Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2024**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

1518005877

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

This document has **20** pages. Any blank pages are indicated.

1 An eyepiece graticule can be calibrated using a stage micrometer.

What is the correct reason why an eyepiece graticule is calibrated?

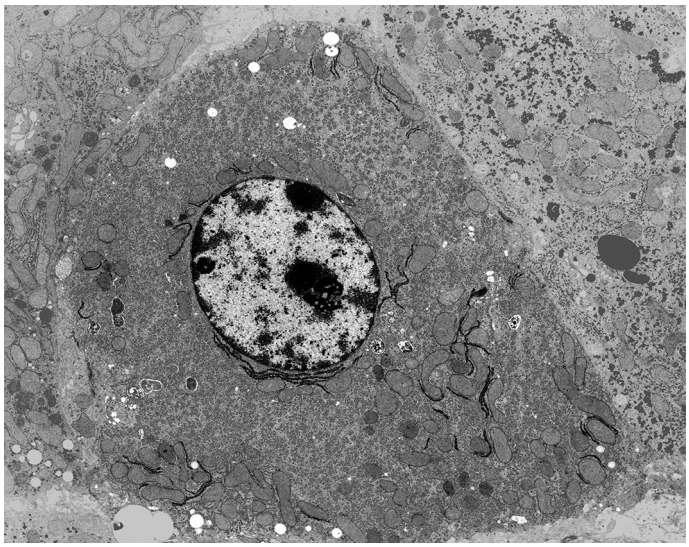
A An eyepiece graticule can be used to make measurements.

B An eyepiece graticule is magnified by the objective lens.

C An eyepiece graticule magnifies the specimen.

D An eyepiece graticule makes comparisons.

2 The image is an electron micrograph of a typical eukaryotic cell.



What can be concluded about the eukaryotic cell from the electron micrograph?

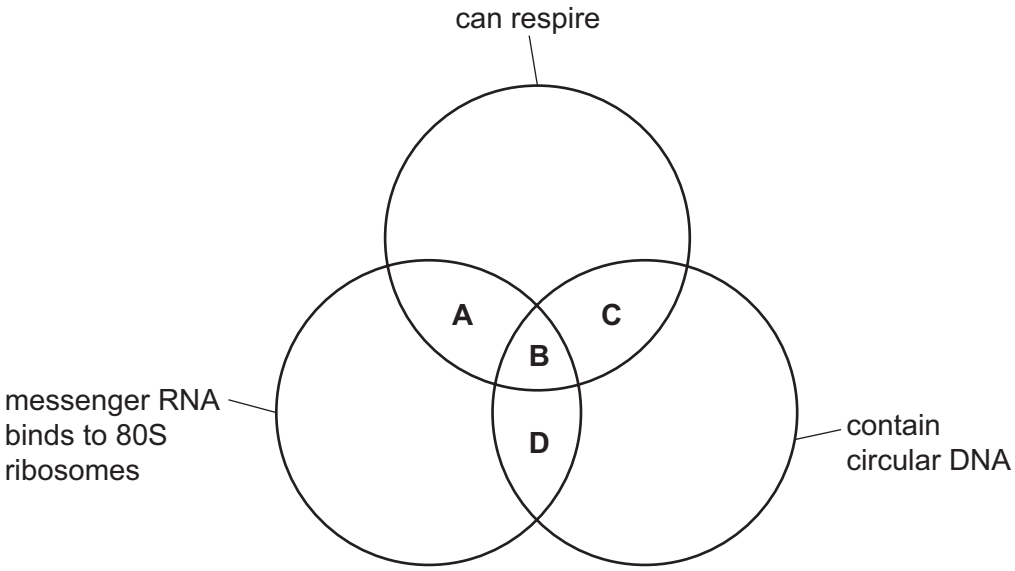
A It is an animal cell because it does **not** have a cell wall.

B It is an animal cell because it contains a permanent vacuole.

C It is a plant cell because it contains many chloroplasts.

D It is a plant cell because it contains many lysosomes.

3 Which features are found in typical eukaryotes **and** also in typical bacteria?



4 Which type of cell will have the highest proportion of its volume taken up with cell structures bound by a single membrane?

A ciliated epithelial cell

B goblet cell

C red blood cell

D companion cell

5 What causes the phosphate heads of phospholipids to become polar?

A The phosphate heads are joined to water molecules by hydrogen bonds.

B The phosphate heads are insoluble in water.

C The phosphate heads become ionised in water.

D The phosphate heads are joined to water molecules by covalent bonds.

