Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2019**

1 hour

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

5573008854

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.

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1 Plant cells are stained and then seen with a simple light microscope using daylight as the only light source.

Which cell structures are clearly visible at a magnification of ×400?

A chloroplast grana

B lysosomes

C nucleoli

D ribosomes

2 How many nanometres are there in one millimetre?

A 1000 **B** 10 000 **C** 100 000 **D** 1 000 000

3 Which cell structures contain 70S ribosomes?

1 chloroplasts

2 mitochondria

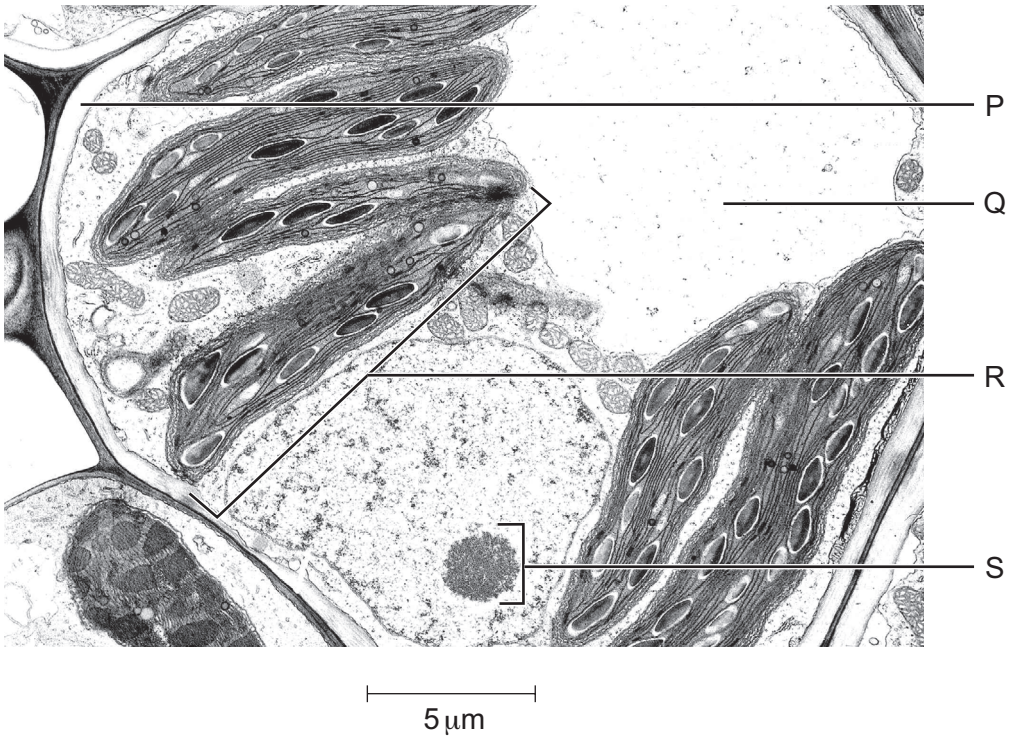
3 nucleus

4 cytoplasm

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

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4 The electron micrograph shows part of a plant cell.



Which combination correctly identifies the labelled cell structures?

	P	Q	R	S
A	cell surface membrane	cytoplasm	mitochondrion	nucleus
B	cell surface membrane	vacuole	chloroplast	nucleus
C	cell wall	cytoplasm	mitochondrion	nucleolus
D	cell wall	vacuole	chloroplast	nucleolus

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[Turn over

5 Four students were asked to match the function with the appearance of some cell structures in an animal cell.

The functions were listed by a number.

1 mRNA passes through to the ribosome

2 organises microtubules to produce the spindle during cell division

3 packaging of hydrolytic enzymes that will remain in the cell

The appearances were listed by a letter.

V membranes which surround an enclosed inner cavity

W non-membrane bound, spherical structures

X a double membrane interspersed with pores

Y non-membrane bound, cylindrical structures

Z membrane-bound sacs, arranged as a flattened stack

Which student correctly matched the numbered function with the appearance of the cell structure?

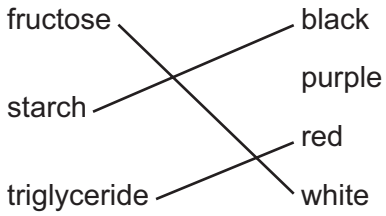
	1	2	3
A	V	W	Y
B	V	Y	Z
C	X	W	Y
D	X	Y	Z

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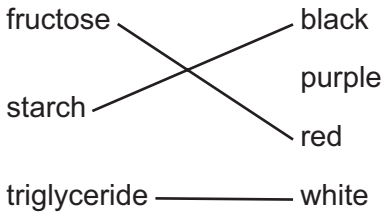
6 Tests for biological molecules were carried out on food samples.

