

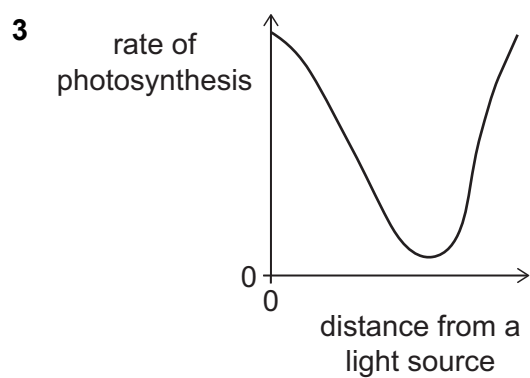
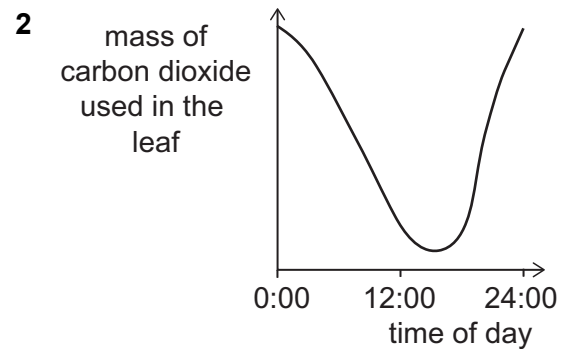
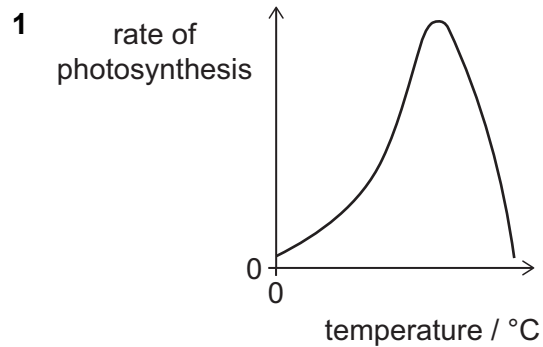
PART D Biology

- 61** Ambrosia beetles carry fungal spores from tree to tree. The beetles make holes in the branches of trees and create a network of tunnels in the wood. The fungus grows along the walls of the tunnels providing the only food source for the beetles. The fungus can penetrate xylem vessels and block them, which eventually kills the tree.

Which option correctly describes the relationship between these organisms?

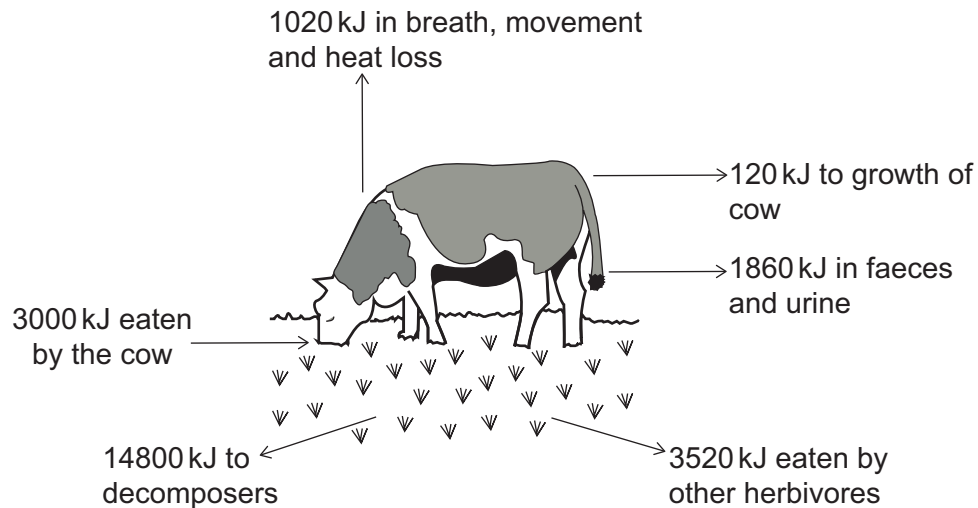
- A** The beetle and the fungus have a mutualistic relationship.
- B** The beetle and the tree have a mutualistic relationship.
- C** The fungus is a parasite on the beetle.
- D** The fungus is the primary producer that the beetle feeds on.
- E** The tree is the primary producer that the beetle feeds on.

- 62** Which of the following graphs could describe processes taking place in the leaf of an oak tree in the presence of light?