6 Which statements describe features of cellulose that adapt it for its function in plant cells?

1 Three cellulose molecules coil around each other to form a triple helix structure.

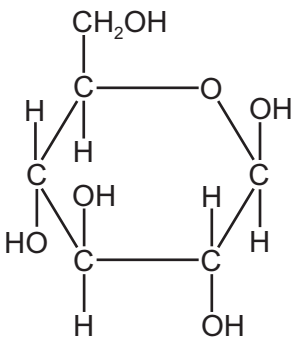
2 Many hydrogen bonds form between adjacent cellulose molecules.

3 Covalent bonds form between adjacent cellulose molecules.

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

7 Which structure shows α-glucose?

A



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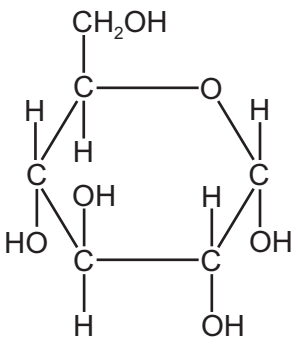

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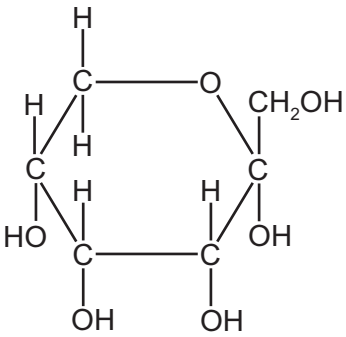

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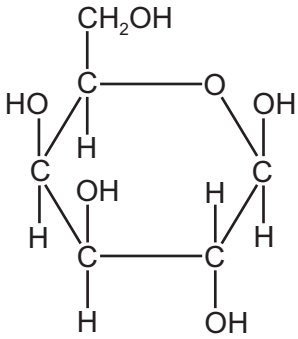


8 What **cannot** occur as a result of a condensation reaction?

A breaking of a glycosidic bond

B formation of a disaccharide

C joining together of two amino acids

D production of a molecule of water

9 Which fact about the quaternary structure of proteins is correct?

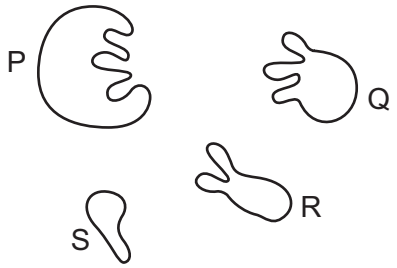
A consists of four polypeptides

B depends on the presence of metal ions

C depends on the primary structure of the polypeptides

D is made of α and β polypeptides

10 The diagram shows different molecules in a solution.



Which statement could explain what happens when some of the molecules are mixed together?

A Molecule P forms an enzyme–substrate complex with the non-competitive inhibitor molecule Q.

B Molecule Q binds to molecule P, increasing the activation energy.

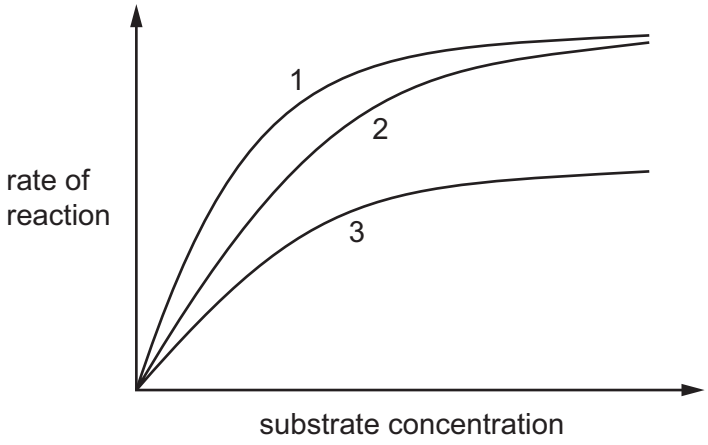
C Molecules R and S bind to the active site of molecule P.

D Molecules S and R are the products of the breakdown of molecule P.

11 The effect of substrate concentration on an enzyme-catalysed reaction was measured in three different conditions:

- without an inhibitor
- with a competitive inhibitor
- with a non-competitive inhibitor.

The graph shows the results.



Which row is correct?

	without an inhibitor	with a competitive inhibitor	with a non-competitive inhibitor
A	1	2	3
B	1	3	2
C	3	1	2
D	3	2	1

12 Which aspect of enzyme activity can be compared by the Michaelis–Menten constant?

A activation energy of a reaction with or without an enzyme

B affinity of different enzymes for their substrates

C affinity of an enzyme at different substrate concentrations

D maximum rate of reaction (V_{max}) at different temperatures

13 The number of substrate molecules one enzyme molecule can convert to product in a second is called the turnover number. This number is obtained when all conditions are optimum for the specific enzyme-catalysed reaction.

enzyme	turnover number / s^{-1}
catalase	2 800 000
carbonic anhydrase	600 000
phosphatase	971
protease	100

How many times faster at converting substrate to product is catalase compared to phosphatase?

