National Qualifications

X807/76/12

Biology
Paper 1 — Multiple choice

Duration — 40 minutes

Total marks — 25

Attempt ALL questions.

You may use a calculator.

Instructions for the completion of Paper 1 are given on *page 02* of your answer booklet X807/76/02.

Record your answers on the answer grid on *page 03* of your answer booklet.

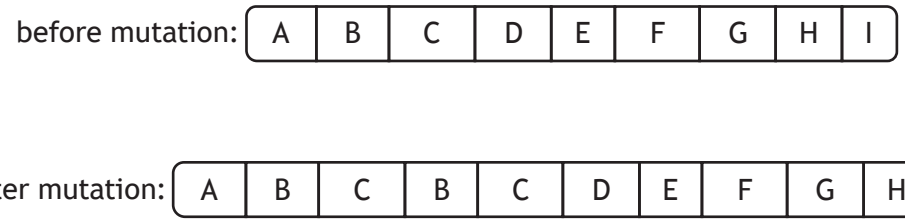
Space for rough work is provided at the end of this booklet.

Before leaving the examination room you must give your answer booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

Total marks — 25

Attempt ALL questions

1. The diagram shows the arrangement of genes on a chromosome before and after a mutation.



Which type of mutation has taken place?

A Inversion

B Insertion

C Duplication

D Translocation

2. Which row in the table matches each type of cell with how its DNA is organised?

	Type of cell	Organisation of DNA
A	animal	linear and circular chromosomes only
B	bacterial	linear chromosomes and plasmids only
C	yeast	circular chromosomes and plasmids only
D	plant	linear chromosomes only

3. Which of the statements about a primary mRNA transcript are correct?

1. It contains introns and exons.
2. Its exons are removed.
3. Its exons are spliced together to form the mature mRNA transcript.

A 3 only

B 1 and 2 only

C 2 and 3 only

D 1 and 3 only

4. The following list describes functions of DNA sequences.

1. Transcribed to mRNA
2. Transcribed to tRNA
3. Regulate transcription

Which of these are functions of non-coding regions of the genome?

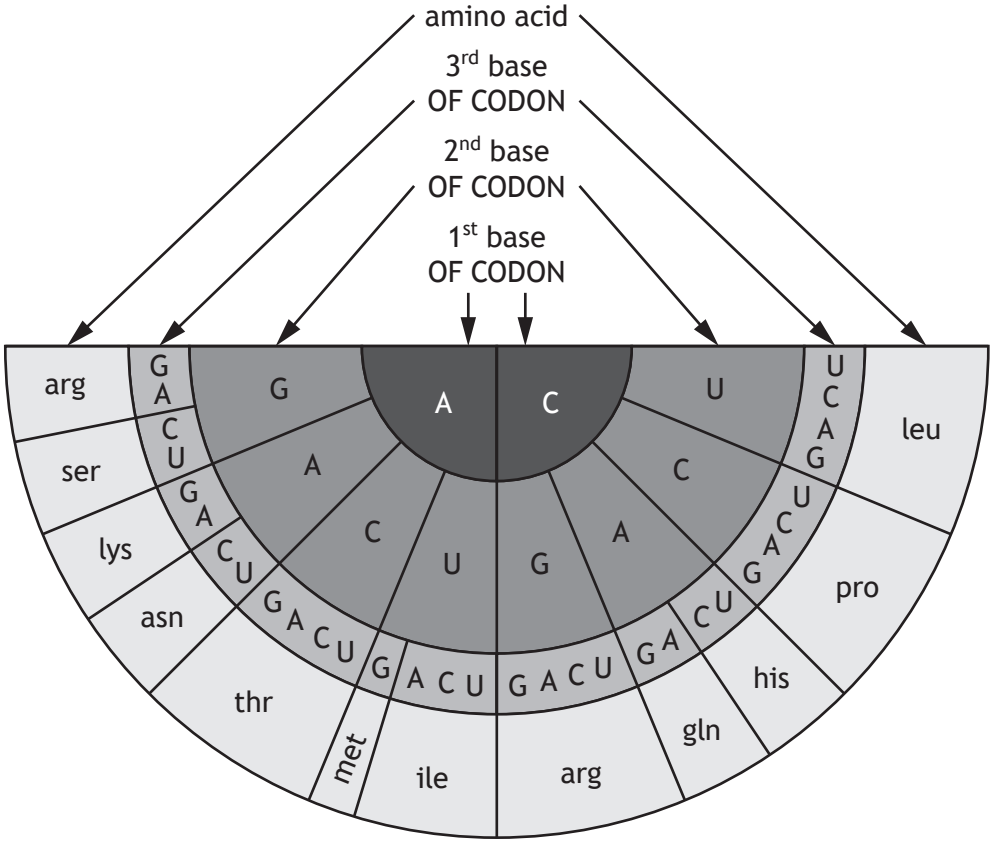
A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

