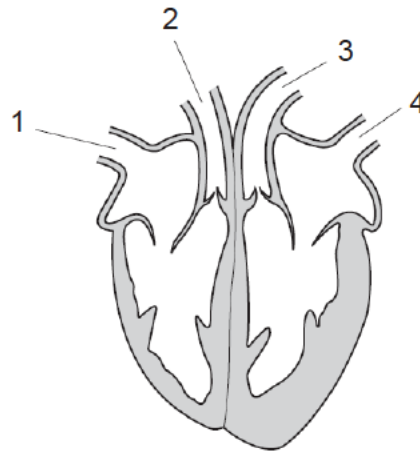
29 The graph shows pressure changes on the left side of the heart during a cardiac cycle.



Which row correctly identifies W, X, Y and Z?

	W	X	Y	Z
A	atrioventricular valves close	semi-lunar valves close	semi-lunar valves open	atrioventricular valves open
B	atrioventricular valves close	semi-lunar valves open	semi-lunar valves close	atrioventricular valves open
C	semi-lunar valves close	atrioventricular valves open	atrioventricular valves close	semi-lunar valves open
D	semi-lunar valves open	atrioventricular valves close	atrioventricular valves open	semi-lunar valves close

30 The diagram shows a section through the mammalian heart.



Which labelled structures carry oxygenated blood?

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

31 What is the minimum number of cell membranes a molecule of oxygen passes through during gaseous exchange between the alveoli and the blood plasma in the capillaries?

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

32 When the nervous system responds to a stimulus, there are several stages to the response.

- 1 The central nervous system processes the information.
- 2 The receptors detect the stimulus.
- 3 A nerve impulse is sent to the central nervous system.
- 4 A response is produced.
- 5 A nerve impulse is sent to the muscles.

What is the correct order of the stages?

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

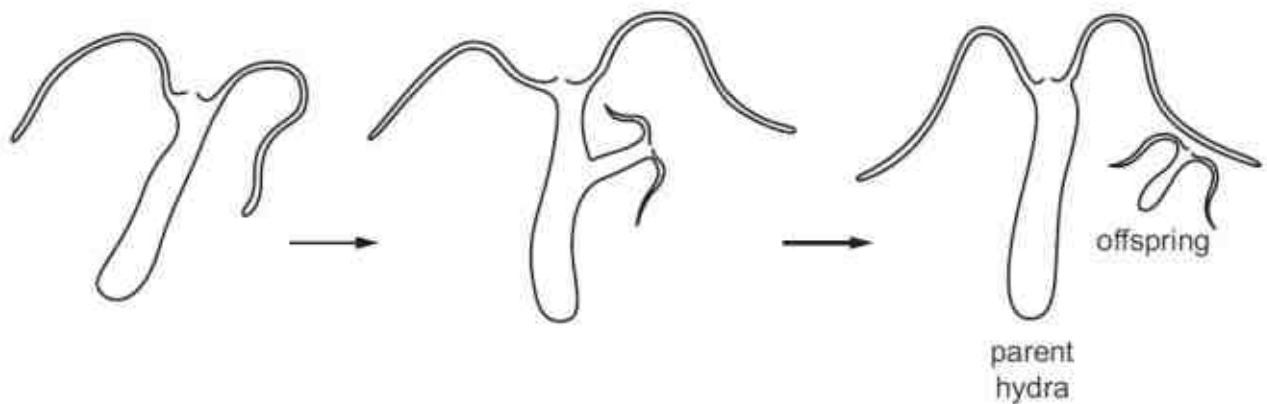
- 33 A person looks at some hills far away.

Which row shows the state of the lenses, ciliary muscles and suspensory ligaments in her eyes?

	lenses	ciliary muscles	suspensory ligaments
A	thick	contracted	slacken
B	thick	relaxed	taut
C	thin	contracted	slacken
D	thin	relaxed	taut

- 34 A hydra was kept in an aquarium and its growth was observed.

The diagram shows the hydra growing and releasing an offspring from the side of its body.



Which row describes the reproduction of hydra?

	parent and offspring are genetically identical	uses sexual reproduction
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

- 35 Which plants are most likely to adapt successfully to a climate change in their environment?

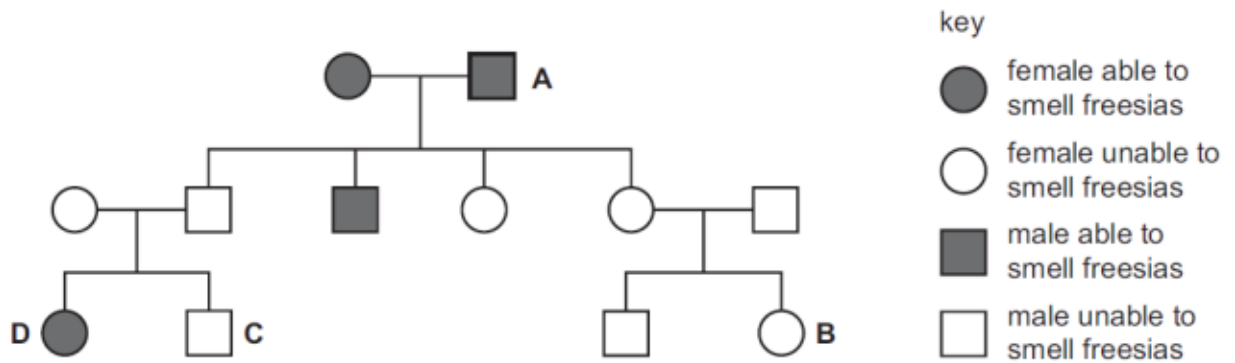
- A** plants that are cross-pollinated
- B** plants that do not rely on wind-pollination
- C** plants that grow rapidly
- D** plants that reproduce asexually

36 What does a gene control production of?

- A a chromosome
- B an allele
- C protein
- D DNA

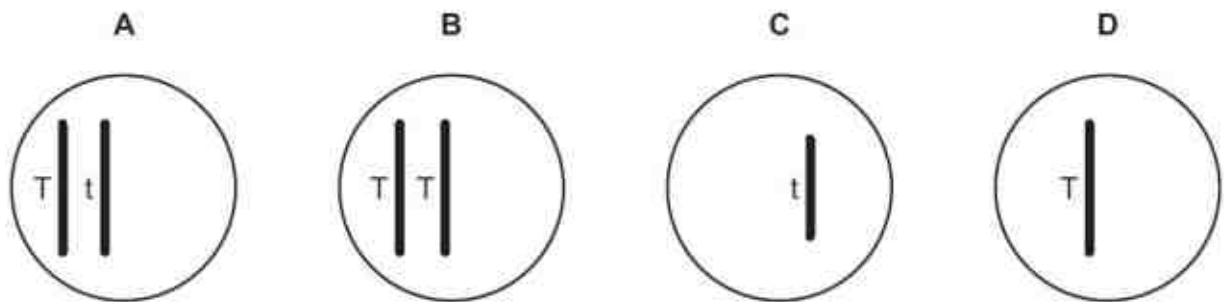
37 The family tree shows the inheritance of the ability to smell flowers called freesias. The allele for the ability to smell freesias is dominant.

Which individual's symbol is not correct?

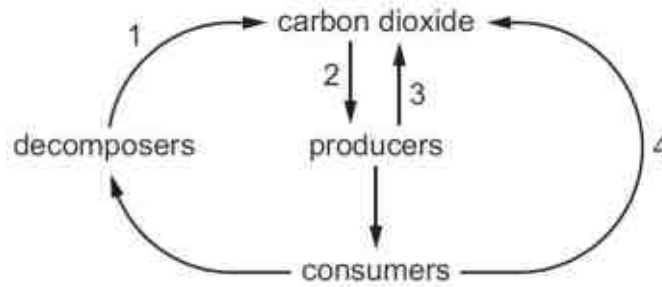


38 An organism is homozygous dominant for a gene which has two possible alleles, T and t.

Which diagram represents a gamete from this organism?



39 The diagram shows part of the carbon cycle.



In which labelled stage(s) is respiration occurring?

	1	2	3	4
A	✓	✓	✓	✗
B	✓	✗	✓	✓
C	✗	✓	✓	✓
D	✗	✗	✗	✓

40 The table shows the ability of three species of fish and their eggs to survive in water at different pH levels.

fish species	pH					
	4.0	4.5	5.0	5.5	6.0	6.5
trout	✗	✓	✓	✓	✓	✓
sea bass	✗	✗	✗	✓	✓	✓
perch	✗	✗	✓	✓	✓	✓
fish eggs	✗	✗	✗	✓	✓	✓

key

✓ = survive

✗ = do not survive

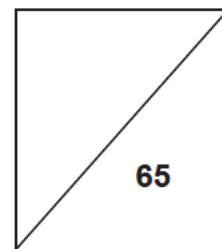
A lake at pH 6.0 contains breeding populations of all three fish.

If acid rain causes the pH to fall to 5.0, which outcome would likely occur?

- A** Trout and perch will survive and produce offspring.
- B** Trout and perch will survive but only perch will produce offspring.
- C** Trout and perch will survive but produce no offspring.
- D** Trout, sea bass and perch will survive but produce no offspring.



NORTH VISTA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018



NAME: _____ ()

CLASS: _____

SUBJECT: SCIENCE (BIOLOGY) (PAPER 4)

DATE: 28 AUGUST 2018

LEVEL / STREAM: SECONDARY 4 EXPRESS

TIME: 1 HOUR 15 MINUTES

CODE : 5078/04

INSTRUCTIONS TO CANDIDATES

Write your full name, register 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.

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

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

You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer **all** questions.

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

Section B

Answer any **two** questions.

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

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.

This question paper consists of 14 printed pages.

Section A

Answer **all** questions in the spaces provided.

- 1 Fig. 1.1 shows an organ, **X**, and its associated blood vessels, **P**, **Q** and **R**.

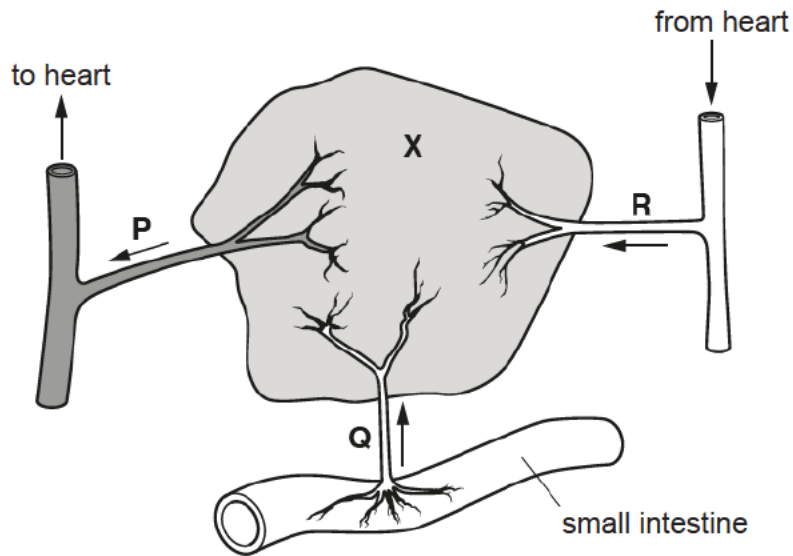


Fig. 1.1

Organ **X** is involved in deamination of excess amino acids and the breakdown of chemical substances, including alcohol.

- (a) Name organ **X** and each of its associated blood vessels.

organ **X**

blood vessel **P**

blood vessel **Q**

blood vessel **R**[4]

- (b) Compare the structure of the blood vessels **P** and **R** in Fig. 1.1.

.....

.....

.....

.....[2]

- (c) State **two** other functions of organ **X**.

.....

.....

.....[2]

- 2 (a) (i) State the word equation for photosynthesis.

.....[2]

- (ii) Name the part of the plant cell that contains chlorophyll.

.....[1]

- (iii) State two types of specialised cell that contain chlorophyll.

.....[1]

- (b) In an investigation, some students placed a plant in bright light.

They measured the rate of photosynthesis at different temperatures.

The results are shown in Fig. 2.1.

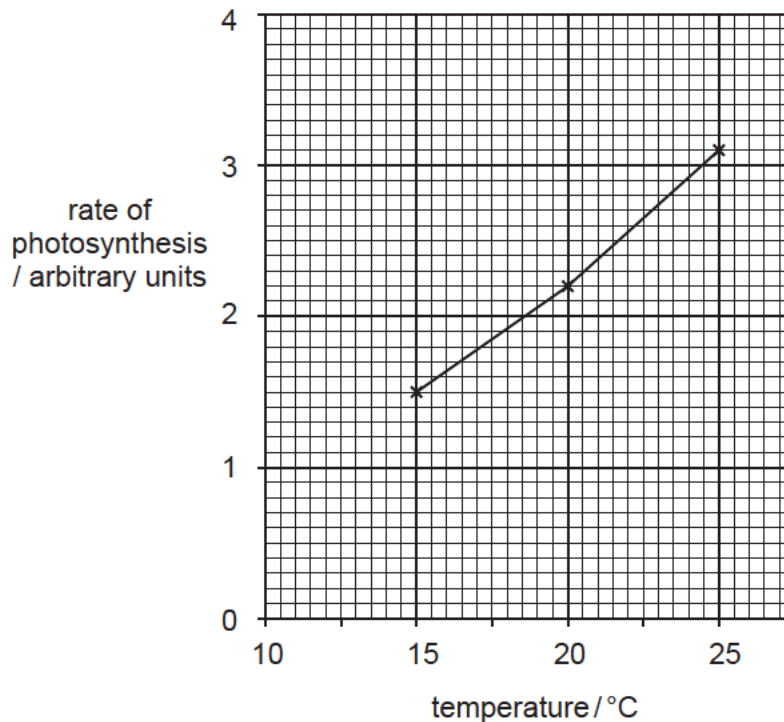


Fig. 2.1

- (i) Describe the results shown in Fig. 2.1.

.....

[2]

- (ii) Suggest an explanation for these results.

.....
.....
.....[2]

- (iii) Predict the effects on the rate of photosynthesis if the investigation is carried out at 60°C. Explain your reason.

.....
.....
.....[2]

- 3 Fig. 3.1 shows flowers from the same species of plant at different stages, **D** and **E**, in their development.

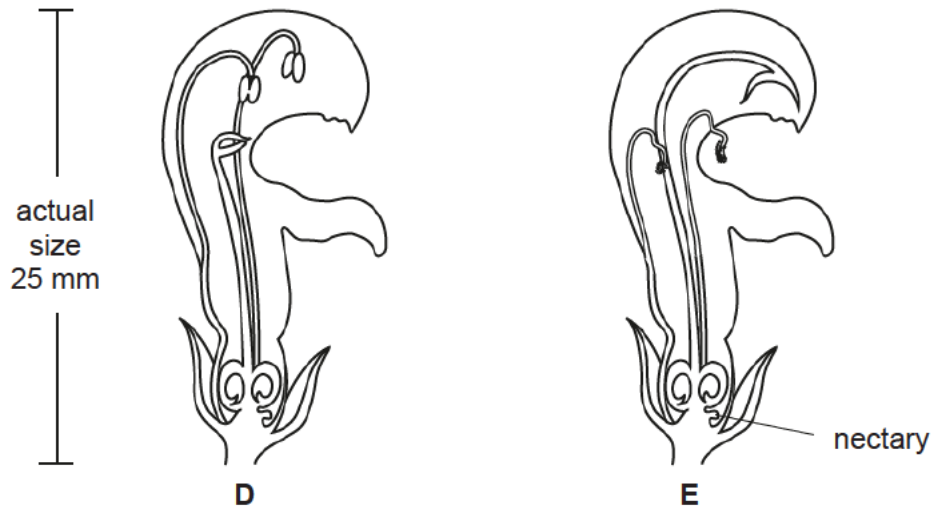


Fig. 3.1

- (a) On Fig. 3.1, use labelled lines to indicate the position of a sepal, anther and stigma. [3]

- (b) The flowers are cross-pollinated by an insect.

- (i) Define cross-pollination.

.....

[2]

- (ii) Explain why the insect must visit flower **D** before visiting flower **E**.

.....

[3]

- (c) From Fig. 3.1, suggest how flowers of this species are adapted to be pollinated by an insect such as a bee.

.....

[2]

- 4 Fig. 4.1 shows a section of a bronchiole from the lungs of a non-smoker and a section of a bronchiole from a smoker of several years.

The two sections were taken from the same relative position in the lungs and are drawn to the same scale.

