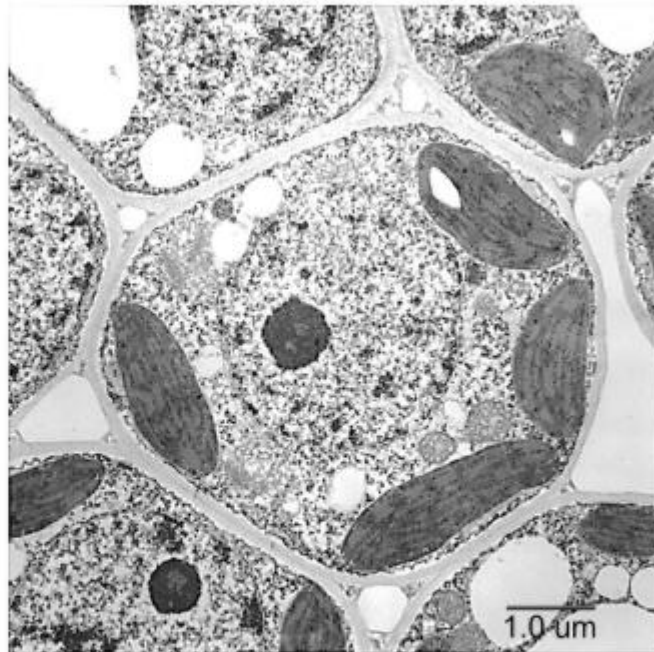
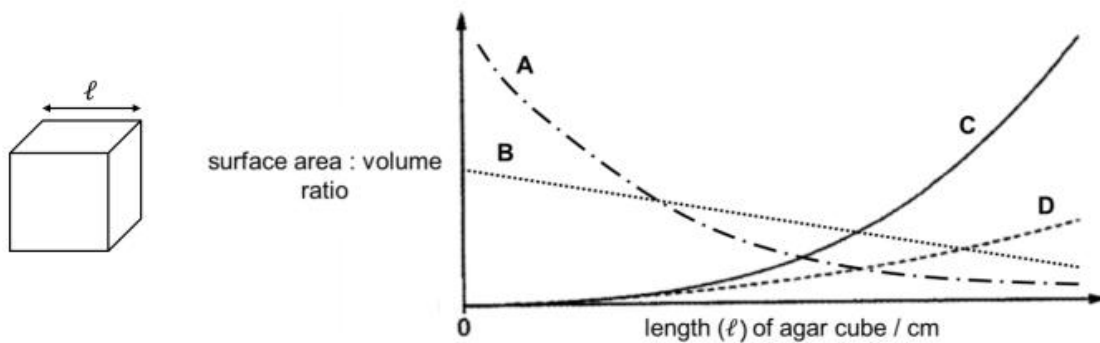


- 1 What can be identified in the electron micrograph?

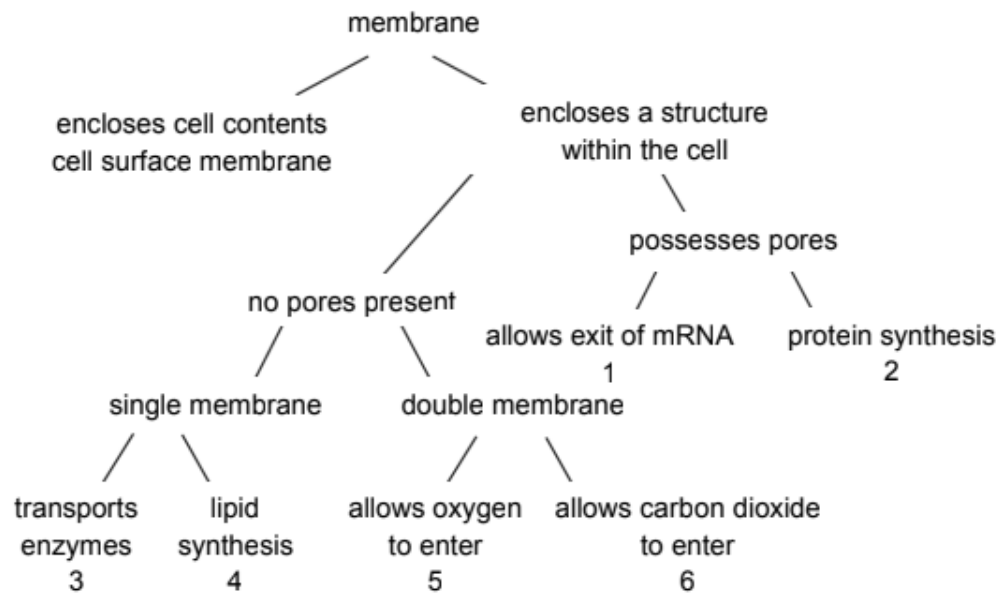


- A animal cells with prominent mitochondria
 B animal cells with vesicles and Golgi apparatus
 C plant cells with cell walls, nuclei and chloroplasts
 D plant cells with chloroplasts and large central vacuoles containing nuclei
-
- 3 Which line graph accurately shows how increasing the length (ℓ) of an agar cube affects its surface area-to-volume ratio?



