

1 The actual length of a cell structure is 8 μm .

Which steps are used to calculate the magnification of an electron micrograph of this cell structure?

- step 1 measure the length of the cell structure image on the micrograph in centimetres
- step 2 measure the length of the cell structure image on the micrograph in millimetres
- step 3 divide the image length by 1000
- step 4 multiply the image length by 1000
- step 5 divide by 8
- step 6 multiply by 8

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

2 What is the typical resolution of a microscope using daylight as a light source with a $\times 10$ eyepiece lens and a $\times 40$ objective lens?

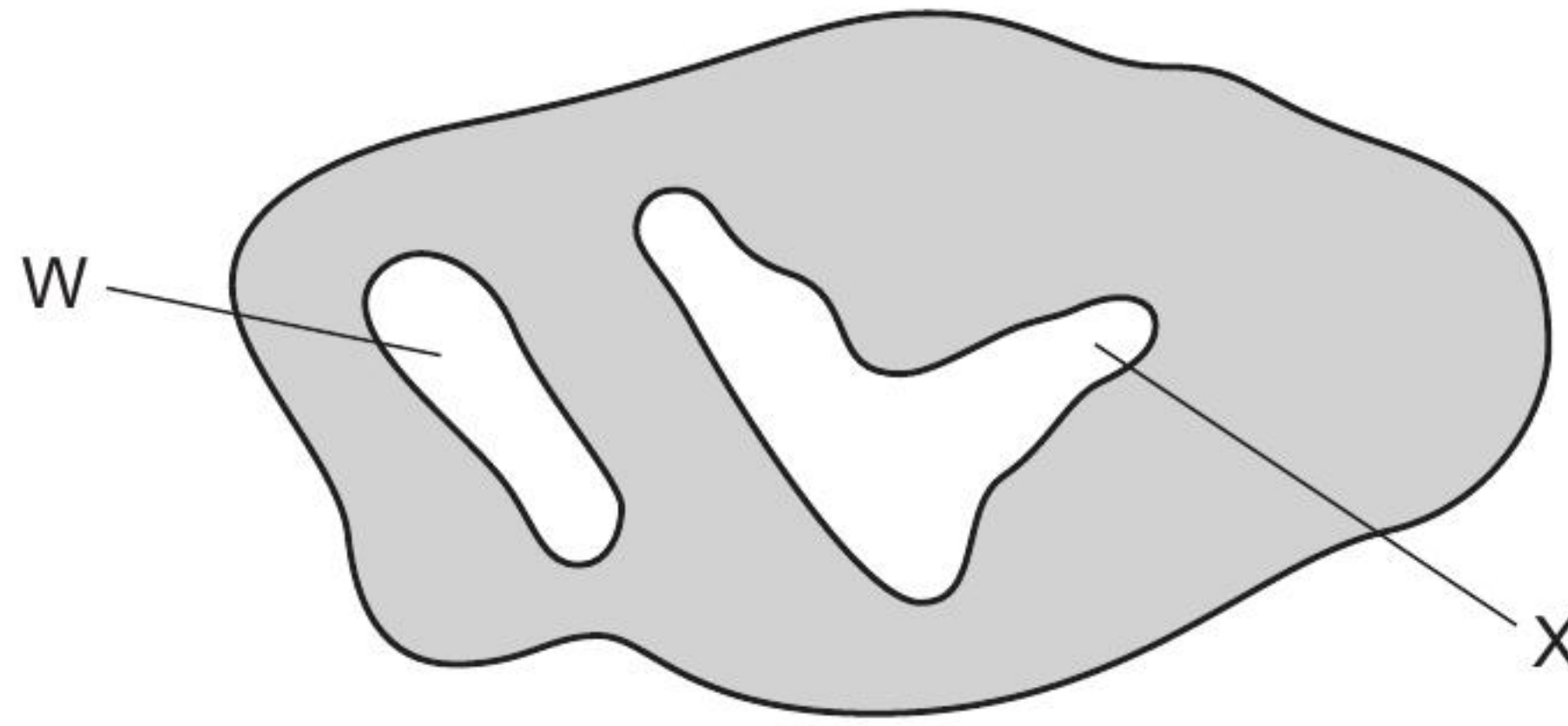
- A** 0.20 nm
- B** 200 nm
- C** 100 μm
- D** 400 μm

3 Two different types of cell, P and Q, were broken up using ultrasound and their contents analysed. Both types of cell contained small circular DNA. The circular DNA from P all carried the same base sequence, but those from Q were of two types, with different base sequences.

What may be concluded about the identity of cell types P and Q?

| | P | Q |
|----------|------------------------|---|
| A | heart muscle fibres | root cortical cells |
| B | lymphocytes | mature red blood cells contaminated by bacteria |
| C | mature red blood cells | phloem sieve tube element |
| D | root cortical cells | leaf mesophyll cells |

27 The diagram shows a cross-section through a mammalian heart.



Which chambers of the heart are represented by W and X?

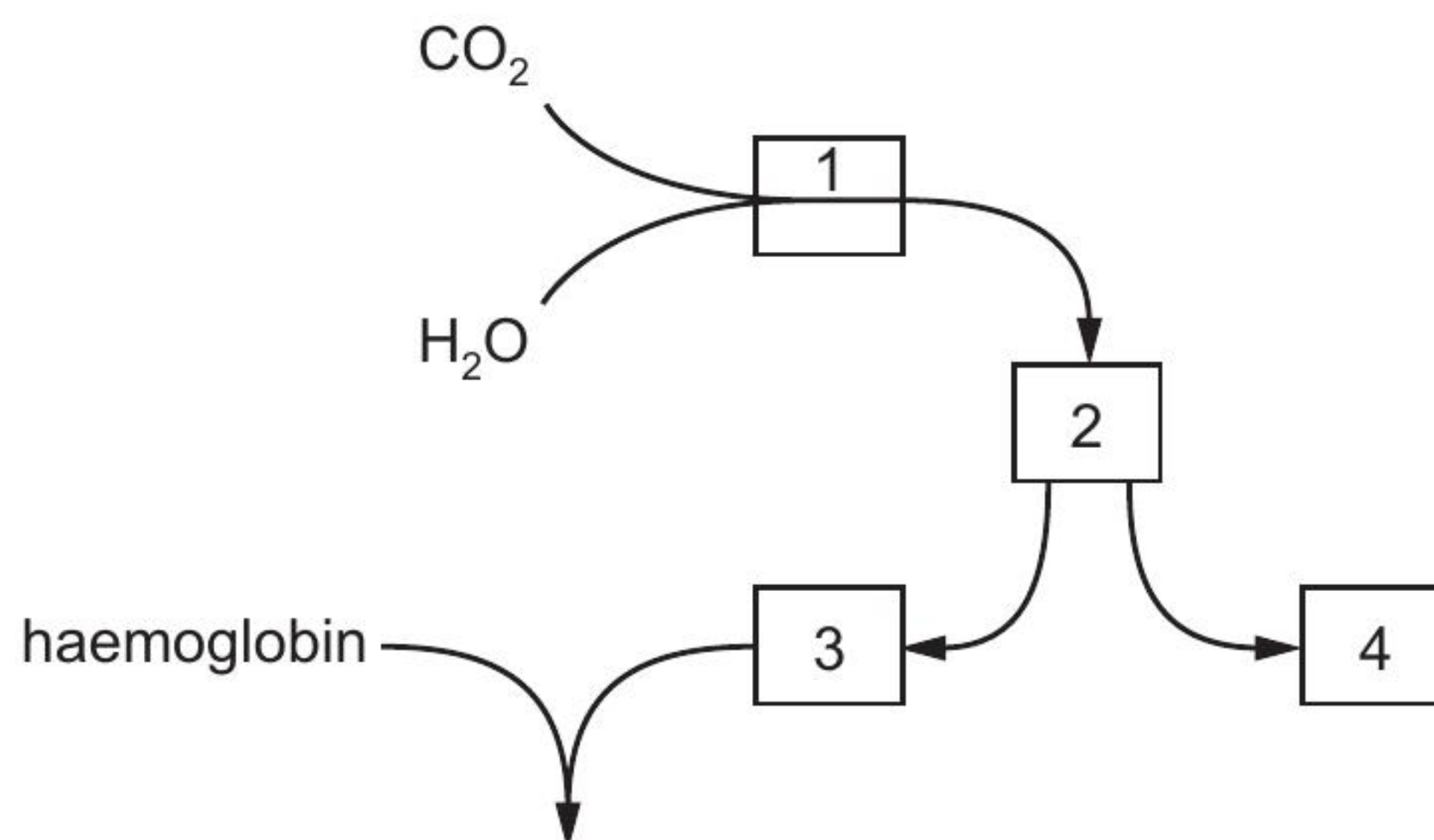
| | W | X |
|----------|-----------------|-----------------|
| A | left ventricle | right ventricle |
| B | right atrium | left atrium |
| C | right atrium | right ventricle |
| D | right ventricle | left ventricle |

28 At a certain point in a cardiac cycle, the pressure in the right ventricle is lower than that in the right atrium and lower than that in the pulmonary artery.

Which row is correct?

| | atrioventricular valve | semilunar valve |
|----------|------------------------|-----------------|
| A | closed | closed |
| B | closed | open |
| C | open | closed |
| D | open | open |

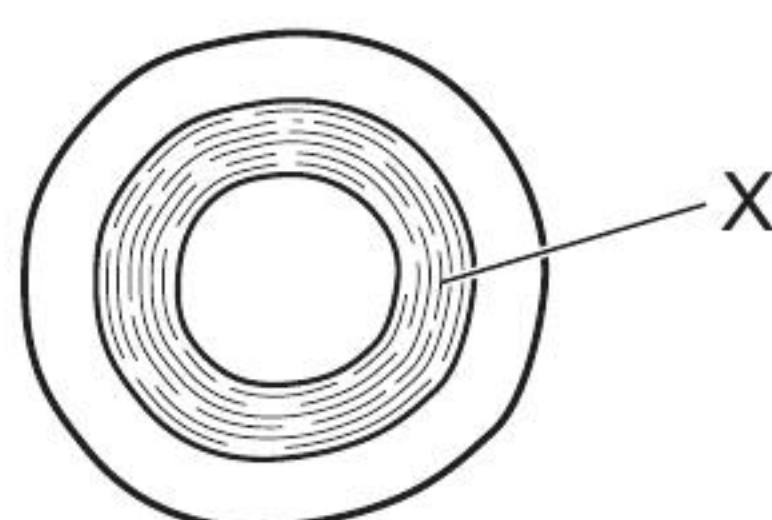
29 The diagram shows the pathway for the transport of carbon dioxide that occurs in red blood cells.



