Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **February/March 2017**

1 hour

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

3372033796

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.

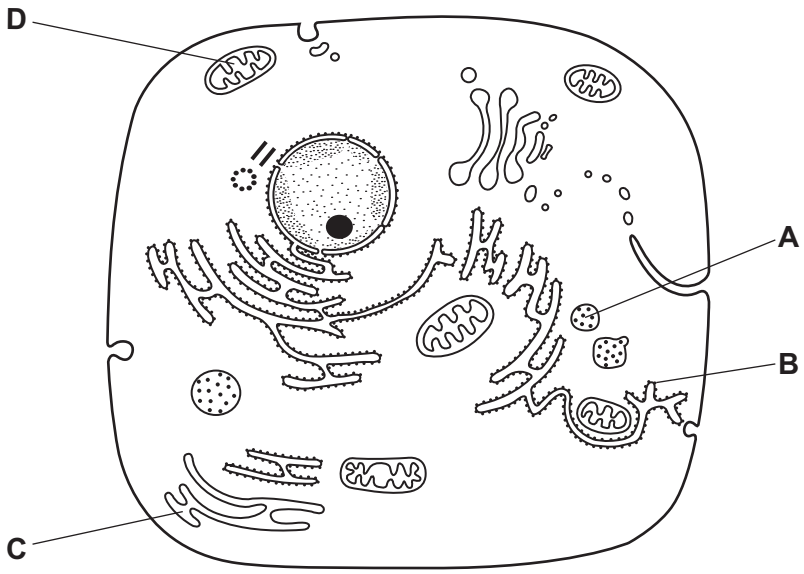
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.

This document consists of **17** printed pages and **3** blank pages.

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1 The diagram shows the ultrastructure of a typical animal cell.

Which structure synthesises and transports lipids?



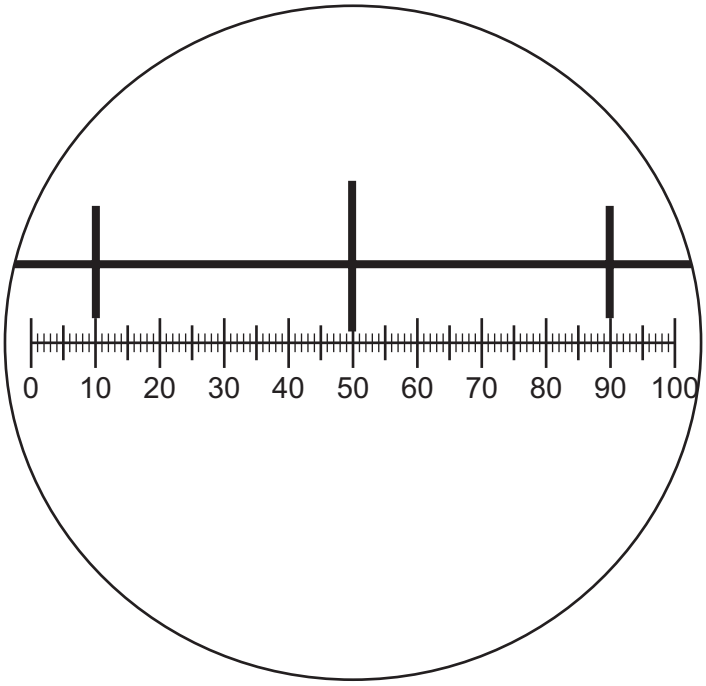
2 A light microscope is used to observe two structures that are 200 nm apart.

How far apart are the structures when the magnification is changed from ×40 to ×400?

