Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2025**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

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

INSTRUCTIONS

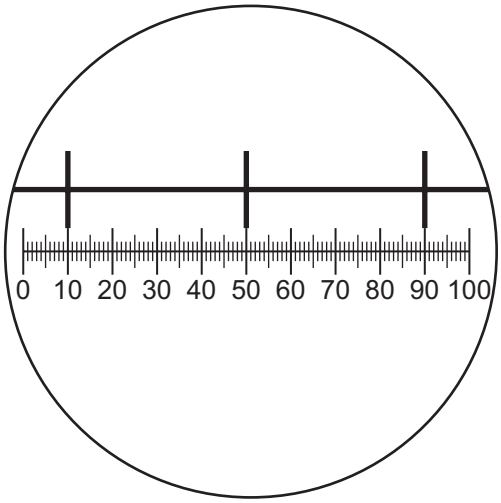
- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the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

INFORMATION

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

IB25 11_9700_13/5RP

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



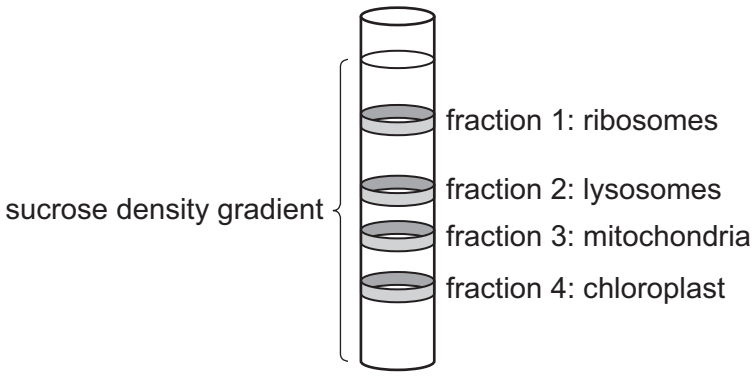
The same eyepiece is now used to examine a blood smear.

How many graticule divisions will cover the diameter of a lymphocyte of 10 μm?

A 1 **B** 4 **C** 10 **D** 20

2 Cell structures can be isolated by centrifuging the cells in a sucrose density gradient. This breaks up the cells and separates the cell structures into fractions.

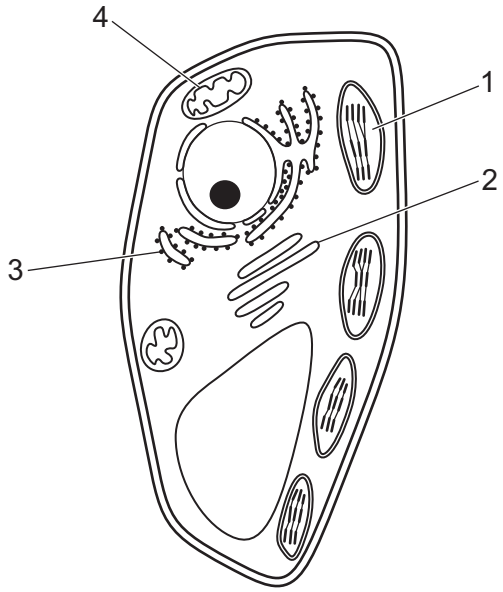
The diagram shows the positions of some of these fractions in a sucrose density gradient.



Which fractions contain cell structures that carry out protein synthesis?

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

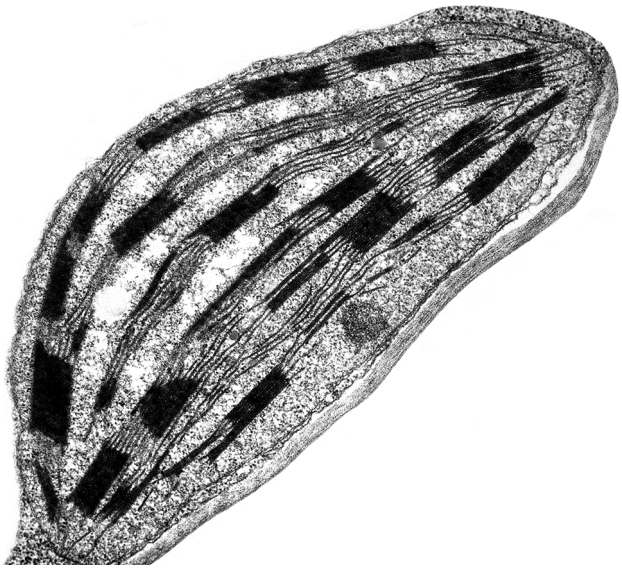
3 The diagram shows a plant cell.



