



National
Qualifications
2022

X807/76/12

Biology
Paper 1 — Multiple choice

THURSDAY, 19 MAY

9:00 AM – 9:40 AM

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.

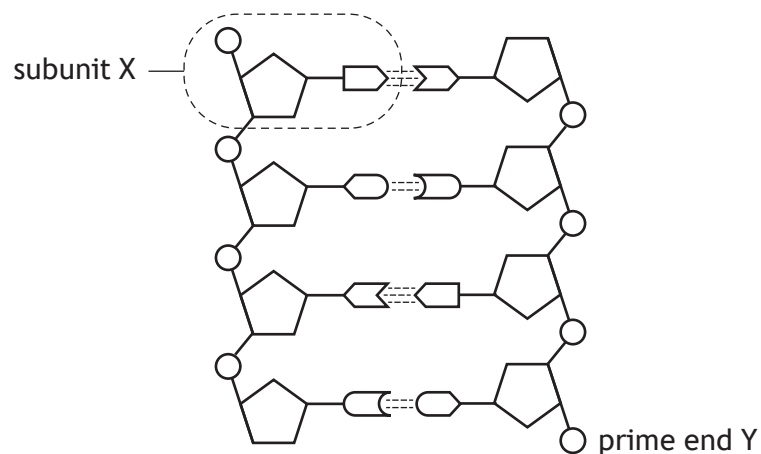
Before leaving the examination room you must give your answer booklet to the Invigilator; if you do not, you may lose all the marks for this paper.



* X 8 0 7 7 6 1 2 *

Total marks — 25
Attempt ALL questions

1. The diagram shows the structure of part of a DNA molecule.



Which row in the table identifies subunit X and prime end Y?

	Subunit X	Prime end Y
A	nucleotide	3'
B	amino acid	5'
C	amino acid	3'
D	nucleotide	5'

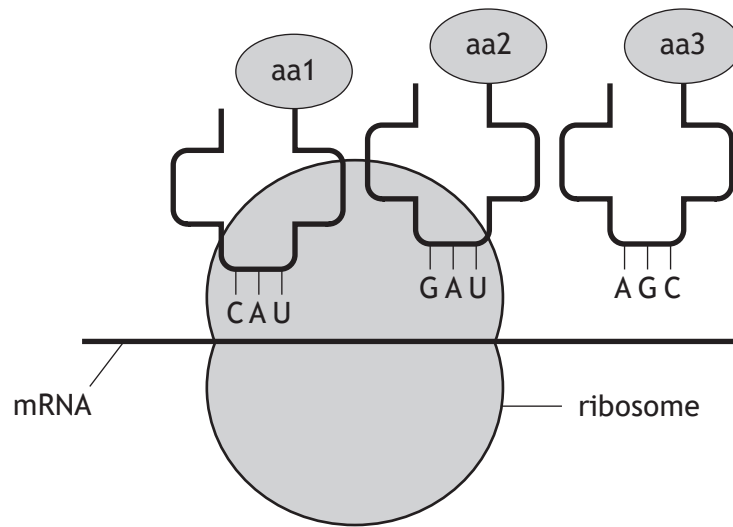
2. The list describes features of different chromosomes:

1. Circular shape.
2. Linear shape.
3. Associated with proteins.

Which of the descriptions apply to chromosomes in prokaryotes?

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

3. The diagram shows three tRNA molecules and their attached amino acids during translation.



Identify the **DNA** sequence that codes for the amino acid aa1.

