Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **October/November 2016**

1 hour

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

7093770083

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.

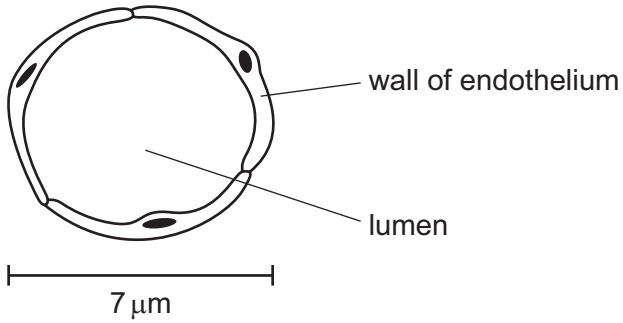
Read the instructions on the Answer Sheet very carefully.

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.

This document consists of **15** printed pages and **1** blank page.

© UCLES 2016

1 The diagram shows a transverse section through a blood capillary.



What is the magnification of the drawing?

A ×200 **B** ×245 **C** ×500 **D** ×5000

2 A culture of human cells had its cell surface membranes removed, releasing the cell contents.

This material became contaminated by bacteria.

The material was then centrifuged, separating out the various cell structures according to size and mass.

Which cell structure would be separated out along with the bacteria?

A endoplasmic reticulum

B mitochondria

C nuclei

D ribosomes

3 Which parts of a cell contain ribosomes?

1 chloroplast

2 mitochondrion

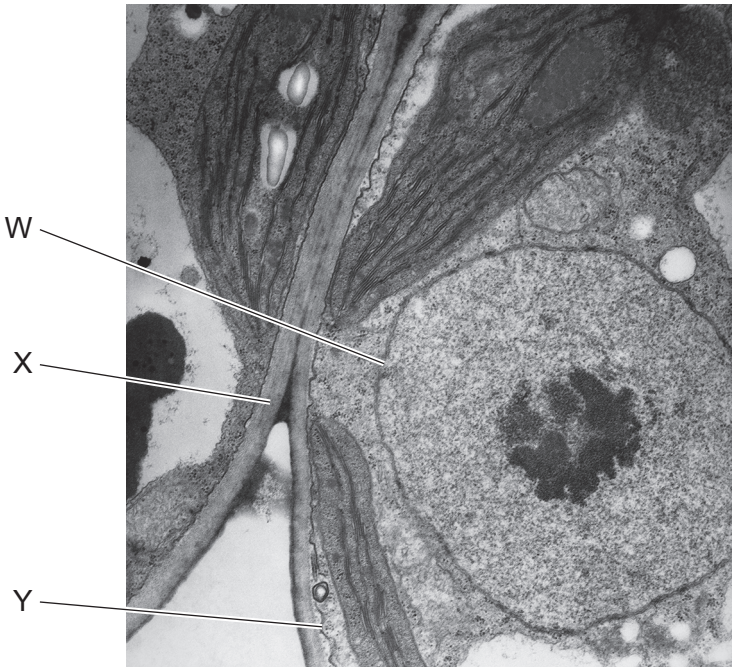
3 nucleus

4 cytoplasm

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

© UCLES 2016

4 The electron micrograph shows part of two eukaryotic cells.



Which features are also found in prokaryotes?

A W only **B** X only **C** X and Y only **D** W, X and Y

5 Which of the structures are found in photosynthetic prokaryotes?

1 cell surface membrane

2 cellulose wall

3 ribosomes

4 chloroplasts

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

6 In order to estimate the quantity of glucose in a solution, equal volumes of a range of known concentrations were mixed with equal excess volumes of Benedict's solution and placed in a thermostatically controlled water-bath at 90 °C for the same length of time.

The unknown solution was then treated in the same way and the colours of the known and unknown solutions compared.

What is the independent variable in this procedure?

A concentration of glucose

B final colour of solutions

C temperature of water-bath

D volumes of glucose solutions

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

A breaking of a glycosidic bond

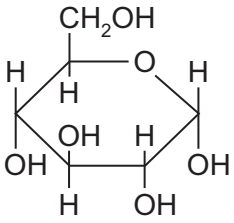
B formation of a disaccharide

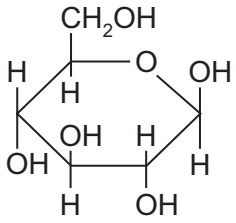
C joining together two amino acids

D production of a molecule of water

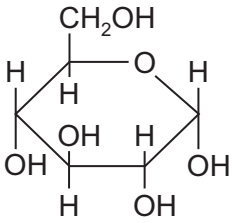
8 Which pair of monosaccharides forms sucrose?

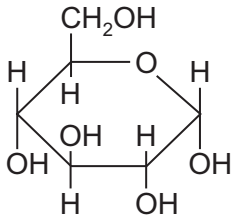
A



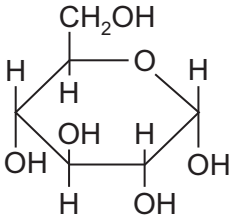


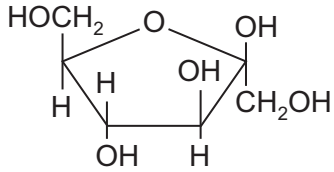
B



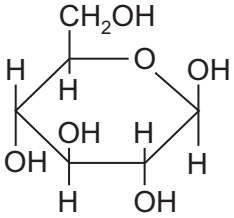


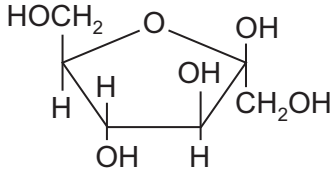
C





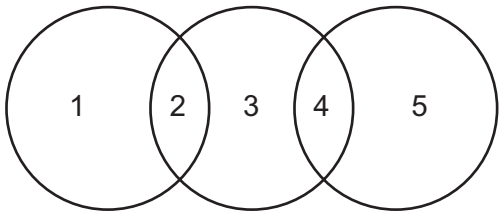
D





© UCLES 2016

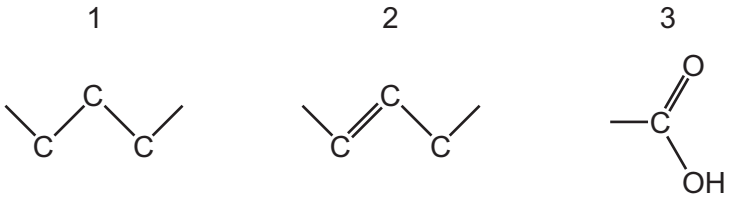
9 The diagram shows the relationship between different polysaccharides and the glycosidic bonds formed between the monomers.



Which row is correct?

	1	2	3	4	5
A	amylopectin	α-1,6	cellulose	β-1,4	glycogen
B	amylose	α-1,4	glycogen	β-1,4	amylopectin
C	cellulose	β-1,4	amylose	α-1,4	glycogen
D	glycogen	α-1,6	amylopectin	α-1,4	amylose

10 The diagrams show some of the types of bond in fatty acids.



Which row shows the bonds found in each type of molecule?

	unsaturated fatty acid	saturated fatty acid
A	1, 2 and 3	1 and 3 only
B	1, 2 and 3	2 and 3 only
C	1 and 3 only	1, 2 and 3
D	2 and 3 only	1, 2 and 3

11 What could describe the tertiary structure of a protein?

1 α-helix

2 a globular structure

3 the specific order of amino acids

4 a specific three-dimensional (3D) shape

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

12 Following a heart attack, the enzyme lactate dehydrogenase leaks into the blood plasma from damaged heart muscle.

Which steps are required to obtain an estimate of lactate dehydrogenase activity in a sample of blood plasma?

	sterilise blood plasma by heating	incubate with substrate for lactate dehydrogenase	incubate with lactate dehydrogenase inhibitor
A	✓	✓	✓
B	✗	✓	✓
C	✗	✓	✗
D	✗	✗	✓

key

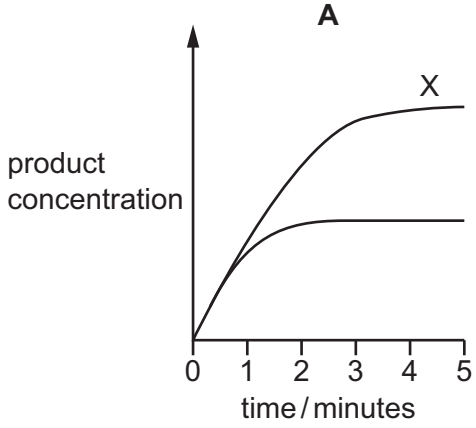
✓ = step required

✗ = step not required

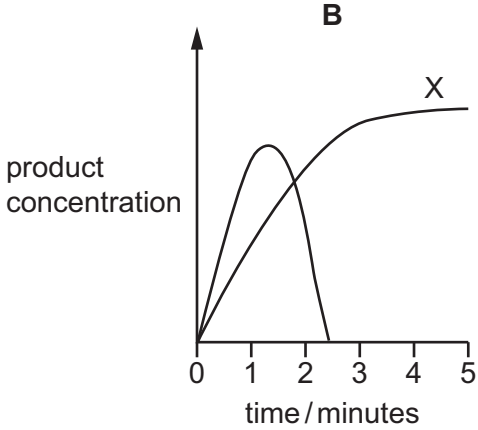
13 Two experiments were carried out using an enzyme from humans. The first experiment, X, was carried out at a constant temperature of 37 °C. During the second experiment, the temperature was increased from 37 °C to 80 °C. All other factors were kept the same.

Which graph shows the results?

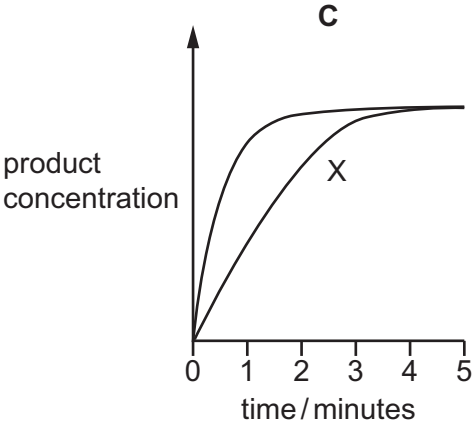
A



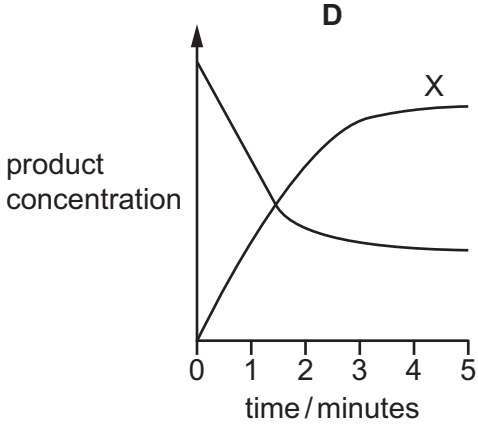
B



C



D



14 Which molecules are found at the outer surface of a cell surface membrane?

	cholesterol	glycolipids	phospholipids
A	✓	✓	✗
B	✓	✗	✓
C	✓	✗	✗
D	✗	✓	✓

key

✓ = present

✗ = absent

15 Which substances can pass directly through cell surface membranes **without** using a carrier protein or channel protein?