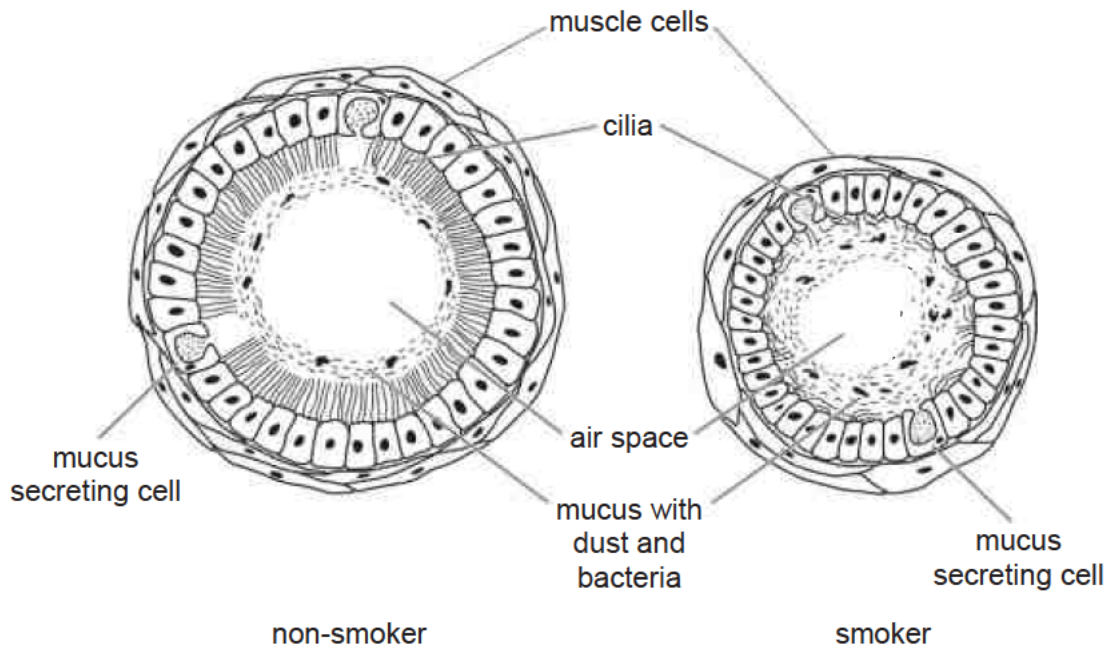


Fig. 4.1

- (a) (i) Table 4.2 gives a comparison between the bronchiole of a non-smoker and a smoker.

Use Fig. 4.1 to complete Table 4.2. An example is given in the table.

Table 4.2

feature	bronchiole of non-smoker	bronchiole of smoker
size of mucus layer	thin	thick
length of cilia		
size of air space		

[2]

- (ii) From Fig. 4.1, identify **two** other ways in which the bronchiole in a non-smoker is different from the bronchiole in a smoker.

1

.....

2

.....[2]

- (b) A person who smokes has a higher risk of lung infections than a person who does not smoke.

Use evidence from Fig. 4.1 to explain why the smoker has a higher risk of lung infections than a non-smoker.

.....

.....

.....

.....[2]

- (c) Name two substances in tobacco smoke that are harmful.

.....[2]

- 5 A student carried out an investigation into the relationship between the concentration of sucrose solution and the number of plant cells which were plasmolysed.

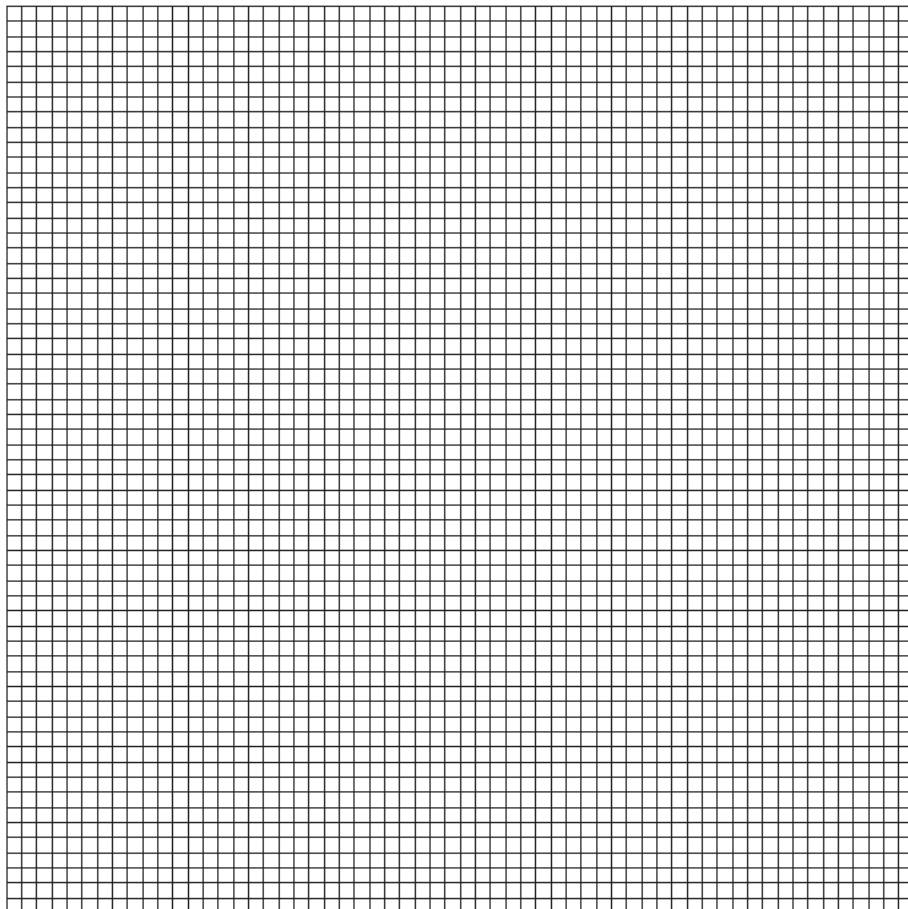
She placed small pieces of plant tissue in sucrose solutions and counted the number of cells that were plasmolysed. She then calculated the percentage of cells that were plasmolysed in each solution.

Her results are shown in Table 5.1.

Table 5.1

concentration of sucrose solution / mol per dm ³	percentage of cells that were plasmolysed
0.0	0
0.2	5
0.4	18
0.6	75
0.8	100

- (a) (i) Plot a graph of the results in Table 5.1.



[3]

- (ii) Use your graph to find the concentration of sucrose solution in which 50% of the cells would be plasmolysed. On your graph, show how this value is obtained.

.....[2]

- (b) Explain why the cells plasmolysed.

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

- (c) Suggest why the cells plasmolysed over a range of concentration of sucrose solution.

.....[1]

Section B

Answer any **two** questions in this section

Write your answers in the spaces provided.

- 6 Fig. 6.1 shows the flow of energy within a biological system.

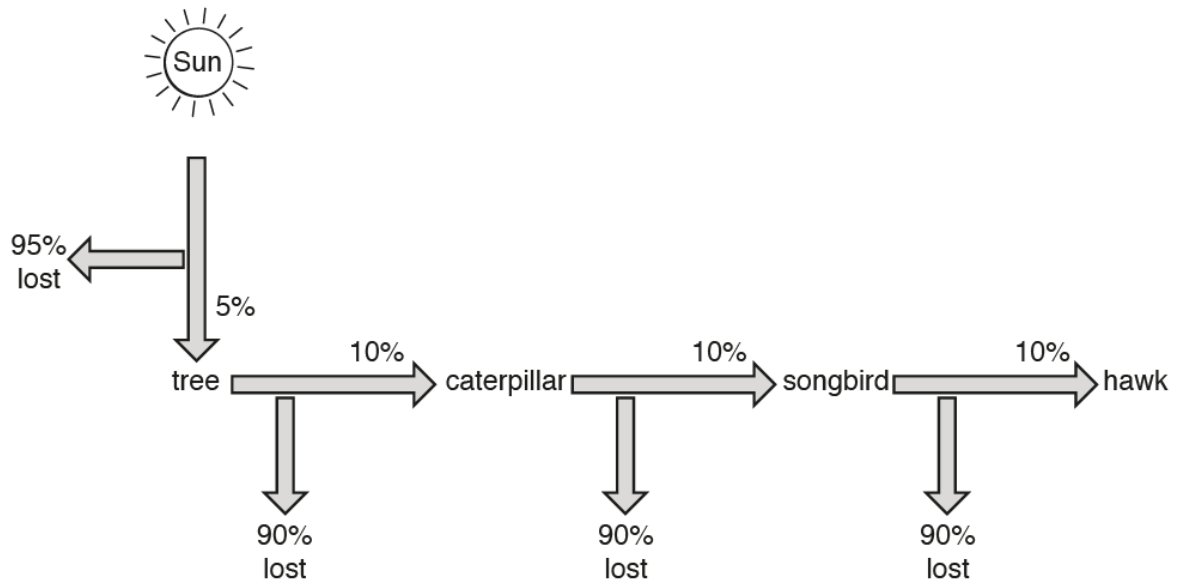


Fig. 6.1

- (a) Name **one** example, shown in Fig. 6.1, of each of the following types of organism.
- producer
- carnivore[2]

- (b) (i) Suggest why only 5% of the energy from the Sun passes to the tree.

.....

.....

.....

.....[2]

- (ii) Describe how energy is lost between the songbird and the hawk.

.....

[2]

- (c) Fig. 6.2 shows two possible uses of the same area of land to produce food.

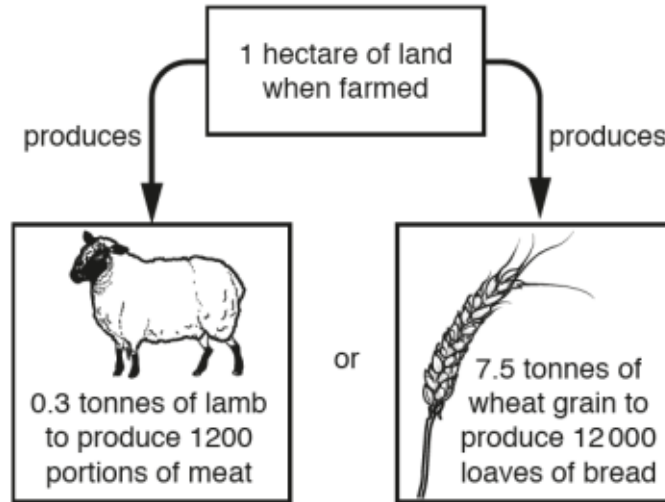


Fig. 6.2

Use the information in Fig. 6.1 and Fig. 6.2, and your own knowledge, to explain why it is possible to feed a greater number of people if the area of land is used to farm crops rather than to farm animals.

.....

[4]

- 7 Table 7.1 shows the loss of water vapour by two similarly-sized potted plants, **X** and **Y**, grown in the same environment over a period of 14 hours.

Table 7.1

time of day / hours	water vapour loss / arbitrary units	
	plant X	plant Y
06.00 – 08.00	0.8	5.0
08.00 – 10.00	1.8	13.6
10.00 – 12.00	5.6	14.6
12.00 – 14.00	4.6	9.0
14.00 – 16.00	3.4	6.6
16.00 – 18.00	2.8	4.2
18.00 – 20.00	1.8	0.8

- (a) State the time of day at which the combined loss of water vapour from the two plants is at its greatest.

.....[1]

- (b) Described the trends observed and suggest reasons for each of the following:

- (i) the difference between the total amount of water vapour lost by plants **X** and **Y** during the 14-hour period,

.....

.....

.....

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.....[5]

- (ii) the change in rate of water vapour loss by plant Y from 06.00 hours to 12.00 hours.

.....

.....

.....

.....

.....

.....

.....[4]

- 8 (a) Describe the structure of a DNA molecule.

.....

.....

.....

.....

.....[3]

- (b) Genes can mutate.

State the causes of mutation and state one effect that this may have in humans.

.....

.....

.....

.....

.....[3]

(c) Apple scab is a disease that infects apple trees.

A gene that determines whether or not apple trees are resistant to apple scab disease has two alleles:

- disease-resistant, **R**
- not disease-resistant, **r**

A farmer crosses two of his apple trees. Out of the 100 offspring produced, 53 are not resistant to apple scab disease.

Use a genetic diagram to show the genotypes of the two apple trees that were crosses and the genotypes and phenotypes of the offspring.

[4]

P1 answers

21	22	23	24	25	26	27	28	29	30
C	B	B	B	B	D	B	B	B	D
31	32	33	34	35	36	37	38	39	40
C	A	D	B	A	C	D	D	B	C

- 21 At the epidermis of a leaf, only the guard cell (Y) has chloroplast. The nucleus is already present in the drawing for cell Y. Cell X does not have chloroplast and only the nucleus is missing from this cell.
- 22 P shows a root hair cell, Q shows tissue and R represents the root which is an organ.
- 23 The rectangular molecule concentration is the same on both sides of the membrane, hence there will be no net movement. There is a higher concentration of the oval molecule at P and a higher concentration of the circular molecule at Q, hence both will move to the side with lower concentration.
- 24 The positive test for biuret test is purple which shows that protein is present while the positive test for iodine solution is blue-black which shows that starch is present.
- 25 The enzyme represents the lock while the substrate represents the key.
- 26 Glucose and amino acids will be absorbed into the hepatic portal vein represented by D hence the concentration is the highest at D. A is the oesophagus, B is the bile duct and C is the large intestine.
- 27 In tube P, photosynthesis occurs which uses carbon dioxide. Carbon dioxide in tube P thus decreases and indicator turns purple. In Q, due to absence of light, the plant only respire and gives off carbon dioxide causing the carbon dioxide concentration in tube Q to increase. Hence the indicator turns yellow.
- 28 B is the xylem as it points to the inner part of the vascular bundle.
- 29 Atrioventricular valve is found between the atrium and ventricle while semilunar valve is found between the aorta and ventricle.
At W, the ventricular pressure is increasing above the atrial pressure, hence the atrioventricular valve closes.
At X, the ventricular pressure is increasing above the aortic pressure, hence the semilunar valve opens.
At Y, the ventricular pressure is decreasing below the aortic pressure, hence the semilunar valve closes.
At Z the ventricular pressure is decreasing below the atrial pressure, hence the atrioventricular valve opens.
- 30 1 is the vena cava which carries deoxygenated blood from all parts of the body into the right side of the heart. 2 is the pulmonary artery which carries deoxygenated blood from the right ventricle. 3 is the aorta which carries oxygenated blood from the left side of the heart. 4 is the pulmonary vein which carries oxygenated blood from the lungs into the left side of the heart.
- 31 The 4 membranes are: into alveolar cell membrane, out of alveolar cell membrane, into blood capillary membrane, out of blood capillary membrane to plasma

- 32 Nerve impulses travel from receptor to sensory neurone to relay neurone (central nervous system) to motor neurone and finally effector (muscles) to produce a response.
- 33 To view far objects, the lens must be thin due to suspensory ligaments pulling on it. For the suspensory ligament to be taut, the ciliary muscles have to relax.
- 34 The hydra in the aquarium reproduces on its own (1 parent). There is no fusion of gametes hence this is asexual reproduction and the parent and offspring are genetically identical.
- 35 Plants that are cross-pollinated (different parents) have greater genetic variation hence are more likely to adapt successfully to environmental changes.
- 36 This is a knowledge type question on function of a gene.
- 37 Parents of offspring D only has recessive allele, hence D cannot inherit a dominant allele.
- 38 Gametes only have half the number of chromosomes compared to other cells as they will undergo fusion to produce zygote. Hence a gamete can only contain 1 allele of each gene. Since the organism is homozygous dominant, it can only produce gametes with dominant alleles.
- 39 Decomposes, consumers and producers all respire to return carbon dioxide to the atmosphere. Arrow 2 shows producers taking in carbon dioxide due to photosynthesis.
- 40 At pH 5 only trout and perch survives, sea bass dies. Fish eggs are unable to survive at pH5, hence no offspring can be produced.

P4 Answers

- 1(a) organ X: liver ;
R: hepatic vein ;
Q: hepatic portal vein ;
R: hepatic artery ;
- 1(b) any 2 of
P has thinner wall / less muscular wall than R ;
P has valves while R does not ;
P has wider lumen than R;
- 1(c) any 2 of
converts glucose to glycogen / stores glycogen ;
converts glycogen to glucose ;
produces bile ;
iron storage ;
- 2(a)(i) carbon dioxide + water ;
glucose + oxygen ;
- 2(a)(ii) chloroplasts ;

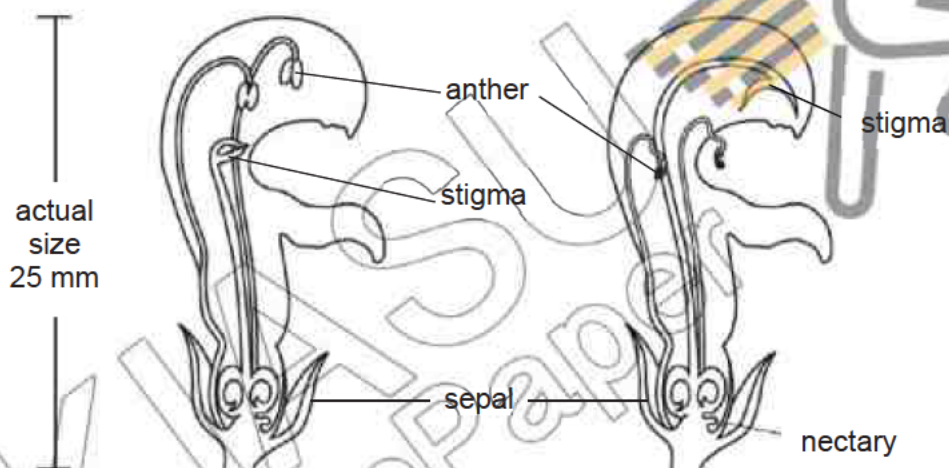
2(a)(iii) palisade mesophyll cell / spongy mesophyll cell / guard cell ;

2(b)(i) any 2 of
rate of photosynthesis increases as temperature rises ;
data quote ;
rate doubles with 10 °C rise in temperature ;

2(b)(ii) any 2 of
photosynthesis involves enzymes;
particles / enzymes have more energy (at higher temperatures) so move more quickly ;
more frequent collisions between enzyme and substrate ;

2(b)(iii) rate of photosynthesis decrease / stop ;
enzymes denatured / destroyed ;

3(a) line ending either on or in sepal + labelled sepal ;
line ending either on or in anther + labelled anther ;
line ending either on or in stigma + labelled stigma ;



3(b)(i) transfer of pollen grains from anther to stigma ;
between flowers of the same species on different plants ;