A 29 **B** 288 **C** 2884 **D** 28 836

14 A red indicator solution was mixed with agar, and the resulting solid was cut into small cuboid blocks. The blocks were placed in an acid which turns the indicator yellow, and all other variables were kept constant. The dimensions of the three blocks used are shown.

block 1 3 mm × 3 mm × 3 mm

block 2 8 mm × 8 mm × 8 mm

block 3 11 mm × 11 mm × 11 mm

Which row shows the correct surface area (SA) to volume (V) ratio for each block, and the time taken for the block to turn yellow?

	block 1		block 2		block 3	
	SA to V ratio	time to turn yellow / mins	SA to V ratio	time to turn yellow / mins	SA to V ratio	time to turn yellow / mins
A	0.5 : 1.0	4	1.33 : 1.0	11	1.83 : 1.0	13
B	0.5 : 1.0	13	1.33 : 1.0	11	1.83 : 1.0	4
C	2.0 : 1.0	4	0.75 : 1.0	11	0.55 : 1.0	13
D	2.0 : 1.0	13	0.75 : 1.0	11	0.55 : 1.0	4

15 The statements describe some events in the process of exocytosis of glycoprotein molecules.

1 Membrane of the Golgi body folds around glycoprotein molecules.

2 Vesicle binds to and fuses with the cell surface membrane.

3 Vesicle attached to microtubules moves through the cytoplasm.

4 Secretory vesicle forms.

What is the correct order of events for exocytosis?

A $1 \rightarrow 4 \rightarrow 2 \rightarrow 3$

B $1 \rightarrow 4 \rightarrow 3 \rightarrow 2$

C $2 \rightarrow 3 \rightarrow 1 \rightarrow 4$

D $4 \rightarrow 1 \rightarrow 3 \rightarrow 2$

16 Four cylinders that were identical in size, **A**, **B**, **C** and **D**, were cut from potatoes that had been stored for different lengths of time.

The cylinders were weighed, immersed in 10% salt solution for 45 minutes and then reweighed.

The percentage change in mass was then calculated.

Which cylinder had a water potential similar to the 10% salt solution?

	percentage change in mass
A	–7.2
B	–2.5
C	–0.9
D	+3.4

17 The contents of a daughter cell are compared to the parent cell after one cell cycle.

Which row is correct?

	number of chromosomes	volume of cytoplasm	length of telomeres
A	increases	remains the same	decreases
B	increases	decreases	remains the same
C	remains the same	remains the same	remains the same
D	remains the same	decreases	decreases

18 A high-power photomicrograph shows a cell in a stage of mitosis.

The chromosomes are visible and lined up along the cell equator but there is no nuclear envelope.

Which stage of mitosis is shown by the photomicrograph?

A prophase

B metaphase

C anaphase

D telophase

19 Which statements about the cell cycle are correct?

1 The cell cycle includes interphase and mitosis.

2 DNA replication takes place in interphase.

3 A cell can remain in interphase for several months.

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

20 A scientist stains the chromosomes of a plant cell with a fluorescent dye to observe the telomeres.

This cell has 38 chromosomes.

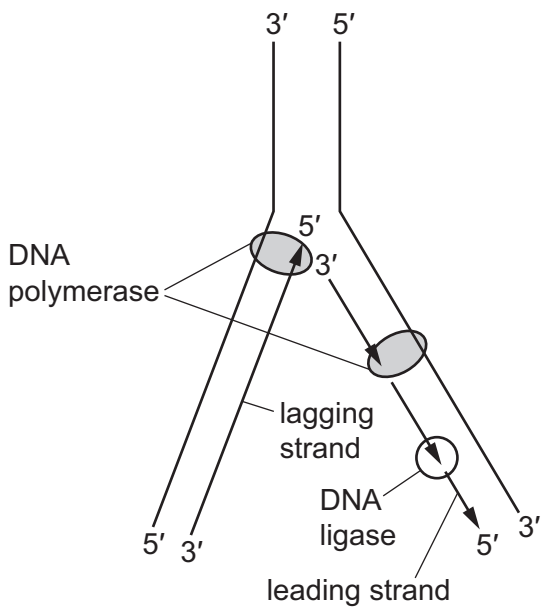
How many telomeres will the scientist observe in one of the nuclei during telophase of mitosis?

A 38 **B** 76 **C** 114 **D** 152

21 During the semi-conservative replication of DNA, the double helix is unwound by an enzyme.

Which diagram shows how the strands are copied?

