

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 |

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

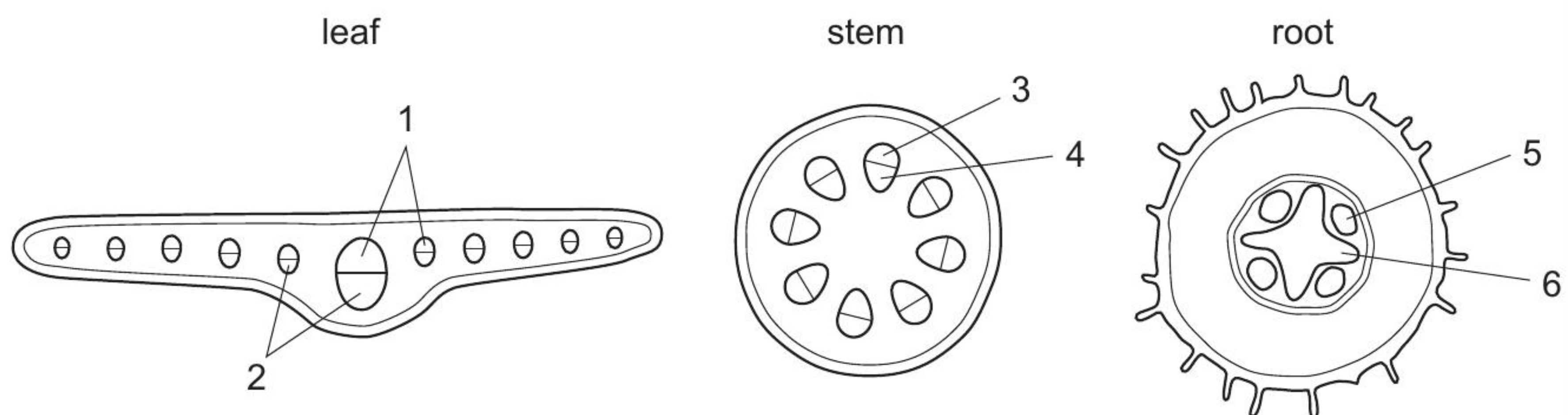
A 1, 2 and 3 **B** 1, 3 and 4 **C** 1 and 4 only **D** 2 and 3 only

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.

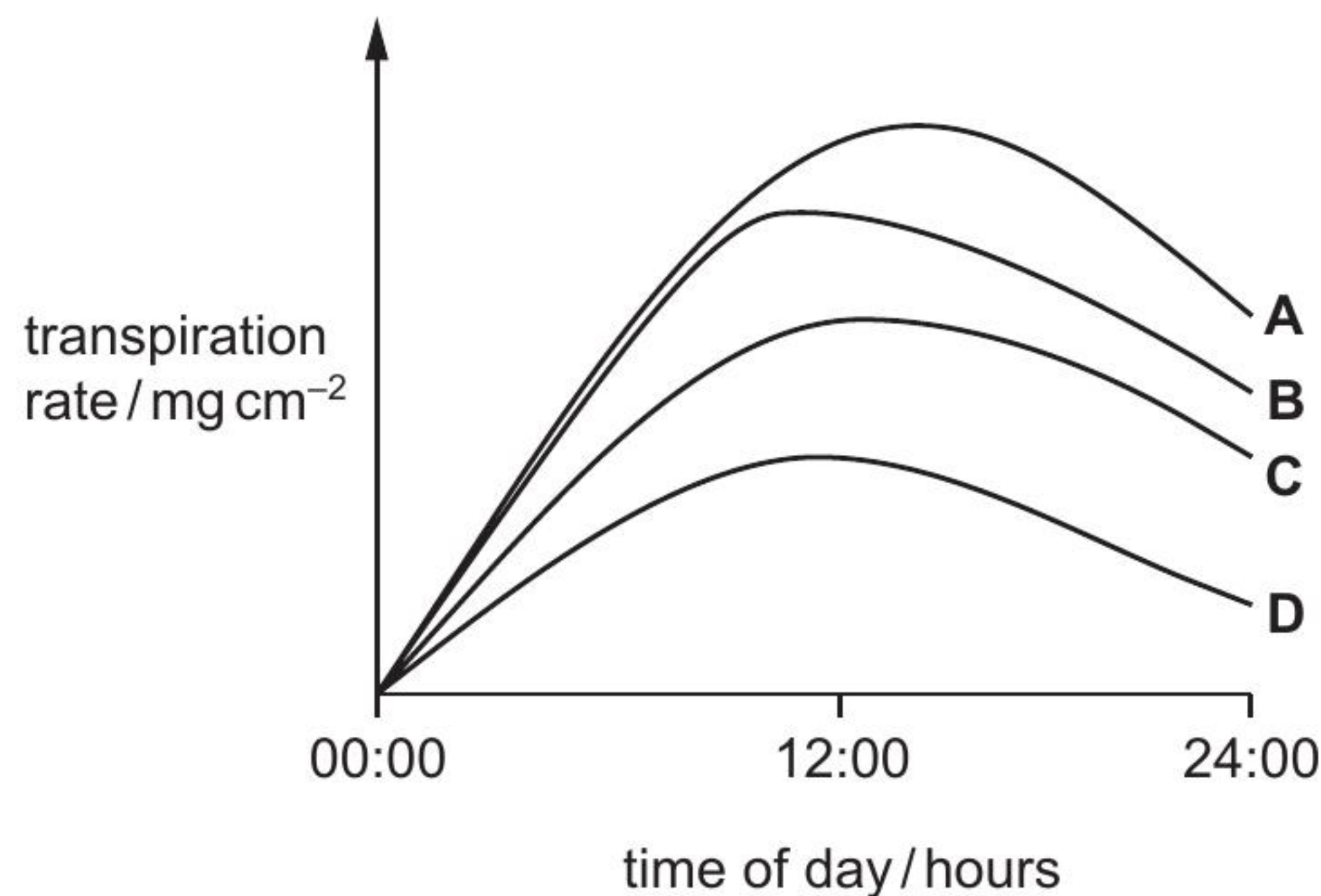
- 1 Water enters cell walls.
- 2 Water enters cytoplasm by osmosis.
- 3 Water moves from cell to cell through plasmodesmata.
- 4 Water moves through cell walls.

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?