3(b)(ii) any 3 of
1 flower D, anther mature / pollen grain produced / present ;
2 flower D, stigma closed / immature ;
3 flower E, stigma open / mature ;
4 flower E, anther withered / no pollen present ;

3(c) bee land on large petals ;
bee makes contact with anther/stigma + while collecting nectar;

4(a)(i)

feature	non-smoker	smoker
length of cilia	long	shorter ;
size of air space	Wide	narrow ;

accept alternative wording ;

4(a)(ii) any two of

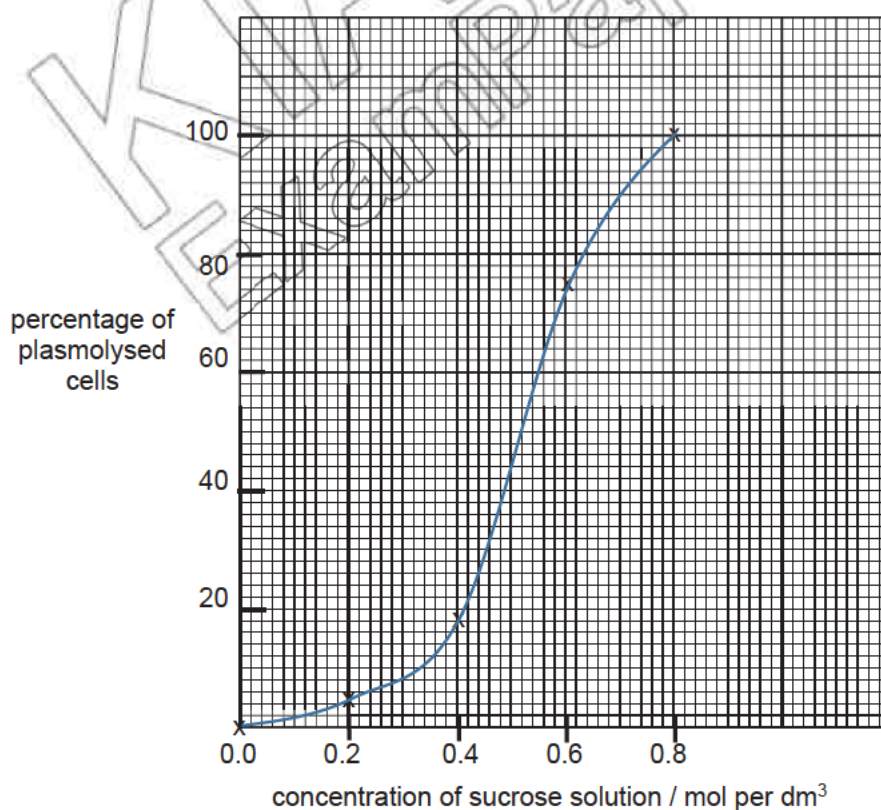
Feature	non-smoker	smoker
size of mucus layer	thin / narrow / even distribution	thick / wide / uneven distribution
bacteria present in mucus	few	many / more ;
diameter / bronchiole size	wide / larger / longer	narrow / smaller ;
shape of lumen	circular	oval ;
number of muscle cells	many / more	few / less ;
size of muscle cells	small	large ;
number of cilia	many / more / large	few / little / less ;

accept alternative wording ;
accept other possible comparisons ;

4(b) insufficient / damaged cilia to sweep mucus ;
bacteria trapped in mucus not removed / stay in / build up in, (lung / bronchiole)
or
mucus / bacteria, will enter alveoli ;

4(c) any two of
carbon monoxide / tar / nicotine / irritants ;;

5a)(i) 1 both axes fully labelled -
'concentration of sucrose solution / mol per dm³' on x-axis and 'percentage of plasmolysed cells' on y axis;
2 all 5 points visibly plotted correctly ;
3 plotted points joined with smooth lines + not extrapolated beyond first and last plots
+ graph occupies at least 50% of grid ;



- 5(a)(ii) working shown on graph ;
value read correctly from working + mol per dm³ (allow ecf);
- 5(b) 1 sucrose solution at lower water potential than cell sap ;
2 net movement of water molecules / water molecules move by osmosis from cell sap solution into sucrose solution / out of cell ;
3 too much water loss from cell, cell membrane pulls away from cell wall ;
- 5(c) cells saps at different concentrations / water potential ;
- 6(a) tree ;
songbird / hawk ;
- 6(b)(i) any 2 of
doesn't reach the leaves / tree / intercepted by other objects ;
reflected off leaves ;
not used in photosynthesis ;
- 6(b)(ii) any 2 of
movement / flight ;
excretion ;
egestion / faeces ;
respiration which releases heat / maintaining body temp / warm blooded ;
hawk doesn't eat / digest all of songbird (s);
- 6(c) any 4 of
1 more food produced ;
2 quote from Fig. 6.2 (e.g. 12 000 leaves vs. 1200 portions of meat) ;
3 25 X more mass / 10 X more food products (for wheat);
4 fewer levels in food chain ;
5 correct reference to herbivore / carnivore + human OR correct reference to primary / secondary + consumer ;
6 less energy lost / more efficient ;
7 example of energy not lost (e.g. through movement);
- 7(a) 10.00 – 12.00 ;
- 7(b)(i) any 5 of
state at least 1 trend:
1 plant X lost less water vapour than plant Y from 06.00 to 18.00 ;
2 plant X lost more water vapour than plant Y from 18.00 to 20.00 ;
Accept plant Y lost more water vapour than plant X over the 14-hour period
- reasons:
3 plants may be of different species ;
4 plant Y + more / faster transpiration ;
5 plant Y + more / bigger leaves ;
6 plant Y + more stomata / pores / guard cells OR stomata bigger / wider
AW ;
7 plant Y + better / bigger root system / absorbs more water ;
8 plant Y + thinner (waxy) cuticle ;

7(b)(ii) any 4 of

state at least 1 trend:

1 more rapid loss of water vapour from 06.00 to 10.00;

2 rate of water loss slows from 10.00 to 12.00;

Accept water loss increase from 06.00 to 12.00

reasons:

from 06.00 – 10.00,

3 increased + light (intensity) ;

4 increased rate of photosynthesis ;

5 stomata / pores / guard cells + open /wider ;

6 increased + temperature / heat ;

7 reference to wind OR increased + air movement ;

8 decreased + humidity ;

8(a) any 3 of

double helix ;

made of nucleotides ;

A joins with T and C joins with G ;

strands / bases, join / pair up, by crosslinks / hydrogen bonds ;

8(b) mutation caused by radiation;

or chemicals;

can cause change in gene structure e.g. sickle cell anaemia

or change in chromosome number e.g. Down's syndrome

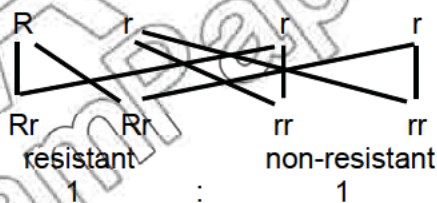
8(c) parental phenotype Resistant x non-resistant
parental genotype Rr x rr

gametes

F1 genotype

F1 phenotype

F1 phenotype ratio



parental phenotype and genotype ;

gametes ;

F1 genotype ;

F1 phenotype ;

P5 answers

2(a)(i)

piece	dimensions / mm	Time taken / s
A	20 x 10 x 10	
B	<u>10 x 10 x 10</u>	
C	<u>5 x 10 x 10</u>	

correct dimensions ;
time taken in seconds and decreasing trend ;

2(a)(ii) the bigger/larger the piece of agar, the longer the time taken for the agar to change colour ;
accept reverse argument

2(a)(iii) diffusion ;

2(a)(iv) for faster removal of ;
waste products / carbon dioxide ;

OR
for faster absorption of;
nutrients / oxygen ;

A for named substances oxygen, CO₂, waste products, ions, vitamins, hormones
(anything small enough to diffuse)

A faster diffusion into and out of cell ;

2(b) 1 cut agar of the same dimensions ;
2 place them in different concentrations of liquid X ;
3 record time taken for each agar to completely change colour ;

2(c)(i) outline clear and continuous + no shading ;
larger than actual slice, fills at least half the available space + correct proportions ;

2(c)(ii)

food test	unripe banana	ripe banana
starch test	large areas of blue black colouration	smaller areas of blue black coloration / remains yellow
reducing sugar test	remains blue / green / yellow precipitate forms	orange / brick-red precipitate forms

correct observations for unripe banana ;
correct observations for ripe banana ;

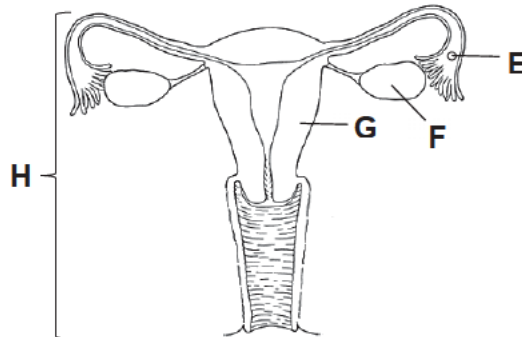
OR any 2 correct observations 1 mark

2(c)(iii) less starch in S2 than S1 ;
more reducing sugar in S2 than S1 ;



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21 The figure shows the female reproductive system.



Which is correct?

	E	F	G	H
A	cell	organ	tissue	organ system
B	cell	tissue	organ	organ system
C	tissue	cell	organ	organ system
D	organ system	tissue	organ	cell

22 Which of these processes require energy?

	diffusion	osmosis
A	+	+
B	-	-
C	+	-
D	-	+

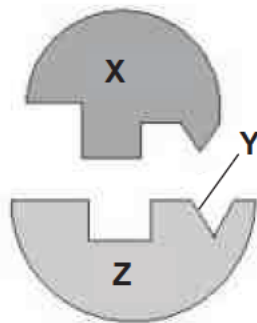
key:

+ energy required
- energy not required

23 Which matches the large molecule to its basic units?

	basic unit	large molecule
A	amino acids	fat
B	glucose	glycogen
C	glycerol	glycogen
D	starch	glucose

- 24 The figure illustrates the 'lock and key' hypothesis of enzyme action.



Which are the substrate, the enzyme and the active site?

	substrate	enzyme	active site
A	X	Y	Z
B	X	Z	Y
C	Y	X	Z
D	Z	X	Y

- 25 The table shows the amount of certain substances in different blood vessels.

	oxygen	carbon dioxide	digested nutrients
A	+++	+	+
B	+	+++	+
C	+++	+++	+++
D	+	+	+++

key:

+ low amounts
 ++ moderate amounts
 +++ high amounts

Which best represents the hepatic portal vein?

26 Which describes the function of chlorophyll during photosynthesis?

- A** absorb carbon dioxide
- B** absorb oxygen
- C** trap light energy for production of starch
- D** trap light energy for conversion of light energy into chemical energy

27 Which conditions will cause a plant to transpire the most?

	temperature /°C	humidity /%	light intensity /arbitrary units
A	15	30	16
B	25	30	16
C	37	20	14
D	37	60	14

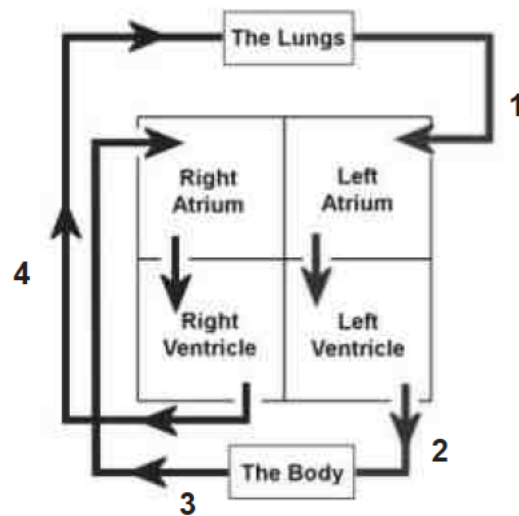
28 The table shows the full blood count of a child suffering from Thalassemia, a type of blood disorder.

	Thalassemia	Normal range
number of red blood cell per litre of blood	2.77×10^{12}	$3.9 - 5.3 \times 10^{12}$
number of white blood cell per litre of blood	8.4×10^9	$5.0 - 17.0 \times 10^9$
number of platelet per litre of blood	192×10^9	$150 - 450 \times 10^9$
amount of haemoglobin / g/dl	7.5	11.5 – 13.5

Which statement describes the effect Thalassemia may have on the child's health?

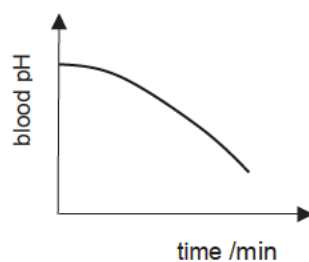
- A** He is often pale and breathless.
- B** His blood does not clot.
- C** He is unable to fight against bacterial infections.
- D** His red blood cells are not able to carry oxygen.

- 29 The figure shows the double circulation of blood.



Which of the following statements is correct?

- A Blood vessel 1 carries blood under high pressure.
 - B Blood vessel 2 is an artery.
 - C Blood vessel 3 carries oxygenated blood.
 - D Blood vessel 4 have thick and muscular walls.
- 30 The figure shows the effect of vigorous exercise on blood pH.



Which statement explains the change in blood pH?

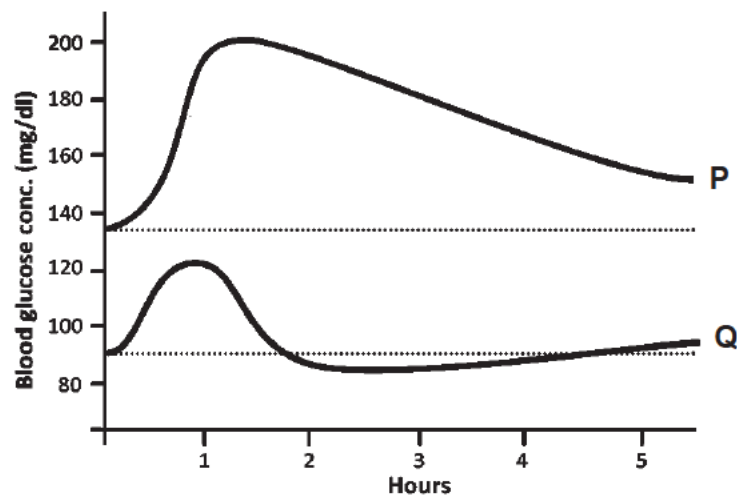
- A There is an increase in oxygen levels in the blood.
- B There is an increase in carbon dioxide levels in the blood.
- C The muscles are undergoing anaerobic respiration.
- D The muscles are suffering from aches and fatigue.

31 In the nervous system, which of the following are NOT considered effectors?

- I photoreceptors
- II salivary glands
- III sensory cells in the skin
- IV sphincter muscles of the alimentary tract

- A I and III
- B II and III
- C II and IV
- D III and IV

32 The figure shows the blood glucose concentration of two individuals, **P** and **Q**.



Based on the figure, which hormone is responsible for regulating the blood glucose concentration for individual **P** and how much is it found in the blood?

	hormone involved	hormone levels in blood
A	glucagon	high
B	glucagon	low
C	insulin	high
D	insulin	low

33 Which of the following correctly describes the relationship between genes, DNA and chromosomes?

- A** A gene is a short segment of DNA.
- B** Base pairing of chromosomes results in the double helix structure.
- C** DNA is made up of many chromosomes joined together.
- D** The condensed form of genes is DNA.

34 What causes sickle cell anaemia?

- A** a change in chromosome number
- B** a change in the structure of a gene
- C** a virus infection
- D** uncontrolled cell division of red blood cells

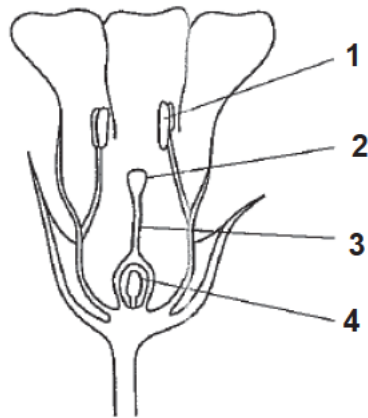
35 The figure shows a leaf with buds growing from it.



Which row describes the type of reproduction and the genotype of the offspring?

	reproduction	genotype
A	asexual	genetically dissimilar
B	asexual	genetically identical
C	sexual	genetically dissimilar
D	sexual	genetically identical

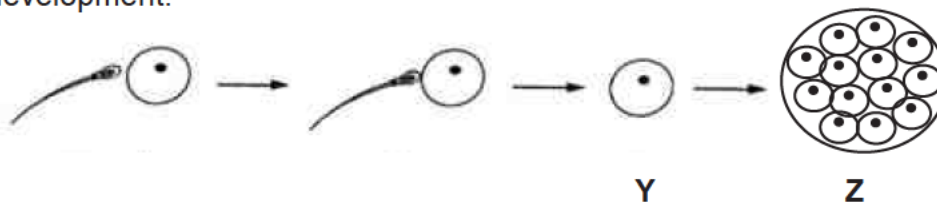
- 36 The figure shows the cross section of a flower.



Where does pollination and fertilisation take place?

	pollination	fertilisation
A	1	2
B	2	1
C	1	4
D	2	4

- 37 The figure shows the fertilisation of the human ovum and subsequent development.



Which statement is correct?

- A Y is an ovum released by the ovary.
- B Z is the zygote.
- C Y is implanted into the uterine lining.
- D Z is implanted into the uterine lining.

- 38 The figure shows the number of people in country X infected with HIV from 2012 to 2016.