Which correctly matches the biological molecules in the food samples with the colour for a positive result?

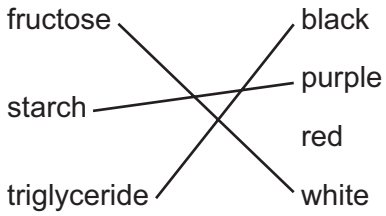
A



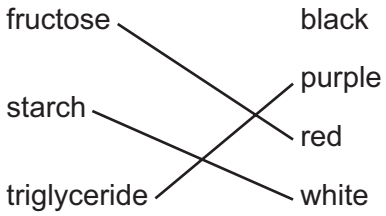
B



C



D



7 What occurs during the formation of a glycosidic bond between two α-glucose molecules?

A a 1, 4 bond is always formed

B a hydrogen bond is always formed

C a molecule of water is always formed

D a hydroxyl (OH) group is always formed

8 What is the maximum number of condensation reactions that occur when a triglyceride is synthesized?

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

9 Three proteins that have a quaternary structure are listed.

- Type IX collagen is formed from three different polymers.
- The main form of haemoglobin contains two alpha globins and two beta globins.
- HIV protease consists of two identical polymers.

Which row shows the correct number of genes needed to code for each protein?

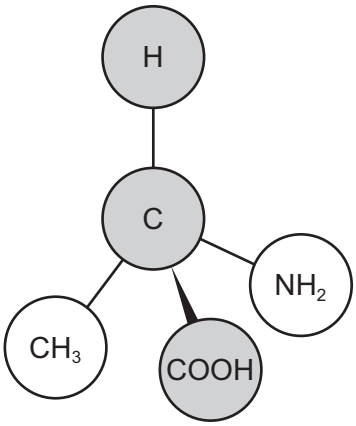
	number of genes		
	type IX collagen	haemoglobin	HIV protease
A	1	2	2
B	1	4	1
C	3	2	1
D	3	4	2

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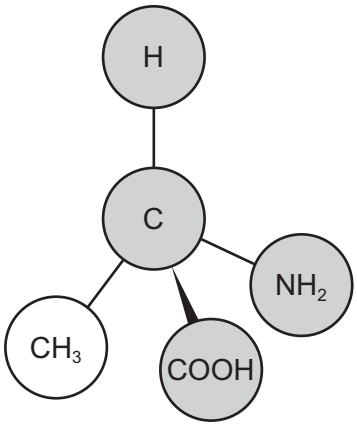
10 The diagrams show the structure of an amino acid with some parts of the molecule shaded.

Which diagram shows the shaded part of the molecule that is common to all amino acids?

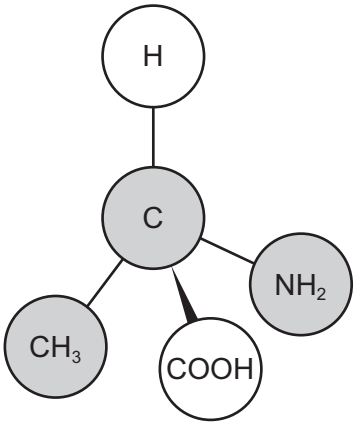
A



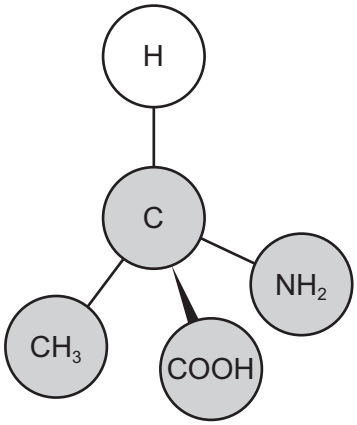
B



C



D



11 Some extracellular protease enzymes are synthesised in an inactive form called zymogen.

Zymogen is converted to the active protease in the Golgi body.

What is the purpose of producing zymogen before converting it to the extracellular protease?

A to avoid unwanted digestion of proteins inside the cell

B to avoid unwanted digestion of proteins outside the cell

C to catalyse digestion of proteins in the cytoplasm

D to catalyse digestion of proteins in the rough endoplasmic reticulum

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[Turn over

12 The Michaelis-Menten constant for an enzyme-catalysed reaction is referred to as K_m, and the maximum velocity of such a reaction is known as V_{max}.

