PART D Biology

55 Which of the following statements is/are correct for both bacterial cells and sperm cells?

1 The cell can divide.

2 The cell contains DNA.

3 The cell has a cell wall.

4 The cell has a nucleus.

5 The cell can carry out respiration.

A 2 only

B 4 only

C 1 and 2 only

D 2 and 5 only

E 3 and 4 only

F 3 and 5 only

G 1, 2 and 5 only

H 1, 3 and 4 only

56 Which one of the following statements about cells or tissues is correct?

A Any adult stem cells can naturally give rise to all tissue.

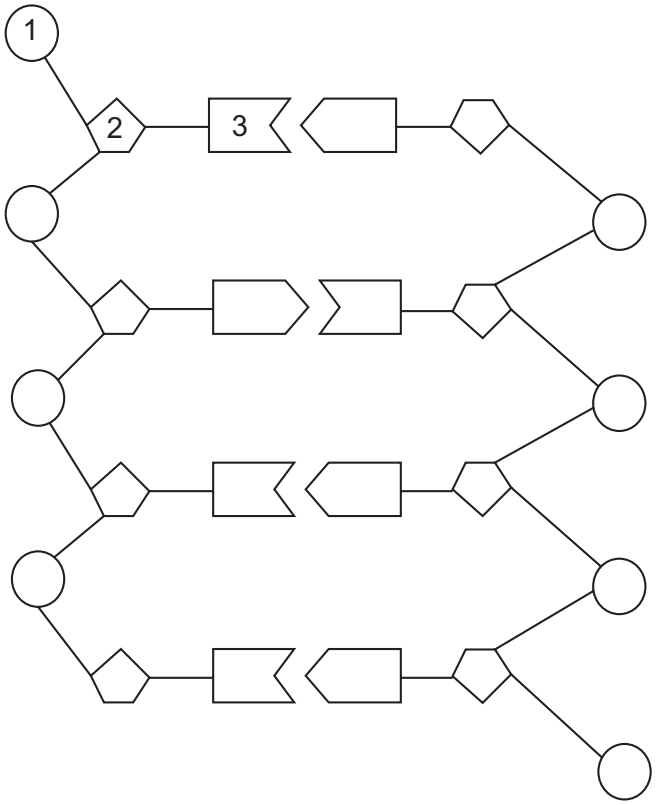
B Endocrine glands secrete enzymes into the bloodstream.

C Embryonic stem cells divide by meiosis to form all cell types.

D Receptor cells send chemical impulses along neurones.

E The stomach wall contains a tissue that enables movement of food.

57 The diagram represents a section of DNA.



What do the parts labelled 1, 2 and 3 represent?

	1	*2*	*3*	*1 and 2 and 3*
A	base	phosphate	glycerol	gene
B	base	sugar	amino acid	gene
C	phosphate	sugar	base	nucleotide
D	phosphate	sugar	base	DNA strand
E	sugar	phosphate	base	nucleotide
F	sugar	phosphate	fatty acid	DNA strand

58 Using the information in the table, which animal (**A**-**F**) is most at risk of extinction?

animal	*geographic range*	*habitat tolerance*	*population size*
A	restricted	broad	large
B	extensive	broad	large
C	restricted	narrow	small
D	extensive	narrow	small
E	restricted	broad	small
F	extensive	broad	small

59 An ecologist used a 50 cm × 50 cm square quadrat to estimate the number of meadow buttercups present in a field with an area of 50 m^2. The quadrat was distributed randomly on ten occasions in the field and the number of buttercups counted in each quadrat.

quadrat	*number of buttercups*
1	3
2	10
3	0
4	4
5	21
6	19
7	6
8	11
9	15
10	3

How many buttercups were there estimated to be in the 50 m^2 field?

