Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **February/March 2020**

1 hour

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

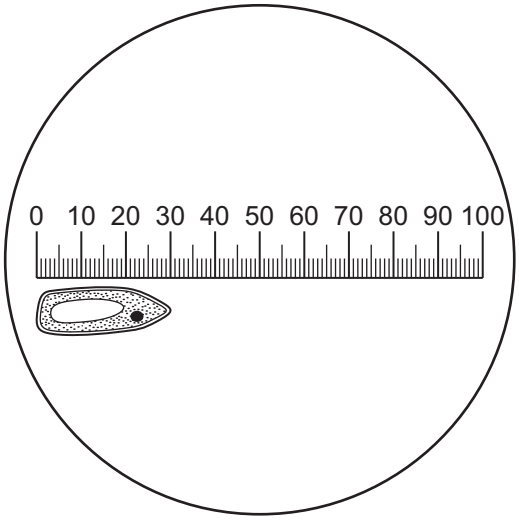
- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.

This document has **16** pages. Blank pages are indicated.

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1 The diagram shows an eyepiece graticule and cell viewed through a microscope. When the eyepiece graticule was calibrated at this magnification, the whole length of the graticule shown covered 12 divisions of a stage micrometer scale.

There were 100 divisions in 10 mm of the stage micrometer.



What is the actual length of the cell?

A 2.5 μm **B** 3.6 μm **C** 360 μm **D** 3 mm

2 Which cell structures can form vesicles?

	cell structure		
	cell surface membrane	endoplasmic reticulum	Golgi body
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

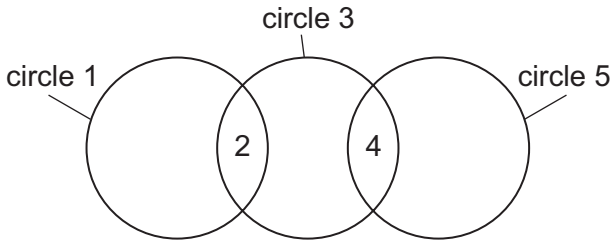
key

✓ = can form vesicles

✗ = cannot form vesicles

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3 The diagram shows three circles, 1, 3 and 5, representing chloroplasts, mitochondria and typical prokaryotes.



Which row correctly identifies the three circles and some of the structures that are shared between them?

	circle 1	2	circle 3	4	circle 5
A	chloroplasts	circular DNA	mitochondria	80S ribosomes	prokaryotes
B	chloroplasts	80S ribosomes	mitochondria	circular DNA	prokaryotes
C	prokaryotes	circular DNA	mitochondria	circular DNA	chloroplasts
D	prokaryotes	70S ribosomes	chloroplasts	80S ribosomes	mitochondria

4 Which cell structures contain RNA?

1 centrioles

2 mitochondria

3 nucleus

4 ribosomes

A 1, 2, 3 and 4

B 1 and 2 only

C 2, 3 and 4 only

D 3 and 4 only

5 It is possible for a bacterium to synthesise a eukaryotic protein.

This involves introducing a eukaryotic gene into the bacterial DNA. The eukaryotic gene is then translated by the bacterium.

What explains why a bacterial cell can produce a eukaryotic protein but cannot produce a eukaryotic glycoprotein?

A Bacteria do not have rough endoplasmic reticulum.

B Bacteria do not have a nuclear envelope.

C Bacteria do not have mitochondria.

D Bacteria do not have Golgi bodies.

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6 Which structures are found in typical prokaryotic cells and also in typical plant cells?

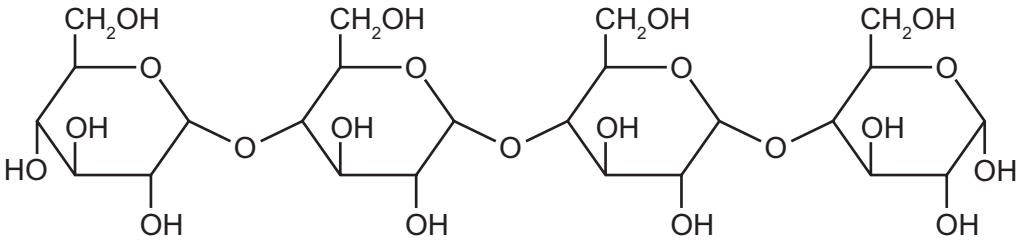
A cell walls

B histones

C telomeres

D tonoplasts

7 The molecule shown is a polymer of reducing sugars.



Which procedures could be carried out to show that this molecule is a polymer of reducing sugars?