1 CO_2

2 Ca^{2+} and Na^{+}

3 H_2O

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

16 Which statements about the proteins in cell surface membranes are correct?

1 They can be involved in active transport and facilitated diffusion.

2 They can be involved in antigen recognition.

3 They have hydrophilic R groups to interact with the inner portion of the membrane.

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

17 Which row is correct for a human cell just before the cell enters prophase of mitosis?

	number of chromatids	number of molecules of DNA in nucleus	spindle present	nuclear envelope present
A	46	46	yes	no
B	46	92	yes	yes
C	92	46	no	yes
D	92	92	no	yes

18 Which event is part of the mitotic cell cycle?

A anaphase

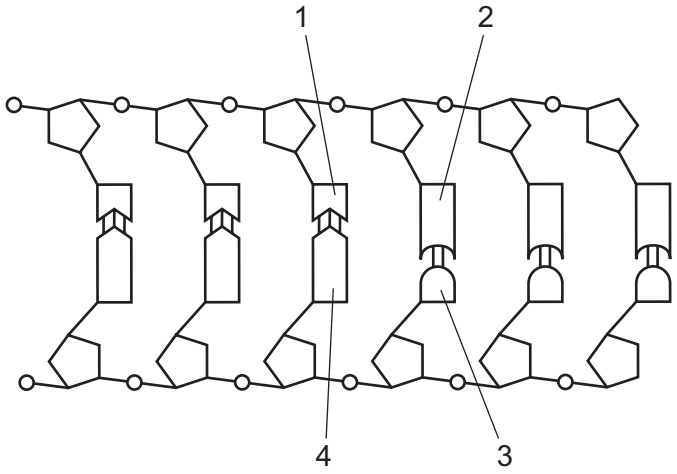
B cytokinesis

C DNA replication

D interphase

© UCLES 2016

19 The diagram shows part of a DNA molecule.



Which labels represent purines?

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

20 A double stranded DNA molecule was analysed and 29% of its nucleotide bases were found to be adenine.

What percentage of its nucleotide bases will be cytosine?

A 21% **B** 29% **C** 42% **D** 58%

21 When a gene mutation occurs, which of the following may be altered, resulting in the production of a non-functional protein?

1 amino acid sequence

2 DNA nucleotide sequence

3 mRNA nucleotide sequence

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

© UCLES 2016

22 The diagram shows the nucleotide sequence of a small section of a gene which is transcribed.

GCAGCATGCGCG

The table shows the amino acids coded for by 10 mRNA codons.

mRNA codon	amino acid
AAG	Lys
ACG	Thr
CGG CGC CGU	Arg
CCG	Pro
GCC GCG	Ala
GGC	Gly
UGC	Cys

What is the order of the four amino acids in the polypeptide translated from this small section of a gene?

A Ala-Ala-Cys-Ala

B Ala-Arg-Gly-Ala

C Arg-Ala-Pro-Arg

D Arg-Arg-Thr-Arg

23 Which changes to the water potential and the volume of liquid in the phloem occur when carbohydrate is taken out of a sink into a phloem sieve tube element?

	water potential in phloem sieve tube element	volume of liquid in phloem sieve tube element
A	higher	decreases
B	higher	increases
C	lower	decreases
D	lower	increases

© UCLES 2016

24 A dendrograph records changes in the diameter of a tree. The diagram shows a dendrograph fixed to a tree.

Some results are shown on the chart recording.

dendrograph fixed to a tree

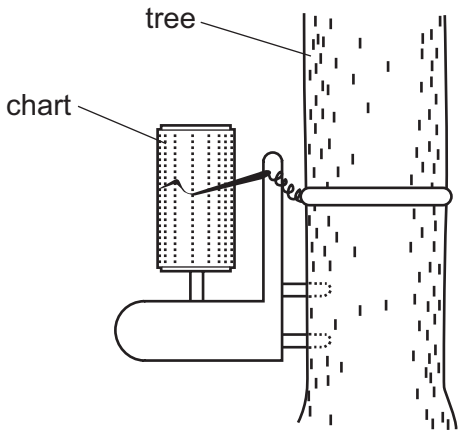
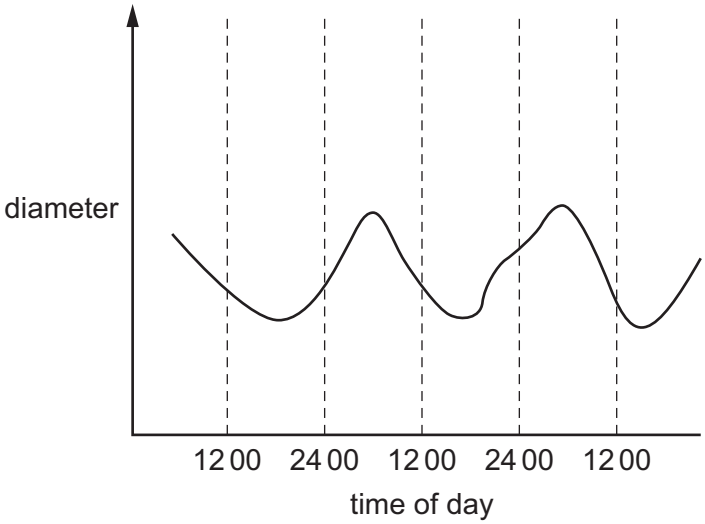


chart recording



What explains the diameter changes recorded during the day and night?

A Adhesion forces decrease during the night.

B Cohesive tension forces increase during the day.

C Mass flow of sucrose increases during the night.

D Root pressure decreases during the day.

25 Which description is correct for xylem vessel elements?

A cells joined to form a tube, pits at intervals, sieve plates between cells, surrounded by the endodermis in roots

B contains cells joined end to end, containing cytoplasm, cell walls with lignin, located to the outside of phloem in vascular bundles

C contains elongated cells with end walls broken down, located in vascular bundles in the stem and centrally in the roots

D dead elongated cells, lignified cell walls with pits at intervals, associated with companion cells in the roots only

© UCLES 2016

26 Different substances, such as sucrose and amino acids, can move in different directions in the phloem sieve tube elements.

Which statement explains this?

A Active transport occurs in some phloem sieve tube elements and mass flow occurs in other sieve tube elements.

B Both active transport and mass flow occur in each individual phloem sieve tube element.

C Mass flow occurs in both directions at the same time in each individual phloem sieve tube element.

D Mass flow occurs in different directions in different phloem sieve tube elements at the same time.

27 Which describes possible mechanisms by which sucrose is transferred from a mesophyll cell into a companion cell?

1 co-transport with the active transport of hydrogen ions

2 co-transport by passive diffusion of hydrogen ions

3 facilitated diffusion through plasmodesmata

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

28 Which statement about haemoglobin is correct?

A Carbon dioxide increases its affinity for oxygen.

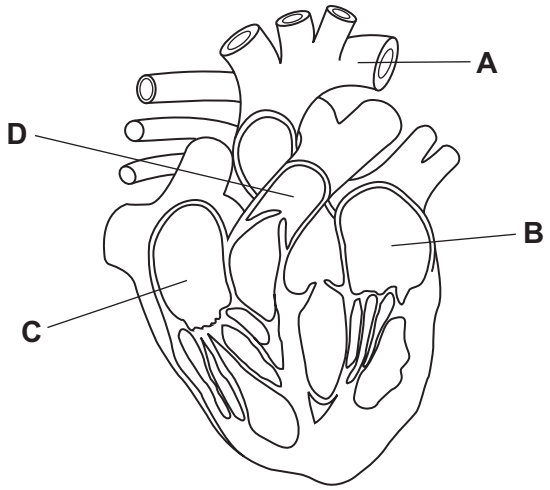
B Its affinity for oxygen changes with altitude.

C It can combine reversibly with carbon monoxide.

D It can combine with carbon dioxide.

© UCLES 2016

29 The diagram shows a section through the heart.



Which label is correct?

A pulmonary artery

B left ventricle

C right atrium

D aorta

30 What is the reason for the increase in red blood cells in humans at high altitudes?

A to compensate for the low percentage saturation of haemoglobin

B to enable haemoglobin to unload more oxygen in the tissues by the Bohr effect

C to ensure that haemoglobin is almost 90% saturated when it reaches the tissues

D to increase the number of mitochondria in the blood for ATP production

31 Which statement explains why the oxygen dissociation curve for haemoglobin is S-shaped?

A At high oxygen concentrations, oxygen dissociates from the haemoglobin molecule.

B Haemoglobin becomes saturated at low partial pressures of oxygen.

C Oxygenated haemoglobin accepts hydrogen ions from carbonic acid.

D The shape of the haemoglobin molecule changes when oxygen binds to it.

© UCLES 2016

32 Which reactions take place in a capillary in an alveolus?

1 carbon dioxide + water → carbonic acid

2 carbon dioxide + haemoglobin → carbaminohaemoglobin

3 haemoglobinic acid → haemoglobin + hydrogen ions

4 hydrogencarbonate ions + hydrogen ions → carbon dioxide + water

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

33 A student viewed three slides at both low magnification and high magnification. Each slide was a section through a different airway of the gas exchange system.

The student observed three features in each slide.

slide	three features observed by student
1	irregular arrangement of cartilage highly folded inner layer cilia on epithelial cells
2	very few goblet cells cilia on epithelial cells thick layer of smooth muscle relative to wall thickness
3	smooth muscle tissue blood vessels many goblet cells

Which row is the correct set of identifications for the three slides?

	slide 1	slide 2	slide 3
A	bronchus	bronchiole	trachea
B	bronchus	trachea	bronchiole
C	trachea	bronchiole	bronchus
D	trachea	bronchus	bronchiole

34 Which organelle is present in large quantities in ciliated epithelial cells?

A Golgi body

B lysosomes

C mitochondria

D rough endoplasmic reticulum

© UCLES 2016

35 In some cases where a person has lung disease, the partial pressure of oxygen in the pulmonary veins is less than the partial pressure of oxygen in the alveoli.

