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Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **October/November 2023**

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.

This document has **20** pages. Any blank pages are indicated.

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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 a light microscope with a maximum resolution of 0.25 μm **and** an electron microscope?

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

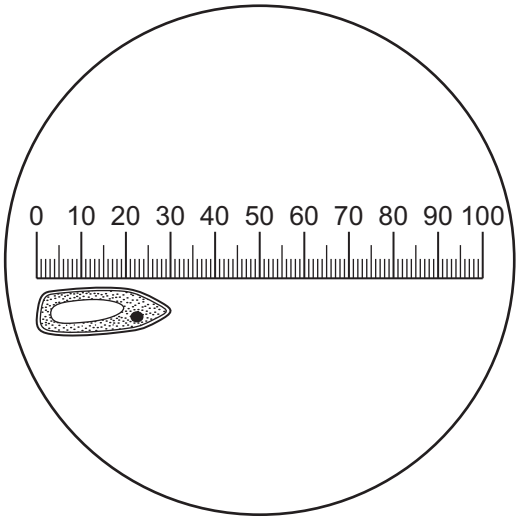
key

✓ = can be seen

✗ = cannot be seen

2 The diagram shows an eyepiece graticule and a 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

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3 Tay-Sachs disease results in a build-up of lipids in cells.

Which cell structure does **not** function correctly in this disease?

A Golgi body

B lysosome

C mitochondrion

D smooth endoplasmic reticulum

4 Which animal cells would have the most extensive Golgi bodies?

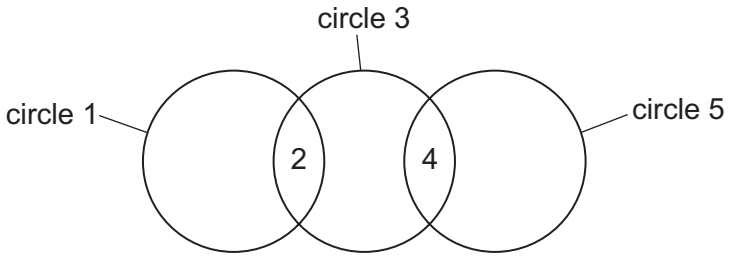
A ciliated epithelial cells

B goblet cells

C red blood cells

D smooth muscle cells

5 The diagram shows three circles, 1, 3 and 5, and the shared structures, 2 and 4.



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

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6 Which row about the genetic material in animal cells and prokaryotic cells is correct?

	animal cells contain linear DNA	prokaryotic genetic material is surrounded by a double membrane	prokaryotic genetic material is double-stranded DNA
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✗	✓

key

✓ = correct

✗ = not correct

7 What is present in **all** viruses?

A uracil

B ribose

C thymine

D guanine

8 The test for non-reducing sugars requires a second Benedict's test to be carried out.

Which set of steps is the correct method for carrying out the non-reducing sugar test **before** carrying out the second Benedict's test?

A Perform the Benedict's test, which gives a negative result.
Warm gently with dilute hydrochloric acid.
Neutralise with sodium hydrogencarbonate.

B Perform the Benedict's test, with the colour of the solution remaining red.
Boil with dilute hydrochloric acid.
Neutralise with sodium hydrogencarbonate.

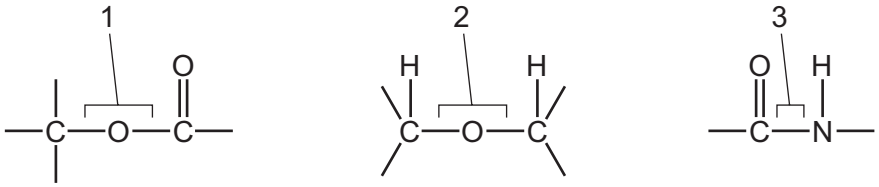
C Perform the Benedict's test, with the colour of the solution remaining blue.
Boil with dilute hydrochloric acid.
Neutralise with sodium hydrogencarbonate.

D Perform the Benedict's test, which gives a negative result.
Neutralise with sodium hydrogencarbonate.
Warm gently with dilute hydrochloric acid.

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9 The diagrams show three types of covalent bonds.