What conclusion may be drawn from the figure?

- A The number of women infected decreases every year.
 - B More men died from AIDS than women.
 - C The decrease in number of men and women infected by HIV could be due to effective programmes that educate the public on HIV infections.
 - D The increase in tax on condoms resulted in the rise of HIV infections.
- 39 The table shows the amount of energy available when man feeds on a producer and a primary consumer.

	producer	primary consumer
amount of energy available /KJ	1 000	100

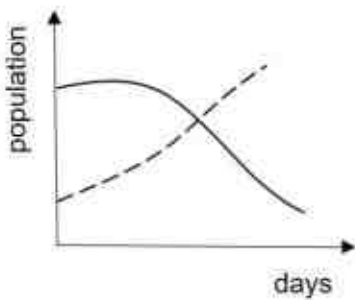
Based on your knowledge on energy transfer, which statement best explains the table?

- A Less energy is available in producers as not all light energy from the sun can be absorbed.
- B Less energy is available in the primary consumer as it stored most of the energy as carbohydrates.
- C More energy is available to man if they feed on producers as most of the energy is lost as it is transferred from one trophic level to another.
- D More energy is available in producers as they exist in greater numbers.

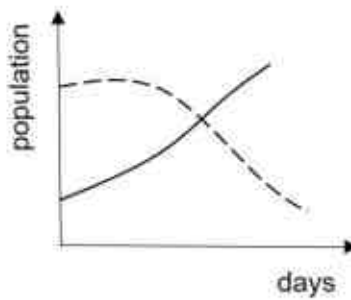
- 40 The figure shows the amount of submerged aquatic plants present and the bacterial count in four different rivers.

In which river has eutrophication occurred?

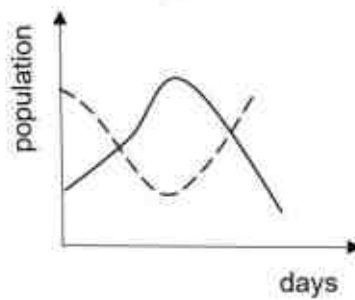
key: — submerged aquatic plants
--- bacteria



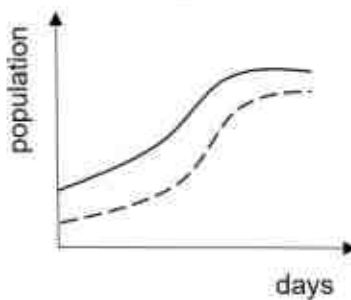
A



B



C



D

- End of Paper -

Section A [45 marks]

Answer all the questions in the spaces provided.

- 1 (a) Fig. 1.1 shows an animal cell.

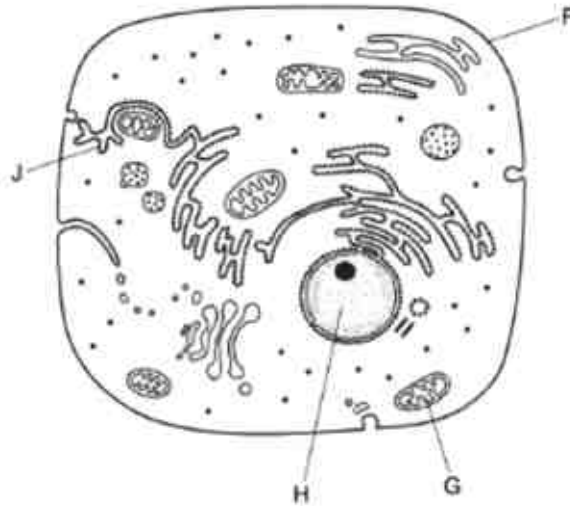


Fig. 1.1

- (a) Name the following labelled organelles as shown in Fig. 1.1. [2]

(i) **G**

(ii) **H**

- (b) State the function of the organelles labelled [2]

(i) **F**
.....

(ii) **G**
.....

- (c) Table 1.1 shows the number of organelle **G** in different types of cells.

cell type	red blood cell	muscle cell	skin cell
number of organelle G / arbitrary units	0	1400	200

Table 1.1

- (i) Suggest why the red blood cell contains no organelle **G**. [1]

.....

.....

- (ii) Suggest why the number of organelle **G** between muscle cells and skin cells differ in great numbers. [1]

.....

.....

- 2 (a) Fig. 2.1 shows an experimental set-up. The height of the liquid level in the capillary tube was measured at regular time intervals and recorded in Table 2.1.

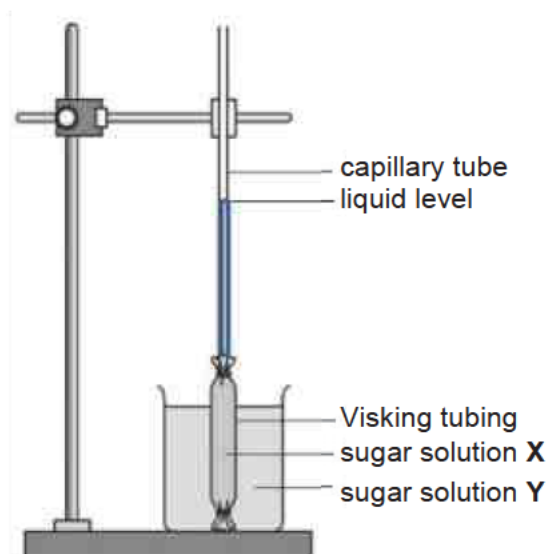


Fig. 2.1

Time /minutes	Height of liquid level in capillary tube /mm
0	20
30	22
60	25
90	29
120	34

Table 2.1

- (i) On the grid provided on the next page, plot a graph of height of liquid in capillary tube against time using the results in Table 2.1.

On your graph, use appropriate scales, label the axes and draw a curve of best fit. [4]

- (ii) With reference to the shape of the graph you have drawn in part (i), suggest an appropriate sugar concentration for sugar solutions **X** and **Y**: [2]

sugar solution **X**: % sugar

sugar solution **Y**: % sugar

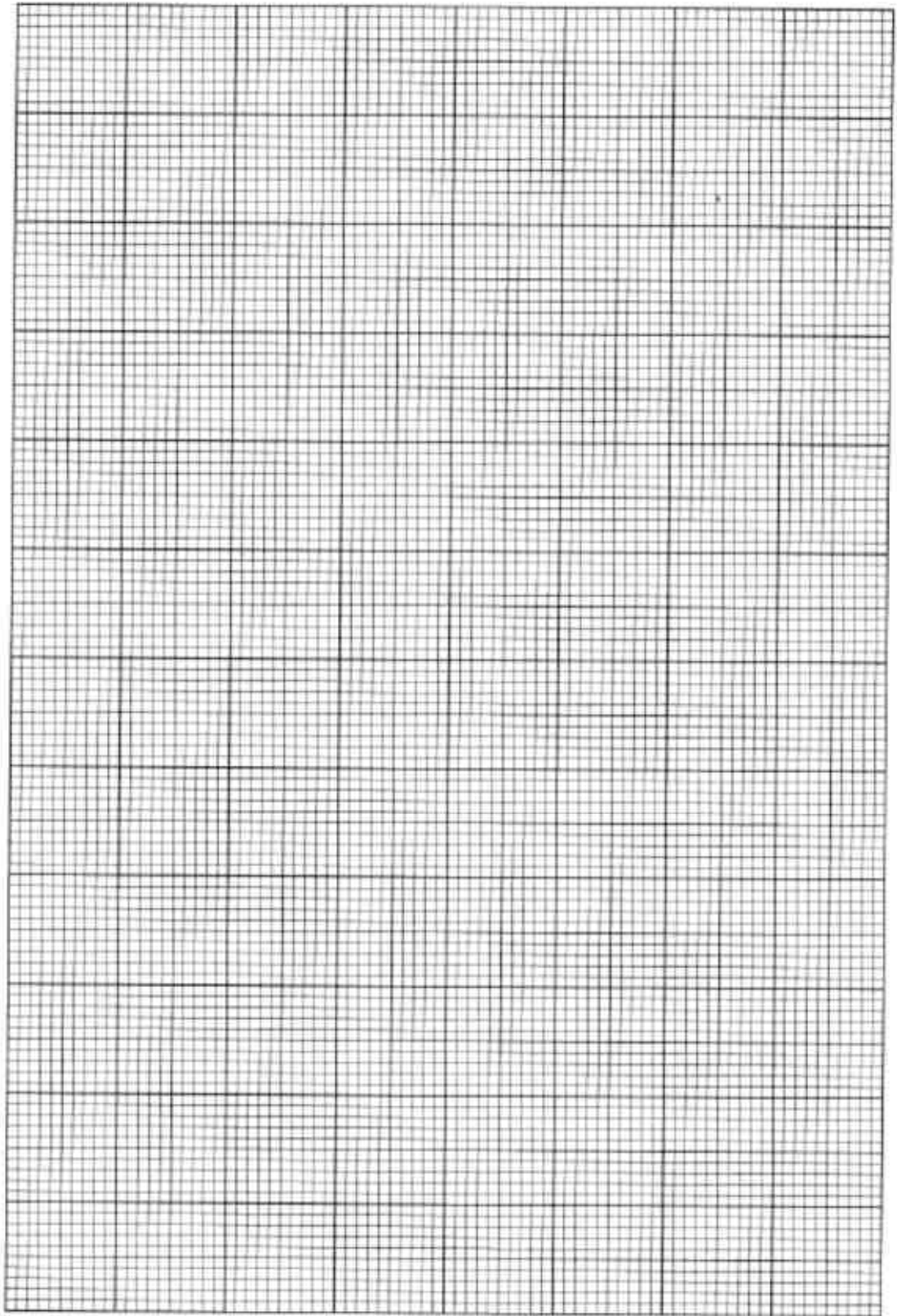
- (iii) Explain your answer for part (ii) above. [3]

.....

.....

.....

.....



- 3 The enzyme lipase digests fat molecules. During this process acids are formed which decrease the pH of the mixture.

Four different tubes, **A**, **B**, **C**, **D** and **E** were set up to investigate the effect of lipase on fat in different conditions. The initial pH of each mixture was pH 8.0.

Table 3.1 shows the results obtained.

tube	condition				pH of mixture after 10 min
	amount of lipase added /mg	amount of fat added /mg	amount of substance P added /mg	temperature /°C	
A	0	4	0	37	8.0
B	0	4	5	37	8.0
C	10	4	5	37	5.5
D	10	4	0	37	7.0
E	10	4	5	75	

Table 3.1

- (a) Based on the results in Table 3.1, list the conditions necessary for most fat digestion. [3]

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- (b) Identify substance **P**. [1]

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- (c)** Name and describe the process involved when substance **P** is added to fats. [2]

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- (d)** Complete Table 3.1 by filling in an appropriate pH value for test tube **E**. [1]

- (e)** Explain your answer for part **(d)** above. [2]

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- (f)** State the end-product(s) of fat digestion. [1]

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- 4 Fig. 4.1 shows the internal structure of a dicotyledonous green leaf.

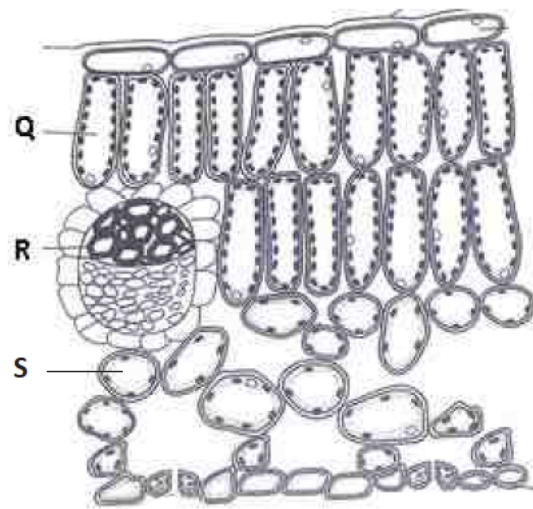


Fig. 4.1

- (a) Name the parts labelled **Q** and **R**. [2]

Q

R

- (b) Describe and explain how chloroplast distribution differs between cell **Q** and cell **S**. [3]

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- (c) State the process by which carbon dioxide gas from the surroundings reaches cell **Q**. [1]

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- (d) Describe and explain two ways in which cell **R** is adapted to its function. [4]

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- 5 (a) A group of scientists created 2 artificial nucleotides, named **P** and **Q**.

Fig. 5.1 shows a segment of DNA containing the artificial nucleotides.

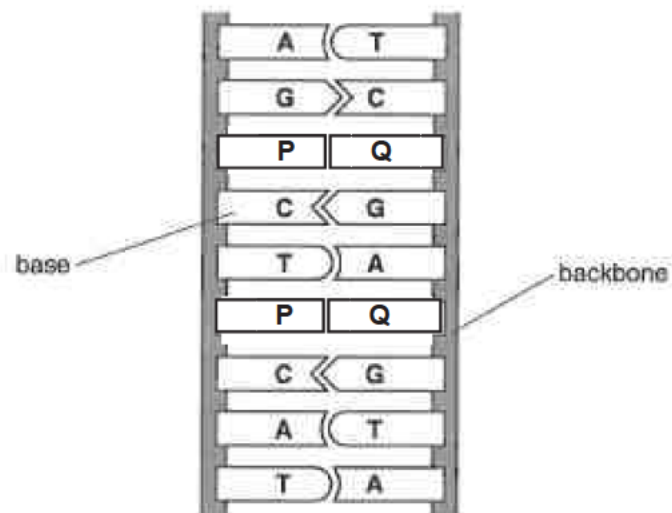


Fig. 5.1

- (i) State what the letters **A**, **T**, **G** and **C** represents.

[2]

A

T

G

C

- (ii) Use the information given in Fig. 5.2 to explain how creating the two artificial nucleotides, **P** and **Q**, leads to more different types of proteins produced. [2]

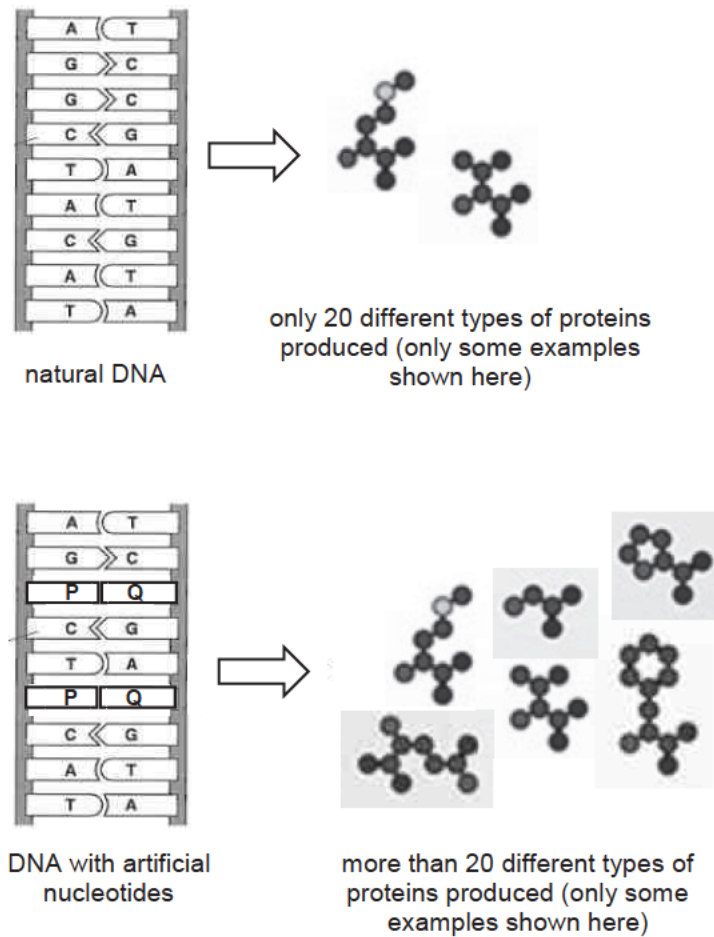


Fig. 5.2

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- (b) Niemann-Pick disease is a rare genetic disorder that causes the nervous system and the muscular system to degenerate from birth. Children born with this disease inherited defective genes from their parents.

Fig. 5.3 describes how the defective genes of the parents are passed on to the children.

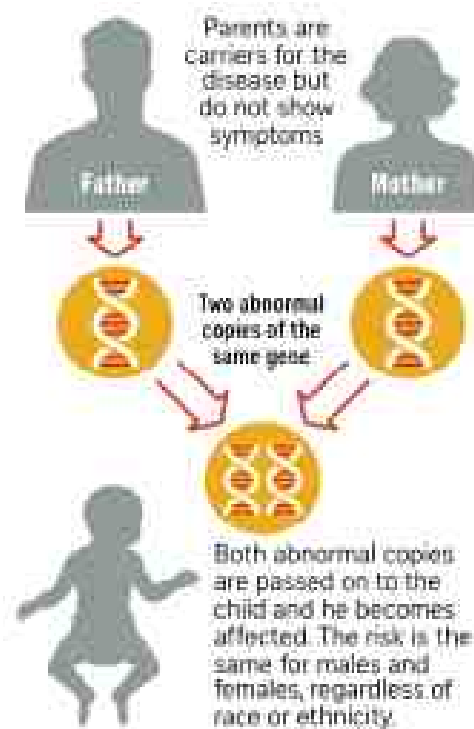


Fig. 5.3

- (i) Using suitable letters, suggest the genotype of the [2]
- father
- child

- (ii) Explain why the parents are not affected by the disease. [1]

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.....

- (iii) Use a genetic diagram to work out the chance of the child having Niemann-Pick disease. [3]

Section B [20 marks]

Answer **any 2** of the 3 questions.