5. The diagram shows the base sequence of some mRNA codons and the amino acids for which they code. For example, mRNA codons AGG and AGA both code for the amino acid **arg**.



A section of polypeptide contains the amino acid sequence **-ser-pro-lys-**.

Identify the DNA sequence that codes for this amino acid sequence.

A AGCCCAAAG

B ACTAGGCTT

C UCGGGGUUC

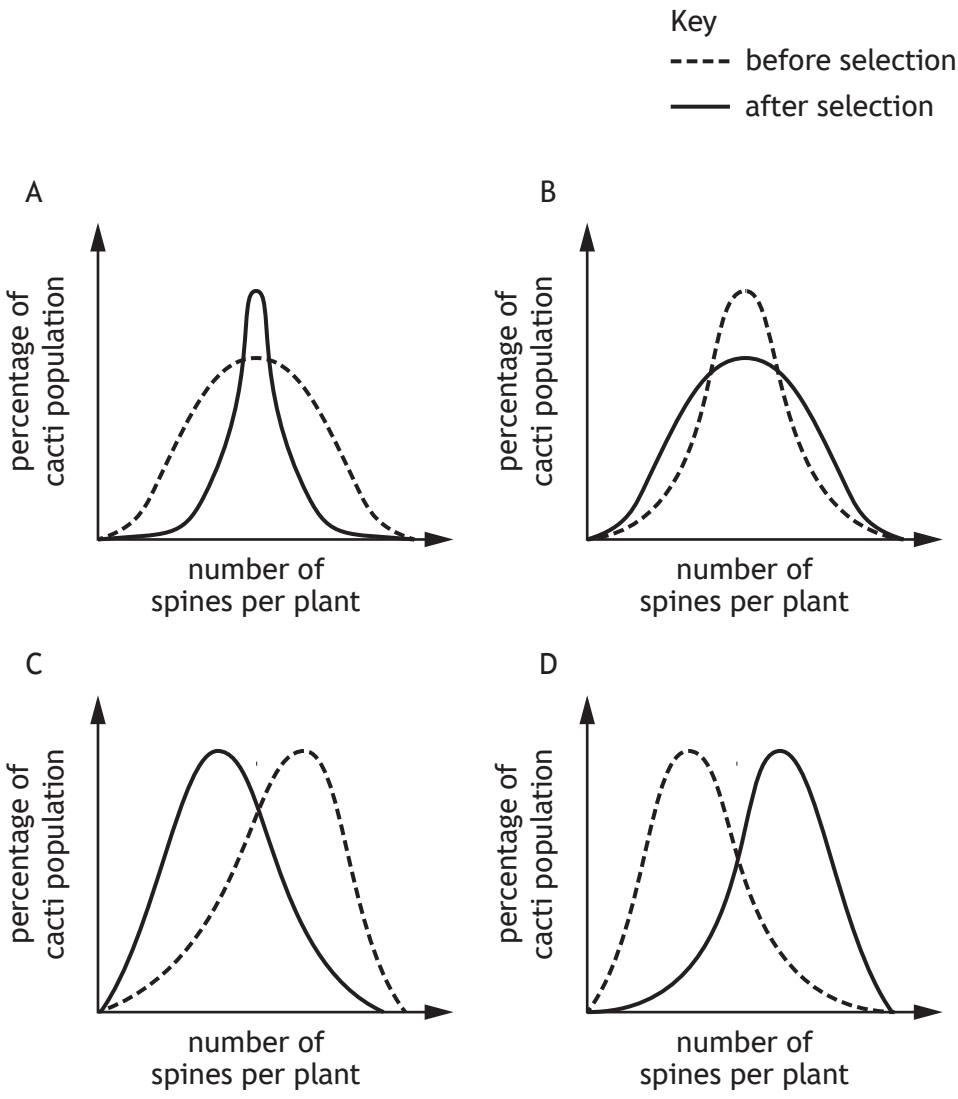
D TCGGGGTTC

[Turn over

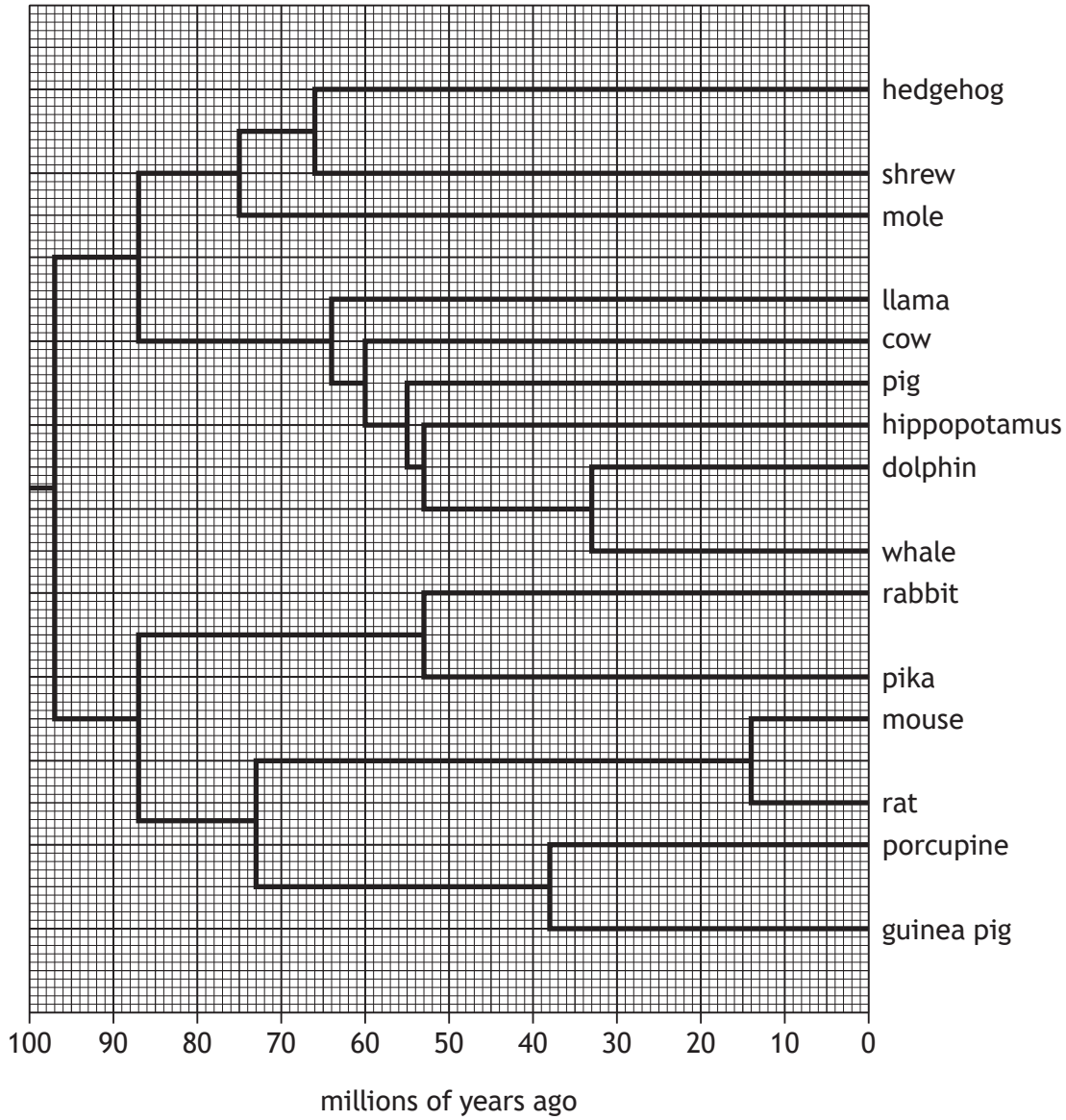
6. Cacti are plants that have spines to protect them from being eaten by herbivores. Cacti with more spines are less likely to be eaten.

