Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **May/June 2016**

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.

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

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1 A student was presented with a photomicrograph of a cell organelle. The magnification of the photomicrograph is known.

Which calculation of the actual length of the organelle in μm is correct?

A actual size in cm × 100 divided by the magnification

B actual size in mm × 100 divided by the magnification

C image size in cm × 1000 divided by the magnification

D image size in mm × 1000 divided by the magnification

2 Which statements about **both** mitochondria and chloroplasts are correct?

1 They contain 80S ribosomes.

2 They contain circular DNA molecules.

3 They produce ATP.

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

3 Which range of sizes would include most eukaryotic cells?

A 1×10^2 nm to 1 μm

B 1 μm to 1×10^1 μm

C 1×10^1 μm to 1×10^2 μm

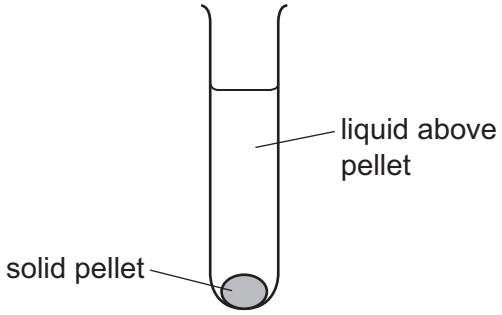
D 1×10^2 μm to 1×10^3 μm

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4 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 speed that separates the heaviest organelle. This organelle 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 4?

A digestion of old organelles

B production of ATP

C production of mRNA

D synthesis of protein

5 Which row shows the monomer and type of bond that form the polymer?

	monomer	type of bond	polymer
A	α-glucose	1,4 only	starch
B	α-glucose	1,4 and 1,6	amylopectin
C	β-glucose	1,4 only	glycogen
D	β-glucose	1,4 and 1,6	cellulose

6 Which biological molecules **always** contain the element nitrogen?

A amino acids, cellulose, mRNA

B amino acids, DNA, lipids

C enzymes, mRNA, tRNA

D membrane proteins, starch, tRNA

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7 Which statement about the quaternary structure of proteins is correct?

A consists of four subunits

B depends on the presence of metal ions

C depends on the primary structure of the subunits

D is made of α and β subunits

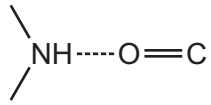
8 Which set of statements correctly describes haemoglobin?

A	four polypeptide chains, each containing a haem group	iron ions can associate with oxygen forming oxyhaemoglobin	in each chain, hydrophobic R groups of amino acids point towards the centre of the molecule	at 50 % saturation, two oxygen molecules are transported by the molecule
B	polypeptide chains interact to produce a globular chain	each chain contains a haem group of amino acids surrounding an iron ion	consists of two identical alpha chains and two identical beta chains	each chain can transport an oxygen molecule
C	polypeptide chains interact to produce an almost spherical molecule	an iron ion is present within each haem group	quaternary structure has two alpha chains and two beta chains	each molecule can transport a total of four oxygen atoms
D	polypeptide chains produce a loose helical shape, which folds to form a spherical molecule	iron ions in the molecule can bind reversibly with oxygen	in each chain, hydrophobic R groups of amino acids surround the iron ion	each molecule can transport a total of eight oxygen atoms

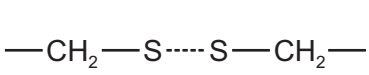
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9 The diagrams show different types of bond found in biological molecules.

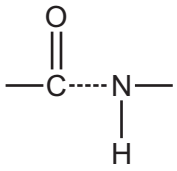
1



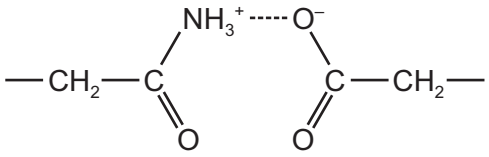
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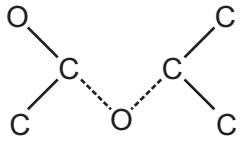
3



4



5



Which bonds are found in proteins with a tertiary structure?