What could explain the difference in partial pressure of oxygen?

1 A high proportion of alveoli are collapsed and do not have enough alveolar capillaries.

2 The partial pressure of oxygen in the pulmonary arteries is lower than in the alveolar air.

3 The rate of diffusion of oxygen from the alveolar air to the surrounding alveolar capillaries is too slow.

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

36 Why is it difficult to control the spread of malaria?

1 Global air travel for commerce and tourism has increased.

2 The mosquito vector rapidly evolves resistance to insecticides.

3 The *Plasmodium* pathogen shows great antigenic variability.

4 Civil unrest and poverty result in overcrowded living conditions.

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

37 Which description gives the correct cause and transmission for TB, measles and HIV / AIDS?

	TB		measles		HIV / AIDS	
	cause	transmission	cause	transmission	cause	transmission
A	bacteria	airborne droplets	virus	airborne droplets	virus	bodily fluids
B	bacteria	water borne	bacteria	airborne droplets	protoctist	insect vector
C	protoctist	airborne droplets	bacteria	insect vector	virus	airborne droplets
D	virus	bodily fluids	protoctist	bodily fluids	bacteria	bodily fluids

38 What describes a function of a T-lymphocyte?

A They are only found in blood and secrete cytokines in response to infection.

B They can leave the blood and accumulate at sites of inflammation.

C They can leave the blood and secrete cytotoxins when exposed to bacteria.

D They circulate in the blood and always present antigens in response to infection.

© UCLES 2016

39 A person's blood group is determined by antigens present on the red blood cells.

The table shows the antigens and antibodies in the blood of people with different blood groups.

blood group	antigens on red blood cells	antibodies in plasma
A	A	antibodies to B
B	B	antibodies to A
AB	A and B	neither
O	neither	antibodies to A and B

During a blood transfusion, it is essential that the recipient's blood does not contain antibodies to the donor's blood.

Which blood group can be given to a person with blood group AB?

A AB only

B O only

C B and A only

D A, B, AB and O

40 Which statement about immunity is correct?

A Antibody donation, but not antibody production, occurs with artificial active and artificial passive immunity.

B Artificial active immunity lasts for a greater length of time than natural passive immunity.

C Natural active immunity provides a faster response to infection than artificial active immunity.

D Recognition and binding by specific B-lymphocytes only occurs with natural immunity.

© UCLES 2016

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **October/November 2016**

1 hour

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

1003441361

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.

This document consists of **16** printed pages.

© UCLES 2016

1 Until recently, the typical viruses known to science were 20 – 150 nm in size.

In 2003, the Mimivirus was discovered with a size of approximately 680 nm.

In 2013, the Pandoravirus was discovered which has a size of over 1000 nm.

Which viruses can be seen using **both** a light microscope with a maximum resolution of 0.25 μm and an electron microscope?

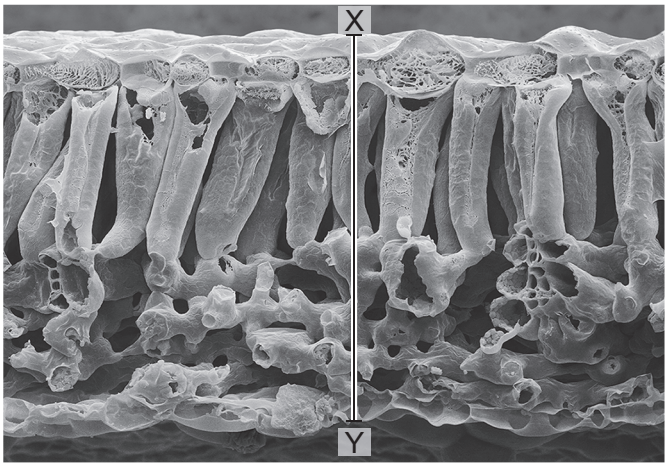
	typical virus	Mimivirus	Pandoravirus
A	✓	✓	✓
B	✗	✓	✓
C	✗	✗	✓
D	✗	✗	✗

key

✓ = can be seen

✗ = cannot be seen

2 This electron micrograph of a section of a leaf has a magnification of × 210.



What is the actual length along the line X–Y?

A 2.43 μm **B** 24.3 μm **C** 243.0 μm **D** 2430 μm

3 What is the correct order in which organelles function to make and secrete an enzyme?

A nucleolus → ribosome → Golgi body → vesicle

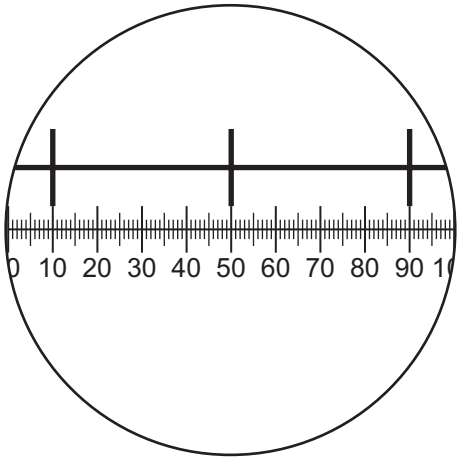
B nucleolus → smooth endoplasmic reticulum → lysosome → vesicle

C nucleus → rough endoplasmic reticulum → Golgi body → vesicle

D nucleus → smooth endoplasmic reticulum → lysosome → vesicle

© UCLES 2016

4 The diagram shows a stage micrometer scale, with divisions 0.1 mm apart, viewed through an eyepiece containing a graticule.



What is the area of the field of view of the microscope at this magnification? (π = 3.14)

A $\pi \times 12.5 \times 12.5 = 4.9 \times 10^2\ \mu m^2$

B $\pi \times 50 \times 50 = 7.9 \times 10^3\ \mu m^2$

C $\pi \times 125 \times 125 = 4.9 \times 10^4\ \mu m^2$

D $\pi \times 250 \times 250 = 2.0 \times 10^5\ \mu m^2$

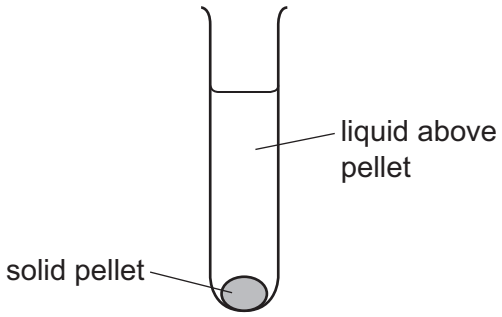
© UCLES 2016

[Turn over

5 A scientist carried out an experiment to separate the organelles in an animal cell by mass.

The scientist mixed the cells with a buffer solution which had the same water potential as the cells. He then broke the cells open with a blender to release the organelles.

The extracted mixture was filtered and then spun in a centrifuge at a high speed to separate the heaviest organelle. This sank to the bottom, forming a solid pellet, 1.



The liquid above pellet 1 was poured into a clean centrifuge tube and spun in the centrifuge at a higher speed to separate the next heaviest organelle. This organelle sank to the bottom, forming a solid pellet, 2.

He repeated this procedure twice more to obtain pellet 3 and pellet 4, each containing a single organelle.

What is the function of the organelle extracted in pellet 2?

A digestion of old organelles

B production of ATP

C production of mRNA

D synthesis of protein

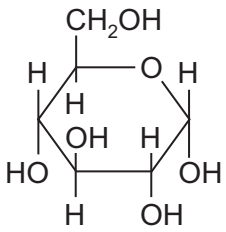
6 Which is a correct comparison between a typical prokaryotic cell and a typical eukaryotic cell?

	prokaryote	eukaryote
A	circular DNA only	linear DNA only
B	naked DNA	DNA associated with protein
C	rough endoplasmic reticulum present	smooth endoplasmic reticulum and rough endoplasmic reticulum present
D	ribosomes approximately 22 nm diameter	ribosomes approximately 18 nm in diameter

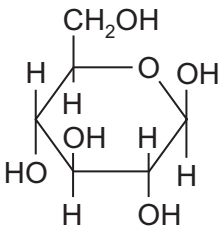
© UCLES 2016

7 The diagrams show four monosaccharides with the formula $C_6H_{12}O_6$.

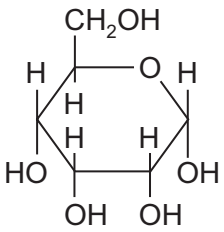
1



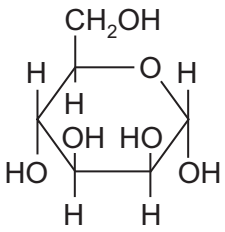
2



3



4



Which diagrams do **not** show glucose molecules?

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

8 Complete digestion of polysaccharides requires all the glycosidic bonds between the monomers to be broken.

Amylase breaks only α-1,4 glycosidic bonds.

How completely can amylase digest molecules of amylose, amylopectin or glycogen?

	carbohydrate		
	amylose	amylopectin	glycogen
A	+	+++	++
B	+	++	+++
C	++	+	+++
D	+++	++	+

key

+	some digestion
++	more digestion
+++	most digestion

9 Which statements about a triglyceride molecule are correct?

1 It always contains unsaturated hydrocarbon tails.

2 It is formed using ester bonds.

3 It does not form hydrogen bonds.

4 It contains a hydrophilic glycerol head.

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

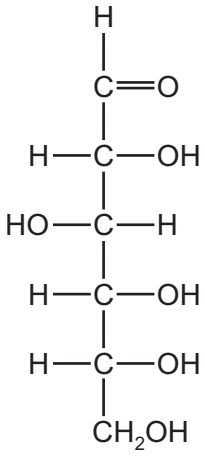
© UCLES 2016

10 The table shows some features of collagen and haemoglobin.

Which row is collagen?

	type of protein	number of polypeptides	solubility in water
A	fibrous	three	insoluble
B	fibrous	four	soluble
C	globular	three	insoluble
D	globular	four	soluble

11 The ring structure of sugars can also be represented as a linear structure, as shown in the diagram.



Which of the sugar molecules could be represented by this formula?

1 β-glucose

2 ribose

3 sucrose

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

12 What is the minimum number of carbon atoms in an amino acid?

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

© UCLES 2016

13 HIV-1 protease is an enzyme produced by the HIV virus.

Two identical chains of 99 amino acids form the enzyme. In each chain, amino acids 25, 26 and 27 in the sequence form part of the active site.

Which orders of protein structure control the shape of the active site?