CGSS 2025

3 Membranes within and at the surface of cells have different roles.



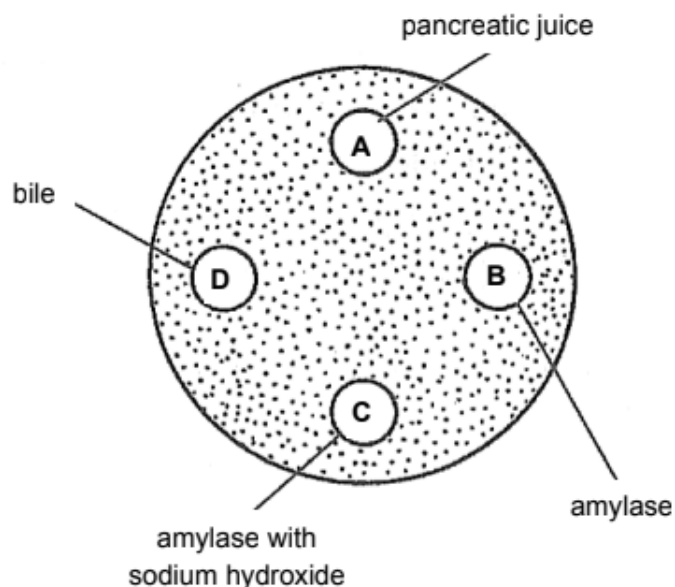
Which of the outcomes correctly identifies the organelles that possess the membrane and function concerned?

	outcome 1	outcome 3	outcome 4	outcome 6
A	chloroplast	smooth ER	rough ER	mitochondrion
B	nucleolus	vesicle	smooth ER	mitochondrion
C	nucleus	vesicle	smooth ER	chloroplast
D	nucleus	mitochondrion	rough ER	chloroplast

- 5** Bromothymol blue is a blue indicator that turns yellow when pH decreases below pH 6.

A dish was filled with agar jelly containing adipose tissue extracts. Four holes were cut in the jelly and each hole was filled with the substances shown in the diagram. After 30 minutes, bromothymol blue was poured over the jelly.

Which hole would be surrounded by the largest yellow region?



- 12** The alimentary canal is made of muscles.
How do the muscles, especially those in the walls of the oesophagus, act when pushing a bolus of food along?

	longitudinal muscles behind bolus	circular muscles behind bolus
A	contract	contract
B	contract	relax
C	relax	relax
D	relax	contract

- 3 The diameters of three onion rings are measured before and after they are immersed in 100 cm³ of sucrose solutions at different concentrations for 20 minutes.

The results are recorded in the following table.

solution	initial diameter of onion ring / cm	final diameter of onion ring / cm
1	7.8	7.2
2	7.8	7.5
3	7.8	6.9

Which row correctly ranks the solutions that the onion rings were immersed in from the lowest to the highest water potential?

	lowest → highest		
A	1	2	3
B	1	3	2
C	3	2	1
D	3	1	2

- 4 The table gives the results of an investigation into the rates of absorption of digested food in the ileum.

The experiment is carried out in the presence of oxygen and then repeated without oxygen, with the same amount of food being tested each time.

product of digestion	rate of absorption in the presence of oxygen / arbitrary units	rate of absorption in the absence of oxygen / arbitrary units
amino acids	5.0	3.6
fatty acids	1.5	1.6
glucose	8.2	3.1
glycerol	3.5	3.4

Which conclusion can be drawn from these results?

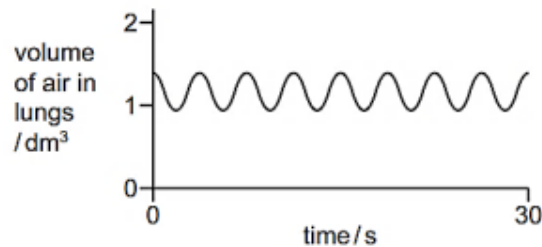
- A** Fatty acids and glycerol is absorbed mainly by active transport.
- B** More glucose is absorbed by active transport than by diffusion.
- C** Amino acids are absorbed by active transport only.
- D** Glycerol is absorbed more slowly than fatty acids.

5 Which statement is true about starch and glycogen?

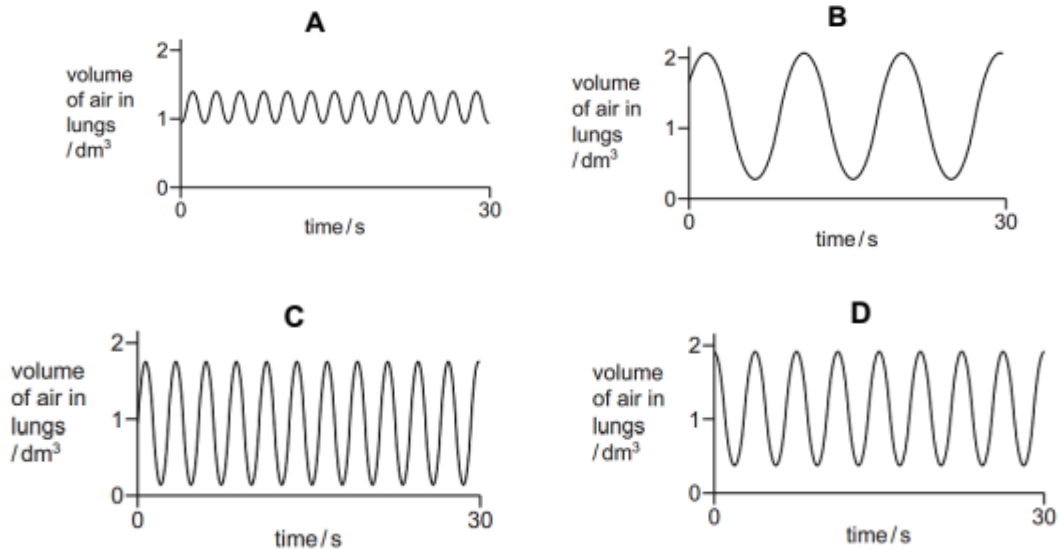
- 1 Starch is found in plants, while glycogen is found in animals.
- 2 Both glycogen and starch are made up of many glucose molecules joined together.
- 3 Starch does not affect the water potential of cells while glycogen affects the water potential of cells.
- 4 Glycogen is used for long-term energy storage while starch is used for short-term energy storage.