A 368

B 460

C 920

D 1840

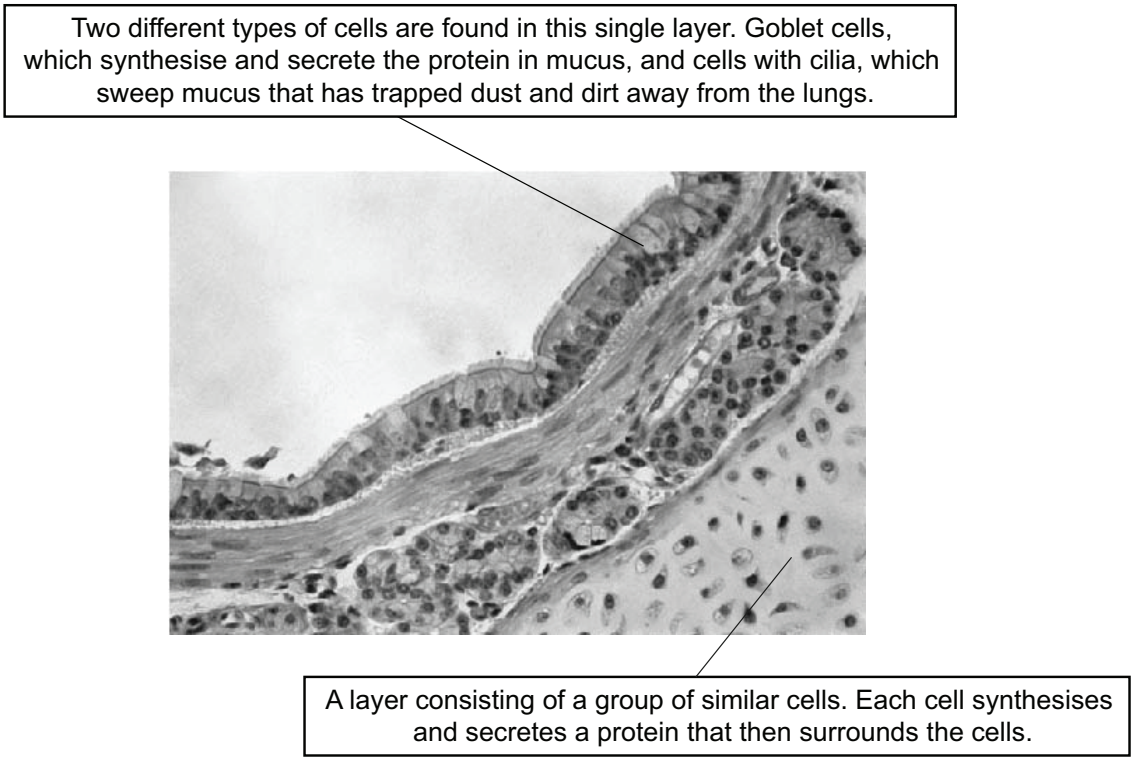
E 4600

F 18 400

G 45 000

60 The photomicrograph shows a section through the wall of a human bronchus, one of the tubes which carries air towards the lungs.

A student studying this structure annotated the photomicrograph by describing the cells found in two different layers in the wall of the bronchus.



The student used these observations to write some conclusions.

Which of the following conclusions is/are correct?

1 The two different layers are both tissues.

2 The bronchus can be described as an organ.

3 Amino acids are found in the cytoplasm of cells in each layer.

A none of them

B 1 only

C 2 only

D 3 only

E 1 and 2 only

F 1 and 3 only

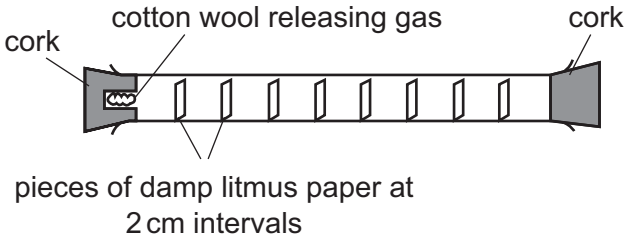
G 1, 2 and 3

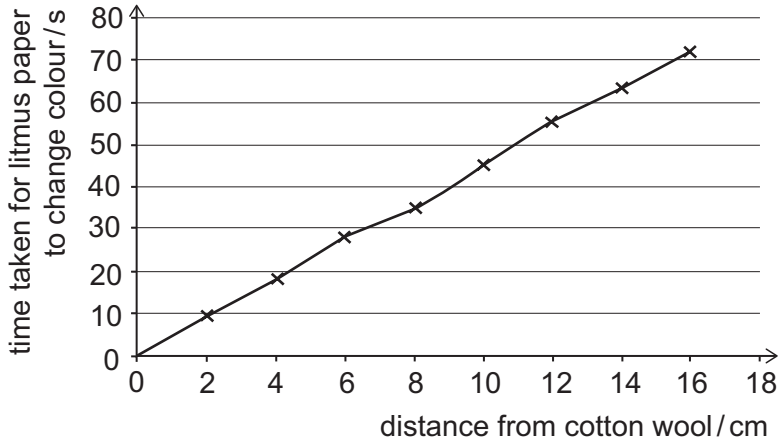
61 A student carried out an investigation using the diffusion of a gas along a tube to model movement of gases in the air space of a leaf. An alkaline gas was released from a solution that evaporated from the cotton wool.

