Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2014**

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

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READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

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

IB14 06_9700_13/4RP

1 The eyepiece lens of a microscope is fitted with an eyepiece graticule.

Which statements about the graticule are correct?

1 It allows you to measure the actual length of cells.

2 It allows you to draw cells with correct proportions.

3 It changes in size as the objective lens changes from ×10 to ×40.

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

2 The diameter of living cells varies considerably.

The diameter of a typical eukaryotic cell is 1.5×10^1 μm.
The diameter of a typical prokaryotic cell is 7.5×10^2 nm.

Using these measurements, what is the maximum number of each cell type which could fit along a line 1 cm long?

	number of white blood cells	number of *Streptococcus cells*
A	6.7×10^4	1.3×10^2
B	6.7×10^3	1.3×10^5
C	6.7×10^2	1.3×10^4
D	6.7×10^1	1.3×10^3

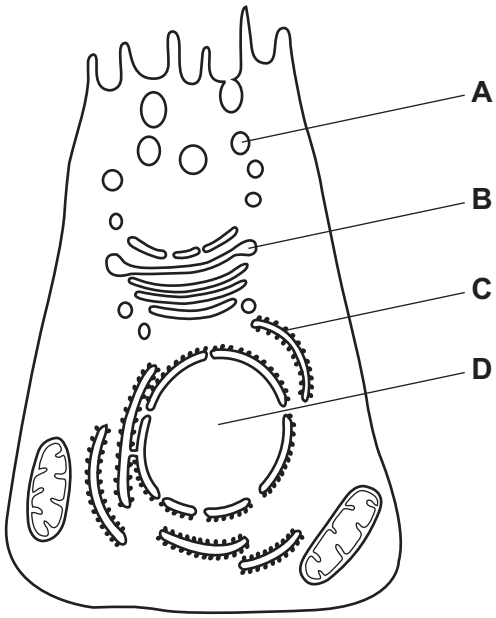
3 In order to complete the sentence below, what is the correct process and cell structure?

Cells which have a high rate of ……1…… will have many ……2…… .

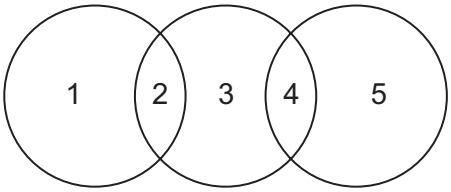
	1	2
A	DNA replication	lysosomes
B	exocytosis	Golgi vesicles
C	facilitated diffusion	mitochondria
D	phospholipid production	ribosomes

4 A cell secreting glycoproteins is supplied with radioactively-labelled glucose which is [illegible] the cytoplasm first.

In which organelle would radioactively-labelled glucose be detected next?



5 The diagram shows some similarities between chloroplasts, mitochondria and typical prokaryotes.



Which row is correct?

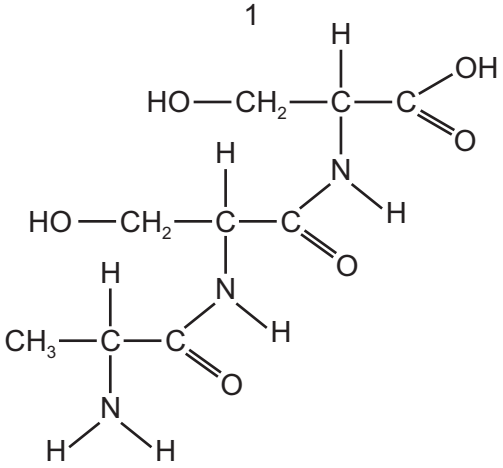
	1	2	3	4	5
A	chloroplasts	circular DNA	mitochondria	linear DNA	prokaryotes
B	mitochondria	linear DNA	chloroplasts	70S ribosomes	prokaryotes
C	mitochondria	70S ribosomes	chloroplasts	linear DNA	prokaryotes
D	prokaryotes	70S ribosomes	mitochondria	70S ribosomes	chloroplasts

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

test for biological molecule	observation
iodine solution	orange
biuret	blue
Benedict's	orange
emulsion	clear

Which molecules are present in this solution?