A



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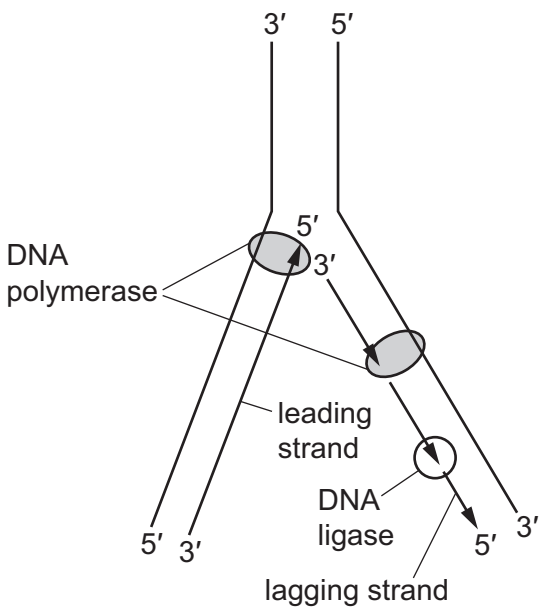

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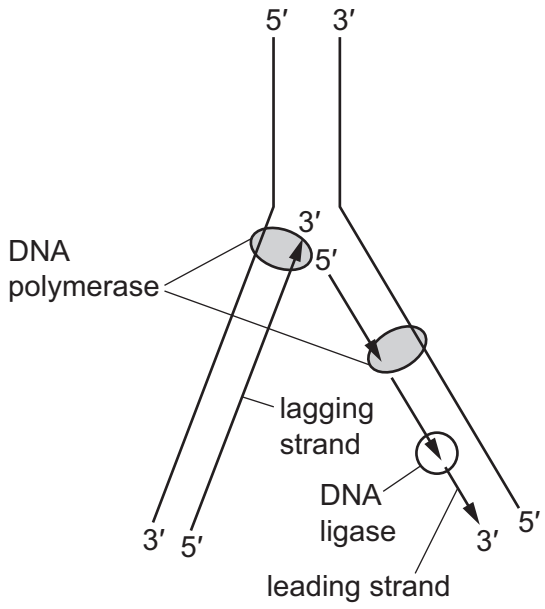

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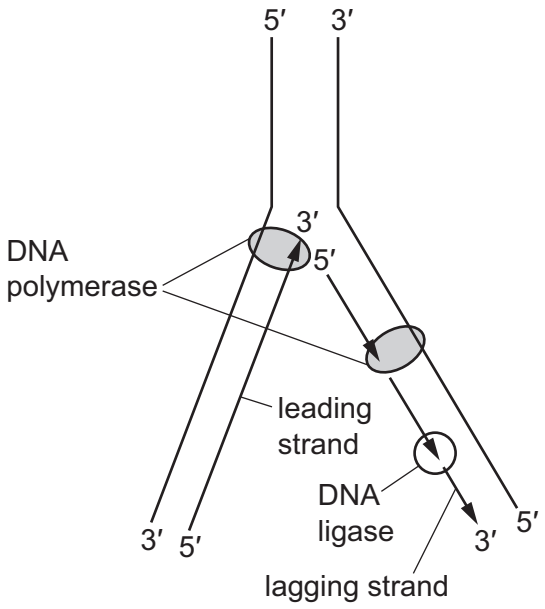


22 A transcription error results in the deletion of one nucleotide from the middle of a primary transcript. mRNA forms from the primary transcript.

Which statement describes one possible effect of this deletion on the protein translated from this mRNA?

A The protein will be unchanged as the same amino acids can be coded by another codon formed by the deletion.

B The tertiary structure of the protein is **not** affected as only one amino acid has been changed by the deletion.

C Only one amino acid has been changed by the deletion but this changes the quaternary structure of the protein.

D The sequence of amino acids in the protein will be different as all the codons from the deletion onwards are changed.

23 Which statements correctly describe the process of translation?

1 The nucleotide sequence on an mRNA molecule is used to produce a specific amino acid chain.

2 A section of DNA is copied into an mRNA molecule by RNA polymerase.

3 A polypeptide is produced because anticodons on tRNA molecules attach to mRNA codons through peptide bonds.

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

24 A molecule of mRNA was used in translation. Part of its sequence is shown.

GAU CUG UAA CGG

There were no introns present in the section of DNA that was transcribed to make this mRNA.

What is the sequence of the **non-transcribed** DNA strand for this section?