Which statement about K_m and V_{max} is correct?

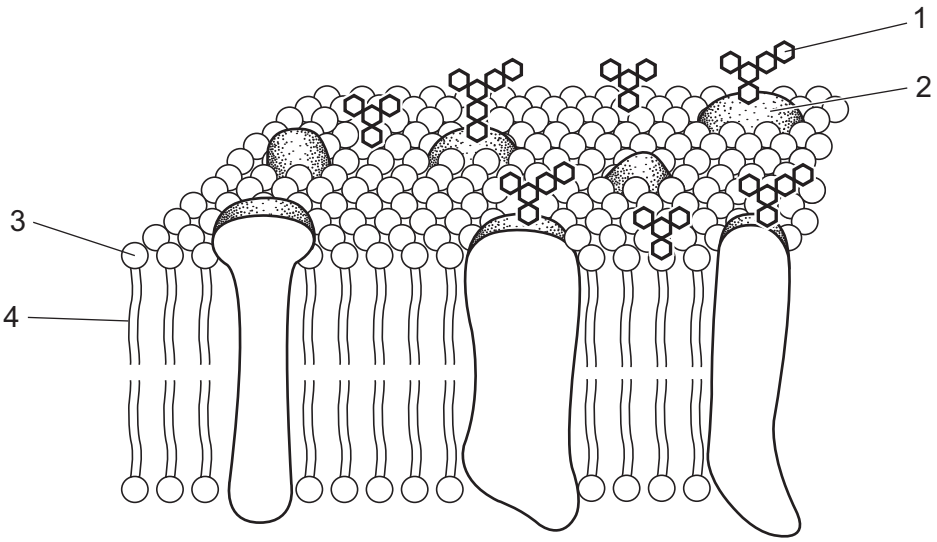
A An enzyme with a high value of K_m can reach its V_{max} at a low substrate concentration.

B An enzyme with a high value of K_m has a high affinity to its substrate.

C An enzyme with a low value of K_m can reach its V_{max} at a high substrate concentration.

D An enzyme with a low value of K_m has a high affinity to its substrate.

13 The diagram represents part of the fluid mosaic model of a cell surface membrane.



Which parts of the membrane are hydrophilic?

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

14 Which statements about the proteins and glycoproteins in cell surface membranes are correct?

1 They can allow cells to bond together to form tissues.

2 They can recognise messenger molecules like hormones.

3 They can be antigens and allow cell to cell recognition.

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

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15 Which pair of factors is inversely proportional to the rate of diffusion?

A concentration gradient and surface area over which diffusion occurs

B distance over which diffusion occurs and size of diffusing molecule

C size of diffusing molecule and concentration gradient

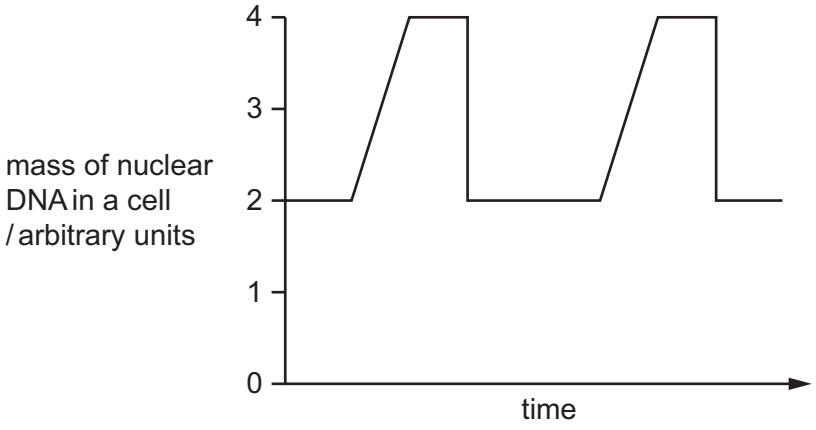
D surface area over which diffusion occurs and distance over which diffusion occurs

16 Raisins are dried fruit that contain high concentrations of sugar.

Which row is correct when raisins are first put into water?

	water potential in the raisin compared to surrounding water	direction of water movement
A	less negative	into the raisin
B	less negative	out of the raisin
C	more negative	into the raisin
D	more negative	out of the raisin