Which labelled organelles would contain nucleotides?

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

4 The image shown is produced using a microscope.



How many statements about this image are correct?

- It is an electron micrograph.
- It shows part of a eukaryotic cell.
- It shows at least one mitochondrion.
- It shows a specimen viewed at more than ×400 magnification.

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

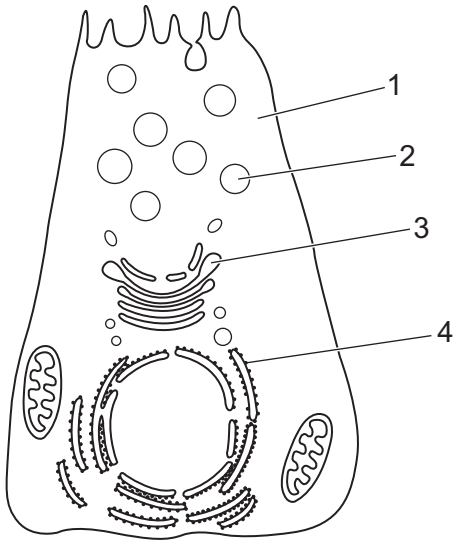
5 Bacterial ribosomes consist of two subunits and a total of three rRNA molecules per ribosome. An analysis of **all** the 70S ribosomes from a single cell of the bacterium *Escherichia coli* showed that there were:

- 57 000 rRNA molecules
- three types of rRNA molecule
- 19 000 copies of each type of rRNA molecule.

How many 70S ribosomes were there in the *E. coli* cell?

A 9500 **B** 19 000 **C** 38 000 **D** 57 000

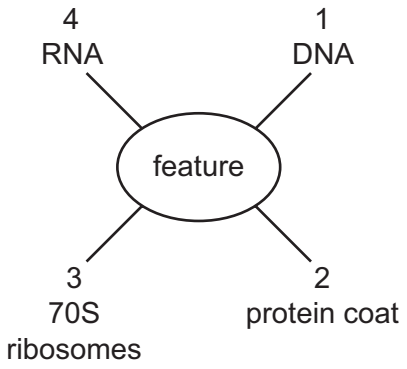
6 Radioactively labelled amino acids are introduced into a tracheal cell that uses them to make mucus (a glycoprotein).



Which route will the amino acids take?

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

7 Which features shown in the diagram can be present in viruses?



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

8 The diagram shows some steps in a laboratory method used to identify the presence of non-reducing sugars in a food sample.

Some terms are missing.

Which terms are correct for the expected result for a very low concentration of non-reducing sugar?

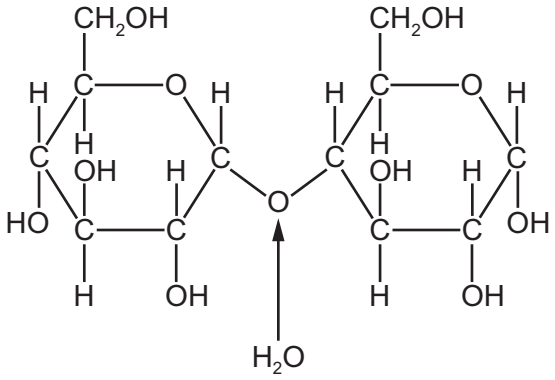
	X	Y	Z
A	acid hydrolysis	Benedict's test	orange
B	Benedict's test	acid hydrolysis	orange
C	acid hydrolysis	Benedict's test	green
D	Benedict's test	acid hydrolysis	green

9 Many biological molecules exist as polymers made up of monomer subunits.

Which row correctly identifies the monomer in each of the biological molecules?

	collagen	glycogen	cellulose
A	amino acid	α-glucose	β-glucose
B	α-glucose	β-glucose	amino acid
C	β-glucose	amino acid	α-glucose
D	amino acid	β-glucose	α-glucose

10 Which statement correctly explains the result when the two molecules shown in the diagram react together?



A A hydrolysis reaction is forming the disaccharide maltose.

B A reducing sugar is split into two monosaccharides by hydrolysis.

C Condensation of two α-glucose molecules is taking place.

D A condensation reaction is forming two reducing sugars.