A CTA GAC ATT GCC

B CUA GAC AUU GCC

C GAT CTG TAA CGG

D GAU CUG UAA CGG

25 Which properties of water are dependent on hydrogen bonding between water molecules?

	cohesion	high latent heat of vaporisation	solvent action	high specific heat capacity
A	✓	✓	✓	✗
B	✓	✓	✗	✓
C	✓	✗	✓	✓
D	✗	✓	✓	✓

key

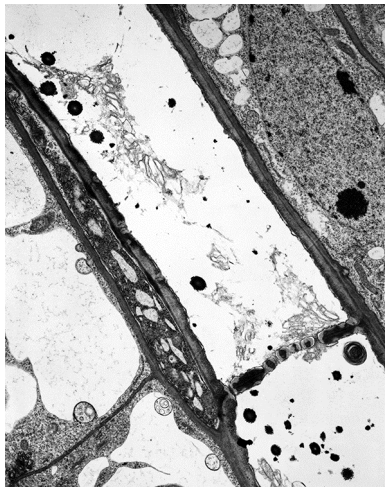
✓ = dependent

✗ = not dependent

26 Which substances in xylem tissue are impermeable to water and prevent the collapse of the vessels?

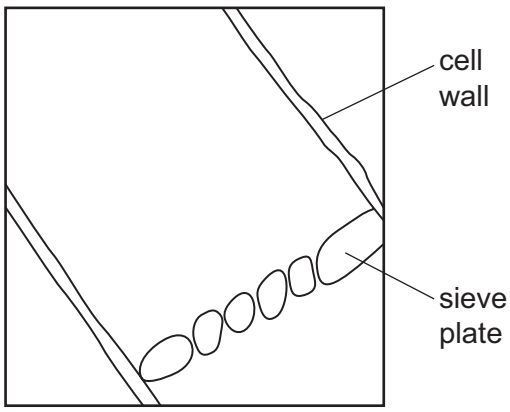
	impermeable to water	prevent collapse
A	cellulose	cellulose only
B	cellulose	lignin only
C	lignin	cellulose only
D	lignin	cellulose and lignin

27 The electron micrograph shows a longitudinal section through phloem tissue.

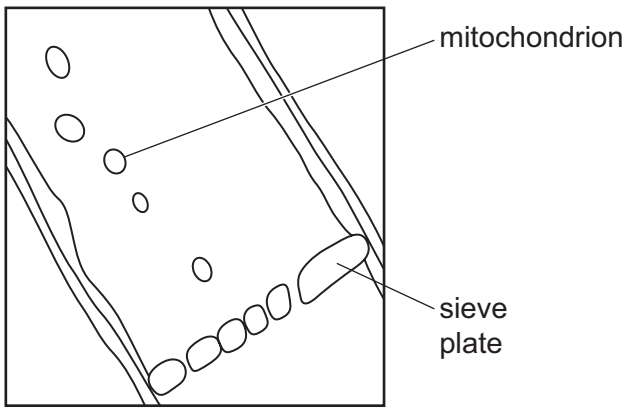


Which student's drawing of a sieve tube element is correctly drawn and labelled?