1 Add hydrolytic enzyme and then heat with Benedict's solution.

2 Dissolve in water, neutralise and then heat with Benedict's solution.

3 Boil with hydrochloric acid, neutralise and then heat with Benedict's solution.

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

8 Which statement about biological molecules is correct?

A Amylopectin, amylose and cellulose are all polymers.

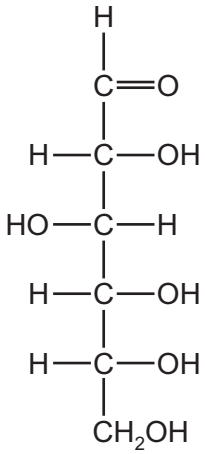
B Amylose, cellulose and glucose are all macromolecules.

C Cellulose, glucose and starch are all monomers.

D Sucrose, starch and amylopectin are all polysaccharides.

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9 Sugars with a ring structure can also have a linear structure.



Which of these sugar molecules could be represented by the linear structure in the diagram?

1 glucose

2 ribose

3 sucrose

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

10 Which statements about phospholipids and triglycerides are correct?

1 They both contain ester bonds.

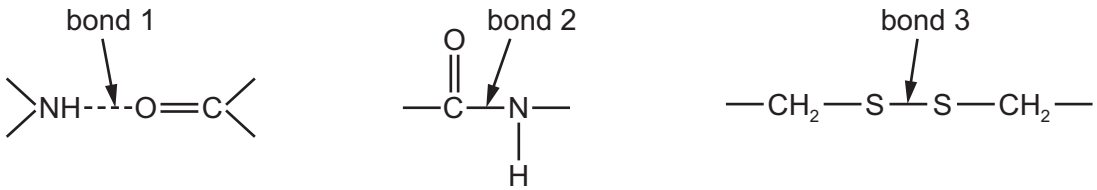
2 They both have three fatty acid chains per molecule.

3 They both may have saturated and unsaturated fatty acid chains.

4 They are both used only as storage molecules.

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

11 The diagrams show three examples of different bonds.



Which bonds hold the secondary structure of proteins together?

A 1, 2 and 3

B 1 and 2 only

C 1 only

D 2 and 3 only

12 Hydrogen bonding explains many of the properties of water, including the high latent heat of vapourisation and high specific heat capacity.

For which processes in plants is hydrogen bonding in water important on hot sunny days?

1 preventing denaturation of enzymes in leaves

2 reducing water loss by evaporation

3 allowing leaves to cool down quickly at night

4 holding the column of water in xylem vessels together

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1, 3 and 4 only

D 2 and 3 only

13 What is the most appropriate set of controls to use in an investigation into the rate of an enzyme-catalysed reaction over a range of temperatures from 25 °C to 65 °C?

A enzyme and substrate at all temperatures tested

B enzyme and boiled substrate at all temperatures tested

C boiled enzyme only at all temperatures tested

D substrate only at all temperatures tested

14 An investigation is carried out with an enzyme at its optimum temperature and pH.

The rate of the enzyme reaction is measured at different substrate concentrations.

The investigation is repeated in the presence of a competitive inhibitor.

How will the results with the competitive inhibitor be different from the original results?

	K_m with competitive inhibitor	V_{max} with competitive inhibitor
A	higher	lower
B	higher	the same
C	the same	lower
D	the same	the same

15 Which description of cell surface membrane permeability is correct?

A An increase in the concentration of cholesterol molecules in the cell surface membrane can increase its permeability to hydrophilic substances.

B Cell surface membrane permeability to large hydrophilic molecules is high and can be increased by membrane transport proteins involved in facilitated diffusion.

C The permeability of the cell surface membrane to ions increases as the proportion of saturated fatty acid chains in the phospholipids increases.

D Without the presence of carrier and channel membrane proteins, the cell surface membrane has a low permeability to large polar molecules.