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

10 In two investigations, the rate of an enzyme-catalysed reaction was measured in the presence of either a competitive inhibitor or a non-competitive inhibitor.

What could be the effect of increasing the substrate concentration on each rate of reaction?

	rate of reaction	
	with competitive inhibitor	with non-competitive inhibitor
A	decreases	no change
B	increases	decreases
C	increases	no change
D	no change	decreases

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11 Two enzymes, X and Y, were used in an experiment.

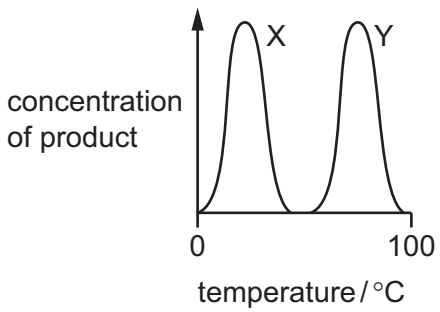
Enzyme X was from bacteria that live in rivers and lakes at temperatures from 5 °C to 20 °C.

Enzyme Y was from bacteria that live in hot water springs at temperatures from 40 °C to 85 °C.

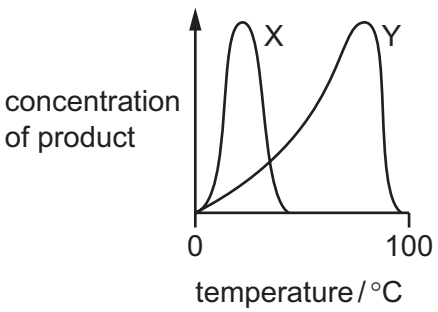
The experiment measured the concentration of product produced by each enzyme at temperatures between 0 °C and 100 °C after 5 minutes.

Which graph shows the results?

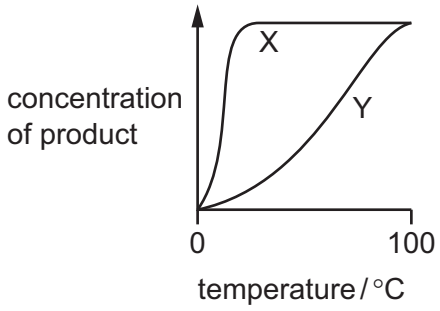
A



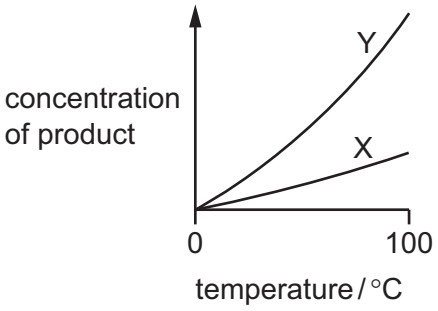
B



C



D



12 What is a function of the cholesterol in a cell surface membrane?

A acting as a membrane-bound receptor

B controlling active transport

C helping cells join together

D regulating the flexibility of the membrane

13 Which roles of the cell surface membrane are a result of the properties of the phospholipids?

1 to allow cytokinesis to occur in mitotic cell division

2 to allow entry and exit of oxygen and carbon dioxide

3 to allow the phagocytosis of a bacterium into a cell

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

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14 Which statements about active transport are **always** correct?

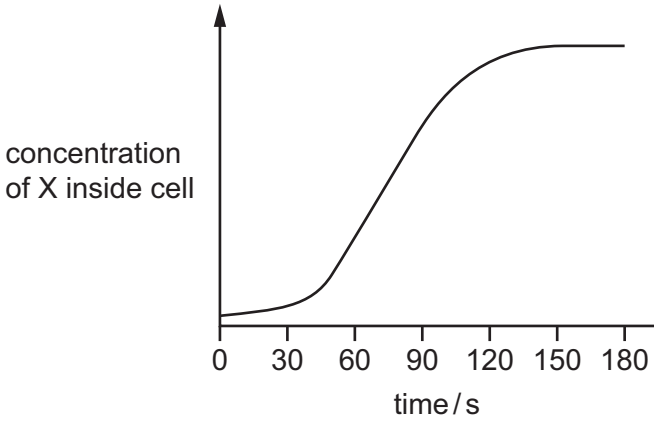
1 It does not require a membrane.