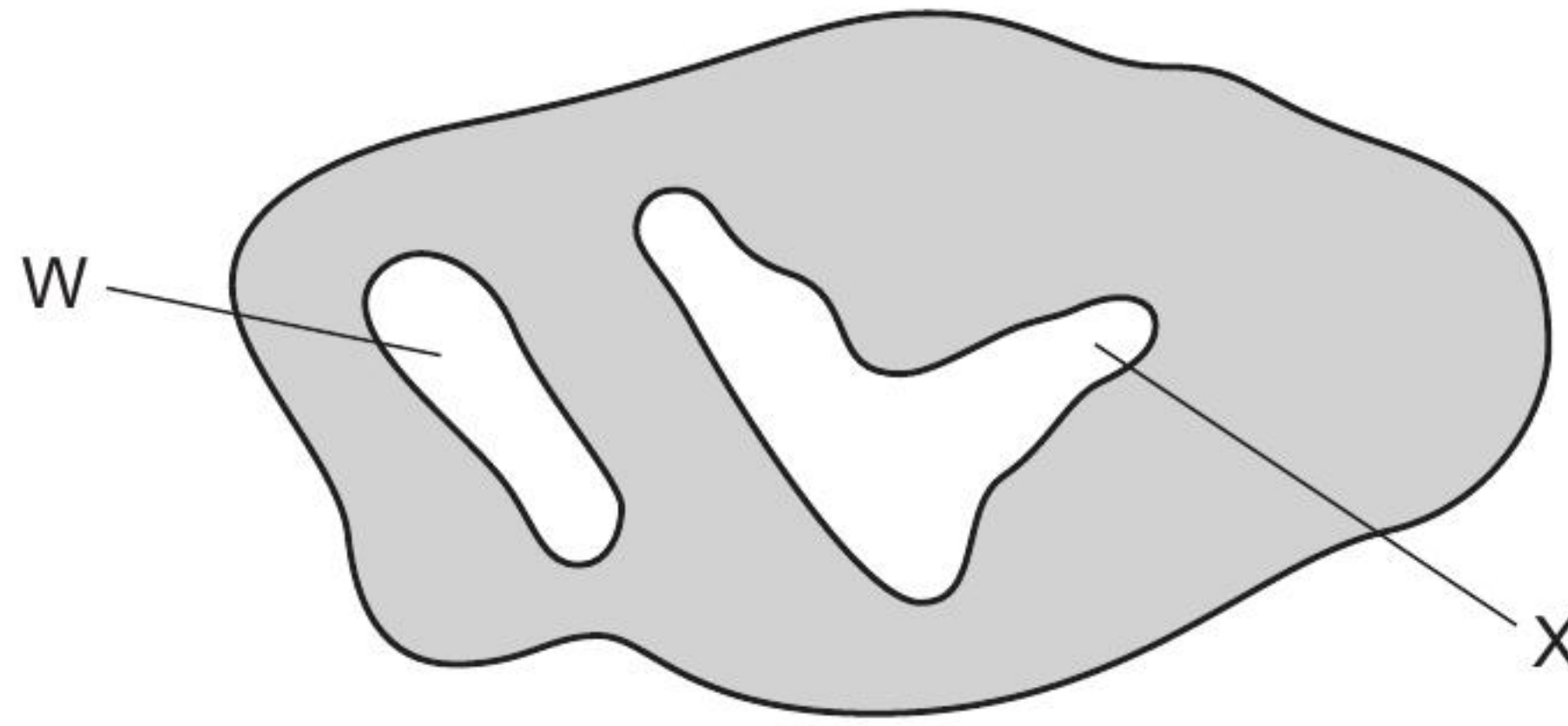


26 Sucrose moves from a mesophyll cell in a leaf into a phloem sieve tube element.

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 |

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



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

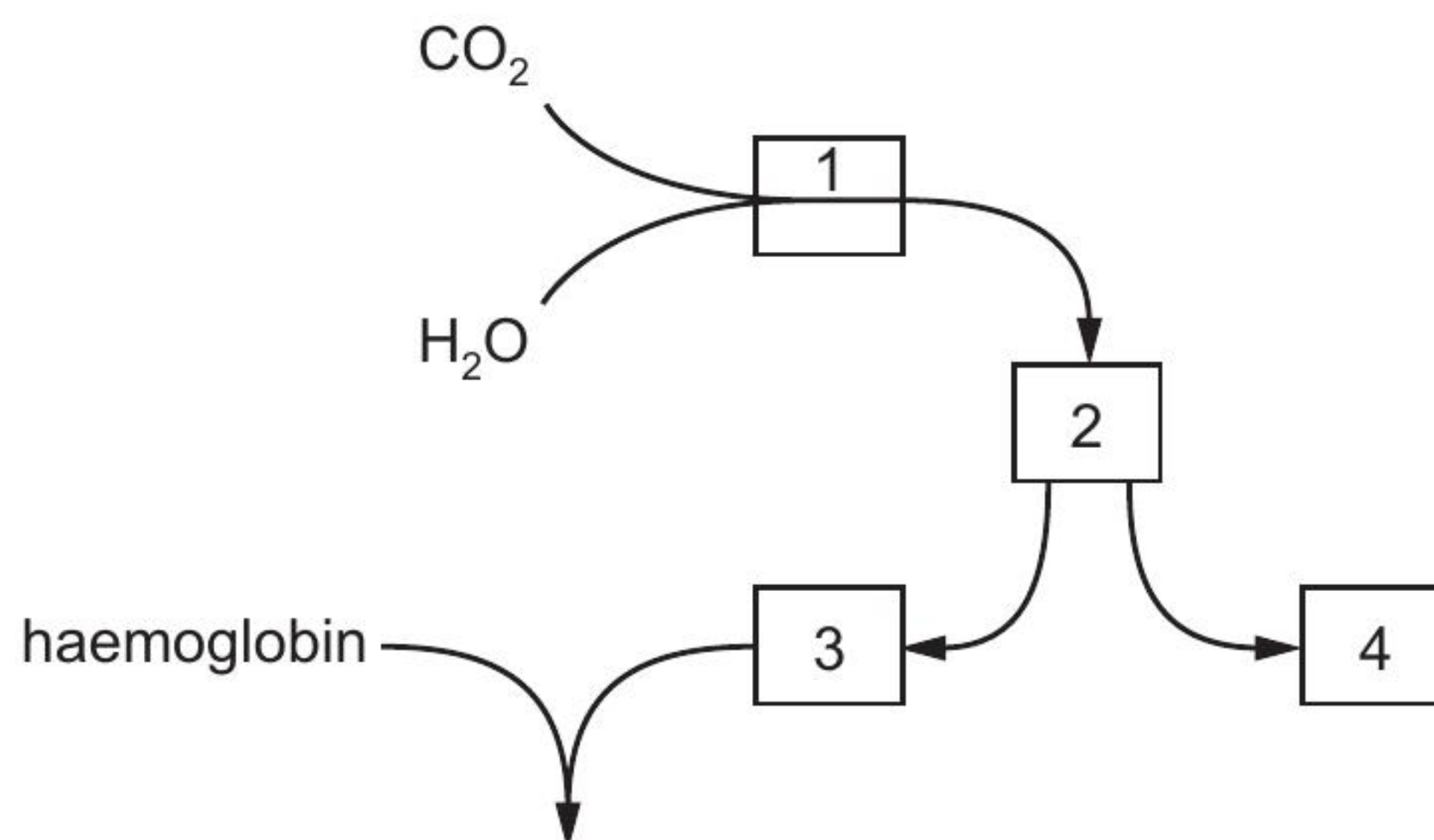
| | W | X |
|----------|-----------------|-----------------|
| A | left ventricle | right ventricle |
| B | right atrium | left atrium |
| C | right atrium | right ventricle |
| D | right ventricle | left ventricle |

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 |

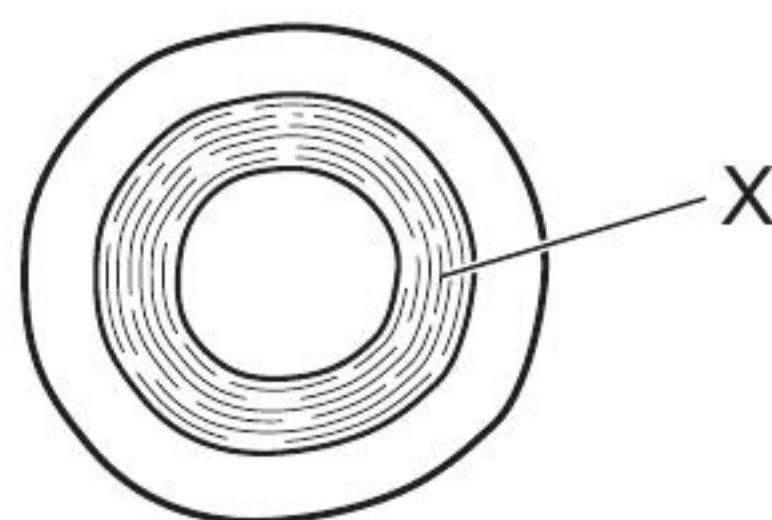
29 The diagram shows the pathway for the transport of carbon dioxide that occurs in red blood cells.



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 | |
|----------|----------|------------------------------|---------------|
| | | 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 |

key
✓ = present
x = absent

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

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Important values, constants and standards

| | |
|---------------------------------|---|
| molar gas constant | $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$ |
| Faraday constant | $F = 9.65 \times 10^4 \text{ C mol}^{-1}$ |
| Avogadro constant | $L = 6.022 \times 10^{23} \text{ mol}^{-1}$ |
| electronic charge | $e = -1.60 \times 10^{-19} \text{ C}$ |
| molar volume of gas | $V_m = 22.4 \text{ dm}^3 \text{ mol}^{-1}$ at s.t.p. (101 kPa and 273 K) $V_m = 24.0 \text{ dm}^3 \text{ mol}^{-1}$ at room conditions |
| ionic product of water | $K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ (at 298 K (25 °C)) |
| specific heat capacity of water | $c = 4.18 \text{ kJ kg}^{-1} \text{ K}^{-1}$ (4.18 J g ⁻¹ K ⁻¹) |