Which row is correct?

| | 1 | 2 | 3 | 4 |
|----------|----------------------|--------------------|------------------------|------------------------|
| A | carbaminohaemoglobin | haemoglobinic acid | hydrogen ions | hydrogencarbonate ions |
| B | carbonic anhydrase | carbonic acid | hydrogen ions | hydrogencarbonate ions |
| C | carboxyhaemoglobin | carbonic anhydrase | carbonic acid | carbon dioxide |
| D | haemoglobinic acid | carbonic acid | hydrogencarbonate ions | hydrogen ions |

30 The diagram shows a transverse section through an artery.



Which statement describes the tissues present in layer X?

- A** collagen and smooth muscle only
- B** elastic fibres and collagen only
- C** elastic fibres and smooth muscle only
- D** elastic fibres, collagen and smooth muscle

31 The large arteries close to the heart have a thick elastic layer in their walls.

Which statements about this layer are correct?

- 1 helps to maintain the blood pressure in arteries
- 2 reduces friction within the arteries
- 3 prevents too much pressure bursting the artery wall

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

32 Which tissues are present in the walls of a trachea and an alveolus?

| | | tissue | | key ✓ = present x = absent |
|----------|----------|------------------------------|---------------|--------------------------------------|
| | | epithelium with goblet cells | smooth muscle | |
| A | trachea | ✓ | ✓ | |
| | alveolus | x | x | |
| B | trachea | ✓ | ✓ | |
| | alveolus | x | ✓ | |
| C | trachea | ✓ | x | |
| | alveolus | ✓ | ✓ | |
| D | trachea | x | ✓ | |
| | alveolus | x | x | |

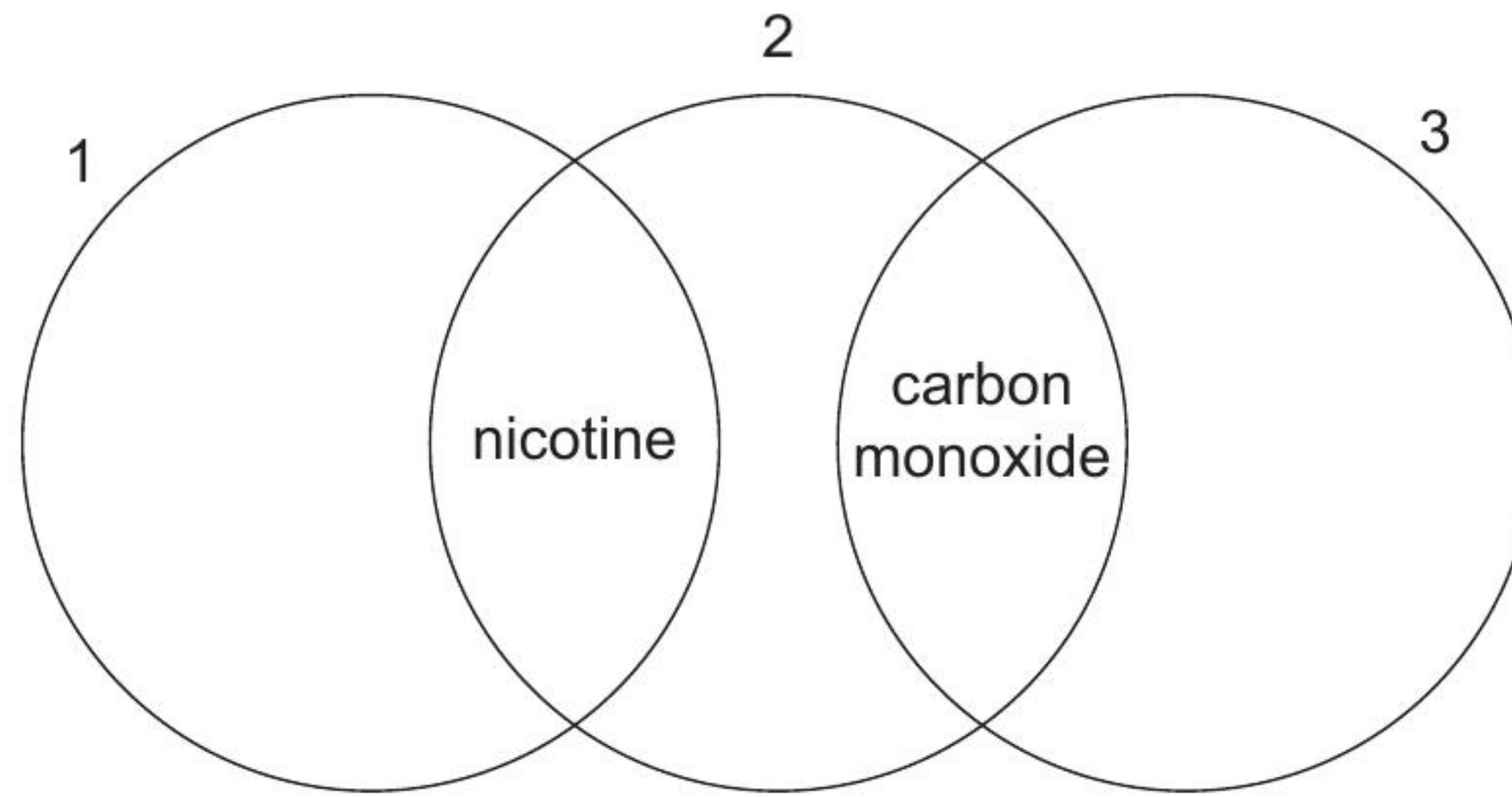
33 The surface tension of the layer of liquid lining the alveoli tends to pull the walls inwards so alveoli could collapse.

Which statements could explain how this is prevented?

- 1 Alveolar fluid is moved around by cilia.
- 2 Elastic fibres keep the alveoli open.
- 3 Epithelial cells secrete a chemical that reduces the cohesion in water.

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

34 The diagram shows some of the effects of nicotine and carbon monoxide in cigarette smoke.



Which row is correct?

| | 1 | 2 | 3 |
|----------|---|--|--|
| A | increase in heart rate | short-term effect on cardiovascular system | combines more readily with haemoglobin than oxygen |
| B | increases diameter of small arteries | can cause chronic bronchitis | combines irreversibly with haemoglobin |
| C | reduces the oxygen carrying capacity of blood | short-term effect on gas exchange system | reduces the blood supply to hands and feet |
| D | stimulates goblet cells to secrete more mucus | highly addictive | increases risk of blood clotting |

35 Which row correctly identifies the causative organism of each disease?

| | cholera | measles | smallpox | tuberculosis |
|----------|----------------|----------------------|----------------|----------------------|
| A | <i>Variola</i> | <i>Morbillivirus</i> | <i>Vibrio</i> | <i>Mycobacterium</i> |
| B | <i>Variola</i> | <i>Mycobacterium</i> | <i>Vibrio</i> | <i>Morbillivirus</i> |
| C | <i>Vibrio</i> | <i>Morbillivirus</i> | <i>Variola</i> | <i>Mycobacterium</i> |
| D | <i>Vibrio</i> | <i>Mycobacterium</i> | <i>Variola</i> | <i>Morbillivirus</i> |

36 The following advice was given to a person travelling to a country where there had been an outbreak of an infectious disease.

- cook food well and eat it hot
- peel fruit and vegetables
- drink only cool, boiled water
- wash hands often with soap and cool, boiled water

Which infectious disease would this advice help to protect against?

- A** cholera
- B** malaria
- C** measles
- D** tuberculosis

37 What is a **social** factor that affects the spread of malaria?

- A** an increase in drug resistant forms of malaria
- B** climate change
- C** difficulty in producing a vaccine
- D** migration of people because of wars

38 Which are specific immune responses?

- 1 phagocytosis
- 2 production of antibodies
- 3 production of memory cells

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

39 Newborn babies have natural passive immunity.

What is correct for this type of immunity?

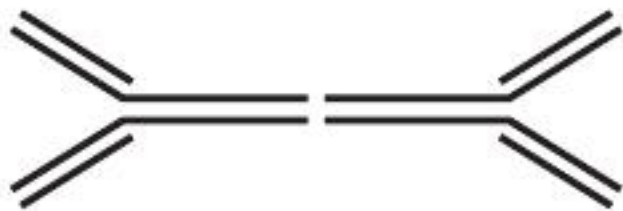
| | immunity is temporary | antibodies are broken down |
|----------|-----------------------|----------------------------|
| A | ✓ | ✓ |
| B | ✓ | ✗ |
| C | ✗ | ✓ |
| D | ✗ | ✗ |

key
✓ = correct
✗ = not correct

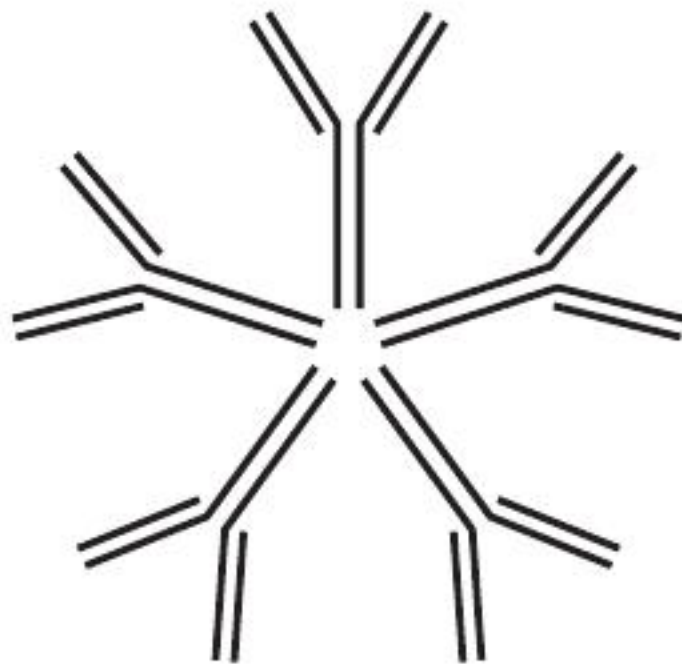
40 The diagrams show three different types of antibody structure.