2 It occurs against the concentration gradient.

3 It moves oxygen molecules.

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

15 There is a high concentration of molecule X outside the cell which enters the cell by facilitated diffusion. The results of measuring the concentration of X inside the cell at 30 s intervals are shown by the graph.



Why does the concentration of X inside the cell remain constant after 150 s?

1 There is no more of X outside the cell.

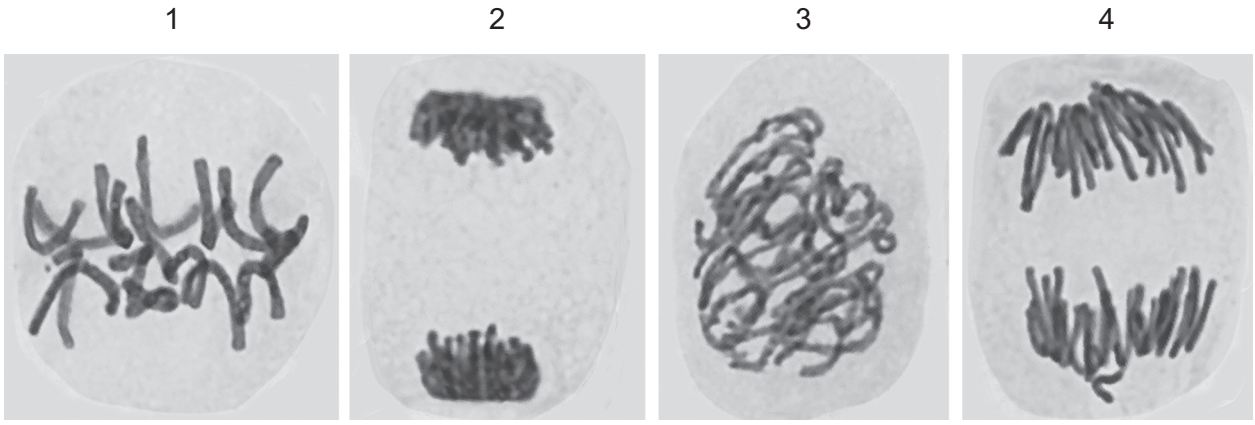
2 The number of carrier proteins is limiting.

3 There is no net movement of X.

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

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16 The photomicrographs show cells in various stages of the cell cycle.



Which cells contain twice as many DNA molecules as a cell from the same organism after cytokinesis?

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2 and 4 only

17 A group of chemicals used to treat cancer prevents the formation of the spindle during mitosis.

Which phase of mitosis is the **first** to be affected?

A anaphase

B metaphase

C prophase

D telophase

18 Mitosis is an important process for organisms.

Which features of mitosis are important for single-celled organisms?

1 asexual reproduction

2 growth

3 production of genetically identical cells

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

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19 Which statements about complementary base pairing are correct?

1 Cytosine forms three hydrogen bonds with guanine.

2 Purines and pyrimidines are different sizes.

3 It allows transcription to occur.

4 The base pairs are of different lengths.

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

20 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.

The remaining bacteria were left in the medium with ^{14}N and allowed to divide one more time. The DNA of some of these bacteria was extracted and analysed.

What is the composition of this DNA?

A 25% hybrid DNA

B 50% hybrid DNA

C 75% hybrid DNA

D 100% hybrid DNA

21 Which statements about tRNA are correct?

1 It contains base pairing.

2 It contains hydrogen bonds.

3 It contains uracil.

4 It is single stranded.

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

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

TTCTTCCCGTTC

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?