However, the spines are sites where parasitic insects lay eggs and the larvae that hatch eat the plant. Cacti with a higher number of spines have a greater population of larvae.

Which graph represents these selection pressures?



7. The genomes of 15 related mammals were sequenced and the information was used in the construction of the phylogenetic tree shown.



Which two mammals are the most distantly related?

A Whale and rabbit

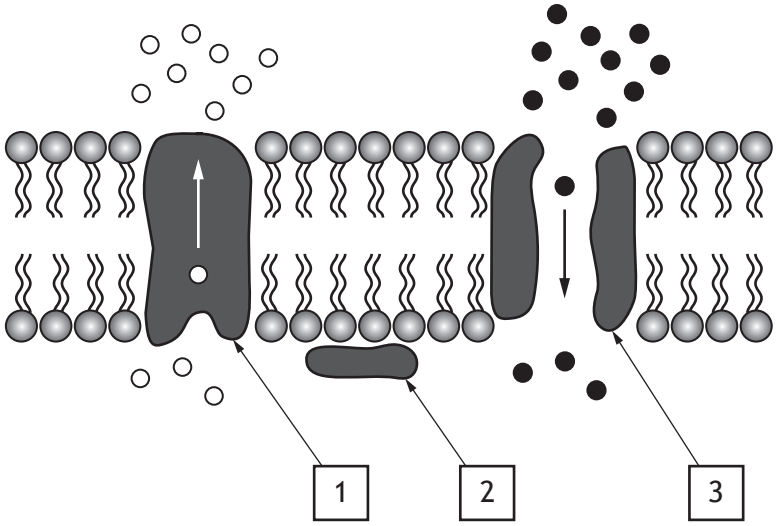
B Dolphin and shrew

C Whale and hedgehog

D Guinea pig and rabbit

[Turn over

8. The diagram shows part of a cell membrane and movement of substances through this membrane.

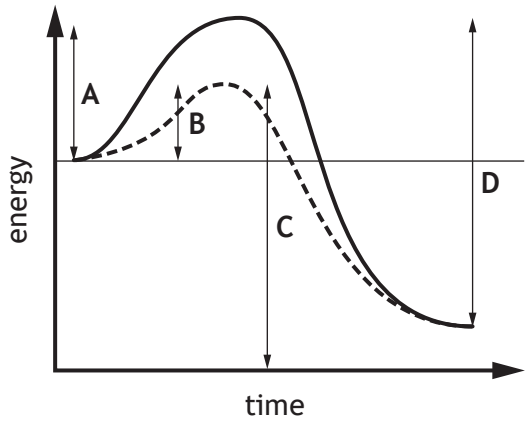


Which row in the table identifies proteins 1, 2 and 3?

	Pore	Pump	Enzyme
A	1	2	3
B	3	1	2
C	3	2	1
D	2	1	3

9. The graph shows the energy at different times of a reaction in the presence and absence of an enzyme.

Which letter represents the activation energy for this reaction in the presence of an enzyme?



10. Which of the following is true for conformers?

A They use negative feedback to control their internal environment

B They make behavioural responses to optimise metabolic rate

C They occupy a wide range of ecological niches

D They use energy from their metabolism to achieve homeostasis

11. Which row in the table identifies features of an amphibian heart?

	Number of atria	**Number of ventricles**	**Mixing of oxygenated and deoxygenated blood**
A	1	1	no
B	2	1	no
C	1	2	yes
D	2	1	yes