- A G T A
- B G U A
- C C A T
- D C A U

4. Which row in the table describes research and therapeutic uses of stem cells?

	Research use	Therapeutic use
A	To provide information on cell differentiation	To test drugs
B	To test drugs	To provide information on cell differentiation
C	To study how diseases develop	To repair damaged tissue
D	To repair damaged tissue	To regenerate damaged skin

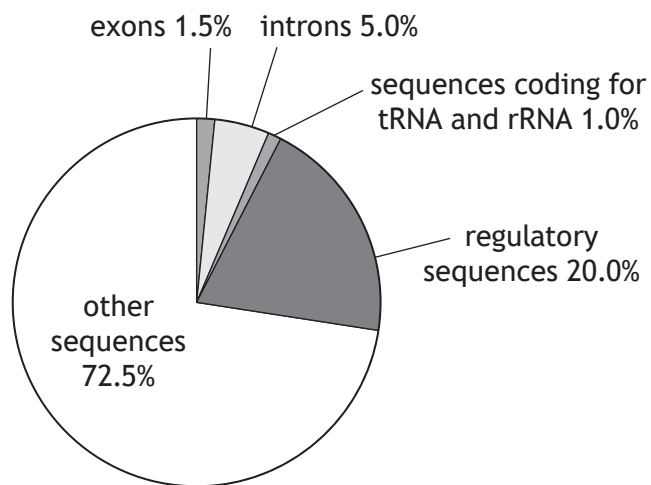
[Turn over

5. The protein dystrophin contains 3684 amino acids. A mutation in the dystrophin gene causes cells to produce a protein with 2428 amino acids.

Which type of mutation could have caused this?

- A Nonsense
- B Duplication
- C Missense
- D Inversion

6. The pie chart shows the estimated composition of a genome.

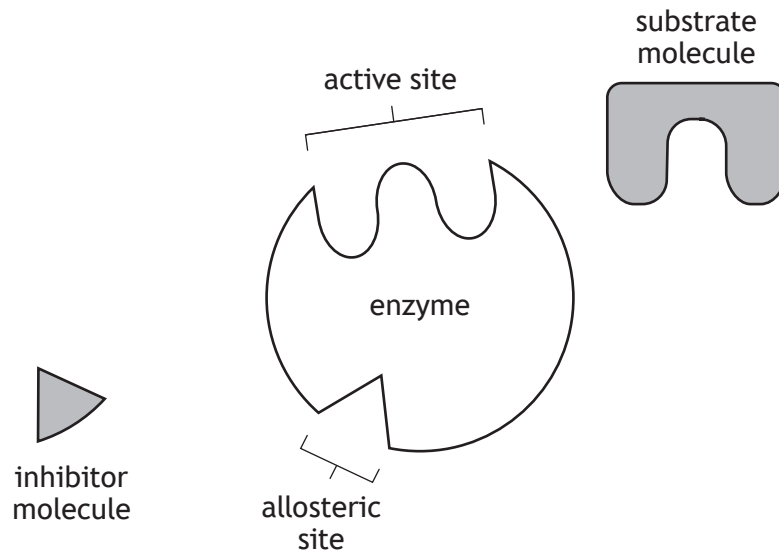


The genome is estimated to contain 3200 million base pairs.

Calculate how many base pairs code for protein.