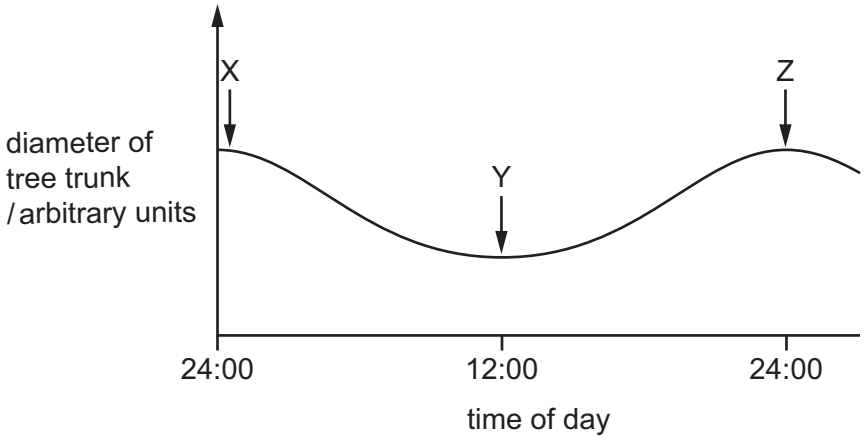
A Cys-Cys-Gly-Cys

B Lys-Lys-Gly-Lys

C Lys-Lys-Pro-Lys

D Thr-Thr-Pro-Thr

23 The graph shows the diameter of a tree trunk at different times.



Which statement is correct?

A X shows the expansion of the trunk as water fills the xylem during transpiration.

B Y shows a reduction in diameter of trunk as water is lost from the xylem due to transpiration.

C Y shows a reduction in diameter of trunk due to water held in tension in the xylem.

D Z shows the expansion of the trunk as the phloem tissue acts as a sink at night.

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24 Some plant species can take up toxic heavy metal ions that are dissolved in water in the soil. These ions accumulate in the aerial parts of the plant, which can be harvested and disposed of safely.

An investigation was carried out into the ability of a plant species to remove a heavy metal ion from soil. This produced the following observations:

- some heavy metal ions accumulated in the cells of the root cortex
- within these cells, most of these ions were in the vacuole
- in the roots and leaves, the ions were transported dissolved in water.

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

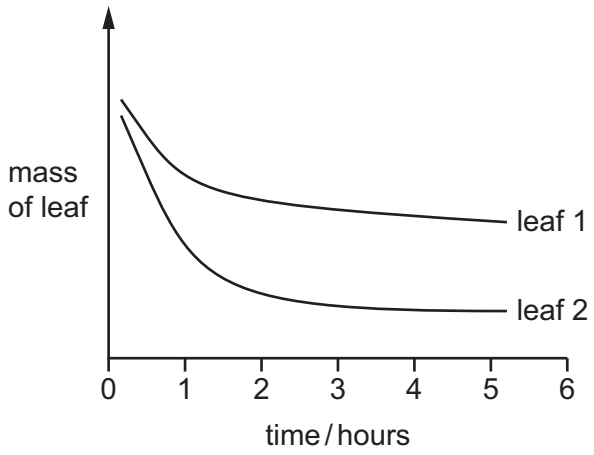
1 After initial entry into the root, some of the ions can pass through the tonoplast.

2 In the roots and leaves, the ions pass through a symplastic or apoplastic pathway but at the endodermis they must take a symplastic pathway.

3 In xylem vessels, the ions pass through an apoplastic pathway only.

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

25 The diagram shows the results of an experiment on transpiration using two different leaves. Each leaf was left on a balance in daylight in a closed room and its mass recorded at 1 hour intervals.



Which conclusions could be correct?

1 The loss of mass is mainly due to evaporation of water.

2 Most stomata close in both leaves after 1 hour.

3 Leaf 1 has a larger surface area than leaf 2.

4 Leaf 1 has a thicker cuticle than leaf 2.

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 2 and 3 only

D 3 and 4 only

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26 Which statement about the transport of sucrose is correct?