Which bonds will be found in glycolipids and glycoproteins?

	bond 1	bond 2	bond 3
A	glycolipids only	glycolipids and glycoproteins	glycoproteins only
B	glycolipids and glycoproteins	glycolipids only	glycoproteins only
C	glycoproteins only	glycolipids only	glycolipids and glycoproteins
D	glycoproteins only	glycolipids and glycoproteins	glycolipids only

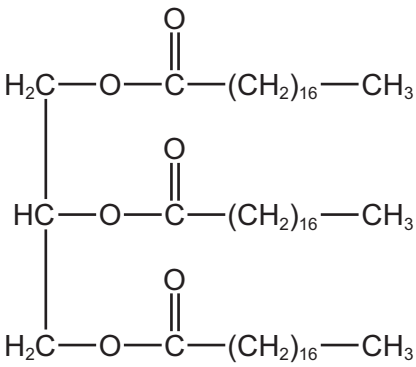
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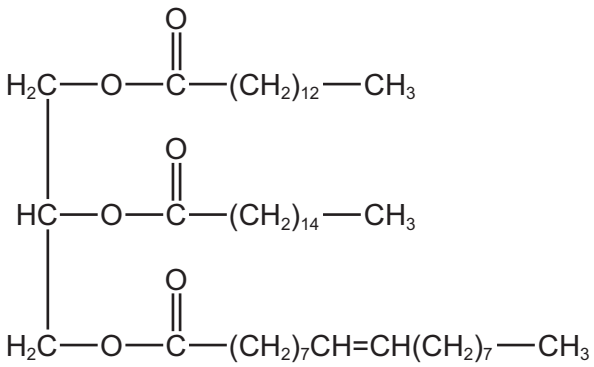
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10 Which molecules would be found in an oil (liquid) more than in a fat (solid)?

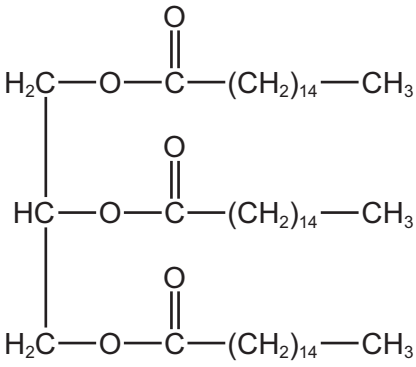
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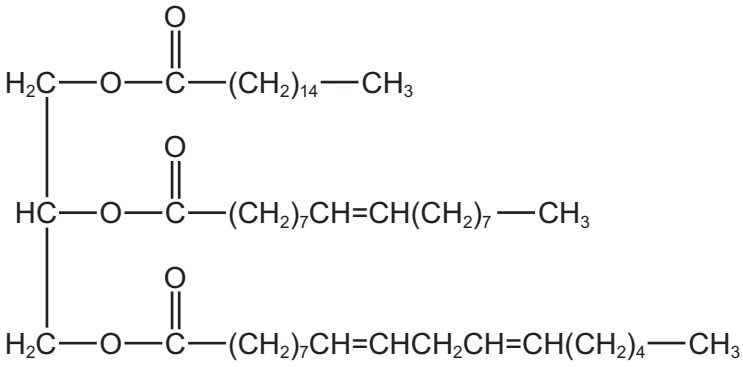
2



3



4



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

11 Which row about the bonding found in the primary, secondary, tertiary and quaternary structure of proteins is correct?

	primary	secondary	tertiary	quaternary
A	covalent	covalent	ionic and disulfide only	hydrogen and hydrophobic interactions only
B	covalent	hydrogen	hydrogen, ionic, covalent and hydrophobic interactions	hydrogen, ionic, covalent and hydrophobic interactions
C	peptide	covalent	hydrogen, ionic, disulfide and hydrophobic interactions	hydrogen, ionic and disulfide
D	peptide	hydrogen	ionic and disulfide only	ionic and disulfide only

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12 The specific heat capacity of different substances is shown.

substance	specific heat capacity / $J\,g^{-1}\,°C$
air	1.0
hydrogen gas	14.3
water (liquid)	4.2
water (steam)	2.1

Which statement is correct?

A Air is a more stable environment than water because it is more resistant to changes in temperature.