Write your answers in the spaces provided.

- 6 (a)** Fig. 6.1 shows a section through an alveolus and an adjacent blood capillary in a human lung.

The arrows shows the passage of oxygen.

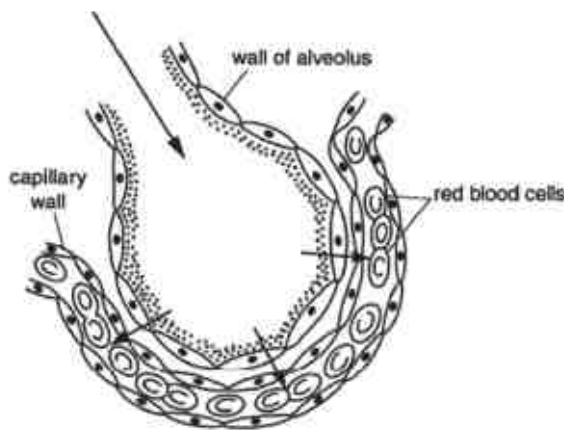


Fig. 6.1

Using Fig. 6.1, describe and explain how oxygen is rapidly absorbed into the blood.

Suggest how the absorption and transport of oxygen will be affected by cigarette smoke.

[6]

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- (b) Oxyhaemoglobin is formed when oxygen binds to haemoglobin.

Fig. 6.2 shows how the concentration of oxyhaemoglobin changes during exercise.

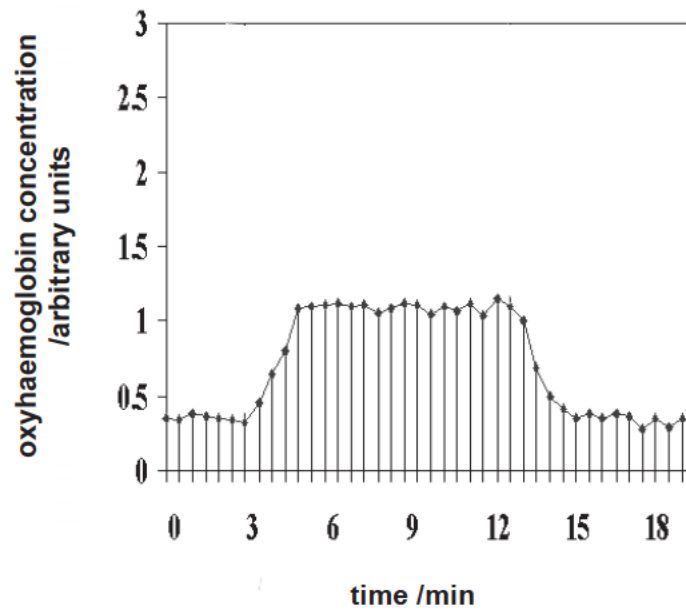


Fig. 6.2

Explain why the concentration of oxyhaemoglobin in blood rises and falls as shown in Fig 6.2. [4]

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- 7 (a) Fig. 7.1 shows how a human eye responds to bright light with and without the administration of a drug, which targets the circular muscles.

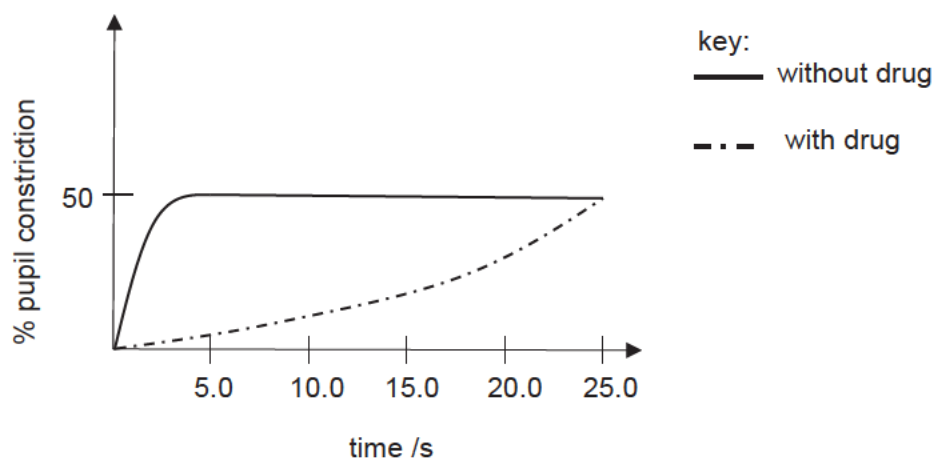


Fig. 7.1

Using Fig. 7.1 and your knowledge of the eye and the nervous system, describe how the eye's response to bright light differs with and without the drug. [6]

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- (b)** The change in pupil size is an example of a reflex action. Describe, using an example, how this differs from an action controlled by conscious thought. [4]

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- 8 (a) Fig. 8.1 shows the change in average global temperature from 1880 to 2004.

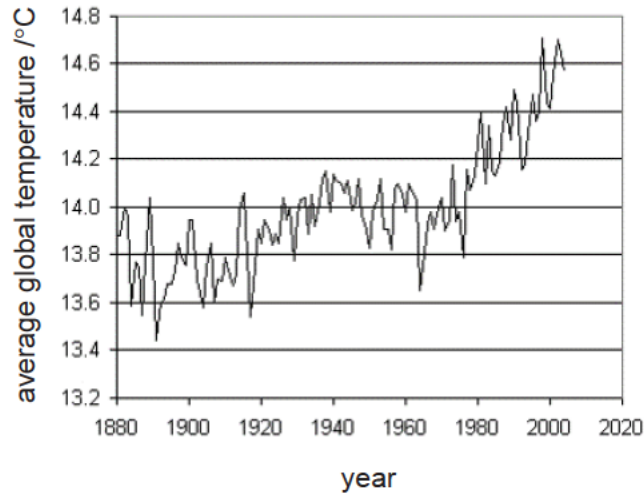


Fig. 8.1

One of the main cause of the current global warming trend is the increase in carbon dioxide emission caused by human activities.

Suggest possible reasons for the trend in average global temperature shown in Fig. 8.1 and explain the effect increasing carbon dioxide emission will have on the carbon cycle. [6]

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- (b)** Scientists are carrying out trials of 'carbon farming', where large masses of the jatropha plant, which absorbs and stores large amounts of carbon dioxide are grown.

Using your knowledge of carbon sinks, suggest how this may reduce global warming. [4]

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- End of Paper -

4E5N Prelim 2018 P1
MARKSCHEME

21	A	26	D	31	A	36	D
22	B	27	C	32	D	37	D
23	B	28	A	33	A	38	C
24	B	29	B	34	B	39	C
25	D	30	C	35	B	40	A

KIASU
ExamPaper

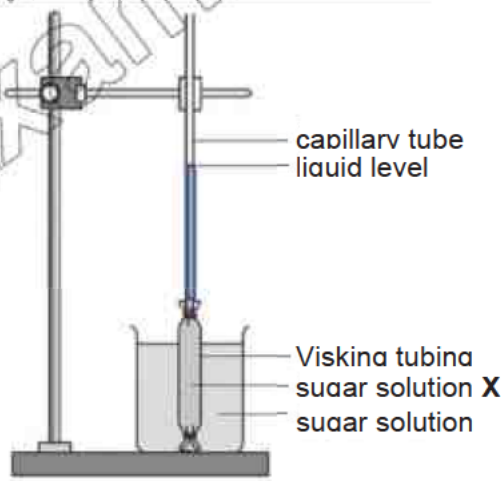
Answer all the questions in the spaces provided.

Answer all the questions in the spaces provided.

A diagram of an animal cell. The cell is roughly spherical with a wavy outer boundary. Inside, there are various organelles: a large central nucleus with a prominent nucleolus (labeled H), several mitochondria with internal folds (labeled J), and a network of endoplasmic reticulum (labeled F). Other smaller organelles like Golgi bodies and lysosomes are also visible. A label G points to a small, dark, oval structure near the bottom right.

Fig. 1.1

2

	(c)	Table 1.1 shows the number of organelle G in different types of cells.			
		cell type	red blood cell	muscle cell	skin cell
		number of mitochondria / arbitrary units	0	1400	200
		Table 1.1			
	(i)	Suggest why the red blood cell contains no organelle G . [1]			
		Red blood cell has no cytoplasm and organelles in order to contain more haemoglobin. [1] or Red blood cells exchange substances with its surroundings through <u>passive transport</u> and hence do not carry out aerobic respiration. [1]			
	(ii)	Suggest why the number of organelle G between muscle cells and skin cells differ in great numbers. [1]			
		Muscle cells has many more organelle G than skin cells as they carry out more aerobic respiration to meet the cells' energy needs. [1] or Muscle cells require more energy for movement. [1]			
2	(a)	Fig. 2.1 shows an experimental set-up. The height of the liquid level in the capillary tube was measured at regular time intervals and recorded in Table 2.1.			
					
		Fig. 2.1			

		<table border="1"> <thead> <tr> <th>Time /minutes</th> <th>Height of liquid level in capillary tube /mm</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>20</td> </tr> <tr> <td>30</td> <td>22</td> </tr> <tr> <td>60</td> <td>25</td> </tr> <tr> <td>90</td> <td>29</td> </tr> <tr> <td>120</td> <td>34</td> </tr> </tbody> </table> Table 2.1	Time /minutes	Height of liquid level in capillary tube /mm	0	20	30	22	60	25	90	29	120	34
Time /minutes	Height of liquid level in capillary tube /mm													
0	20													
30	22													
60	25													
90	29													
120	34													
	(i)	On the grid provided on the next page, plot a graph of height of liquid in capillary tube against time using the results in Table 2.1. On your graph, use appropriate scales, label the axes and draw a curve of best fit. [4] Mark points: Correct scaling - at least $\frac{3}{4}$ of graph paper [1] Correct axes with labels and units [1] All points plotted correctly [1] All points joined with a smooth curve, with no extension past points [1]												
	(ii)	With reference to the shape of the graph you have drawn in part (i), suggest an appropriate sugar concentration for sugar solutions X and Y: [2] sugar solution X: <u>40</u> % sugar [1] sugar solution Y: <u>10</u> % sugar [1] accept any answer that shows sugar solution Y has higher water potential, provided difference is not too narrow (less than 5%)												
	(iii)	Explain your answer for part (ii) above. [3] The height of the liquid level in the capillary tube increased, suggesting that water molecules moved from sugar solution Y to sugar solution X by osmosis [1]. During osmosis, water molecules move from a region of higher water potential to that of a lower water potential [1]. Hence the concentration of sugar solution X is higher than that of Y [1]												
		Mark points: Suggests osmosis has occurred [1]												

			Suggests movement of water molecules from higher water potential to lower [1] Compares sugar concentration/water potential of X and Y [1]
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- 3 The enzyme lipase digests fat molecules. During this process acids are formed which decrease the pH of the mixture.

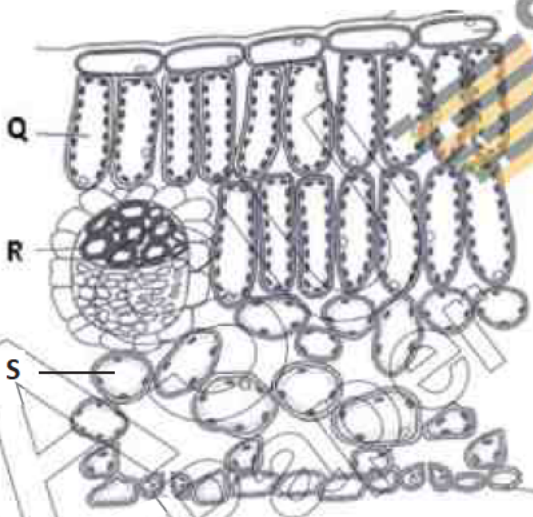
Four different tubes, **A, B, C, D** and **E** were set up to investigate the effect of lipase on fat in different conditions. The initial pH of each mixture was pH 8.0.

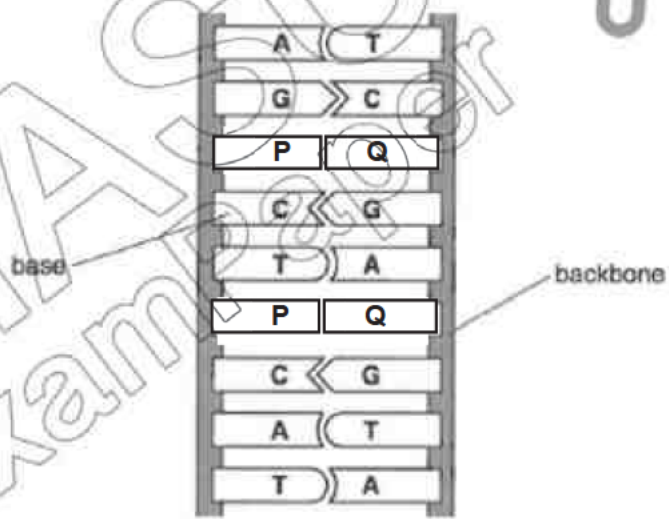
Table 3.1 shows the results obtained.

tube	condition				pH of mixture after 10 min
	amount of lipase added /mg	amount of fat added /mg	amount of substance P added /mg	temperature /°C	
A	0	4	0	37	8.0
B	0	4	5	37	8.0
C	10	4	5	37	5.5
D	10	4	0	37	7.0
E	10	4	5	75	8.0 [1]

Table 3.1

(a)	Based on the results in Table 3.1, list the conditions necessary for most fat digestion. [3] lipase [1], substance P/bile [1], temperature of 37°C [1] omits value for temperature – deduct ½ m
(b)	Identify substance P. [1] bile [1]
(c)	Name and describe the process involved when substance P is added to fats. [2] Emulsification [1] Big fat globules are broken up into smaller fat droplets [1] Omits name but states 'emulsifies' – award 0.5m

	(d)	Complete Table 3.1 by filling in an appropriate pH value for test tube E. [1]
	(e)	Explain your answer for part (d) above. [2] Lipase was <u>denatured</u> at 75°C, losing its active sites [1] No enzyme-substrate complex formed as <u>shape of enzyme active site changed and is no longer complementary with that of the substrate.</u> [1]
	(f)	State the end-product(s) of fat digestion. [1] fatty acids [0.5] and glycerol [0.5]
4		Fig. 4.1 shows the internal structure of a dicotyledonous green leaf.
		 Fig. 4.1
	(a)	Name the parts labelled Q and R. [2] Q <u>palisade mesophyll cell</u> [1] R <u>xylem</u> [1]
	(b)	Describe and explain how chloroplast distribution differs between cell Q and cell S. [3] There are more chloroplasts in cell Q than S [1] Cell Q is nearer to the upper epidermis [0.5] and hence gain more sunlight than cell S [0.5]

		This leads to increased rate of photosynthesis as more light is trapped by chlorophyll for conversion of light energy into chemical energy. [1]
	(c)	State the process by which carbon dioxide gas from the surroundings reaches cell Q. [1] diffusion [1]
	(d)	Describe and explain two ways in which cell R is adapted to its function. [4] Long and hollow (with no protoplasm and 'end-walls') [1] This reduces resistance to water flowing through the xylem vessel / ensure there is no obstruction to water flow[1] Walls are thickened with lignin [1] To prevent collapse of the vessel / provide mechanical support [1]
5	(a)	A group of scientists created 2 artificial nitrogenous bases, named P and Q. Fig. 5.1 shows a segment of DNA containing the artificial nitrogenous bases.  Fig. 5.1
	(i)	State what the letters A, T, G and C represents. [2] A <u>adenine</u> [0.5] T <u>thymine</u> [0.5] G <u>guanine</u> [0.5] C <u>cytosine</u> [0.5]

- (ii) Use the information given in Fig. 5.2 to explain how creating the two artificial nucleotides, **P** and **Q**, leads to more different types of proteins produced. [2]

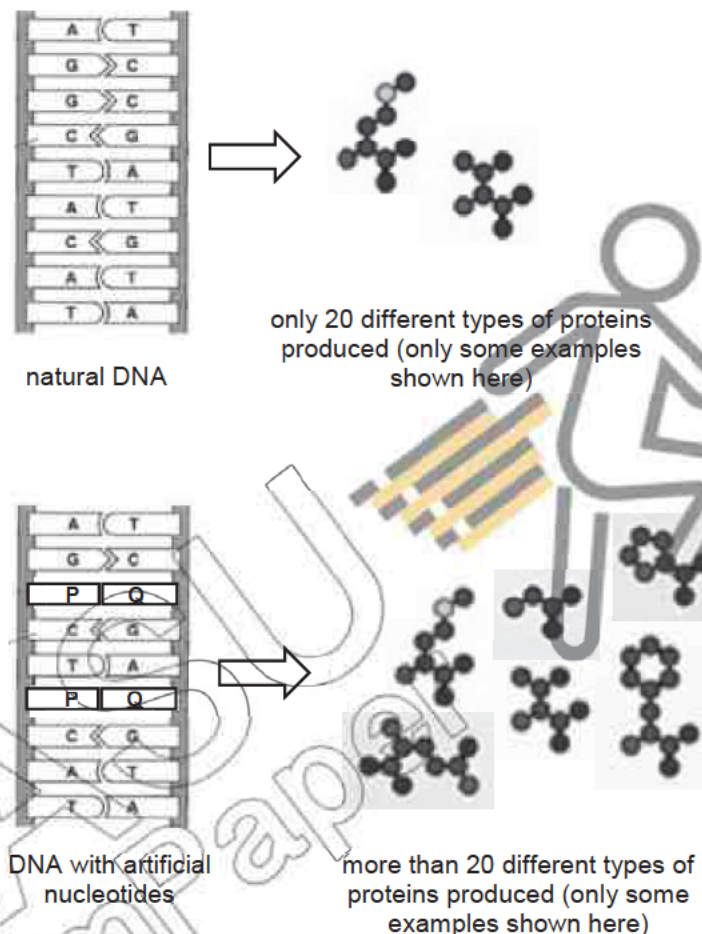


Fig. 5.2

Nitrogenous bases form part of a nucleotide molecule [0.5], where many are joined together to form a gene [0.5] Since each gene codes for a specific protein [0.5], creating two new nitrogenous bases will lead to more diversity of genes with different nucleotide sequence and hence more diverse selection of proteins. [0.5]

mark points:

mentions gene codes for protein [1]

mentions more variety of nucleotides leads to increased variety of genes [1]

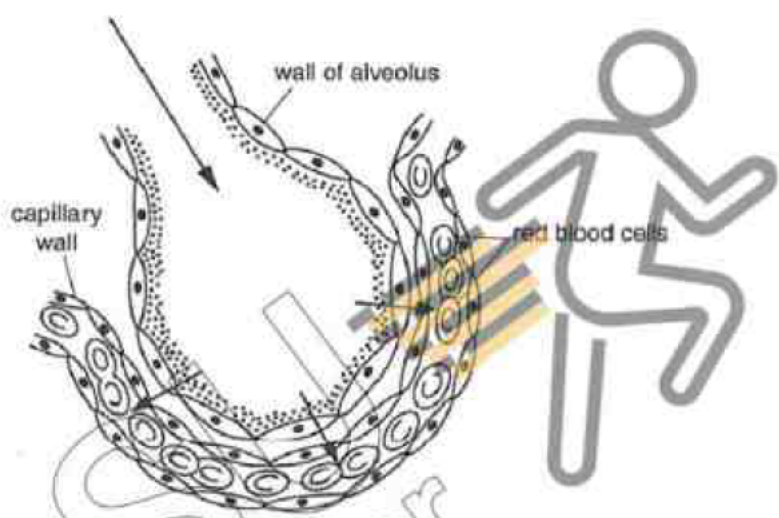
(b)	Niemann-Pick disease is a rare genetic disorder that causes the nervous system and the muscular system to degenerate from birth. Children born with this disease inherited defective genes from their parents. Fig. 5.3 describes how the defective genes of the parents are passed on to the children. Fig. 5.3
(i)	Using suitable letters, suggest the genotype of the father Nn [1] child nn [1]
(ii)	Explain why the parents are not affected by the disease. [1] Both parents are heterozygous for the trait [1] and hence disease is not expressed.