- 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

- 63** The diagram shows the flow of energy in a year's growth of grass from 1 m² of grassland.



Which of the following statements is/are correct?

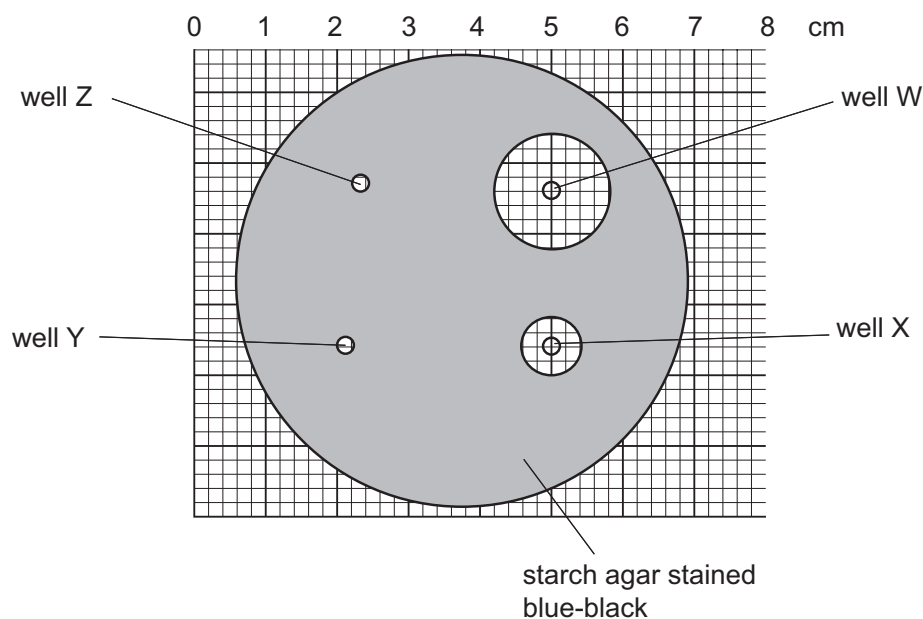
- 1** 62% of the energy consumed by the cow is lost in faeces and urine.
 - 2** The diagram illustrates all the main processes of carbon uptake and release in the carbon cycle.
 - 3** 4% of the energy absorbed by the cells of the cow is used for growth.
- A** none of them
- B** 1 only
- C** 2 only
- D** 3 only
- E** 1 and 2 only
- F** 1 and 3 only
- G** 2 and 3 only
- H** 1, 2 and 3

- 64** A Petri dish was filled with agar that had been mixed with starch. The agar is not digested by enzymes used in the experiment.

Four small wells were cut in the agar. Three were filled with different solutions. Well Y was filled with water to act as a control.

The dish was kept at 30 °C for 30 minutes. The surface of the agar was then washed with iodine solution, turning parts of it blue-black in the presence of starch.

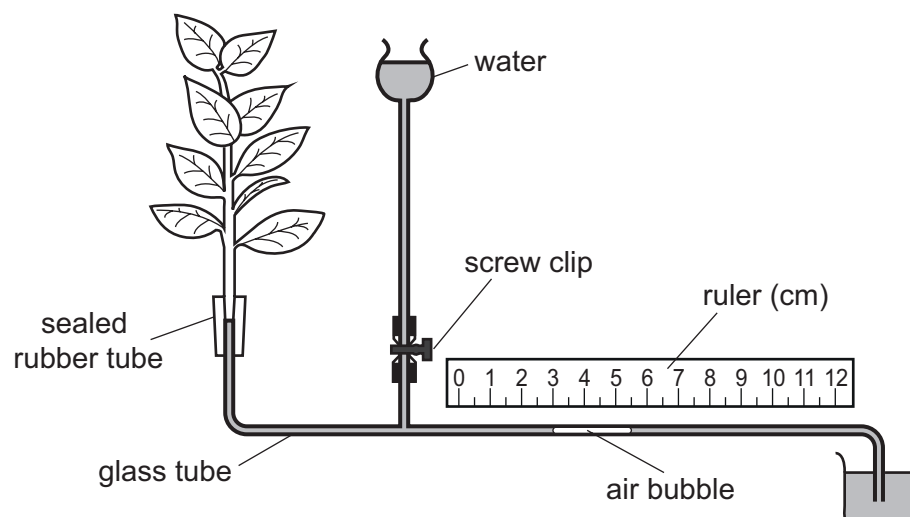
The Petri dish was placed on a piece of graph paper, as shown in the diagram, to measure the clear areas around the wells. The area of each well should be considered negligible.