12. The following list relates to growth phases in a culture of the fungus *Penicillium chrysogenum*.

1. Growth is most rapid
2. Nutrients are completely depleted
3. Enzymes are induced
4. Antibiotics are produced

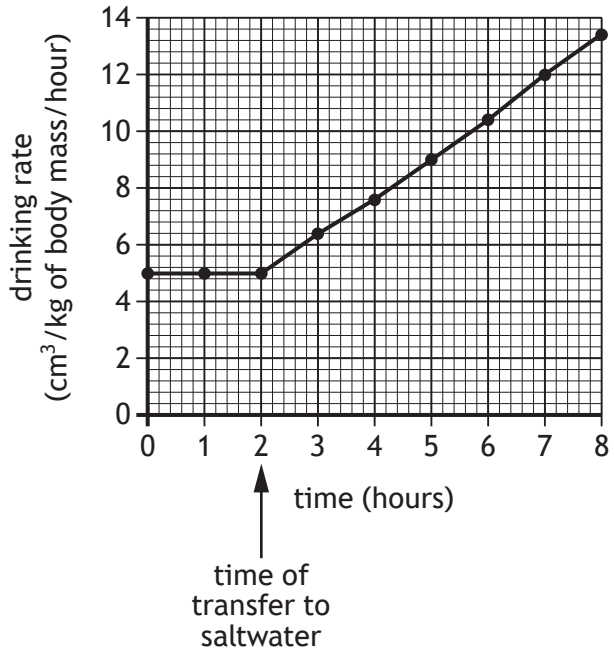
Which row in the table identifies the growth phases of this culture?

	Lag phase	**Log phase**	**Stationary phase**	**Death phase**
A	3	2	4	1
B	1	2	3	4
C	3	1	4	2
D	4	1	3	2

[Turn over

13. A sea trout (*Salmo trutta trutta*) was transferred from freshwater to saltwater.

The graph shows the change in the drinking rate of the sea trout.



The sea trout weighed 3 kg at 0 hours.

Calculate the volume of water the sea trout drank over the 2 hour period before it was transferred to saltwater.

A 5 cm^3

B 10 cm^3

C 15 cm^3

D 30 cm^3

14. An investigation was carried out to determine the respiration rate of maggots at different temperatures.

A probe was used to measure the CO_2 concentration in a sealed flask containing 20 maggots over a 10 minute period at three different temperatures.

The results are shown in the table.

Time (minutes)	CO_2 concentration (ppm)		
	3 °C	20 °C	30 °C
0	7100	7315	7105
2	7760	8010	8330
4	8160	8920	10 480
6	8500	9940	11 980
8	8840	11 840	13 470
10	9150	13 040	15 200

The conclusion relating to the aim of this investigation is, as the temperature increases the rate of

A CO_2 production increases

B CO_2 production decreases

C respiration increases

D respiration decreases.

15. An experiment was set up to investigate the effect of temperature on the heart rate of water fleas. The heart rates of 20 water fleas were measured at different temperatures of water at pH 6·5.

The results are shown in the table.

Temperature of water (°C)	Average heart rate (beats per minute)
5	23
10	80
20	92
30	173