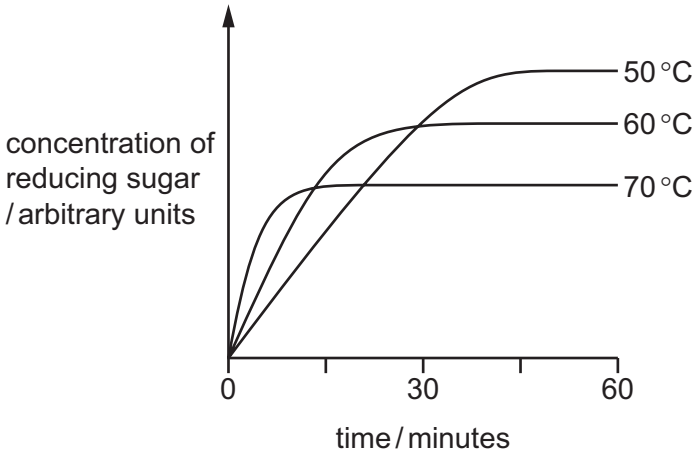
A primary, secondary, tertiary and quaternary

B primary, secondary and tertiary only

C primary and quaternary only

D quaternary only

14 The graph shows the results of an investigation into the effect of amylase on starch at three different temperatures.



Which statements are correct conclusions using these results?

1 The optimum temperature is 50 °C.

2 The initial rate of reaction is highest at 70 °C.

3 The higher the temperature the more quickly the enzyme denatures.

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

15 Substances called furanocoumarins are found in some fruits, where they act as inhibitors of the enzyme CYP3A4. This enzyme is needed to break down toxins in the human digestive system, so dangerous levels of these toxins may develop if these fruits are eaten.

What does this information suggest about molecules of the enzyme CYP3A4?

A They lower the activation energy of the toxin breakdown process.

B They show specificity for a particular substrate found in fruits.

C They will change permanently when acted upon by furanocoumarin molecules.

D They will resume normal activity when levels of furanocoumarins decrease.

© UCLES 2016

16 Which observations support a link between active transport and ATP production?

1 Active transport occurs only in living cells.

2 The rate of active transport decreases in low oxygen concentrations.

3 Companion cells have large numbers of mitochondria.

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

17 A method called freeze-fracture can be used to study the structure of cell membranes. The membrane is frozen and then split down the middle, separating the two layers of phospholipids from each other. Any proteins contained within one layer remain in that layer. Proteins which span the membrane can be found in either layer after freeze-fracture, depending on the properties of the protein.

Which statement about the results of freeze-fracture studies are correct?

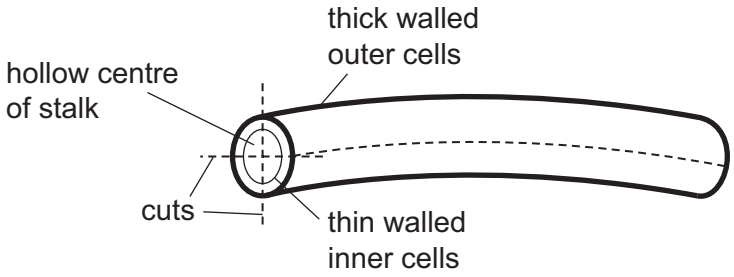
1 It provides evidence for the bilayer nature of membranes.

2 It provides evidence for the arrangement of proteins.

3 It shows that the proteins in the membrane do not contribute to its strength.

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

18 The stalk of a dandelion flower is a hollow tube. Pieces of the stalk are cut as shown and placed in sucrose solutions of different water potentials.



Which diagram shows the piece that is placed in the sucrose solution with the highest water potential?

A



B



C



D



19 Three of the molecules found in prokaryotes are listed below.

1 phospholipid

2 protein

3 peptidoglycan

Which of these molecules are found in prokaryotic cell surface membranes?

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

20 Which row correctly shows the behaviour of the nuclear envelope, the centrioles and the spindle during a stage of mitosis?

	stage of mitosis	behaviour of organelle		
		nuclear envelope	centrioles	spindle
A	prophase	disappears	replicate	spindle microtubules begin to form
B	metaphase	not present	begin to move to poles of cell	spindle microtubules fully formed
C	anaphase	begins to reform	at opposite poles of the cell	some spindle microtubules shorten
D	telophase	reforms	one beside each nucleus	spindle microtubules break down

21 Which group of cells can all divide by mitosis?

A bacterial cells, cancer cells, stem cells

B bacterial cells, lymphocytes, stem cells

C cancer cells, lymphocytes, red blood cells

D cancer cells, lymphocytes, stem cells

22 Which row represents the correct features of the nitrogenous base cytosine?

	has a single ring structure	is a purine	joins its complementary base by three hydrogen bonds
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key

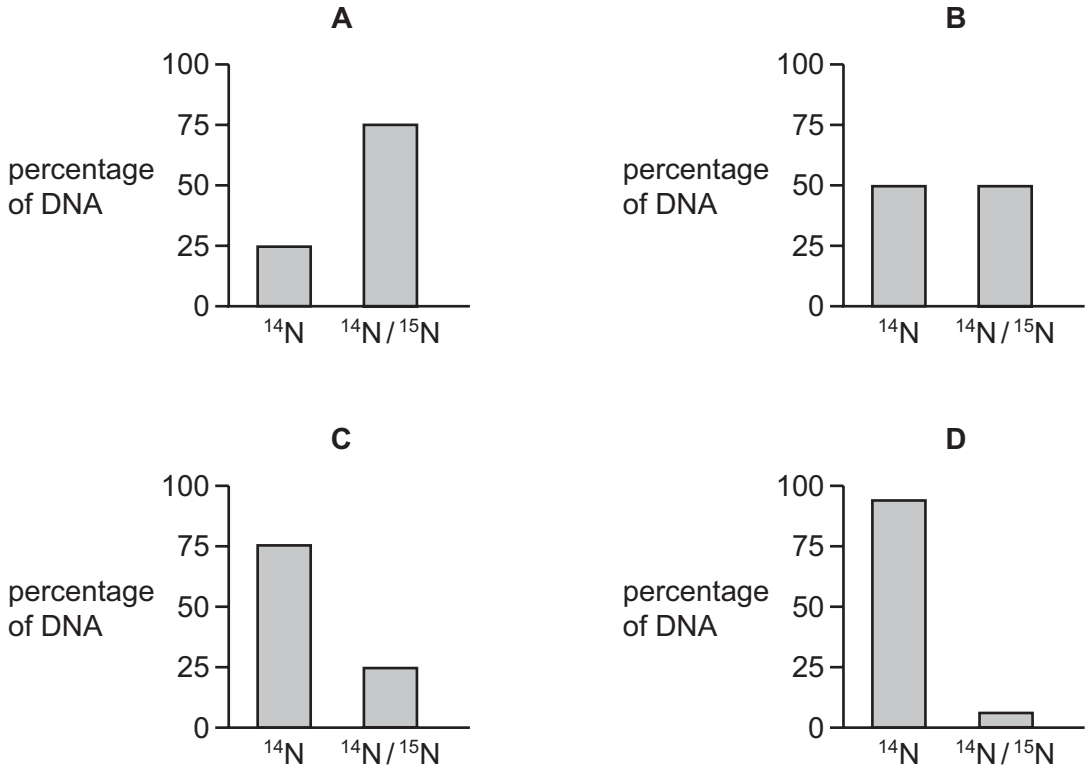
✓ = true

✗ = false

23 Bacteria were grown in a medium containing ^{15}N. After several generations, all of the DNA contained ^{15}N. Some of these bacteria were transferred to a medium containing the common isotope of nitrogen, ^{14}N. The bacteria were allowed to divide once. The DNA of some of these bacteria was extracted and analysed. This DNA was all hybrid DNA containing equal amounts of ^{14}N and ^{15}N.

In another experiment, some bacteria from the medium with ^{15}N were transferred into a medium of ^{14}N. The bacteria were allowed to divide three times. The DNA of some of these bacteria was extracted and analysed.

What is the composition of this DNA?



24 Which processes are involved in the mass movement of water through xylem vessels?

1 hydrogen bonding between water molecules

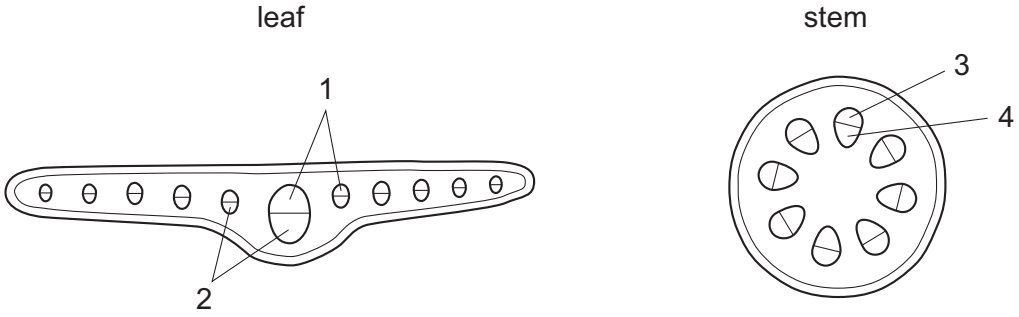
2 cohesion between water molecules

3 adhesion between water molecules and lignin

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

© UCLES 2016

25 The diagrams show transverse sections of parts of a plant.



In the transverse sections, which tissues transport most mineral ions?

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

key
✓ = yes
✗ = no

26 Which changes to the water potential and the volume of liquid in the phloem occur when amino acids are transferred from leaves to be transported to a sink in the phloem sieve tube element?

	water potential in phloem sieve tube element	volume of liquid in phloem sieve tube element
A	higher	decreases
B	higher	increases
C	lower	decreases
D	lower	increases

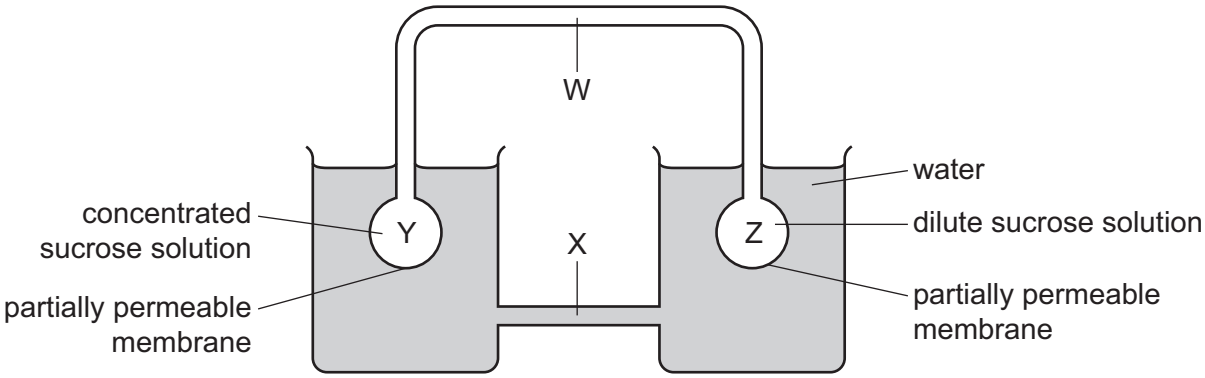
27 External factors change the rate of transpiration, which also affects the water potential gradient of cells in the leaf.