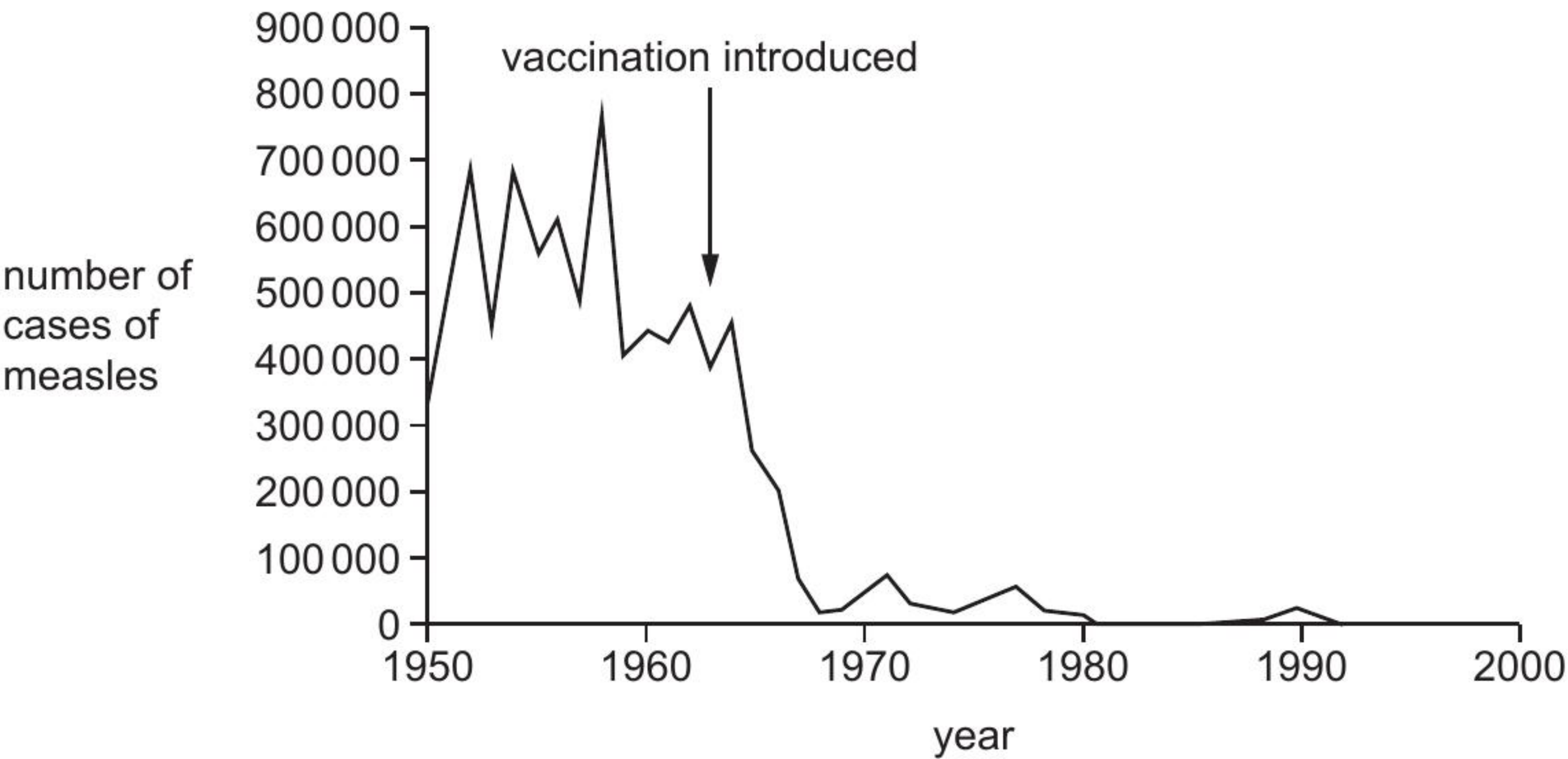
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40 Measles is an infectious disease caused by a virus.

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

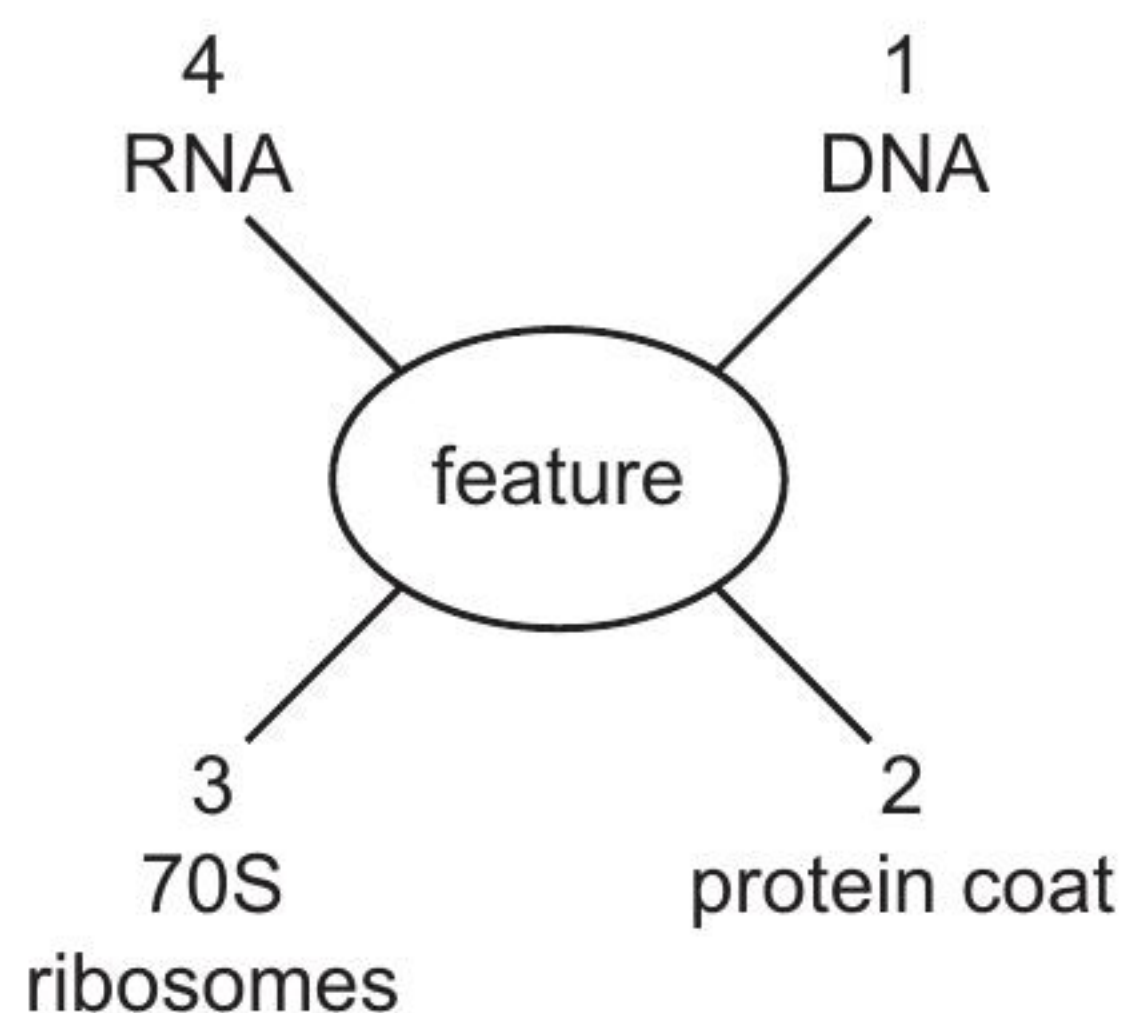


What could have caused the decrease in the number of cases of measles after vaccination was introduced?

| | 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

4 Which features shown in the diagram can be present in viruses?



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

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

Which conclusion about the sample of milk is correct?