1



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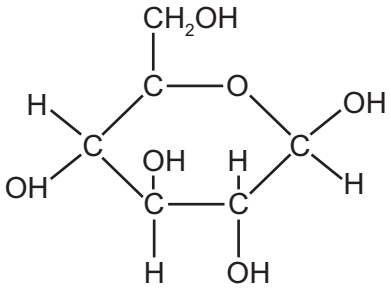

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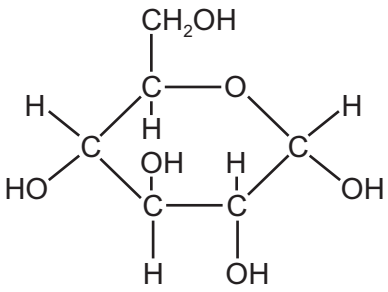

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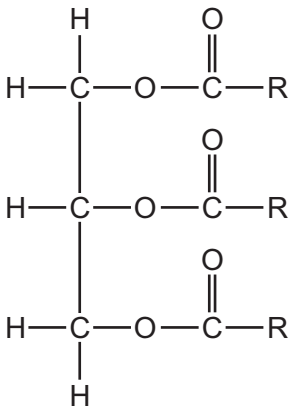


A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

7 Which bonds will be broken when a molecule of amylose is hydrolysed?

1 α1,4

2 β1,4

3 α1,6

4 β1,6

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

8 Which statement describes how the molecular structure of starch is suited to its function?

A Amylose has a branched structure and amylopectin is coiled to give a compact molecule for transport.

B In the breakdown of amylose and amylopectin, many condensation reactions release stored energy.

C In the formation of amylose and amylopectin, many hydrolysis reactions allow the release of stored energy.

D The amylose-amylopectin complex is insoluble and does not affect the water potential of the cell.

9 Which comparative statements concerning biological molecules are correct?

1 A collagen molecule is a fibrous protein that contains many amino acids with hydrophobic R-groups whereas a haemoglobin molecule is a globular protein with no amino acids with hydrophobic R-groups.

2 Sucrose hydrolysis results in glycosidic bond breakage and the production of equal proportions of fructose and α-glucose molecules, whereas cellulose hydrolysis results in only β-glucose molecules.

3 The glycosidic bonds of glycogen have been formed between two α-glucose molecules, whereas with amylopectin, the bonds have been formed between an α-glucose molecule and a β-glucose molecule.

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

10 In triglyceride molecules, where are double bonds located?

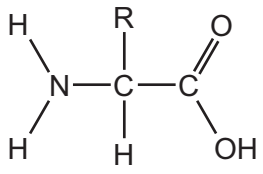
A between fatty acids and glycerol

B within fatty acids and within glycerol

C within fatty acids only

D within glycerol only

11 The diagram represents an amino acid.



R represents a variable side chain.

Which is **not** a possible side chain?

A CH_3

B $CH_2CH_2SCH_3$

C CH_2CONH_2

D $HOCH_2CH(OH)CH_2OH$

12 Which of the statements describe some roles of enzymes?

1 catalyse the breakdown of larger molecules into smaller ones

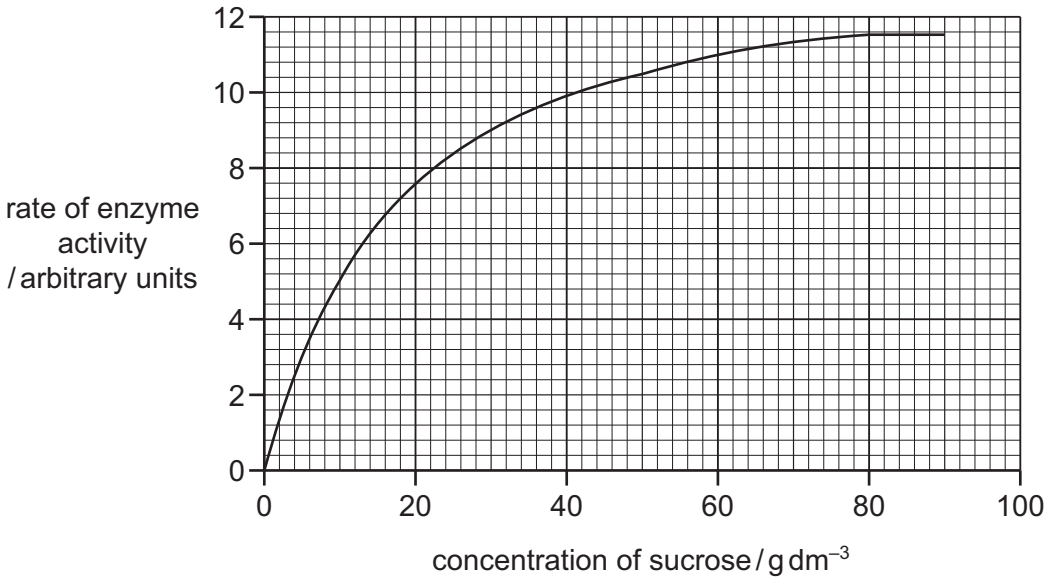
2 lower the activation energy required to start a reaction