Which combination of statements is correct?

	external factor changing the rate of transpiration	water potential gradient in the leaf
A	decreasing temperature	increases
B	decreasing wind speed	increases
C	increasing relative humidity	decreases
D	increasing sunlight	decreases

© UCLES 2016

28 The diagram shows a model to demonstrate mass flow.



In a plant, what are the structures W, X, Y and Z and what is the direction of flow of solution along W?

	phloem	xylem	roots	leaves	direction of flow along W
A	W	X	Y	Z	from Z to Y
B	W	X	Z	Y	from Y to Z
C	X	W	Y	Z	from Y to Z
D	X	W	Z	Y	from Z to Y

29 Which blood vessels carry blood into the atria of the heart?

A coronary artery and pulmonary artery

B pulmonary artery and vena cava

C pulmonary vein and vena cava

D vena cava and coronary artery

30 Which statement describes the effect of increased carbon dioxide concentration on the oxygen dissociation curve of human haemoglobin and its significance?

A The curve shifts to the left allowing haemoglobin to bind more oxygen in active tissues.

B The curve shifts to the left allowing haemoglobin to offload more oxygen in active tissues.

C The curve shifts to the right allowing haemoglobin to bind more oxygen in active tissues.

D The curve shifts to the right allowing haemoglobin to offload more oxygen in active tissues.

31 What combines with haemoglobin to form carbaminohaemoglobin?

A carbon dioxide

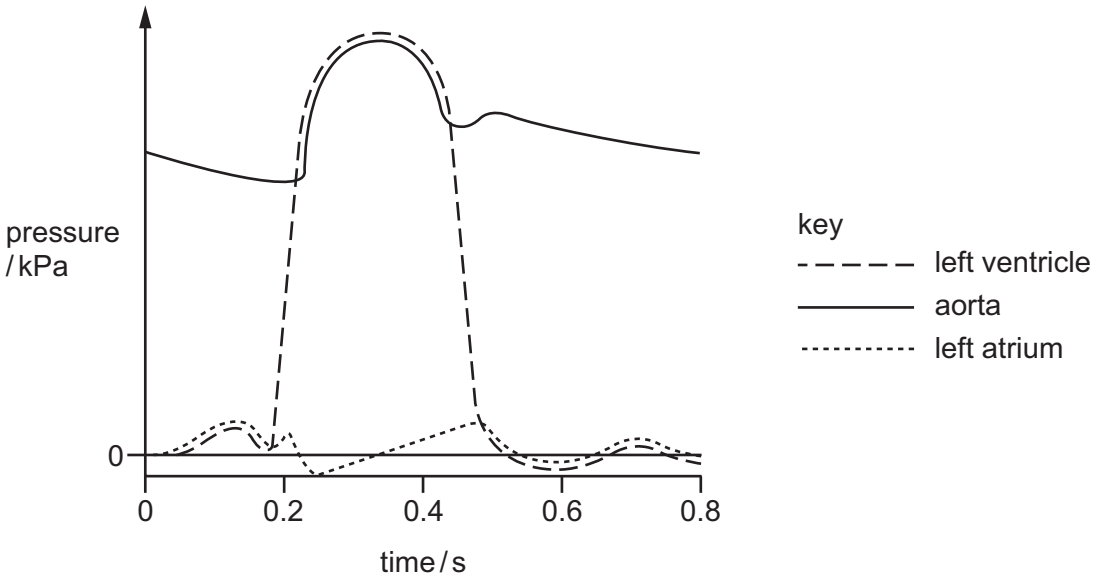
B carbon monoxide

C carbonic acid

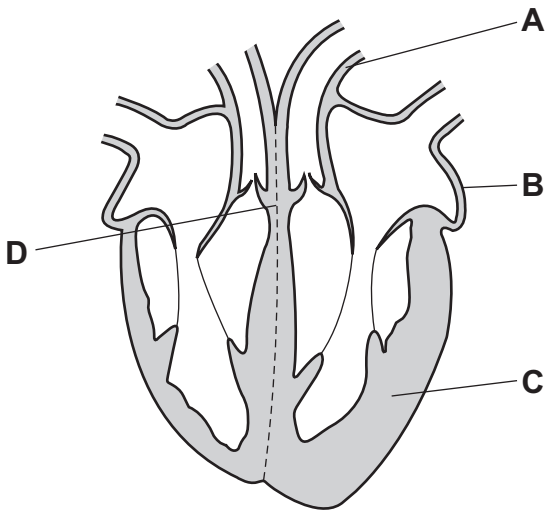
D hydrogencarbonate ions

© UCLES 2016

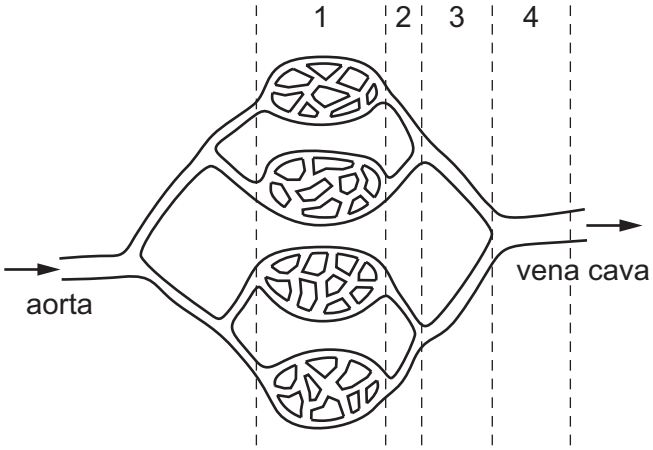
32 The graph shows the pressure in three parts of the heart during one cycle.



At 0.2 seconds, which part of the heart is responding to the excitatory stimulus?



33 The diagram shows part of the organisation of the circulation of a mammal.



Where are **both** the blood pressure and speed of flow lowest?

	lowest blood pressure	lowest speed of flow
A	1	4
B	2	3
C	3	2
D	4	1

34 A student made some labelled drawings of lung tissue using the high-power lens of a light microscope, but did not label two airways, P and Q.

The drawing of the lining layer of P showed both ciliated cells and goblet cells, whilst the drawing of the lining layer of Q showed ciliated cells but very few goblet cells.

What are airways P and Q?

	airway	
	P	Q
A	bronchiole	trachea
B	bronchiole	bronchus
C	bronchus	bronchiole
D	trachea	bronchus

© UCLES 2016

35 What maintains the steep concentration gradients needed for successful gas exchange in the lungs?

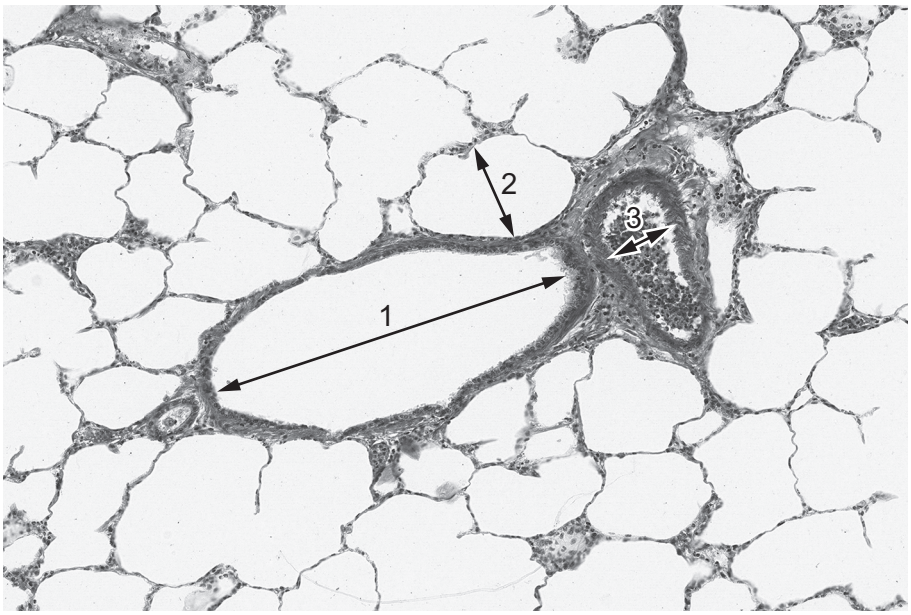
1 Air flow in the alveoli is in the opposite direction to blood flow in the capillaries.

2 Blood arrives in the lungs with a lower oxygen concentration and a higher carbon dioxide concentration than the air in the alveoli.

3 Blood is constantly flowing through and out of the lungs, bringing a fresh supply of red blood cells.

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

36 The photomicrograph shows part of the lung as seen using a light microscope.



Which row is correct for the features labelled 1, 2 and 3?

	1	2	3
A	alveolus	bronchiole	capillary
B	alveolus	capillary	bronchiole
C	bronchiole	alveolus	small artery
D	small artery	alveolus	bronchiole

37 Which disease is **not** likely to be passed directly from parents to child?

A cholera

B malaria

C sickle cell anaemia

D tuberculosis

© UCLES 2016

38 Why is it difficult to control the spread of measles?

1 Global air travel for commerce and tourism has increased.

2 The virus that causes measles rapidly evolves resistance to antibiotics.

3 The virus that causes measles shows great antigenic variability.

4 Civil unrest and poverty result in overcrowded living conditions.

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

39 The following are all responses made by cells of the immune system to a pathogen.

1 mitosis

2 bind to infected cell

3 produce memory cells

4 secrete antibodies

Which of the responses is correct for β-lymphocytes?

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

40 What occurs when active immunity is artificially induced?

A Non-self antibodies attack self antigens.

B Non-self antigens attack self antibodies.

C Self antibodies attack non-self antigens.

D Self antigens attack non-self antibodies.

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2016**

1 hour

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

3184501009

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.

This document consists of **17** printed pages and **3** blank pages.