As the gas diffused, it caused damp litmus paper to change colour.

The time was recorded when each piece of litmus paper changed colour.

The apparatus and a graph of the results are shown below.





Which of the following statements about the investigation is/are correct?

1 The dependent variable has been plotted on the x-axis.

2 If diffusion of the gas was slower, the graph line would become steeper.

3 If a more concentrated solution was used in an identical set of apparatus, the data collected would result in a line on the graph below the points plotted for the original gas.

A none of them

B 1 only

C 2 only

D 3 only

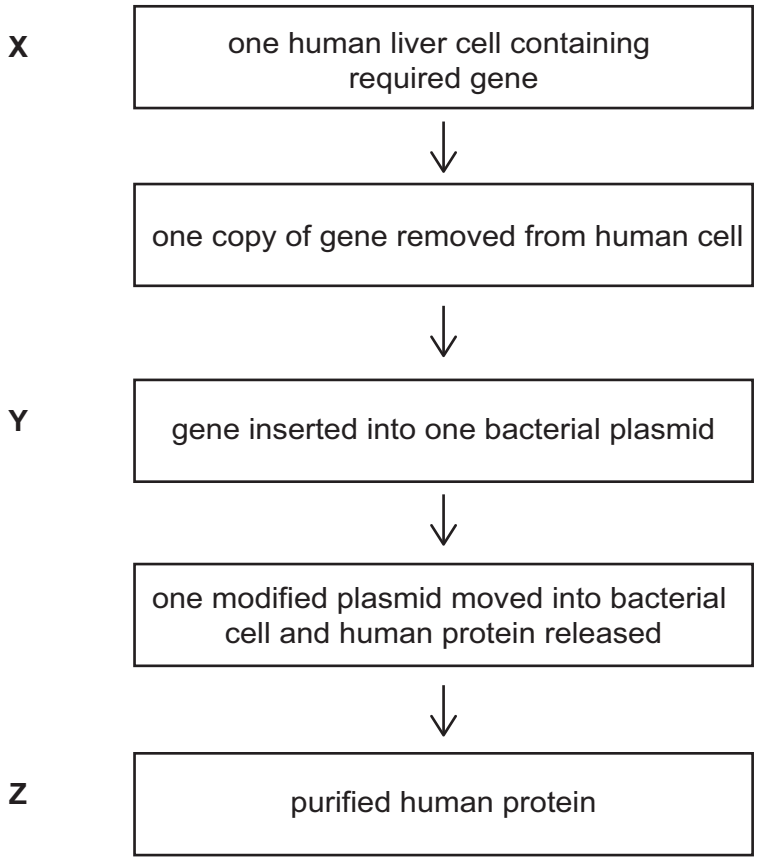
E 1 and 2 only

F 1 and 3 only

G 2 and 3 only

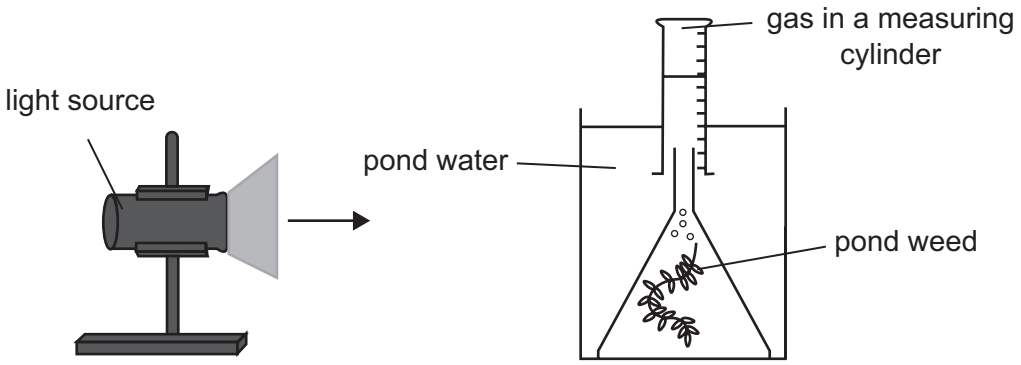
62 A bacterium was genetically modified by inserting a human gene into a plasmid. A plasmid is a small circle of DNA that can be used to transfer genes into bacterial cells. These modified bacteria then secrete the protein that the human gene codes for. The gene contains a sequence of bases that is not repeated anywhere else in its DNA and is not found in the DNA of other organisms. This sequence of bases is found in every allele of this gene.