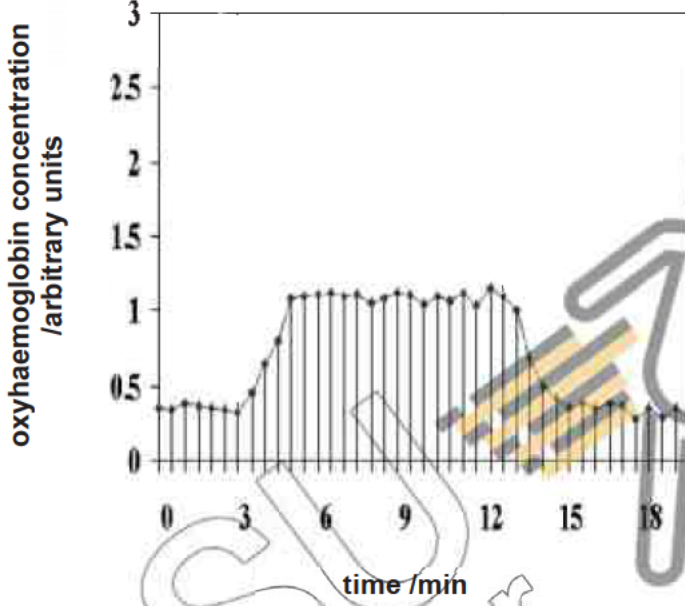
		(iii) Use a genetic diagram to work out the chance of the child having Niemann-Pick disease. [3] Phenotype of parents healthy X healthy Genotype of parents Nn X Nn Gametes N n N n Genotype of offspring NN Nn Nn nn Phenotype of offspring healthy healthy healthy diseased Phenotypic ratio 3 healthy : 1 diseased ∴ The child has a 25% chance of having Niemann-Pick disease. [1] Replaced genetic cross diagram with Punnet square – max 2 m
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Section B [20 marks]

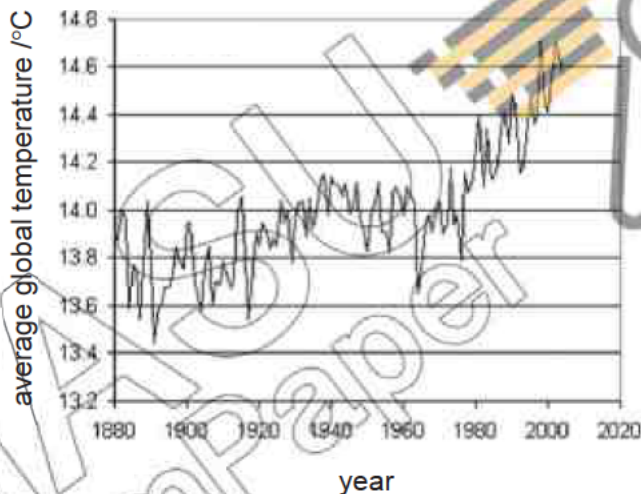
Answer **any 2** of the 3 questions.

Write your answers in the spaces provided.

6	(a) Fig. 6.1 shows a section through an alveolus and an adjacent blood capillary in a human lung. The arrows shows the passage of oxygen.  Fig. 6.1
	Using Fig. 6.1, describe and explain how oxygen is rapidly absorbed into the blood. Suggest how the absorption and transport of oxygen will be affected by cigarette smoke. [6] Any 2 of: Wall of alveolus is one cell thick [1] to provide a short diffusion distance for gases, hence ensuring a faster rate of diffusion. [1] A thin film of moisture covers the inner surface of the alveolus [1] to allow gases to dissolve in it. [1] Walls of alveoli are richly supplied with blood capillaries [1] so that the flow of blood in the capillaries maintains the concentration gradient of gases. [1] Max 4m for above Tar [0.5] in cigarette smoke increases the risk of emphysema, reducing gaseous exchange in the alveoli [0.5] Carbon monoxide [0.5] in cigarette smoke binds irreversibly with haemoglobin to form carboxyhaemoglobin, reducing ability of red blood cells to carry oxygen. [0.5]

(b)	Oxyhaemoglobin is formed when oxygen binds to haemoglobin. Fig. 6.2 shows how the concentration of oxyhaemoglobin changes during exercise.  Fig. 6.2
	Explain why the concentration of oxyhaemoglobin in blood rises and falls as shown in Fig 6.2. [4] During exercise, <u>more energy</u> is needed due to increased muscle contractions [1] Hence <u>more oxygen is taken in to increase aerobic respiration</u> (so as to meet the increased demand for energy) [1], leading to a rise in oxyhaemoglobin concentration. After exercise, oxyhaemoglobin concentration remains high as oxygen is taken in to repay oxygen debt incurred during exercise [1]. It slowly decreases to original levels when oxygen debt is fully repaid [1]. Other mark points for consideration: Explains how oxyhaemoglobin increases due to more oxygen binding to haemoglobin – 1m Mentions 'stopped exercising/body resting/recovering from exercise' – award 0.5 m

7	(a)	Fig. 7.1 shows how a human eye responds to bright light with and without the administration of a drug, which targets the circular muscles. key: — without drug - - - with drug 50 % pupil constriction 5.0 10.0 15.0 20.0 25.0 time /s Fig. 7.1
		Using Fig. 7.1 and your knowledge of the eye and the nervous system, describe how the eye's response to bright light differs with and without the drug. [6] When the drug was administered, the pupil took a longer time, 25s to constrict 50% of its size, compared to without drug, 2.5s. [1] In bright light, an increase in light intensity stimulates the photoreceptors in the retina, which then produce nerve impulses. [1] The optic nerve transmits the nerve impulses to the relay neurone in the brain [0.5], which then transmits the nerve impulses to the motor neurone. [0.5] The motor neurone transmits the nerve impulses from the brain to the effector, muscles of iris. [1] The circular muscles contract and the radial muscles relax [0.5]. The pupil constricts, reducing the amount of light entering the eye. [0.5] In the presence of the drug, the nerve impulses are transmitted to the muscles of the iris, but the circular muscles are slower to react/impaired, causing pupil to take a longer time to constrict. [1]

	(b)	The change in pupil size is an example of a reflex action. Describe, using an example, how this differs from an action controlled by conscious thought. [4] An example of an action controlled by conscious thought is the raising of a hand to switch on of the lights in a room. [1] The pupil reflex is involuntary in nature, while the raising of the hand is voluntary in nature. [1] The raising of the hand is not as fast in response as the pupil reflex. [1] In the pupil reflex, the same stimulus always result in same response, while in the raising of the hand, same stimulus may produce different responses. [1]
8	(a)	Fig. 8.1 shows the change in average global temperature from 1880 to 2004.  Fig. 8.1
		One of the main cause of the current global warming trend is the increase in carbon dioxide emission caused by human activities. Suggest possible reasons for the trend in average global temperature shown in Fig. 8.1 and explain the effect increasing carbon dioxide emission will have on the carbon cycle [6] An increase in combustion of fossil fuels leads to an increase in carbon dioxide levels in the atmosphere, causing an increase in global temperature [1] An increase in deforestation results in less trees available for photosynthesis [1], hence more carbon dioxide accumulates in the atmosphere, causing an increase in global temperature [1].

		The increasing carbon dioxide emission causes an imbalance in the carbon cycle [1] as the amount of carbon dioxide released into the atmosphere by combustion, respiration and decomposition [1] exceeds that absorbed by photosynthesis [1].
	(b)	Scientists are carrying out trials of 'carbon farming', where large masses of the jatropha plant, which absorbs and stores large amounts of carbon dioxide are grown. Using your knowledge of carbon sinks, suggest how this may reduce global warming. [4] Carbon sinks are areas that store more carbon compounds than it releases, for an indefinite period [1]. Plants absorb carbon dioxide for photosynthesis, through which carbon compounds are formed [1]. When the plants die, their remains may be buried deep in the ground and form fossil fuels after millions of years [1]. As such, since the jatropha plant absorbs and stores large amounts of carbon dioxide, large masses of it may function as a carbon sink and help reduce global warming [1].

- End of Paper -

Name: _____ ()

Class: _____



WOODLANDS SECONDARY SCHOOL PRELIMINARY EXAMINATION 2018

Level:	Sec 4 Express & Sec 5 Normal Academic	Marks:	40 marks
Subject:	5078 Science (Chemistry/Biology)	Day:	Tuesday
Paper:	1	Date:	28 th Aug 2018
Duration:	1 hour	Time:	1230 – 1330

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the question paper.

Write in dark blue or black pen. You may use a soft pencil for any diagrams, graphs, tables or rough working. The use of a calculator is expected, where appropriate.

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

Section A

There are twenty questions. 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 provided. Hand in **both** multiple choice answer sheet and question paper separately.

FOR EXAMINER'S USE	
Section A	/20
Total	/20

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

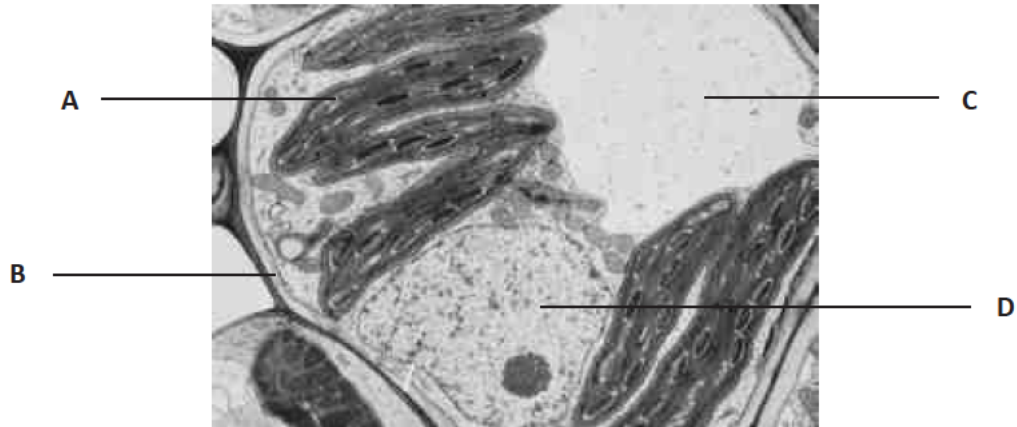
This document consists of **9** printed pages and **1** blank page only.

Section A: Multiple Choice Questions (20 marks)

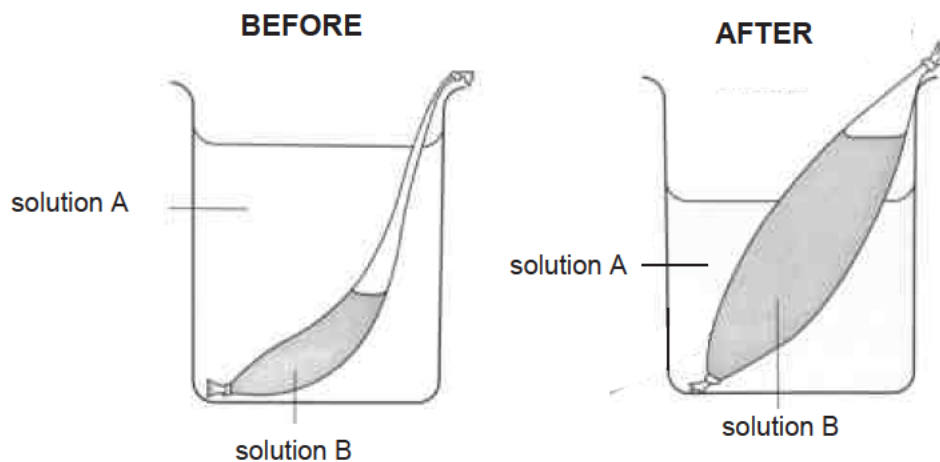
Answer **all** questions. Shade your answers in the multiple choice answer sheet provided.

- 1 The electron micrograph below shows part of a plant cell.

Which cell structure is responsible for the production of a new cell?

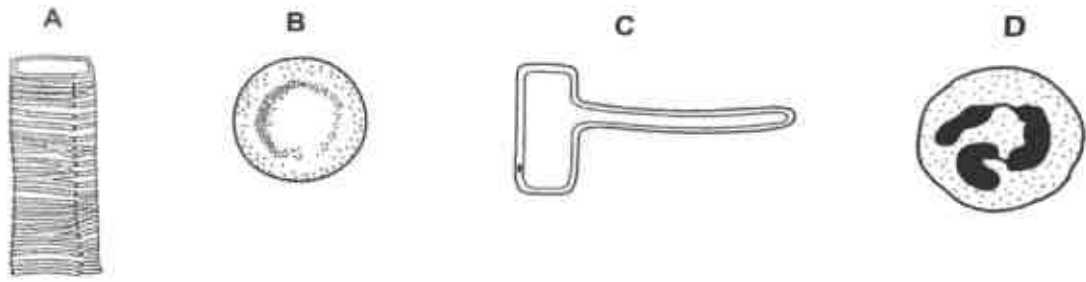


- 2 Which set of conditions will result in the following observations in the dialysis tube?

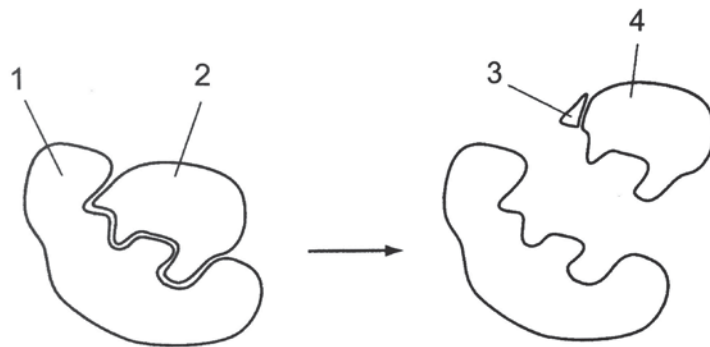


	solution A	solution B
A	0.5 % sucrose solution	2 % sucrose solution
B	2 % sucrose solution	water
C	10 % sucrose solution	0.5 % sucrose solution
D	20 % sucrose solution	10 % sucrose solution

- 3 The diagram shows four types of cells, not drawn to scale. Which cell does not contain cytoplasm?



- 4 The diagram represents the activity of an enzyme.



What are the labelled structures?

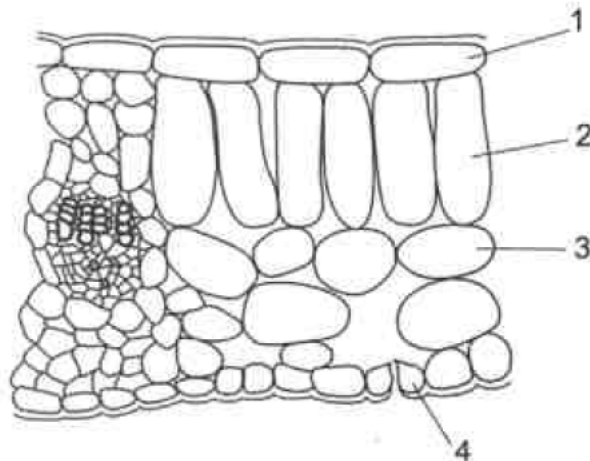
	'lock'	'key'	product	substrate
A	1	2	2	4
B	2	1	3	2
C	4	3	2	1
D	1	2	4	2

- 5 Milk produces a brick red precipitate when heated with Benedict's solution. It develops a purple colour when biuret test is conducted.