Which of the statements is/are correct?

- 1 The area of starch digested around well W is 4 times the area digested around well X.
 - 2 Amylase could have been used in well W and protease could have been used in well X.
 - 3 The solution put in well Z could have contained boiled enzyme.
- 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

- 65 The diagram shows a bubble potometer at the start of an experiment.



The glass tube has an internal diameter of 1 mm.

After five minutes, one end of the air bubble had moved to the 4 cm mark on the scale.

Which row is correct?

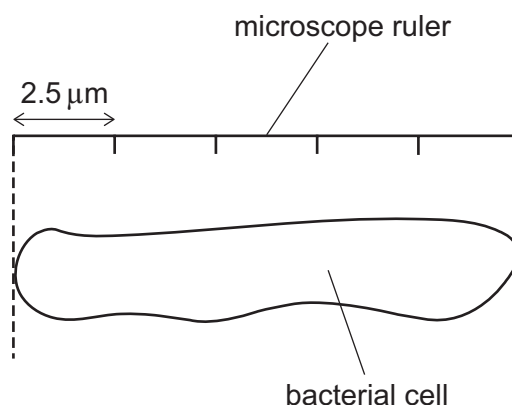
	<i>name of process being investigated</i>	<i>volume of water taken up / mm³</i>
A	translocation	$\pi \times (0.5)^2 \times 10$
B	translocation	$\pi \times (0.5)^2 \times 15$
C	translocation	$2\pi \times (0.5) \times 10$
D	translocation	$2\pi \times (0.5) \times 15$
E	transpiration	$\pi \times (0.5)^2 \times 10$
F	transpiration	$\pi \times (0.5)^2 \times 15$
G	transpiration	$2\pi \times (0.5) \times 10$
H	transpiration	$2\pi \times (0.5) \times 15$

- 66** A chemical was added to a cell dividing by mitosis. This chemical binds to molecules, preventing the separation of the replicated chromosomes.

Using this information, which of the following effects could this chemical have on this cell division?

- 1** The four daughter cells contain double the normal number of chromosomes.
 - 2** The gametes contain the haploid number of chromosomes.
 - 3** The cell does not divide and contains the diploid number of replicated chromosomes.
-
- 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** A student viewed a bacterial cell using a microscope. The cell was measured with a microscope ruler as shown in the diagram. Each division on this ruler measures $2.5\mu\text{m}$.



The student made a drawing of this cell. The drawing was 5.0 cm in length and included the structures that the student expected to see.

Which row of the table gives the magnification of the student's drawing and one of the structures that should be included?

	<i>magnification of the student's drawing</i>	<i>structure that should be included</i>
A	2.5×10^{-4}	cell wall
B	2.5×10^{-4}	nucleus
C	4.0×10^{-1}	cell wall
D	4.0×10^{-1}	nucleus
E	4.0×10^3	cell wall
F	4.0×10^3	nucleus
G	2.0×10^4	cell wall
H	2.0×10^4	nucleus

- 68** The table shows details of genetic characteristics of three species of organisms and the genetic crosses carried out with them.

<i>cross</i>	<i>organism</i>	<i>dominant characteristic</i>	<i>recessive characteristic</i>	<i>description of parents in cross</i>	
V	cattle	have horns	hornless	heterozygous horned	× hornless
W	fruit flies	grey-bodied	ebony-bodied	heterozygous grey-bodied	× heterozygous grey-bodied
Y	pea plants	round seeds	wrinkled seeds	wrinkled seeds	× homozygous round seeds

All alleles exhibit simple dominant/recessive relationships.

Which of the following statements is/are correct?

- 1** If two of the offspring from cross V are bred together, three different crosses could result, with three different probabilities of phenotypes in the next generation: 100% hornless, 50% hornless, or 25% hornless.
 - 2** The genotypes of the offspring with the dominant characteristic from cross W will be identifiable through their phenotypes.
 - 3** A farmer planted seeds collected from the offspring of cross Y. If these seeds grew and produced flowers which were then cross-pollinated with each other, the resulting seeds would yield a crop containing 50% homozygous plants.
- 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