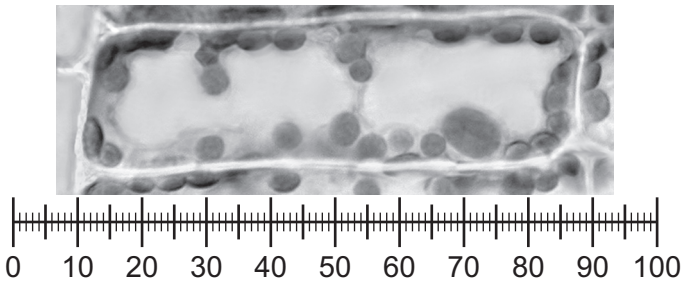
A 2 μm **B** 20 μm **C** 200 nm **D** 2000 nm

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3 The diagram shows a stage micrometer scale viewed through an eyepiece containing a graticule. The small divisions of the stage micrometer scale are 0.1 mm.



The stage micrometer scale is replaced by a slide of a plant cell.



What is the length of the nucleus in the plant cell?

A 0.8 mm **B** 8 μm **C** 25 μm **D** 200 μm

4 Some features of cells are listed.

1 cytoplasm

2 cell surface membrane

3 ribosomes

Which features are found in **both** animal and prokaryotic cells?

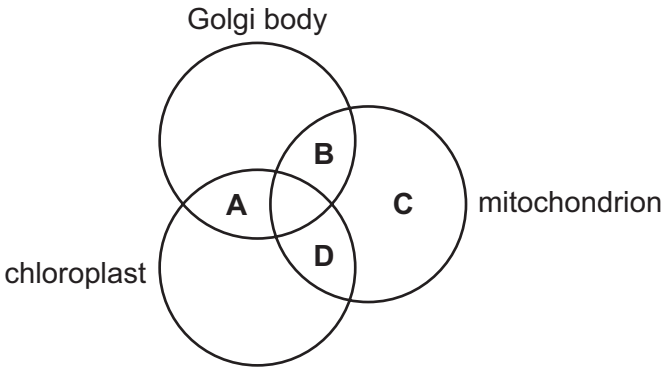
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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5 Which size of ribosomes is found in chloroplasts?

A 60S **B** 70S **C** 80S **D** 90S

6 In which of these organelles is ATP synthesised?



7 A sample of milk is tested with Benedict's solution. After boiling, a yellow colour is observed.

Which conclusion is correct?

A A high concentration of glucose is present.

B A low concentration of sucrose is present.

C No reducing sugars are present.

D Reducing sugars are present.

8 The table shows some information about carbohydrate polymers.

Which row describes amylose?

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

key
✓ = present
✗ = absent

9 Which row about α-glucose and β-glucose molecules is correct?

	carbon atom on which the OH position is different	cellulose contains both molecules
A	1	no
B	1	yes
C	4	no
D	4	yes

10 Some of the molecules found in animal tissues are grouped into three lists.

1 glucose, cholesterol, triglycerides, water

2 glycogen, antibodies, adenine, phospholipids

3 haemoglobin, carbon dioxide, mRNA, monosaccharides

Which lists include one or more molecules that always contain nitrogen atoms?

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

11 Haemoglobin consists of two α chains and two β chains. Approximately 5% of all humans have one amino acid in the β chain that has been changed, affecting the structure and stability of haemoglobin.

Which of the levels of protein structure could be changed in the haemoglobin of these humans?

A primary only

B primary and quaternary only

C primary, secondary, tertiary and quaternary

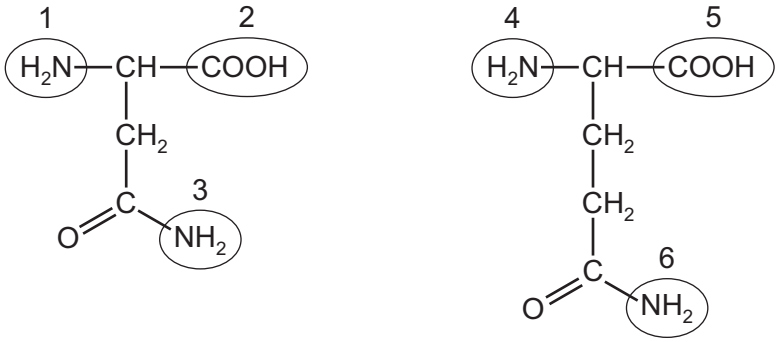
D secondary, tertiary and quaternary only