IgG



IgA



IgM

Which row is correct?

| | IgG | IgA | IgM |
|---|--|--|---|
| A | one binding site for an antigen molecule | two light chains | two heavy chains |
| B | two heavy chains | four binding sites for antigen molecules | five hinge regions |
| C | two hinge regions | four heavy chains | five light chains |
| D | two light chains | four hinge regions | ten binding sites for antigen molecules |

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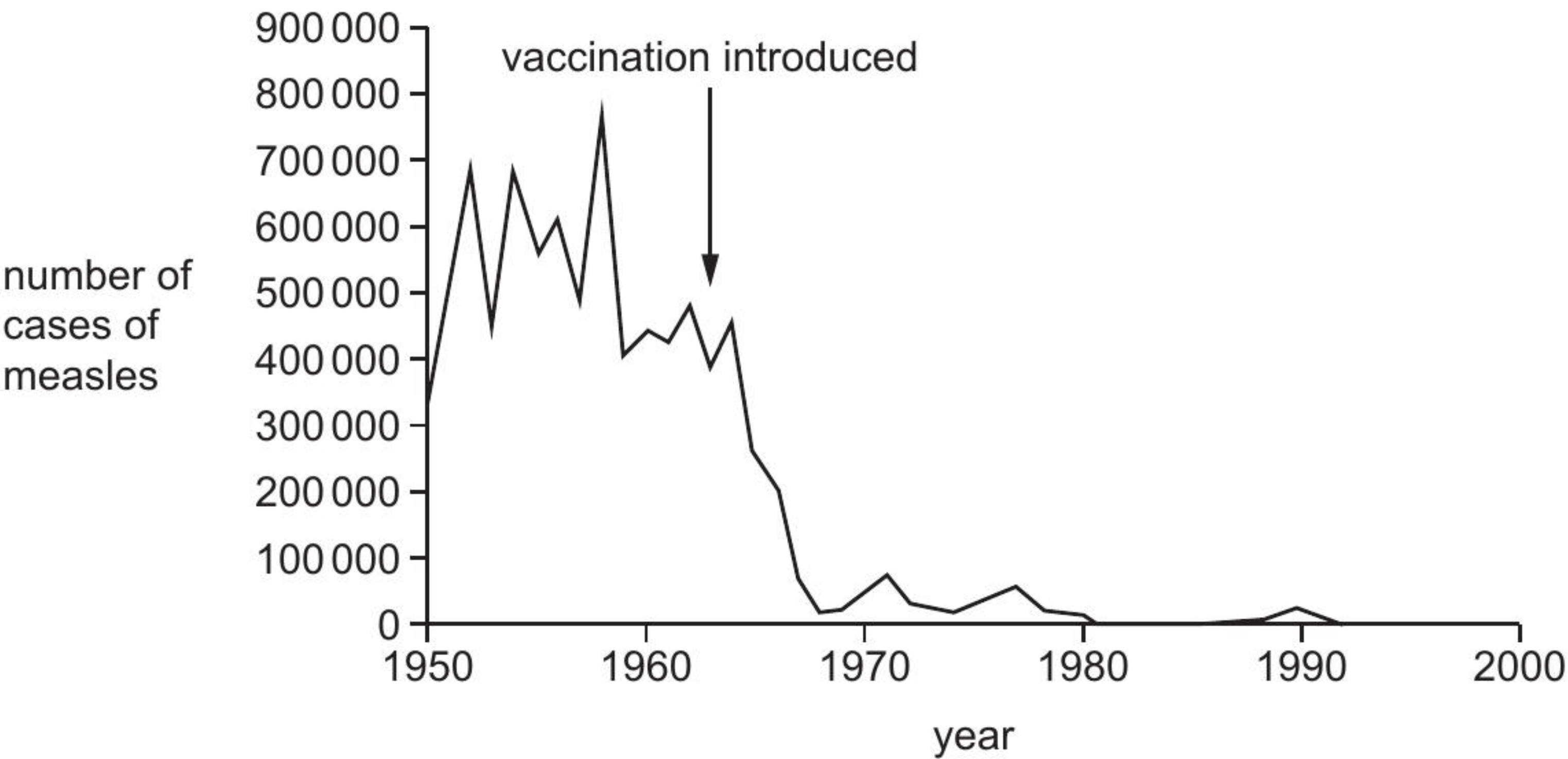
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40 Measles is an infectious disease caused by a virus.

The graph shows the number of cases of measles each year in a country before and after a vaccine was introduced.

