A

AQA

Surname _____

Forename(s) _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE
BIOLOGY

F

Foundation Tier Paper 2F

8461/2F

Friday 9 June 2023 Afternoon

Time allowed: 1 hour 45 minutes

[Turn over]

At the front of this book, write your surname and forename(s), your centre number, your candidate number and add your signature.

MATERIALS

For this paper you must have:

- **a ruler**
- **a scientific calculator.**

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Pencil should only be used for drawing.**
- **Answer ALL questions in the spaces provided.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**

- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **In all calculations, show clearly how you work out your answer.**

INFORMATION

- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

0 1

Hormones are important for controlling many processes in the human body.

Hormones are produced by glands.

0 1 . 1

Which organ system has glands that produce hormones? [1 mark]

Tick (✓) ONE box.

- ☐ **The circulatory system**
- ☐ **The endocrine system**
- ☐ **The nervous system**

0 1 . 2

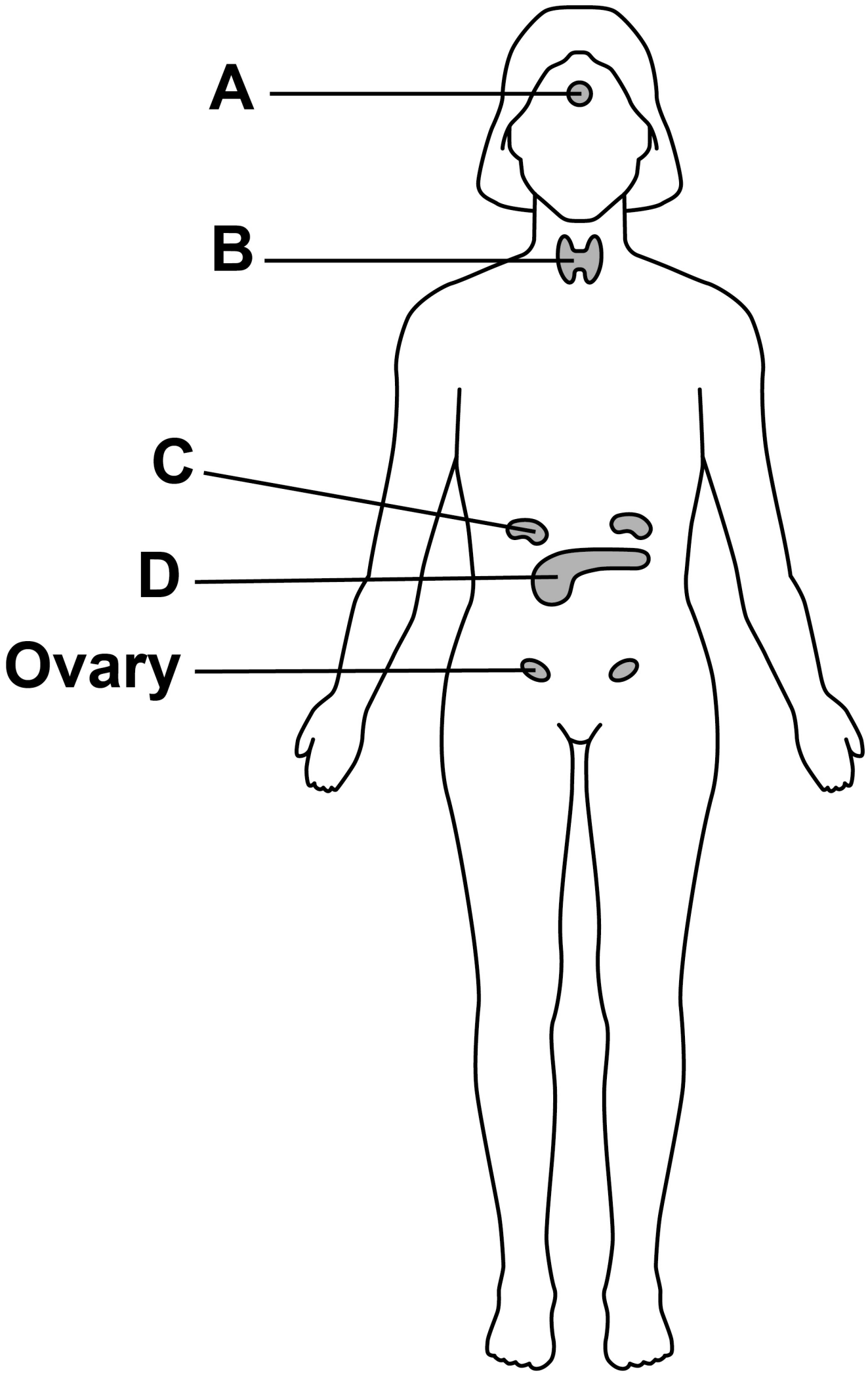
How are hormones transported around the body? [1 mark]

Tick (✓) ONE box.

- ☐ **By the blood**
- ☐ **By the muscles**
- ☐ **By the nerves**

FIGURE 1 shows glands in a woman's body.

FIGURE 1



0 1 . 3

Draw ONE line from each gland to the name of that gland. [3 marks]

GLAND	NAME
A	Adrenal
B	Pituitary
C	Testes
	Thyroid

0 1 . 4

Which gland in FIGURE 1, on page 6, produces insulin? [1 mark]

Tick (✓) ONE box.

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

0 1 . 5

Which organ does insulin mainly affect? [1 mark]

Tick (✓) ONE box.

☐ **The brain**

☐ **The liver**

☐ **The ovary**

0 1 . 6

Give ONE effect of insulin. [1 mark]

Some hormones control a woman's menstrual cycle.

0 1 . 7

Which hormone causes an egg to mature in the ovary? [1 mark]

Tick (✓) ONE box.

- ☐ **Adrenaline**
- ☐ **Follicle stimulating hormone (FSH)**
- ☐ **Testosterone**

0 1 . 8

Which TWO are hormones that help to maintain the lining of the uterus during pregnancy? [2 marks]

Tick (✓) TWO boxes.

- ☐ **Amylase**
- ☐ **Oestrogen**
- ☐ **Progesterone**
- ☐ **Protease**
- ☐ **Thyroxine**

[Turn over]

0 1 . 9

Contraception prevents pregnancy.

Give TWO methods of contraception that use hormones. [2 marks]

1

2

13

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[Turn over]

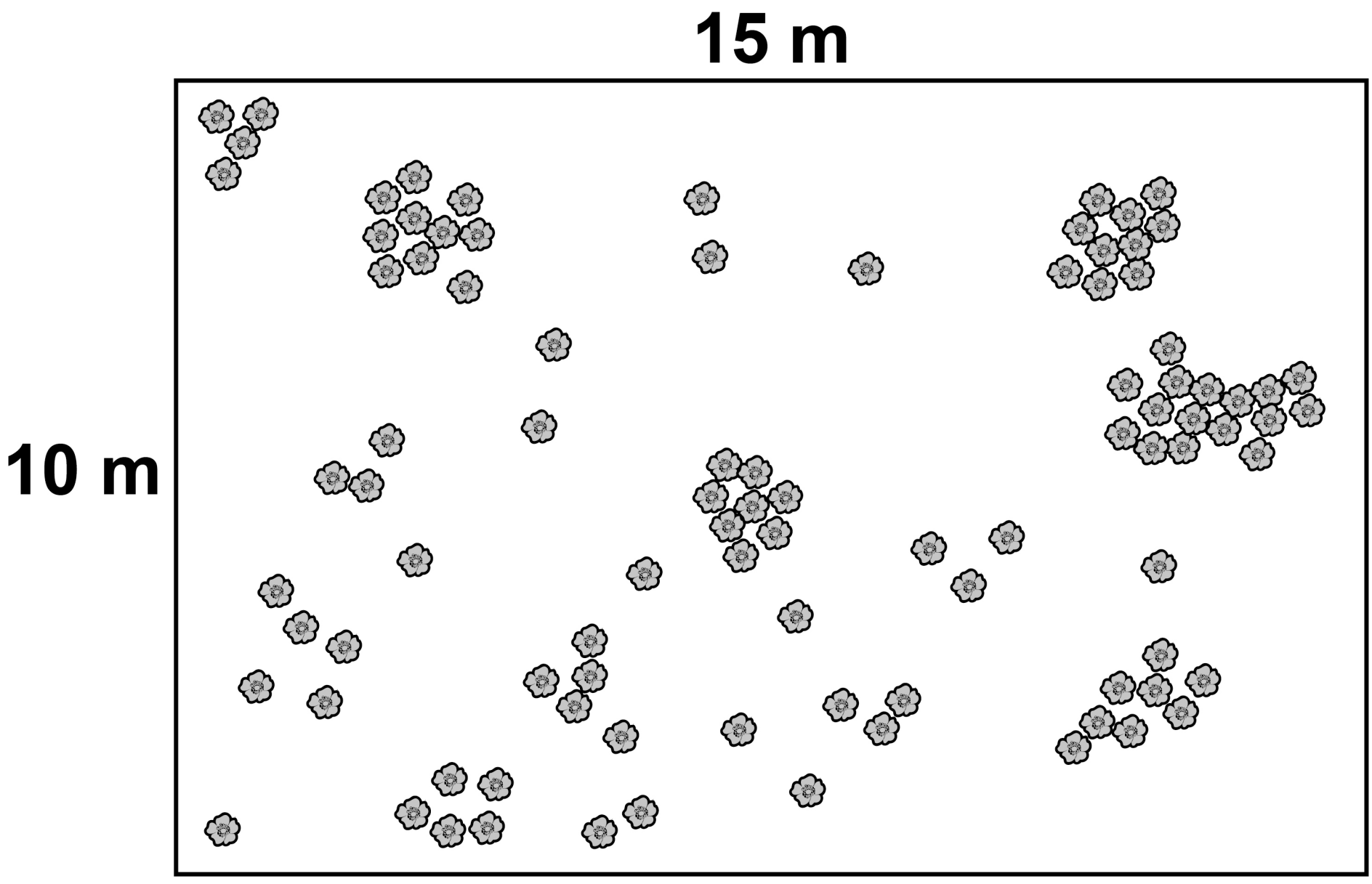
0 2

Students estimated the population of buttercup plants growing on a lawn.