3 increase the number of collisions between molecules

4 supply the activation energy required to start a reaction

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

13 The graph shows the rate of activity of the enzyme sucrase plotted against the con f sucrose.



Why does the rate of enzyme activity remain constant from 80 – 90 g dm^{-3}.

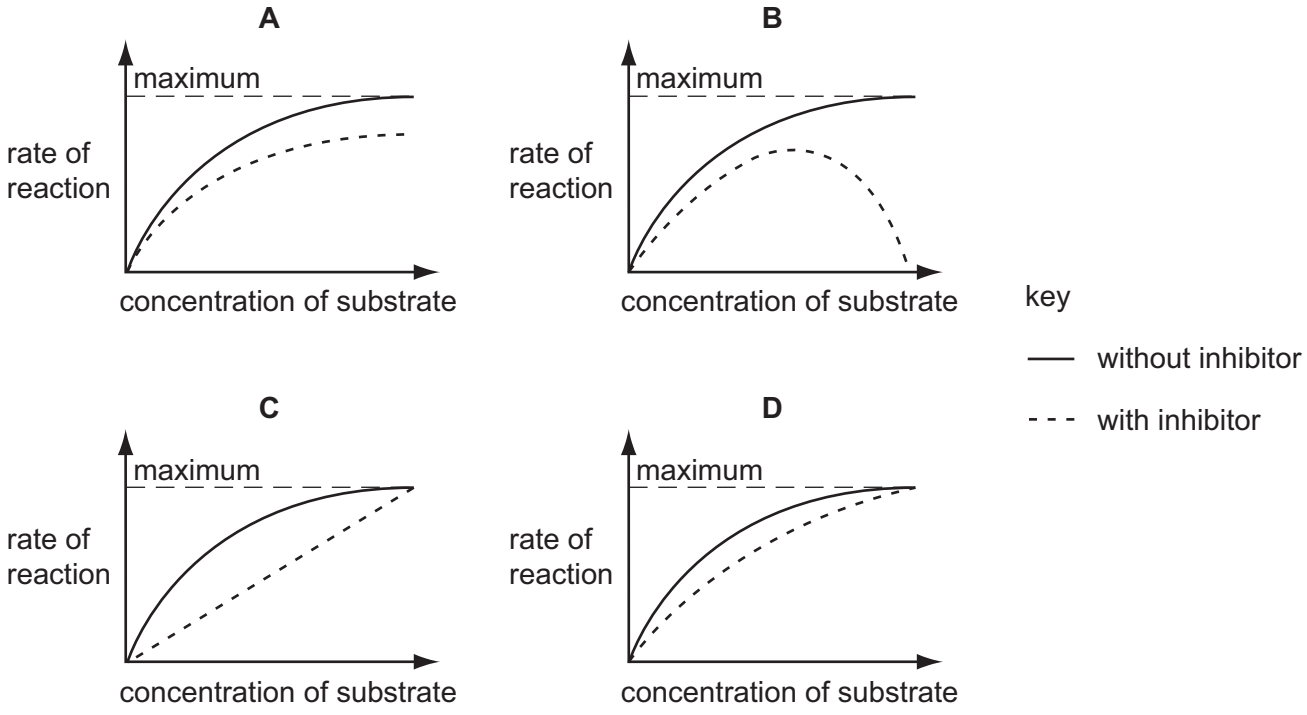
A All the enzyme has been inhibited.

B All the substrate has been used up.