© UCLES 2016

1 Which structure is **only** found in typical eukaryotic animal cells?

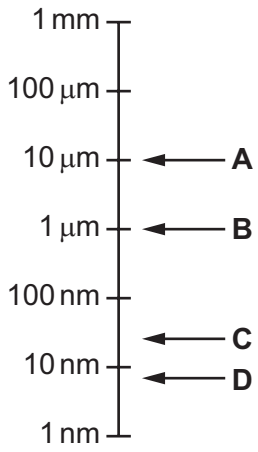
A cell surface membrane

B centriole

C Golgi body

D ribosome

2 Which letter on the logarithmic scale corresponds to the size of a typical prokaryote?



3 Which calculation is used to find the actual length of an organelle from an image?

A image size ÷ magnification

B image size × magnification

C image size × resolution

D magnification ÷ image size

4 Which statement is correct?

A Prokaryotes and chloroplasts have circular DNA where genes carrying the code for cell walls are located.

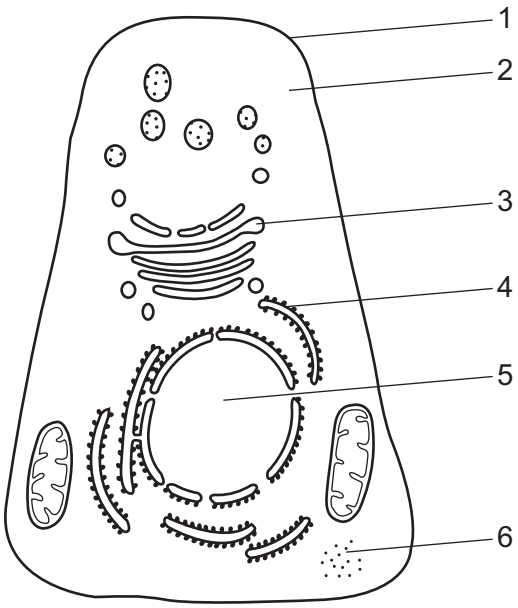
B Prokaryotes and chloroplasts have 70S ribosomes that are the sites for translation and polypeptide synthesis.

C Prokaryotes and mitochondria have an outer membrane and a separate inner, folded membrane where ATP synthesis occurs.

D Prokaryotes and mitochondria have double-stranded linear DNA where genes carrying coded information are located.

© UCLES 2016

5 The diagram shows a typical animal cell.



Which features are also found in **both** plant cells and prokaryotic cells?

	1	2	3	4	5	6
A	✓	✓	✓	✓	✓	✓
B	✓	✓	✗	✗	✗	✓
C	✓	✗	✗	✓	✗	✗
D	✗	✓	✓	✓	✓	✗

key
✓ = present
✗ = absent

6 A student carried out the Benedict's test on four different concentrations of glucose solution and then recorded the time taken for the first appearance of a colour change (the end-point).

The student found it difficult to identify the first appearance of a colour change and consistently timed each solution for two seconds after it had appeared. This introduced a source of error into the experiment.

Which statements about this error are correct?

1 The effect of the error will be reduced if the student performs three repeats at each concentration of glucose.

2 The error will prevent the student from identifying which solution has the highest concentration of glucose.

3 The error is systematic as the student consistently timed each solution for two seconds after the end-point.

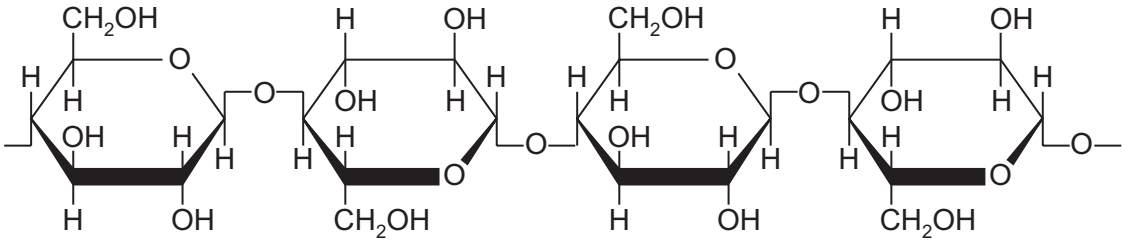
A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 only

© UCLES 2016

7 Which row is correct for each of the molecules?

	collagen	haemoglobin	sucrose
A	has a structural function, found in blood vessel walls	contains the elements carbon, hydrogen, iron, nitrogen and sulfur	formed by releasing a molecule of water in a hydrolysis reaction
B	molecules consist of three polypeptide chains, linked by ionic bonds	each non-protein haem group contains a central iron ion	composed of two monosaccharides linked by a glycosidic bond
C	molecules lie parallel to each other, with cross-links and staggered ends	has two identical α chains and two identical β chains	formed by condensation of two identical monosaccharides
D	polypeptide chains interact to produce a fibrous protein	has all four levels of protein structure and at least four types of bond	digestion yields glucose and fructose in equal proportions

8 The diagram shows how the β-glucose units of cellulose are linked to each other.



What is the significance of the fact that the OH groups on carbon 2 in adjacent glucose molecules are on opposite sides of the molecule?

A They can cross-link with other cellulose molecules by both hydrogen and glycosidic bonds.

B They can form glycosidic bonds with adjacent OH groups of other cellulose molecules.

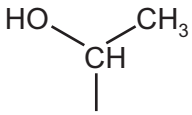
C They can form hydrogen bonds between the CH_2OH and OH on adjacent glucose molecules of the cellulose molecule.

D They can form hydrogen bonds with adjacent OH and CH_2OH groups of other cellulose molecules.

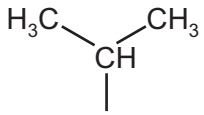
© UCLES 2016

9 Threonylvaline is a dipeptide formed from the two amino acids, threonine and valine. A peptide bond forms between the carboxyl group of threonine and the amine group of valine.

The side-chains (R groups) of the two amino acids are shown.



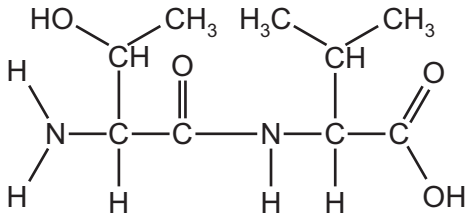
threonine



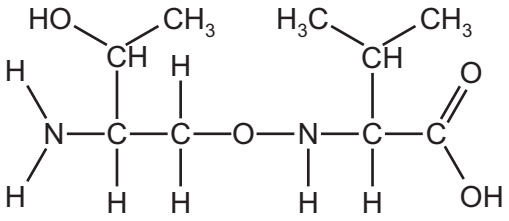
valine

Which molecular structure is threonylvaline?

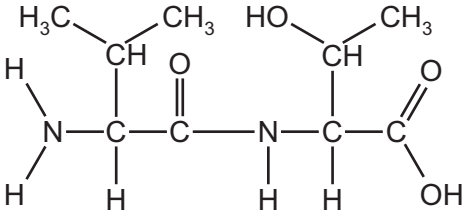
A



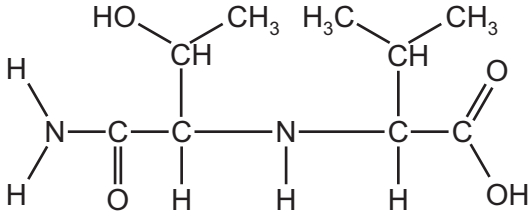
B



C



D



10 Which feature explains why haemoglobin is soluble?

A All four polypeptide chains are linked together to form a spherical molecule.

B Each polypeptide chain folds due to interactions between hydrophobic R groups.

C The hydrophilic R groups are arranged around the outside of the molecule.

D The iron-containing haem group of each polypeptide chain is water soluble.

© UCLES 2016

[Turn over

11 An investigation into the rate of an enzyme-catalysed reaction was carried out. During the investigation the concentration of the substrate was kept higher than the concentration of the enzyme.

During this investigation, which change in the variables would always lead to an increase in the rate of the reaction?

1 increase in enzyme concentration

2 increase in pH

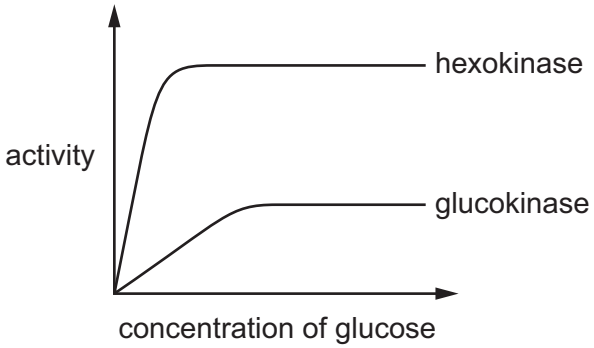
3 increase in temperature

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

12 The enzymes glucokinase in the liver and hexokinase in the brain both catalyse the phosphorylation of glucose:

$$\text{glucose} + \text{ATP} \rightarrow \text{glucose phosphate} + \text{ADP}$$

The activity of each enzyme was measured at different concentrations of glucose. The graph shows the results.



What describes the different activities of the two enzymes?

A Both enzymes hold glucose and ATP molecules together at the active site.

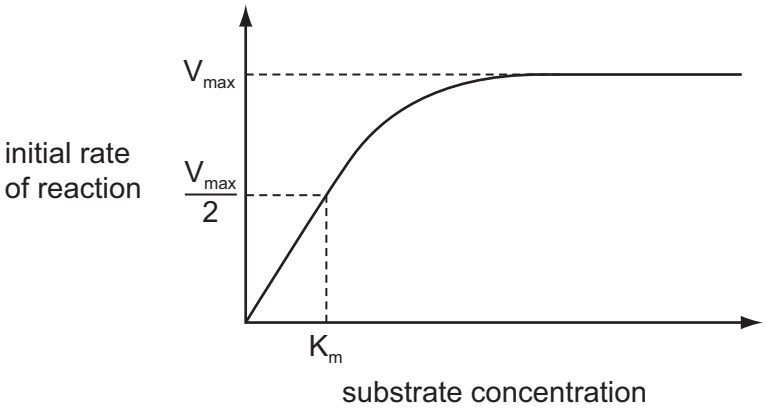
B Glucokinase becomes saturated with glucose at a lower concentration of glucose than hexokinase.

C Glucokinase phosphorylates more molecules of glucose per minute.

D The affinity of hexokinase for glucose is greater than that of glucokinase.

© UCLES 2016

13 The value K_m is the substrate concentration at which the rate of an enzyme-catalysed reaction is half its maximum rate, $\frac{V_{max}}{2}$.



The K_m was measured in the presence of a competitive inhibitor and in the presence of a non-competitive inhibitor.