The dependent variable in this experiment was the

A average heart rate of the water fleas

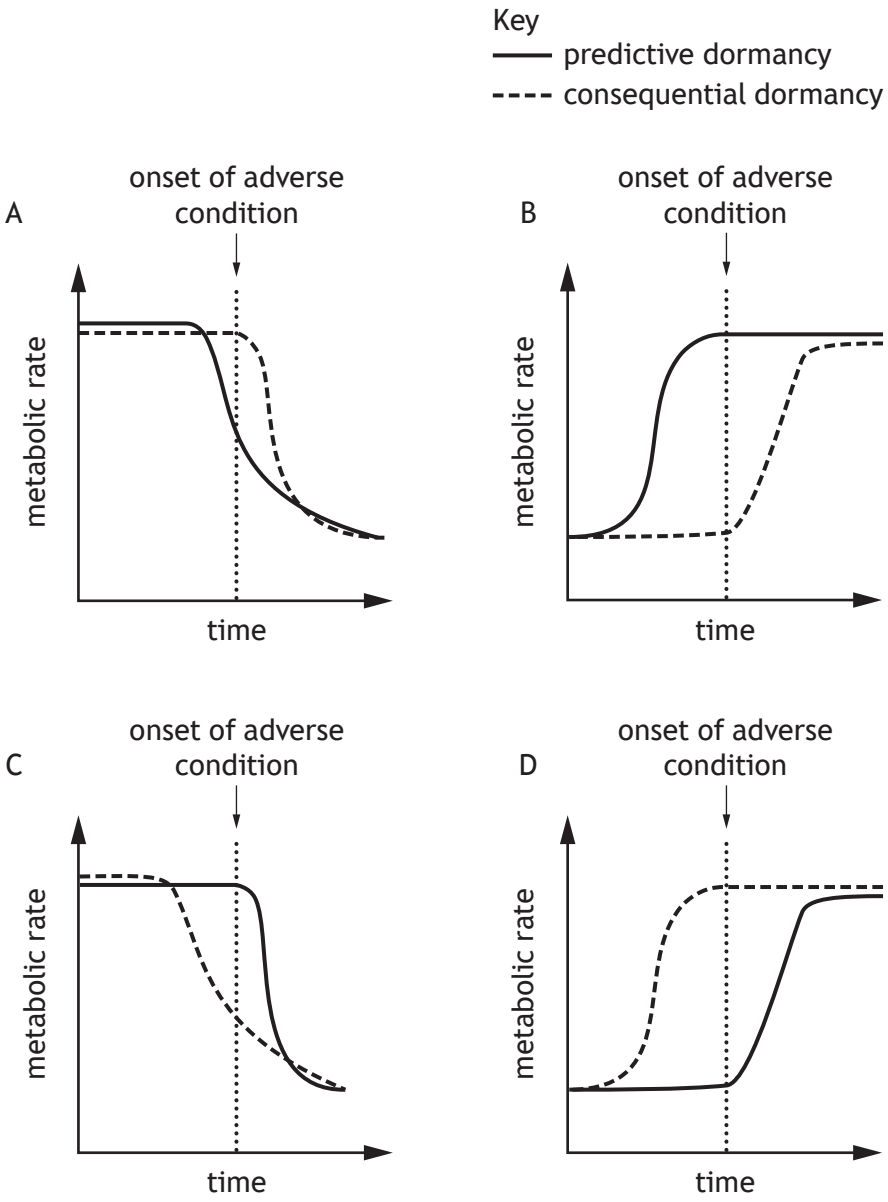
B temperature of the water

C number of water fleas

D pH of the water.

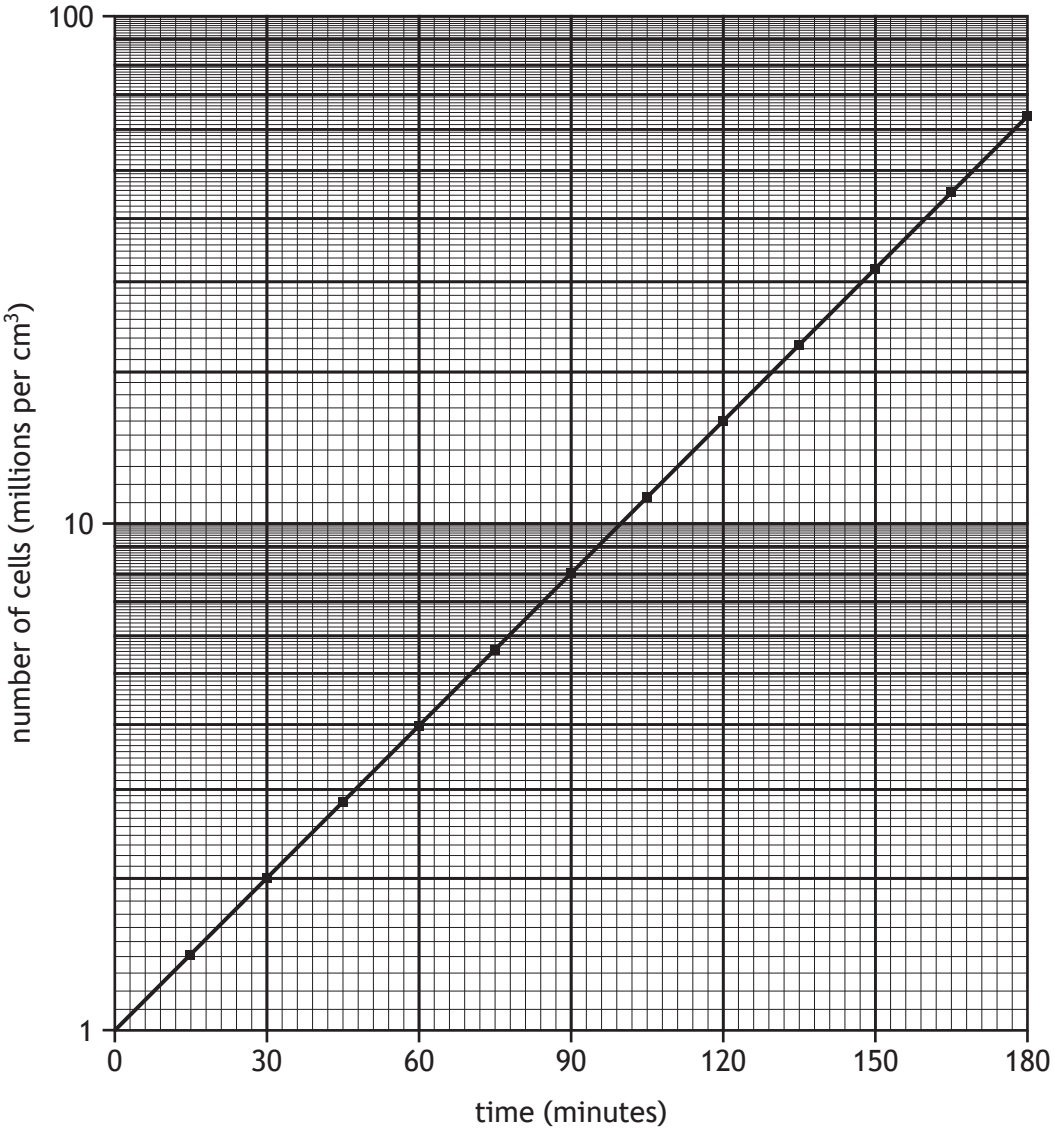
16. Dormancy in organisms can be predictive or consequential.