11 Which row describes amylopectin?

	α-1,4 glycosidic bonds	α-1,6 glycosidic bonds	shape of molecule	function of molecule
A	✓	✓	branched	storage
B	✓	✗	helical	storage
C	✓	✓	branched	structural
D	✗	✓	helical	structural

key
✓ = present
✗ = **not** present

12 What is a feature of triglyceride molecules?

A They are hydrophobic molecules.

B They are molecules with a single ester bond.

C They are polar molecules.

D They are water-soluble molecules.

13 An unsaturated fatty acid molecule has 17 carbon atoms in the tail which is attached to its carboxyl group. The tail contains three double bonds.

How many hydrogen atoms does the tail contain?

A 29 **B** 31 **C** 33 **D** 35

14 Which statement about phospholipids in the bilayer of a cell surface membrane is correct?

A The non-polar phosphate heads face outwards and the polar fatty acid tails face inwards.

B The polar phosphate heads face outwards and the non-polar fatty acid tails face inwards.

C The non-polar fatty acid tails face outwards and the polar phosphate heads face inwards.

D The polar fatty acid tails face outwards and the non-polar phosphate heads face inwards.

15 Which descriptions of enzymes that use the lock-and-key hypothesis are correct?

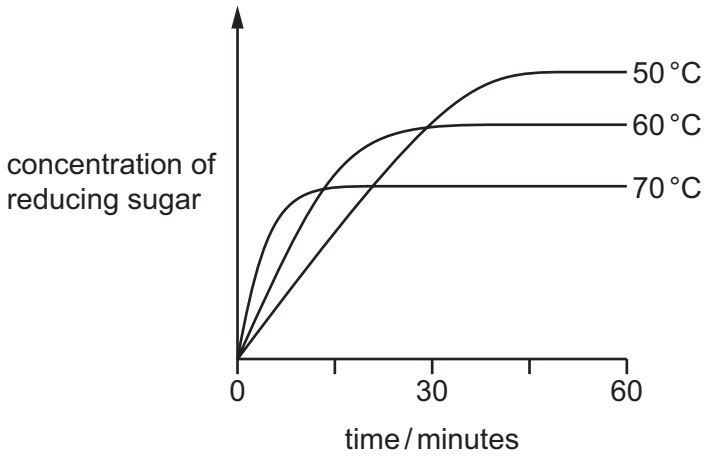
1 The active site is complementary to the substrate the enzyme acts on.

2 Bonds that form in the enzyme–substrate complex change the shape of the active site.

3 Most of the amino acids in an enzyme help to maintain the specific shape of the enzyme.

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

16 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

17 The rate of enzyme-catalysed reactions in human cells is regulated.

What may be involved in this regulation?

1 a change in enzyme concentration

2 a change in substrate concentration

3 inhibition by the final product of the reaction

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

18 Proteins in the cell surface membranes of human cells and mouse cells were labelled with fluorescent dyes. The human cells were labelled with a red dye and the mouse cells were labelled with a green dye.

A human cell and a mouse cell were then fused to form a hybrid cell.

At first, the different dyes remained separate. After 40 minutes, the two dyes were evenly distributed in the hybrid cell surface membrane.

What explains this observation?

A All protein molecules in the cell surface membrane are fixed to structures within the cell, but phospholipid molecules move freely between them.

B Groups of protein and phospholipid molecules in the cell surface membrane are attached to each other and move together.

C Only protein molecules in the outer layer of the cell surface membrane can move freely between phospholipid molecules.

D Protein molecules in the outer layer of the cell surface membrane and those which span the bilayer can move freely between phospholipid molecules.