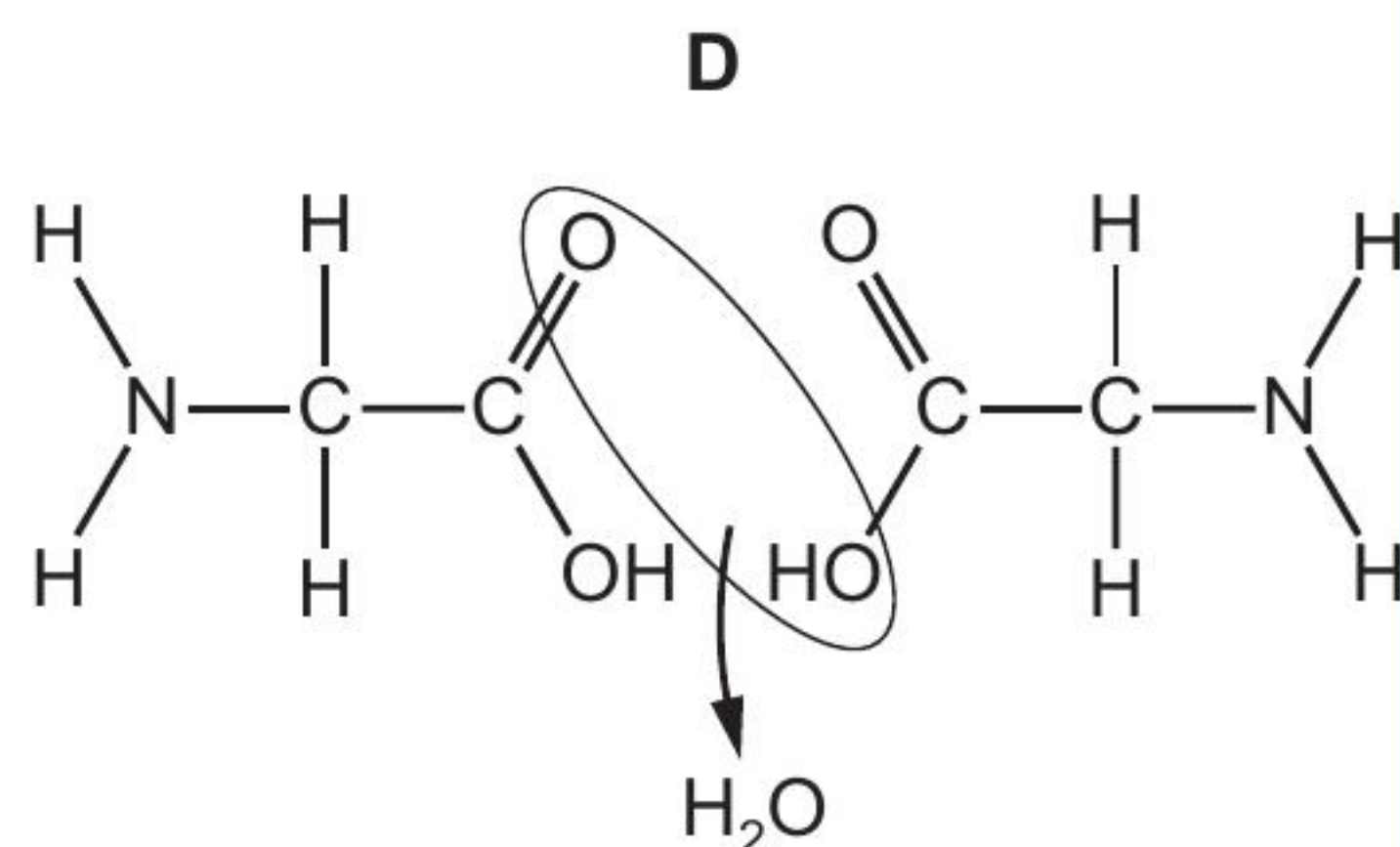
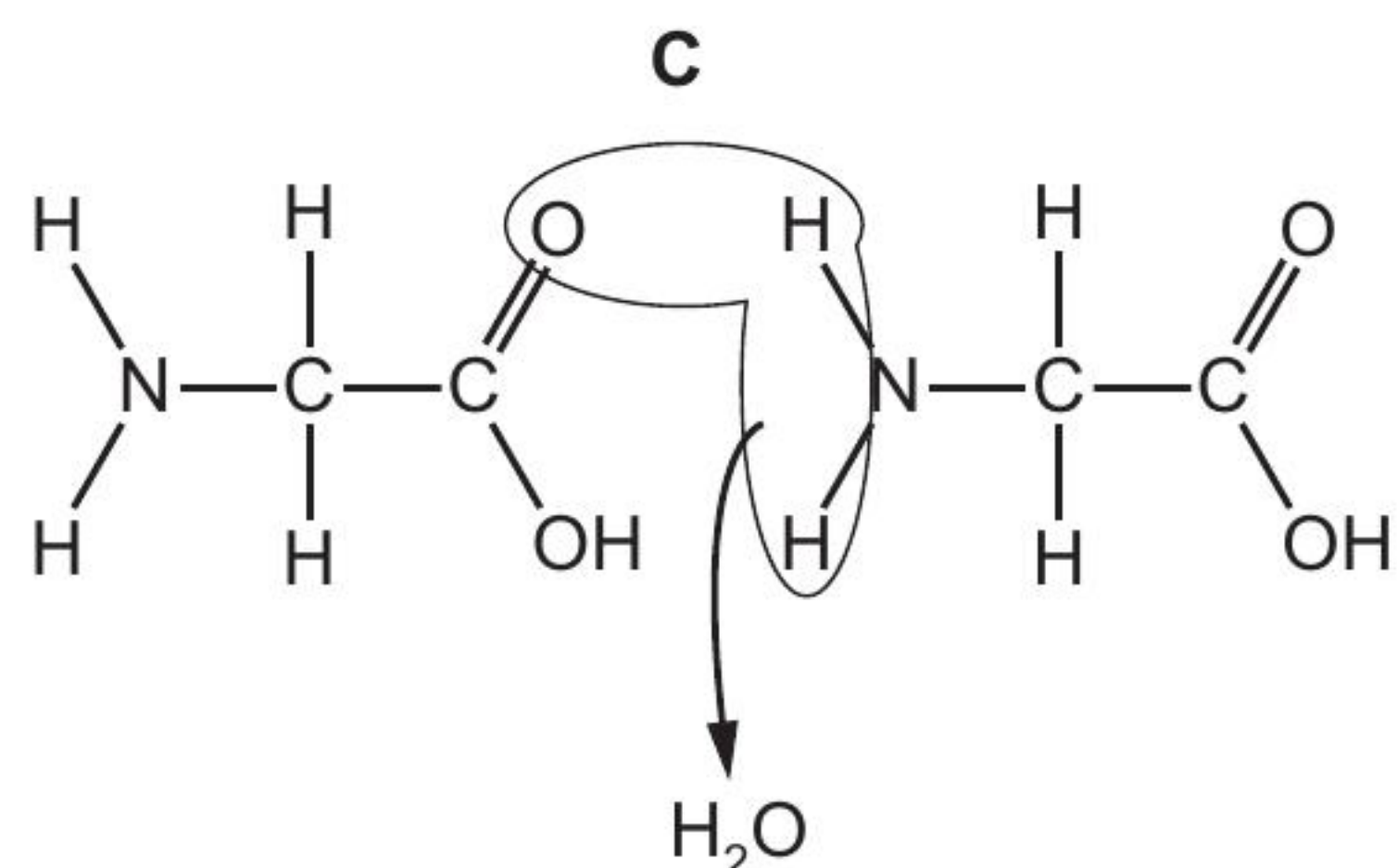
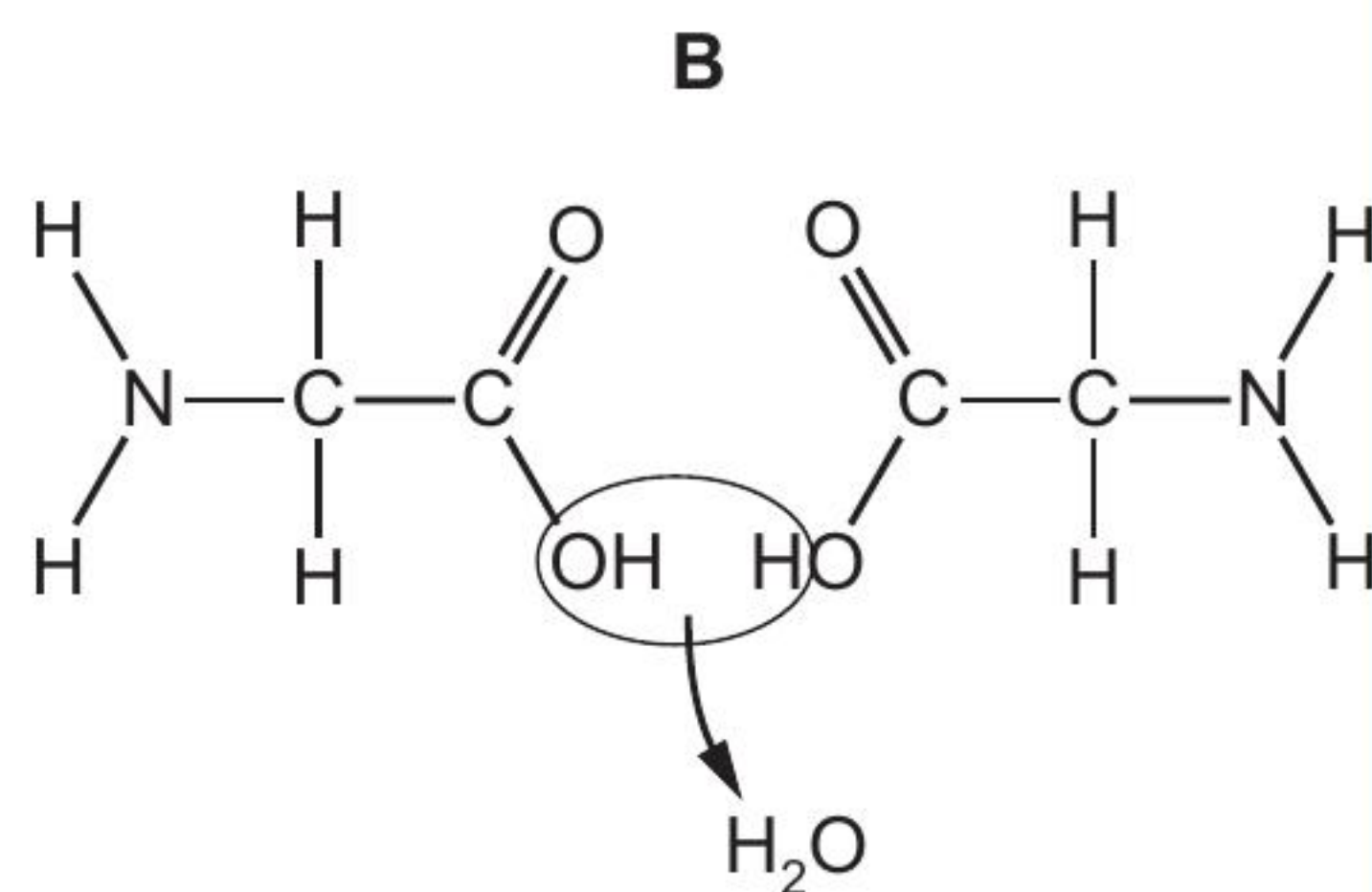
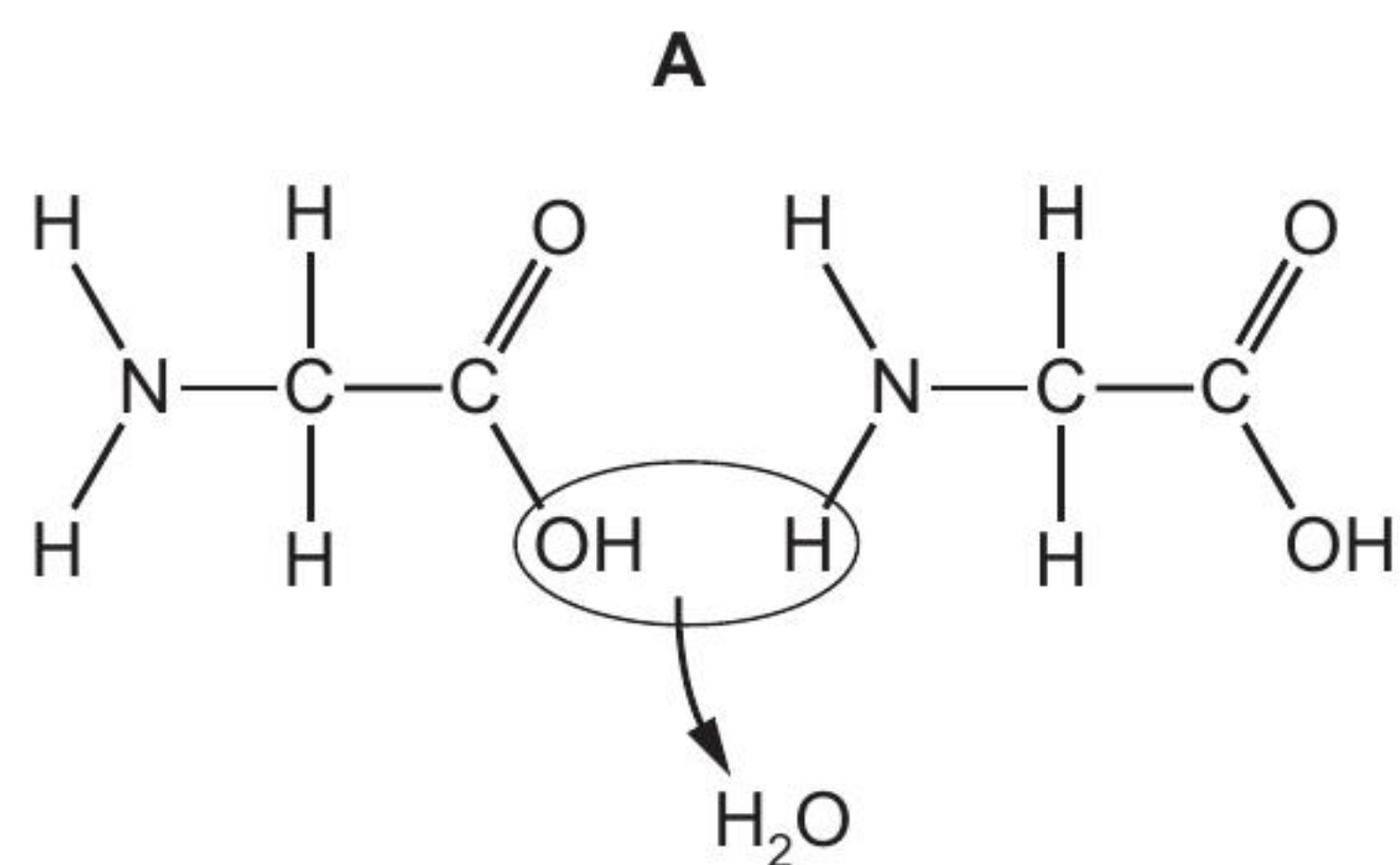


What could have caused the decrease in the number of cases of measles after vaccination was introduced?

| | vaccines provided artificial active immunity in people | vaccines provided artificial passive immunity in people | fewer people are able to act as hosts for the virus |
|---|--|---|---|
| A | ✓ | ✗ | ✓ |
| B | ✗ | ✓ | ✓ |
| C | ✗ | ✓ | ✗ |
| D | ✓ | ✗ | ✗ |

key
✓ = yes
✗ = no

7 Which diagram shows the formation of a peptide bond?



8 In enzyme-catalysed reactions, the position of the amino acids found at the active site is important.

During the synthesis of enzymes, amino acids are brought together in the correct position to form the active site.