Which of the following graphs shows the changes in metabolic rate in organisms entering predictive and consequential dormancy?



17. Yeast cells were cultured in a growth medium and the number of cells were counted at regular intervals over a period of 180 minutes.

The semi-logarithmic graph shows the number of cells per cm^3 of culture medium during this period.



How many yeast cells were present in the culture after 2 hours?

A 1·6 million per cm^3

B 10·6 million per cm^3

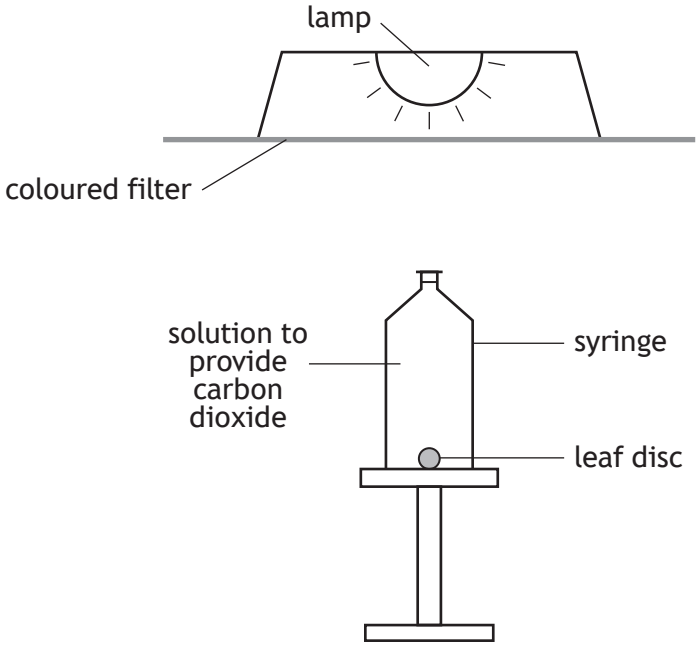
C 16·0 million per cm^3

D 70·0 million per cm^3

[Turn over

18. An experiment was carried out to investigate the effect of different colours of light on the rate of photosynthesis in oak leaf discs.

The apparatus was set up as shown, using different coloured filters to provide green, red or blue light.



Five syringes were set up for each filter colour and the times taken for the leaf discs to float to the top of the syringes were measured using a stopwatch.

The reliability of these results was improved by using

A the same size of leaf disc in each syringe

B five syringes for each filter colour

C a stopwatch to record the time

D three colours of light.