16 Which transport mechanism within a cell can occur in the absence of membranes?

A active transport

B diffusion

C facilitated diffusion

D osmosis

17 A student measured the time taken for complete diffusion of a dye into agar blocks of different sizes.

The results are shown in the table.

size of agar block / mm × mm × mm	time for diffusion / s
5 × 5 × 5	6.2
10 × 10 × 10	16.1
15 × 15 × 15	34.5
5 × 10 × 15	

What is the predicted time for complete diffusion of the dye into the agar block measuring 5 mm × 10 mm × 15 mm?

A 6.2 s

B 16.1 s

C 34.5 s

D more than 34.5 s

18 A plant cell with a water potential of –600 kPa was placed in a solution with a water potential of –410 kPa for 10 minutes.

Which row is correct?

	net movement of water	water potential of cell	effect on cell
A	into cell	becomes higher	becomes turgid
B	into cell	becomes lower	bursts
C	out of cell	becomes higher	swells
D	out of cell	becomes lower	becomes plasmolysed

19 Which cells contain telomeres that are longer than those in a helper T-lymphocyte secreting cytokines?

1 bone marrow stem cells

2 mature red blood cells

3 activated memory B-lymphocytes

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

20 In which stage of the cell cycle are telomeres needed to prevent the loss of genes?

A prophase

B cytokinesis

C G_1 phase

D S phase

21 Which row shows **part** of the correct sequence of mitosis?

A	chromosomes condense	→	chromosomes line up at the equator	→	nuclear envelope disappears	→	spindle fibres shorten
B	chromosomes line up at the equator	→	spindle fibres shorten	→	chromosomes condense	→	nuclear envelope reappears
C	chromosomes line up at the equator	→	spindle fibres shorten	→	nuclear envelope reappears	→	chromosomes uncoil
D	chromosomes uncoil	→	nuclear envelope disappears	→	spindle fibres shorten	→	chromosomes line up at the equator

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22 What is correct for cytosine?

	has a single ring structure	is a pyrimidine	joins to its complementary base with 3 hydrogen bonds
A	✓	✓	✓
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key

✓ = correct

✗ = incorrect

23 Scientists grew bacteria in a medium containing heavy nitrogen, ^{15}N, as the only source of nitrogen. After many generations, both strands of all of the bacterial DNA molecules contained heavy nitrogen.

These bacteria were then moved from the heavy nitrogen medium into a medium with only light nitrogen, ^{14}N. The bacteria divided once to form the first generation and once more to form the second generation.

A sample of bacteria was collected from the second generation and the DNA was analysed to find:

- the percentage of DNA strands that contained only light nitrogen
- the percentage of DNA molecules that contained light nitrogen **and** heavy nitrogen.

Which row shows the results of this analysis?

	percentage of DNA strands that contained only light nitrogen	percentage of DNA molecules that contained light nitrogen **and** heavy nitrogen
A	50	25
B	50	50
C	75	25
D	75	50

24 The table shows the tRNA anticodons for four amino acids.

amino acid	tRNA anticodons
asparagine	UUA, UUG
glutamic acid	CUU, CUC
proline	GGA, GGG, GGU, GGC
threonine	UGA, UGG, UGU, UGC

A cell makes a polypeptide containing the amino acid sequence shown.

asparagine – threonine – proline – glutamic acid

Which sequence of bases on the transcribed strand of a DNA molecule could code for this part of the polypeptide?

A AATACCCCTGAA

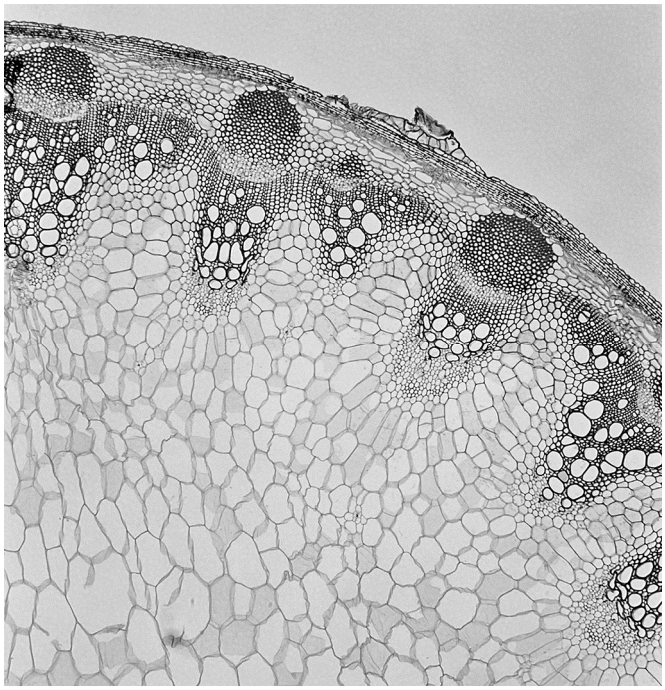
B AATACCCCTCAA

C TTACTTGGATGG

D TTATGGGGACTT

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25 The photomicrograph shows a section of a plant organ.