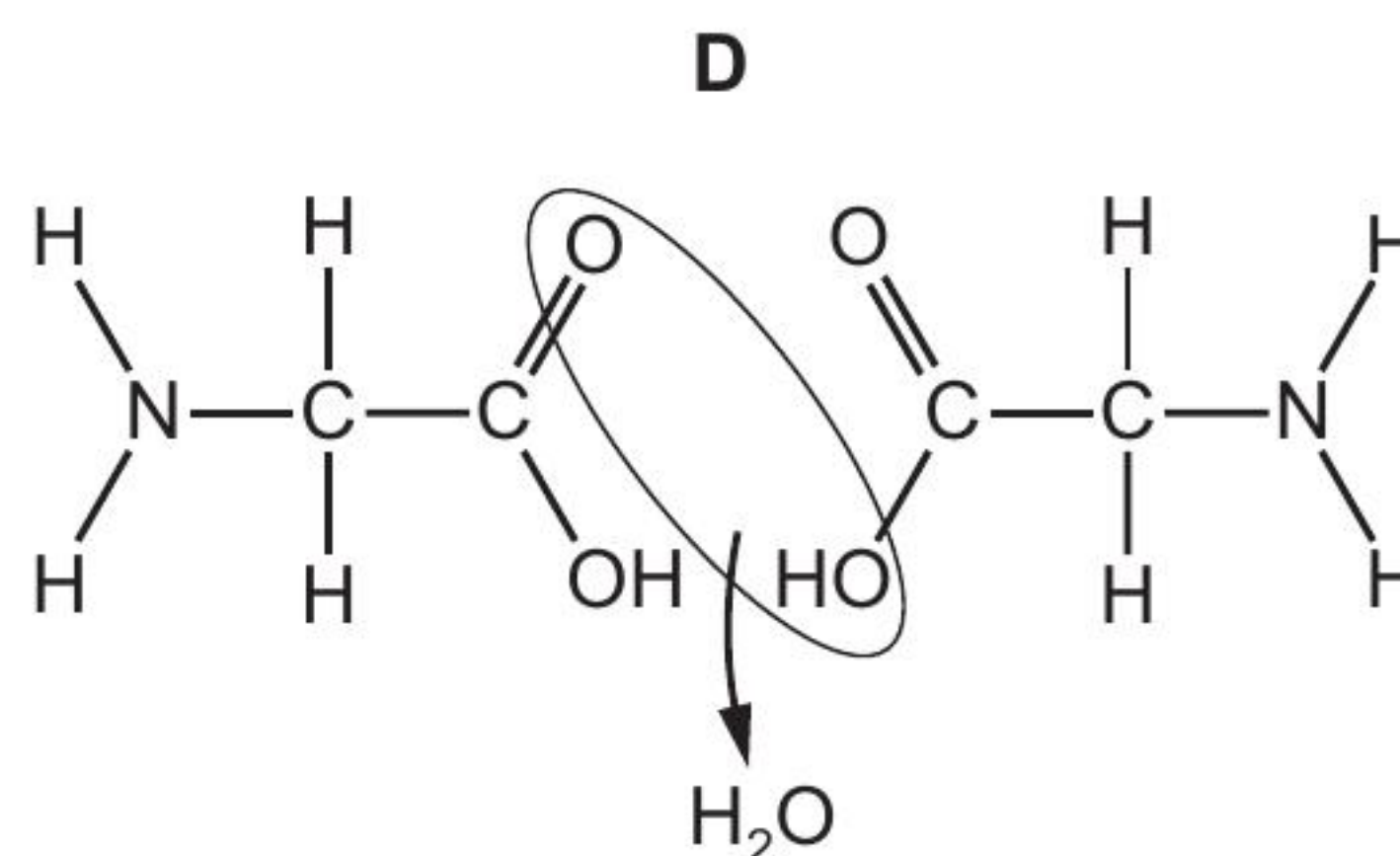
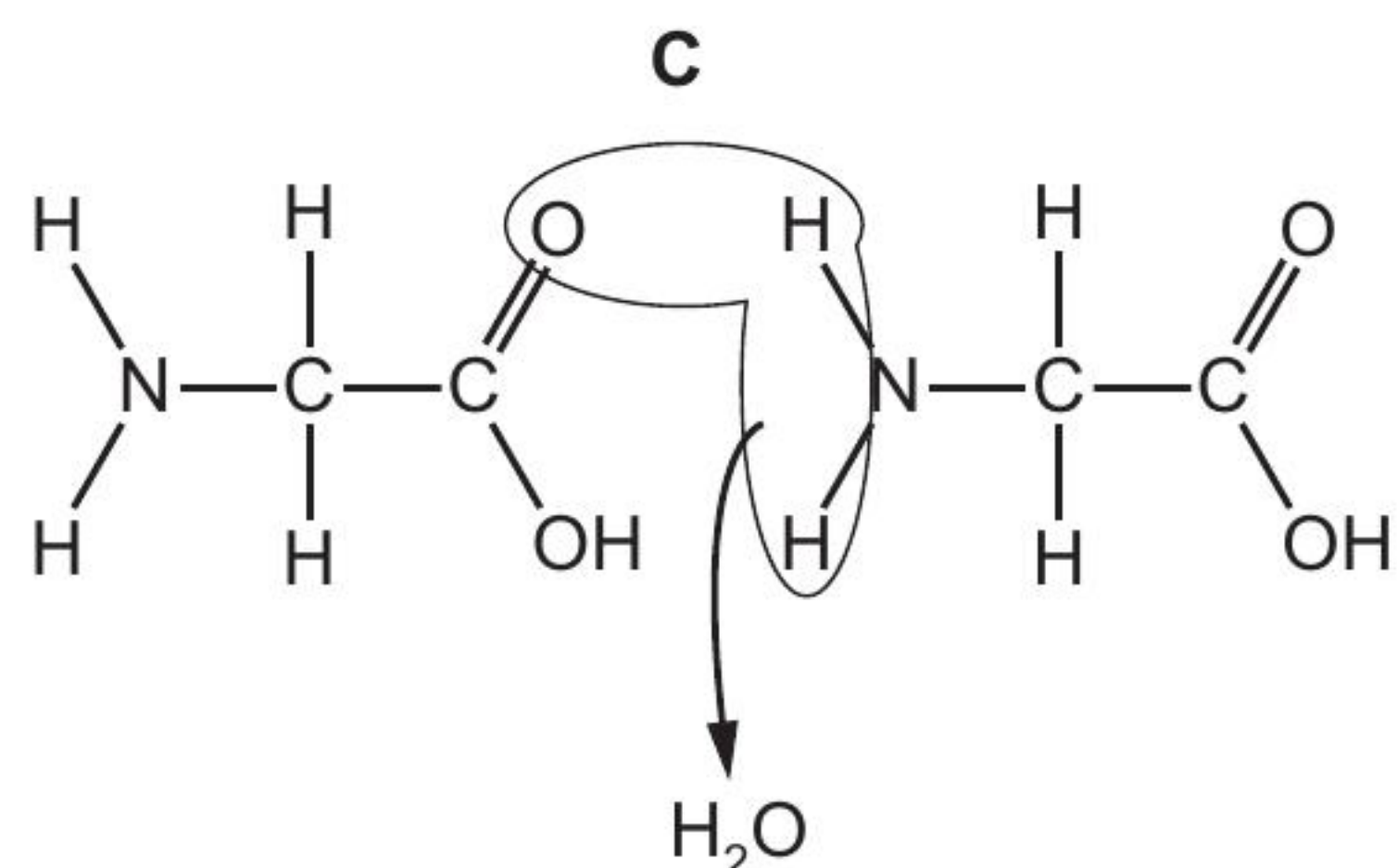
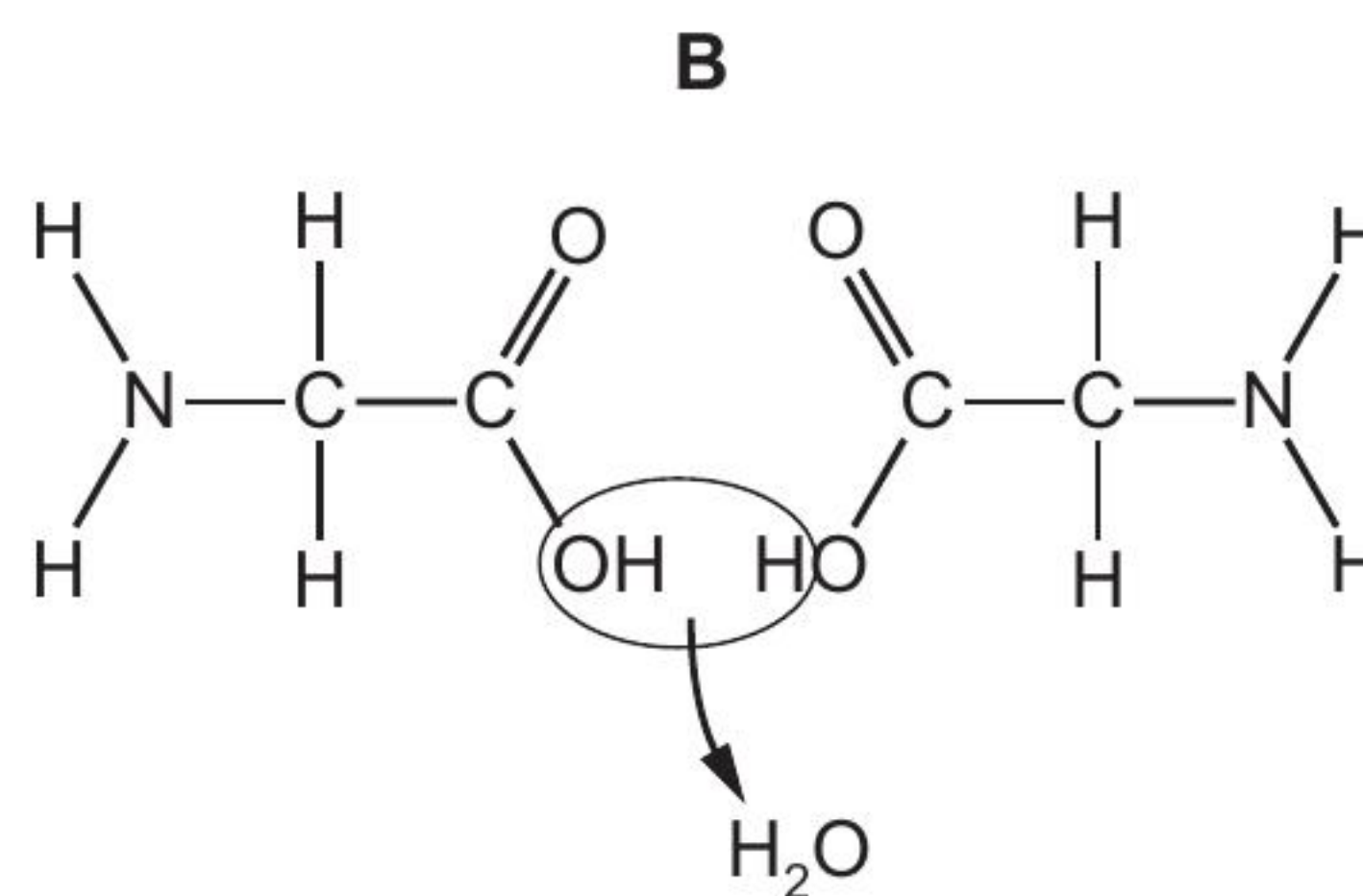
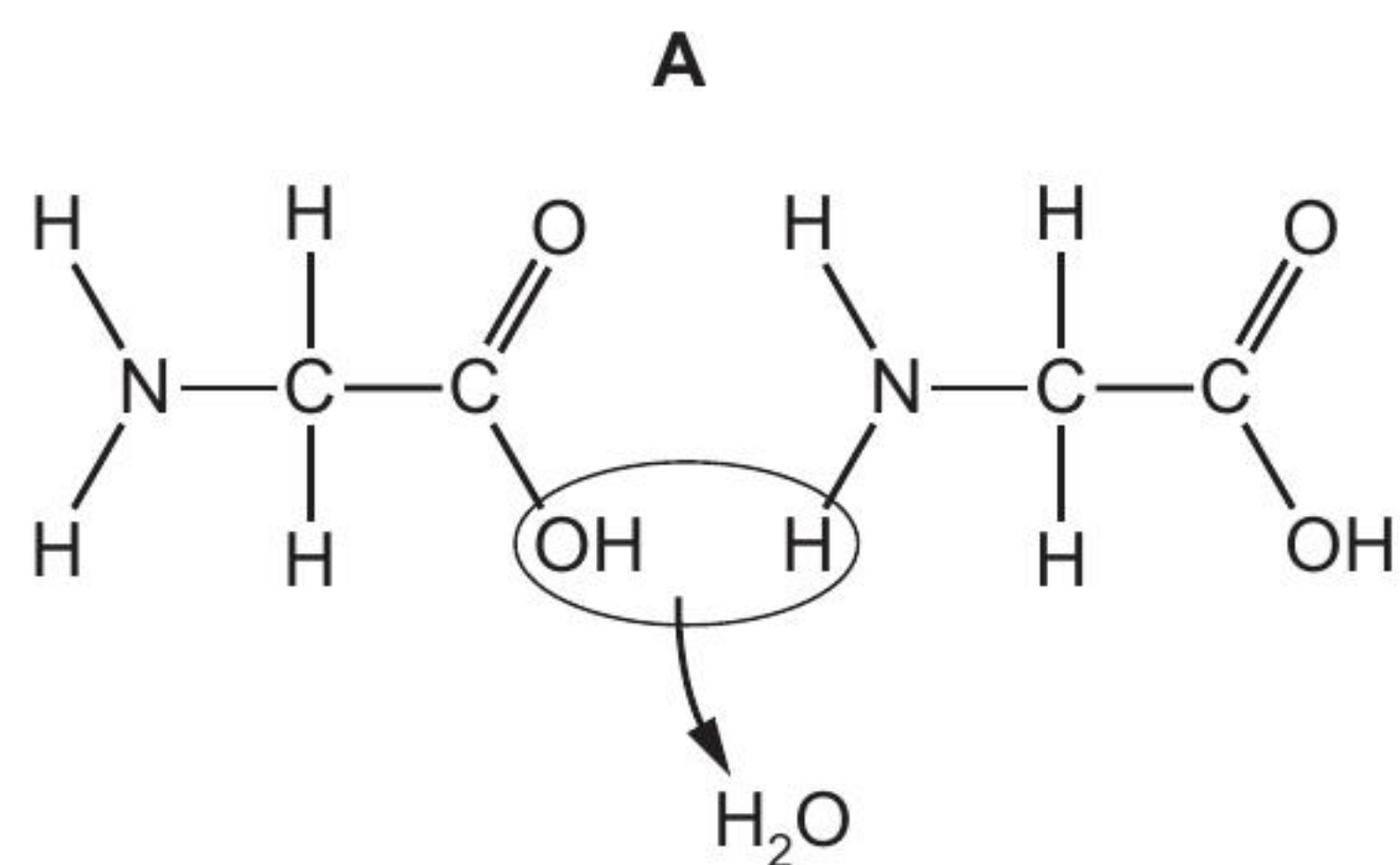
- A** Reducing sugars are not present.
B Reducing sugars are present.
C There is a high concentration of fructose.
D There is a low concentration of sucrose.

