

## **PART D Biology**

- 61** A selection pressure is a biological or physical factor in an environment that may result in evolution.

Which of the following situations result in selection pressures on one or more organisms?

- 1** clearing rainforests to grow palm oil plantations
- 2** introduction of a predator to islands with seabird colonies
- 3** long-term use of antibiotics in hospital wards
- 4** using an insecticide to kill the mosquitoes that spread malaria

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

- 62** A particular cell has the following features:

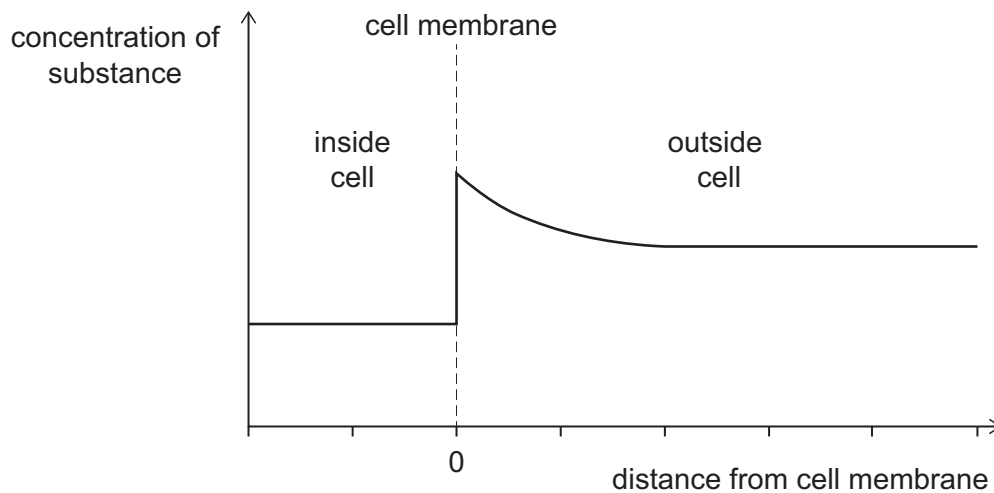
- a cell wall
- a cell membrane
- no mitochondria

Which of the following statements about this cell is correct?

- A** It may be an animal cell.
- B** It may have no nucleus.
- C** It may contain chloroplasts.
- D** It contains X and Y chromosomes.
- E** It is not able to respire.

- 63** A cell is studied. The graph shows the concentration of a substance at different distances from the cell membrane.

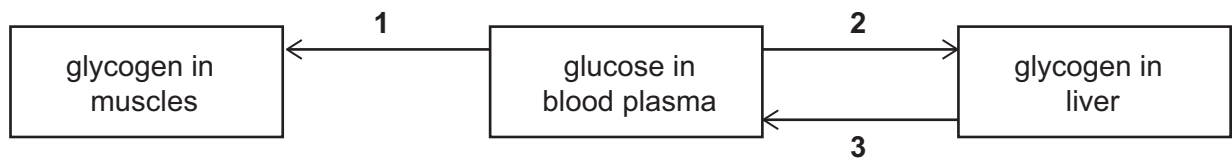
The concentrations shown are maintained over time.



Which of the following processes is/are responsible for maintaining the difference in the concentration of the substance across the membrane?

- 1 active transport
  - 2 diffusion
  - 3 osmosis
- A** none of them
- B** 1 only
- C** 2 only
- D** 3 only
- E** 1 and 2 only
- F** 1 and 3 only
- G** 2 and 3 only
- H** 1, 2 and 3 only

- 64** The diagram shows some of the ways in which glucose can be added to or removed from blood plasma in humans.

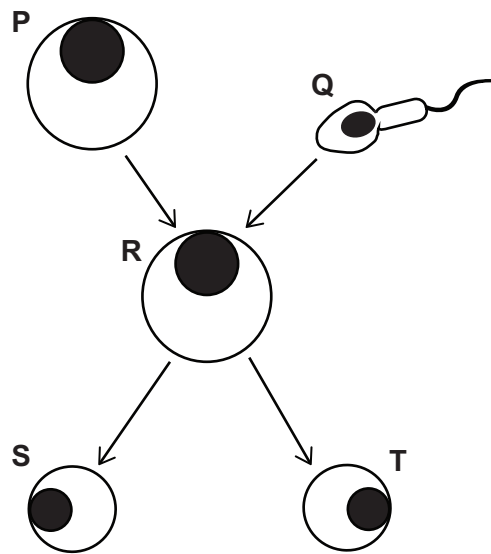


Which hormones stimulate the processes shown by the arrows?