A ATP synthesised by mitochondria of companion cells provides the energy to move sucrose from phloem sieve tube elements in leaves to sinks.

B Sucrose moves through plasmodesmata by passive diffusion from mesophyll cells through companion cells to phloem sieve tube elements.

C The water potential in phloem sieve tube elements becomes more negative following the entry of sucrose.

D Water enters companion cells and hydrostatic pressure builds up to push sucrose into phloem sieve tube elements by mass flow.

27 Which of the tissue types below are present in the walls of **all** blood vessels?

1 collagen

2 elastic

3 endothelial

4 smooth muscle

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 2 and 3 only

D 3 only

28 Which components of blood are present in tissue fluid?

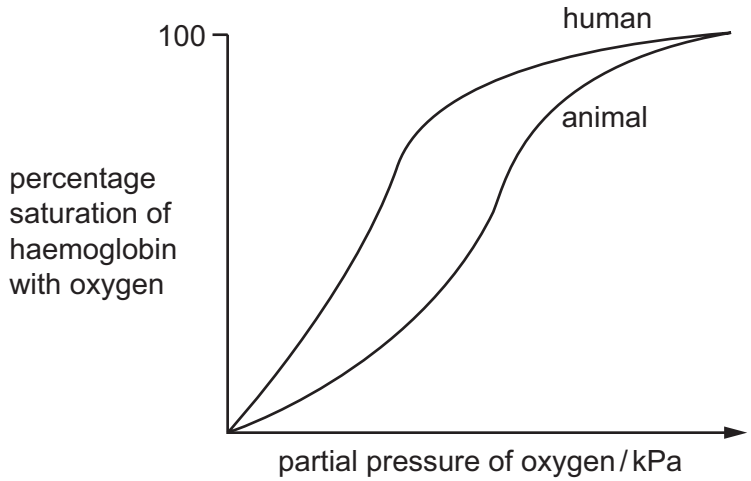
	phagocytes	proteins	sodium ions
A	✓	✓	✓
B	✓	✗	✗
C	✗	✓	✓
D	✗	✓	✗

key

✓ = present

✗ = absent

29 The graph shows changes in percentage saturation of haemoglobin with oxygen in the blood of a human and of another animal. The partial pressure of carbon dioxide remains constant at 1.0 kPa and the temperature is constant at 25 °C.



Which conclusion is supported by the graph?

A At 25 °C the affinity of haemoglobin for oxygen increases more in humans than in the animal.

B Haemoglobin in the animal carries less oxygen than haemoglobin in the human.

C Oxygen is more easily released from haemoglobin in animal muscle than in human muscle.

D The Bohr effect in the haemoglobin of the animal is greater than in human haemoglobin.

30 Which statements about the formation of haemoglobinic acid are correct?

1 It can only occur with the dissociation of oxygen from haemoglobin.

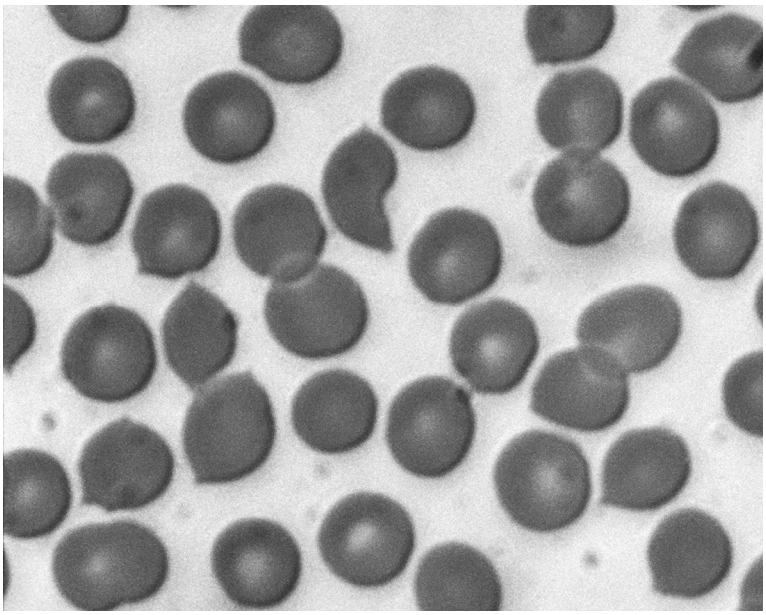
2 It acts to prevent excess hydrogen ions causing acidity in blood.