6 Which of the statements about polysaccharides can be used to describe amylose and cellulose?

- 1 contains 1,4 glycosidic bonds
- 2 contains 1,6 glycosidic bonds
- 3 polymer of glucose

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

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

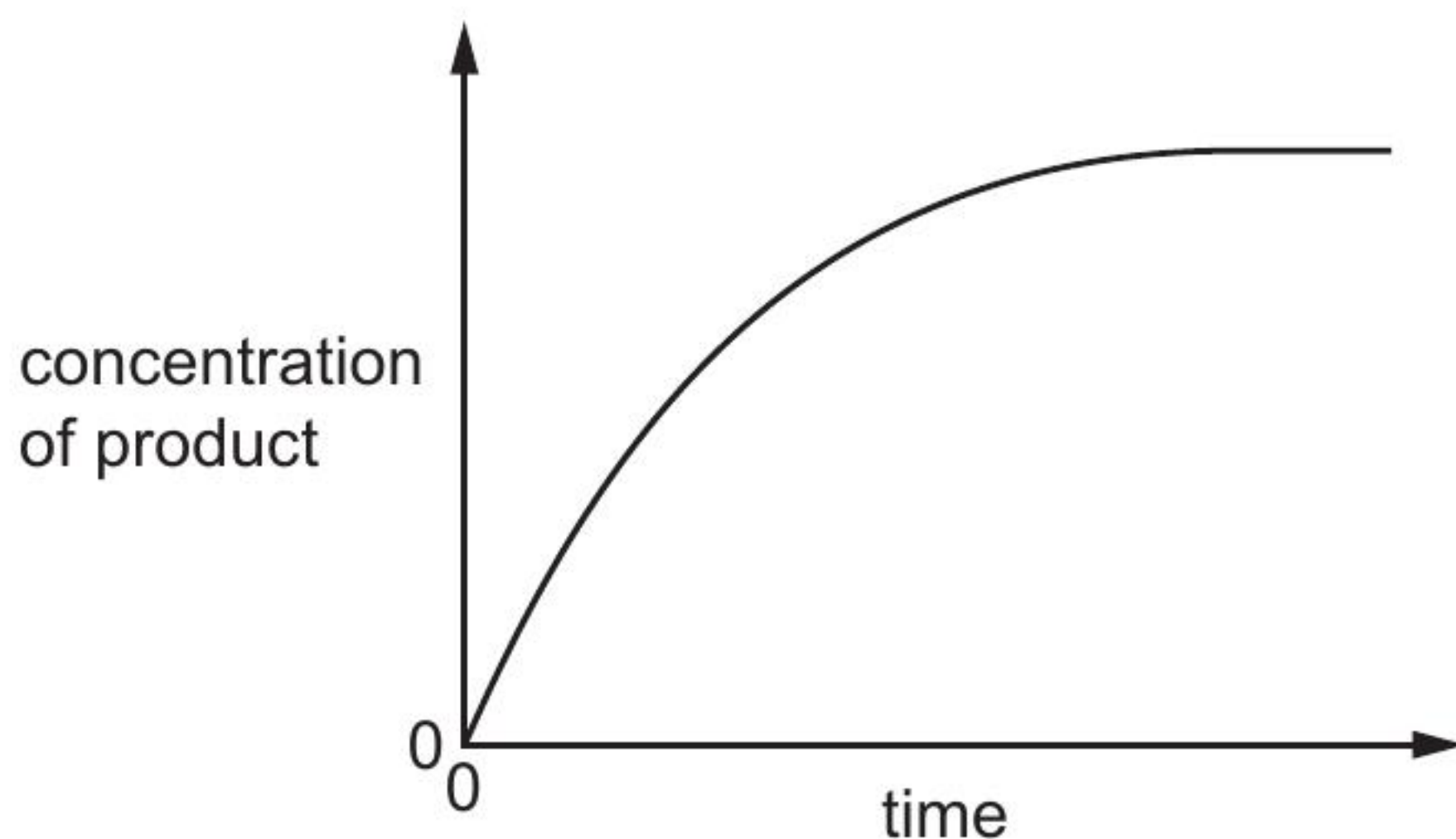
✗ = not involved

9 Which features affect the tensile strength of collagen?

- 1 the helical structure of collagen chains
- 2 the small R group of the amino acids in collagen
- 3 the insoluble nature of collagen
- 4 the bonds between collagen molecules

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

10 A fixed volume of the enzyme catalase was added to a fixed volume of hydrogen peroxide solution. The diagram shows how the concentration of product changed over the course of the reaction.