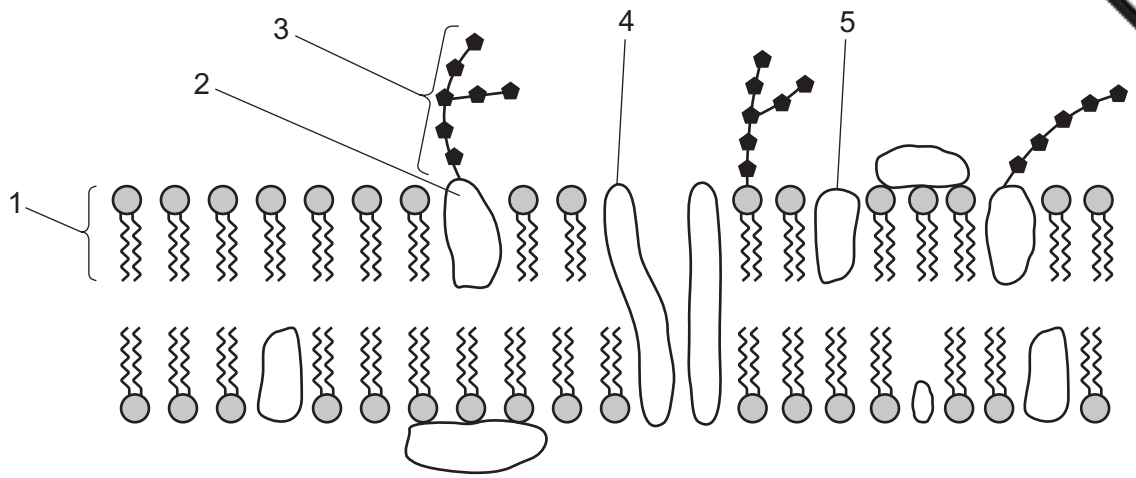
C The concentration of the enzyme is limiting the rate.

D The concentration of the substrate is limiting the rate.

14 Which graph represents the action of a non-competitive inhibitor?



15 The diagram shows part of a cell surface membrane.



Which molecules have both hydrophobic and hydrophilic regions?

A 1, 2, 4 and 5 **B** 1, 3 and 5 **C** 1 and 5 only **D** 2 and 4 only

16 One type of antigen is formed by a reaction between two different molecules.

Apart from oxygen, which other elements are found in this antigen?

A carbon and hydrogen only

B hydrogen and nitrogen only

C carbon, nitrogen and phosphorus

D carbon, hydrogen, nitrogen and sulfur

17 What are the features of facilitated diffusion?

1 It uses protein channels in the membrane and is driven by the energy from ATP.

2 It moves molecules from regions of higher concentration to lower concentration and is driven by the kinetic energy of the molecules which are diffusing.

3 It uses protein channels in the membrane, and the maximum rate of diffusion depends on the number of these channels.

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

18 Single-celled animals that live in fresh water have a vacuole that contracts regularly to remove excess water. Single-celled plants that live in fresh water do not have a similar vacuole.

Which statement explains why these animals need this vacuole but plants do not?

A Plant cell cytoplasm and animal cell cytoplasm both have a lower water potential than fresh water.

B Plant cell sap has the same water potential as fresh water, animal cytoplasm has a lower water potential than fresh water.

C Plant cell walls are impermeable to water, animal cell surface membranes are permeable to water.

D Plant cell walls restrict the entry of water, animal cell membranes allow the entry of water.