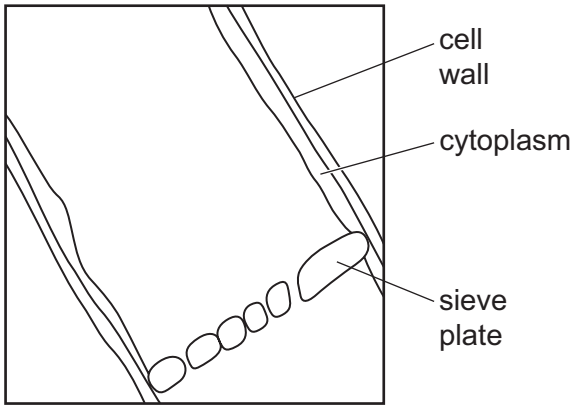
A



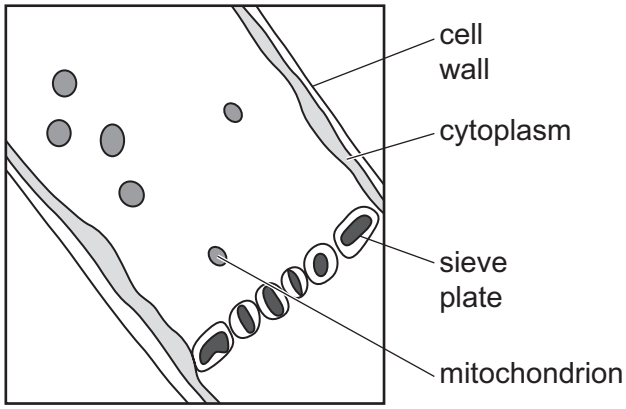
B



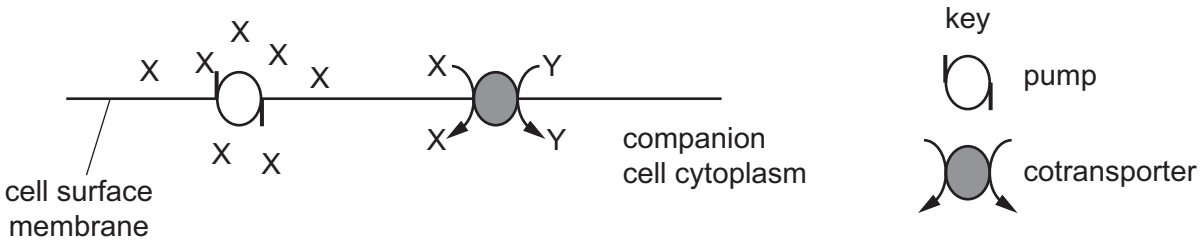
C



D



28 Carrier proteins in the cell surface membranes of companion cells are involved in the transfer of assimilates to phloem sieve tubes. The diagram represents the use of two types of carrier protein in this process.

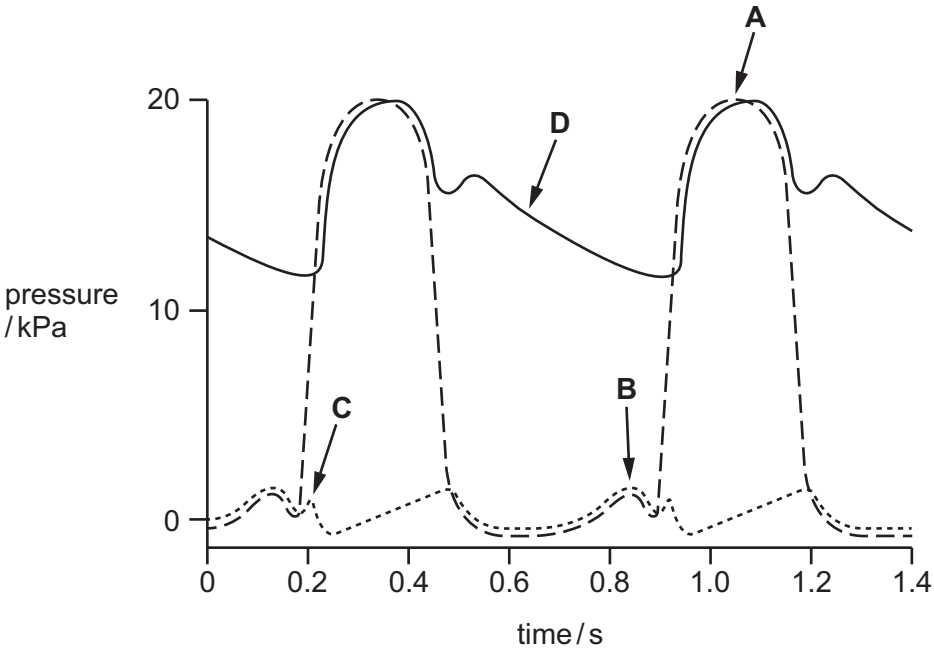


What are the substances labelled X and Y?

	X	Y
A	H^+ ions	sucrose
B	H^+ ions	glucose
C	sucrose	H^+ ions
D	glucose	H^+ ions

29 The diagram shows pressure changes during two cardiac cycles.

Which arrow indicates atrial systole?



30 An irregular heartbeat may be the result of ineffective electrical stimulation of the atria.

Which area of the heart could be damaged, causing this irregular heartbeat?