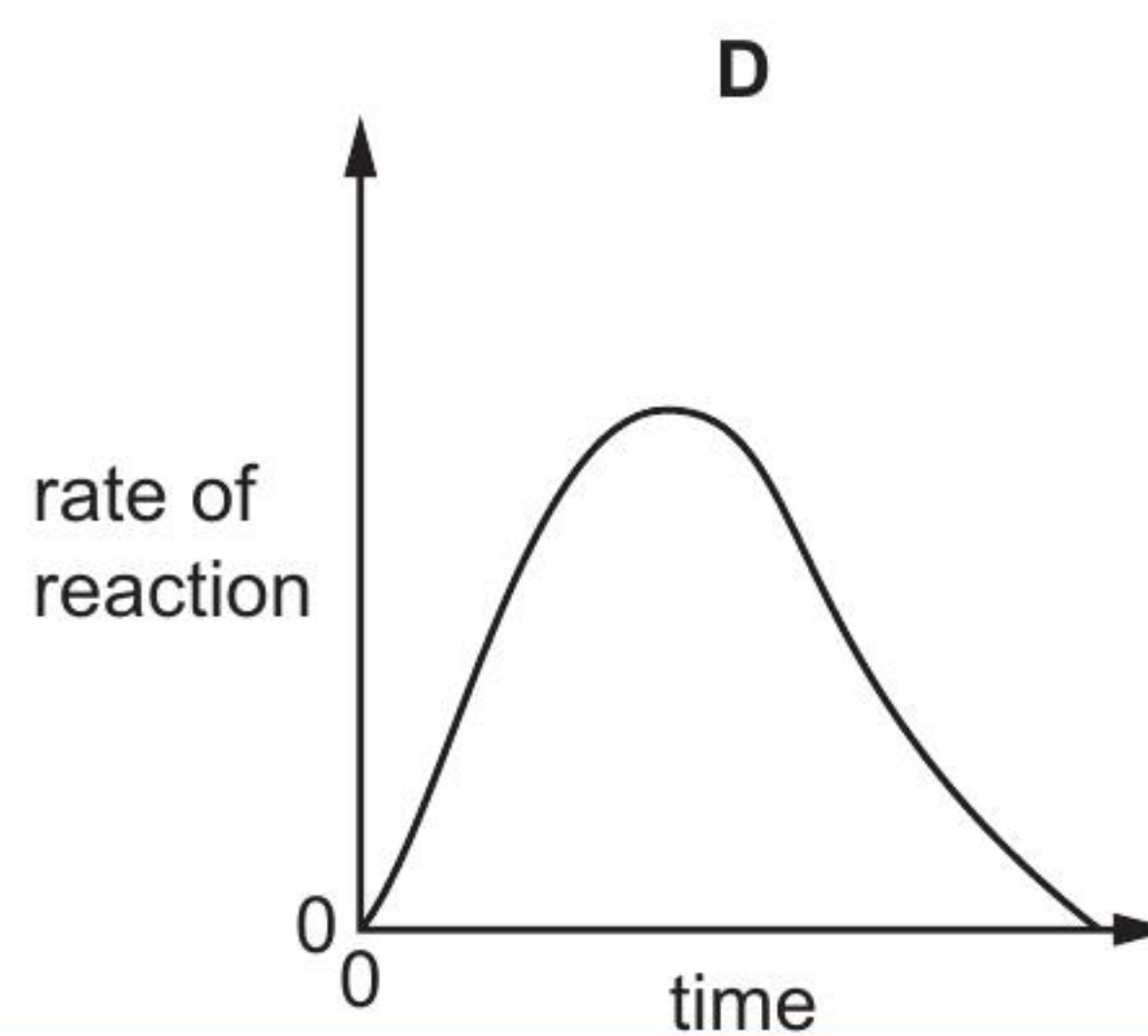
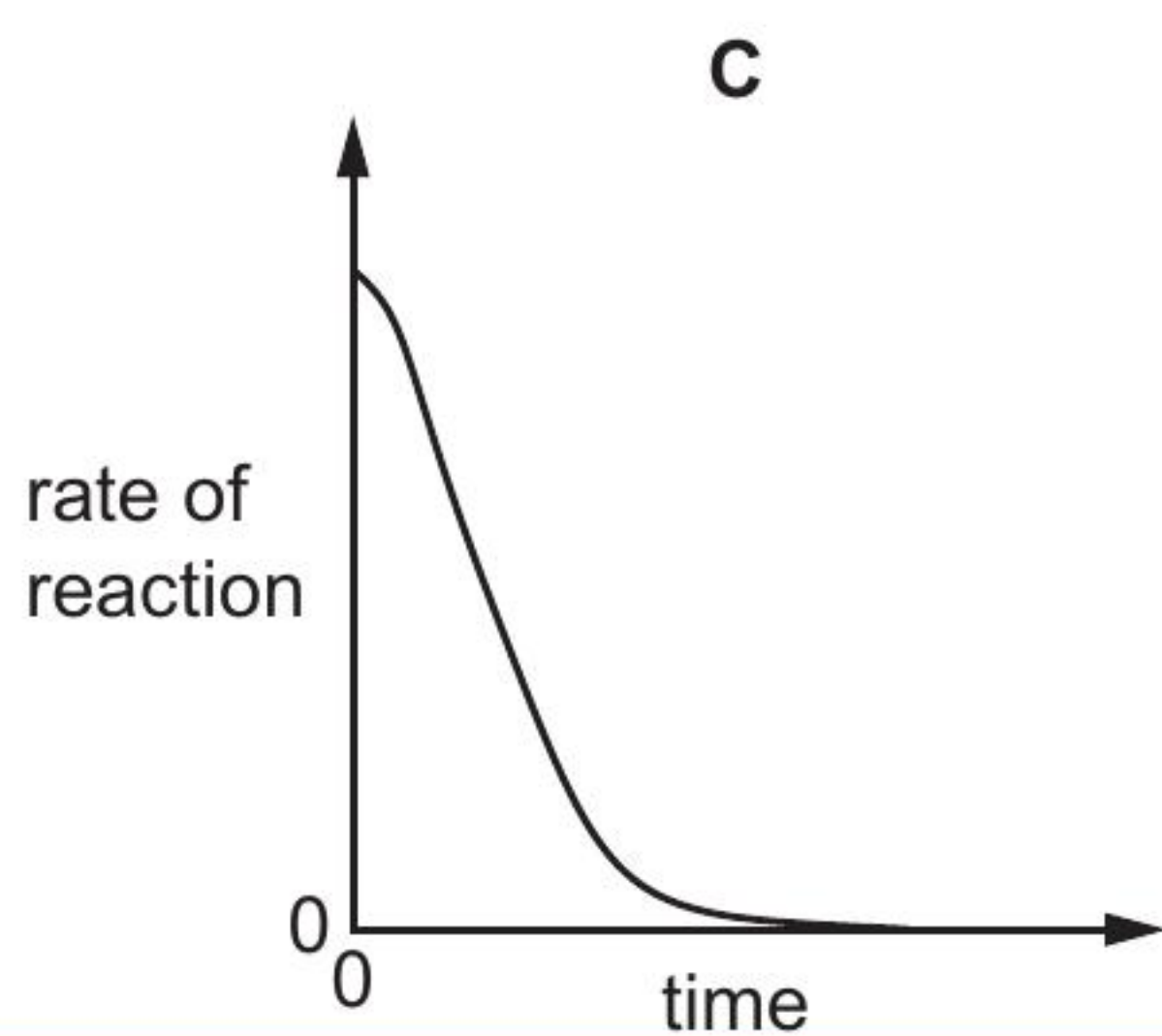
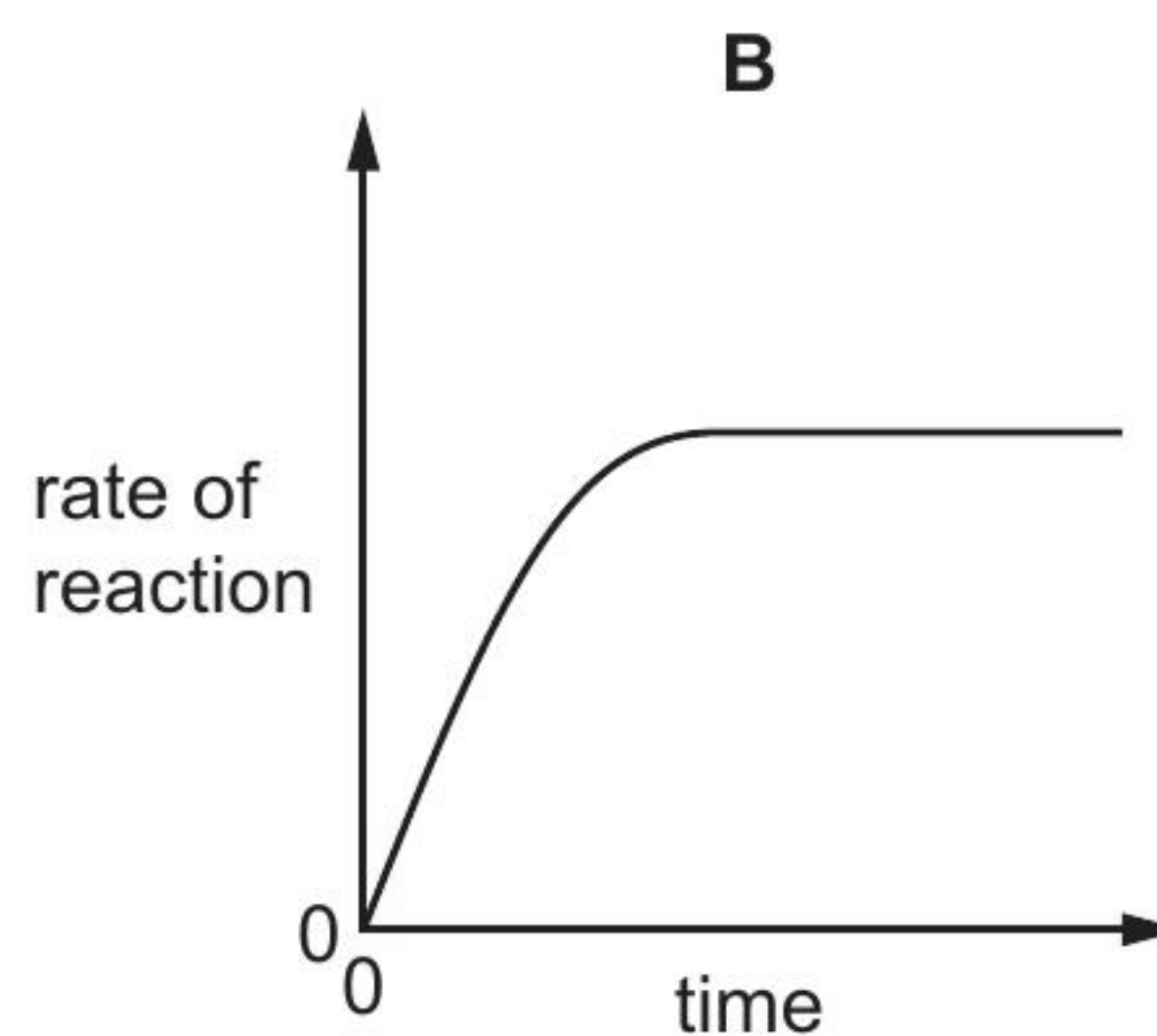
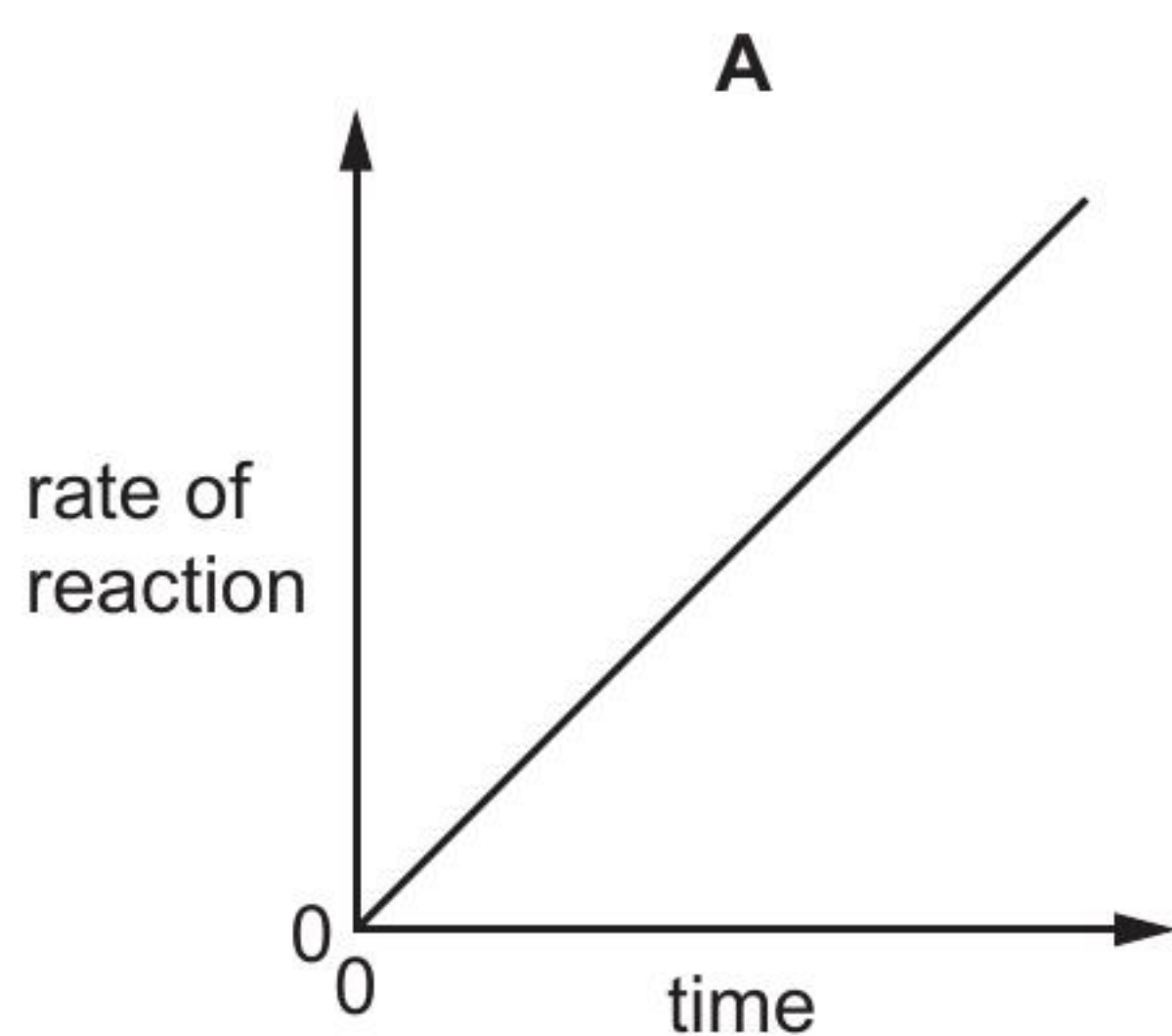