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12 Which row gives the correct description of **both** a collagen molecule and a collagen fibre?

	collagen molecule	collagen fibre
A	α and β polypeptide chains forming a double helix, held together by disulfide bonds	molecules of collagen arranged randomly to each other, linked by hydrogen bonds
B	a polypeptide chain, with repeating amino acids, forming an α-helix	three molecules of collagen, forming a triple helix, held together by hydrogen bonds
C	a polypeptide chain, with three repeating amino acids, forming a helix	three α helical collagen molecules, forming a triple helix, held together by ionic bonds
D	three helical polypeptide chains, forming a triple helix, held together by hydrogen bonds	molecules of collagen lying parallel and cross-linked to each other

13 The diagrams show the structures of two amino acids, each of which has two amine ($-NH_2$) groups.



A peptide bond is formed between the two amino acids.

Which groups could form the peptide bond?

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

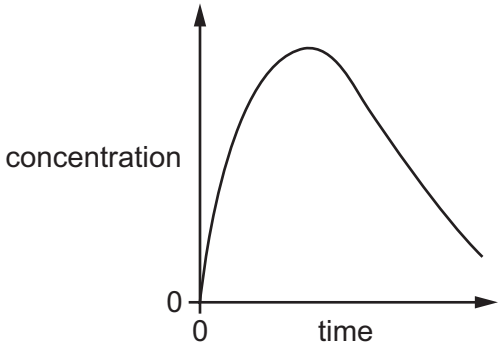
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14 An enzyme was added to a small excess of its substrate. All variables were kept constant.

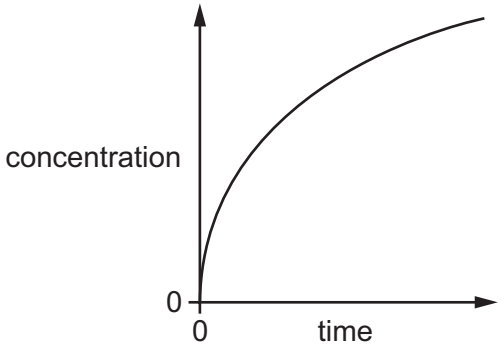
A student was asked to sketch a graph to show how the concentration of the enzyme-substrate complex changes over time.

Which graph shows this correctly?

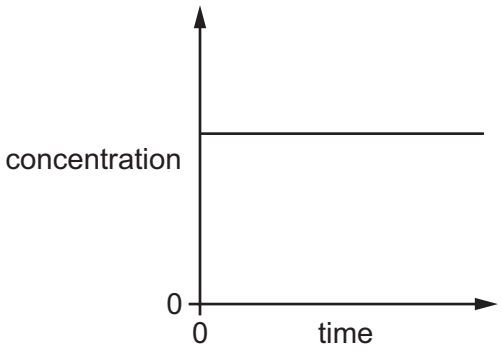
A



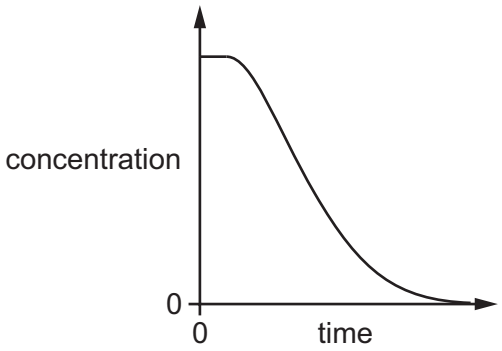
B



C



D



15 The table contains results recorded by a student from an investigation into the effect of temperature on an enzyme-catalysed reaction. All other variables were standardised.

temperature / °C	rate of reaction / arbitrary units
10	3
20	7
30	16
40	33
50	32
60	14

What is the correct conclusion?

A 40 °C was the optimum temperature.

B The data for 50 °C was anomalous.

C The optimum temperature was between 30 °C and 50 °C.