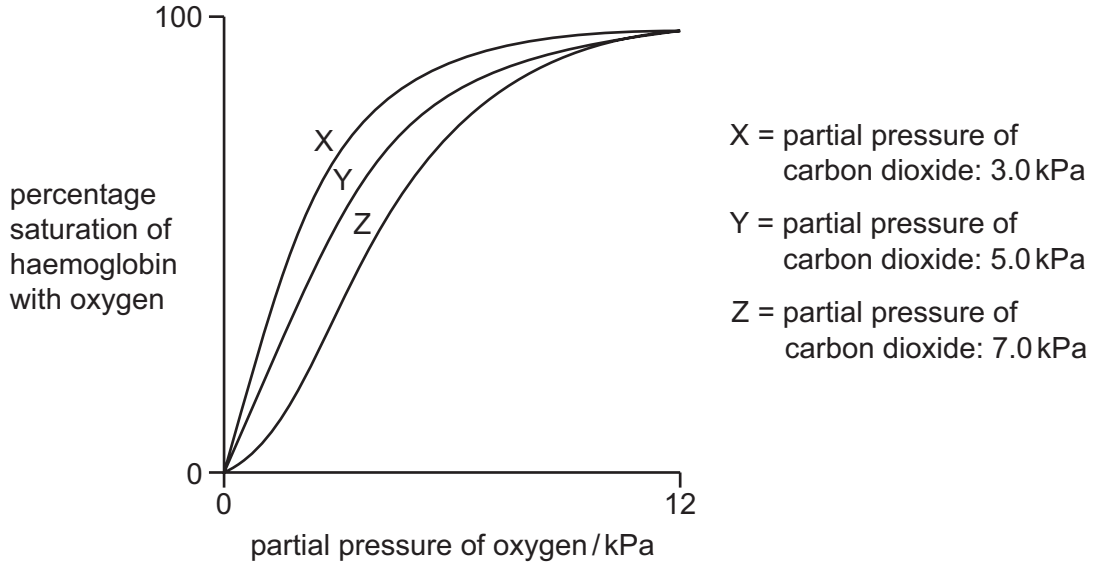
A atrioventricular node

B septum

C Purkyne tissue

D sinoatrial node

31 The diagram shows the effect of three different concentrations of carbon dioxide on the oxygen dissociation curve for human haemoglobin.



Which effect does increasing carbon dioxide concentration have on haemoglobin?

A It makes haemoglobin less efficient at taking up oxygen and less efficient at releasing oxygen.

B It makes haemoglobin less efficient at taking up oxygen and more efficient at releasing oxygen.

C It makes haemoglobin more efficient at taking up oxygen and less efficient at releasing oxygen.

D It makes haemoglobin more efficient at taking up oxygen and more efficient at releasing oxygen.

32 Which reactions will be taking place in blood in a capillary that is next to an alveolus?

1 $Hb + 4O_2 \rightarrow HbO_8$

2 $H_2O + CO_2 \rightarrow H_2CO_3$

3 $H_2CO_3 \rightarrow H^+ + HCO_3^-$

key

Hb = haemoglobin

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

33 Which structure of the gas exchange system always contains cartilage?

A alveoli

B bronchiole

C capillary

D bronchus

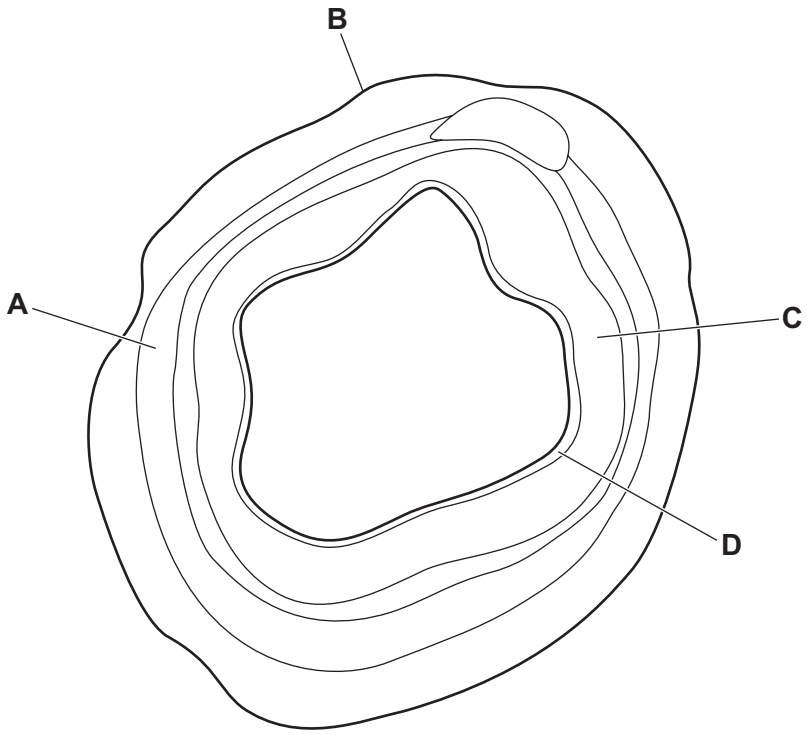
34 Exchange of carbon dioxide and oxygen occurs between air in the alveoli and blood in the capillaries of the lung.

Which partial pressures of the gases will allow gaseous exchange to occur?

	CO_2 in alveolar air / kPa	CO_2 in blood / kPa	O_2 in alveolar air / kPa	O_2 in blood / kPa
A	5.3	6.0	13.3	13.9
B	5.3	6.0	13.9	5.3
C	6.0	5.3	13.9	5.3
D	6.0	5.3	13.3	13.9

35 The plan diagram shows a cross-section of a trachea.

Which labelled tissue prevents the trachea from collapsing?