What could be the value of K_m with inhibitor compared to the value of K_m with no inhibitor?

	value of K_m in presence of	
	competitive inhibitor	non-competitive inhibitor
A	less	less
B	less	more
C	more	less
D	the same	more

14 Which molecules, found in cell surface membranes, help the immune system to identify cells?

1 cholesterol

2 glycolipids

3 glycoproteins

4 proteins

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

15 The following are all processes by which substances can enter a cell.

1 endocytosis

2 facilitated diffusion

3 osmosis

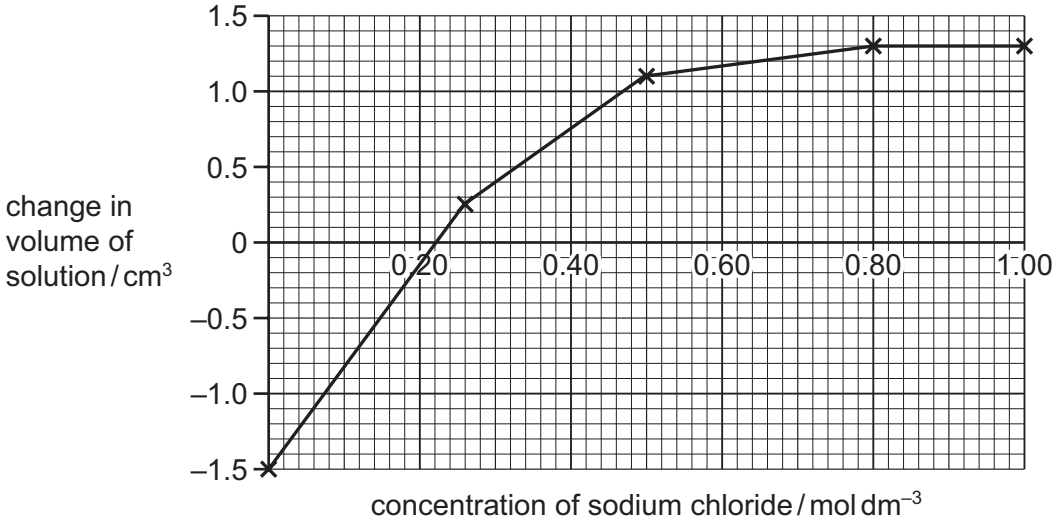
Which processes are passive?

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

© UCLES 2016

16 Equal volumes of five concentrations of sodium chloride solution were placed into five containers. An identical piece of plant tissue was placed into each container and left for 48 hours.

The plant tissues were removed and the volumes of the sodium chloride solution were accurately measured. The results are shown below.



Which statements explain the results from 0.80 to 1.00 mol dm^{-3} sodium chloride?

1 There was no net movement of water into or out of the plant tissues.

2 The plant root tissues had a water potential of zero.

3 The plant tissues were fully plasmolysed.

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

17 Chromosome telomeres are essential for DNA replication and are **not** completely replaced during mitosis.

Substance X completely replaces telomeres during mitosis.

What will be the effect of growing cells with and without substance X?

	with substance X	without substance X
A	cells divide continually	cell division eventually slows and stops
B	cells divide more rapidly	cells divide continually
C	cell division eventually slows and stops	cell division stops immediately
D	cell division stops immediately	cells divide continually

© UCLES 2016

18 Gene mutations in either the *BRCA1* or the *BRCA2* genes are responsible for the majority of hereditary breast cancer in humans.

The proteins produced by the two genes migrate to the nucleus where they interact with other proteins, such as those produced by the tumour suppressor gene, *p53*, and the DNA repair gene, *RAD51*.

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

	gene		
	BRCA1 or *BRCA2*	*p53*	*RAD51*
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✗	✗

key

✓ = gene produces normal protein

✗ = gene produces abnormal protein or no protein

19 The information describes some events of mitosis.

1 chromosomes undergo condensation and spiralisation

2 centromeres are pulled by shortening of spindle fibres

3 sister chromatids are orientated across the centre of the cell

4 centrioles separate from each other

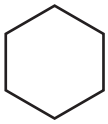
5 spindle fibres disperse

Which row correctly identifies the stages of mitosis in which these events occur?

	1	2	3	4	5
A	metaphase	telophase	prophase	metaphase	anaphase
B	prophase	anaphase	metaphase	prophase	telophase
C	prophase	metaphase	anaphase	telophase	telophase
D	telophase	metaphase	prophase	anaphase	prophase

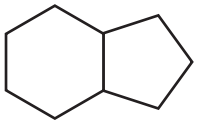
20 Which diagram shows a correct ring structure and named nucleic acid base?

A



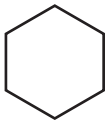
adenine

B



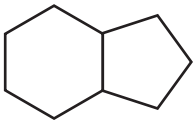
cytosine

C



thymine

D



uracil

21 The diagram shows the nucleotide sequence of a small section of a gene which is transcribed.

GCGCGCGGCCGC

The table shows the amino acids coded for by 10 mRNA codons.

mRNA codon	amino acid
AAG	Lys
ACG	Thr
CGG CGC CGU	Arg
CCG	Pro
GCC GCG	Ala
GGC	Gly
UGC	Cys

What is the order of the four amino acids in the polypeptide translated from this small section of a gene?

A Ala-Ala-Cys-Ala

B Ala-Arg-Gly-Ala

C Arg-Ala-Pro-Ala

D Arg-Arg-Thr-Arg

22 The following events occur during transcription.

1 Bonds break between complementary bases.

2 Bonds form between complementary bases.

3 Sugar-phosphate bonds form.

4 Free nucleotides pair with complementary nucleotides.

Before the mRNA molecule leaves the nucleus, which events will have occurred twice?

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

23 Which statements about water movement in plants are correct?

1 Water cannot pass through cellulose.

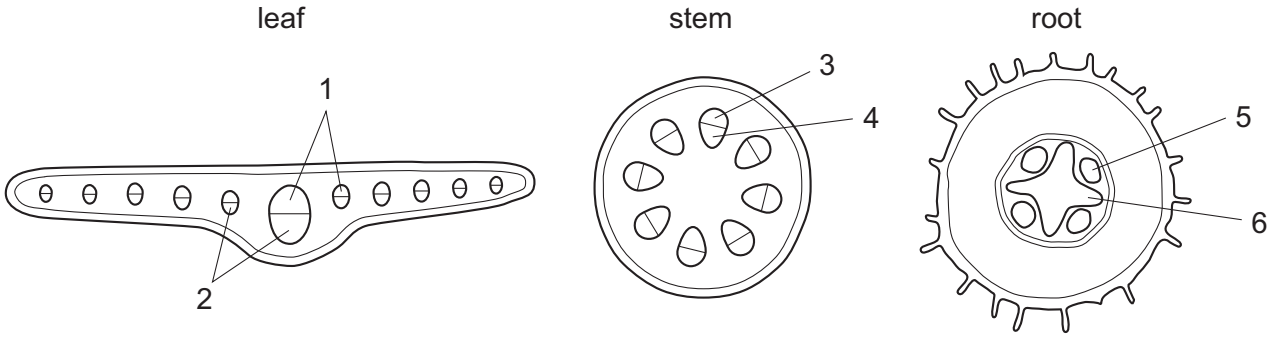
2 Water cannot pass through lignin.

3 Water cannot pass through the Casparian strip.

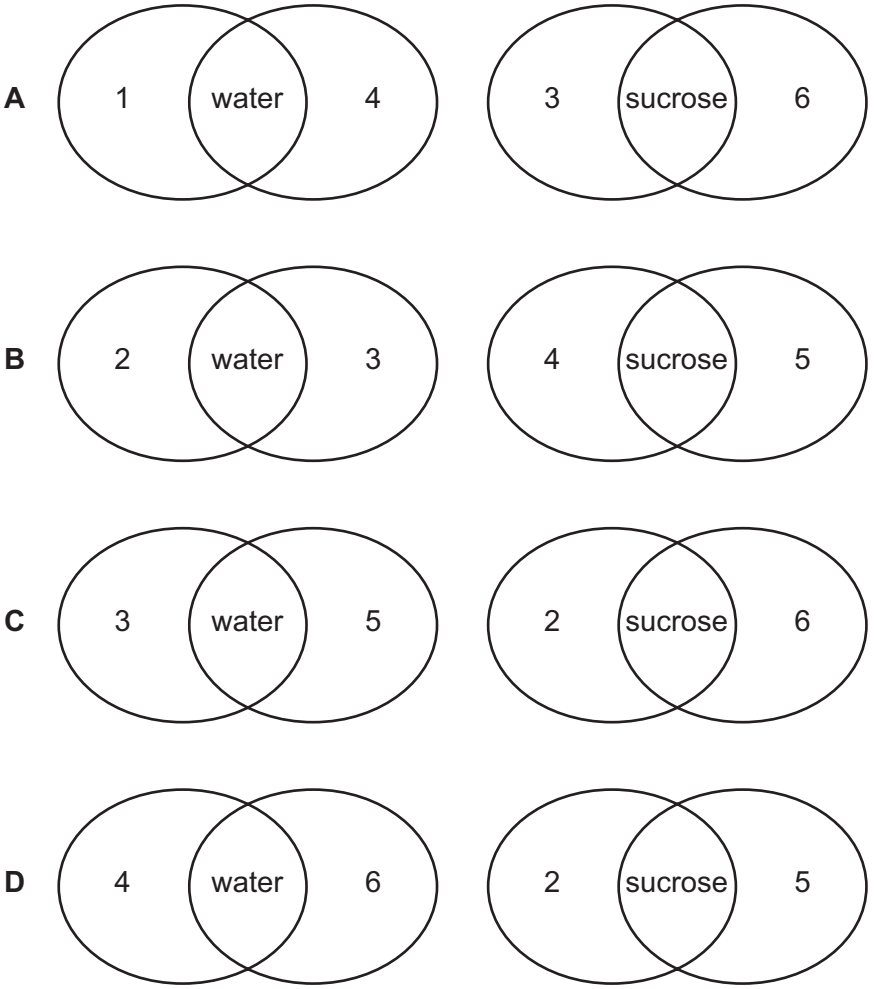
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

© UCLES 2016

24 The diagrams show transverse sections of parts of a plant.

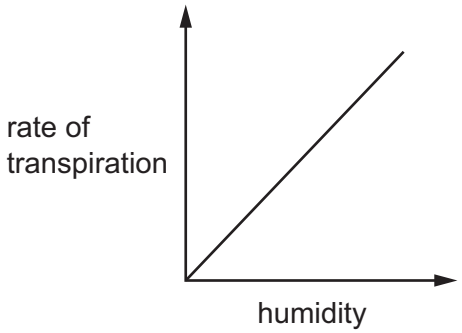


In the transverse sections, which tissues transport water and which tissues transport sucrose?