What explains the shape of this graph?

- A** The active sites become saturated.
B The enzyme was denatured.
C The hydrogen peroxide inhibited the reaction.
D The substrate molecules were used up.

- 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?

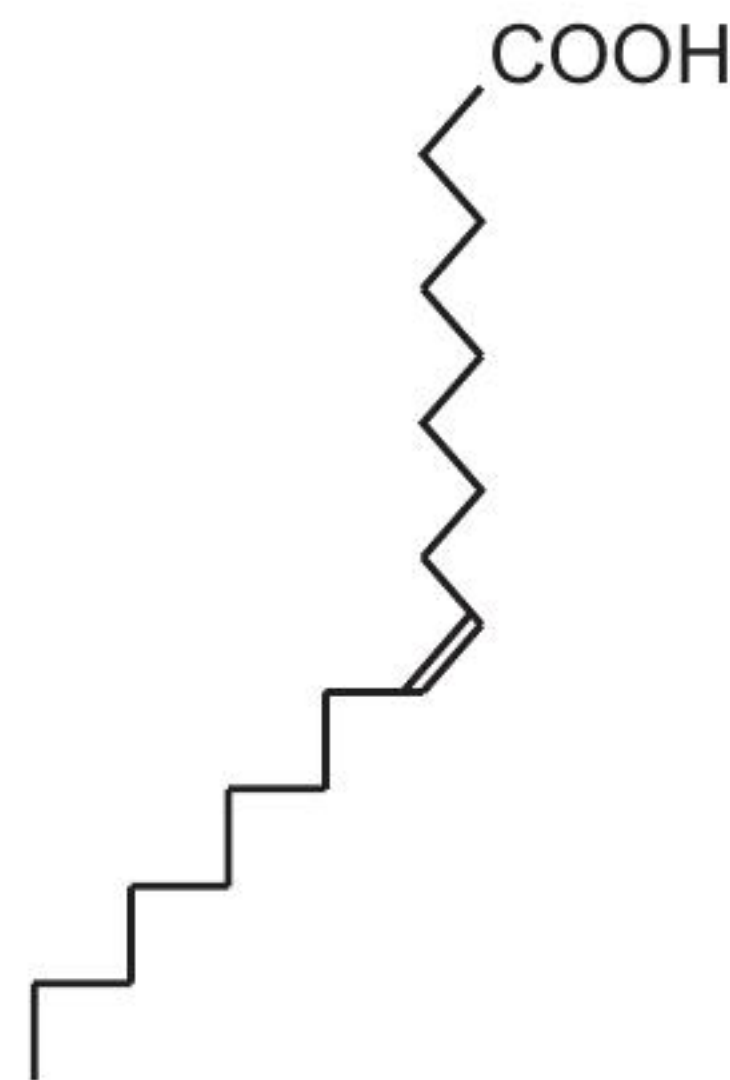


- 12** The fatty acids elaidic acid and oleic acid have exactly the same structural formulae, with one double bond in the chain. However, the shapes of the chains are different, as shown in the diagram.