Assuming that no mutations occur, how many copies of this base sequence would you expect to find at each of the stages X, Y and Z?



	number of copies of DNA sequence found		
	stage X	*stage* Y	*stage* Z
A	1	1	0
B	1	2	1
C	1	1	1
D	2	1	0
E	2	1	1
F	2	2	0

63 A student set up an experiment to measure the rate of photosynthesis, as shown in the diagram.



Data was collected and plotted on a graph.

If plotted, which of the following variables would give a gradient that is directly proportional to the rate of photosynthesis?

(All other variables were kept constant.)

	x-axis	*y-axis*
1	time	volume of CO_2 released
2	time	number of gas bubbles released per minute
3	volume of oxygen released	time

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 Bacteria reproduce asexually by dividing into two by binary fission.

Which of the following statements is/are correct about binary fission in bacteria?

1 As it is a form of asexual reproduction, there cannot be any variation in the offspring.

2 It can lead to a repeated doubling in population size if there are no limiting factors.

3 If binary fission occurs every 20 minutes, one bacterium would become 72^2 bacteria in 24 hours.

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 Which of the following may stay the same when a mutation occurs in a human gene that codes for a protein?

1 the genotype of the organism's offspring

2 the phenotype of the organism

3 the sequence of amino acids in the protein

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 A child is affected by a dominant genetic condition. All of his cells have the same genotype. The allele associated with this condition is not present in either of his parents.

Which of the following statements could explain this?

1 A mutation occurred during meiosis in his father.

2 A random mutation occurred in his DNA after he was born.

3 Both of his grandmothers had the condition.

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 Phosphatase enzymes break the bond between a phosphate group and the rest of a molecule.

Phenolphthalein phosphate (PPP) is colourless and is a substrate for phosphatase enzymes.

- The phosphate group of PPP can be removed by the phosphatase enzyme to produce the indicator phenolphthalein.
- Phenolphthalein goes pink in alkaline conditions.

Five tubes were set up with equal concentrations of PPP and a plant phosphatase enzyme.

Each tube was at a different pH. The tubes were incubated at the same temperature. After 10 minutes Na_2CO_3 was then added to each tube until a pH of 9.5 was reached. The colour was observed immediately and then again after another 5 minutes.

tube	1	2	3	4	5
pH of the initial reaction	3.2	4.2	5.2	8.2	9.2
colour immediately after Na_2CO_3 addition	pale pink	pink	dark pink	colourless	colourless
colour after another 5 minutes	pale pink	pink	dark pink	colourless	colourless

Which of the following statements is/are correct?