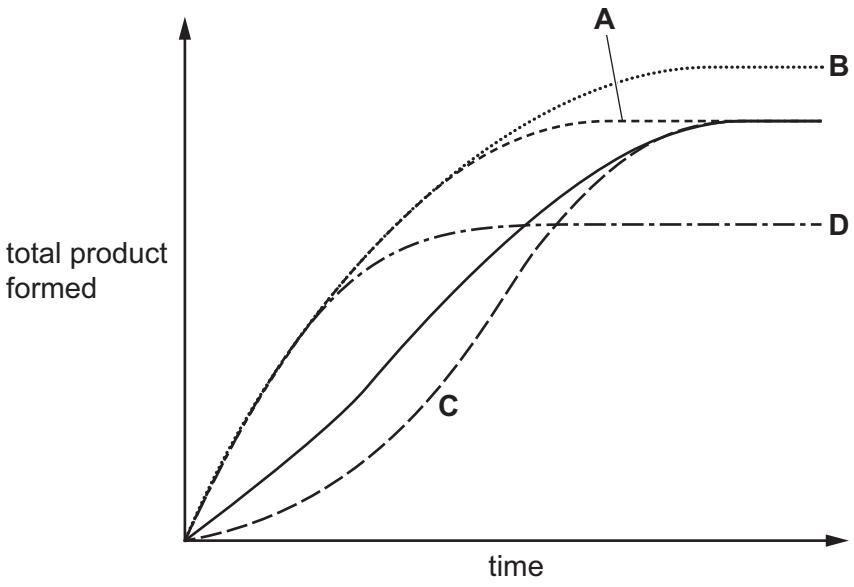
B It takes more energy to raise the temperature of hydrogen gas than it does to raise the temperature of water.

C A specific heat capacity of $4.2\,J\,g^{-1}\,°C$ means that it takes 4.2 J of energy to vaporise 1.0 g of liquid water.

D There are more hydrogen bonds between water molecules in a gas than between water molecules in a liquid.

13 The solid line on the graph represents the product formed over time for a reaction in a cell.

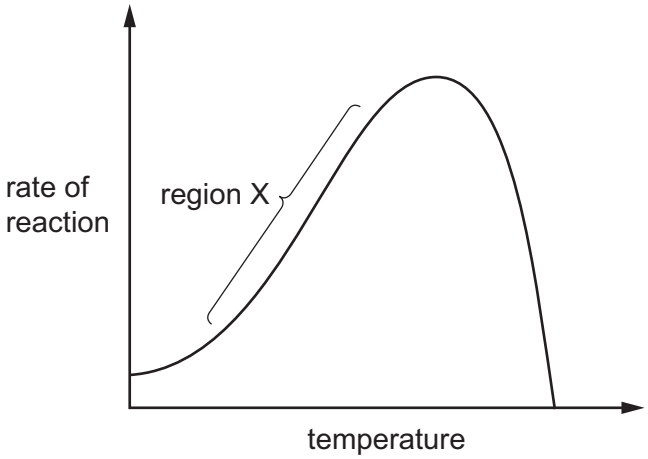
Which other line represents the effect of adding the enzyme for this reaction?



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14 The graph shows how the rate of an enzyme-controlled reaction is affected by the change in temperature. All other variables were standardised.



What is the factor limiting the rate in region X?

A substrate concentration

B enzyme concentration

C temperature

D number of empty active sites

15 How will the removal of a reversible non-competitive enzyme inhibitor affect an enzyme-catalysed reaction?

A The K_m will decrease and the V_{max} will increase.

B The K_m will increase and the V_{max} will not change.

C The K_m will not change and the V_{max} will increase.

D The K_m will not change and the V_{max} will not change.

16 The dimensions of three agar cylinders, X, Y and Z, are summarised in the table.

cylinder	radius / mm	length / mm
X	2	10
Y	1	20
Z	5	5

What is the correct order of surface area : volume ratio for the cylinders, from smallest to largest?

A X → Y → Z **B** Y → X → Z **C** Z → X → Y **D** Z → Y → X

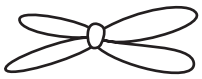
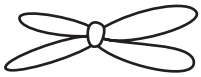
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17 Three individual plant leaf cells were each placed in a different solution for 30 minutes. Each solution had a different water potential.