Using these results only, what can we conclude about the nutrients present in milk?

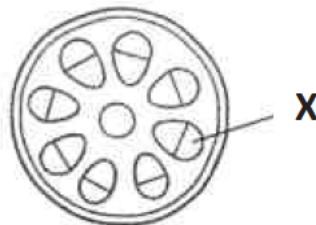
- A** proteins present, reducing sugars absent
- B** reducing sugars and proteins present
- C** reducing sugars and starch present
- D** starch and proteins present

- 6 The diagram below shows part of a transverse section of a leaf.



Which cells have the ability to convert light energy to chemical energy?

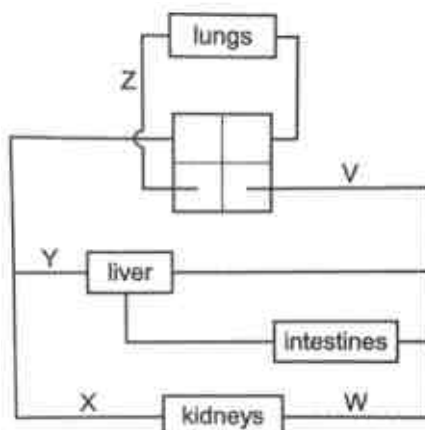
- A** 1, 2 and 3 only
B 2 and 3 only
C 2, 3 and 4 only
D 3 and 4 only
- 7 The diagram below shows a cross-section through a stem.



Which option identifies tissue X and describes the process occurring in it?

	tissue X	process
A	phloem	translocation
B	phloem	transpiration
C	xylem	translocation
D	xylem	transpiration

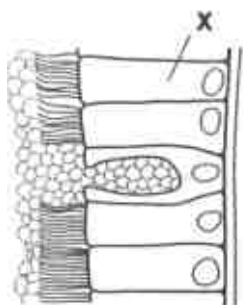
- 8 The diagram represents part of the human circulatory system, with some blood vessels identified by letters.



Which comparison of carbon dioxide concentration is correct?

	higher carbon dioxide concentration	lower carbon dioxide concentration
A	V	Y
B	W	X
C	X	V
D	X	Z

- 9 The diagram shows part of the lining of the human trachea.



What is the function of cell **X**?

- A** gaseous exchange
- B** moisten the air
- C** mucus removal
- D** secretion of mucus

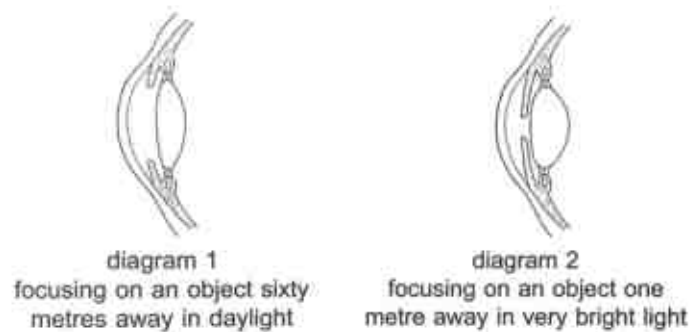
10 Some substances secreted by the pancreas are listed below.

- 1 amylase
- 2 glucagon
- 3 insulin
- 4 lipase

Which substances are released from the endocrine cells in the islets of Langerhans of the pancreas?

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

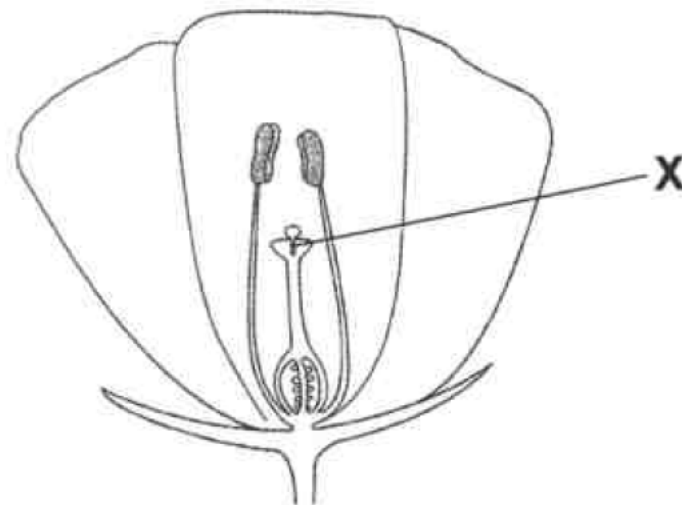
11 The diagrams show two sections through the eye of the same person viewing different things.



What happens to achieve the changes from the eye in diagram 1 to the eye in diagram 2?

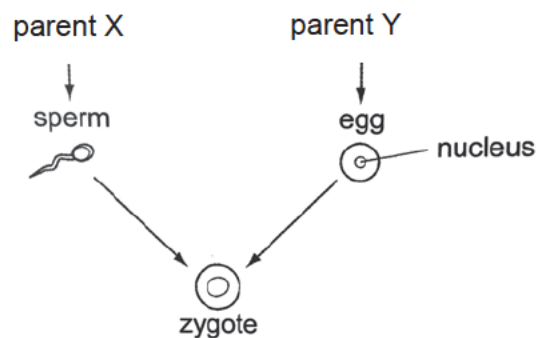
	ciliary muscles	iris radial muscles
A	contract	relax
B	contract	contract
C	relax	relax
D	relax	contract

- 12 The diagram shows a section through a flower that has been pollinated.



What passes through tube X?

- A female gamete
 - B male gamete
 - C pollen grain
 - D seed
- 13 The diagram below shows the production of a zygote.



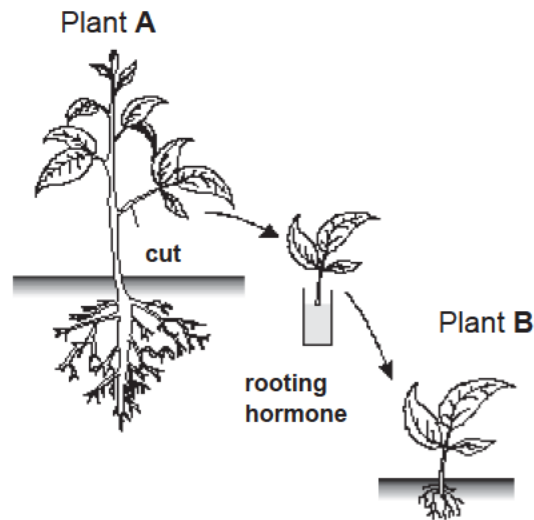
Which option correctly describes the zygote?

	multicellular	genetically similar as parent X	contains same number of chromosomes as parent Y
A	no	yes	no
B	no	no	yes
C	yes	yes	no
D	yes	no	yes

14 Which statement about DNA is correct?

- A A molecule of DNA contains many genes.
- B A molecule of DNA is larger than a chromosome.
- C A molecule of DNA refers to a single allele.
- D Each molecule of DNA will contain a single type of base.

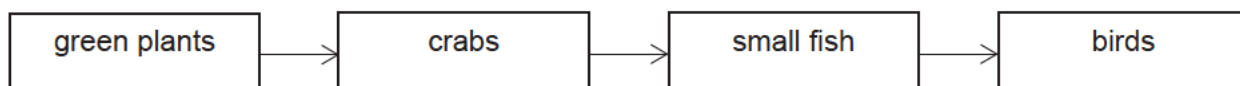
15 Plant B is produced from plant A in the following manner as shown in the diagram below.



Which of the following is **not** true of plant B?

- A It has one parent.
 - B It is produced by asexual reproduction.
 - C It is produced by self-fertilisation.
 - D It will have the same genetic make-up as plant A.
- 16 A gene contains 15% of guanine bases. How many percent of thymine bases does the gene contain?
- A 5 %
 - B 15 %
 - C 35 %
 - D 70 %

- 17 A farmer sprays insecticide on his crops for a year. The insecticide washes off into a nearby lake where it is absorbed by the producer to enter the food chain (as shown below).



The insecticide is unable to be excreted by the organisms.

Which option shows the likely levels of insecticide in these organisms at the end of the year?

	Insecticide found in organism / ppm (parts per million)			
	green plants	crabs	small fish	birds
A	0.05	0.05	0.05	0.05
B	0.05	0.5	0.05	0.05
C	0.05	0.5	5	25.0
D	25.0	5.0	0.5	0.05

- 18 The fertilisation of which pair of sperm and egg will result in a child with Down's syndrome?

	chromosomes in egg	chromosomes in sperm
A	23	23
B	24	24
C	24	23
D	46	47

- 19 Some processes are listed below.

- 1 absorption of carbon dioxide by oceans
- 2 feeding activity of carnivores
- 3 respiration by animals and plants
- 4 photosynthesis by land plants

Which processes act as carbon sinks?

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

- 20 The events of the menstrual cycle are dependent on the hormonal changes occurring in the female body.

Which option correctly shows the hormonal changes during ovulation and menstruation?

	ovulation	menstruation
A	increase in oestrogen	decrease in progesterone
B	increase in oestrogen	increase in progesterone
C	peak in oestrogen	decrease in progesterone
D	peak in oestrogen	increase in progesterone

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Name: _____ ()

Class: _____



WOODLANDS SECONDARY SCHOOL PRELIMINARY EXAMINATION 2018

Level:	Sec 4 Express & Sec 5 Normal Acad	Marks:	65 marks
Subject:	5078 Science (Biology)	Day:	Friday
Paper:	4	Date:	3 rd Aug 2018
Duration:	1 hour 15 minutes	Time:	0800 – 0915

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the question paper.

Write in dark blue or black pen. You may use a soft pencil for any diagrams, graphs, tables or rough working. The use of a calculator is expected, where appropriate.

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

Section A

Answer **all** questions in the spaces provided on the question paper.

Section B

Answer **any two** out of three questions in the spaces provided on the question paper.

Indicate your question choices on this page.

FOR EXAMINER'S USE	
Section A	/45
Section B Qn: ____ & ____	/20
Total	/65

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

This document consists of **14** printed pages.

Section A (45 marks)

Answer **all** questions in the spaces provided on the question paper.

- 1 Fig. 1.1 shows the cells on the lower surface of a leaf.

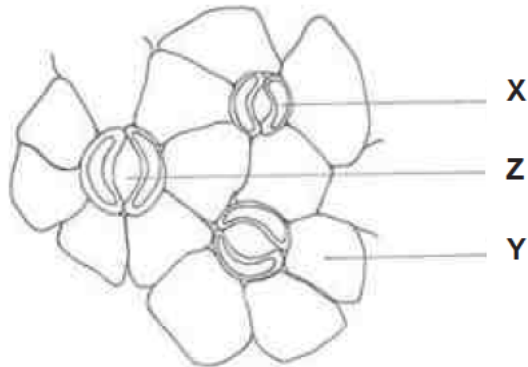


Fig. 1.1

- (a) Identify cell **X** and state its function.

Cell **X**:

Function:

.....
 [2]

- (b) (i) Identify cell **Y**.

Cell **Y**: [1]

- (ii) There is a layer of substance covering cell **Y**. State its function.

.....
 [1]

- (c) The size of **Z** expands during the daytime. State and explain how this affects the rate of photosynthesis in mesophyll cells.

.....

 [2]

- (d) The closure of **Z** is beneficial to the plant during wilting. Explain why.

.....
 [1]

[Total: 7m]

- 2 Fig. 2.1 gives some information about the feeding relationships in a tropical rainforest.

- Hornbills feed on orchids and seeds.
- Fruit bats feed on banana plants and orchids.
- Monkeys feed on banana plants and bamboo plants.
- Pythons feed on fruit bats, monkeys and hornbills.
- Wild boars feed on monkeys and fruit bats.

Fig. 2.1

- (a) Fig. 2.2 shows a food web based on the information in Fig. 2.1. Use the information in Fig. 2.1 to complete the food web by adding **two** arrows and naming the organisms in boxes 1 and 2.

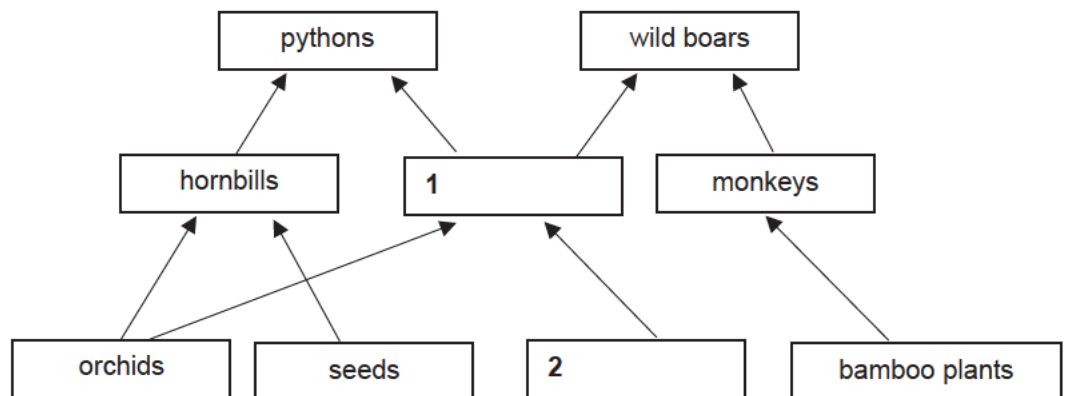


Fig. 2.2

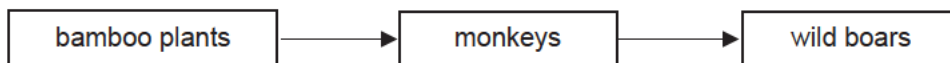
[3]

- (b) Decomposers are not shown in the food web. Describe their importance.

.....

.....[1]

- (c) In the space below, sketch and label the pyramid of biomass for the following food chain. Describe and explain the shape of your sketch.



.....

.....

..... [3]

[Total: 7m]

- 3 A hand grip test is a measure of one's grip strength, which refers to the force generated from contracting the muscles in one's hand. In the hand grip test, a person grips the equipment shown in Fig. 3.1 below by contracting the muscles in his hand continuously for 30 seconds.



Fig. 3.1

Fig. 3.2 shows the results of the hand grip test between a healthy person and a person with multiple sclerosis (MS).

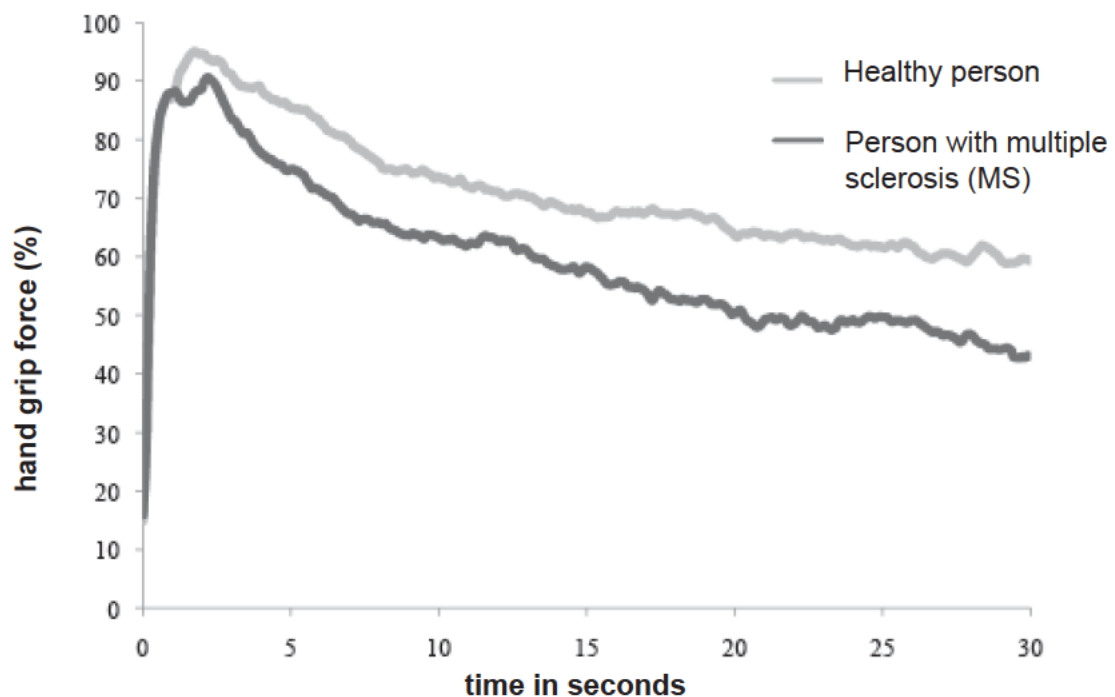


Fig. 3.2

- (a) (i) Refer to Fig. 3.2.
Describe the similarities and differences between the two persons in the results.

.....

.....

.....

.....

..... [3]

- (ii) To produce the strongest grip, aerobic respiration in the hand muscles is not sufficient.
Describe what happens in the hand muscles to meet the needs of the grip test.

.....

 [1]

- (iii) Hand grip force at 30 seconds will not be able to reach the higher percentages of above 90 %. Explain why this is so.

.....

 [2]

- (b) A person suffering from MS may also experience the following symptoms.