19 Which statements about the cell surface membrane are correct?

1 Channel proteins allow water soluble ions and molecules across the membrane.

2 Glucose can pass into the cell via carrier proteins.

3 Oxygen passes freely through the membrane as it is soluble in lipids.

4 Some glycoproteins act as antigens.

A 1, 2, 3 and 4

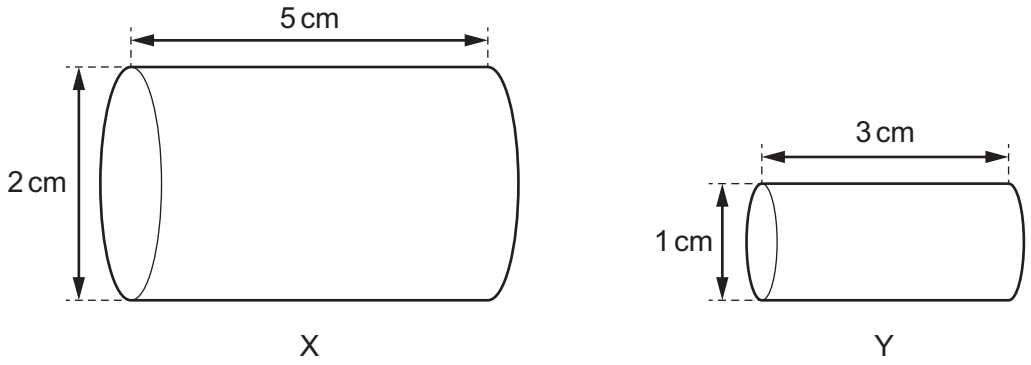
B 1, 3 and 4 only

C 1 and 2 only

D 2, 3 and 4 only

20 The diagram shows two cylinders of agar.

The agar cylinders are placed into a solution of dye at the same time. The time taken for the dye to diffuse into the centre of each cylinder is recorded.



Which statement explains why the dye reaches the centre of one agar cylinder faster than the other agar cylinder?

A The dye reaches the centre of X in a shorter time than the dye reaches the centre of Y because X has a larger surface area to volume ratio.

B The dye reaches the centre of X in a shorter time than the dye reaches the centre of Y because X has a larger surface area.

C The dye reaches the centre of Y in a shorter time than the dye reaches the centre of X because the dye has a shorter distance to diffuse to the centre.

D The dye reaches the centre of Y in a shorter time than the dye reaches the centre of X because Y has a smaller volume.

21 What are roles of adult stem cells in humans?

1 repair other cells by mitosis

2 divide to replace cells in tissues

3 differentiate into a new organism

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

22 Which statements are correct for the mitotic cell cycle?

1 DNA is replicated semi-conservatively during mitosis.

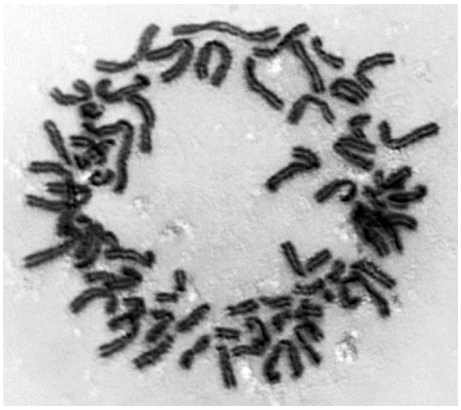
2 DNA is never changed from one generation of cells to the next generation.

3 The daughter cells at the end of a mitotic cell division have the potential to produce the same enzymes as the parent cell.

4 The same quantity of DNA is distributed to the nuclei of two new cells at the end of a mitotic cell division.

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

23 The photomicrograph shows a stage of the cell cycle.



Which stage is shown in the photomicrograph?

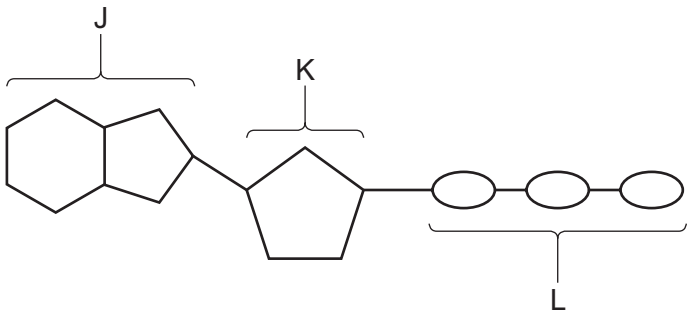
A anaphase

B interphase

C metaphase

D telophase

24 The diagram represents a molecule of ATP.



What are the components of ATP labelled J, K and L?

	J	K	L
A	adenine	deoxyribose	phosphates
B	adenosine	pentose	a phosphate group
C	adenosine	ribose	phosphorus
D	purine	pentose	phosphates

25 Which statements about complementary base pairing are correct?

1 It occurs during translation.

2 Purines and pyrimidines are the same size.

3 The base pairs are of equal length.

4 Uracil forms three hydrogen bonds with adenine.

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

26 Which statement is correct for protein synthesis?

A During translation, the strand of DNA used is the template strand.

B mRNA is formed when introns are removed from the primary transcript.

C The DNA primary transcript is modified by removing exons.