D The optimum temperature was between 40 °C and 50 °C.

16 What is the correct range of measurements for the width of the cell surface membrane?

A 0.5–1.0 nm **B** 5–10 nm **C** 50–100 nm **D** 0.5–1 μm

17 The cells in the roots of beetroot plants contain a red pigment.

When pieces of root tissue are soaked in cold water, some of the red pigment leaks out of the cells into the water.

An experiment was carried out to investigate the effect of temperature on the loss of red pigment from the root cells. It was found that the higher the temperature of the water, the higher the rate of loss of red pigment from the root cells.

Which of these statements could explain this trend?

1 Enzymes in the cells denature as the temperature increases, so the pigment can no longer be used for reactions inside the cells and diffuses out.

2 As the temperature increases, the tertiary structure of protein molecules in the cell surface membrane changes, increasing the permeability of the membrane.

3 Phospholipid molecules gain kinetic energy as temperature rises, increasing the fluidity of the phospholipid bilayer and allowing pigment molecules to diffuse out more easily.

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

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18 The cell surface membrane structure is described as a 'fluid mosaic'.

Which statement describes the 'mosaic' part of the cell surface membrane?

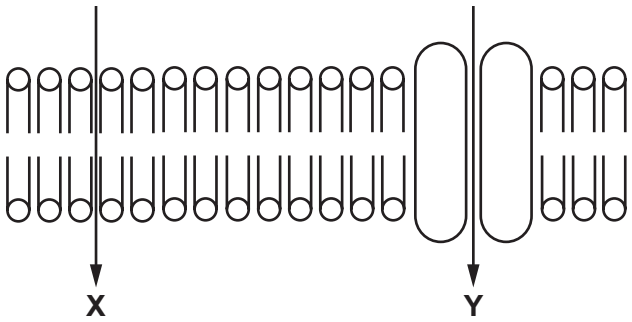
A the different patterns that are obtained by the moving phospholipid molecules

B the random distribution of cholesterol molecules within the phospholipid bilayer

C the regular pattern produced by the phospholipid heads and membrane proteins

D the scattering of the different proteins within the phospholipid bilayer

19 The diagram shows two pathways, **X** and **Y**, through which molecules can diffuse across a cell surface membrane.



Which row correctly shows possible pathways for lipids, water and glucose?

	lipids	water	glucose
A	X only	X and Y	Y only
B	X only	Y only	Y only
C	X and Y	X only	X and Y
D	X and Y	X and Y	X only

20 Some stem cells divide and give rise to phagocytes.

Where in the human body do these stem cells divide?

1 blood

2 bone marrow

3 lymph nodes

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

21 What is the correct sequence of stages in the mitotic cell cycle?

A G1 → G2 → mitosis → S → cytokinesis

B G1 → G2 → S → mitosis → cytokinesis

C G1 → S → G2 → mitosis → cytokinesis

D S → G1 → mitosis → G2 → cytokinesis

22 The enzyme telomerase repairs telomeres. It stops the telomeres from getting shorter each time a chromosome is replicated.

Telomerase is not normally active in human body cells, but in some diseases telomerase can be activated.

In which disease is the enzyme telomerase activated?

A cancer

B HIV/AIDS

C malaria

D myasthenia gravis

23 The statements describe events during the mitotic cell cycle.

1 Chromosomes migrate to opposite poles of the spindle.

2 Chromosomes arrange themselves at the equator of the spindle.

3 Chromosomes condense and the nuclear membrane disappears.

4 Centromeres divide.

What is the correct order of three of these events in the mitotic cell cycle?

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

24 Which statement about nitrogenous bases is correct?

A Adenine is a pyrimidine with a double ring structure.

B Cytosine is a purine with a double ring structure.

C Guanine is a purine with a single ring structure.

D Uracil is a pyrimidine with a single ring structure.

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25 Rifampicin is an antibiotic used to treat tuberculosis.

It works by inhibiting RNA polymerase in bacteria.