Which row correctly shows the **change in volume** of the three cells after 30 minutes?

	water potential of solution		
	lower than cells	equal to cells	higher than cells
A	decreased	increased	decreased
B	decreased	no change	increased
C	increased	decreased	decreased
D	increased	no change	increased

18 Which row is a representation of one chromosome at the beginning of prophase of mitosis and the number of DNA strands in the chromosome?

	appearance of one chromosome	number of DNA strands
A		2
B		4
C		1
D		2

19 Which events are part of mitosis?

1 interphase

2 telophase

3 cytokinesis

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

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20 The statements are about genes and proteins involved in breast cancer.

- The protein coded by the *BRAC1* gene inhibits the growth of breast cancer cells.
- The protein coded by the *p53* gene suppresses tumours.

Which combination of genes is **most likely** to result in breast cancer?

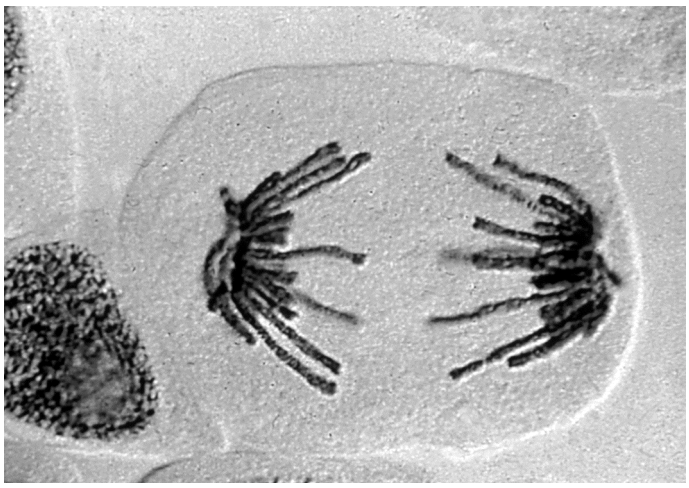
	BRAC1	*p53*
A	✗	✗
B	✗	✓
C	✓	✗
D	✓	✓

key

✓ = normal active gene

✗ = mutated gene

21 The photomicrograph shows a cell during mitosis.



What is happening in this cell?

1 Chromosomes are condensing.

2 Centromeres are moving to opposite poles.

3 Spindle microtubules are shortening.

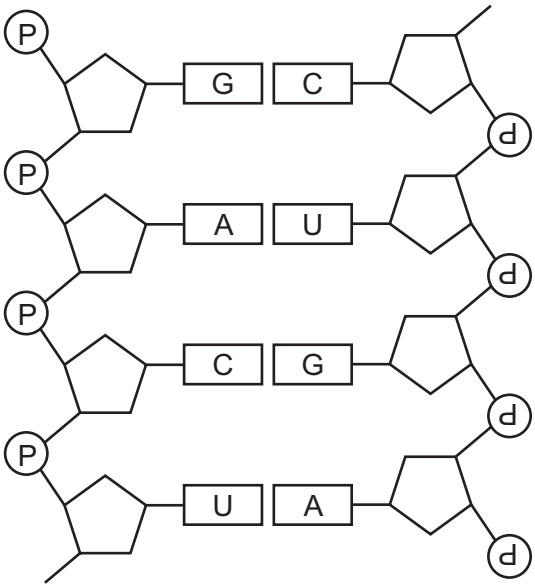
A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 only

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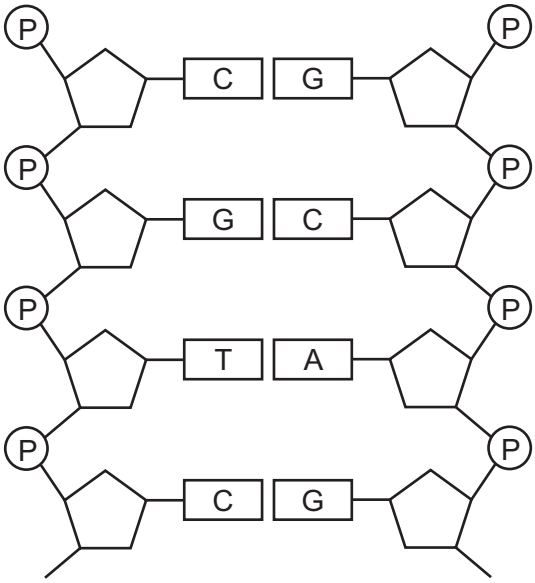
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22 Which diagram correctly shows the structure of a piece of DNA?