1 Na_2CO_3 solution inhibited the activity of the phosphatase enzyme.

2 More substrate was produced in conditions of high acidity compared to low acidity.

3 The optimum pH for this plant phosphatase must be 5.2.

A none of them

B 1 only

C 2 only

D 3 only

E 1 and 2 only

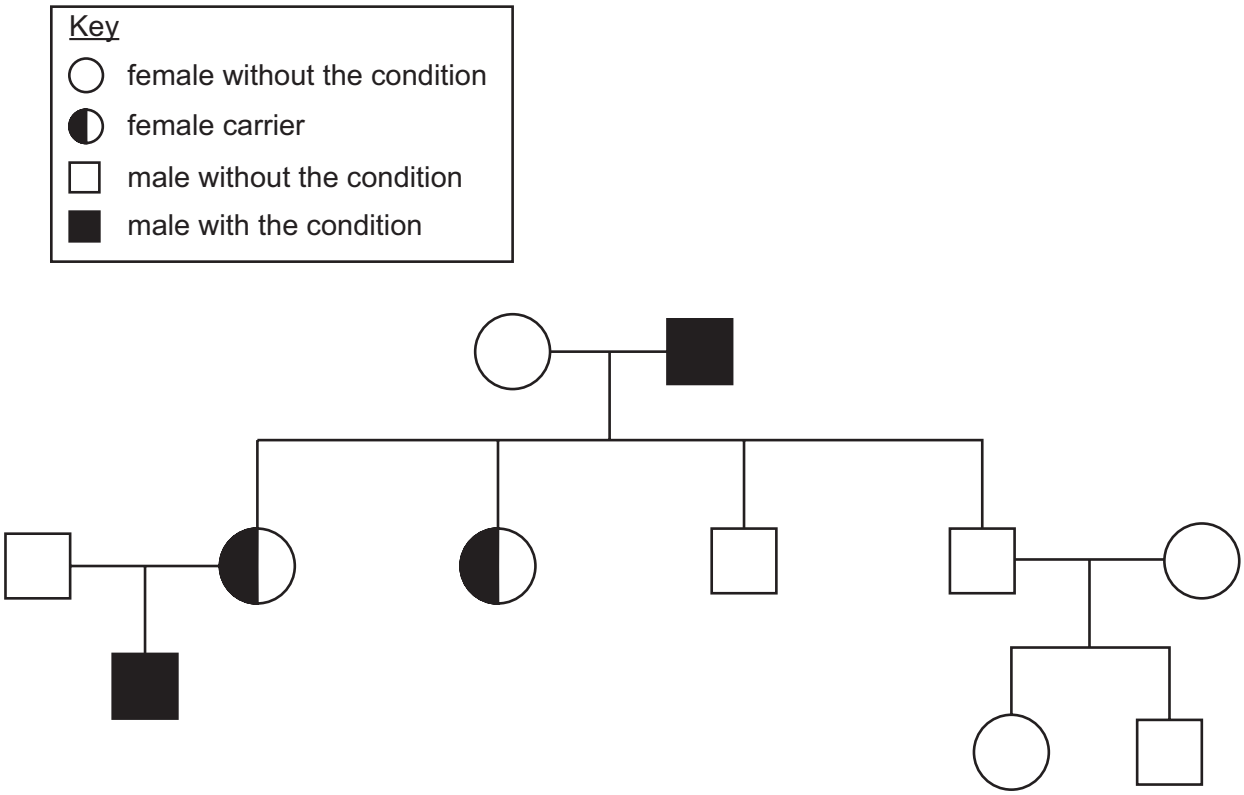
F 1 and 3 only

G 2 and 3 only

H 1, 2 and 3

68 A gene found on the X chromosome in humans has two alleles, dominant and recessive. Individuals who have only recessive alleles have a condition that affects their eyesight.

The inheritance of the condition in one family is shown in the family tree.



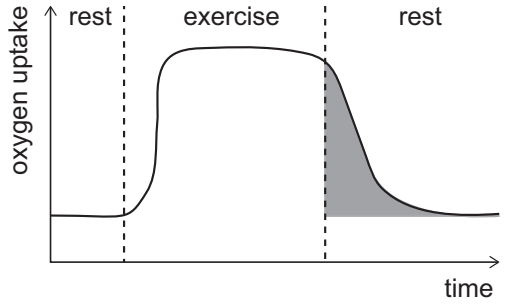
If one living skin cell from each member of this family were analysed, how many of the following alleles would be found?

	number of copies of the recessive allele	*number of copies of the dominant allele*
A	2	7
B	2	12
C	2	14
D	4	7
E	4	12
F	4	14
G	6	7
H	6	12

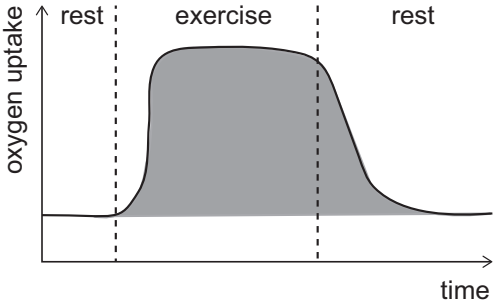
69 The graphs below show the oxygen uptake before, during and after a period of strenuous physical exercise.

Which shaded area correctly represents the additional oxygen taken in to repay the oxygen debt acquired through anaerobic respiration?