Which of these processes will be **directly** inhibited by this antibiotic?

1 ATP synthesis

2 transcription

3 translation

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

26 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 contained only heavy nitrogen.

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

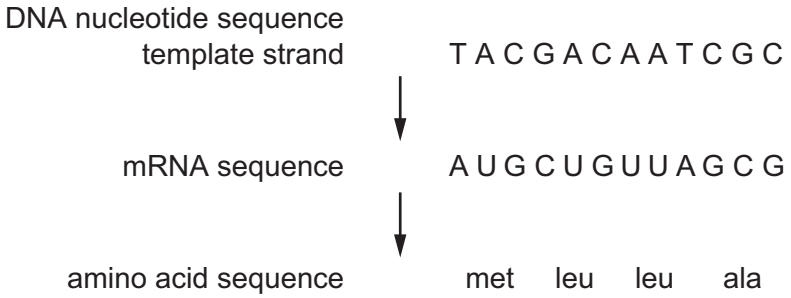
Some bacteria were collected from each of the **next** three generations and their DNA was analysed.

Hybrid DNA contains both heavy and light nitrogen.

Which row shows the correct DNA of the first and third generations?

	DNA of first generation	DNA of third generation
A	all hybrid	half hybrid, half light
B	all hybrid	one quarter hybrid, three quarters light
C	half hybrid, half heavy	half hybrid, one quarter heavy, one quarter light
D	half hybrid, half light	one quarter hybrid, three quarters light

27 The diagram shows the stages in the production of part of a polypeptide.



Which feature of the triplet code is illustrated by the information given?

A An amino acid can be coded for by more than one triplet.

B The triplet code is non-overlapping and is only read in one direction.

C The triplet code is universal for the DNA of all organisms.

D There are some triplets that code for 'start' and 'stop'.

28 Which combination of features is characteristic of a phloem sieve tube element as it unloads into a sink?

	water potential	lignification of the cell wall
A	higher than sink	absent
B	higher than sink	present
C	lower than sink	absent
D	lower than sink	present

29 Which statements correctly describe transport pathways in dicotyledonous plants?

1 In the symplast pathway, water may move through intercellular spaces.

2 The symplast pathway may be blocked by the tonoplast.

3 In the apoplast pathway, water does not move through plasmodesmata.

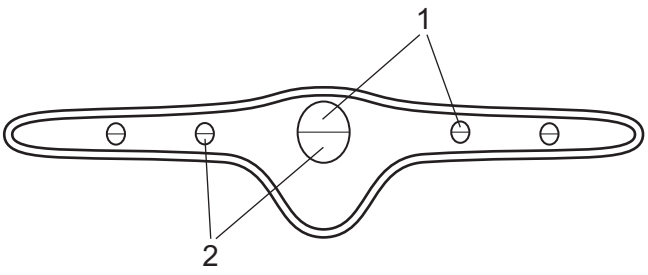
4 The apoplast pathway may be blocked by the Casparian strip.

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

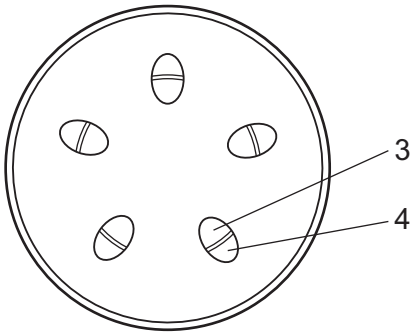
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30 The diagrams show transverse sections of parts of a plant.

leaf



stem



Which labelled structures transport mineral ions?

	1	2	3	4
A	✓	✗	✓	✗
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✓	✗	✓

key
✓ = yes
✗ = no

31 Which feature of transport in plants is correct for **both** xylem and phloem?

A It is passive.

B It occurs by mass flow.

C It occurs from source to sink.

D It occurs only in one direction.