Students were asked to study the photomicrograph and identify the organ, giving a reason to support their answer.

Which statement written by the students correctly identifies the organ and provides a correct reason to support this identification?

A It is a leaf because the xylem is located on the inner side of each vascular bundle.

B It is a stem because there is a ring of endodermis visible around the edge of the vascular tissue.

C It is a stem because the vascular bundles are arranged in a ring near the epidermis.

D It is a xerophytic leaf because there is a thick epidermis made up of many layers of cells.

26 What is correct about the apoplastic pathway and symplastic pathway in a root?

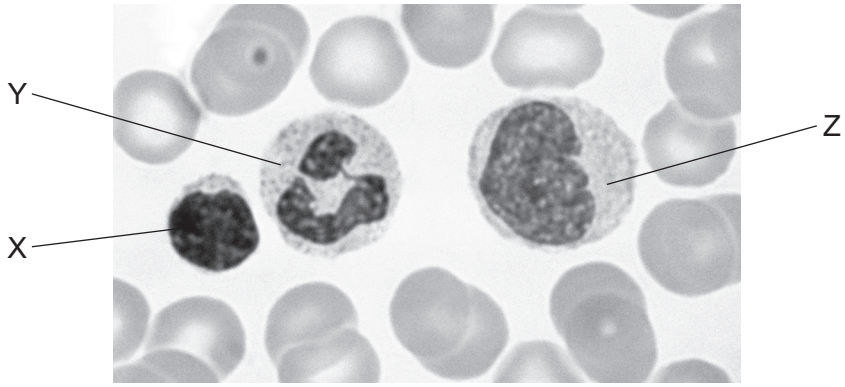
	apoplastic pathway	symplastic pathway
A	Casparian strip blocks the movement of water	water moves across the root through cell walls
B	water moves across the root through cell walls	water moves from cell to cell via the plasmodesmata
C	water moves from cell to cell via the plasmodesmata	water passes through the cytoplasm
D	water passes through the cytoplasm	Casparian strip blocks the movement of water

27 Sucrose moves into a phloem sieve tube element from a leaf mesophyll cell.

Which changes to the water potential and the volume of solution in the phloem sieve tube element are correct?

	water potential becomes	volume of solution
A	higher	decreases
B	higher	increases
C	lower	decreases
D	lower	increases

28 The photomicrograph shows three white blood cells labelled X, Y and Z.



Which row correctly identifies these cells?

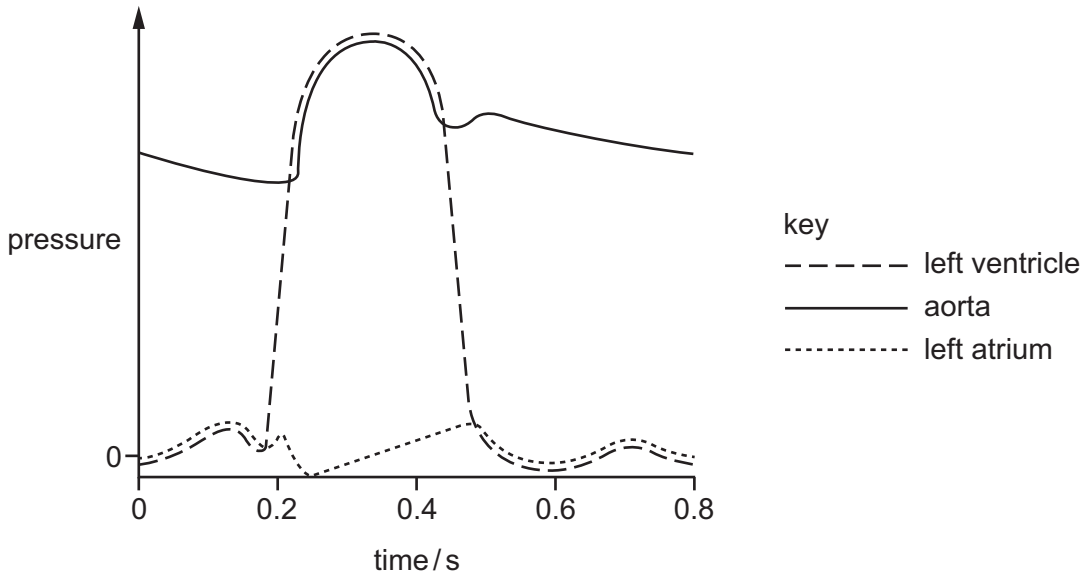
	cell X	cell Y	cell Z
A	lymphocyte	monocyte	neutrophil
B	lymphocyte	neutrophil	monocyte
C	monocyte	neutrophil	lymphocyte
D	neutrophil	monocyte	lymphocyte