D tRNA has codons which attach to anticodons on the mRNA.

27 A mutation occurred in this original DNA nucleotide sequence.

C T A G A A T C C T C T C C C

After the mutation occurred, the new DNA nucleotide sequence coded for the amino acids Asp, Leu, Gly and Glu.

The table shows the amino acids that are coded for by each DNA triplet.

1st base	2nd base: A	2nd base: G	2nd base: T	2nd base: C
A	AAA Phe AAG Phe AAT Leu AAC Leu	AGA Ser AGG Ser AGT Ser AGC Ser	ATA Tyr ATG Tyr ATT *Stop* ATC *Stop*	ACA Cys ACG Cys ACT *Stop* ACC Trp
G	GAA Leu GAG Leu GAT Leu GAC Leu	GGA Pro GGG Pro GGT Pro GGC Pro	GTA His GTG His GTT Gln GTC Gln	GCA Arg GCG Arg GCT Arg GCC Arg
T	TAA Ile TAG Ile TAT Ile TAC Met	TGA Thr TGG Thr TGT Thr TGC Thr	TTA Asn TTG Asn TTT Lys TTC Lys	TCA Ser TCG Ser TCT Arg TCC Arg
C	CAA Val CAG Val CAT Val CAC Val	CGA Ala CGG Ala CGT Ala CGC Ala	CTA Asp CTG Asp CTT Glu CTC Glu	CCA Gly CCG Gly CCT Gly CCC Gly

Which type of gene mutation occurred in the DNA nucleotide sequence?

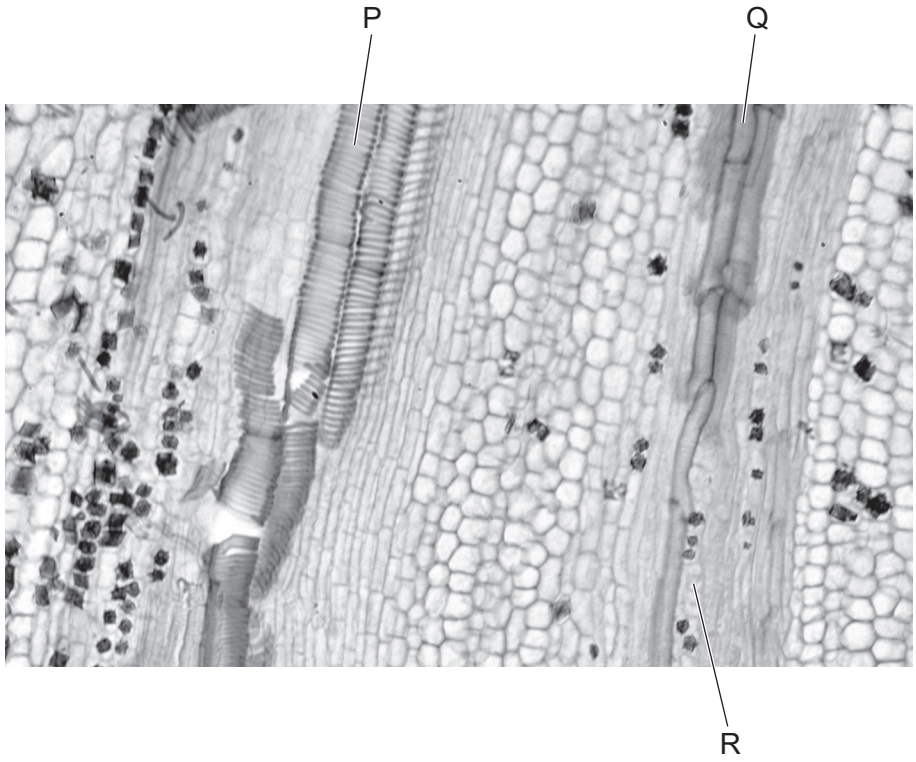
A deletion of one nucleotide

B insertion of one nucleotide

C insertion of two nucleotides

D substitution of one nucleotide

28 The photomicrograph shows a longitudinal section of part of a plant stem.



Which row correctly identifies structures P, Q and R?

	P	Q	R
A	phloem sieve tube element	companion cell	xylem vessel element
B	phloem sieve tube element	xylem vessel element	companion cell
C	xylem vessel element	phloem sieve tube element	companion cell
D	xylem vessel element	companion cell	phloem sieve tube element

29 Which statement about the pathway taken by a water molecule travelling from the soil to the xylem is correct?

A A water molecule in a cortex cell that takes the symplast pathway must enter the next cortex cell by passing between two adjacent phospholipid molecules in a cell surface membrane.