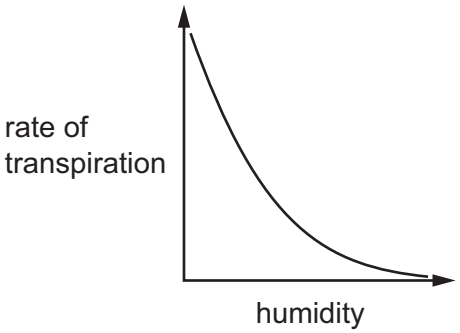


25 Which diagram represents the effect of atmospheric humidity on the rate of transpiration?

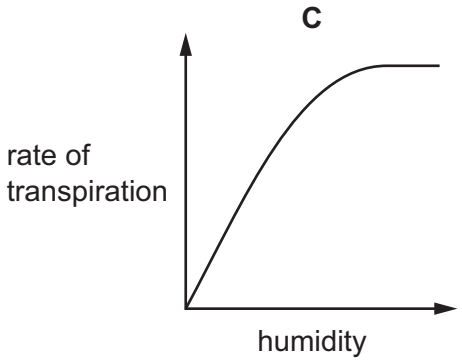
A



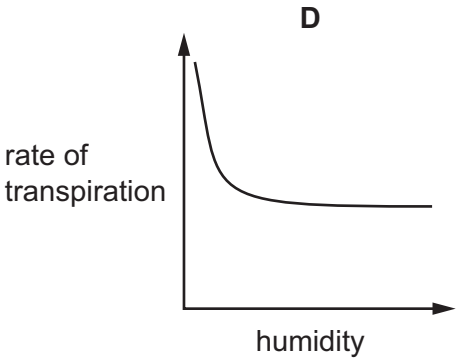
B



C



D



26 Which parts of a plant have plasmodesmata?

1 companion cells

2 phloem sieve tube elements

3 root hair cell

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

© UCLES 2016

27 The following are all structural components of blood vessels.

1 collagen fibres

2 elastic fibres

3 endothelial cells

4 smooth muscle cells

Which row shows the components in an artery and a vein?

	artery	vein
A	1, 2 and 4	1, 3 and 4
B	2, 3 and 4	1, 3 and 4
C	1, 2, 3 and 4	1, 2, 3 and 4
D	1, 2, 3 and 4	2, 3 and 4

28 Scientists have shown that the oxygen dissociation curves for haemoglobin of smaller mammals are to the right of those of larger mammals.

What does this suggest about the haemoglobin of smaller mammals?

A It carries more oxygen when the partial pressure of oxygen is higher.

B It releases oxygen less easily at lower partial pressures of oxygen.

C It saturates with oxygen more easily.

D It unloads oxygen more easily.

29 Which row could be correct for the average blood pressure in different parts of the human circulatory system?

	blood pressure				key	
	right atrium	artery in arm	vein in arm	capillary in arm		
A	+	++++	++	+++	++++	highest average blood pressure
B	++	++++	+++	+	+++	↓
C	+++	++	++++	+	++	
D	++++	+++	+	++	+	lowest average blood pressure

30 Which statements are correct?

1 The activity of carbonic anhydrase increases the hydrogen ion concentration in blood passing through active tissue.

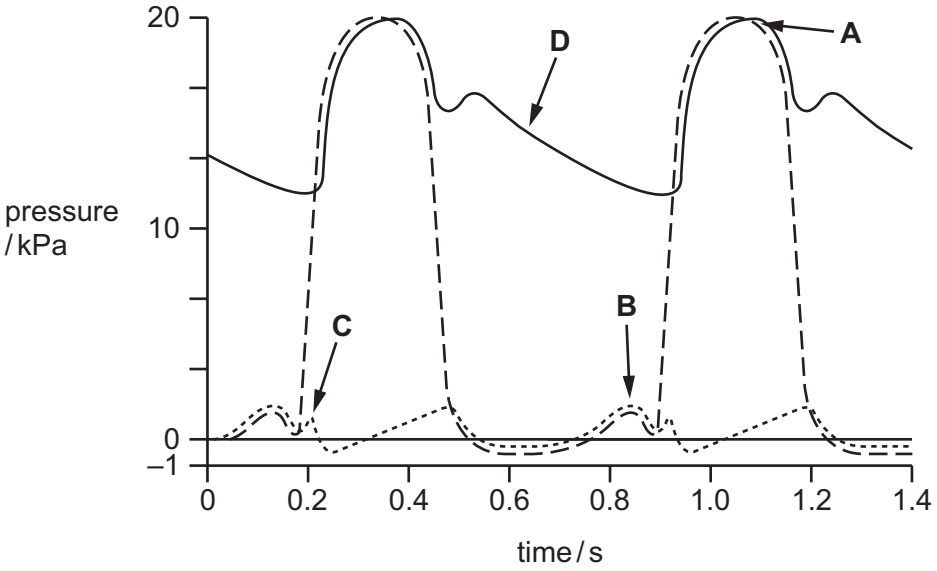
2 Carbon dioxide can react with haemoglobin in red blood cells to form carboxyhaemoglobin.

3 When haemoglobin binds with the hydrogen ion its affinity for oxygen decreases.

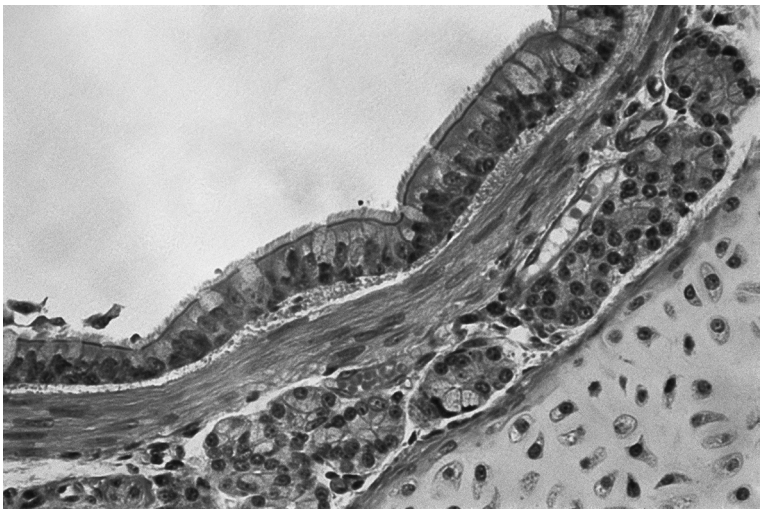
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

31 The diagram shows pressure changes during the cardiac cycle.

Which arrow indicates atrial systole?



32 The image shown is a photomicrograph of a transverse section of part of the gas exchange system.



What describes the image?

A a thin inner layer of ciliated epithelial cells on top of a layer containing cartilage and supported by elastic fibres

B a very thin epithelial lining with walls containing elastic fibres, surrounded by many blood vessels

C an inner layer of ciliated epithelial and goblet cells on top of elastic fibres and supported by an outer layer consisting of blocks of cartilage

D an inner layer of ciliated epithelial and goblet cells on top of loose tissue with mucous glands supported by an outer layer of cartilage

33 The table lists some of the effects of smoking.

Which row shows the effect of nicotine and carbon monoxide?

	nicotine	carbon monoxide
A	decreases heart rate	decreases blood pressure
B	increases blood flow to the feet	increases blood pressure
C	increases blood pressure	combines with haemoglobin
D	increases blood pressure	increases heart rate

34 Which statement about chronic obstructive pulmonary disease (COPD) is correct?

A The disease can often be reversed by treatment.

B The disease occurs in people of all ages.

C The patient coughs a lot, bringing up mucus.

D The patient's symptoms change over time.

© UCLES 2016

35 Which row is correct?

	disease	pathogen	method of infection
A	cholera	bacterium	food borne
B	malaria	prokaryote	insect bite
C	measles	bacterium	water borne
D	tuberculosis (TB)	virus	airborne

36 What do pathogens of HIV / AIDS, malaria and TB have in common?

	they have a cell surface membrane	they have genes	they have ribosomes
A	✓	✓	✓
B	✓	✗	✗
C	✗	✓	✓
D	✗	✓	✗

key

✓ present in each causative agent

✗ not present in each causative agent

37 Which factor might have contributed to the spread of HIV / AIDS?

A few clinics and hospitals

B insufficient education

C malnutrition

D poor sanitation

38 Which event will occur following antigen-antibody binding?

A agglutination of bacteria to reduce their spread

B decreased susceptibility to phagocytosis

C more helper T cells are activated by the release of cytokines

D more plasma cells are cloned to produce more antigens

© UCLES 2016

39 Which statements about macrophages are correct?

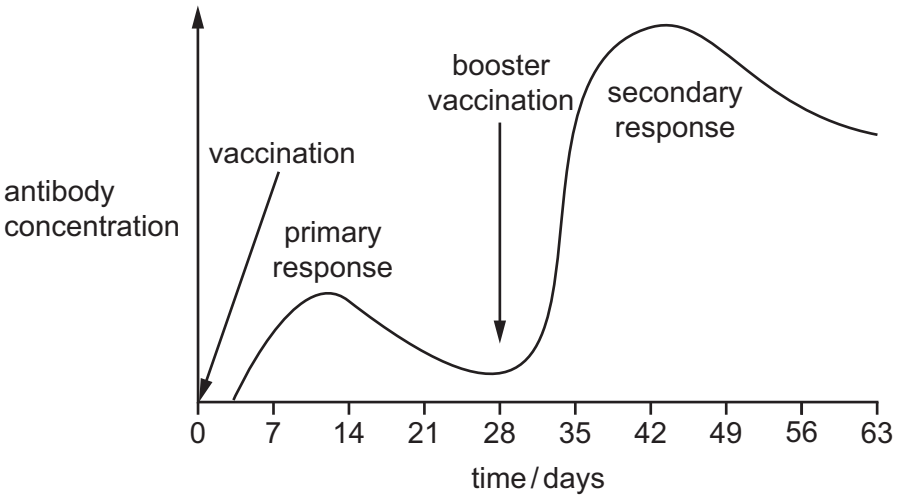
1 More are found in tissues such as the lungs, than in the blood.

2 They have a role in antigen presentation.

3 They can engulf pathogens, dust particles and damaged body cells.

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

40 The graph shows the antibody concentration in blood following vaccination and a booster vaccination 28 days later.



Which statements about the changes in antibody concentration are correct?

1 Antibody concentration falls after the primary response because antibodies are broken down and are no longer being produced.

2 The secondary response is more rapid due to memory B cells produced from activated B cells in the primary response.

3 The secondary response lasts longer than the primary response because memory B cells live longer than plasma B cells.

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

© UCLES 2016

BLANK PAGE

BLANK PAGE

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.