- A 32 million
- B 48 million
- C 160 million
- D 640 million

7. The diagram shows an enzyme and molecules that can bind to it.

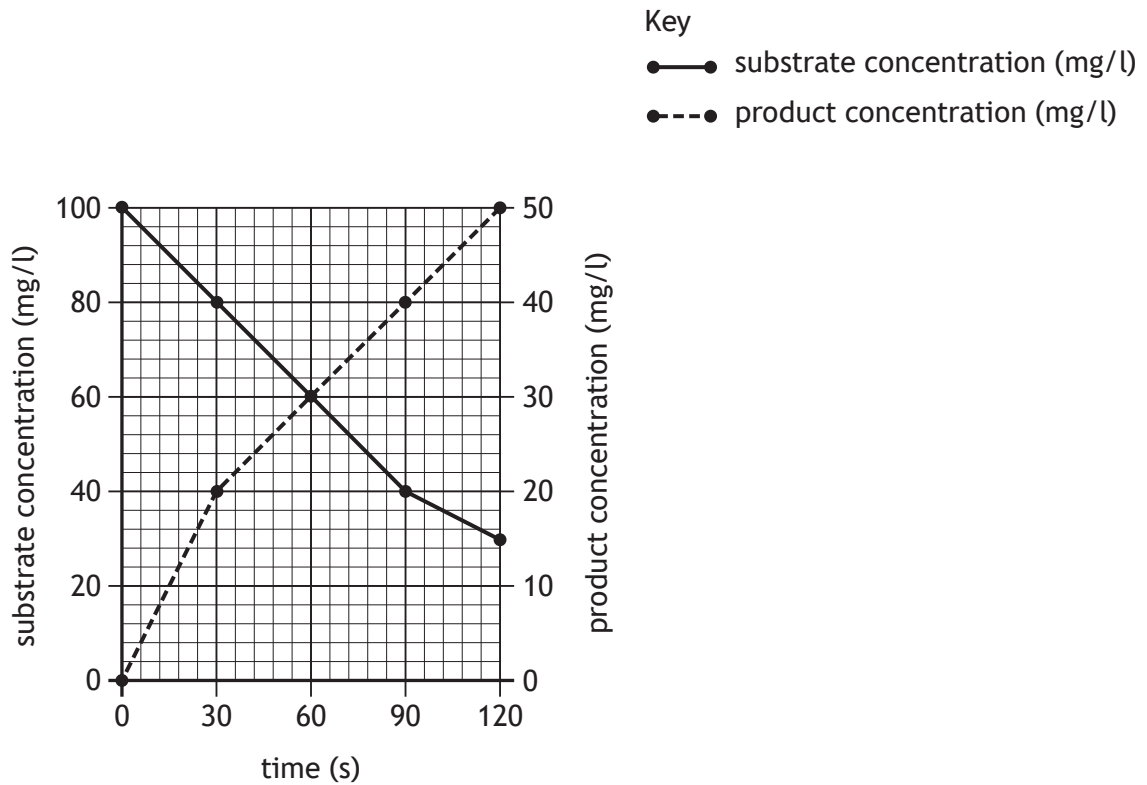


Which of the following will change shape during induced fit?

- A Active site
- B Allosteric site
- C Substrate molecule
- D Inhibitor molecule

[Turn over

8. The graph shows the substrate and product concentrations during a reaction in a metabolic pathway.



At which time is the product concentration exactly 50% of the substrate concentration?

- A 30 seconds
- B 60 seconds
- C 75 seconds
- D 90 seconds

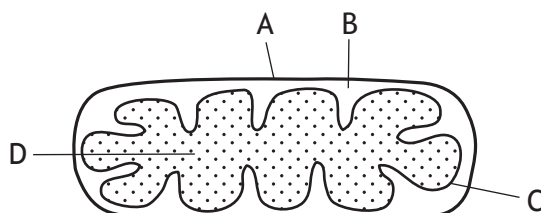
9. Test tubes each containing an enzyme solution with different concentrations of substrate were incubated. After 10 minutes enzyme activity was measured.

The results are shown in the table.

Substrate concentration (mol/l)	Enzyme activity (units)		
	No inhibitor	Inhibitor X	Inhibitor Y
0.0	0.0	0.0	0.0
0.2	0.2	0.1	0.1
0.4	0.3	0.1	0.2
0.6	0.4	0.2	0.4
0.8	0.5	0.2	0.4
1.0	0.5	0.2	0.5

Which of the following statements is supported by the data?

- A Inhibitor Y changes the shape of the active site.
 - B The optimum substrate concentration is 1.0 mol/l.
 - C Inhibitor X binds to the active site.
 - D Inhibitor Y is a competitive inhibitor.
10. Which of the following must be present in a living cell for glycolysis to occur?
- A Glucose and ATP
 - B NADH and oxygen
 - C Glucose and oxygen
 - D ATP and NADH
11. The main site of ATP synthesis is the electron transport chain. The diagram shows parts of a mitochondrion.



Identify the main site of ATP synthesis.

12. An experiment was carried out to investigate the effect of different respiratory substrates on the rate of respiration in yeast (*Saccharomyces cerevisiae*).

Resazurin dye was added to five test tubes containing this species of yeast, each with a different respiratory substrate. As yeast cells carry out respiration the dye changes colour. This colour change was measured using a colorimeter.

Which feature of the experimental design allowed a valid conclusion to be drawn?