B A water molecule can pass into xylem vessels either through pits or through the cell wall of the xylem vessel elements by osmosis.

C A water molecule would pass into the cytoplasm of the endodermal cell if it always takes the apoplast pathway all the way to the xylem.

D A water molecule that has left the endodermal cells can travel by either the apoplast pathway or symplast pathway.

30 Amino acids move from a phloem sieve tube element into a root cell.

What are the changes to the water potential and the volume of liquid in the phloem sieve tube element at the sink, when this event is happening?

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

31 The table shows the comparison of blood pressure in three main blood vessels during diastole.

	vessel 1	vessel 2	vessel 3
blood pressure in the vessel during diastole	low	very high	high

Which row identifies the three blood vessels?

	vessel 1	vessel 2	vessel 3
A	pulmonary vein	pulmonary artery	aorta
B	vena cava	aorta	pulmonary vein
C	pulmonary vein	aorta	pulmonary artery
D	pulmonary artery	pulmonary vein	vena cava

32 Red blood cells may contain a molecule known as 2,3-bisphosphoglycerate (2,3-BPG).

When 2,3-BPG binds to haemoglobin, a higher partial pressure of oxygen is needed to bring about 50% saturation of haemoglobin with oxygen.

Which statements about the effect of 2,3-BPG are correct?

1 2,3-BPG in red blood cells causes the oxygen dissociation curve to shift to the right.

2 The binding of 2,3-BPG to haemoglobin reduces the Bohr effect.

3 The binding of 2,3-BPG to haemoglobin lowers the affinity of the haemoglobin for oxygen.

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

33 A person has a small hole in the septum between the ventricles. This is called a ventricular septal defect (VSD). The person has no other heart defects.

What is the direction of the net flow of blood during ventricular systole in the heart of this person?

A left ventricle to left atrium

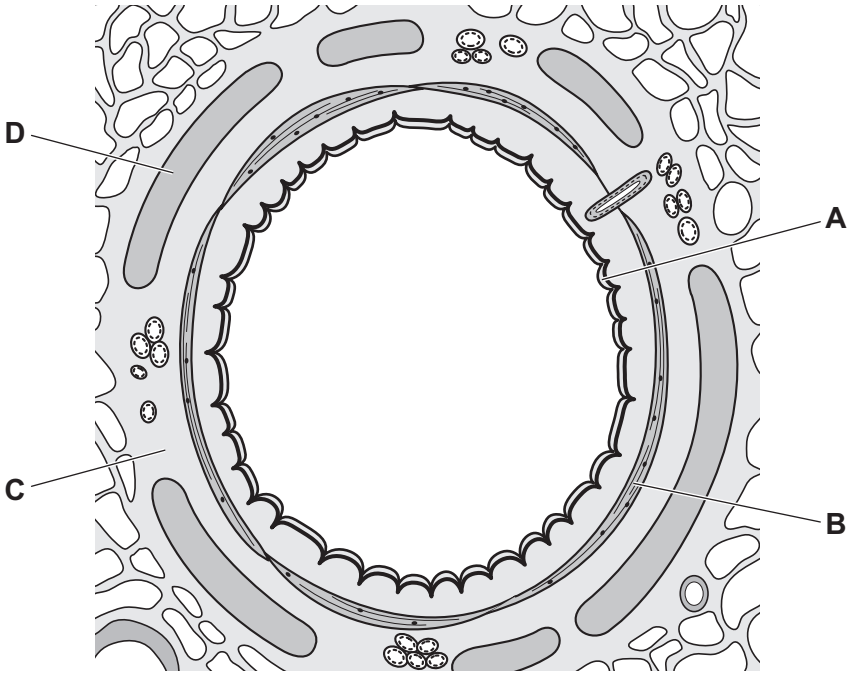
B right ventricle to right atrium

C left ventricle to right ventricle

D right ventricle to left ventricle

34 The diagram shows a transverse section through a human bronchus.

Which labelled tissue is the cartilage?