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

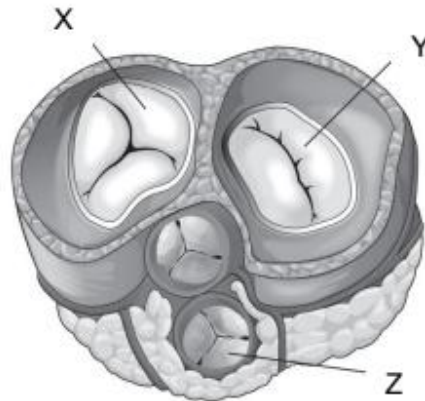
12 The graph shows changes in the volume of air in the lungs of a person at rest over a period of 30 seconds.



Which graph shows changes in the volume of air in the lungs of the same person immediately after they have done five minutes of vigorous exercise?



- 15 The diagram shows a transverse section of the heart.



In what state are the valves when the muscles of the left ventricle are contracting?

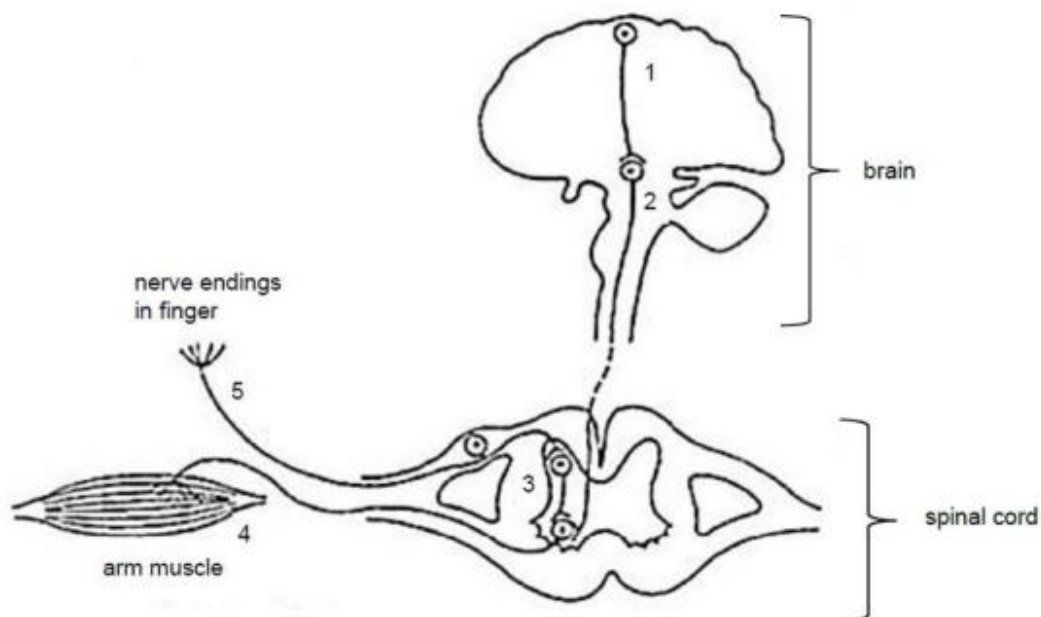
	X	Y	Z
A	open	open	open
B	open	open	closed
C	closed	closed	closed
D	closed	closed	open

Chung Cheng 2025

- 6 Transfusion of donor red blood cells to a recipient can result in an agglutination reaction, which can lead to adverse effects in the recipient. Options **A**, **B**, **C** and **D** each describe two different red blood cells transfusions. Which option will result in agglutination reactions for both of the described transfusions?

	person	type of transfusion
A	blood group A	- donates blood to person with blood group AB - receives blood from person with blood group O
B	blood group AB	- donates blood to person with blood group O - receives blood from person with blood group A
C	blood group B	- donates blood to person with blood group O - receives blood from person with blood group AB
D	blood group O	- donates blood to person with blood group B - receives blood from person with blood group AB

- 8 The diagram shows the arrangement of some neurons in a man.

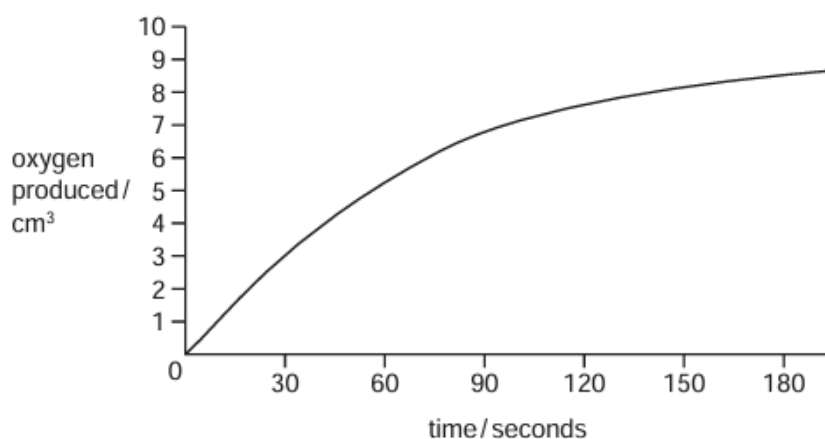


Which sequence shows the pathway when the arm is voluntarily moved?

- A** 1 → 2 → 4
B 5 → 3 → 4
C 1 → 2 → 3 → 5
D 4 → 2 → 1 → 2 → 5

ANDSS 2025

- 14 Catalase was added to hydrogen peroxide solution. The volume of oxygen produced was measured at intervals. The results are shown on the graph.



What was the initial rate of reaction?