- A The same species of yeast was used.
- B Five different respiratory substrates were used.
- C Respiration rate was measured using a colorimeter.
- D Resazurin dye was used.

13. Which of the following statements about micro-organisms is correct?

- A All micro-organisms require amino acids in their growth medium.
- B Micro-organisms use a variety of metabolic substrates.
- C Micro-organisms include bacteria and archaea only.
- D Light can be used as an energy source by all micro-organisms grown in culture.

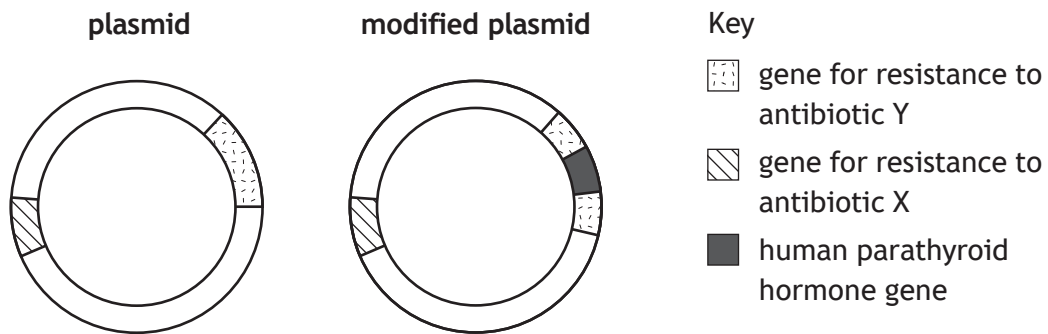
14. An experiment was carried out to determine how different types of sugar solution affect the growth rate of the bacteria *Escherichia coli* (*E. coli*).

Three flasks were set up each containing 25 cm³ of either glucose, lactose, or fructose and 10 cm³ of *E. coli* suspension. The flasks were incubated at 30 °C and viable cell counts were recorded every 20 minutes.

Identify the independent variable in this experiment.

- A Time
- B Growth rate of *E. coli*
- C Type of sugar solution
- D Viable cell count

15. Human parathyroid hormone can be produced in bacterial cells by recombinant DNA technology. The diagram shows a plasmid before and after being modified by inserting the human parathyroid hormone gene. This disrupted the gene for resistance to antibiotic Y.



Bacterial cells were incubated with the modified plasmids and grown on nutrient media in three different Petri dishes.

The table shows the nutrient media used in each Petri dish.

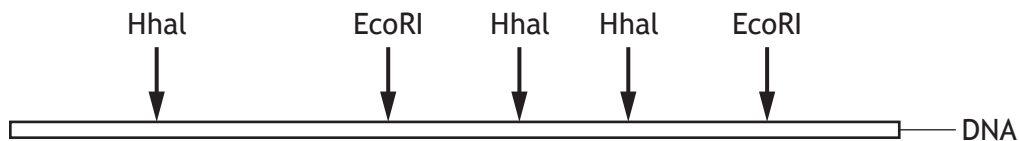
Petri dish	Nutrient medium
1	with antibiotic X only
2	with antibiotic Y only
3	with antibiotics X and Y

In which Petri dish(es) would the human parathyroid hormone be produced?

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

[Turn over

16. During recombinant DNA technology, restriction endonucleases are used to cut DNA into fragments. Each endonuclease recognises a specific DNA sequence called a restriction site. The diagram shows a section of DNA and the restriction sites for two different endonucleases, EcoRI and HhaI.



Identify the number of DNA fragments that would be produced after treating this section of DNA with the restriction endonucleases shown in the table.

	Restriction endonucleases	Number of DNA fragments
A	EcoRI	2
B	HhaI	3
C	EcoRI + HhaI	5
D	EcoRI + HhaI	6

17. The blue dye DCPIP can be used to measure photolysis in chloroplast suspensions.

When photolysis occurs DCPIP changes from blue to colourless.

In an experiment three tubes were set up. The light conditions and contents of each tube are shown in the table.