32 What is the main function of a companion cell in phloem tissue?

A providing cytoplasmic contact with the sieve tube element for loading

B providing structural support for the sieve tube element

C providing the nucleus for cell division in the phloem

D providing the source of assimilates for storage

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[Turn over

33 The contraction of the heart is coordinated through electrical impulses passing through the cardiac muscle.

What is the correct order of part of the sequence of these impulses?

A right and left atria → atrioventricular node → Purkyne tissue → ventricular walls

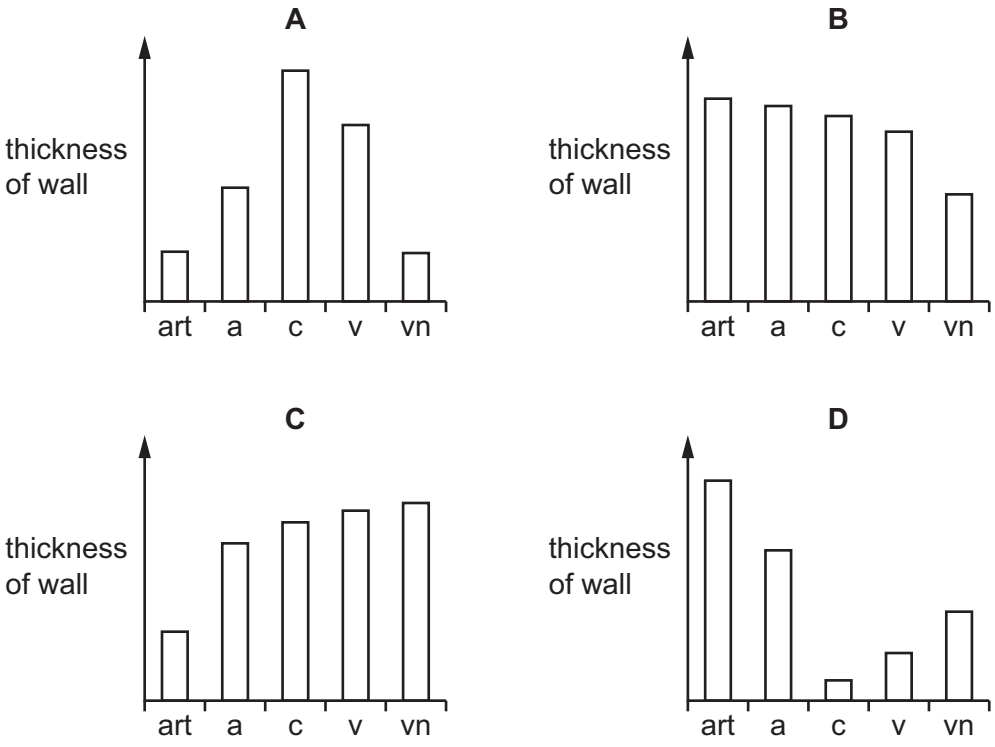
B right and left atria → Purkyne tissue → ventricular walls → atrioventricular node

C right and left atria → sinoatrial node → atrioventricular node → ventricular walls

D sinoatrial node → right and left atria → Purkyne tissue → atrioventricular node

34 As blood flows from an artery to a vein, the thickness of the walls of the vessels changes.

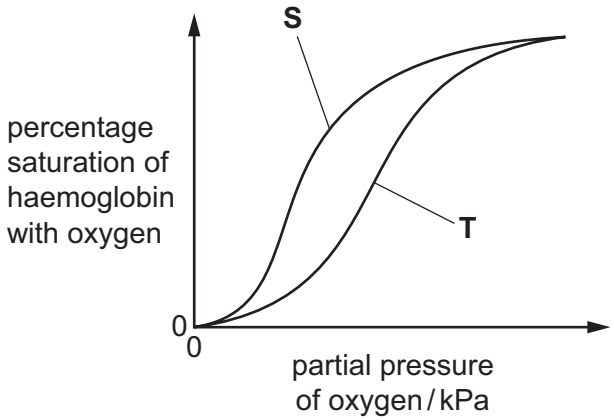
Which bar chart shows these changes correctly?



key

art = artery
a = arteriole (small artery)
c = capillary
v = venule (small vein)
vn = vein

35 The graph shows the oxygen dissociation curves of haemoglobin from two species of mammal, **S** and **T**.



Which statements could explain the difference in the oxygen dissociation curves of species **S** and species **T**?