- A** $0.05 \text{ cm}^3 \text{ s}^{-1}$ **B** $0.10 \text{ cm}^3 \text{ s}^{-1}$ **C** $1.00 \text{ cm}^3 \text{ s}^{-1}$ **D** $10.0 \text{ cm}^3 \text{ s}^{-1}$

- 17 Which pair of factors is inversely proportional to the rate of diffusion?
- A concentration gradient and surface area over which diffusion occurs
- B distance over which diffusion occurs and size of diffusing molecule
- C size of diffusing molecule and concentration gradient
- D surface area over which diffusion occurs and distance over which diffusion occurs
- 18 For organisms undergoing sexual reproduction, a reduction division occurs before fertilisation.

Which reasons explain why this is necessary?

- 1 increase genetic variation
- 2 prevent doubling of the chromosome number
- 3 reduce the chances of mutation

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

9700 2009 Paper

- 26 The scientist Erwin Chargaff analysed the base composition of the DNA of several species. The table shows some of Chargaff's data.

species	percentage of base in DNA			
	adenine	guanine	cytosine	thymine
<i>E. coli</i>	24.7	26.0	25.7	23.6
maize	26.8	22.8	23.2	27.2
grasshopper	29.3	20.5	20.7	29.3
sea urchin	32.8	17.7	17.3	32.1
octopus	33.2	17.6	17.6	31.6
rat	28.6	21.4	20.5	28.4

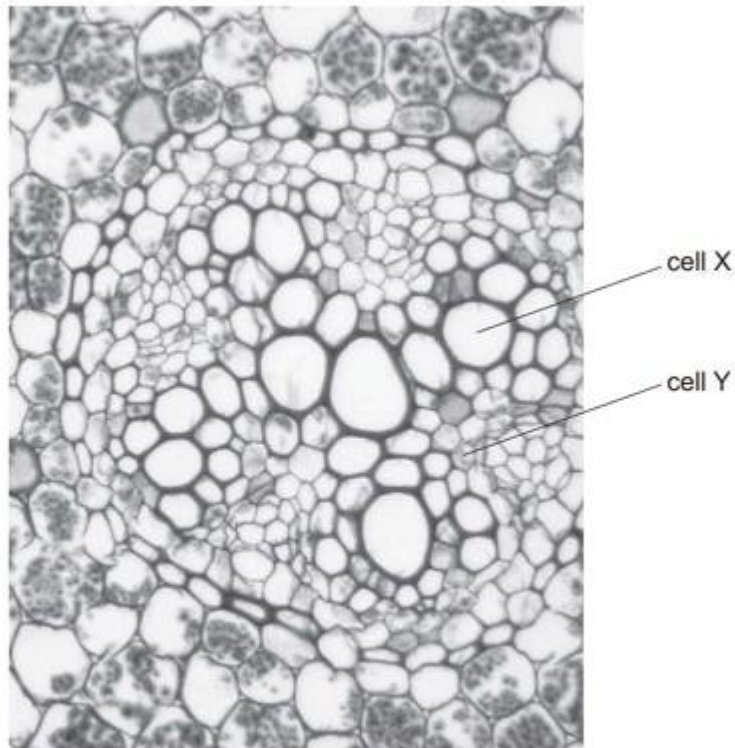
Which statements can be concluded using **only** the data in the table?

- 1 Cytosine binds to guanine using three hydrogen bonds.
- 2 Approximately 50% of the bases in any of the species are either adenine or thymine.
- 3 The base composition of DNA varies between different species.
- 4 The number of cytosine bases in any of the species is approximately the same as the number of guanine bases.

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

9700 2026 m26 q/12

- 20 The photomicrograph shows part of a section through a stem.

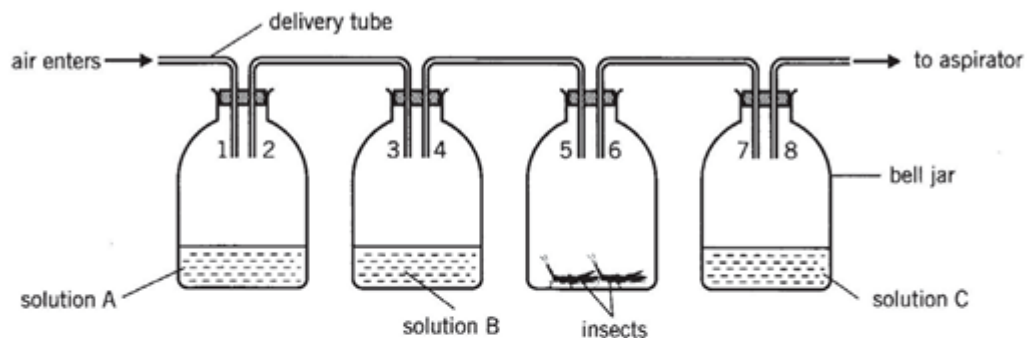


The contents of cell X and the contents of cell Y are each tested with Benedict's reagent and with iodine solution.

What results are expected?

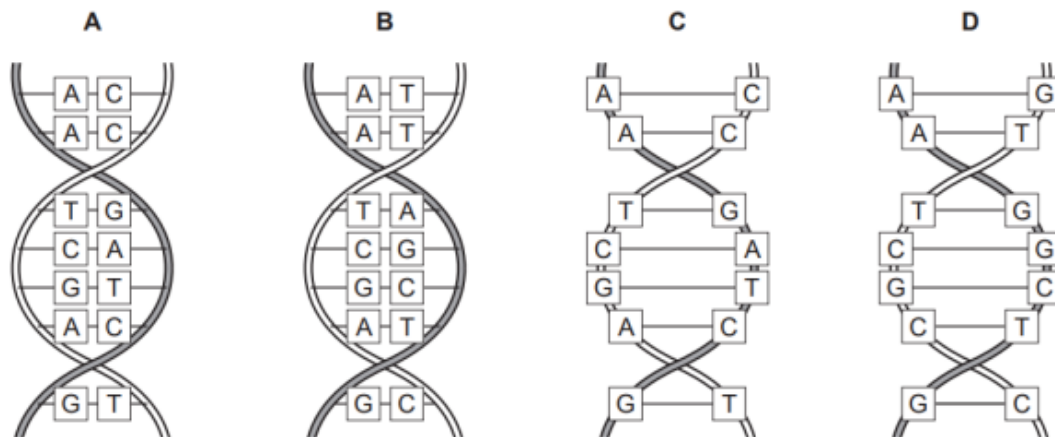
	Cell X		Cell Y	
	Benedict's reagent	Iodine solution	Benedict's solution	Iodine solution
A	+	+	-	-
B	+	-	+	-
C	-	+	-	+
D	-	-	-	-