29 Which row correctly identifies the locations in which a type of molecule or cell is present?

	type of molecule or cell	blood	lymph	tissue fluid
A	antibody	✓	✓	✓
B	large plasma protein	✓	✗	✓
C	lymphocyte	✓	✓	✗
D	phagocyte	✗	✓	✓

key
✓ = present
✗ = not present

30 The graph shows the changes in pressure that occur in the left side of the heart during one cardiac cycle.



At which time are the semi-lunar valves in the heart open?

A 0.1 s **B** 0.3 s **C** 0.5 s **D** 0.7 s

31 What would change the ratio of red blood cells to white blood cells in the blood of a healthy human?

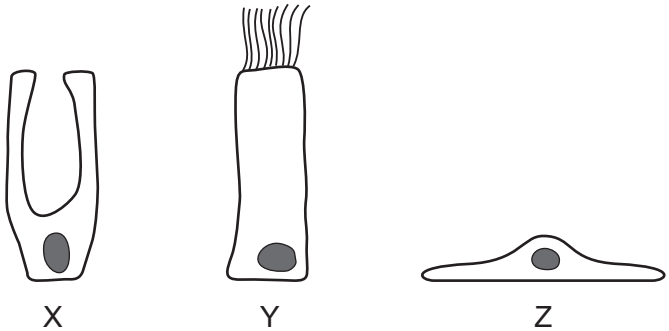
1 development of leukaemia

2 infection with *Variola*

3 living for six months at high altitude

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

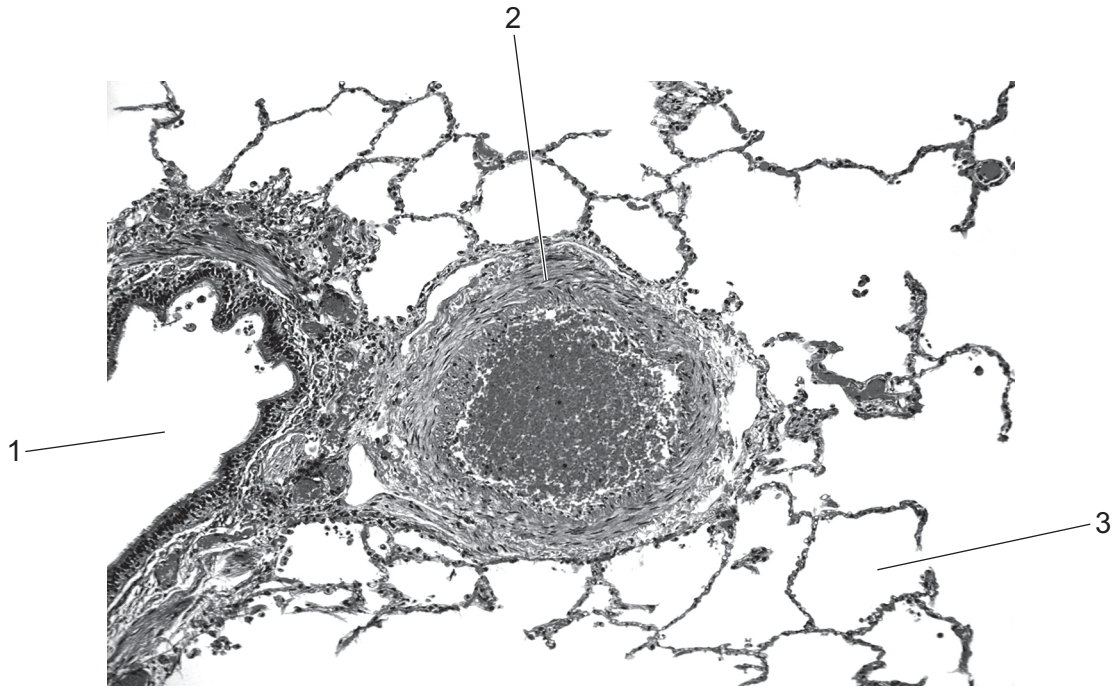
32 The diagram represents three types of cell found in the human gas exchange system.