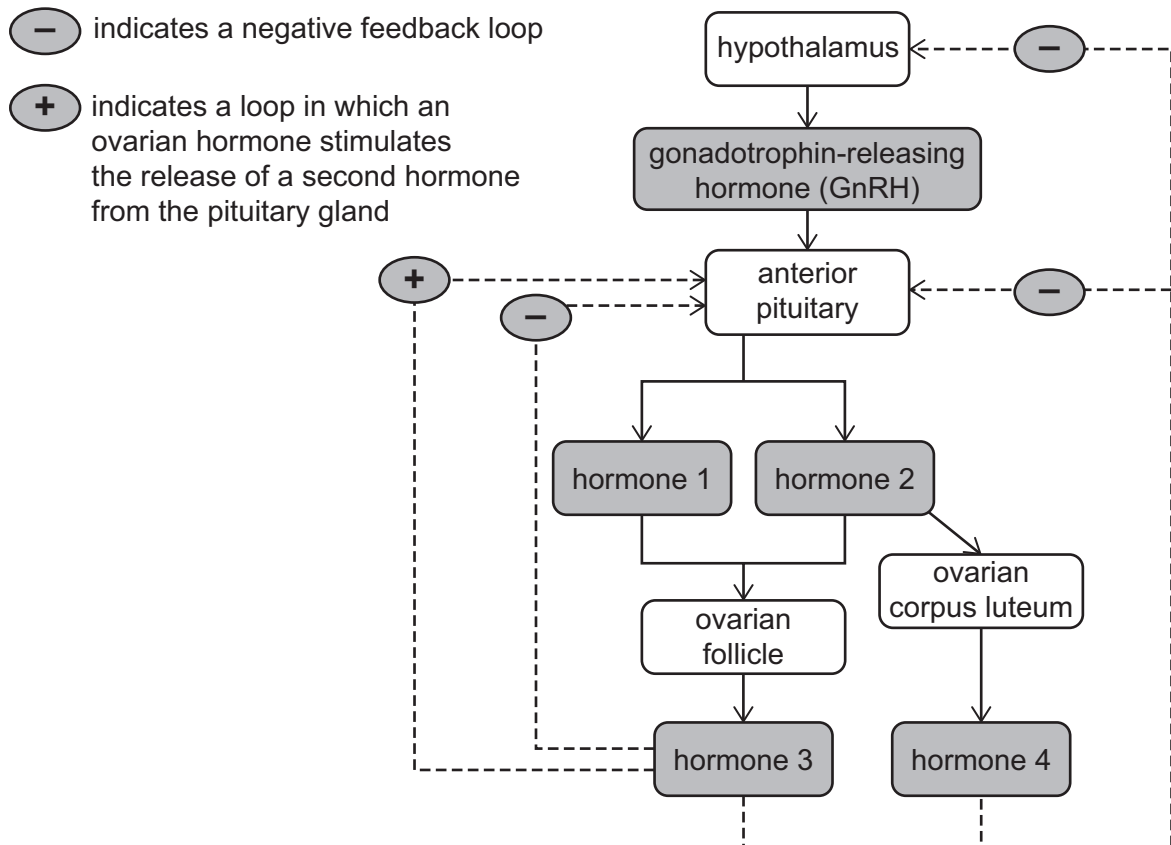
- 69** The table shows the relationship between heart rate and blood output from the left ventricle of a healthy human heart.

<i>heart rate in beats per minute</i>	55	70	80	90	120	140	150	175
<i>blood output in dm³ from the left ventricle of the heart each minute</i>	4.0	5.0	5.2	5.6	6.0	6.0	5.8	4.6

Which of the following statements is/are correct?

- 1** The volume of blood pumped out of the heart each minute is directly proportional to the heart rate.
 - 2** When the heart rate increased from 55 to 70 beats per minute, the blood output from the heart increased by 20%.
 - 3** Blood output from the heart to the lungs will be less than that to the rest of the body.
- 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

- 70** The diagram shows a flow chart representing the hormonal activity associated with the menstrual cycle.



Which of the following statements about the menstrual cycle is/are correct?

- 1 Hormone 1 stimulates follicle maturation and the release of hormone 3 from the ovarian follicle.
 - 2 Hormone 4 maintains the uterus lining.
 - 3 At the end of the menstrual cycle the levels of hormone 1 and hormone 2 will reach their highest point and then decrease, leading to menstruation.
- 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

71 A scientist was investigating the effect of substrate concentration on lipase enzyme activity

Two test tubes were set up:

- one containing a sample of full-fat milk mixed with an alkaline solution, and a pH indicator
- one containing lipase

The pH indicator turned the alkaline milk sample pink.