The lawn is a rectangle measuring 15 m × 10 m.

FIGURE 2 shows the lawn.

FIGURE 2



KEY

Buttercup plant

This is the method used.

1. Measure the length and width of the lawn.
2. Choose five locations to sample.
3. Place a 1 m × 1 m square frame at each location.
4. Record the number of buttercup plants in each square frame.

[Turn over]

0 2 . 1

Complete the sentences.

Choose answers from the list. [2 marks]

- **15 cm ruler**
- **30 m tape measure**
- **balance**
- **quadrat**
- **transect**

The length and width of the lawn should be measured using a _____ .

The 1 m × 1 m square frame is called a _____ .

0 2 . 2

How should the students choose the five locations to sample? [1 mark]

Tick (✓) ONE box.

- ☐ **Choose locations at random.**
- ☐ **Choose locations at the corners of the lawn.**
- ☐ **Choose locations with lots of buttercup plants.**
- ☐ **Choose locations with no buttercup plants.**

[Turn over]

TABLE 1 shows the results.

TABLE 1

SAMPLE NUMBER	NUMBER OF BUTTERCUP PLANTS
1	2
2	7
3	0
4	0
5	1

The students used their results to calculate the population of buttercup plants.

0 2 . 3

Complete the sentences.

Choose answers from the list. [2 marks]

- **area**
- **mean**
- **median**
- **perimeter**
- **volume**

Multiply the length of the lawn by the width of the lawn to give the lawn's

_____ .

Add up the total number of buttercup plants and divide by 5 to give the

_____ .

[Turn over]

REPEAT OF TABLE 1

SAMPLE NUMBER	NUMBER OF BUTTERCUP PLANTS
1	2
2	7
3	0
4	0
5	1

0 2 . 4

The students calculated that the population of buttercup plants on the lawn was 300.

How did the students use the results in TABLE 1 to calculate the population? [1 mark]

0 2 . 5

How could the students improve the accuracy of the estimate? [1 mark]

Tick (✓) ONE box.

- ☐ **Count and record more samples.**
- ☐ **Select locations in the middle of the lawn.**
- ☐ **Use a square frame measuring 0.5 m × 0.5 m.**

0 2 . 6

One ABIOTIC factor that affects the number of buttercup plants on the lawn is soil pH.

Give ONE other ABIOTIC factor that could affect the number of buttercup plants on the lawn.

Do NOT refer to soil pH in your answer.
[1 mark]

_____

_____

[Turn over]

8

0 3

Different species in a habitat may depend on each other for food.

FIGURE 3 shows a food chain.

FIGURE 3

0 3 . 1

The grass needs energy to grow.

What is the source of energy for the grass? [1 mark]

BLANK PAGE

[Turn over]

0 3 . 2

TABLE 2 lists different types of feeding relationship.

TABLE 2

FEEDING RELATIONSHIP	ORGANISM
Secondary consumer	Lynx
Primary consumer	
Producer	
Herbivore	
Carnivore	
Prey	
Predator	

Write the name of ONE organism from FIGURE 3, on page 24, in each box in TABLE 2. [3 marks]

Each organism may be written in one box or in more than one box.

The first box has been completed for you.

[Turn over]

0 3 . 3

FIGURE 4 shows the appearance of the snowshoe hare in the summer and in the winter.

FIGURE 4

SNOWSHOE HARE IN SUMMER

SNOWSHOE HARE IN WINTER

[Turn over]

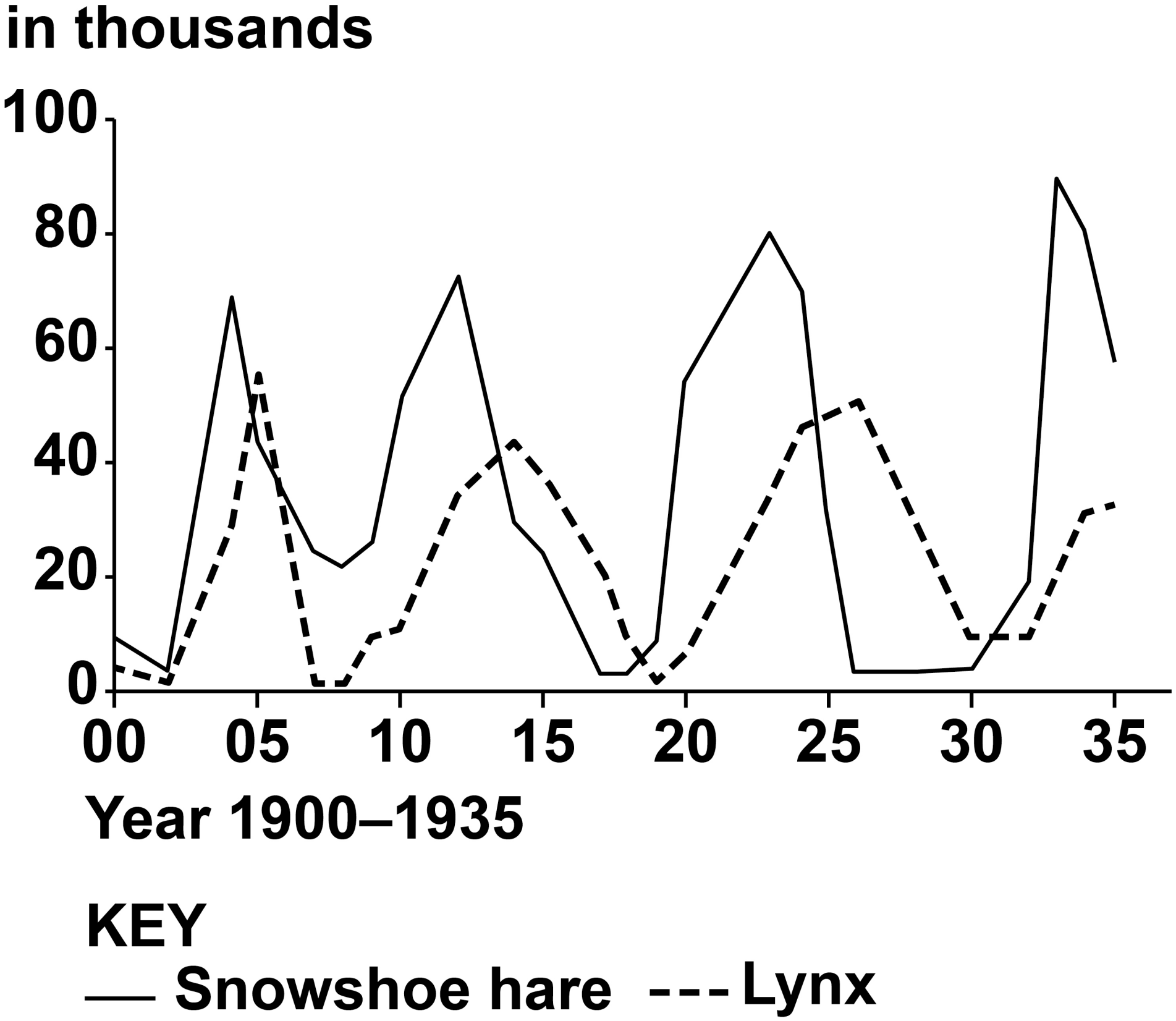
BLANK PAGE

The snowshoe hare has a different fur colour in the summer than in the winter.

Explain how the different fur colour increases the chance of survival of the snowshoe hare. [3 marks]

FIGURE 5 shows how the number of snowshoe hares and the number of lynx varied in one area between 1900 and 1935.

FIGURE 5



0 3 . 4

FIGURE 5 shows that the number of snowshoe hares and the number of lynx increase and decrease several times.