For questions 21 and 22, refer to the experimental setup in the diagram below. The setup is to investigate respiration using living insects. Positions 1 to 8 indicate the end part of the delivery tube.



- 21** There is a mistake in the experimental setup. Which of the following is the best suggestion to rectify the mistake?
- A** Air should enter from tube 8 instead of tube 1.
 - B** The insects should be replaced with freshwater fish as it is a more effective organism to study respiration.
 - C** The end part of delivery tubes at 2 and 4 should be dipped into the solution to let the air flow through solutions A, B and C.
 - D** The end part of delivery tubes at 1, 3 and 7 should be dipped into the solution to let the air flow through solutions A, B and C.
- 22** Assuming that the experimental setup has been rectified, which of the following correctly identifies solution A and its purpose?
- A** Bicarbonate solution. To detect carbon dioxide released by living organism during respiration.
 - B** Sodium hydroxide solution. To remove atmospheric carbon dioxide.
 - C** Potassium hydroxide solution. To detect carbon dioxide released by living organism during respiration.
 - D** Bicarbonate solution. To remove atmospheric carbon dioxide.

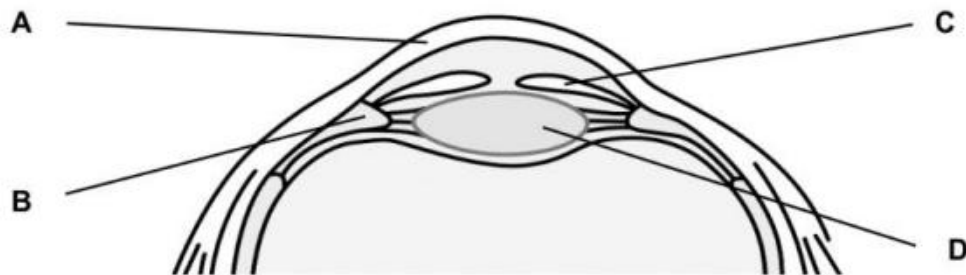
34 Which diagram shows the structure of DNA?



VS 2023

21 The diagram shows a section of the human eye.

Which structure controls the amount of light that enters the eye?



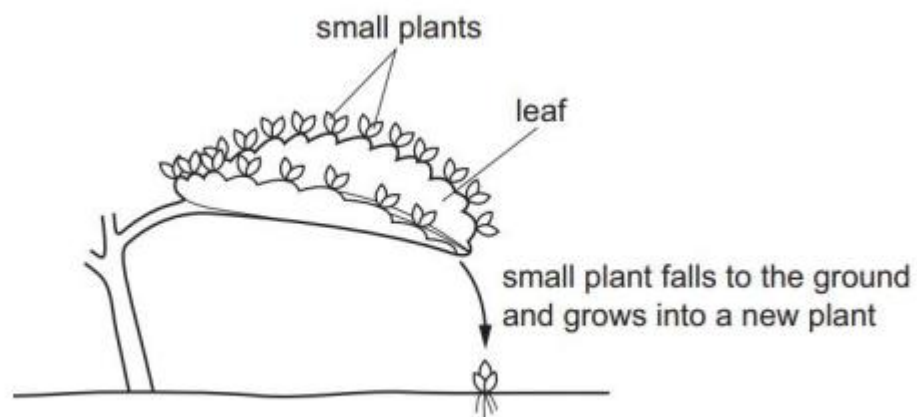
26 A short piece of DNA, 19 base pairs long, was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown.

	number of nucleotide bases			
	A	C	G	T
strand 1				4
strand 2		7		5

How many nucleotide bases containing C were present in strand 1?

- A 2
- B 3
- C 5
- D 7

- 30** The diagram shows part of a Bryophyllum plant.



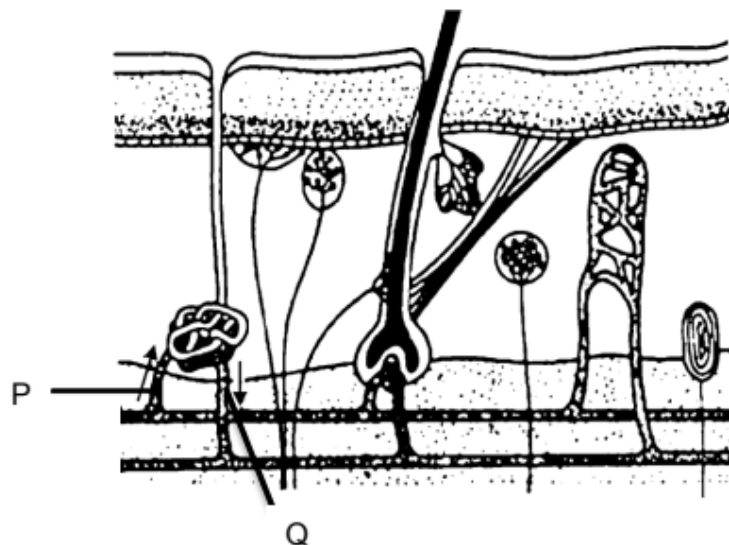
Which row best describes how the new plants are produced?

	type of reproduction		type of cell division	
	asexual reproduction	sexual reproduction	meiosis	mitosis
A	✓	x	✓	x
B	✓	x	x	✓
C	x	✓	✓	x
D	x	✓	x	✓

key
✓ = yes
x = no

SJI 2025

- 18** The diagram below shows a section through the human skin.