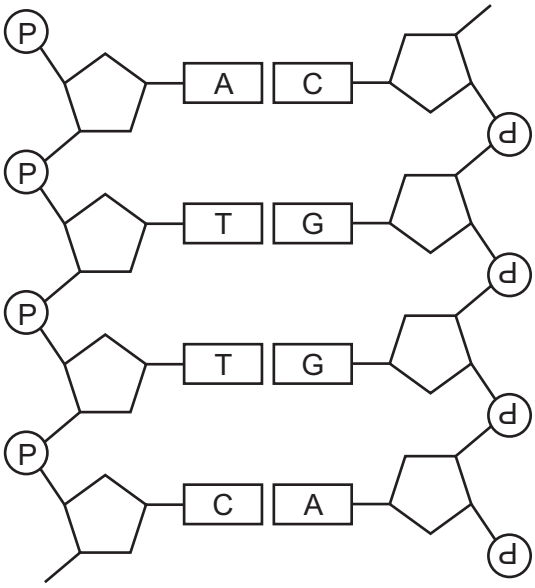
A



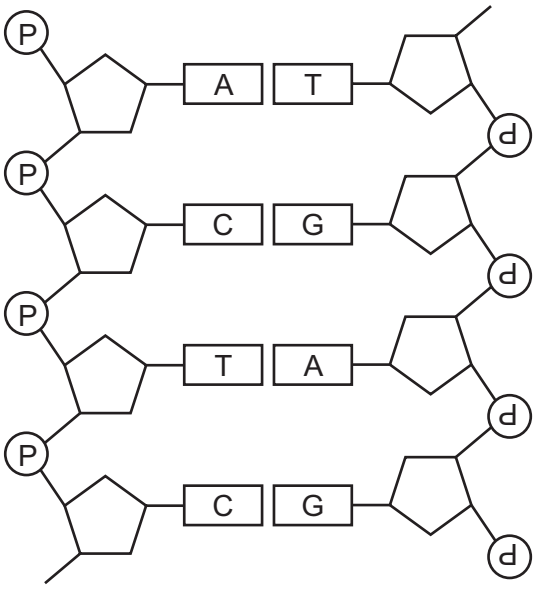
B



C



D



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23 Bacteria were grown in a medium containing ^{15}N. After several generations, all of the bacterial 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 percentage of hybrid DNA?

A 25% hybrid DNA

B 50% hybrid DNA

C 75% hybrid DNA

D 100% hybrid DNA

24 Which statements correctly describe the process of transcription?

1 mRNA is decoded by a ribosome to produce a specific amino acid chain.

2 A section of DNA is converted to RNA by RNA polymerase.

3 tRNA transfers amino acids to the ribosome.

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

25 Sickle cell anaemia is caused by a mutation in an allele of the gene that codes for the β-globin polypeptide of haemoglobin.

The diagram shows the sequence of bases in a small section of the template strand of DNA for both the Hb^A (normal) and Hb^S (sickle cell) β-globin alleles.

Hb^A CTGACTCCTGAGGAGAAGTCT

Hb^S CTGACTCCTGTGGAGAAGTCT

Both the polypeptides for Hb^A and Hb^S are the same length.

How will the mutation in the allele result in the production of an altered version of the β-globin polypeptide?

A A tRNA molecule with the anticodon GUG will form hydrogen bonds with the altered codon on mRNA.

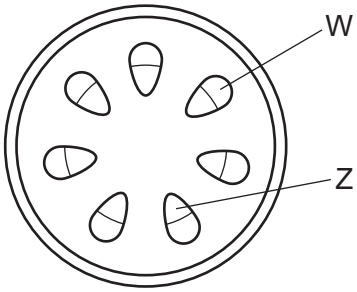
B All the amino acids coded for after the mutation will differ from those in the Hb^A protein.

C mRNA transcribed from the Hb^S allele will contain the codon CAC instead of the codon CTC.

D The ribosome will be unable to continue translation of the Hb^S mRNA after the altered codon.

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26 The plan diagram of a transverse section through a dicotyledonous plant stem was drawn by a student. They had stained the section with a chemical that stains lignin.