1 Species **T** has a lower haemoglobin concentration in its red blood cells than species **S**.

2 The haemoglobin in species **T** has a lower affinity for oxygen than the haemoglobin in species **S**.

3 Species **T** lives at higher altitudes than species **S**.

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

36 Which tissues may be found in bronchioles?

A cartilage, ciliated epithelium, glandular tissue

B ciliated epithelium, elastic fibres, smooth muscle

C elastic fibres, cartilage, smooth muscle

D smooth muscle, glandular tissue, cartilage

37 Which of these statements could describe the effect of carbon monoxide in cigarette smoke?

1 It binds irreversibly to haemoglobin.

2 It causes mucus to accumulate in the bronchioles.

3 It results in more carbon dioxide being transported in the blood.

4 It temporarily increases the heart rate.

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

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38 The global mortality figures for some diseases in 2002 are shown in the table.

cause of death	millions of deaths	percentage of all deaths
HIV/AIDS	2.8	4.4
TB	1.6	2.7
malaria	1.3	2.2
measles	0.6	1.1

How many millions of people died from viral diseases listed in the table in 2002?

A 2.2 **B** 3.4 **C** 3.8 **D** 4.4

39 Which of the statements could describe **both** B-lymphocytes and T-lymphocytes?

1 They contain specific protein receptors in their cell surface membranes.

2 They differentiate into plasma cells.

3 They divide by mitosis.

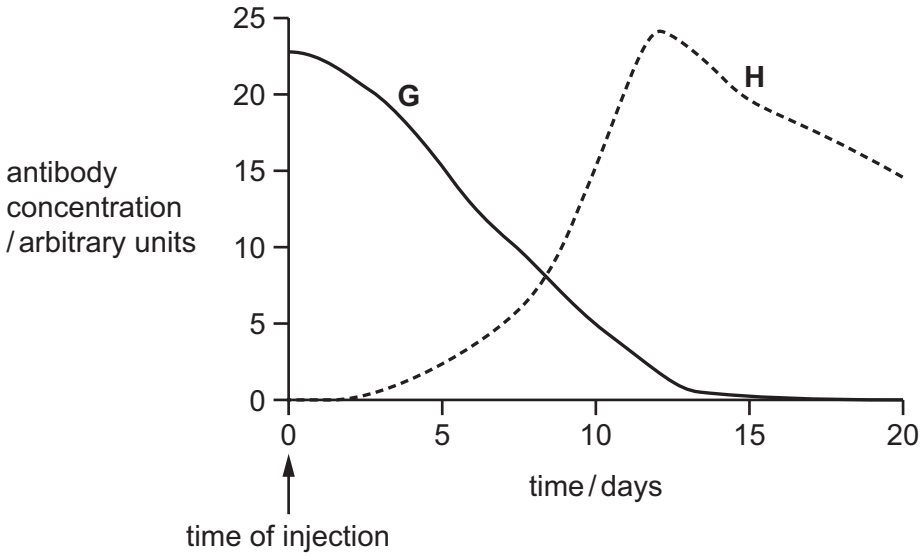
A 1 and 3 **B** 1 only **C** 2 and 3 **D** 2 only

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40 Two people, **G** and **H**, were each given an injection to protect them against a particular pathogen.

One person was injected with antibodies. The other person was injected with a vaccine.

The graph shows the concentrations of the antibody against this pathogen in the blood of the two people, **G** and **H**, over a period of 20 days following the injection.



Which row correctly describes the type of immunity shown by **G** and **H**?

	G	H
A	artificial active immunity	artificial passive immunity
B	artificial passive immunity	artificial active immunity
C	natural active immunity	natural passive immunity
D	natural passive immunity	artificial active immunity

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