Suggest TWO reasons why the number of SNOWSHOE HARES increases.
[2 marks]

1 _____

_____

_____

2 _____

_____

0 3 . 5

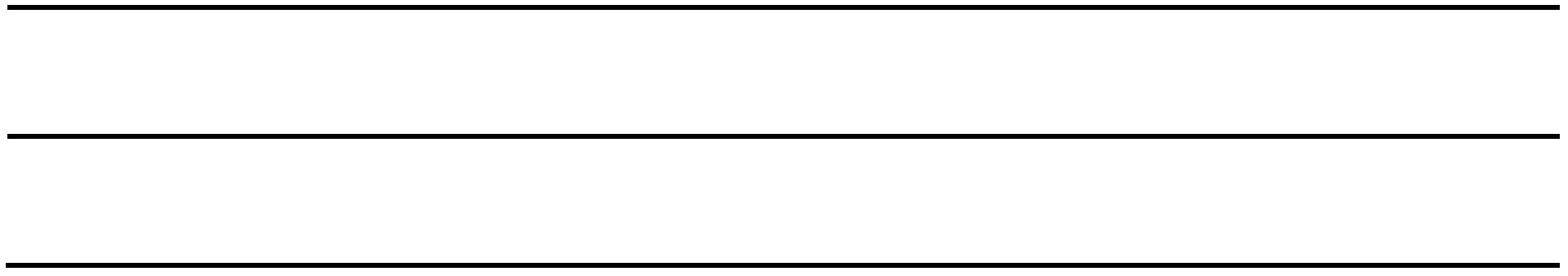
The number of snowshoe hares increased and decreased four times between 1900 and 1935.

What effect does an INCREASE in the number of snowshoe hares have on the number of lynx? [1 mark]

0 3 . 6

Suggest ONE reason why the number of lynx decreased from 1915 to 1919.

Use information from FIGURE 5, on page 32. [1 mark]



[Turn over]

0 3 . 7

When the snowshoe hare eats grass, about 90% of the biomass of the grass is lost.

Give TWO ways the biomass is lost.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

13

BLANK PAGE

[Turn over]

0	4

Some farmers keep cows indoors in large sheds.

Other farmers keep cows outdoors in fields of grass.

FIGURE 6, below and on the opposite page, shows cows being kept indoors and outdoors.

FIGURE 6

COWS KEPT INDOORS

COWS KEPT OUTDOORS

[Turn over]

TABLE 3 shows the energy inputs and energy outputs for keeping cows.

TABLE 3

	Energy in kJ/m^2/year	
	INDOORS	OUTDOORS
Input as food	10 000	5 950
Input as fossil fuel	6 000	50
Output as meat and milk	40	2

0 4 . 1

Calculate the total energy input for keeping cows OUTDOORS.

Use data from TABLE 3. [1 mark]

Total energy input =

_____ **kJ/m^2/year**

0 4 . 2

The total energy input for keeping cows INDOORS is 16 000 kJ/m^2/year.

Calculate the percentage efficiency of keeping cows INDOORS.

Use the equation:

$$\text{Percentage efficiency} = \frac{\text{energy output}}{\text{total energy input}} \times 100$$

[2 marks]

Percentage efficiency = _____ %

0 4 . 3

The percentage efficiency of keeping cows outdoors is 0.03%.

Why is it more energy efficient to keep cows indoors than to keep cows outdoors? [2 marks]

Tick (✓) TWO boxes.

- ☐ **Cows are more stressed indoors.**
- ☐ **Cows move less indoors.**
- ☐ **It is noisier indoors.**
- ☐ **It is warmer indoors.**
- ☐ **There is less light indoors.**

[Turn over]

Diseases in cows can cause problems for farmers.

0 4 . 4

Suggest why diseases spread more quickly when the cows are kept indoors. [1 mark]

One species of bacterium causes a disease in cows.

Scientists investigated the effect of eight different antibiotics on the growth of this species of bacterium.

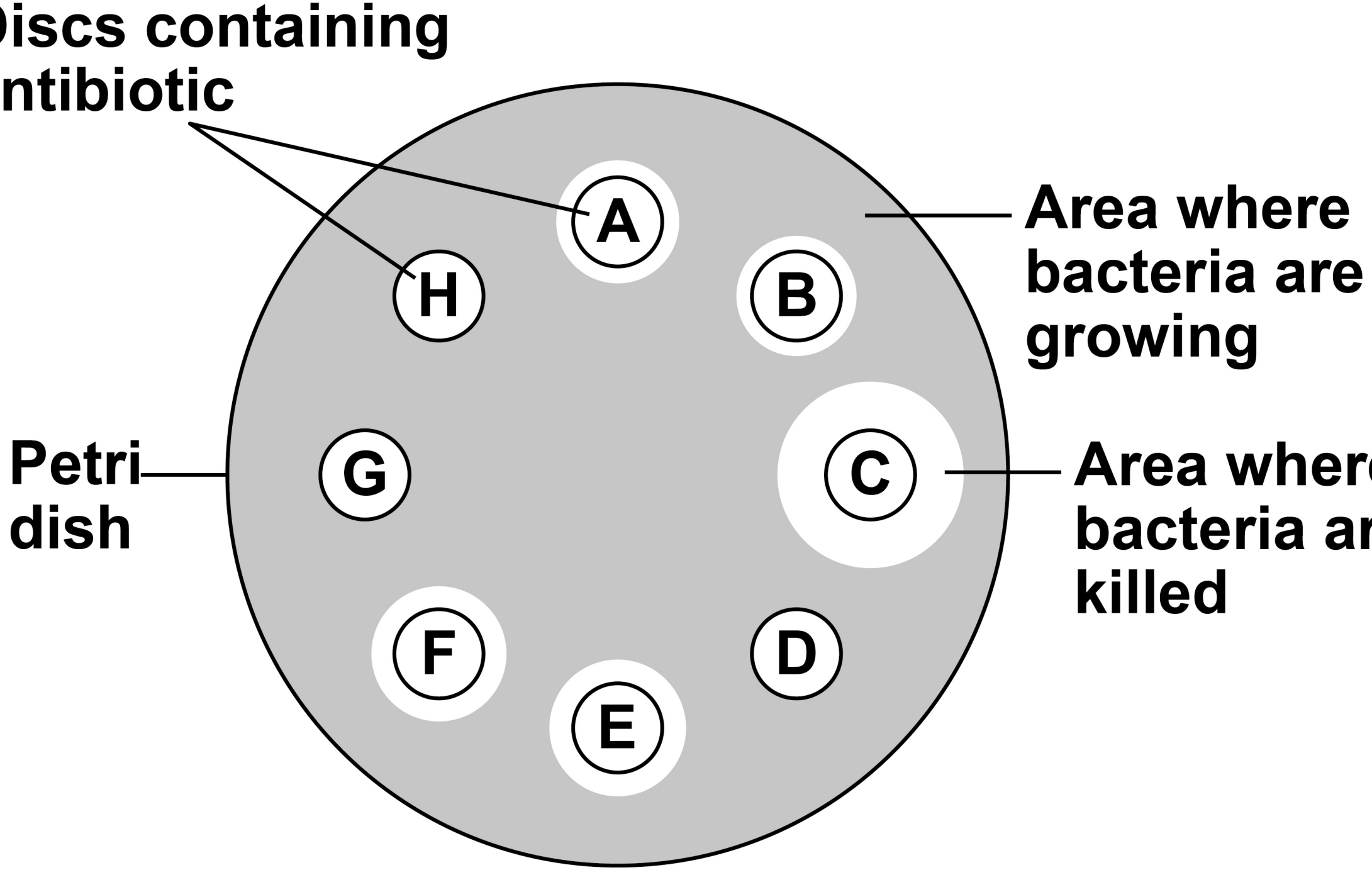
The scientists put discs containing the different antibiotics onto a Petri dish containing the bacteria.

Antibiotics A to H were used in the investigation.

FIGURE 7, on page 46, shows what the Petri dish looked like after 2 days.

[Turn over]

FIGURE 7


Discs containing antibiotic
A
H
B
Area where bacteria are growing
Petri dish
G
C
Area where bacteria are killed
F
D
E

0 4 . 5

This species of bacterium is resistant to some of the antibiotics.

Give the letter of ONE antibiotic the bacterium is resistant to. [1 mark]

_____

[Turn over]

0 4 . 6

Complete the sentence.

Choose the answer from the list.
[1 mark]

- **carbohydrate**
- **DNA**
- **lipid**

Antibiotic resistance in a single bacterium is caused by a change in the bacterium's _____ .

0 4 . 7

Complete the sentence.

Choose the answer from the list.
[1 mark]

- **excretion**
- **feeding**
- **reproduction**

A change in one bacterium can cause millions of bacteria to become resistant to the antibiotic.

This is because bacteria have a high rate of _____ .

[Turn over]

0 4 . 8

Suggest why the production of millions of antibiotic-resistant bacteria is a problem for farmers. [2 marks]

11

0 5

Bacteria are one type of organism that cause decay.

0 5 . 1

Which other type of organism causes decay? [1 mark]

Tick (✓) ONE box.