|          | <i>process 1</i> | <i>process 2</i>       | <i>process 3</i>       |
|----------|------------------|------------------------|------------------------|
| <b>A</b> | adrenaline       | glucagon               | insulin                |
| <b>B</b> | adrenaline       | adrenaline<br>glucagon | glucagon               |
| <b>C</b> | insulin          | adrenaline             | glucagon               |
| <b>D</b> | insulin          | insulin                | adrenaline<br>glucagon |
| <b>E</b> | glucagon         | insulin                | glucagon               |
| <b>F</b> | glucagon         | glucagon               | insulin                |

- 65** The diagram shows two gametes, gamete P and gamete Q, fusing to form cell R in a healthy human. R divides to form two cells, S and T.

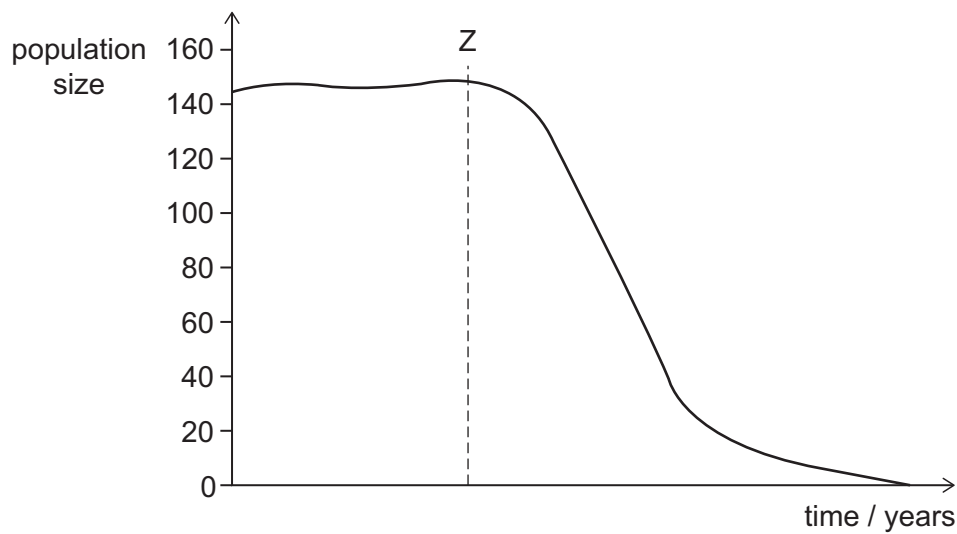
S and T grow into two separate individuals.



Which of the following statements is/are correct?

- 1** The number of double strands of DNA is the same in gamete P and cell T.
  - 2** If gamete Q contains a Y chromosome, then both individuals that grow from cells S and T will be genetically male.
  - 3** A mutation in the DNA in cell R before mitosis will always change the phenotype of cell S.
- A** none of them
- B** 1 only
- C** 2 only
- D** 3 only
- E** 1 and 2 only
- F** 1 and 3 only
- G** 2 and 3 only
- H** 1, 2 and 3

- 66** The graph shows changes in population size (number of individuals) of a species of tortoise over the last century. These tortoises are only found on one small island in the Galapagos.

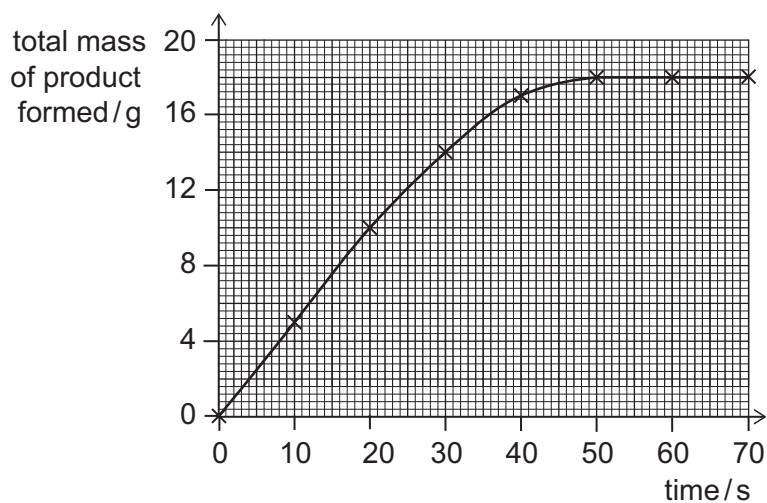


Which of the following could account for the change in population shown after time Z on the graph?