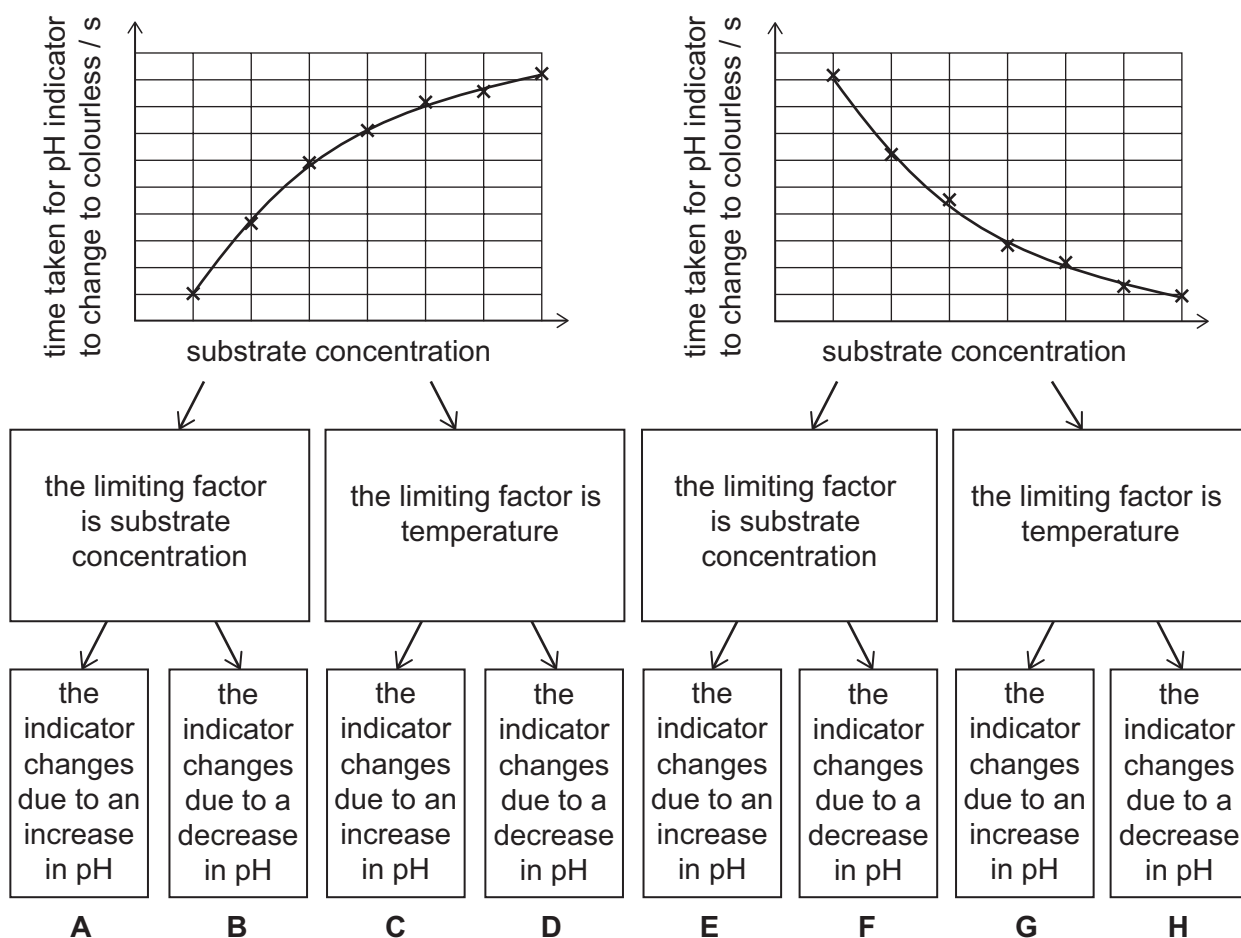
Both tubes were incubated in a water bath set to an optimum temperature for lipase until the contents had reached this temperature.

The scientist then added the lipase to the tube with the milk sample and measured the time taken for the indicator to turn colourless. This colour change was caused by an increase in concentration of one of the products of the reaction.

Further samples of the milk were diluted, and added to the same quantity of alkaline solution and pH indicator, to produce another six different substrate concentrations, and the experiment was repeated. All other variables were kept constant.

The scientist found that each substrate concentration caused the pH indicator to change to colourless in a different length of time. The results of the reaction in all seven tubes were plotted on a graph.