☐ **Fungi**

☐ **Plants**

☐ **Viruses**

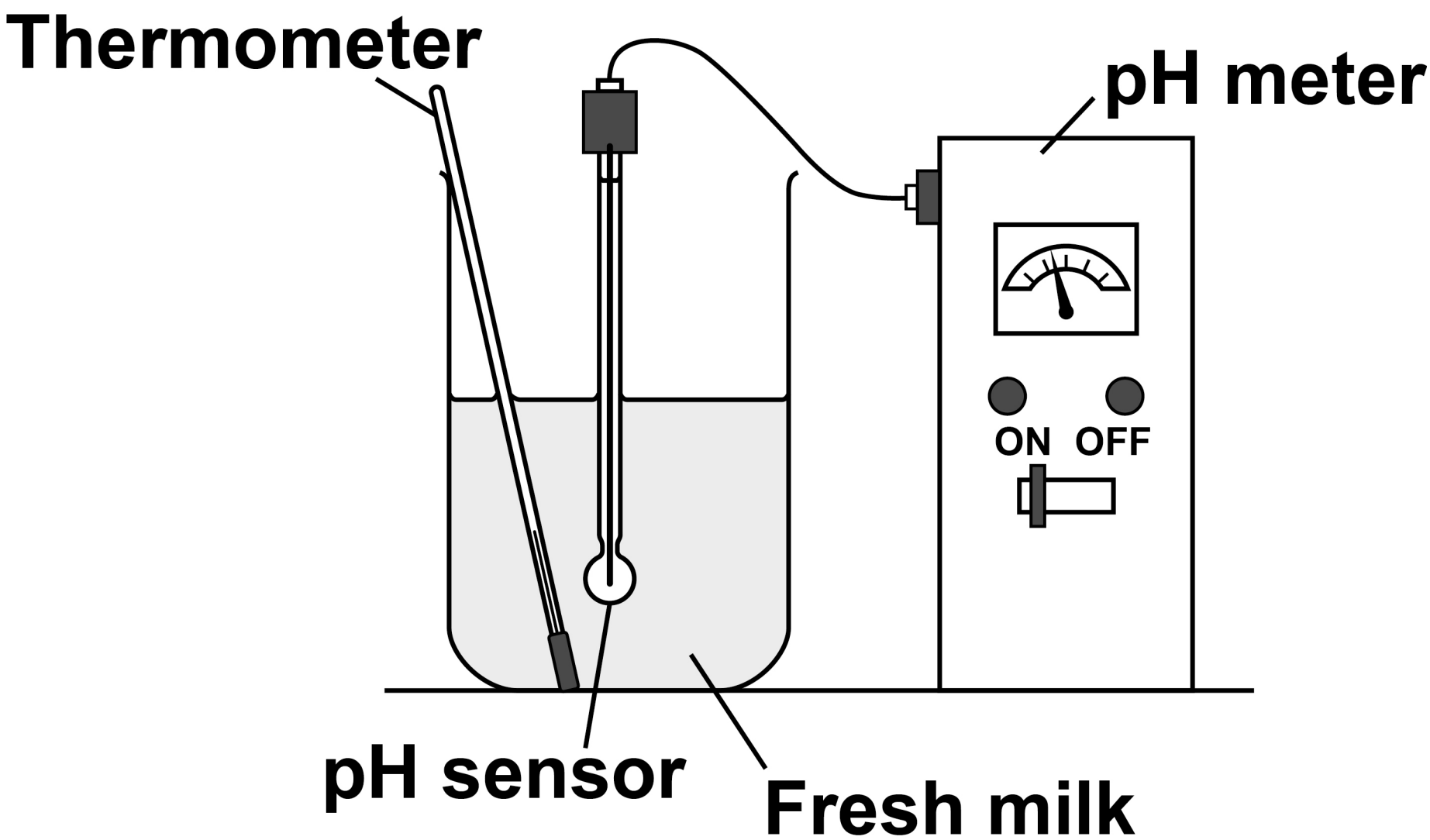
[Turn over]

Students investigated the effect of temperature on the decay of milk.

The decay was caused by bacteria in the milk.

FIGURE 8 shows the apparatus used.

FIGURE 8



This is the method used.

1. Set up the apparatus as shown in FIGURE 8 with the milk at 20 °C.
2. Record the pH each day for 7 days.
3. Repeat with more samples of milk at 5 °C and at 30 °C.

0 5 . 2

What was the dependent variable in the investigation? [1 mark]

Tick (✓) ONE box.

☐ The pH of the milk

☐ The type of milk

☐ The volume of the milk

0 5 . 3

How could the students keep the milk at 30 °C for 7 days? [1 mark]

Tick (✓) ONE box.

- ☐ **Put a lid on the beaker.**
- ☐ **Put the beaker in a water bath.**
- ☐ **Stir the milk continuously.**
- ☐ **Wrap cloth around the beaker.**

0 5 . 4

As the milk decays, the bacteria digest fats in the milk.

What type of acid is produced by digestion of fats in the milk? [1 mark]

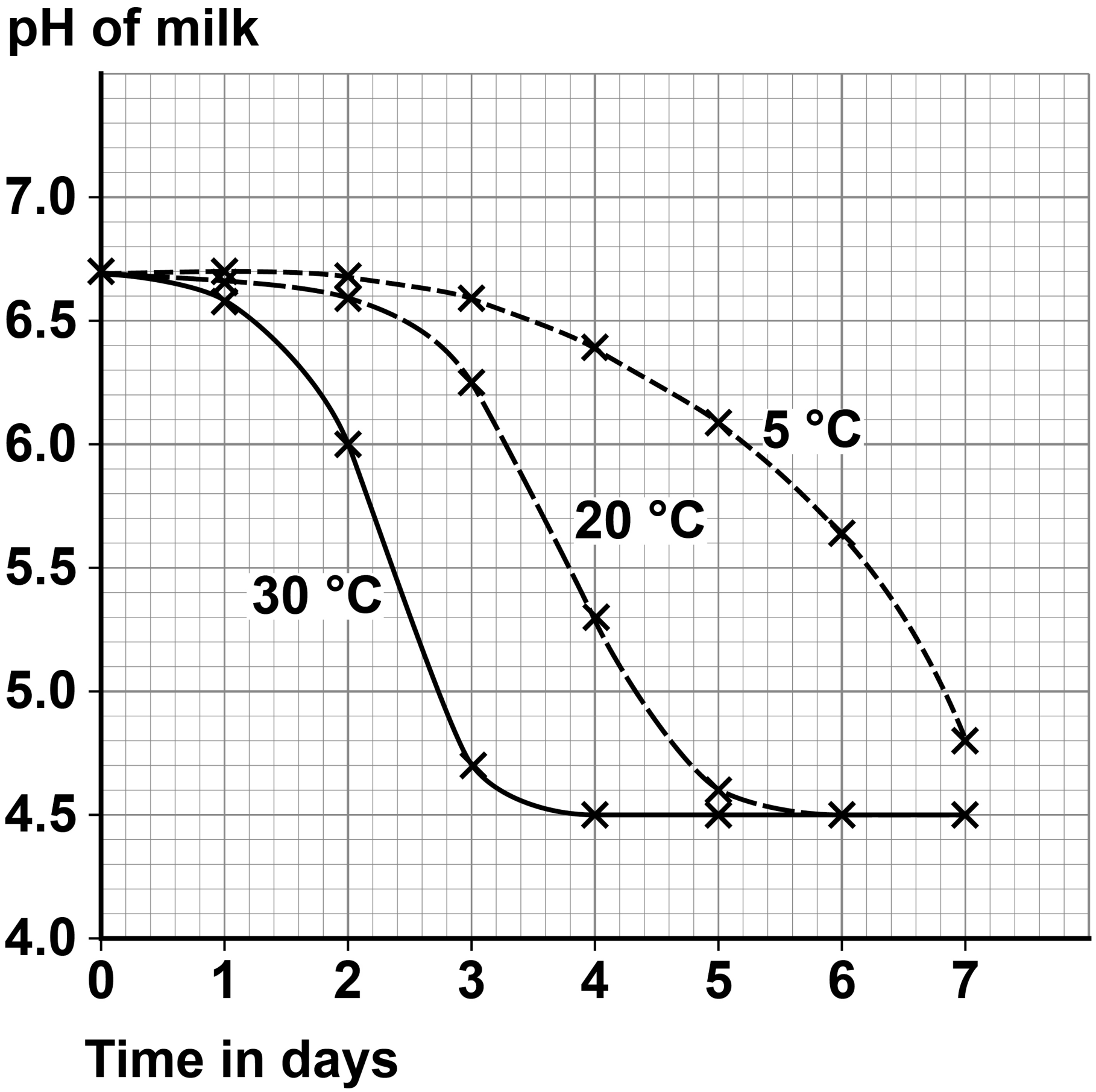
Tick (✓) ONE box.

- ☐ **Amino acid**
- ☐ **Fatty acid**
- ☐ **Hydrochloric acid**

[Turn over]

FIGURE 9 shows the results.