17 Which processes that occur in cell division are represented in the diagram?



A DNA replication and nuclear division only

B DNA replication, nuclear division and cytokinesis

C mitosis and cytokinesis

D mitosis only

18 What happens to the telomeres during mitosis of a cancer cell?

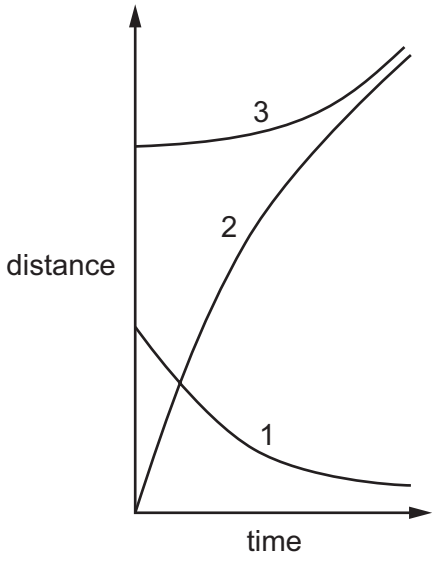
A The length increases.

B The length decreases.

C They are completely lost.

D They stay the same length.

19 The graph shows three measurements obtained after metaphase of mitosis.

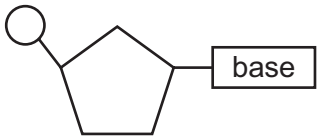


What measurements do the curves represent?

	distance between centromeres and poles of spindle	distance between centromeres of sister chromatids	distance between poles of spindle
A	1	2	3
B	1	3	2
C	3	1	2
D	3	2	1

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20 The diagram represents a nucleotide containing guanine.



Which statements about this nucleotide are correct?

1 The carbohydrate can be ribose or deoxyribose.

2 Base pairing occurs with three hydrogen bonds.

3 Guanine is a purine.

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

21 What is the maximum number of codon-anticodon interactions within one ribosome?

A 2 **B** 3 **C** 4 **D** 6

22 Meselson and Stahl investigated DNA in bacteria. They grew bacteria in a medium with only heavy nitrogen, ^{15}N, until all of the bacterial DNA was heavy.

These bacteria were moved from a heavy nitrogen medium and cultured in a medium with only light nitrogen, ^{14}N.

A sample of bacteria was collected from the first generation and their DNA analysed.

Hybrid DNA contains heavy DNA and light DNA.

Which row shows the percentage of light DNA strands and the percentage of hybrid DNA molecules in the first generation produced in the medium containing light nitrogen?

	percentage of light DNA strands	percentage of hybrid DNA molecules
A	25	50
B	50	50
C	50	100
D	75	100

23 Which statements about tRNA structure are correct?

1 There is a binding site for the attachment of a specific amino acid and a different binding site for the attachment to the ribosome, so that translation can occur.

2 There is a ribose-phosphate backbone with strong phosphodiester bonds and areas within the polynucleotide chain where base pairing occurs.

3 There is an anticodon that contains the same triplet of bases as the triplet of DNA bases that has been transcribed to produce the mRNA codon.

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

24 Which row explains why xylem vessels have no cytoplasm?

	to contain a larger volume of water	to transport water faster	to increase the cellulose content of the vessel walls
A	✓	✓	✓
B	✗	✗	✓
C	✓	✓	✗
D	✓	✗	✓

key

✓ = explains

✗ = does not explain

25 What causes water to move from the root hair cells to the endodermis?

A diffusion through cell walls, osmosis down a water potential gradient in the cytoplasm

B diffusion through the symplast, osmosis and root pressure through the apoplast

C osmosis from cell vacuole to cell vacuole, active transport into the endodermis

D osmosis through the intercellular spaces, diffusion in cell walls and cytoplasm

26 What is true about a Casparian strip?

	location	formed from	effect
A	cell wall of cortical cell	lignin	closes symplastic pathway
B	cell wall of endodermis cell	suberin	closes apoplastic pathway
C	cytoplasm of cortical cell	lignin	closes apoplastic pathway
D	cytoplasm of endodermis cell	suberin	closes symplastic pathway

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27 Which xerophytic adaptations reduce the water potential gradient between leaf surface and atmosphere?

1 rolled leaves

2 hairy leaves

3 sunken stomata

4 fewer stomata

5 fleshy leaves

A 1, 2, 3, 4 and 5

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2 and 5 only

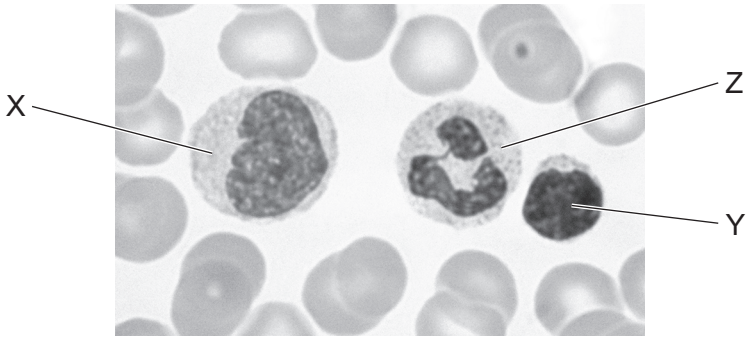
28 When sucrose is loaded into the phloem it has to travel from mesophyll cells to a companion cell and then into the phloem.