35 What helps to maintain a concentration gradient between blood and the air in the alveolus?

A the flow of blood through the lungs

B the presence of haemoglobin in blood cells

C the single-celled alveolar walls

D the squamous epithelium of capillaries

36 Which row correctly identifies the pathogens causing malaria and TB?

	malaria	TB
A	protoctist	virus
B	protoctist	bacterium
C	prokaryote	bacterium
D	prokaryote	virus

37 What could be used to help prevent an outbreak of cholera in a town?

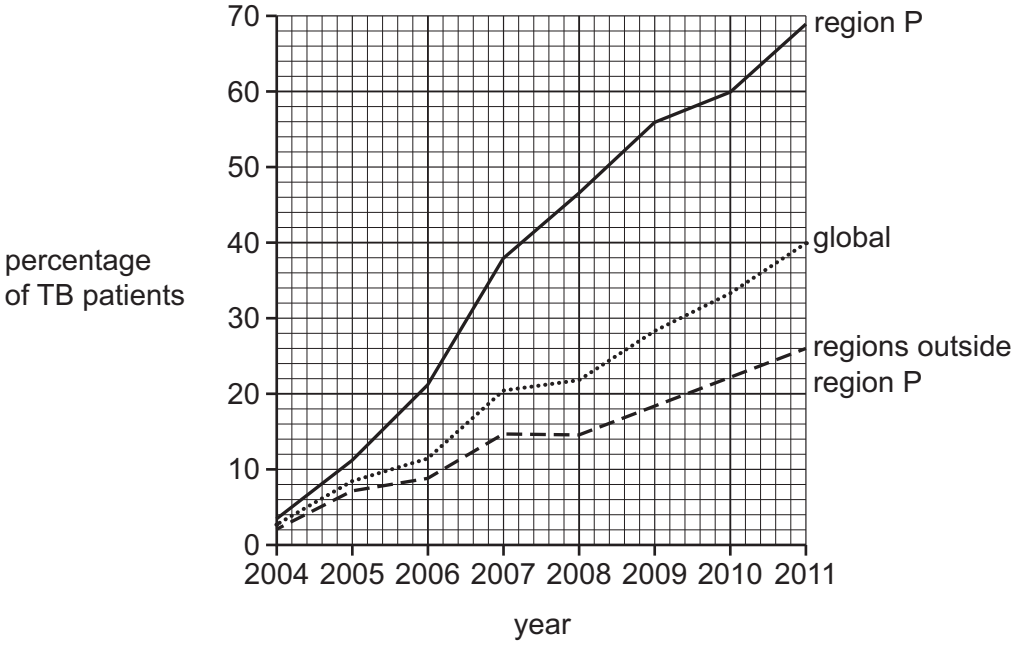
A treatment of sewage waste

B spraying still water with insecticides to kill mosquito larvae

C increased use of antiviral medicine

D preventing the reuse of hypodermic needles

38 The graph shows the percentage of tuberculosis (TB) patients who were also known to be infected with HIV, from 2004 to 2011.



Which statement about the graph is correct?

A From 2004 to 2010, the percentage of TB patients with HIV infection in region P increased from 3% to 69%.

B From 2005 to 2011, the percentage of TB patients with HIV infection increased more rapidly in region P than in regions outside region P.

C From 2006 to 2011, the percentage of TB patients with HIV infection in regions outside region P doubled.

D From 2007 to 2011, the percentage of TB patients with HIV infection globally increased from 20% to 30%.

39 Four different treatments were tested in a human volunteer during a year. One of these treatments was a vaccine.

The treatments were injected into the volunteer and blood samples were taken after two weeks. The samples were analysed to obtain a cell count for four types of cell.

The results are shown in the table.

Which treatment was the vaccine?

(Assume the volunteer's baseline blood cell count was the same before each treatment.)

	cell count / cells per cm^3			
	monocytes	neutrophils	plasma cells	macrophages
A	250	180	450	230
B	500	190	220	240
C	260	450	240	250
D	250	190	230	550

40 A bacterial pathogen produces a protein that acts as a toxin. This toxin is harmful to humans.

People can be vaccinated to protect them from the effects of this pathogen.

Which statement describes the sequences of events that occur in a vaccinated person to protect them from the effects of this pathogen?

A Memory cells divide by mitosis and then differentiate into macrophages that engulf and digest the toxin.

B Memory cells divide by mitosis and then differentiate into plasma cells that produce antibodies to bind to the toxin.

C Macrophages divide by mitosis and then differentiate into memory cells that engulf and digest the toxin.

D Plasma cells divide by mitosis and then differentiate into memory cells that produce antibodies to bind to the toxin.

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