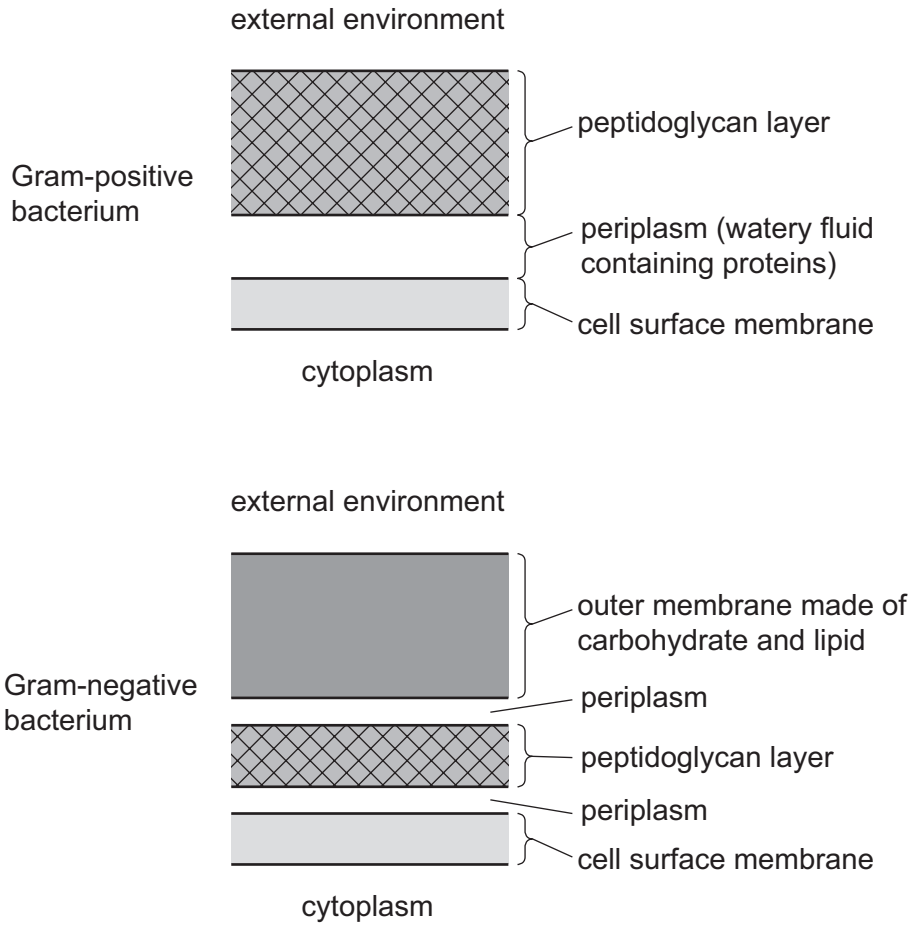


36 Which layers of cells does an oxygen molecule diffuse through when moving from an alveolus into an alveolar capillary?

	alveolus	alveolar capillary
A	squamous epithelium	squamous epithelium
B	endothelium	squamous epithelium
C	squamous epithelium	endothelium
D	endothelium	endothelium

37 Bacteria may be classified according to differences in cell wall structure. The differences are shown by using the Gram stain.

The diagram shows part of a Gram-positive bacterium and part of a Gram-negative bacterium, drawn to the same scale.



The antibiotic penicillin kills bacteria by inhibiting the synthesis of the cell walls during bacterial cell growth.

Which type of bacteria will be killed by penicillin more easily and why?

A Gram-positive bacteria because the peptidoglycan layer is exposed to penicillin directly

B Gram-positive bacteria because it has a thinner layer surrounding the cell membrane overall

C Gram-negative bacteria because the thin peptidoglycan layer can be broken down faster

D Gram-negative bacteria because there is more periplasm available, which gives a weaker structure

38 Which facts relate to the disease TB or its pathogen?

1 Viruses change their antigens to a limited extent.

2 TB is caused by only one species of pathogen.

3 HIV / AIDS makes the bacterial infection worse.

4 The pathogen may be transmitted by ingestion.

5 The pathogen may be transmitted from animals.

6 Multi-drug resistance occurs.

A 1, 4, 5 and 6

B 1, 2 and 6

C 2, 3 and 5

D 3, 4, 5 and 6

39 The events listed occur during the primary immune response to a specific pathogen.

1 activation of B-lymphocyte to produce plasma cells and memory cells

2 phagocytosis of invading pathogens by macrophages

3 T-helper cell activation and production of T-killer cells

4 expression of antigens on phagocyte cell surface

5 production and release of antibodies

Which row identifies a correct sequence of events?

	first → last				
A	5	1	2	4	3
B	2	4	3	1	5
C	4	2	1	5	3
D	4	2	3	1	5

40 Influenza is an infectious disease caused by a virus.

It is possible to have influenza more than once.

Which statements explain why it is possible to have influenza more than once?

1 The viral antigens change as a result of mutations.

2 The immune system may be weak and make few B-memory cells.

3 Untreated HIV infection has resulted in a low T-helper cell count.

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

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