Which of the following changes in concentration of carbon dioxide, urea and salt occur as blood passes from P to Q?

	concentration of		
	carbon dioxide	urea	salt
A	decreases	decreases	decreases
B	decreases	increases	increases
C	increases	decreases	decreases
D	increases	increases	decreases

SCGS

2024

29 The diagram shows the menstrual cycle of a woman in the month of August.

On which day (**A**, **B**, **C** or **D**) should the couple have sexual intercourse to increase the chance of successful fertilisation?

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
6	7 A	8	9	10 B	11	12
13	14	15	16 C	17	18	19
20	21	22	23	24 D	25	26
27	28	29	30	31		

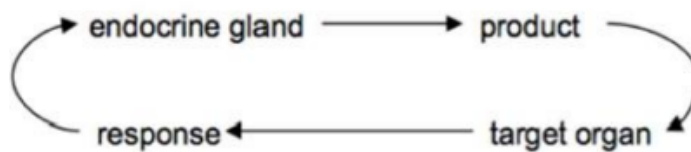
Legend:



= menstruation

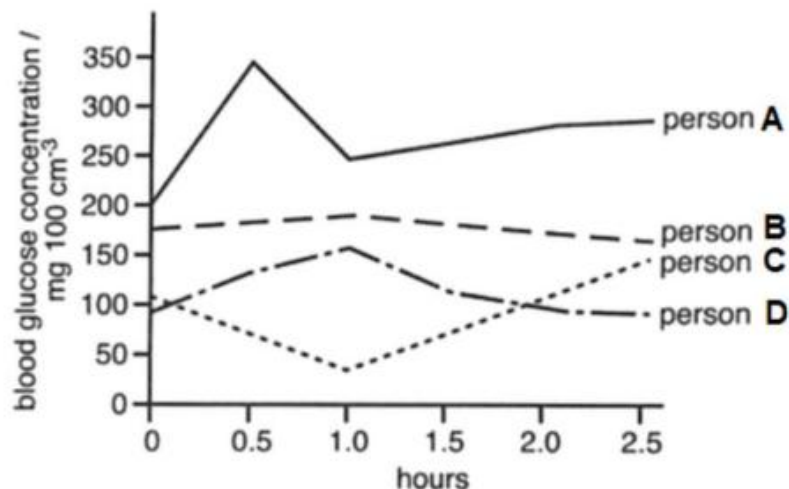
SCGS 2023

- 12 The diagram shows the relationship between two organs and the responses they bring about in the body.



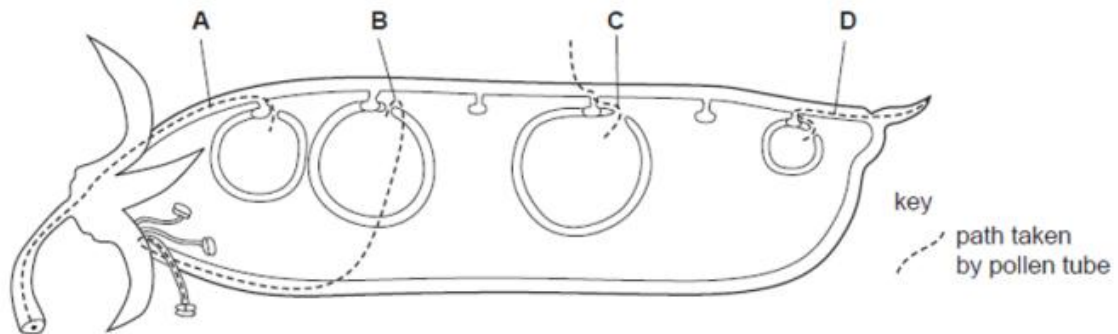
If the response of the target organ is controlled by negative feedback, which statement about the product of the endocrine gland is true?

- A The product of the endocrine gland inhibits the target organ while the response stimulates secretion of the product.
 - B The product of the endocrine gland inhibits the target organ with no effect on the response.
 - C The product of the endocrine gland stimulates the target organ while the response inhibits the secretion of the product.
 - D The product of the endocrine gland stimulates the target organ with no effect on the response.
- 14 The blood glucose concentration of four people was measured over a 2.5 hour period after drinking a concentrated glucose solution. The changes are shown in the graph.

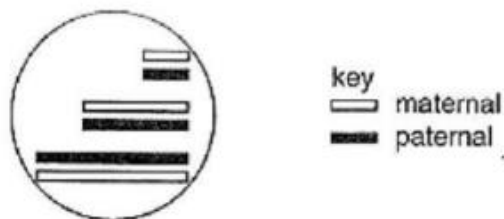


Which person is least likely to have problems with insulin secretion?

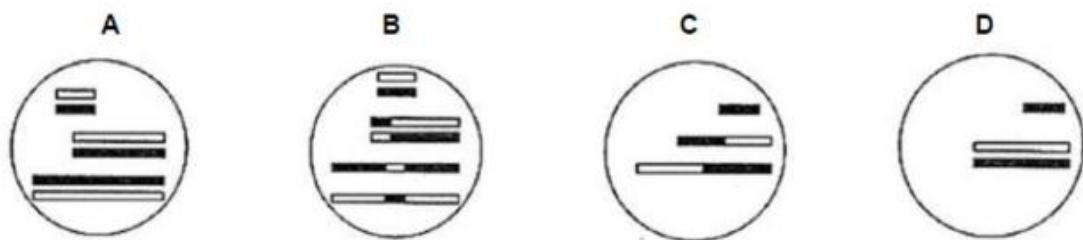
- 20 The diagram shows a pod from a pea plant.
Which line correctly shows the path that was taken by a pollen tube to an ovule?