19 During which process does **only** mitosis occur?

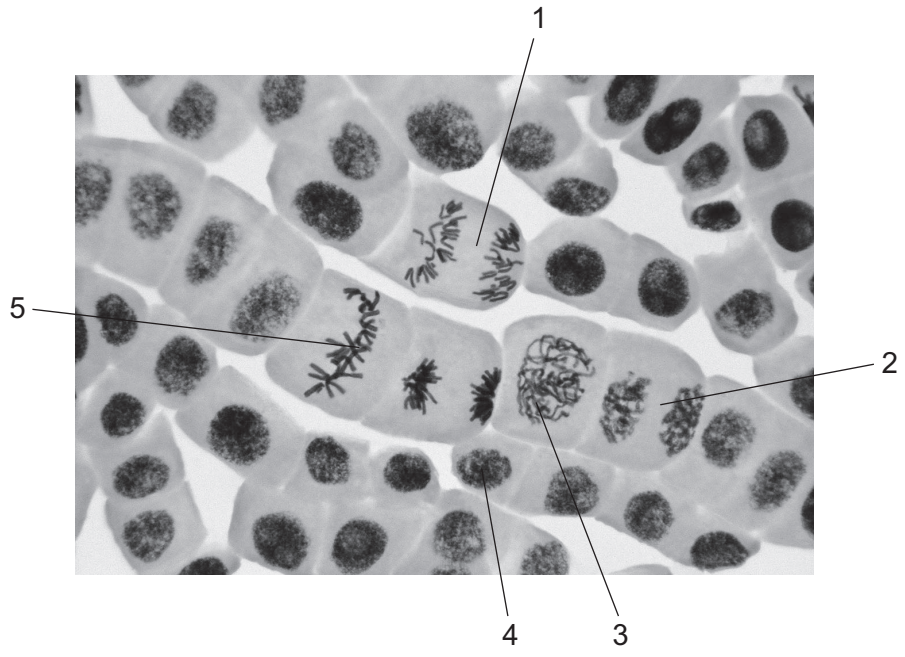
A the production of antibodies from B-lymphocyte memory cells

B the production of cancerous tissue in alveoli

C the production of gametes

D the production of root hairs

20 The photomicrograph shows cells in different stages of mitosis.



In which order do these stages occur?

A 3 → 5 → 2 → 1 → 4

B 3 → 5 → 1 → 2 → 4

C 4 → 3 → 5 → 1 → 2

D 4 → 5 → 1 → 2 → 3

21 The statements are about genes and proteins involved in breast cancer.

- The protein coded by the *BRAC1* gene inhibits the growth of breast cancer cells.
- The protein coded by the *RAD51* gene is required for the repair of damaged DNA.

Which combination of genes is most likely to result in breast cancer?

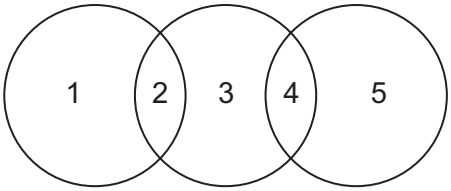
	gene	
	BRAC1	*RAD51*
A	✓	✓
B	✗	✓
C	✓	✗
D	✗	✗

key

✓ = normal active gene

✗ = mutated gene

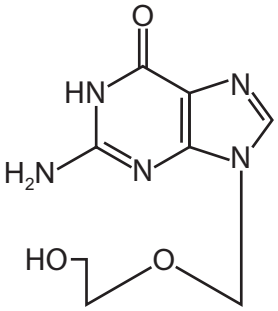
22 The diagram shows some relationships between different nucleic acid bases.



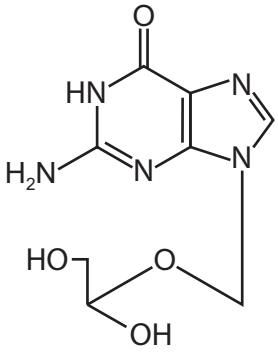
Which row is correct?

	1	2	3	4	5
A	adenine	purine	cytosine	pairs with	guanine
B	cytosine	purine	guanine	pairs with	uracil
C	guanine	pairs with	cytosine	pyrimidine	thymine
D	thymine	pairs with	uracil	pyrimidine	adenine

23 The diagram shows the structures of some drugs that have a similar structure to nucl[illegible]e presence of these drugs reduces nucleic acid synthesis.



acyclovir



gancyclovir

Which statement explains how these drugs reduce nucleic acid synthesis?

A Increasing the concentration of these drugs results in the increased length of the nucleic acid.

B They are non-competitive inhibitors of the enzymes that catalyse the synthesis of DNA or RNA.

C They bind to pyrimidine nucleotides and the base pair is the wrong size.

D They replace purine nucleotides causing the synthesis of incomplete nucleic acids.