FIGURE 9



0 5 . 5

Why did the pH NOT fall below pH 4.5 at 20 °C? [1 mark]

Tick (✓) ONE box.

- ☐ **All the fat had been digested.**
- ☐ **The reaction was too fast.**
- ☐ **The temperature was too low.**

The digestion of fat was fastest at 30 °C and slowest at 5 °C.

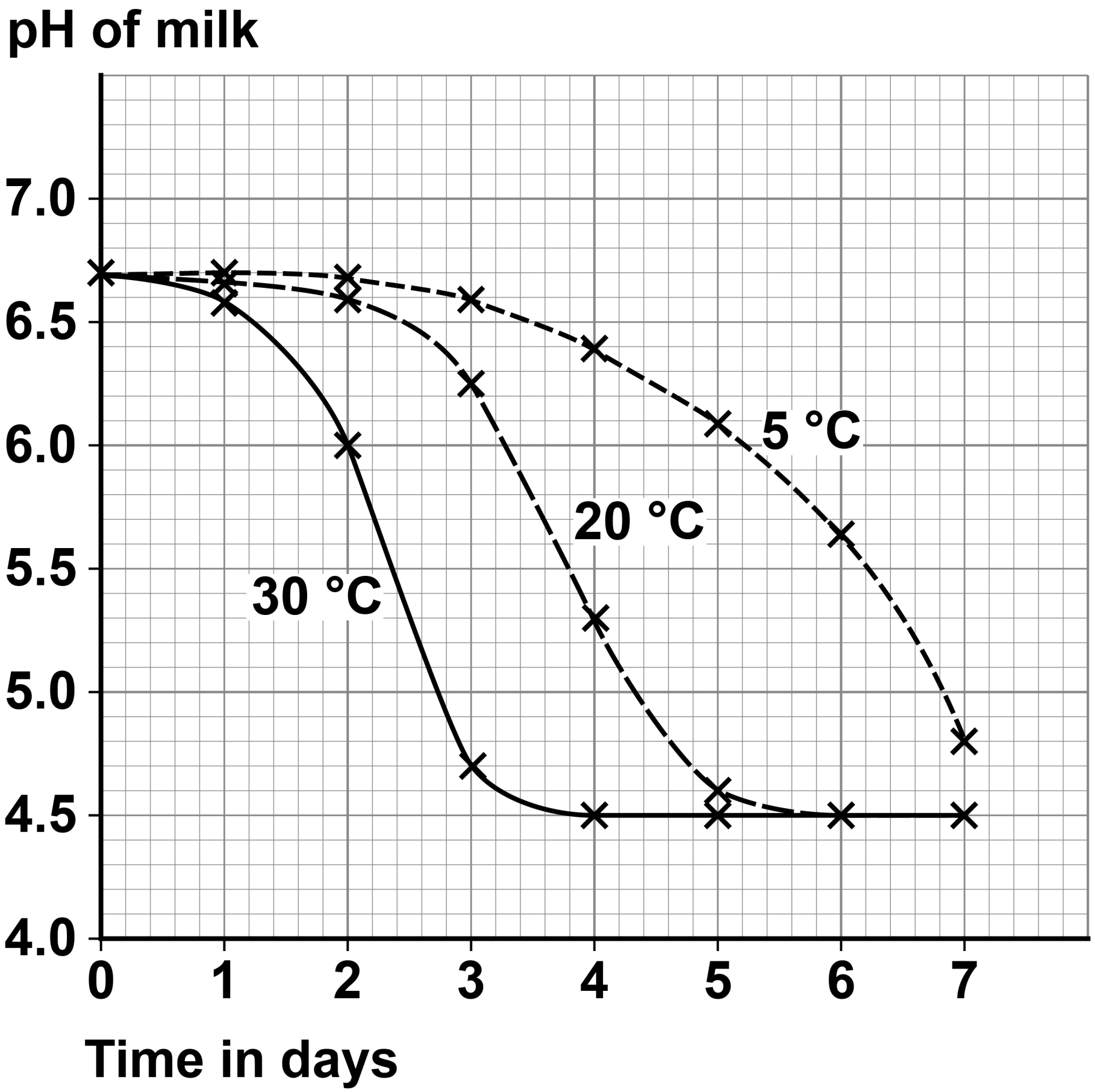
0 5 . 6

Give ONE reason why the rate of digestion was faster at 30 °C than at 5 °C. [1 mark]

BLANK PAGE

[Turn over]

REPEAT OF FIGURE 9



0 5 . 7

Calculate the rate of digestion at 30 °C from day 2 to day 3.

Complete the following calculation.

Use data from FIGURE 9. [2 marks]

At 30 °C, the pH at day 2 = _____

At 30 °C, the pH at day 3 = _____

Therefore the fall in pH at 30 °C from day 2 to day 3 =

_____ pH units/day

[Turn over]

0 5 . 8

The rate of digestion at 5°C from day 2 to day 3 is 0.1 pH units/day.

How many times faster is the rate of digestion at 30°C than the rate of digestion at 5°C from day 2 to day 3?
[2 marks]

Use your answer to Question 05.7.

_____

_____

_____

Rate at 30 °C is _____ times faster

10

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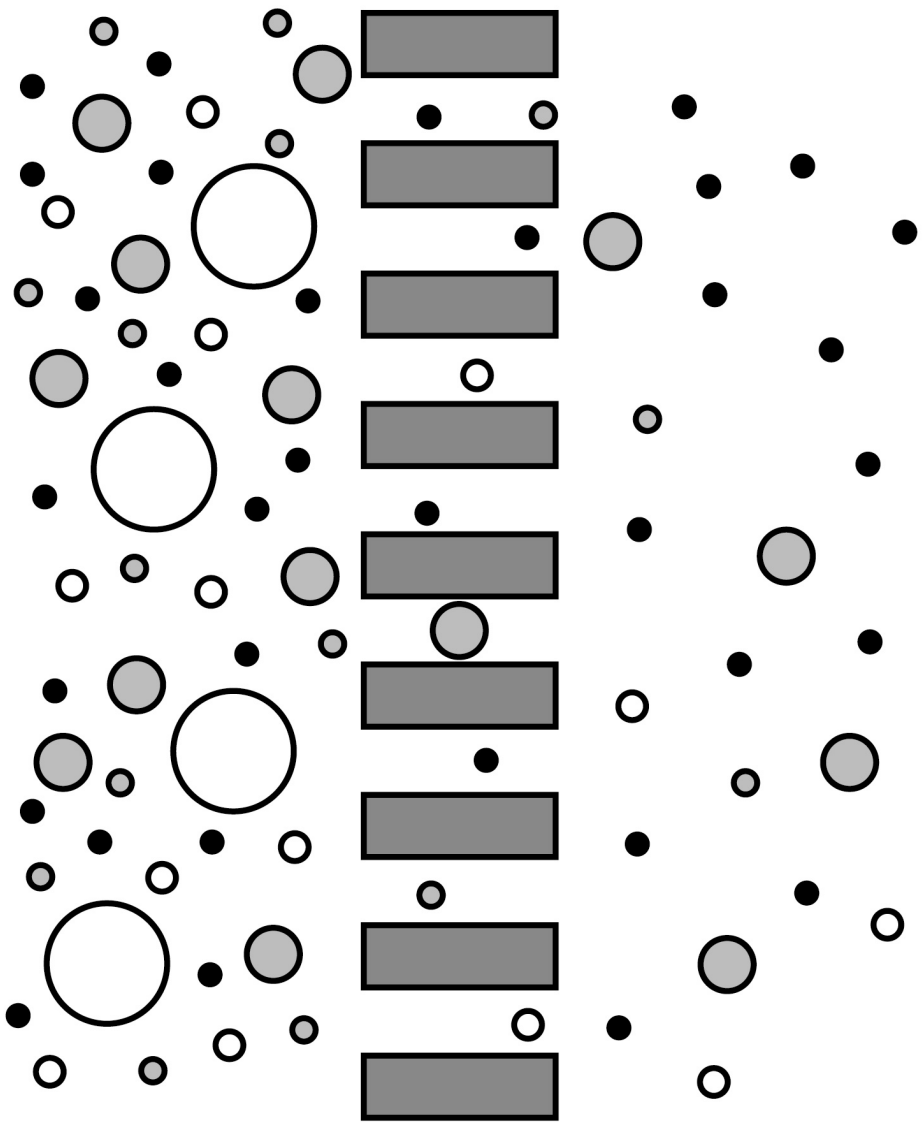
[Turn over]

0	6

The kidneys filter the blood.

FIGURE 10, on the opposite page, shows filtration in the kidney.

FIGURE 10



KEY

- Water molecule
- Sodium ion
- Urea molecule
- Glucose molecule
- Protein molecule

[Turn over]

0 6 . 1

Glucose molecules are found in the blood plasma AND in the filtrate.

Protein molecules are ONLY found in the blood plasma.