elaidic acid



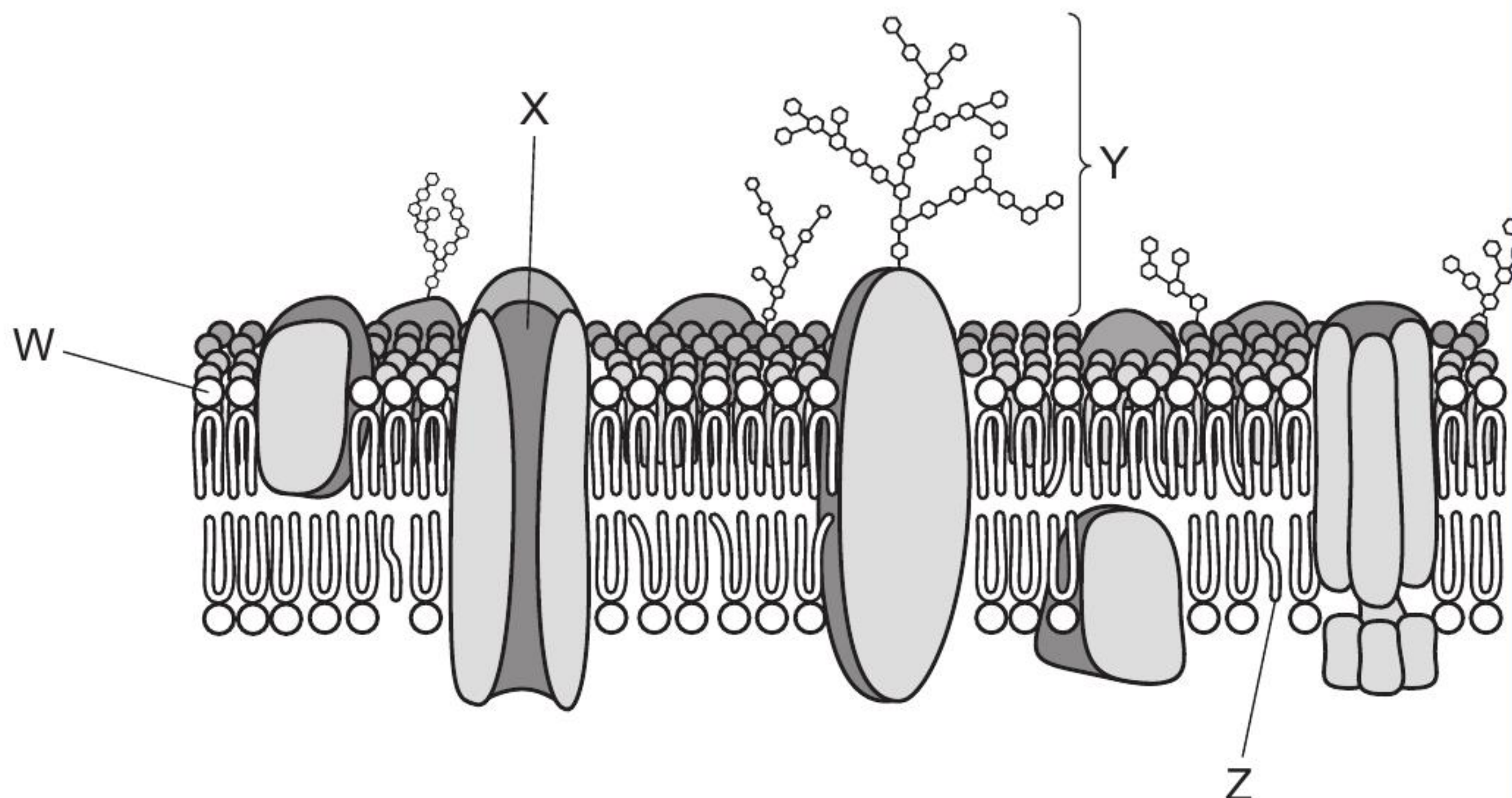
oleic acid



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 |

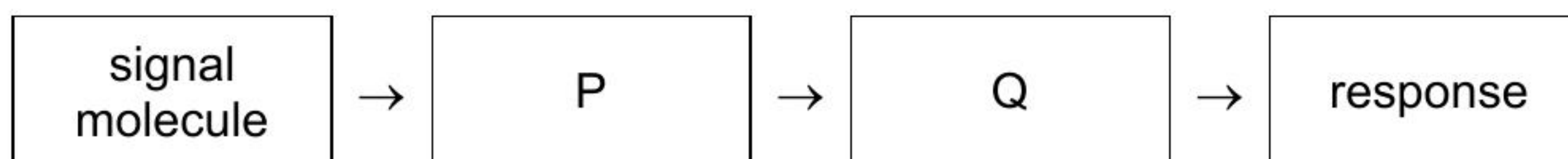
13 The diagram shows a cell surface membrane.



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

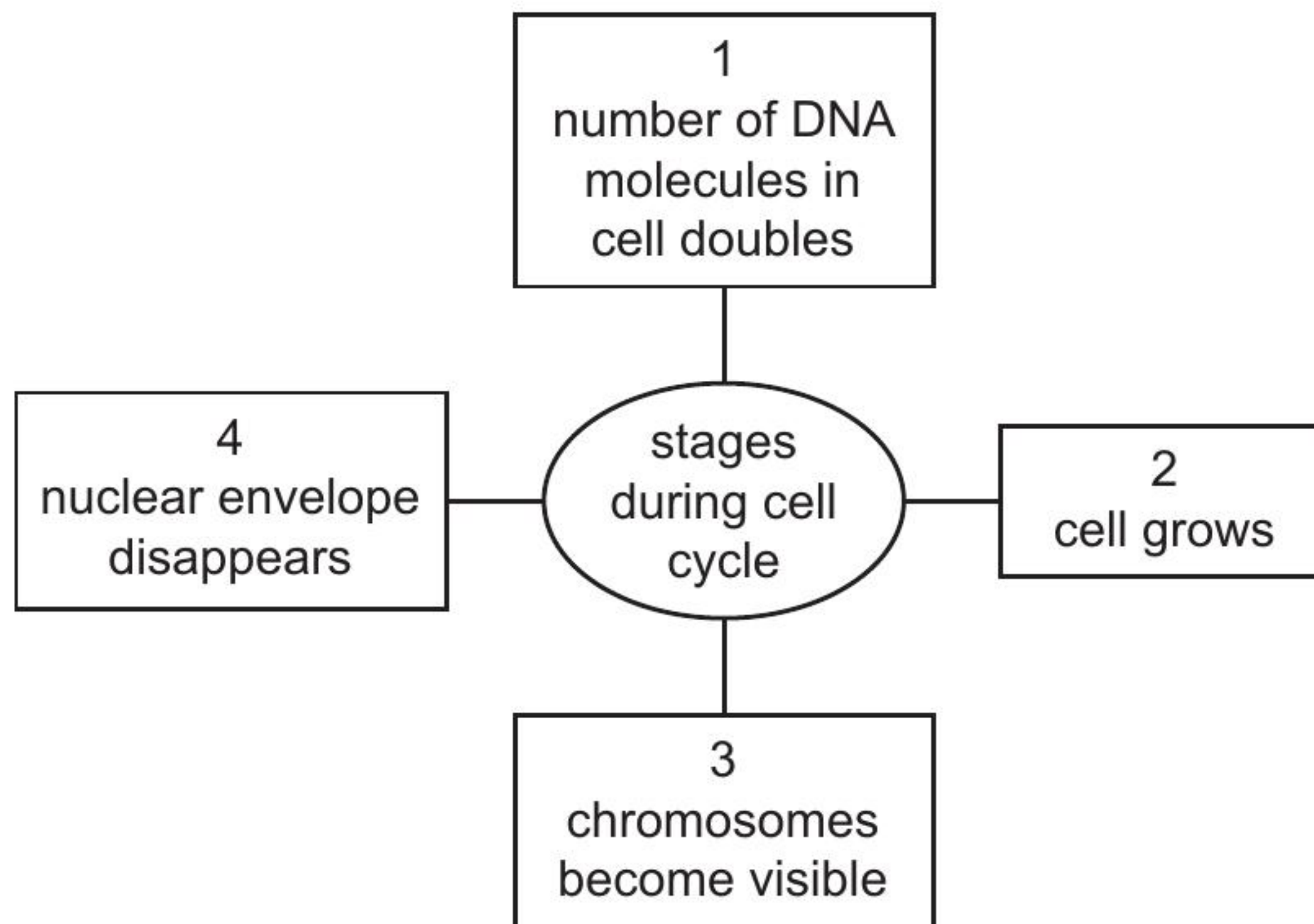
16 The enzyme telomerase prevents loss of telomeres after many mitotic cell cycles.

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?