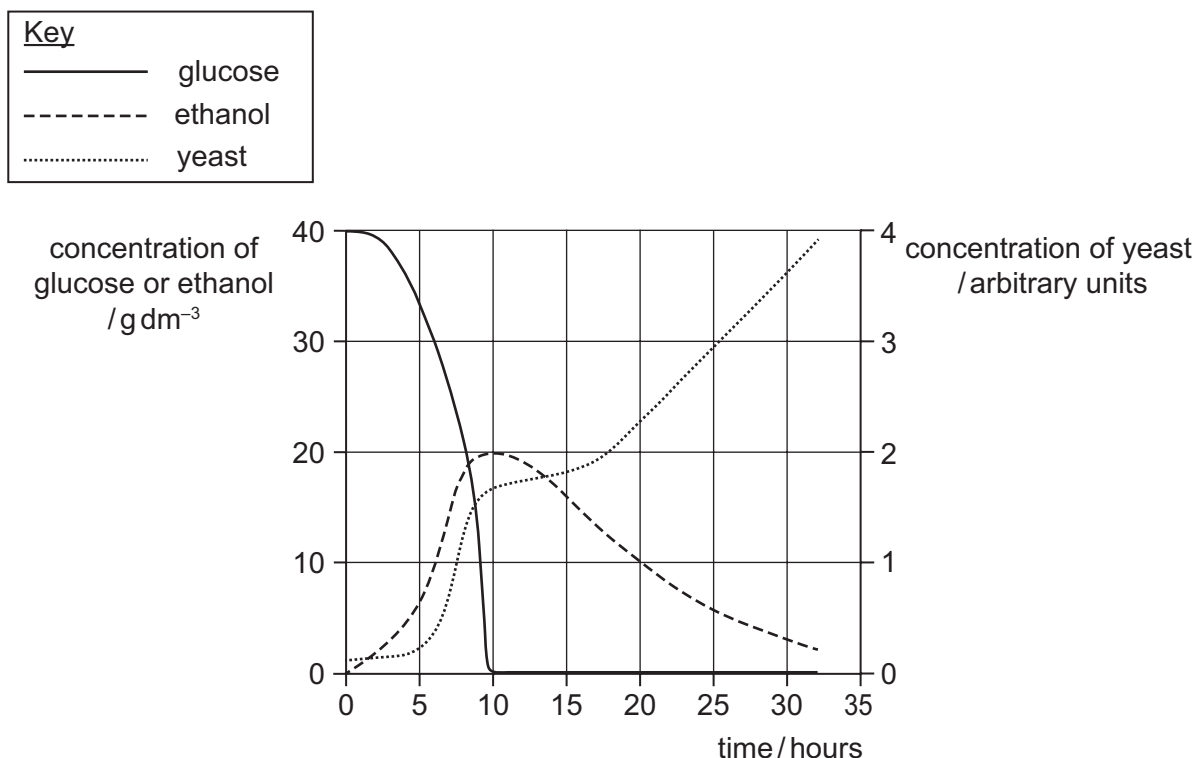
Which option correctly identifies the shape of the graph of the results, the limiting factor during the experiment and an explanation for the change in colour of the pH indicator?



- 72** Even when sufficient oxygen is available, yeast will respire anaerobically using glucose as a substrate. However, if its source of glucose runs out and oxygen is available, yeast can switch to using ethanol as a substrate, which it uses to respire aerobically.

A sample of yeast was added to 100 cm^3 glucose solution in an open flask.

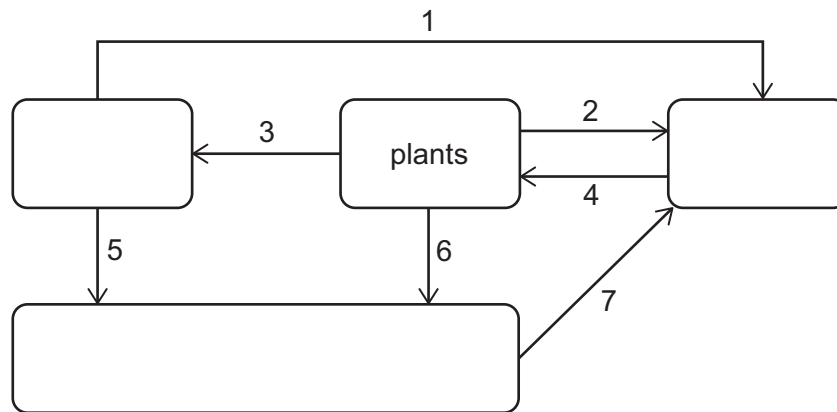
The contents of the flask were monitored over 32 hours and the results are shown in the graph.