Which levels of protein structure **must** be involved in forming the active site?

| | level of protein structure | | | |
|----------|----------------------------|-----------|----------|------------|
| | primary | secondary | tertiary | quaternary |
| A | ✓ | ✓ | ✓ | ✓ |
| B | ✓ | ✓ | ✓ | ✗ |
| C | ✗ | ✓ | ✓ | ✓ |
| D | ✗ | ✓ | ✗ | ✓ |

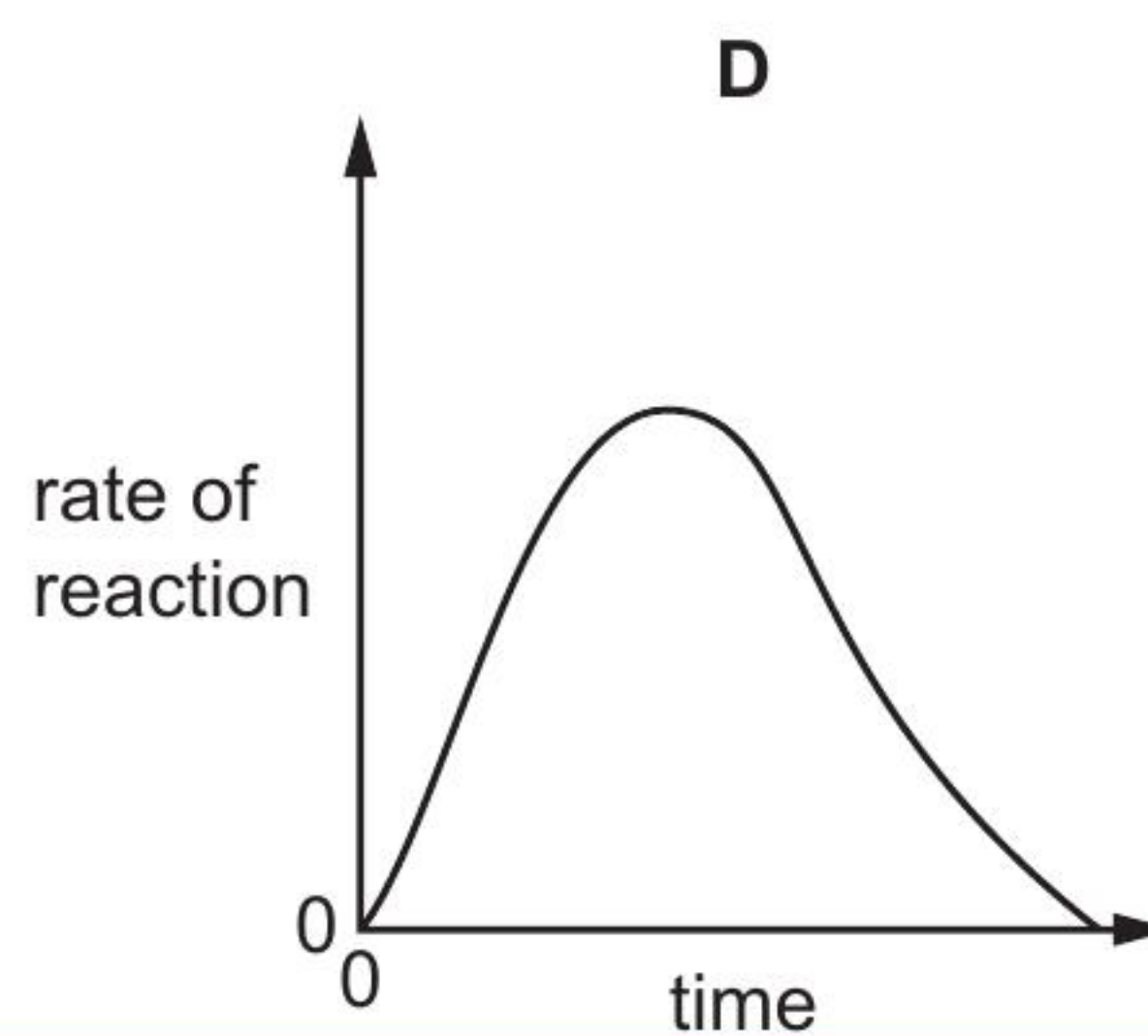
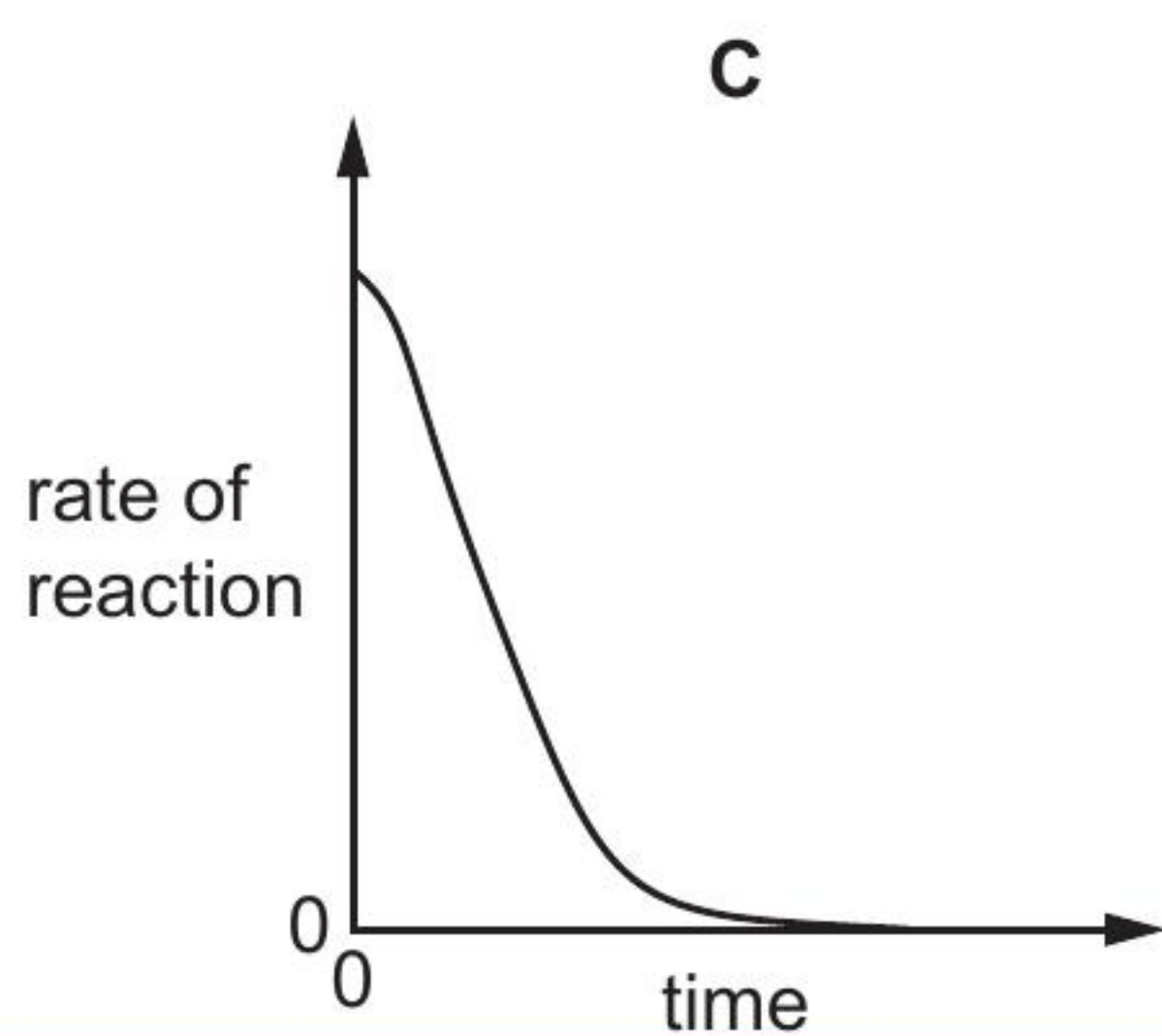
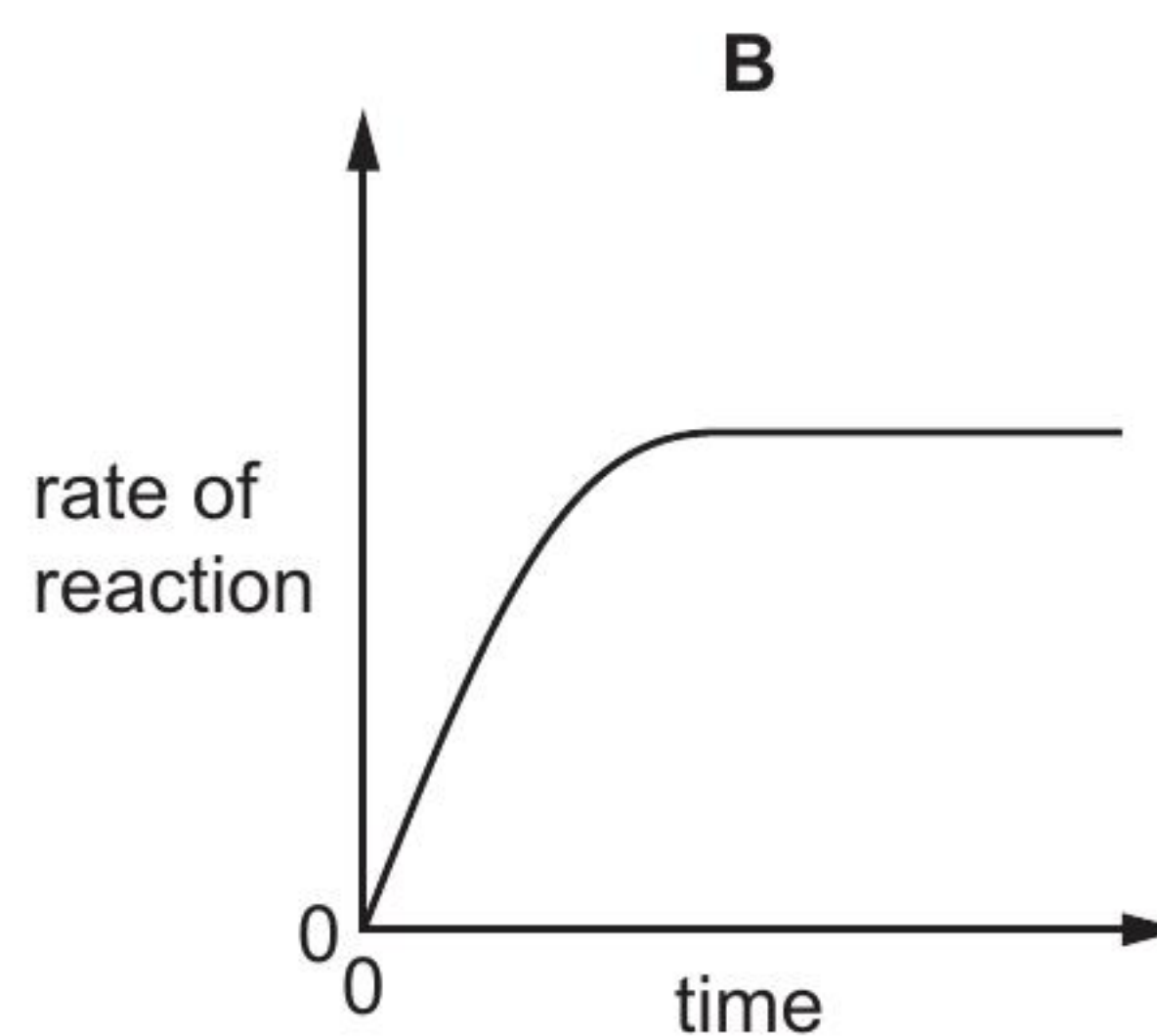
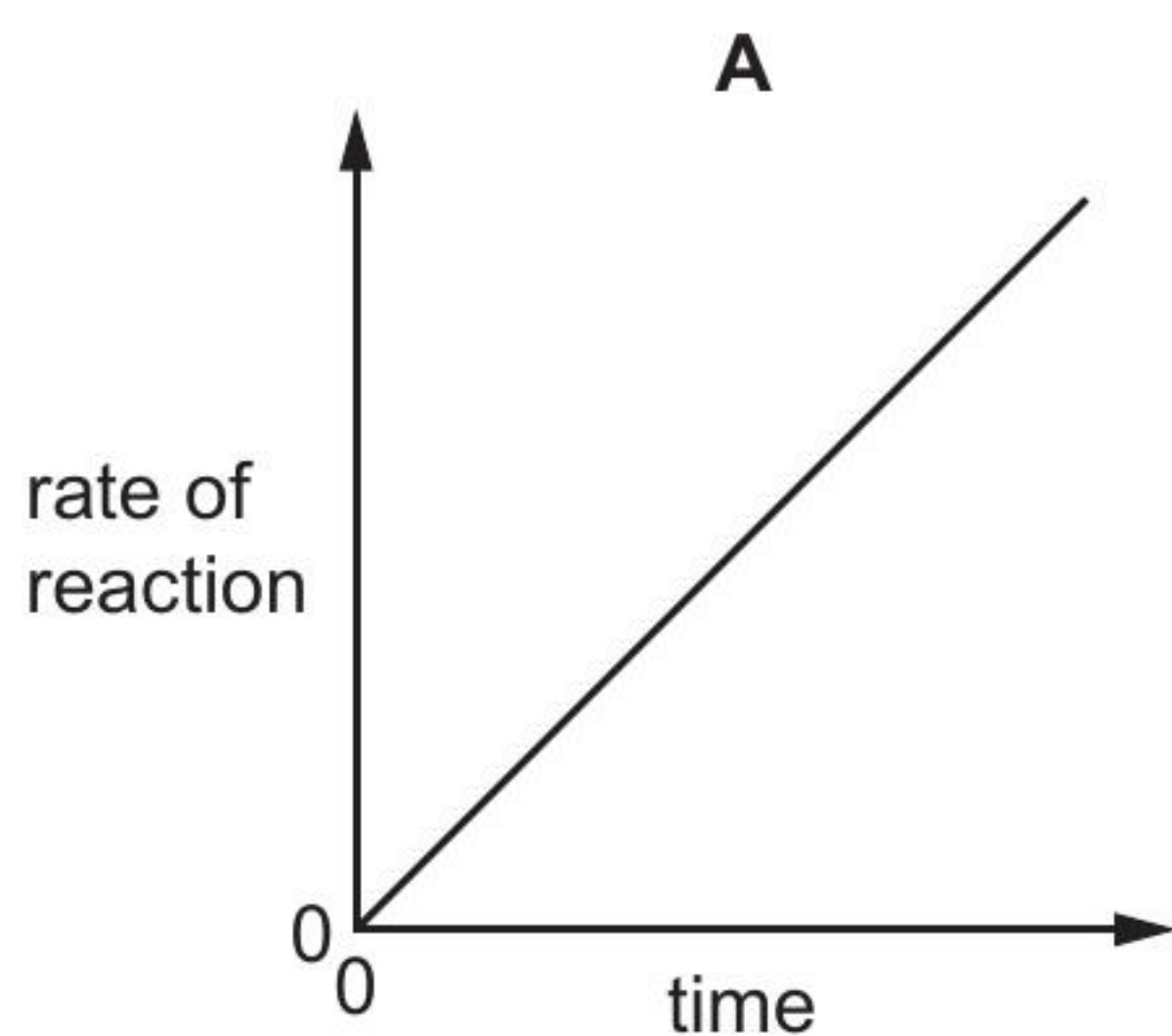
key