Which of these cell types could be affected when a person is exposed to tar in cigarette smoke?

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

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



Which row correctly identifies the features labelled 1, 2 and 3?

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

34 How many times must a molecule of oxygen pass through a cell surface membrane as it diffuses from inside an alveolus, through a cell in the capillary wall, to bind to a molecule of haemoglobin?

A 3 **B** 4 **C** 5 **D** 10

35 A disease is an abnormal disruption to the functioning of an organism or part of an organism.

Which disruption to function is an example of an infectious disease?

A Airflow to one lung is disrupted by uncontrolled cell division forming a mass of cells.

B Airways become inflamed due to exposure to smoke.

C Oxygen transport is disrupted due to changes in protein shape in red blood cells.

D Lung tissue is disrupted by the multiplication of prokaryotic cells.

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36 The number of people at risk of contracting malaria has increased due to an increase in the distribution of *Anopheles* mosquitoes.

What could be the cause of this increase in the distribution of *Anopheles* mosquitoes?

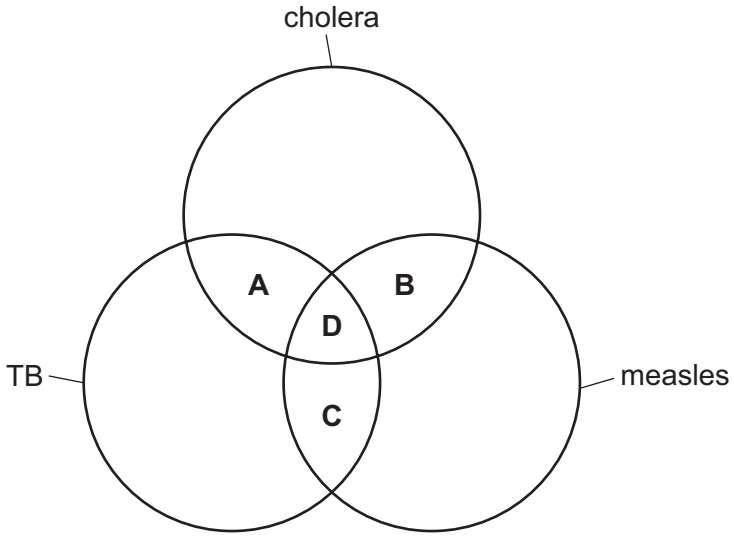
A antibiotic resistance

B drug resistance in *Plasmodium*

C no effective vaccine

D global warming

37 Which diseases are treated with antibiotics?



38 Which row correctly describes B-lymphocytes?

	processed in the thymus	release antibodies immediately after formation
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = correct

✗ = incorrect

39 Which features of monoclonal antibodies are important to their use in the treatment of cancer?

1 They can bind to tumour-associated antigens.

2 They can distinguish between different strains of pathogens.

3 They can deliver drugs to specific targets.

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

key

✓ = is important

✗ = is not important

40 A student was asked to explain why vaccination has successfully eradicated smallpox but not other diseases, such as measles, malaria and sickle cell anaemia. These are the statements made by the student.

1 The antigens of the virus causing smallpox did not change, unlike the antigens of the virus causing measles.

2 Sickle cell anaemia has many different types of mutation, unlike smallpox, so each would require a vaccine.

3 Unlike smallpox, malaria involves animals as part of the transmission cycle and this makes the cycle harder to break.

4 The vaccine against measles often causes a poor primary immune response so that booster vaccines are required, unlike the vaccine against smallpox.

Which statements are possible explanations?

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

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