Which of the following statements are correct?

- 1 Carbon dioxide would be produced in the flask at all times throughout the observation period, regardless of whether the yeast was respiring aerobically or anaerobically.
 - 2 The yeast was respiring using ethanol as the only substrate for 22 hours.
 - 3 The yeast started respiring anaerobically from the start of the observation period.
 - 4 The yeast used an average of 4 g glucose per hour for the first 10 hours.
- A** 1, 2 and 3 only
- B** 1, 2 and 4 only
- C** 1, 3 and 4 only
- D** 2, 3 and 4 only
- E** 1, 2, 3 and 4

73 The diagram represents part of the carbon cycle.



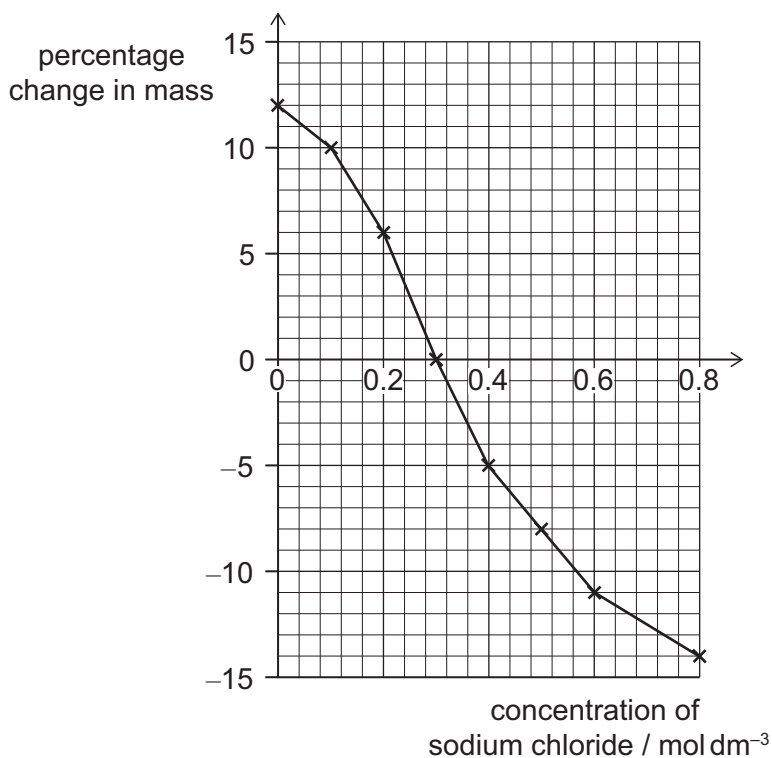
Which of the arrows represent processes resulting in at least one organic product (contains carbon and hydrogen)?

- A** 3 only
- B** 4 only
- C** 5 and 6 only
- D** 1, 2 and 7 only
- E** 3, 5 and 6 only
- F** 1, 2, 3 and 4 only
- G** 3, 4, 5 and 6 only
- H** 1, 2, 3, 4, 5, 6 and 7

- 74** In an experiment, 8 identical cubes of potato were each weighed and placed in a different test tube.

Each of the test tubes contained a different concentration of sodium chloride solution. All other conditions were kept the same throughout the experiment.

After 30 minutes, the potato cubes were removed from the test tubes and weighed, and the percentage change in mass was calculated.



Which of the following statements is/are correct?

- 1** The initial concentration of sodium chloride inside the potato cubes must be 0.3 mol dm^{-3} .
 - 2** Osmosis involves the diffusion of water molecules from a solution of high solute concentration to one of low solute concentration.
 - 3** In this experiment, the rate of osmosis is fastest at a sodium chloride concentration of 0.8 mol dm^{-3} .
- 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

- 75** The same section of a gene was taken from two different people and the DNA sequenced to show the triplets on one strand.

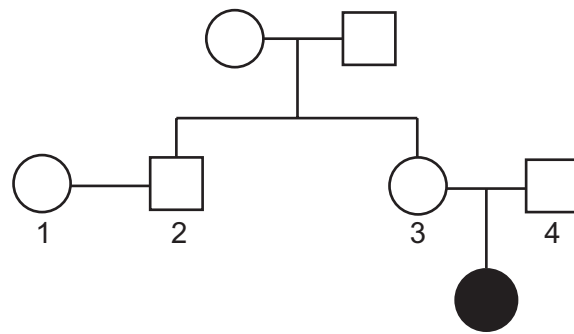
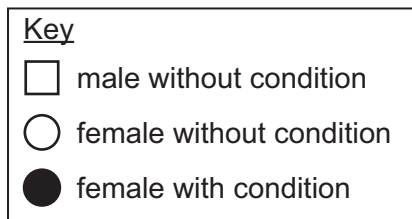
The results for each person are shown.