✓ = involved

✗ = not involved

- 11** A fixed volume and concentration of substrate and enzyme were mixed. All other variables were kept constant. The enzyme-catalysed reaction was left until it was complete.

Which graph shows how the rate of reaction changes with time?

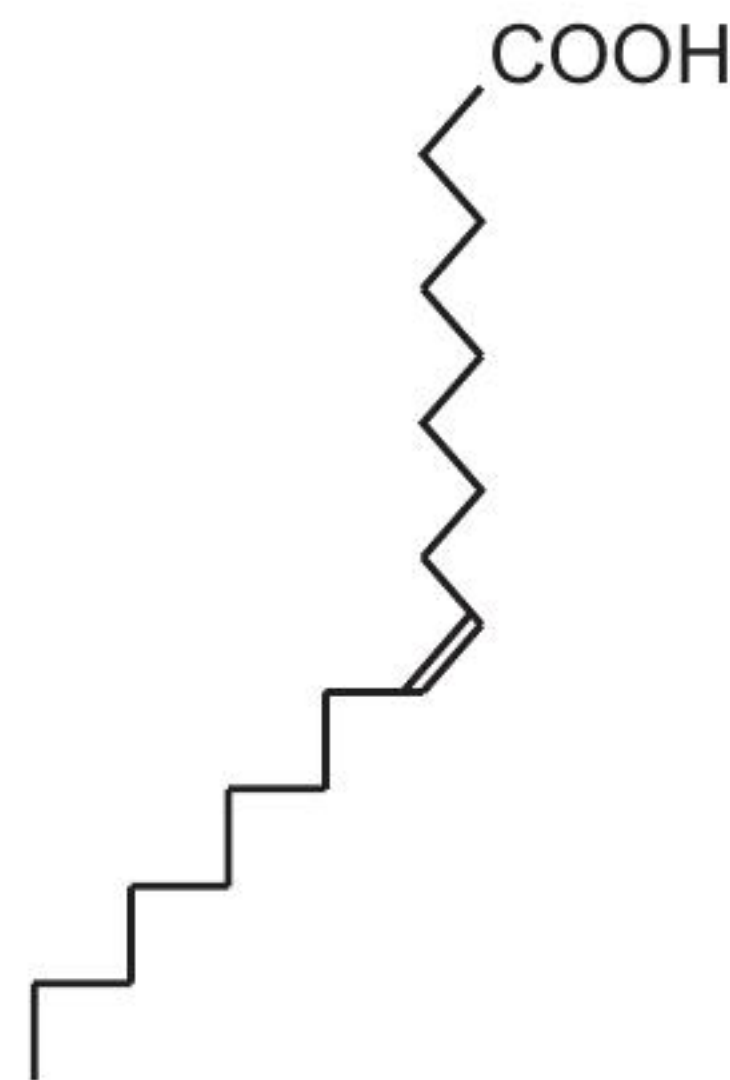


- 12** The fatty acids elaidic acid and oleic acid have exactly the same structural formulae, with one double bond in the chain. However, the shapes of the chains are different, as shown in the diagram.

elaidic acid



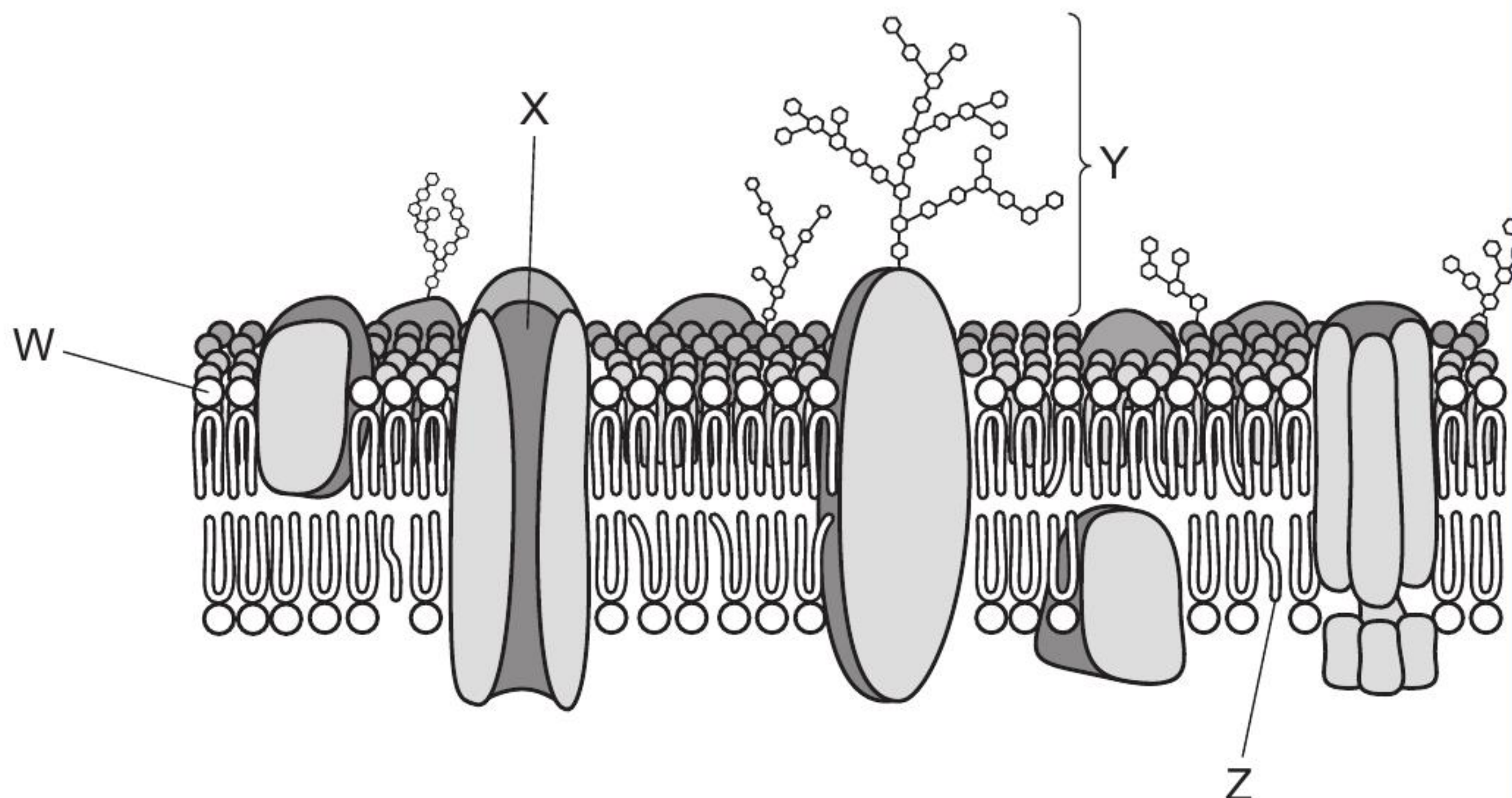
oleic acid



Which row shows the effect of the presence of these fatty acids on the structure and behaviour of a cell surface membrane?

| | elaidic acid | oleic acid |
|----------|---|---|
| A | does not fit closely with other fatty acids so that the membrane is less fluid at high temperatures | fits closely with other fatty acids so that the membrane is less fluid at low temperatures |
| B | does not fit closely with other fatty acids so that the membrane is more fluid at low temperatures | fits closely with other fatty acids so that the membrane is less fluid at low temperatures |
| C | fits closely with other fatty acids so that the membrane is less fluid at high temperatures | does not fit closely with other fatty acids so that the membrane is more fluid at low temperatures |
| D | fits closely with other fatty acids so that the membrane is more fluid at low temperatures | does not fit closely with other fatty acids so that the membrane is more fluid at high temperatures |

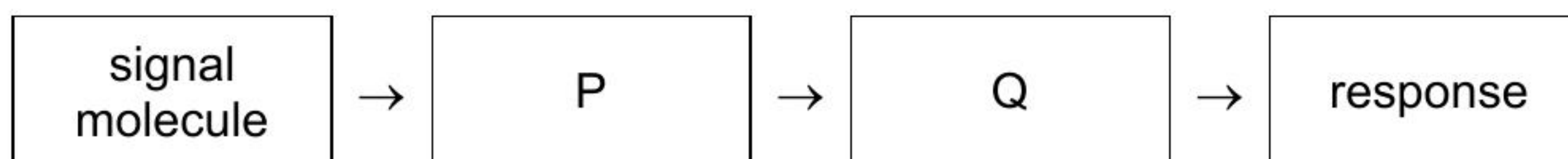
13 The diagram shows a cell surface membrane.