On the opposite page, draw ONE line from each substance to the reason for where the substance is found. [2 marks]

SUBSTANCE	REASON
	The molecules are too large to pass through the filter
Glucose	The molecules are small enough to pass through the filter
Protein	The molecules are too small to pass through the filter

[Turn over]

0 6 . 2

The kidneys control the volume of water in the body.

TABLE 4 shows information about a person on one day.

TABLE 4

	Volume in dm^3
Water filtered from blood	160.0
Water lost in urine	1.9

Calculate the volume of water reabsorbed into the blood. [1 mark]

_____

_____

_____

Volume = _____ dm^3

BLANK PAGE

[Turn over]

0 6 . 3

A person with kidney disease may be treated by dialysis or by having a kidney transplant.

FIGURE 11 gives information about dialysis and kidney transplants.

FIGURE 11

DIALYSIS

- **A person needs 3 dialysis sessions a week, with each session lasting about 8 hours.**
- **Most patients have dialysis in hospital.**
- **Protein and salt levels in food must be kept low.**
- **Dialysis costs £35 000 per year for each patient.**

KIDNEY TRANSPLANT

- In a surgical operation the use of a general anaesthetic can occasionally cause damage to other organs.
- After a transplant the patient must take drugs for the rest of their life to suppress the immune system.
- A transplant costs £17 000 in the first year and then £5 000 in each of the following years for drugs.
- The transplanted kidney will work well for about 10 years.

[Turn over]

A doctor states:

‘It is better to treat a person with kidney disease by using a kidney transplant rather than by dialysis.’

Evaluate the doctor’s statement.

Use information from FIGURE 11, on pages 70 and 71. [6 marks]

[Turn over]

0 6 . 4

A kidney transplant costs £17 000 in the first year and then £5 000 in each of the following years for drugs.

Calculate the total cost of treatment by kidney transplant over the first 5 years. [3 marks]

Total cost = £

12

0 7

Many different species can live together in the same habitat.

0 7 . 1

What name is given to all of the organisms living in the same habitat?
[1 mark]

Tick (✓) ONE box.

☐ **A community**

☐ **A food chain**

☐ **A population**

☐ **An ecosystem**

[Turn over]

FIGURE 12, below and on the opposite page, shows four species of bird from the same habitat in the UK.

FIGURE 12

BRAMBLING (‘Fringilla montifringilla’)

BULLFINCH (‘Pyrrhula pyrrhula’)

CHAFFINCH ('Fringilla coelebs')

GOLDFINCH ('Carduelis carduelis')

[Turn over]

0 7 . 2

Which species of bird in FIGURE 12, on pages 76 and 77, do scientists think are most closely related? [1 mark]

Tick (✓) ONE box.

- ☐ **Brambling and chaffinch**
- ☐ **Brambling and goldfinch**
- ☐ **Bullfinch and chaffinch**
- ☐ **Bullfinch and goldfinch**

0 7 . 3

Scientists think the brambling and the bullfinch belong to different species.

What evidence is used by scientists to classify the brambling and the bullfinch as different species? [1 mark]

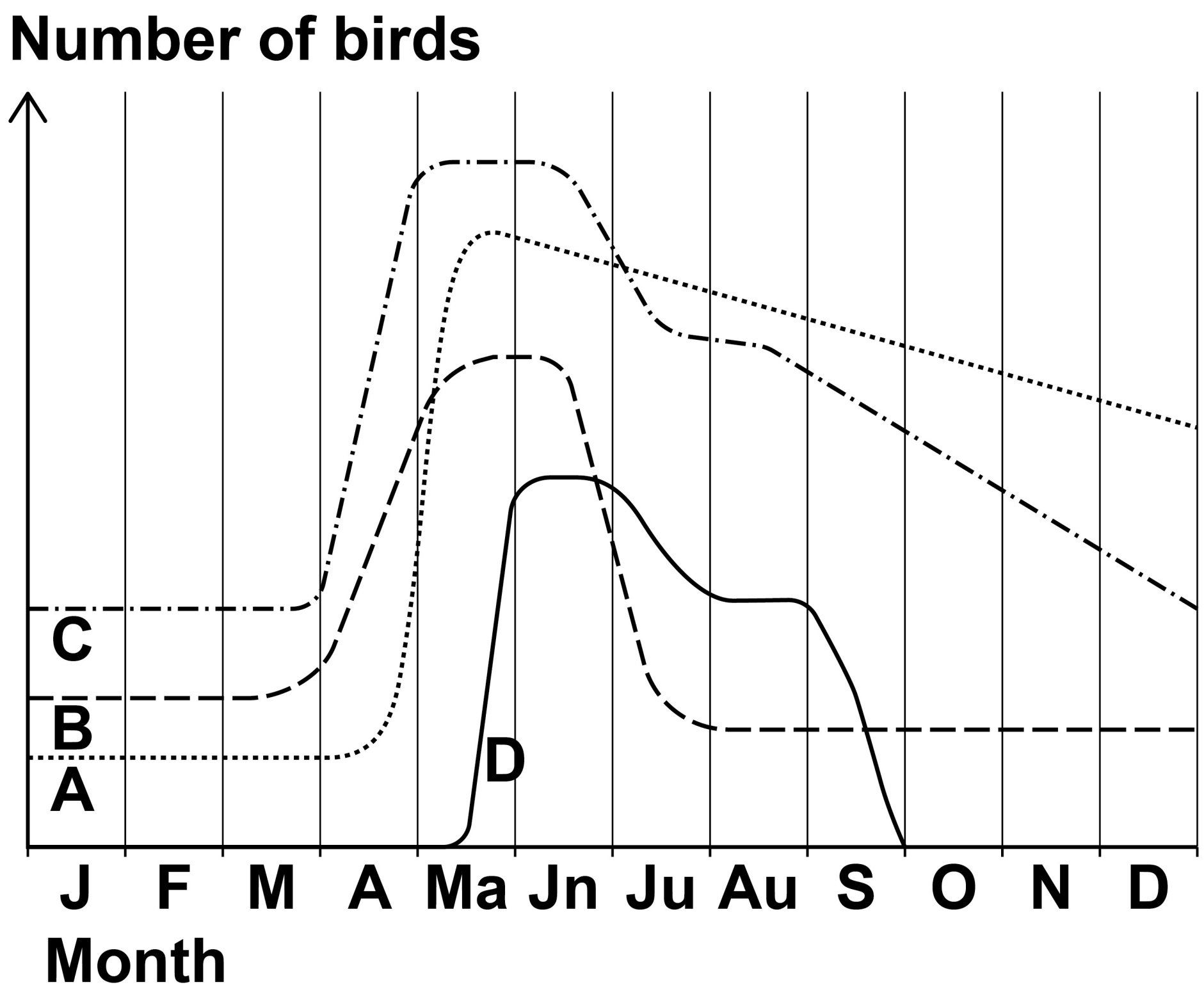
Tick (✓) ONE box.

- ☐ **The brambling and the bullfinch are different sizes.**
- ☐ **The brambling and the bullfinch cannot breed together to give fertile offspring.**
- ☐ **The brambling and the bullfinch live in different parts of the habitat.**
- ☐ **The brambling eats mainly seeds and the bullfinch eats mainly insects.**

Four other species of bird (A, B, C and D) live in a habitat in the UK.

FIGURE 13, below and on the opposite page, shows how the numbers of each species of bird varied during one year.

FIGURE 13



KEY

J = January
F = February
M = March
A = April
Ma = May
Jn = June
Ju = July
Au = August
S = September
O = October
N = November
D = December

[Turn over]

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Use information from FIGURE 13, on pages 80 and 81, to answer Questions 07.4 to 07.6

0 7 . 4

Describe what happens to the number of birds of species A during the year.
[3 marks]

[Turn over]

0 7 . 5

In June and July, a disease affected the populations of some of the species.

Which species had the LOWEST resistance to the disease? [1 mark]

Tick (✓) ONE box.

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

0 7 . 6

One species migrates between the UK and other countries.

Which species migrates between the UK and other countries?

Give a reason for your answer. [1 mark]

Species _____

Reason _____

_____

_____

_____

8

0	8

A person’s eyes can focus on objects at different distances.

A person looks at a distant object.

The person then looks at a near object.

The person’s eyes make adjustments so that the near object forms a clear image.