<i>person 1</i>	TCC	GCG	AGC	CCC	TTG	AGG
<i>person 2</i>	TCC	GCG	AGC	CCG	TTA	AGG

Which of the following statements about the sequences could be correct?

- 1** Person 2 has one mutation in the section of the gene.
 - 2** Both people have the same phenotype for this gene.
 - 3** This section of the gene codes for up to 6 bases.
- 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

- 76** The family tree shows the inheritance of an autosomal recessive genetic condition.



Which of the following statements is/are correct for this family?

- 1** If one cheek cell is collected from each individual, the overall ratio of X chromosomes to Y chromosomes will be 3.67 : 1
- 2** The probability of individual 2 and individual 3 having the same alleles on their X chromosomes is 100%.
- 3** The probability of individual 2 and individual 3 having the same genotype for the condition is 50%.

(Assume no mutations.)

- 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

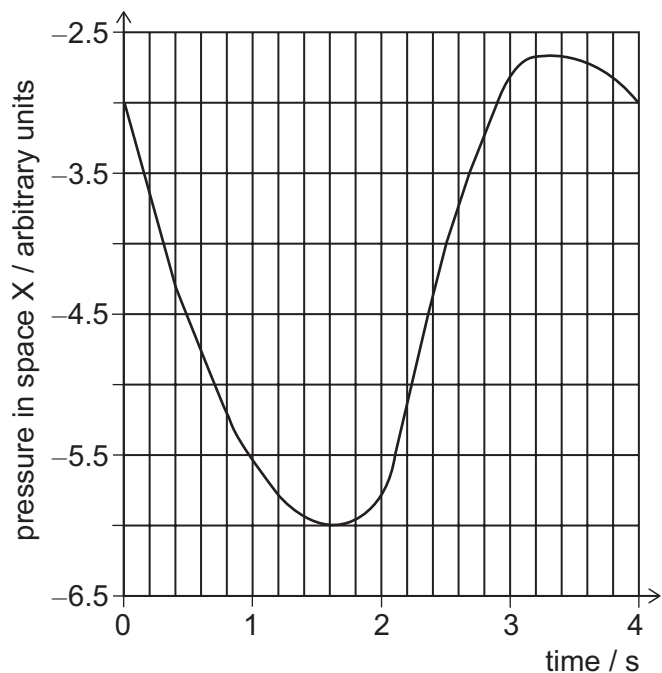
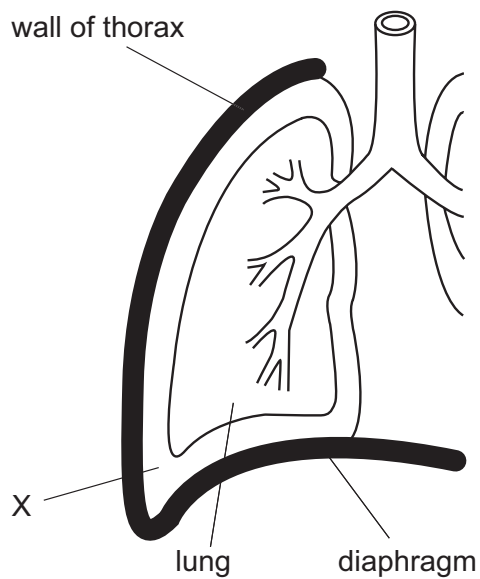
77 The sugar present in DNA contains 5 carbons.

A section of single-stranded DNA contains five different triplets.

Which of the following statements about this strand could be correct?

- 1** There are 75 carbons in the sugar–phosphate backbone in this section.
 - 2** The minimum number of different bases present in the base sequence is 2.
 - 3** The number of sugar-to-phosphate bonds is equal to the number of nucleotides.
- 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

- 78** The graph shows the change in the pressure in the space X between the wall of the thorax and the lungs (as shown in the diagram) during one complete breathing cycle.



Which of the following statements is/are correct?

- 1 The person is breathing out between 0 and 1.5 seconds.
- 2 The diaphragm is relaxing between 2 and 3 seconds.
- 3 The rate of breathing is 15 breaths per minute.

(Assume the person continues breathing at the same rate.)

- 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