Which is a correct role for a labelled molecule?

- A** W is involved in controlling membrane stability.
- B** X is involved in active transport.
- C** Y is involved in cell signalling.
- D** Z is involved in diffusion of ions.

14 The diagram shows a simple cell signalling pathway in which a signal molecule leads to a response, such as a secretion.



Which row identifies P and Q?

| | P | Q |
|----------|----------------------------------|----------------------------------|
| A | activated enzyme in cytoplasm | target in cell surface membrane |
| B | lipid in cell surface membrane | extracellular enzyme |
| C | protein in cell surface membrane | activated enzyme in cytoplasm |
| D | target in cytoplasm | protein in cell surface membrane |

15 Three parts of a chromosome and their functions are listed.

| part | function |
|---------------------|------------------------------------|
| P1 centromere | F1 holds the coils of DNA together |
| P2 histone proteins | F2 holds two chromatids together |
| P3 telomere | F3 prevents loss of genes |

Which part is matched with its correct function?

- A** P1 and F1 **B** P2 and F1 **C** P2 and F3 **D** P3 and F2

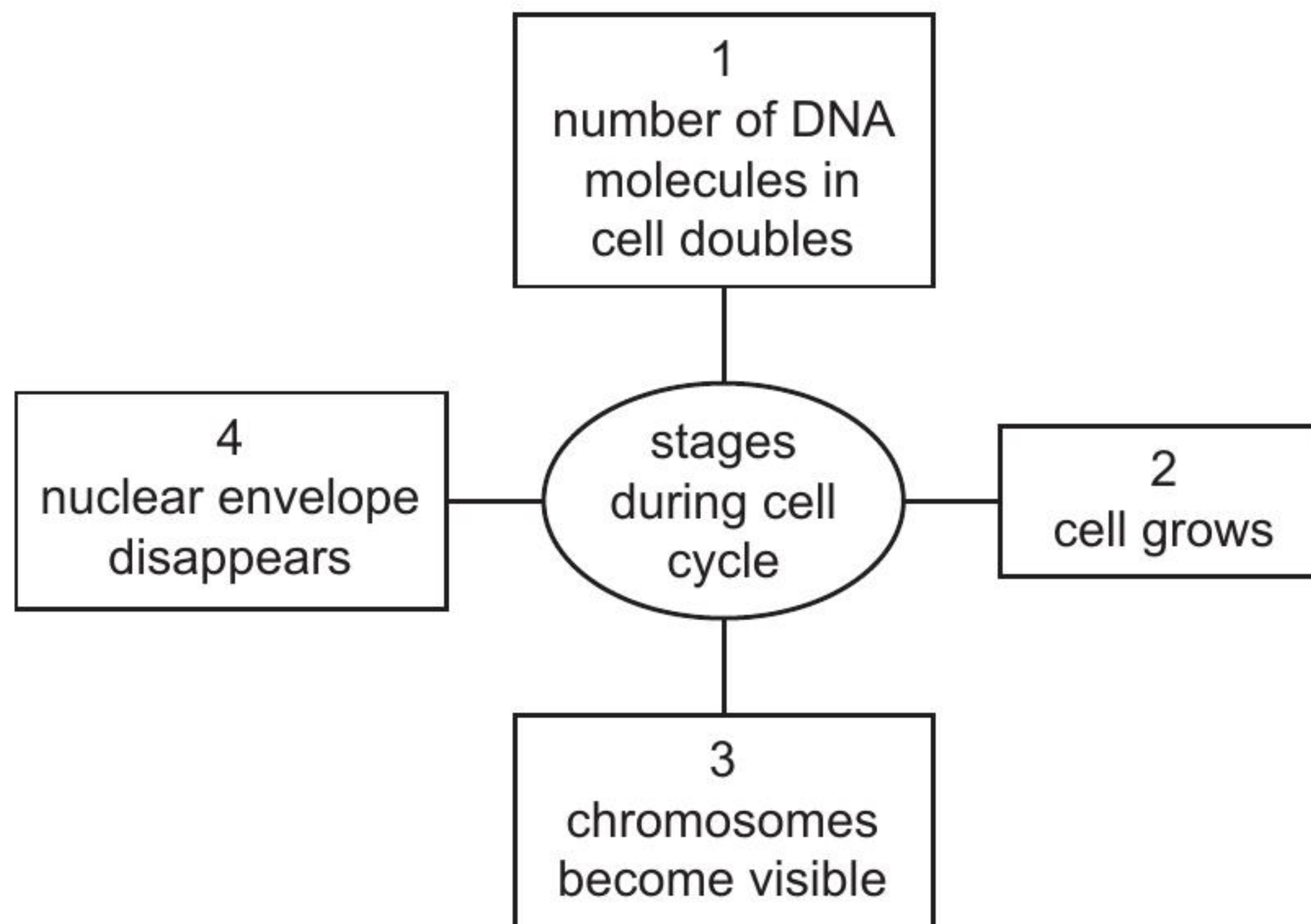
16 The enzyme telomerase prevents loss of telomeres after many mitotic cell cycles.

Which cells need to transcribe telomerase enzyme?

- 1 cancer cells
- 2 stem cells
- 3 activated memory B-lymphocytes

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

17 The diagram shows some of the stages which take place during the cell cycle.



Which two stages take place during interphase?

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

18 Which statement correctly describes the base pairing in a molecule of DNA?

- A** The purine adenine forms bonds with the pyrimidine thymine.
- B** The purine adenine forms bonds with the pyrimidine uracil.
- C** The purine cytosine forms bonds with the pyrimidine guanine.
- D** The purine guanine forms bonds with the pyrimidine thymine.

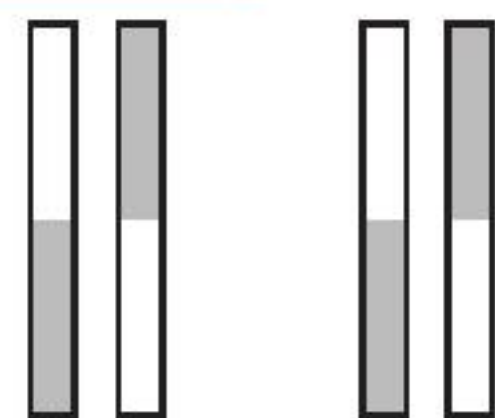
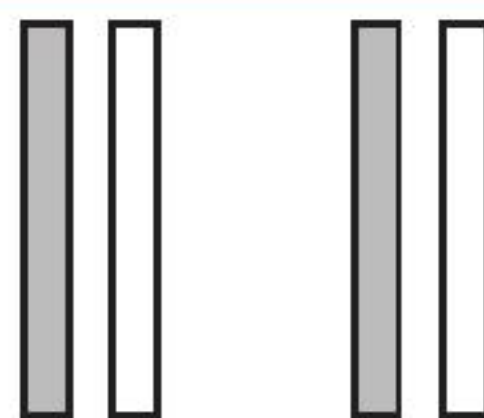
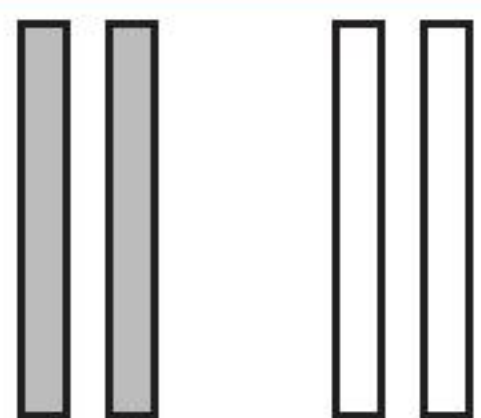
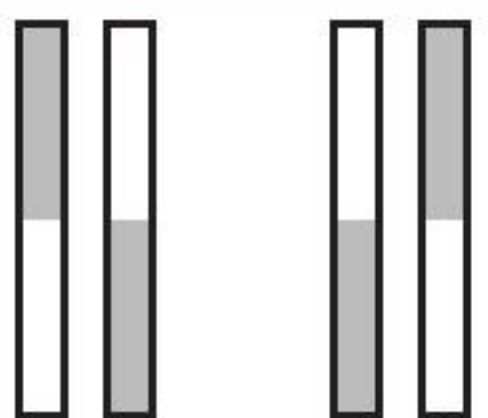
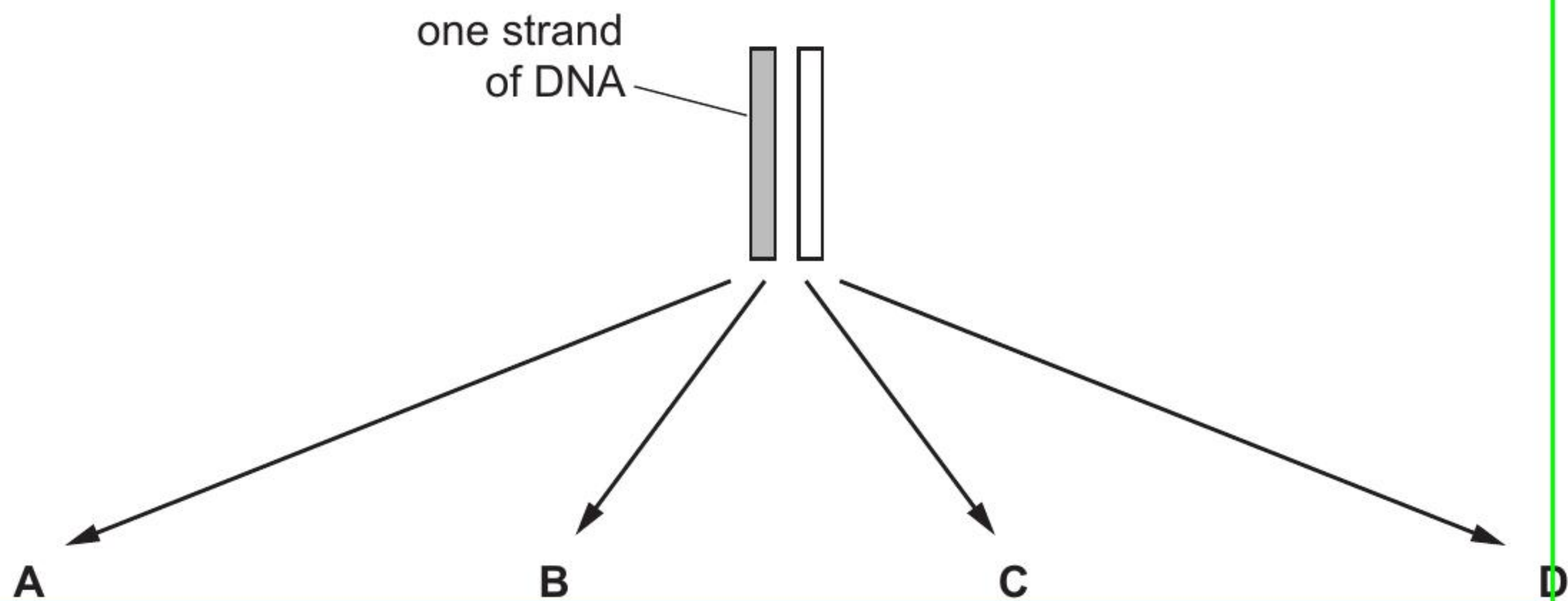
19 Which statements about complementary base pairing are correct?