Which row is correct for tissues W and Z?

	W	Z	stained tissue
A	phloem	xylem	W
B	phloem	xylem	Z
C	xylem	phloem	W
D	xylem	phloem	Z

27 Which routes **must** water travel through in a plant, using the symplast pathway?

1 from soil into root hair cell vacuoles

2 from soil into root hair cell walls

3 from root hair cell walls to root cortex cell walls

4 from cortex cell walls into endodermis cells

5 from endodermis cells into xylem vessels

6 from leaf mesophyll cell walls into air spaces

A 1 and 4 **B** 2, 3 and 6 **C** 3, 5 and 6 **D** 4 and 5

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28 A plant leaf seen in transverse section with a microscope shows the features listed.

- a thick waxy cuticle on upper surface
- sunken stomata on lower surface
- rolled leaf so the edges curl

What is this leaf adapted for?

A to decrease carbon dioxide uptake

B to increase carbon dioxide uptake

C to decrease water loss by transpiration

D to increase water loss by transpiration

29 What occurs as carbohydrate is taken out of a sink into a phloem sieve tube element?

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

30 Which factors affect blood pressure?

1 the diameter of the blood vessels

2 the systolic pressure of the heart ventricles

3 the volume of blood returning to the heart in each cardiac cycle

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

31 Sulthiame is a molecule that inhibits carbonic anhydrase.

Which effect would sulthiame have inside a red blood cell in muscle tissue that is respiring at a high rate?

A a decrease in the rate of formation of haemoglobinic acid

B a decrease in the pH

C an increase in the rate of the chloride shift

D an increase in the dissociation of oxyhaemoglobin

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32 The partial pressure of oxygen in blood vessels in different parts of the body affects the percentage saturation of each haemoglobin molecule with oxygen.

blood vessel	partial pressure of oxygen / kPa	saturation of each haemoglobin molecule with oxygen / %
vein in active muscle	4	25
vein in resting muscle	7	75
arteriole in lungs	12	100

Which statement explains the difference in saturation between a resting and an active muscle?

A A small decrease in partial pressure causes two atoms of oxygen to leave each haemoglobin molecule because the oxygen dissociation curve is sigmoid shaped.

B A small decrease in partial pressure between 4 kPa and 7 kPa causes two molecules of oxygen to leave each haemoglobin molecule because the oxygen dissociation curve is steep.

C Loading of oxygen is slower between 4 kPa and 7 kPa due to binding of one oxygen molecule to each haemoglobin molecule making the next one harder to bind.

D Loading of oxygen is faster between 4 kPa and 7 kPa due to binding of one oxygen molecule to each haemoglobin molecule making the next one easier to bind.

33 Which statements about the Bohr shift are correct?

1 The shift is accelerated by the action of carbonic anhydrase.

2 A decrease in blood pH will cause oxyhaemoglobin to dissociate.

3 A decrease in carbon dioxide concentration will cause more oxygen to bind to haemoglobin.

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

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34 Some of the events during a cardiac cycle are listed.

1 Left and right atria contract.

2 Left and right ventricles contract.

3 A wave of electrical activity is conducted by the Purkyne tissue.

4 A wave of electrical activity passes through the atrioventricular node.

What is the correct sequence of events after the sinoatrial node sends out a wave of electrical activity?

A $1 \rightarrow 3 \rightarrow 4 \rightarrow 2$

B $1 \rightarrow 4 \rightarrow 3 \rightarrow 2$

C $2 \rightarrow 4 \rightarrow 3 \rightarrow 1$

D $4 \rightarrow 1 \rightarrow 3 \rightarrow 2$

35 Oxygen and carbon dioxide enter and leave the blood in the capillaries of the alveoli.

Which statement about this process is correct?

A Oxygen and carbon dioxide only pass through one cell layer to reach their destination.

B Oxygen moves out of the blood and carbon dioxide moves into the blood during gaseous exchange.

C Oxygen rapidly diffuses into the alveoli and carbon dioxide rapidly diffuses out of the alveoli due to the large surface area of the alveoli.

D The capillaries have the lowest blood pressure in the body which allows the blood cells to remain in the alveolar capillaries to maximise gas exchange.