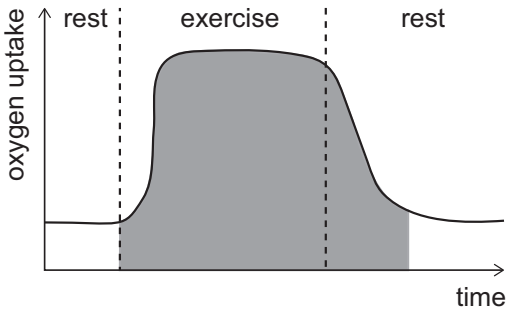
A



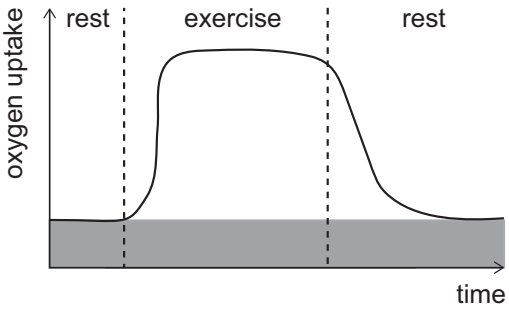
B



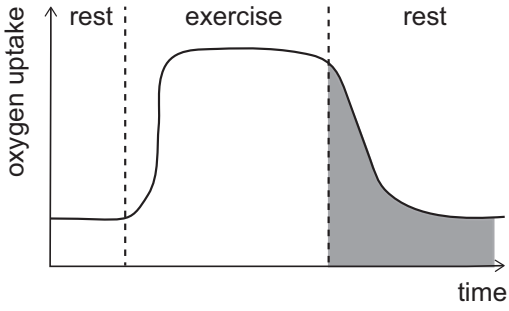
C



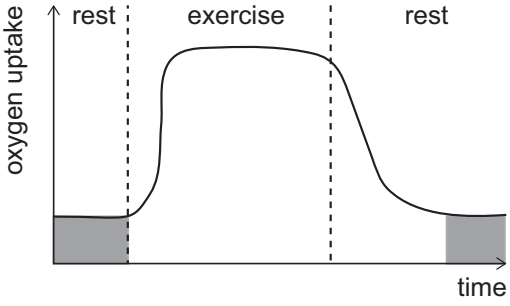
D



E



F

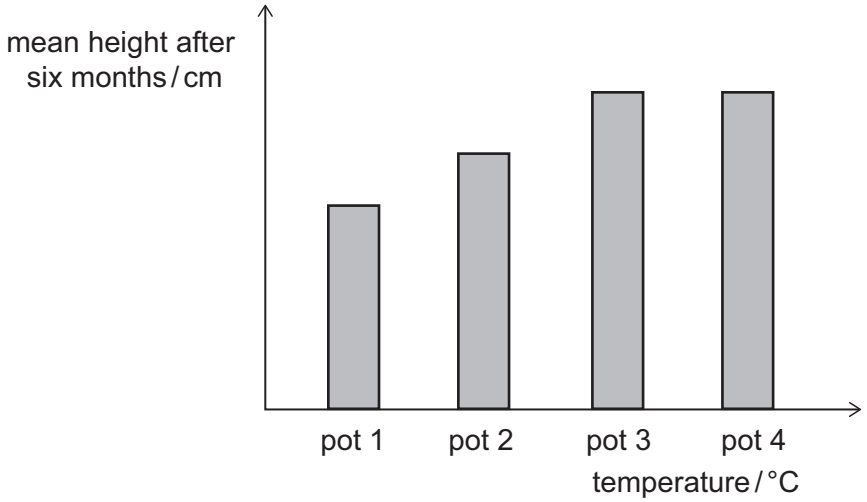


70 An investigation was carried out using clones of one plant.

Twenty plants of the same initial height were selected and divided into four equal groups. Each group was grown for six months and their environments were controlled as follows:

- kept at a different temperature to each other
- grown in a pot with an equal mass of soil with the same nutrients
- watered with an equal volume of water
- kept in the same light intensity

After six months, the height of the plants was measured. The mean height of the plants in each pot was calculated. The results are shown in the chart.



Which of the following statements could explain the results?

1 The difference in mean height between plants in pot 1 and plants in pot 2 could be due to the environment.

2 The mean height of plants in pot 4 equals that of plants in pot 3 because of another environmental factor in addition to temperature.