Tube	Light conditions	Volume of chloroplast suspension (cm ³)	Volume of water (cm ³)	Volume of DCPIP (cm ³)
P	light	5	0	2
Q	dark	5	0	2
R	light	0	5	2

The tubes were left for 10 minutes and then the colour of the DCPIP in each tube was observed.

Which row in the table shows the results of this experiment?

	Colour of DCPIP		
	Tube P	Tube Q	Tube R
A	blue	blue	colourless
B	blue	colourless	blue
C	colourless	blue	blue
D	colourless	blue	colourless

18. The following statements describe events occurring during photosynthesis:

1. Carbon dioxide combines with RuBP.
2. ATP synthase generates ATP from ADP and Pi.
3. Hydrogen binds with the coenzyme NADP.
4. 3PG is phosphorylated by ATP.

Which of the statements identify events that occur in carbon fixation (Calvin cycle)?

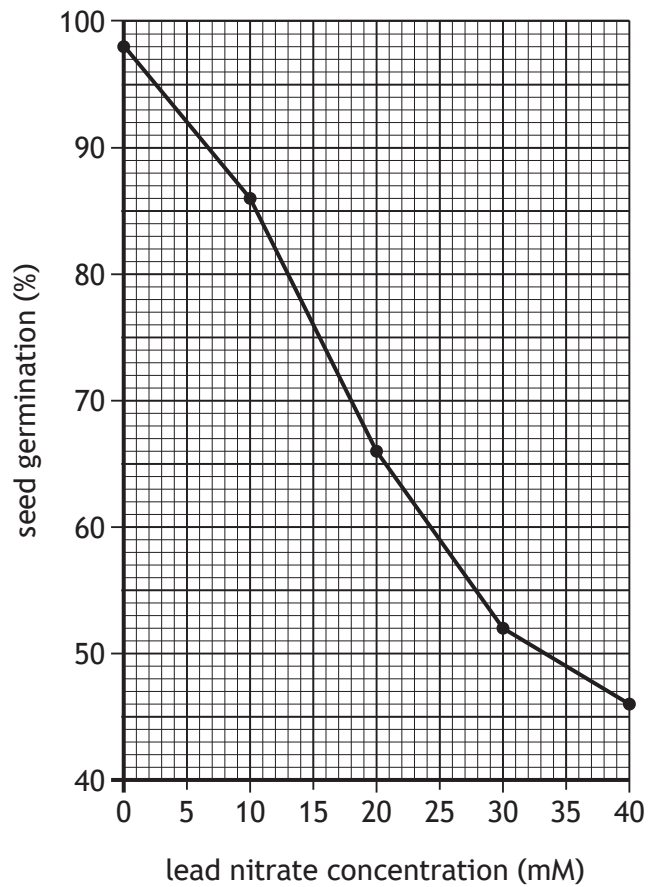
- A 1 and 2 only
- B 1 and 4 only
- C 2 and 3 only
- D 3 and 4 only

19. Which of the following statements about carotenoids in green plants is correct?

- A They increase absorption of green light by chlorophyll.
- B They increase absorption of blue and red light by chlorophyll.
- C They extend the range of wavelengths of light absorbed and pass hydrogen onto chlorophyll.
- D They extend the range of wavelengths of light absorbed and pass energy onto chlorophyll.

[Turn over

20. The graph shows the effect of lead nitrate concentration on seed germination of common wheat (*Triticum aestivum*).



Identify the lead nitrate concentration (mM) in which seed germination was 50% of the control.

- A 18
- B 20
- C 33
- D 35

21. Applications of fungicides to crops can be based on disease forecasts.

The table shows the ranges of temperature, humidity, rainfall, and light intensity that would increase the likelihood of some fungal diseases.

Which fungal disease would be most likely to occur with a temperature of 20 °C, humidity of 60%, rainfall of 9 mm, and light intensity of 6.0 units?