24 What terminates the formation of a polypeptide chain during protein synthesis in cells?

A when a ‘stop’ codon is reached on the mRNA molecule

B when a ‘stop’ codon is reached on the tRNA molecule

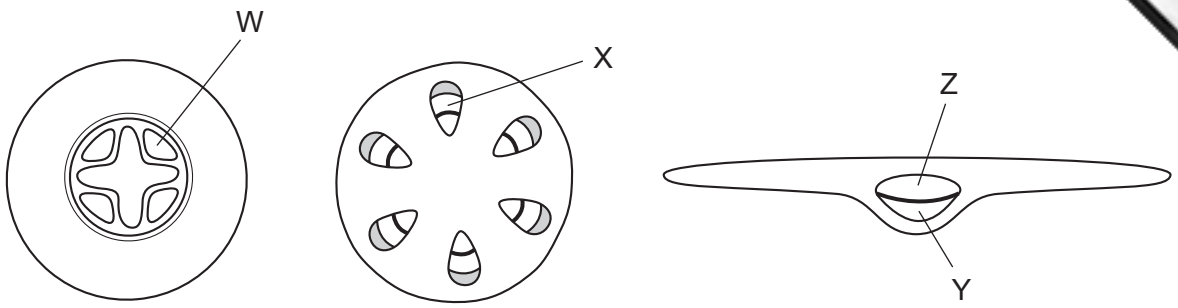
C when the ribosome reaches the end of the mRNA molecule

D when the ribosome reaches the end of the tRNA molecule

25 In which combination of environmental conditions are the stomata of a plant most likely to close?

	atmospheric humidity	soil water potential	wind speed
A	high	low	high
B	high	low	low
C	low	high	high
D	low	low	high

26 The diagrams show some tissue types, in plant organs.



Which row identifies the tissue types?

	W	X	Y	Z
A	phloem	phloem	phloem	xylem
B	phloem	xylem	phloem	xylem
C	xylem	phloem	xylem	phloem
D	xylem	xylem	phloem	xylem

27 Which features apply to **both** sieve tube elements and xylem vessel elements?

1 no cytoplasm

2 no end walls

3 no nucleus

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

28 What changes occur to the water potential and the volume of liquid in the **phloem** when carbohydrate is moved into a sink?

	water potential	volume of liquid
A	lowers	decreases
B	lowers	increases
C	raises	decreases
D	raises	increases

29 Some plant species can take up heavy metal contaminants that are dissolved in so[illegible]d then transport them within the plant. Within plant cells, the heavy metals accumulate ma[illegible] vacuole.

Which are valid suggestions about the transport and accumulation of heavy metals?

1 After initial entry into the root, some of the heavy metals can pass through the tonoplast to be stored in the vacuole of cortical cells.

2 The heavy metals take an apoplastic pathway in the xylem but at the endodermis must take a symplastic pathway.

3 The rate of accumulation of the heavy metals in leaf cells will be faster at night, when photosynthesis is not occurring, than during the day.

4 The presence of the heavy metal will inhibit active transport, causing the transpiration stream to slow down and reduce the rate of transpiration.

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

30 Which process can be carried out by a mature red blood cell?

A active transport

B cell division

C phagocytosis

D protein synthesis

31 Which is **not** a correct statement about phagocytes?

A They are white blood cells with a lobed nucleus.

B They have many lysosomes containing hydrolytic enzymes.

C They have many mitochondria to produce ATP for endocytosis.

D They provide specific defence against disease-causing organisms.