In many plants, proton pumps and co-transporter molecules are involved in this process.

Which row shows the relative concentrations of sucrose in each type of cell?

	relative concentration of sucrose / arbitrary units		
	mesophyll cell	companion cell	phloem sieve tube element
A	5	10	15
B	5	15	10
C	15	10	5
D	15	5	10

29 The image shows three white blood cells labelled X, Y and Z.



Which row correctly identifies these cells?

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

30 Which is the correct sequence for the opening of the valves in the mammalian heart during one cardiac cycle?

A

right atrioventricular valve
↓
pulmonary semilunar valve
↓
left atrioventricular valve
↓
aortic semilunar valve

B

left atrioventricular valve
↓
aortic semilunar valve
↓
right atrioventricular valve
↓
pulmonary semilunar valve

C

left atrioventricular valve
and
aortic semilunar valve
↓
right atrioventricular valve
and
pulmonary semilunar valve

D

left atrioventricular valve
and
right atrioventricular valve
↓
aortic semilunar valve
and
pulmonary semilunar valve

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31 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.

4 When 2,3-BPG is absent, oxyhaemoglobin is less likely to unload oxygen.

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

32 Aortic stenosis is a heart valve disorder in which the aortic semilunar valve opening is narrow.

Which effect could aortic stenosis have on heart structure and function?

A The cardiac muscle of the left ventricle wall is thinned by blood leaking out of the left ventricle during ventricular diastole.

B There is less cardiac muscle in the left ventricle and reduced diastolic blood pressure, caused by the smaller blood volume entering the left atrium.

C The tendons of the heart valves are weakened by blood being forced back through the left atrioventricular valve into the left atrium.

D The wall of the left ventricle thickens, leading to an enlarged heart and inability to relax and fill completely during diastole.

33 What explains why the red blood cell count of humans increases when they remain at high altitudes?

A Haemoglobin is not saturated with oxygen in the lungs.

B The partial pressure of oxygen in the air is higher.

C The percentage of oxygen in the air has decreased.

D There is more carbon dioxide, increasing the Bohr effect.

34 Which may contain ciliated epithelium?

A trachea only

B trachea and bronchi only

C trachea, bronchi and bronchioles

D bronchi, bronchioles and alveoli

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35 Which row shows the effects of chronic bronchitis?

	lymph glands	alveoli	bronchi	infection
A	destroyed	damaged	inflamed	absent
B	destroyed	inflamed	scarred	present
C	swollen	damaged	scarred	present
D	swollen	inflamed	inflamed	absent

36 The statements refer to the disease tuberculosis (TB).

1 The pathogen lives inside human cells so is not accessible to the immune system.

2 The bacterial pathogen reproduces slowly.

3 The pathogen is not very sensitive to antibiotics.

Which explains why antibiotic treatment for TB takes a long time?

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

37 Scientists studied the multidrug resistant bacterial infections in children, caused by one type of bacteria, between 2007 and 2015. The percentage of multidrug resistant infections rose from 0.2% to 1.5%.

What was the percentage increase in multidrug resistant infections between 2007 and 2015?

A 1.3% **B** 87% **C** 130% **D** 650%

38 Why is it necessary for a person with a bacterial infection to take antibiotics at evenly spaced time intervals?

A to increase the concentration of antibiotic slowly to a level which is lethal to the bacteria

B to maintain a concentration of antibiotic in the body which is lethal to the bacteria

C to prevent the development of resistant strains of bacteria

D to select and kill the resistant strains of bacteria

39 The enzyme telomerase prevents loss of telomeres after many mitotic cell cycles. Three types of cell are used to produce monoclonal antibodies.

1 cancer cells undergoing uncontrolled cell division

2 mature B-lymphocytes

3 hybridoma cells

Which cells involved in this technique contain active telomerase enzyme?

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

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40 What explains why monoclonal antibodies are useful in the diagnosis of disease?

A They bind to and neutralise one type of antibody.

B They bind to and neutralise one type of pathogen.

C Their shape is complementary to one specific antibody.

D Their shape is complementary to one specific antigen.

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