- 29 The diagram shows the maternal and paternal chromosomes from a diploid cell.



If the cell divides by meiosis, which diagram shows a possible gamete?



- 36 The following shows a food chain.

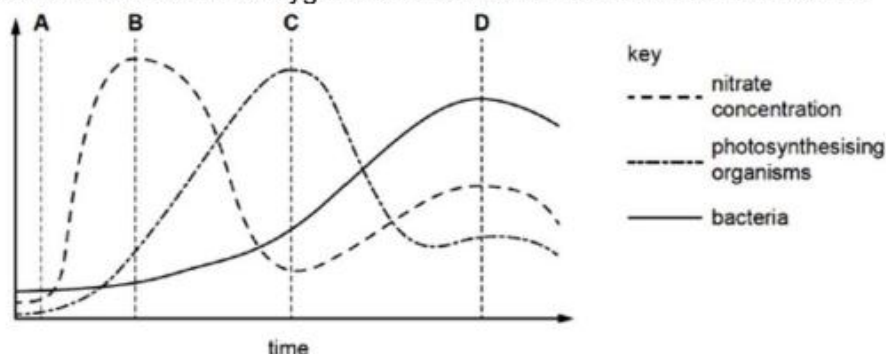
trees → caterpillars → gut parasites of caterpillars

Which row correctly shows the pyramid of numbers, biomass and energy of this food chain?

	pyramid of numbers	pyramid of biomass	pyramid of energy
A			
B			
C			
D			

- 38 The graph shows changes in part of a lake after it has been polluted by fertiliser discharge from a nearby farm.

At which time will the oxygen concentration in the water is the lowest?



- 39 The fishing industry damages the biodiversity of the oceans.

The list shows the possible changes that could be made by the fishing industry.

1. Only catch fish outside the breeding season.
2. Use a larger mesh size in nets.
3. Stop using nets that drag on the ocean floor.

What changes would reduce damage to the biodiversity of the oceans from the fishing industry?

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

ANDSS 2025 32

- 37 Warfarin is a drug that reduces the risk of blood clots.

Alleles for two genes, 1 and 2, affect how quickly Warfarin is metabolised.

Alleles for gene 1 can be G or A.

Alleles for gene 2 can be C₁, C₂ or C₃.

The table shows the recommended Warfarin dose for patients with each genotype.

gene 1 genotypes	warfarin dose (mg / day)					
	gene 2 genotypes					
	C ₁ C ₁	C ₁ C ₂	C ₁ C ₃	C ₂ C ₂	C ₂ C ₃	C ₃ C ₃
GG	6.0	6.0	3.5	3.5	3.5	1.2
GA	6.0	3.5	3.5	3.5	1.2	0.8
AA	3.5	3.5	1.2	1.2	1.2	0.5

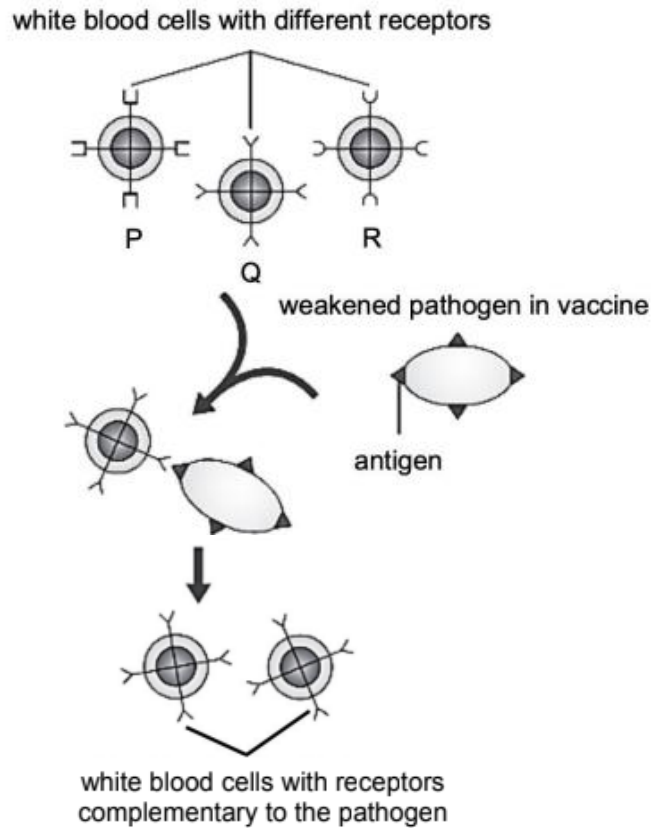
A patient is known to have the GA genotype for gene 1 and is homozygous for the C₃ allele.

What is the recommended Warfarin dose for this patient?