- Muscle weakness or spasms
- Inability to control leg movements
- Problems in vision
- Numbness or tingling in muscles

Based on the information given, identify the system in the body that is affected.

..... [1]

[Total: 7m]

- 4** Cystic fibrosis is a genetic condition which leads to the production of abnormally thick and sticky mucus. It is caused by the recessive alleles of a gene.
- (a)** Draw a full genetic diagram to show how a mother and father, who do not have the condition, can have a child with the disease. Use **A** and **a** as symbols in your genetic diagram.
- (b)** State the type of variation shown by this genetic condition. [4]
 [1]
- (c)** Explain how this condition can cause problems in the lung structure and function.

 [2]
- [Total: 7m]**

- 5 Loss of water from a leafy shoot can be investigated using the apparatus shown in Fig. 5.1 below.

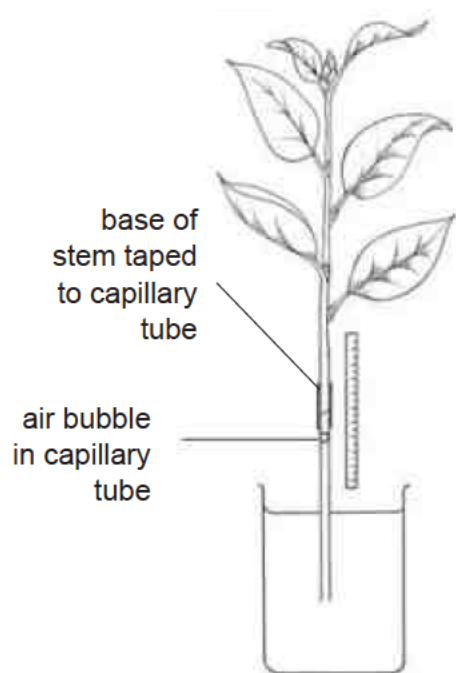


Fig 5.1

This apparatus was used by a student, in a brightly lit room, to measure the rate of water loss from a leafy shoot. He measured the distance moved by the bubble **in five minutes**. He measured this three times.

The results are shown in Table 5.1.

Table 5.1

Measurement	Distance moved by bubble in cm
1	11.9
2	12.6
3	13.0

- (a) What is a key assumption that is made in this investigation?
 [1]
- (b) Use these results to calculate the mean (average) rate of water loss in cm per minute. Show your working.

rate of water loss:cm per minute [1]

- (c) If the temperature of the room dropped, explain why the distance moved by the bubble will be lesser.

.....

 [2]

- (d) Following the same procedure, another student investigated the rate of water loss using a similarly-sized leafy shoot from a different species of plant. She noticed that the upper and lower surfaces of these leaves were covered with tiny hairs.

Describe and explain how these hairs would affect the rate of water loss from this leafy shoot.

.....

 [2]

[Total: 6m]

6 Distinguish between the terms,

- (a) *fertilisation* and *pollination* in plants.

.....

 [2]

- (b) *sugar-phosphate backbone* and *base pairing* in DNA.

.....

 [2]

[Total: 4m]

- 7 Each enzyme in the digestive system works best in certain conditions.

State one condition which stays the same as food passes through the digestive system and one condition that changes as food passes through the digestive system.

- (a) (i) condition which stays the same

..... [1]

- (ii) condition which changes

..... [1]

- (b) Gallstones are made of cholesterol, bile salts and other substances. They may become large enough to block the bile duct.

Suggest how gallstones may affect the digestion of fats.

.....

.....

..... [2]

- (c) The quantity of pure alcohol in a drink can be expressed as alcohol units.

1 alcohol unit = 10 cm³ of pure alcohol

An average person can break down 1 alcohol unit in one hour.

- (i) Name the organ which breaks down alcohol.

..... [1]

- (ii) Calculate the number of alcohol units consumed by a person who drank 350 cm³ of wine with an alcohol strength of 8 %. Show your working.

..... alcohol units [1]

- (iii) State how long it would take for the body to break down the amount of alcohol units in (c)(ii).

..... hours [1]

[Total: 7m]

- (b) Describe three disadvantages of the reduction of biodiversity.

.....

.....

.....

.....

.....

.....

.....

..... [3]

- (c) State two ways in which fisheries may be managed to maintain sustainable fishing practices.

.....

.....

.....

.....

.....

..... [2]

[Total: 10m]

- 9 (a) Describe in detail, how a molecule of oxygen present in the air breathed into the lungs reaches a cell in the tissue of the liver. Name the structures involved.

.....

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..... [6]

- (b) Describe and explain the advantages of having different types of blood vessels in the circulatory system.

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..... [4]

[Total: 10m]

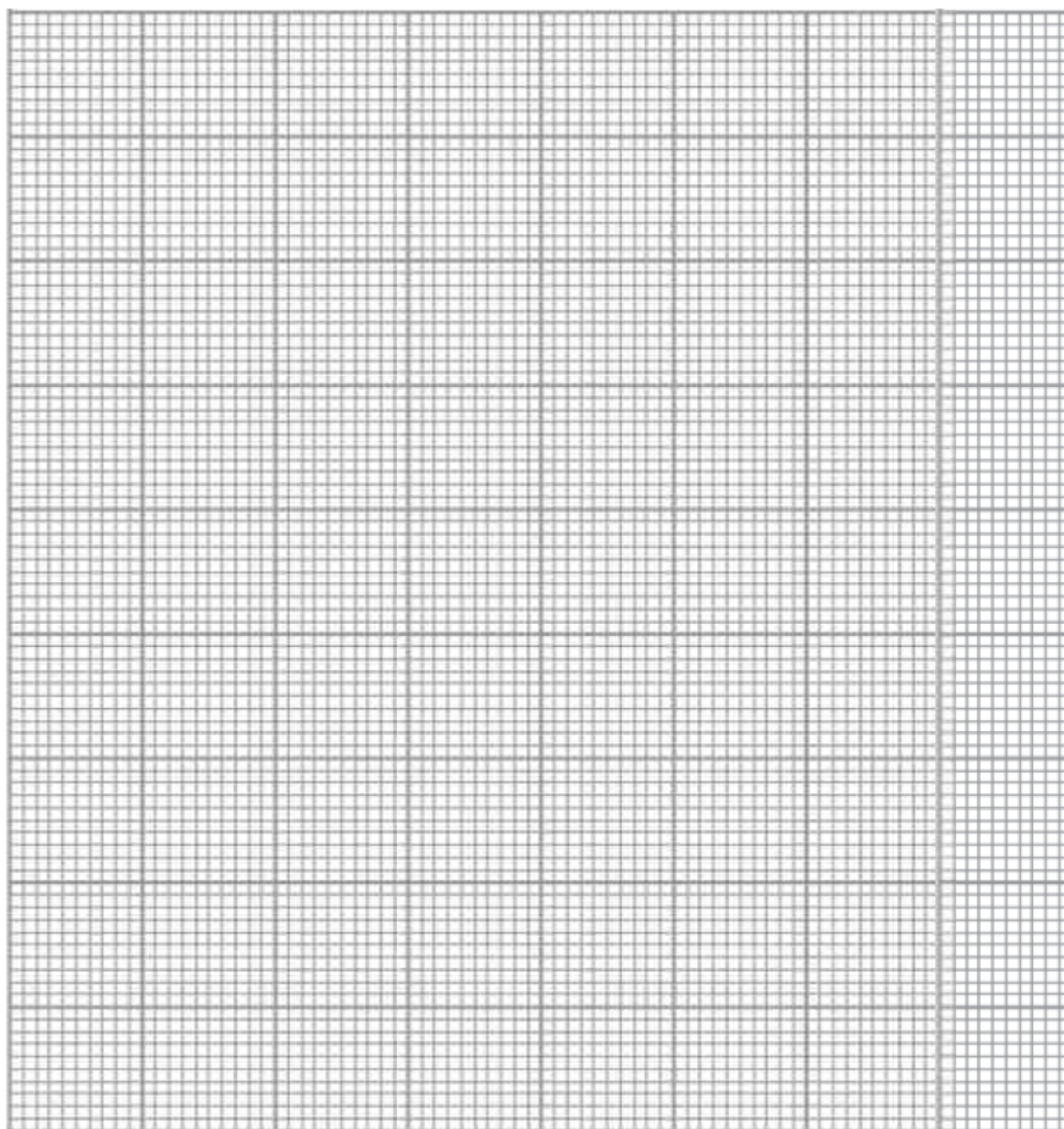
- 10 The table below shows the effects of temperature on the clotting time of blood.

Table 10.1

temperature / ° C	15	20	25	30	35	40	45
clotting time / s	58	48	40	30	24	32	58

- (a)(i) Plot a graph of this data.

[3]



- (b) (i) Name the component of blood that is responsible for blood clotting.
 [1]
- (ii) Name a substance in the plasma that is needed for clotting to take place
 [1]
- (c) With reference to Table 10.1, describe the relationship between temperature and blood clotting time.

 [3]
- (d) Explain why blood clotting time is affected by temperature.

 [2]

[Total: 10m]

END OF PAPER

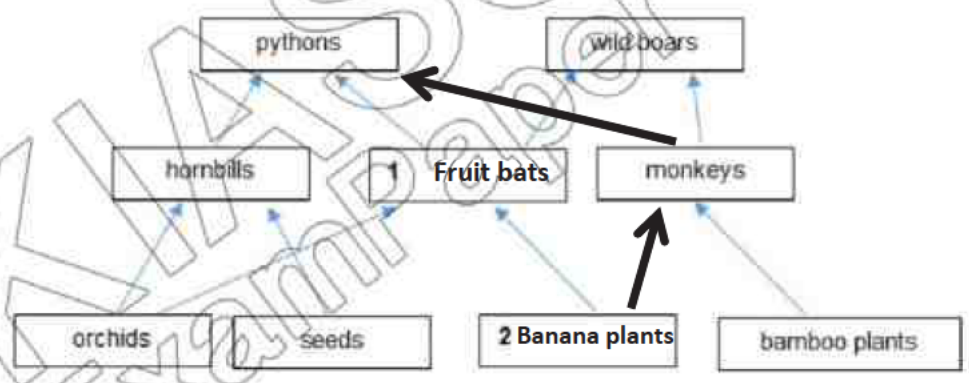
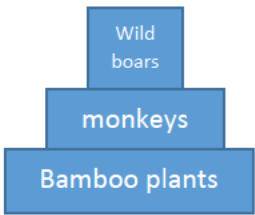
Sec 4E5A Sc Bio Prelim 2018 Ans

Paper 1 : Multiple Choice Questions (12 marks)

21	22	23	24	25	26	27	28	29	30
D	A	A	D	B	C	A	C	C	C
31	32	33	34	35	36	37	38	39	40
A	B	B	A	C	C	C	C	B	C

Paper 4:

Section A (45 marks)

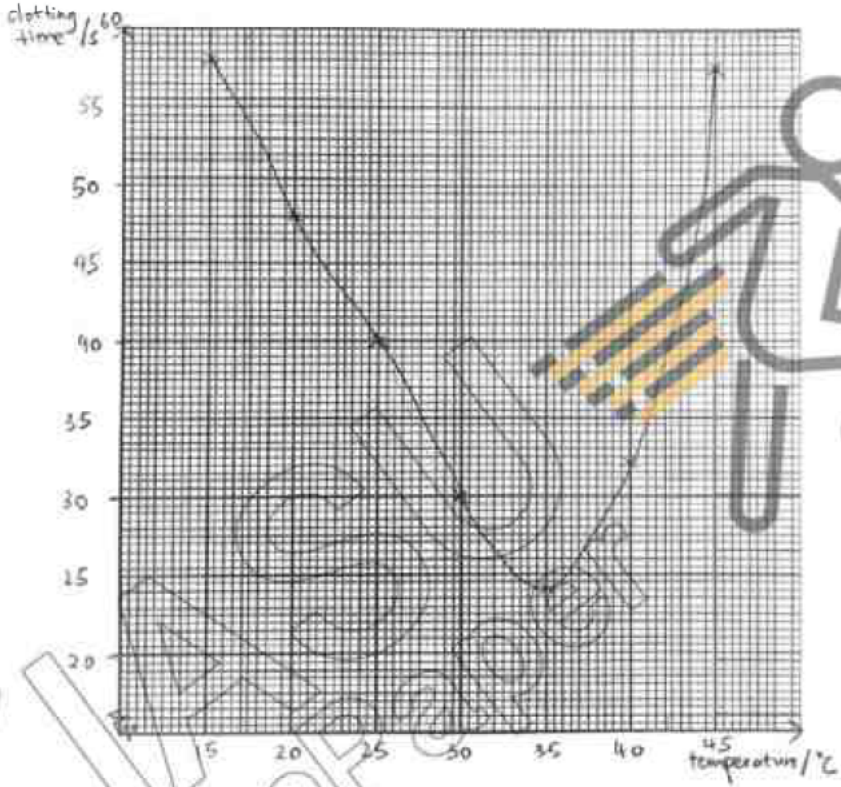
1	a	Guard cell To control the stoma (Z) opening size	1 1
	b(i) b(ii)	(Lower) epidermis/epidermal cell To help prevent water loss	1 1
	c	This <u>increases rate</u> of photosynthesis. <u>More carbon dioxide gas</u> can diffuse into the leaf.	1 1
	d	Lesser rate of transpiration / loss of water vapour	1
			7M
2	a	 1M for Box 1; 1M for Box 2 and arrow from banana plant to monkeys; 1M for arrow from monkeys to pythons	3
	b	They break down dead matter and is important to recycle organic nutrients like carbon.	1
	c	 Base is broad and gets narrower at the top. Energy is lost from one trophic level to the next. So lesser biomass is available to support the next trophic level.	1 1

			7m
3	ai	Similarity: After 2 seconds, the hand grip force in both persons have a decreasing trend. / In the first 2 seconds, hand grip force in both persons increased sharply. Differences: Maximum hand grip force (95%) is higher for healthy person as compared to the MS patient (90%). The healthy person has a stronger grip as compared to the MS patient over the entire 30 seconds duration. / There is a larger decrease in grip strength for person with multiple sclerosis. (values need not be quoted)	1 1 1
	aii	Anaerobic respiration takes place to release extra energy needed for muscle contraction. / Glucose is broken down in the absence of oxygen to release a small amount of energy.	1
	aiii	Over time, <u>lactic acid</u> is produced in the hand muscles due to the high rate of anaerobic respiration. Hand muscles feel <u>fatigue</u> .	1 1
	b	Nervous system	1
			7m
4	a	Phenotype: Normal father, Normal mother Genotype: Aa, Aa Gametes: A, a, A, a F₁ generation genotype: AA, Aa, Aa, aa F₁ generation phenotype: Normal : 1 diseased	1 1 1 1
	b	Discontinuous variation	1
	c	Mucus block gaseous diffusion / slow down rate of gaseous diffusion. A person will start to cough to remove the mucus and persistent coughing can lead to breakdown of alveolar walls.	1 1
			7m
5	a	Amount of water moved up or absorbed is the same as amount of water lost / Water that moves up the capillary tube will not be used/stored by the plant, but instead be lost to surroundings. (or OWTTE)	1
	b	$(11.9+12.6+13) / 15 = 2.5 \text{ cm per minute}$	1
	c	Rate of water evaporation is slower at a lower temperature. A lower concentration of water vapour inside the leaves result in lower transpiration rate. / concentration gradient for diffusion of water vapour or transpiration is less steep.	1 1

Section B (20 marks)

3

	b	1) Leads to extinction of animal and plant species which may be important raw materials for industries, medicine or insecticides. 2) Ecosystem might be affected, which might disrupt water and carbon cycles. 3) Loss of natural scenery and wildlife for future generations to appreciate. 4) Lesser food sources for humans (accept any other logical ans)	1 1 1
	c	1) Ban use of <u>drift</u> nets which indiscriminately trap all forms of marine life, 2) Use nets with a certain mesh size to prevent <u>young</u> fish from being caught, 3) Regulate entry of ships into fishing grounds, 4) Limit period of fishing in fishing grounds, 5) Ban harvesting of <u>endangered</u> species, 6) Raise endangered species of fish in farms and releasing them back into sea. (accept any other logical ans)	Any 2 2m
			10m
9	a	Oxygen diffuses across alveolar walls into blood capillaries, and enters a red blood cell. Red blood cell travels from the lungs to heart by the pulmonary vein and enters the left atrium. Atrium contracts and pushes blood into the left ventricle, and ventricle contracts to push blood into the aorta. The aorta carries blood into the hepatic artery, which branches out into the capillaries at the tissues of the liver. Oxygen then diffuses out of the red blood cell to enter the tissues of the liver.	1 1 1 1 1 1
	b	Arteries have thick muscular walls, which are able to withstand and maintain high blood pressure to carry blood at high pressure that leaves the heart. Capillaries have thin walls made of a single layer of cells so that nutrients and waste products are able to diffuse across easily and quickly to reach their destinations. Veins have valves to aid the blood flow back to the heart, which helps to prevents backflow of blood, since blood in veins is travelling against gravity and at slower speeds. Veins also have large lumens which allows more spaces and reduce obstruction of blood flow back to the heart.	1 1 1 1
			10m

10	ai		1 – axes 1m-pts 1m-curve
	bi	platelets	1
	bii	fibrin	1
	c	When temperature increased from 15 to 35, clotting time decreases. The fastest clotting takes place at 35. When temperature increased beyond 35 to 45, blood clotting time increases.	1 1 1
	d	If occlusion takes place in the coronary arteries, blood could not be transported to the heart muscles. This leads to lack of oxygen and nutrients to heart muscle cells, which can lead to cell death and loss of function of the heart.	1 1
			10m