- 1** reduced rainfall
  - 2** reduced availability of resources
  - 3** failure to adapt to competition from an introduced species
- A** none of them
- B** 1 only
- C** 2 only
- D** 3 only
- E** 1 and 2 only
- F** 1 and 3 only
- G** 2 and 3 only
- H** 1, 2 and 3

- 67** An enzyme-catalysed reaction was studied and the mass of product formed was measured over time.

The results are shown in the graph.



Which of the following statements is/are correct?

- 1** The enzymes may have been used up in the reaction.
  - 2** The initial rate of reaction is  $120 \text{ g min}^{-1}$ .
  - 3** At high concentrations, the product formed may inhibit the enzymes.
- A** none of them
- B** 1 only
- C** 2 only
- D** 3 only
- E** 1 and 2 only
- F** 1 and 3 only
- G** 2 and 3 only
- H** 1, 2 and 3

- 68** A person ran on a treadmill for 360 seconds. Their rates of aerobic and anaerobic respiration were measured at the start and at the end of the time. The table shows the results.

|                                                           | time = 0 seconds | time = 360 seconds |
|-----------------------------------------------------------|------------------|--------------------|
| <i>rate of aerobic respiration</i><br>/ arbitrary units   | 1.01             | 5.77               |
| <i>rate of anaerobic respiration</i><br>/ arbitrary units | 0.01             | 3.67               |

Physiological changes occurred in the person during this time.

Which of the following statements is/are correct during the 360 seconds?

- 1** There was an increase in pH that caused a change in the shape of the respiratory enzyme's active sites.
  - 2** Part of the increase in the rate of cellular respiration may have been due to a temperature increase in the muscles.
  - 3** More carbon dioxide needed to be removed from the muscle cells.
- A** none of them
- B** 1 only
- C** 2 only
- D** 3 only
- E** 1 and 2 only
- F** 1 and 3 only
- G** 2 and 3 only
- H** 1, 2 and 3

- 69** Coat colour variation in a particular population of mice is only affected by one gene with two alleles, R and r. This gene is not on a sex chromosome.

Heterozygous mice have yellow fur. Embryos that are homozygous dominant do not survive.

A yellow male and a yellow female mouse were mated several times and a large number of offspring were produced. Some of the offspring were grey in colour and others were yellow.

Assuming that no new mutations have occurred, which of the following is correct?

- A** 25% of the live offspring will be grey in colour.
- B** All grey mice have a homozygous genotype for coat colour.
- C** Offspring with XY chromosomes are all heterozygous for coat colour.
- D** The live offspring of a cross between a yellow and a grey mouse will always be yellow.
- E** There is a 3 : 1 ratio of dominant to recessive alleles for this gene in the live offspring.

- 70** One strand of a section of DNA has the following sequence of bases:

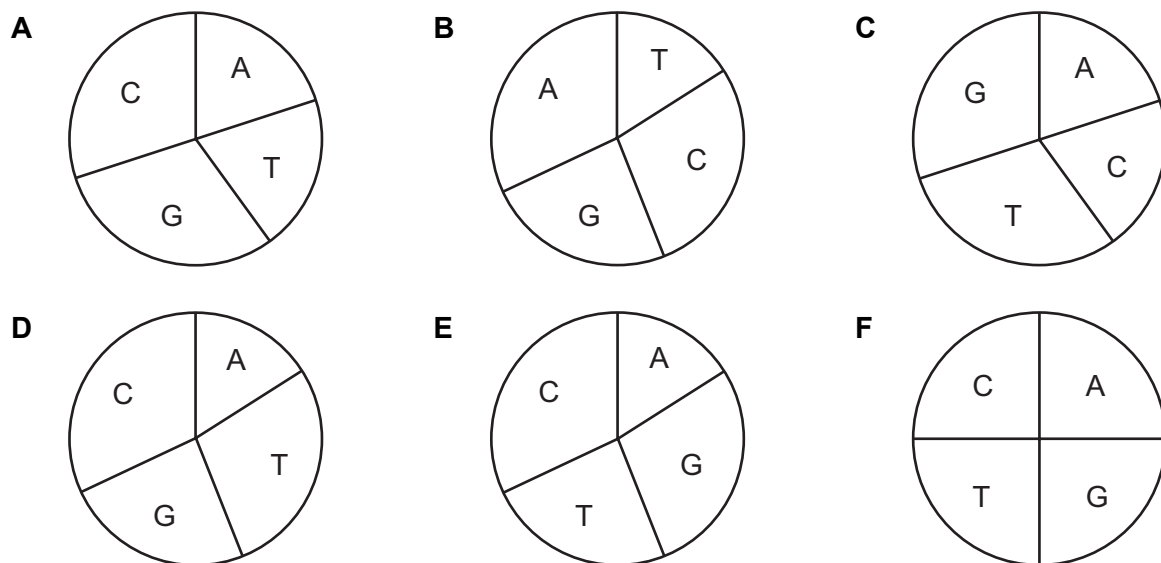
AATCGGTCTTGCGGCCAAGGCCCTT

The complementary strand is not shown.

The charts show the proportions of the four bases A, C, G and T.

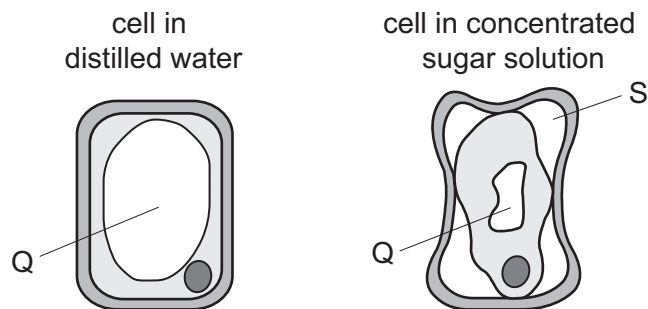
Which chart shows the correct proportions of bases for this section of double-stranded DNA?

(Assume no mutations.)



- 71** Two identical plant cells were removed from a leaf. One was placed in a concentrated sugar solution and the other was placed in distilled water, and both were left for 2 hours.

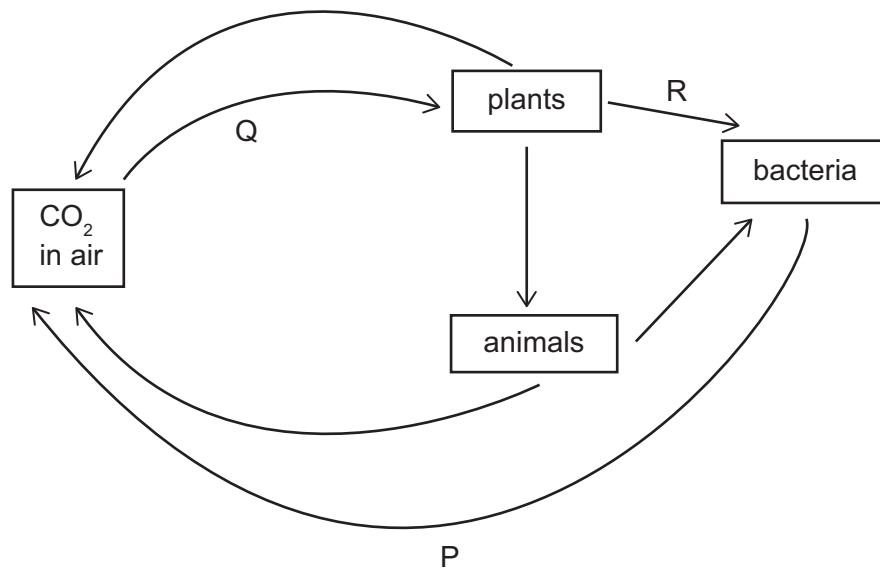
All other factors were kept constant during the experiment. The diagram shows the results, with regions of each cell labelled Q and S.



Which of the following statements is/are correct?

- 1** In the cell in distilled water, Q contains only distilled water.
  - 2** In the cell in concentrated sugar solution, the number of solute particles in Q increased over the two hours.
  - 3** S is a vacuum.
- A** none of them
- B** 1 only
- C** 2 only
- D** 3 only
- E** 1 and 2 only
- F** 1 and 3 only
- G** 2 and 3 only
- H** 1, 2 and 3

- 72** The diagram shows some chemical processes involved in the carbon cycle. Three of these multi-stage processes are labelled P, Q and R.