- | | |
|----------|------------|
| A | 0.8 mg/day |
| B | 1.2 mg/day |
| C | 3.5 mg/day |
| D | 6.0 mg/day |

CGSS 2025

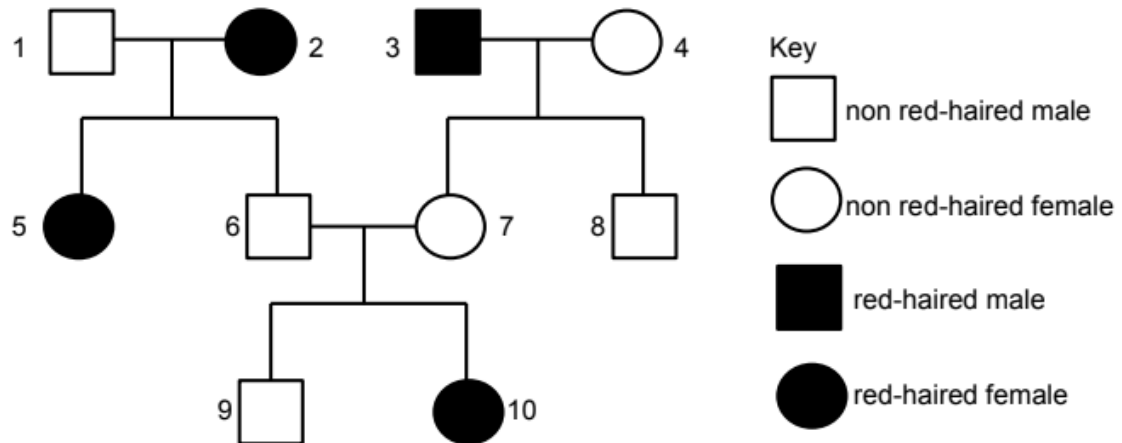
- 16** The diagram below shows the process of vaccination by introducing a weakened pathogen to the body.



Which statement correctly describes the effect of the above process?

- A** Weakened pathogens stimulate all white blood cells to divide.
- B** White blood cells will be able to produce antibodies faster upon entry of the pathogen.
- C** The individual will always be protected from the specific disease.
- D** Vaccinations prevents antibiotic-resistance in bacteria.

- 39 The diagram shows a family tree for the red-haired trait.



Which individuals are definitely heterozygous?

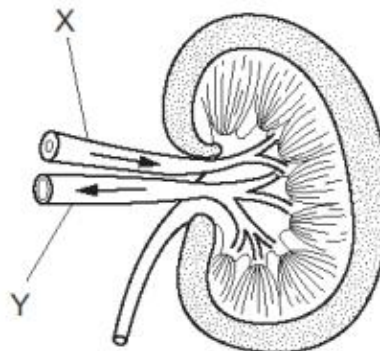
- A 1, 4, 6, 7
 - B 1, 6, 7, 8
 - C 2, 3, 5, 10
 - D 6, 7, 8, 9
- 40 Which statement does **not** form part of the theory of evolution proposed by Charles Darwin?
- A A struggle of existence occurs because organisms tend to produce more offspring than the environment will support.
 - B Any beneficial change in an organism's phenotype is brought about by the direct action of the environment.
 - C Members of the same species are not identical but show variation in almost all characteristics.
 - D Those offspring whose phenotypes are less well suited to the environment are more likely to die before producing offspring.

- 36** Induced chromosomal mutations produced a fertile hybrid species from cabbage and radish. The table shows the chromosome numbers in the parental species and the hybrids.

type of cell	number of chromosomes per cell
parental cabbage	18
parental radish	18
parental gametes	9
F1 hybrids	18
F1 gametes	18
F2 hybrids	36
F2 gametes	18
F3 hybrids	36

At which stage did chromosomal mutation occur?

- A** during formation of F1 gametes
B during formation of F2 gametes
C during fusion of F1 gametes
D during fusion of parental gametes
- 27** The diagram shows a kidney and the blood vessels associated with it.

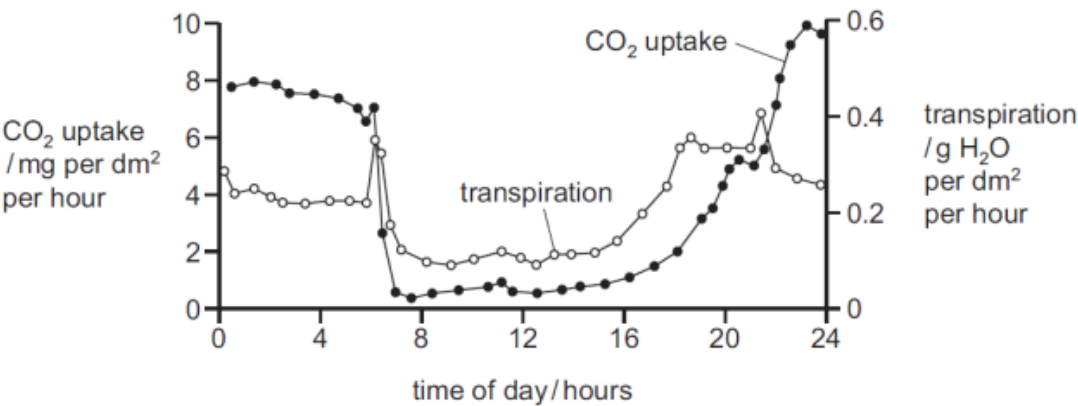


Which statement(s) is/are correct?

- 1 Vessel X contains more urea than vessel Y.
- 2 Vessel Y contains urine.
- 3 Vessel X contains more oxygen than vessel Y.

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

- 15** The graph shows daily carbon dioxide uptake and transpiration by the plant *Agave americana*.
The plant is adapted to live in very dry conditions.



What can be concluded from this graph?

- A** More stomata are closed during dark periods.
- B** More stomata are closed during light periods.
- C** There is no carbon dioxide uptake during dark periods.
- D** There is no water uptake during light periods.

PLMGSS 2024

- 26** Which changes occur in the body when a person is shocked?

	increase in	decrease in
A	diameter of the pupil in the eye	speed of peristalsis
B	rate of conversion of glycogen to glucose	diameter of the pupil in the eye
C	rate of urine formation	rate of conversion of glycogen to glucose
D	speed of peristalsis	rate of urine formation

Fuhua 2020

END OF PAPER