19. Which of the following events in photosynthesis requires hydrogen?

A Excitation of electrons

B Production of glyceraldehyde-3-phosphate (G3P)

C Photolysis of water

D Conversion of glyceraldehyde-3-phosphate (G3P) to RuBP

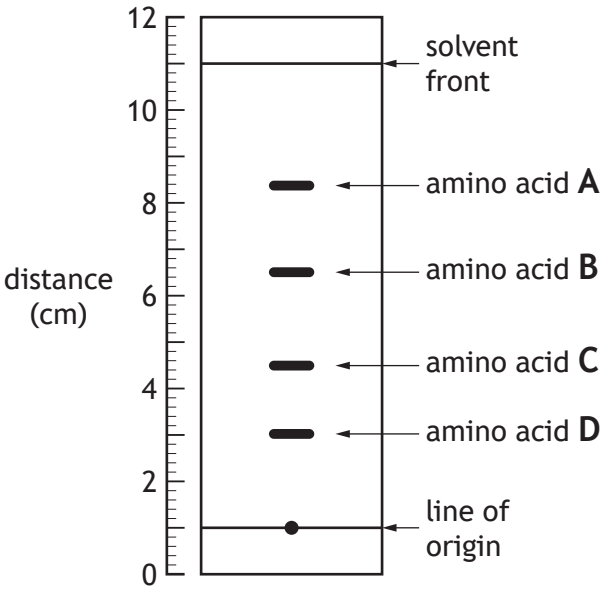
20. Chromatography can be used to separate amino acids in a mixture. To identify amino acids R_f values can be calculated as follows.

$$R_f = \frac{\text{distance travelled by the amino acid from line of origin}}{\text{distance travelled by the solvent from line of origin}}$$

The diagram shows a chromatogram in which four amino acids have been separated.

The table gives the R_f values of some amino acids.

Using information from the chromatogram and the table, identify which amino acid is threonine.



Amino acid	R_f value
glycine	0·26
glutamic acid	0·30
threonine	0·35
tyrosine	0·45
methionine	0·55
phenylalanine	0·68
leucine	0·75

21. Glyphosate is a non-selective herbicide used to control weeds. Recombinant DNA technology has been used to produce GR-maize crops that are resistant to glyphosate.

Which of the following would be an advantage to humans of planting GR-maize?

A Glyphosate could be used without reducing the yield of maize

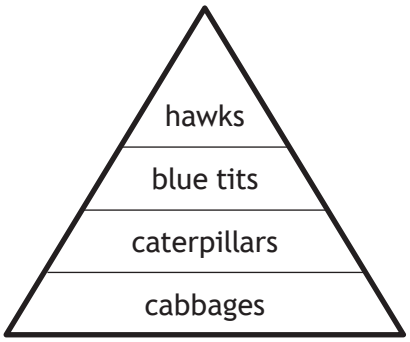
B The GR-maize crops are resistant to all herbicides

C Glyphosate would not be needed to control weeds

D Glyphosate resistance in weed species would occur

[Turn over

22. The diagram illustrates the energy content at different trophic levels of a food chain.



Pesticides are used to control caterpillar populations on cabbage crops.

Which of the following describes a possible bioaccumulation in this food chain after pesticide treatment of the cabbage crop?

A Decrease in energy content between caterpillars and blue tits

B Increase in concentration of pesticides between blue tits and hawks

C Increase in concentration of pesticides in caterpillars

D Increase in pesticide resistance in caterpillar populations

23. The Brangus breed of cattle is an F_1 hybrid produced by crossing the Brahman and Aberdeen Angus cattle breeds.

Which of the following statements could apply to Brangus cattle?

1. They could show inbreeding depression.
2. They could show improved characteristics.
3. Breeding them together could produce a genetically variable F_2

A 1 only

B 2 only

C 1 and 3 only

D 2 and 3 only

24. Painted wolves hunt in packs ranging in size from 3 to 20 individuals.
Compared to hunting alone this means that

A each individual gains less energy
B only subordinate wolves gain more energy
C only dominant wolves gain more energy
D less energy is used per individual.

25. Honeybees are social insects that live in colonies.
Which row in the table identifies activities carried out by drones and workers?

	Drones	**Workers**
A	fertilise eggs	produce eggs
B	fertilise eggs	defend hive
C	collect pollen	care for young
D	care for young	defend hive

[END OF QUESTION PAPER]