0 8 . 1

Which term describes the adjustment of focus from the distant object to the near object? [1 mark]

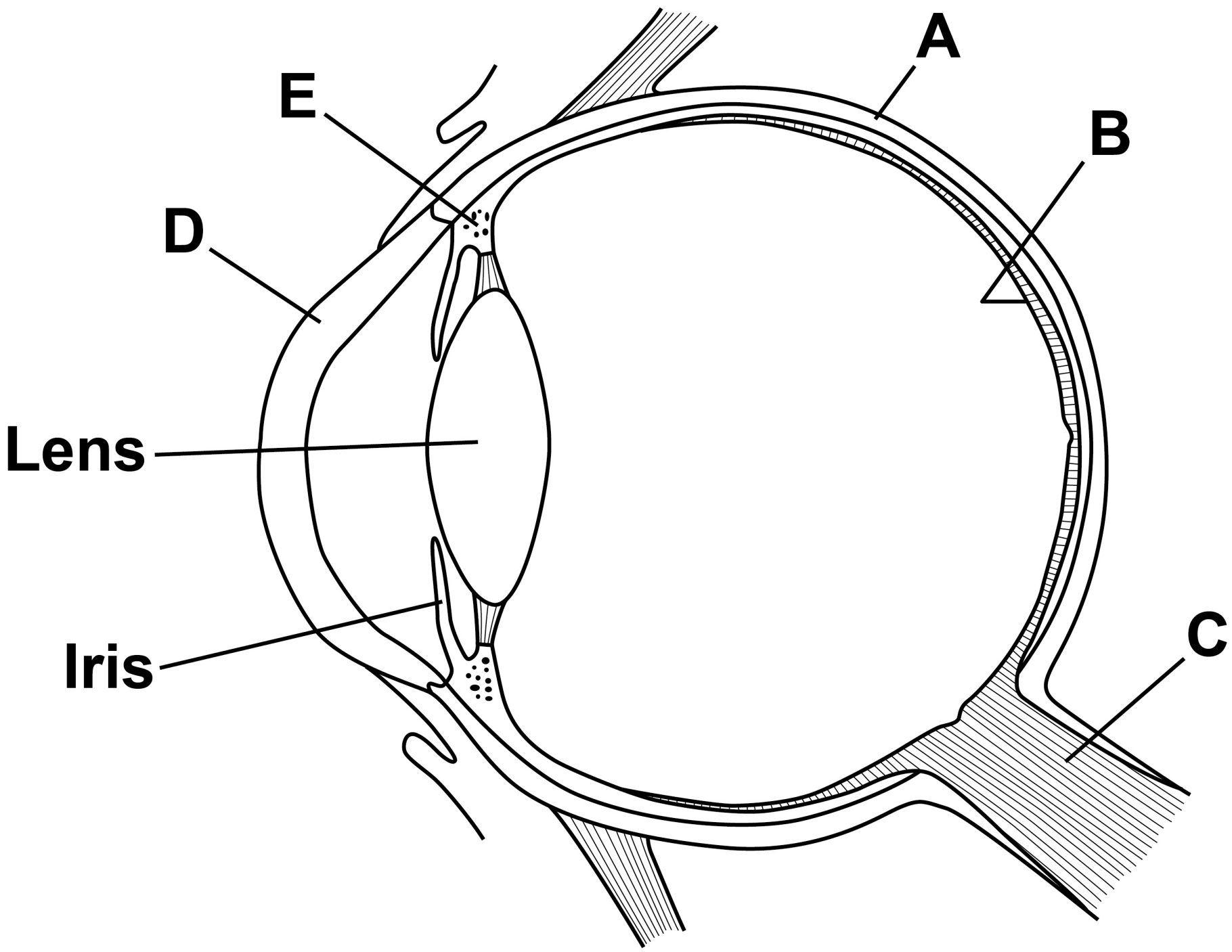
Tick (✓) ONE box.

- ☐ **Accommodation**
- ☐ **Adaptation**
- ☐ **Hyperopia**
- ☐ **Myopia**

[Turn over]

FIGURE 14 shows the eye.

FIGURE 14



0 8 . 2

Which structure in FIGURE 14 is where the image is focused? [1 mark]

Tick (✓) ONE box.

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**
- ☐ **E**

[Turn over]

0 8 . 3

Which structure in FIGURE 14, on page 88, is a muscle that contracts when focusing on a near object? [1 mark]

Tick (✓) ONE box.

☐ **A**

☐ **B**

☐ **C**

☐ **D**

☐ **E**

0 8 . 4

What happens to the shape of the lens when focusing on a near object?
[1 mark]

0 8 . 5

The eyes can function in dimly-lit areas and in brightly-lit areas.

The iris contains muscles.

Describe how muscles in the iris help the person to see clearly when moving from a dimly-lit area to a brightly-lit area.
[2 marks]

BLANK PAGE

[Turn over]

0 8 . 6

It is important to be able to react quickly.

Many people think that drinking coffee decreases reaction time.

Plan an investigation to test the effect of drinking coffee on reaction time.

You should include:

- **the test for reaction time that you would use**
- **how to make the investigation valid.**

[4 marks]

[Turn over]

10

0 9

Reproduction can produce offspring which are:

- **genetically different**

OR

- **genetically identical.**

Farmers grow tomato plants in greenhouses.

The tomatoes are sold in supermarkets.

0 9 . 1

Suggest ONE advantage of growing tomato plants that are genetically different. [1 mark]

0 9 . 2

Suggest ONE advantage of growing tomato plants that are genetically identical. [1 mark]

0 9 . 3

Scientists can grow genetically identical tomato plants using tissue culture.

What is tissue culture? [1 mark]

0 9 . 4

Genetically identical tomato plants growing in the same garden do NOT all grow to the same height.

Give ONE reason why. [1 mark]

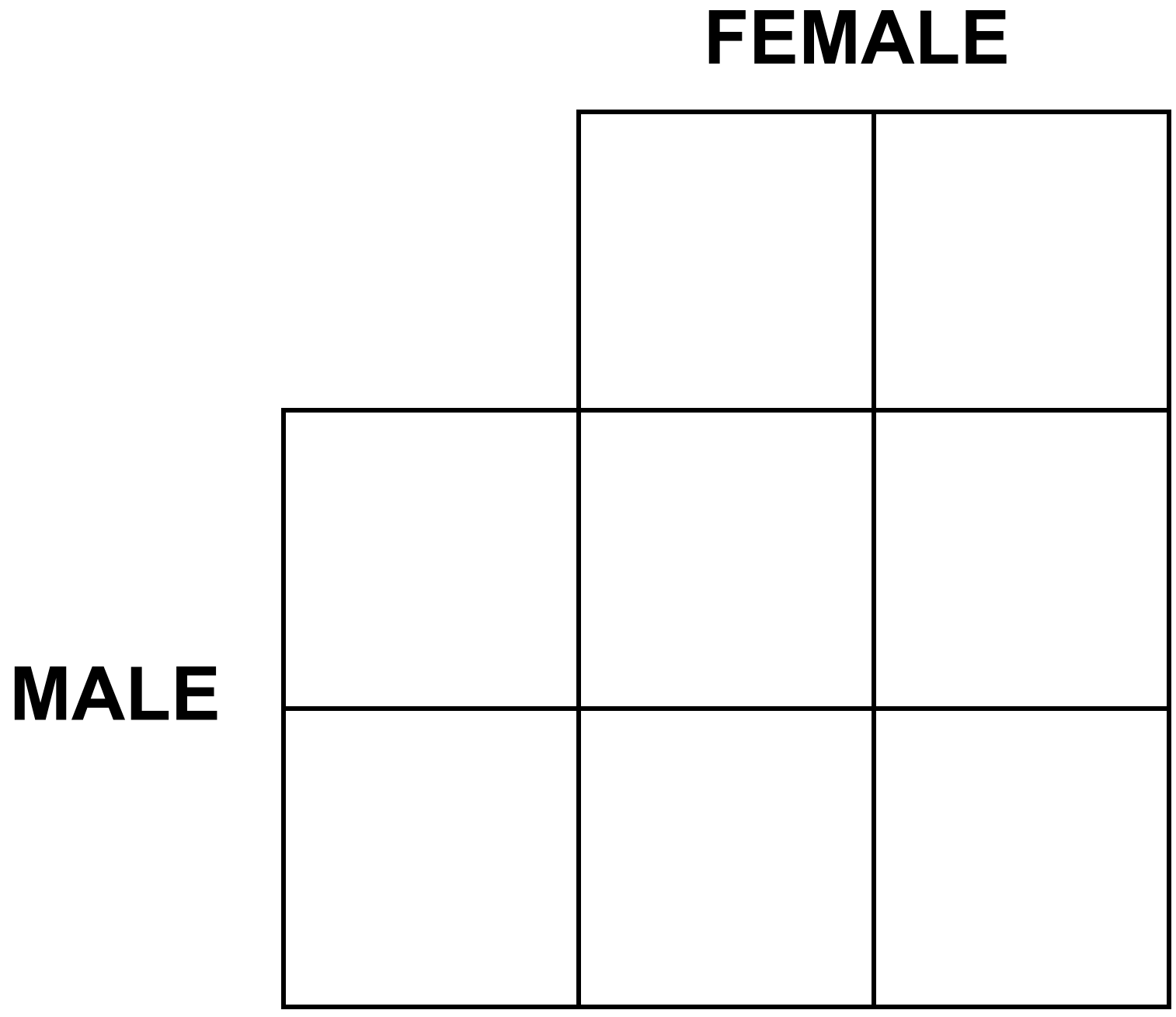
The sex of dogs is determined by X and Y chromosomes in the same way as in humans.

0 9 . 5

Complete the Punnett square diagram in FIGURE 15, on the opposite page, to show the inheritance of sex in dogs.