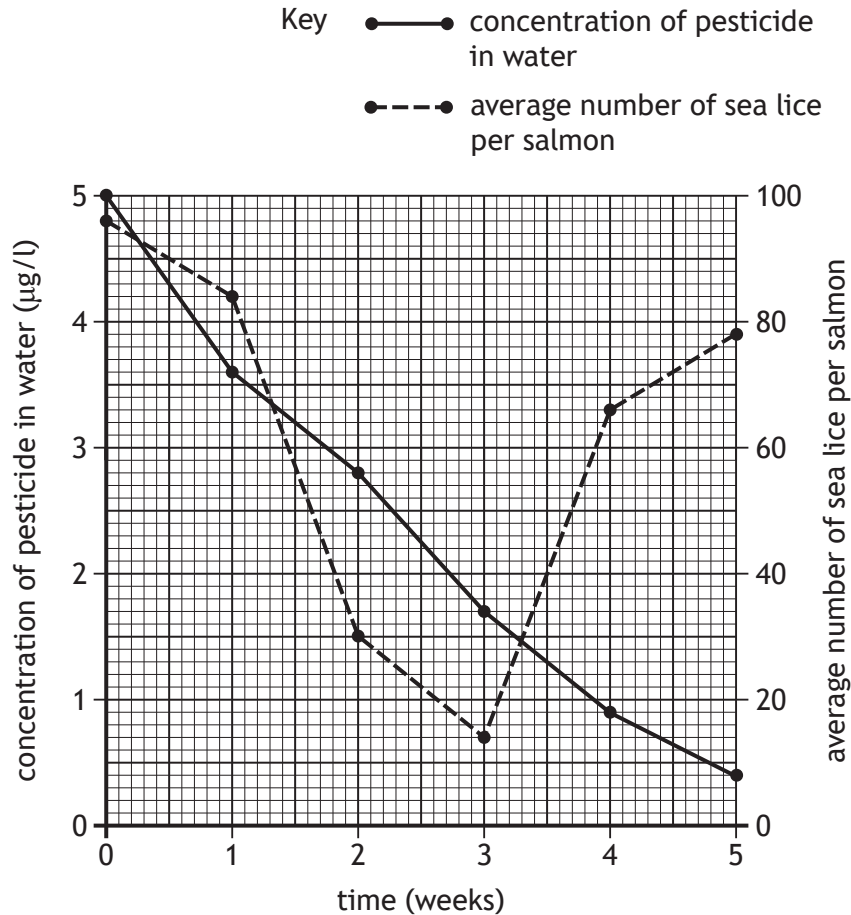
Fungal disease	Temperature (°C)	Humidity (%)	Rainfall (mm)	Light intensity (units)
A	10–19	35–60	5–9	3.9–6.5
B	14–29	61–85	0–2	6.1–6.4
C	16–32	45–83	8–10	5.3–6.3
D	11–25	42–95	7–23	2.5–3.1

[Turn over

22. Farmed salmon are often infested with sea lice. The sea lice can be controlled by adding a pesticide to the water.

The concentration of pesticide in the water and the average number of sea lice per salmon were monitored over a 5-week period.