36 Which statement is correct?

A Cholera is caused by the virus *Vibrio cholerae*.

B Mosquitoes are pathogens that cause malaria.

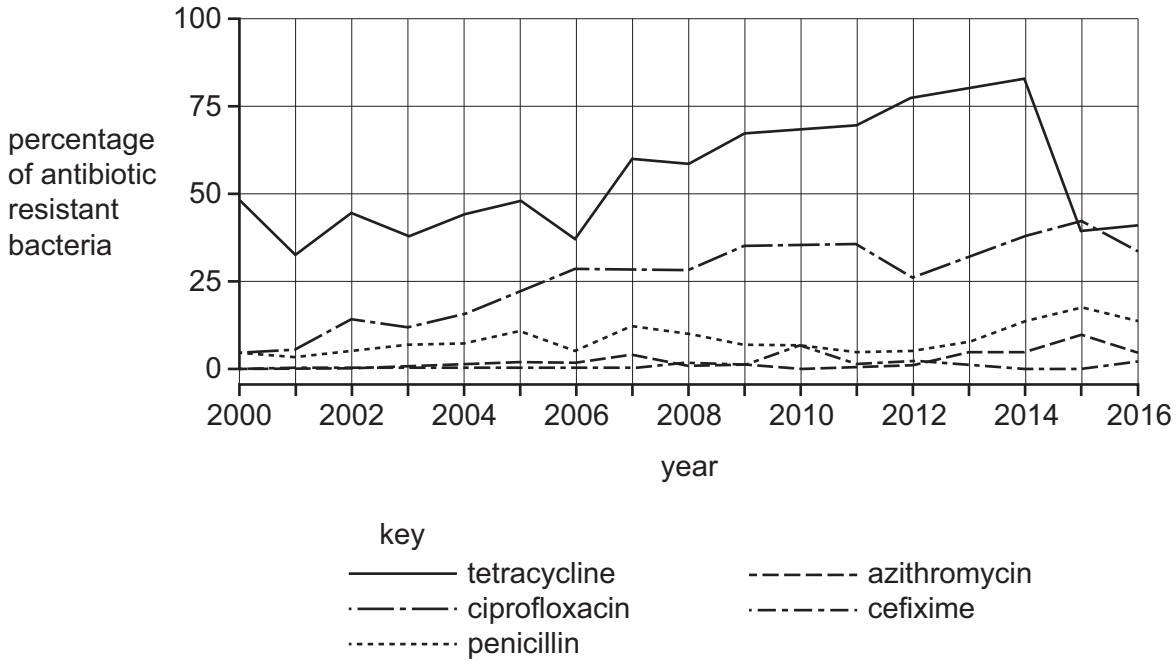
C *Mycobacterium bovis* only causes TB in humans.

D *Plasmodium vivax* is an example of a protoctist.

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37 The graph shows changes in the antibiotic resistance of a species of bacterium between 2000 and 2016 in one country. Samples of bacteria were collected every year from 48 hospitals. The bacteria were tested to see if they showed resistance to five different antibiotics.



What can be concluded from the data in the graph?

A Overuse of ciprofloxacin has caused antibiotic resistance to increase by more than 20% between 2000 and 2016.

B Percentage resistance to three of the antibiotics was at a peak in 2015.

C Changes in treatment guidelines have caused resistance to some antibiotics to decrease from 2015 to 2016.

D The percentage of resistant bacteria is higher in 2016 than 2000 for all antibiotics.

38 Some responses made by cells of the immune system to a pathogen are listed.

1 mitosis

2 bind to specific antigens

3 produce memory cells

4 secrete antibodies

Which responses are correct for B-lymphocytes?

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2, 3 and 4 only

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39 Which statements about uses of monoclonal antibodies are correct?

1 Monoclonal antibodies can be injected into patients to give active immunity.

2 Monoclonal antibodies can be injected into patients to treat viral infections.

3 Monoclonal antibodies can be used as diagnostic tests for specific pathogens.

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

40 Which statement explains how a vaccination programme can control the spread of an infectious disease in a population?

A Unvaccinated individuals are less likely to meet a vaccinated individual.

B Unvaccinated individuals are less likely to meet an infected individual.

C Vaccinated individuals cannot catch the disease.

D Vaccinated individuals have natural active immunity.

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