32 Which of the following are found in blood and lymph and tissue fluid?

1 carbon dioxide

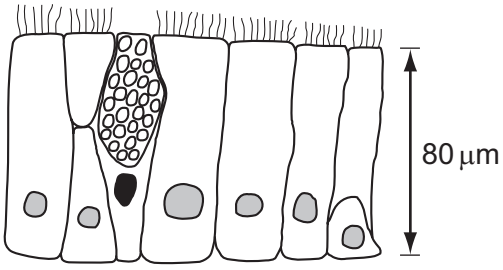
2 glucose

3 white blood cells

4 fatty acids

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

33 The diagram shows a section through a type of epithelium.

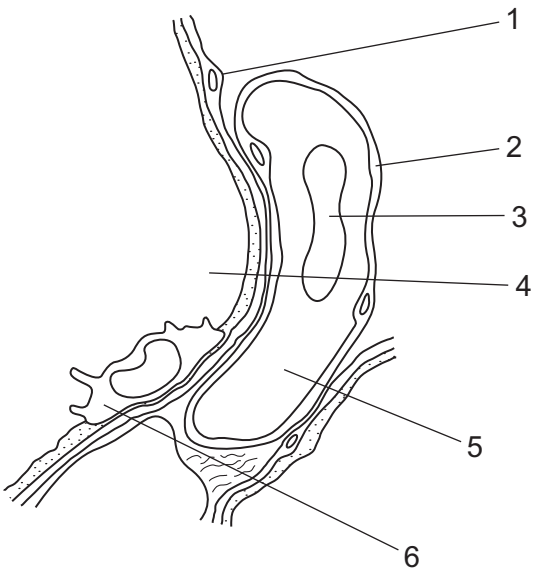


Where is this type of epithelium found in the respiratory system?

	trachea	bronchus	all bronchioles
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key
✓ = present
✗ = absent

34 The diagram shows a magnified section of part of the lungs containing specialised tissues.



Where are there a high proportion of carbonic anhydrase, HCO_3^- ions and lysosomes?

	contains high proportion of		
	carbonic anhydrase	HCO_3^- ions	lysosomes
A	1	3	4
B	2	4	5
C	3	5	6
D	4	6	1

35 Which row correctly identifies the effects of carbon monoxide, nicotine and tar?

	effect		
	raises blood pressure	causes gene mutation	reduces oxygenation of blood
A	carbon monoxide	nicotine	tar
B	nicotine	nicotine	carbon monoxide
C	nicotine	tar	carbon monoxide
D	tar	carbon monoxide	nicotine

36 Which factors may increase the risk of cholera in refugee camps?

1 no refrigeration of food

2 increase in the number of people

3 lack of hand washing facilities

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

37 What are antigens?

A non-self macromolecules found only on bacteria that trigger the formation of antibodies

B non-self macromolecules that trigger an immune response

C proteins that consist of two light and two heavy polypeptide chains

D self macromolecules embedded in B-lymphocyte cell membranes

38 A total of $3 \times 10^6\,kJ\,m^{-2}\,yr^{-1}$ is available from the producers in an ecosystem.

In theory, how much of this energy would be available to tertiary consumers?

A $3 \times 10^4\,kJ\,m^{-2}\,yr^{-1}$

B $3 \times 10^3\,kJ\,m^{-2}\,yr^{-1}$

C $3 \times 10^2\,kJ\,m^{-2}\,yr^{-1}$

D $3 \times 10^1\,kJ\,m^{-2}\,yr^{-1}$

39 In a food chain, which link involves the **least** efficient energy transfer?

A Bull fishes feed on small crustacea.

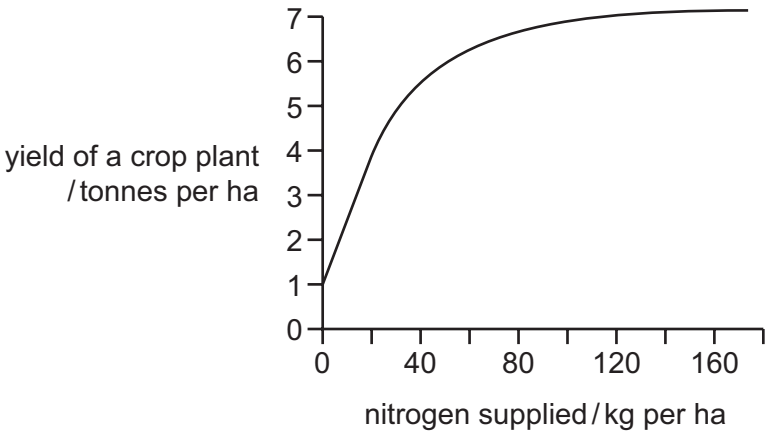
B Herons feed on bull fishes.

C Mangrove plants trap sunlight during photosynthesis.

D Small crustacea feed on dead mangrove leaves.

40 The growth of crop plants is often limited by the availability of nitrogen in the soil.

The graph shows the results of an investigation into the yield of a crop plant, with inc levels of nitrogen supplied.



Which of the following best explains the shape of this curve?

	protein synthesis	DNA synthesis
A	increases	no effect
B	no effect	no effect
C	increases	increases
D	no effect	increases