3 The mean height of plants in pot 3 equals that of plants in pot 4 because of the genotype of the 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

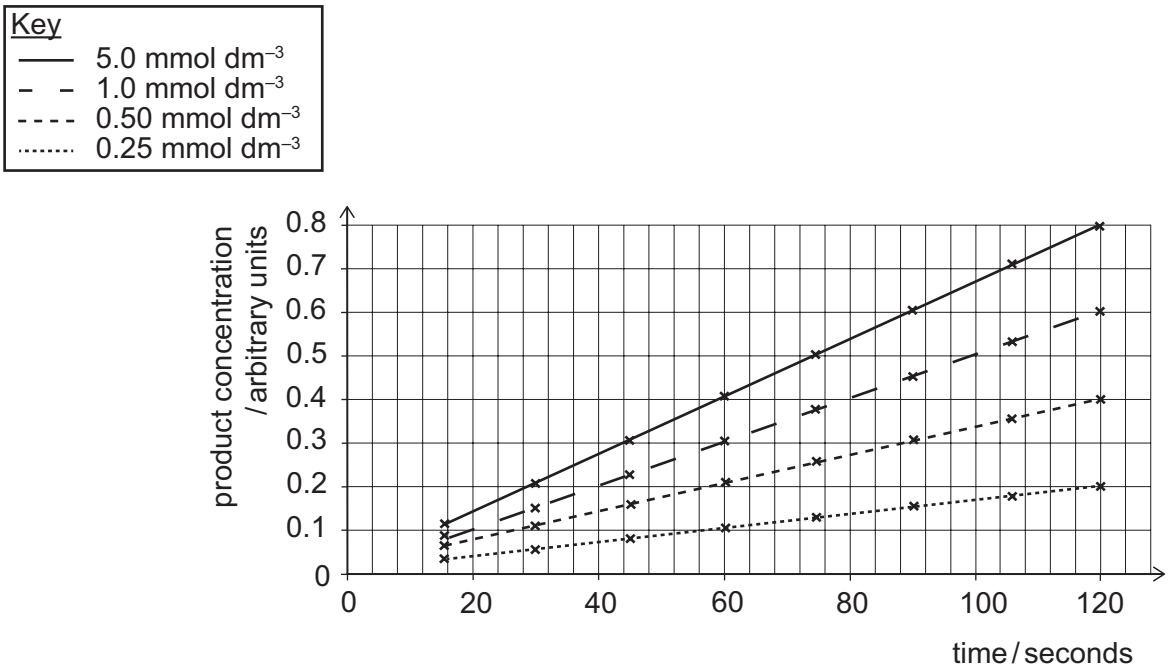
H 1, 2 and 3

71 An investigation was carried out on the effect of substrate concentration on an enzyme-controlled reaction.

Four different concentrations of substrate were tested. In each case, the concentration of product was measured at regular intervals following the introduction of the substrate.

All the other variables were kept constant.

The results obtained are shown on the graph.



Which of the following statements is/are correct?

1 As substrate concentration increases, the time taken to produce 0.2 arbitrary units of product increases.

2 Doubling the substrate concentration always doubles the rate of the reaction.

3 The average rate of reaction for a substrate concentration of 1.0 mmol dm^{-3} is 0.005 arbitrary units per second.

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 sequence of a coding section of DNA is shown below.

CTAGTCTGGTGGCTACGTCCTCCTCTACTATGGCTAGTCGTCTGGTGGCTA

The number of each type of amino acid coded for by this sequence of DNA bases is shown in the table.

amino acid coded for	*number of this type of amino acid present*
Arg	1
Leu	6
Pro	2
Trp	5
Val	3

What is the correct sequence of amino acids coded for by this sequence of DNA?

A Leu-Trp-Trp-Leu-Arg-Pro-Pro-Leu-Leu-Val-Leu-Val-Val-Trp-Trp-Trp

B Leu-Trp-Trp-Leu-Arg-Pro-Pro-Leu-Leu-Trp-Leu-Trp-Val-Val-Val-Val

C Leu-Val-Trp-Trp-Leu-Arg-Pro-Pro-Leu-Leu-Trp-Leu-Val-Val-Trp-Trp

D Leu-Trp-Trp-Leu-Arg-Pro-Pro-Leu-Leu-Val-Leu-Val-Val-Trp-Trp-Trp-Leu

E Leu-Trp-Trp-Leu-Arg-Pro-Pro-Leu-Leu-Trp-Leu-Trp-Val-Val-Val-Val-Leu

F Leu-Leu-Trp-Trp-Leu-Arg-Pro-Pro-Leu-Leu-Trp-Leu-Val-Val-Trp-Trp-Val

G Leu-Val-Trp-Trp-Leu-Leu-Pro-Pro-Leu-Leu-Trp-Leu-Val-Val-Trp-Trp-Leu

H Leu-Val-Trp-Trp-Leu-Arg-Pro-Pro-Leu-Leu-Trp-Leu-Val-Val-Trp-Trp-Leu

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