- 1 It allows translation to occur.
- 2 Purines and pyrimidines are the same size.
- 3 The base pairs are of equal length.
- 4 Uracil forms two hydrogen bonds with adenine.

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

20 The diagram shows the possible organisation of DNA molecules after one replication.

Which organisation is correct?



21 The diagram shows part of the DNA sequence of a gene and a mutated sequence of the same gene.

normal DNA sequence ...CCG GAT TAT TGC GAG AAA TGG CAT TCT AGG ...

mutated DNA sequence ...CCG GAT GTA TTG CGA GAA ATG CAT TCT AGG ...

What are possible effects of the mutated sequence?

- 1 the presence of mRNA stop codons, UAG, UAA or UGA
- 2 a change in the sequence of amino acids
- 3 a non-functional protein
- 4 ribosomes cannot translate the mRNA

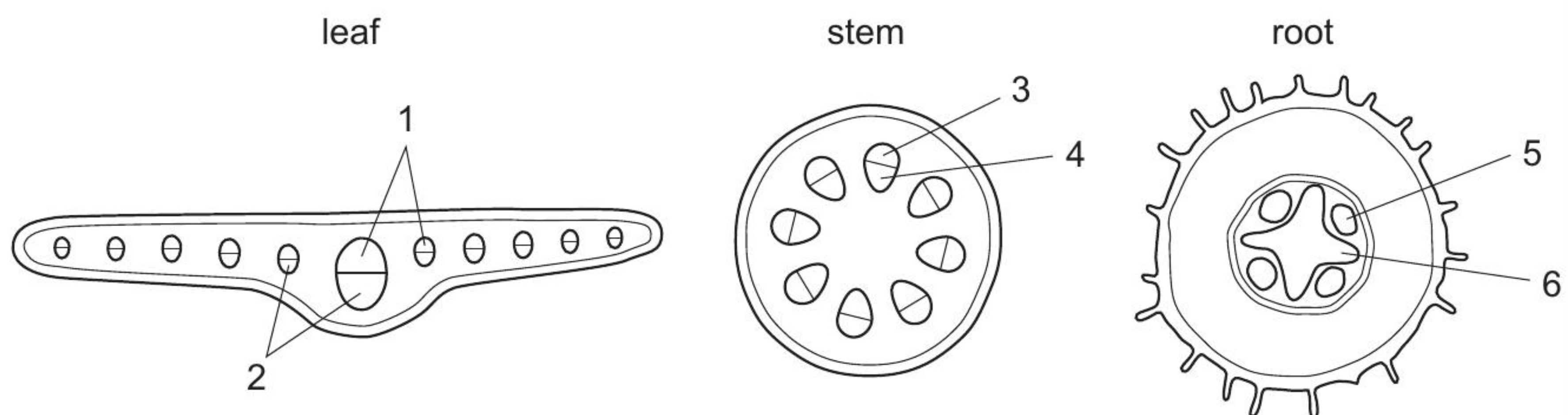
A 1, 2 and 3 **B** 1, 3 and 4 **C** 1 and 4 only **D** 2 and 3 only

22 What is correct for phloem sieve tube elements?

- A** Companion cells provide structural support to the phloem sieve tube elements.
- B** Lignified walls of phloem sieve tube elements prevent transport of mineral salts by mass flow.
- C** Phloem sieve tube elements become narrower as movement of sucrose occurs.
- D** Plasmodesmata allow movement of water and solutes across cell walls of phloem sieve tube elements.

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

Transport tissues are labelled 1 to 6.



Which combination shows the tissues that have a main function of transporting water?

| | 1 | 2 | 3 | 4 | 5 | 6 |
|----------|---|---|---|---|---|---|
| A | ✓ | ✓ | ✗ | ✗ | ✓ | ✓ |
| B | ✓ | ✗ | ✗ | ✓ | ✗ | ✓ |
| C | ✗ | ✓ | ✓ | ✗ | ✓ | ✗ |
| D | ✗ | ✓ | ✗ | ✓ | ✓ | ✗ |

key

✓ = transporting water is a main function

✗ = transporting water is **not** a main function

24 The statements are descriptions of how water moves across the root to the xylem vessel elements.

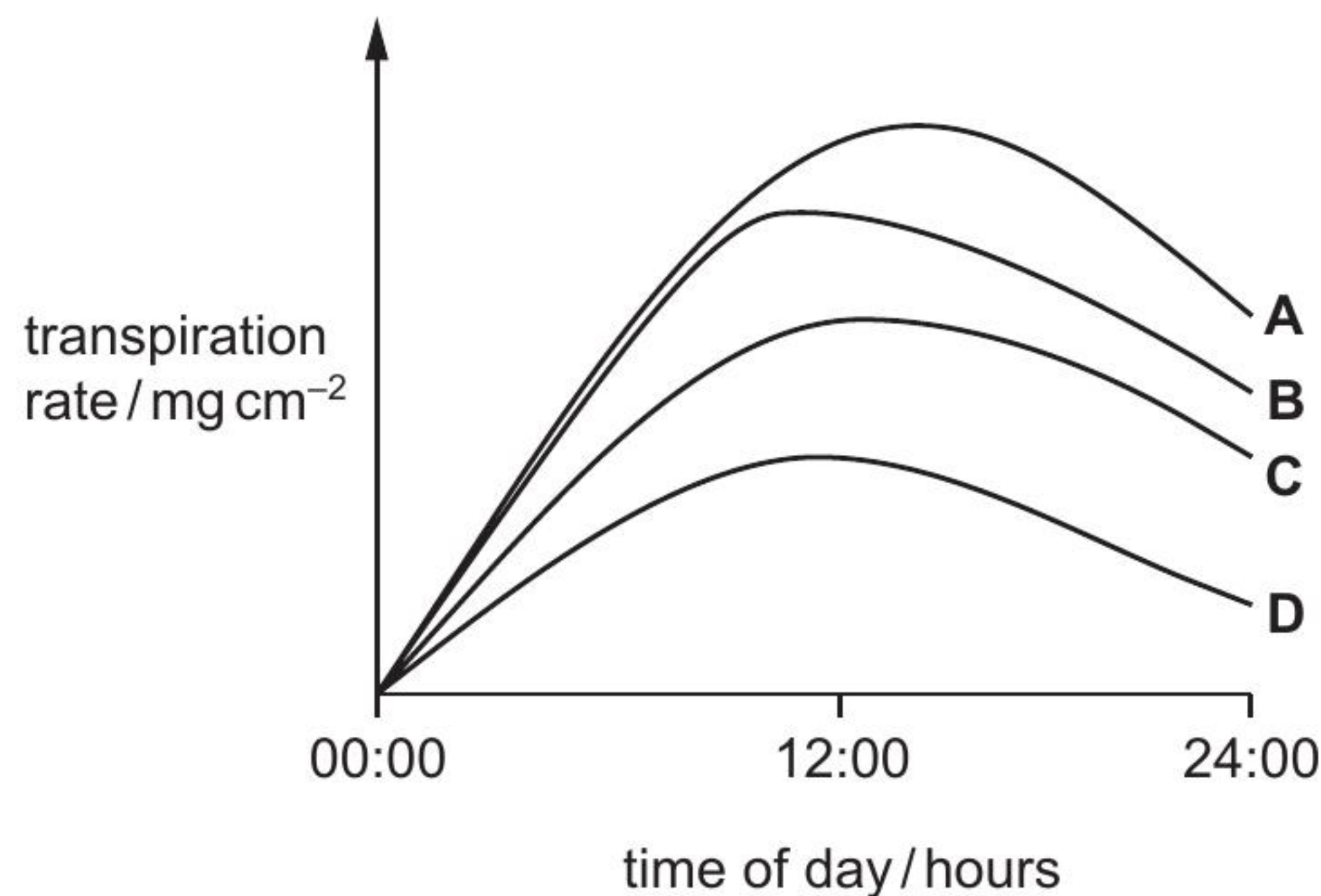
- 1 Water enters cell walls.
- 2 Water enters cytoplasm by osmosis.
- 3 Water moves from cell to cell through plasmodesmata.
- 4 Water moves through cell walls.

Which statements describe the apoplast pathway?

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

25 Four plants, **A**, **B**, **C** and **D**, were grown in the same conditions and their transpiration rates measured.

Which plant is most likely to be a xerophyte?



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

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

| | water potential becomes | volume of liquid |
|----------|-------------------------|------------------|
| A | less negative | decreases |
| B | less negative | increases |
| C | more negative | decreases |
| D | more negative | increases |