Which of the following statements is/are correct?

- 1** P requires the presence of mitochondria.
  - 2** Overall, Q releases heat.
  - 3** R is sensitive to changes in pH and temperature.
- A** none of them
- B** 1 only
- C** 2 only
- D** 3 only
- E** 1 and 2 only
- F** 1 and 3 only
- G** 2 and 3 only
- H** 1, 2 and 3

- 73** Two different cells, cell L and cell M, were studied using a microscope and then drawn. The drawings are not shown.

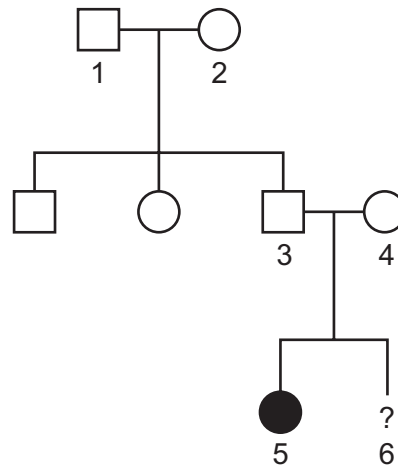
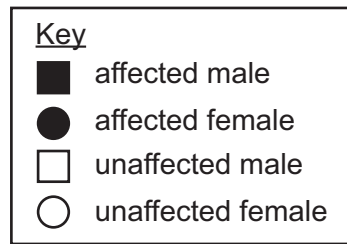
Some of the data collected is shown in the table.

|                                                                 | <i>cell L</i> | <i>cell M</i> |
|-----------------------------------------------------------------|---------------|---------------|
| <i>actual maximum length of cell / <math>\mu\text{m}</math></i> | 400           | 40            |
| <i>maximum length of cell in drawing / cm</i>                   | 2             | 1             |

Which of the following statements is/are correct?

- 1** Cell L has been magnified 50 times.
  - 2** Cell M has been magnified 5 times as much as cell L.
  - 3** Both cells could have a cell wall.
- A** none of them
- B** 1 only
- C** 2 only
- D** 3 only
- E** 1 and 2 only
- F** 1 and 3 only
- G** 2 and 3 only
- H** 1, 2 and 3

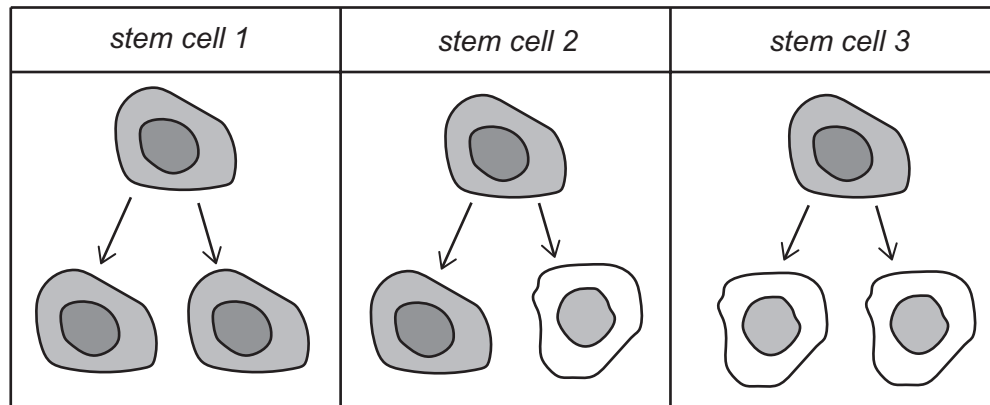
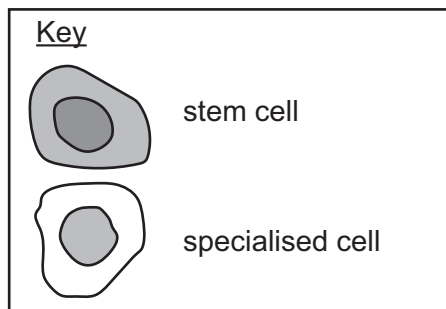
- 74 The pedigree diagram shows the inheritance of a phenotypic feature caused by a recessive allele.



What is the probability that individual 6 is an unaffected male?