3 It depends on the release of hydrogen ions by the action of carbonic anhydrase.

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

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31 The photograph shows a type of blood cell.



Which statements about these cells are correct?

1 Oxygen diffuses through the phospholipid bilayer.

2 Sodium ions diffuse through the phospholipid bilayer.

3 Water passes in and out of these cells by osmosis.

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

32 A student was asked to describe the differences between four microscope slides of sections taken from different parts of the gas exchange system.

slide 1 not present: cartilage, glands
present: few goblet cells, ciliated epithelial cells, smooth muscle

slide 2 present: incomplete cartilage rings, glands, goblet cells, ciliated epithelial cells, smooth muscle

slide 3 not present: cartilage, glands, goblet cells, smooth muscle
present: squamous epithelial cells

slide 4 present: plates of cartilage, glands, goblet cells, ciliated epithelial cells, smooth muscle

Which is the correct identification of the parts of the gas exchange system?

	slide 1	slide 2	slide 3	slide 4
A	alveolus	bronchiole	bronchus	trachea
B	bronchiole	bronchus	alveolus	trachea
C	bronchiole	trachea	alveolus	bronchus
D	bronchus	trachea	bronchiole	alveolus

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33 Which components of the human gas exchange system help to reduce the effects of carcinogens in tar?

A cilia and goblet cells only

B cilia and mucous glands only

C mucous glands and goblet cells only

D mucous glands, goblet cells and cilia

34 What is correct about the affinity between haemoglobin and the gases carbon dioxide, carbon monoxide and oxygen?

	highest affinity → lowest affinity		
A	carbon monoxide	carbon dioxide	oxygen
B	carbon monoxide	oxygen	carbon dioxide
C	oxygen	carbon dioxide	carbon monoxide
D	oxygen	carbon monoxide	carbon dioxide

35 The table shows the names of five pathogens.

Which row matches the pathogens with the diseases they cause?

	Morbillivirus	*Mycobacterium*	*Plasmodium*	*Variola*	*Vibrio*
A	cholera	measles	TB	malaria	smallpox
B	malaria	smallpox	cholera	measles	TB
C	measles	TB	malaria	smallpox	cholera
D	TB	malaria	smallpox	cholera	measles

36 Which disease exhibits all the following features?

- It can be transmitted by animals to other animals, including humans.
- One mode of transmission is by transfusion with contaminated blood.
- The causative organism can show multiple drug resistance.
- The majority of humans who die from the disease are children.

A cholera

B HIV / AIDS

C malaria

D tuberculosis

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37 The proportion of the local population who have malaria in area R is higher than the proportion in area S.

Which factor causes this difference?

A Area R has a more humid climate than area S.

B Area R is nearer the equator than area S.

C There is a higher population in area R than area S.

D There is less sewage treatment in area R than area S.

38 Which statement describes how passive natural immunity is obtained?

A A vaccination containing dead microorganisms is given.

B An immunisation containing specific antigens is given.

C Antibodies are passed from mother to developing baby.

D Antibodies from another individual are injected.

39 What describes a non-specific immune response?

A activation of killer T-lymphocytes by infected cells

B cloning of B-lymphocytes to form plasma cells

C ingestion of a bacterial cell by a neutrophil

D presentation of antigens on the cell surface of macrophages

40 What explains why monoclonal antibodies can be used to target cancer cells?

A Cancer cells have different antigens from normal body cells.

B Specific cancer drugs can be attached to the monoclonal antibody.

C They are one type of a specific antibody that binds to an antigen.

D They are secreted by hybridomas of cancer cells and B-lymphocytes.

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