Use the symbols X and Y. [3 marks]

FIGURE 15



[Turn over]

0 9 . 6

A female dog gave birth to six offspring.

Why would you expect there to be three male offspring and three female offspring?

Use your answer to Question 09.5, on page 99. [1 mark]

Farmers keep chickens for:

- meat production
- egg production.

Some varieties of chicken grow more quickly and are more suitable for meat production.

Other varieties of chicken produce more eggs.

A farmer keeps two varieties of chicken, A and B.

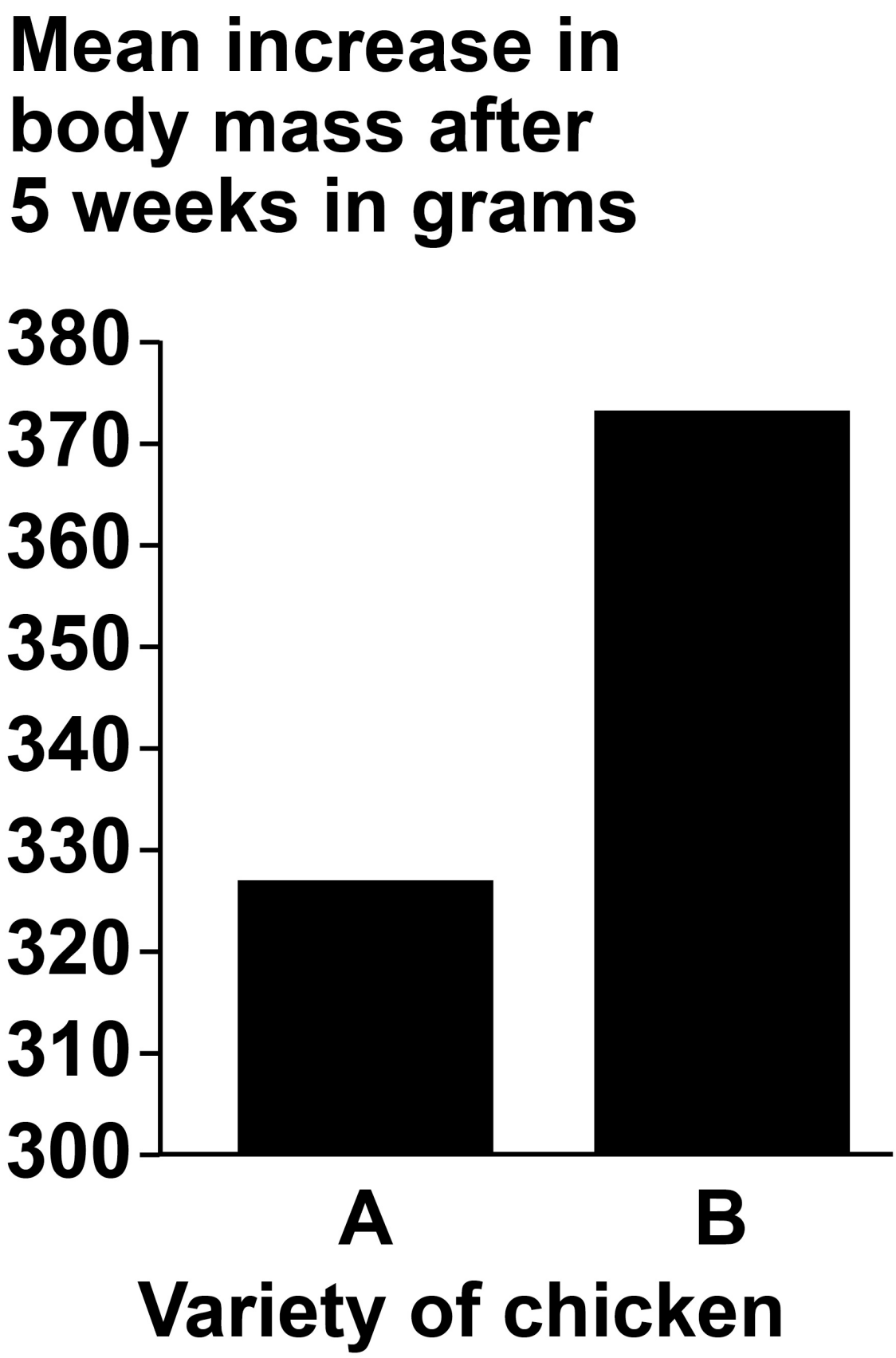
The farmer investigated the growth rates and egg-production rates of both varieties.

FIGURE 16, on pages 102 and 103, shows the results.

[Turn over]

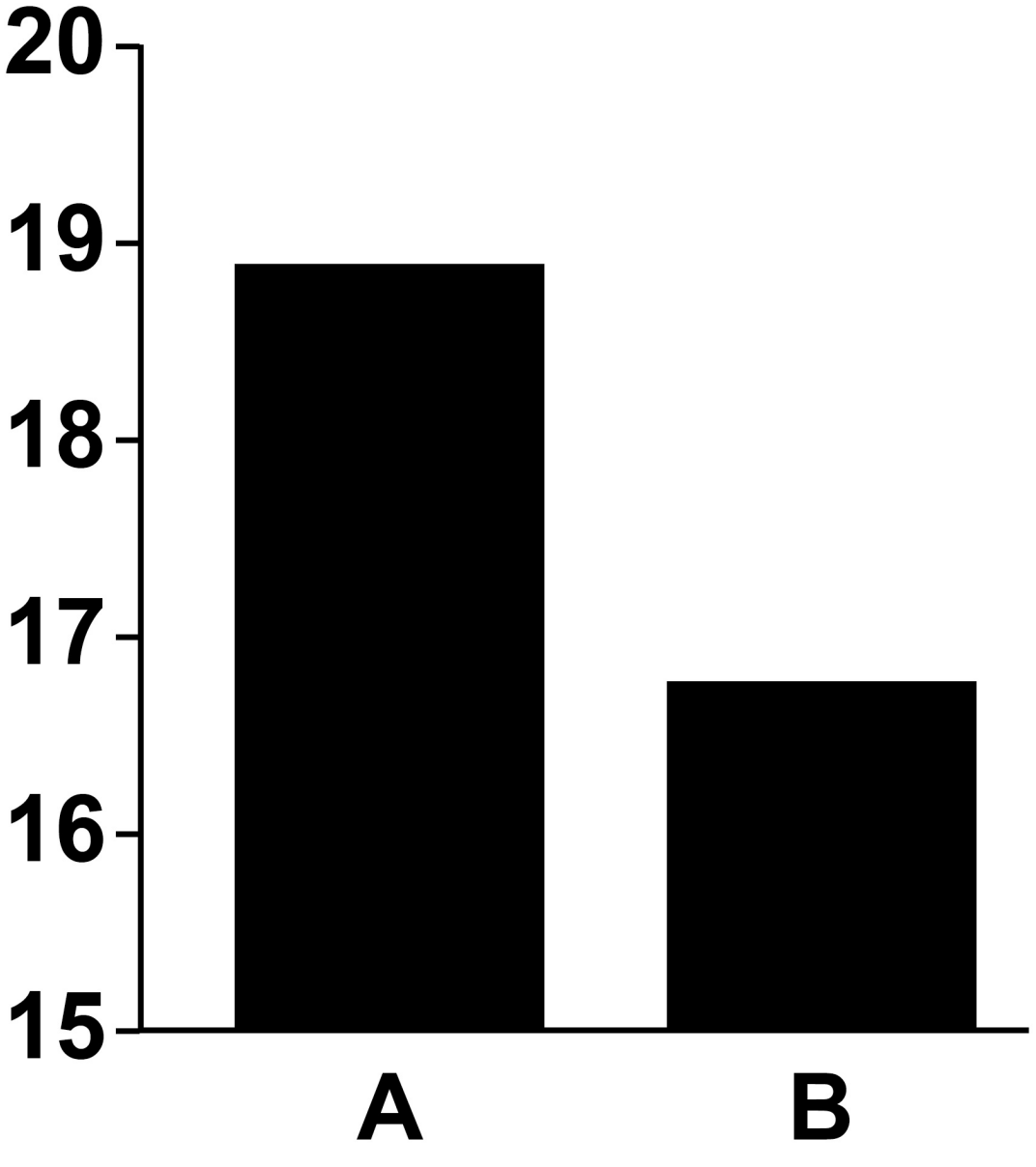
FIGURE 16

GROWTH



EGG PRODUCTION

Mean number of eggs laid per month



[Turn over]

0 9 . 7

Suggest TWO control variables the farmer should have used in this investigation. [2 marks]

1

2

0 9 . 8

FIGURE 16, on pages 102 and 103, shows mean values from 500 chickens of each variety.

Give the reason the farmer used a large number of chickens. [1 mark]

_____

_____

_____

[Turn over]

0 9 . 9

The farmer wants to produce a new variety of chicken that is good for BOTH meat production AND egg production.

Describe how selective breeding of chicken varieties A and B can produce the new variety of chicken. [4 marks]

END OF QUESTIONS

15

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

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For Examiner's Use	
Question	Mark
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