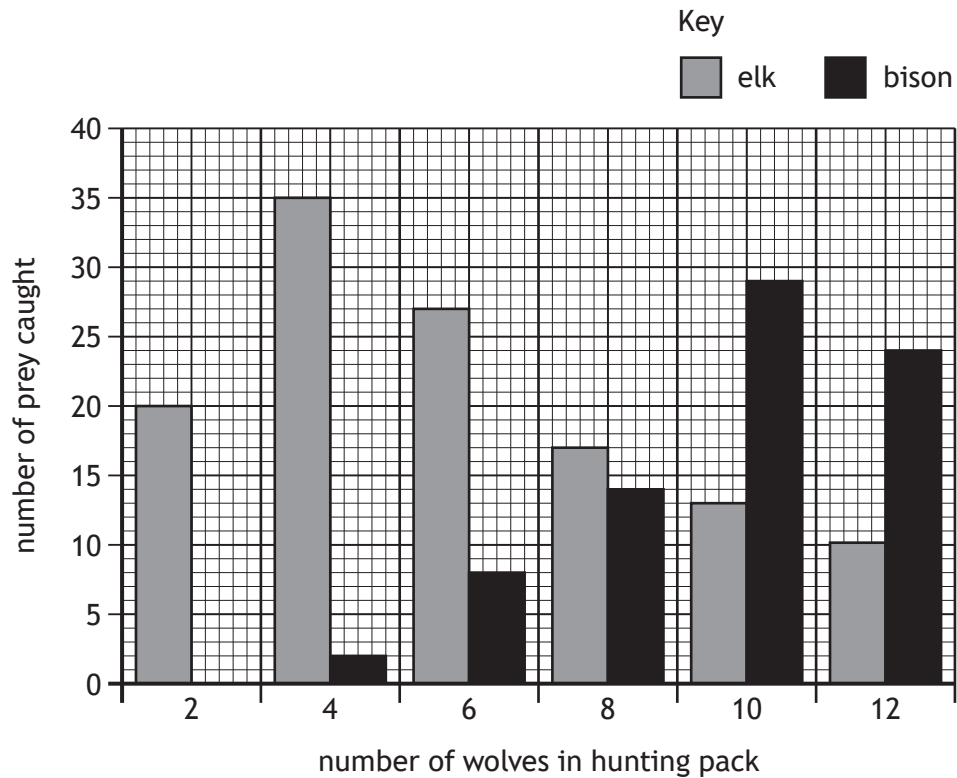
The results are shown in the graph.



What was the average number of sea lice per salmon when the concentration of pesticide was 1.7 µg/l?

- A 0.7
- B 14.0
- C 17.0
- D 34.0

23. Grey wolves (*Canis lupus*) in North America hunt elk (*Cervus canadensis*) and bison (*Bison bison*). An investigation was carried out into the effect of wolf pack sizes on hunting success. The results are shown in the bar graph.



Which of the following statements is supported by this data?

1. As the wolf pack size increases, the number of bison caught increases.
 2. Wolves catch the highest total number of prey when hunting in packs of 10.
 3. Wolves catch most elk when hunting in packs of 4 and most bison when hunting in packs of 10.
- A 1 only
B 3 only
C 1 and 2 only
D 2 and 3 only

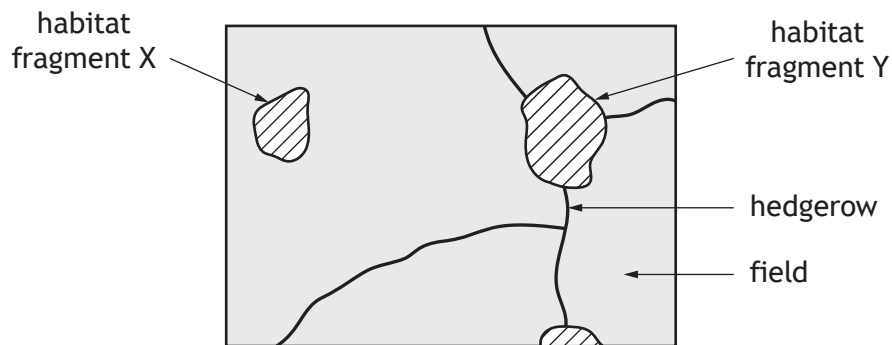
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24. Primates such as chimpanzees (*Pan troglodytes*) live in large groups, in which social hierarchies exist.

Which row in the table shows the type of behaviour displayed by a dominant chimpanzee and its effect on conflict?

	Type of behaviour	Effect on conflict
A	ritualistic	increases
B	appeasement	increases
C	ritualistic	decreases
D	appeasement	decreases

25. The clearing of forests for agriculture has led to habitat fragmentation. Habitat fragments are often connected by hedgerows that provide habitat corridors as shown in the diagram.



Which of the following statements about habitat fragments X and Y are correct?

1. Recolonisation after local extinctions is more likely in fragment Y than X.
2. Fragment Y is likely to have a greater species diversity than fragment X.
3. Degradation of the edges of habitat fragments X and Y is likely to reduce species diversity in both fragments.

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

[END OF QUESTION PAPER]

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