- A 12.5%
- B 25%
- C 37.5%
- D 50%
- E 62.5%
- F 75%

- 75** The diagrams show the daughter cells produced when three different stem cells divide.



Which of the following statements is correct?

- A** Only stem cell 1 shows division by mitosis.
- B** Some cancers result from divisions like that shown for stem cell 1.
- C** The total number of stem cells increases if they divide like stem cell 2.
- D** Stem cells in adults divide like stem cell 3.
- E** The total number of stem cells is maintained if they divide like stem cell 3.

- 76** A fungus feeds by releasing amylase onto starchy food. The soluble products of the breakdown of starch are absorbed by the fungus.

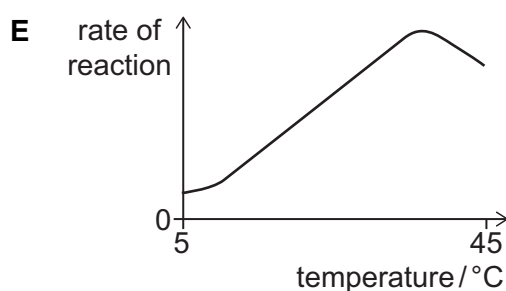
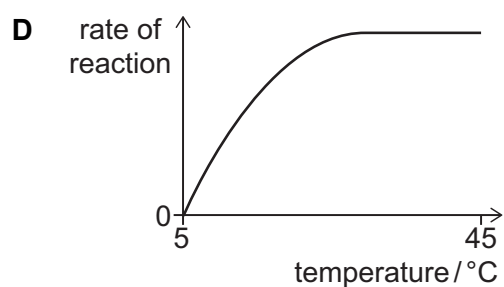
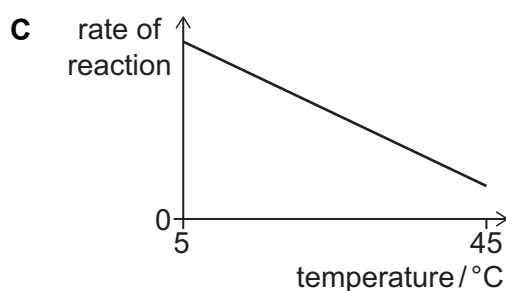
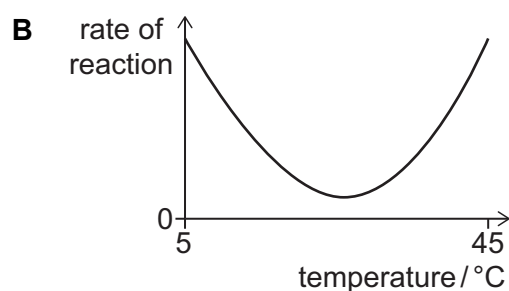
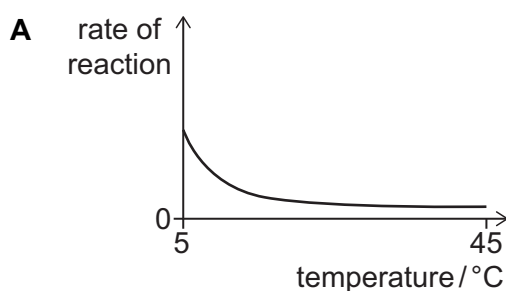
Test tubes were set up containing a mixture of starch solution and fungus. Each test tube was maintained at a different temperature between 5 °C and 45 °C.

Samples of the mixture were removed early in the experiments to determine the initial rates of this enzyme-catalysed reaction.

The results were plotted.

All of the other variables were kept constant.

Which graph shows the expected results?



- 77** Red blood cells are produced by stem cells in the bone marrow.

A  $1\text{ mm}^3$  sample of blood from a healthy person was found to contain  $4 \times 10^6$  red blood cells.

The person has a consistent average total blood volume of  $0.006\text{ m}^3$ . Their total red blood cell count does not change and, on average, red blood cells have a lifespan of 100 days.

Which of the following statements is/are correct?

- 1** Red blood cells are phagocytic cells.
  - 2** The average rate of production of red blood cells is  $1 \times 10^{10}$  cells per hour.
  - 3** The stem cells that produce red blood cells do not have nuclei.
- A** none of them
- B** 1 only
- C** 2 only
- D** 3 only
- E** 1 and 2 only
- F** 1 and 3 only
- G** 2 and 3 only
- H** 1, 2 and 3