



Surname _____

Forename(s) _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

BIOLOGY

H

Higher Tier Paper 2H

8461/2H

Friday 9 June 2023

Afternoon

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.

[Turn over]



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

Many different species can live together in the same habitat.

0 1 . 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



FIGURE 1, below and on page 6, shows four species of bird from the same habitat in the UK.

FIGURE 1

BRAMBLING ('Fringilla montifringilla')



BULLFINCH ('Pyrrhula pyrrhula')



[Turn over]



CHAFFINCH ('Fringilla coelebs')



GOLDFINCH ('Carduelis carduelis')



01.2

Which species of bird in FIGURE 1, on pages 5 and 6, do scientists think are most closely related? [1 mark]

Tick (✓) ONE box.

Brambling and chaffinch

Brambling and goldfinch

Bullfinch and chaffinch

Bullfinch and goldfinch

[Turn over]



01.3

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.



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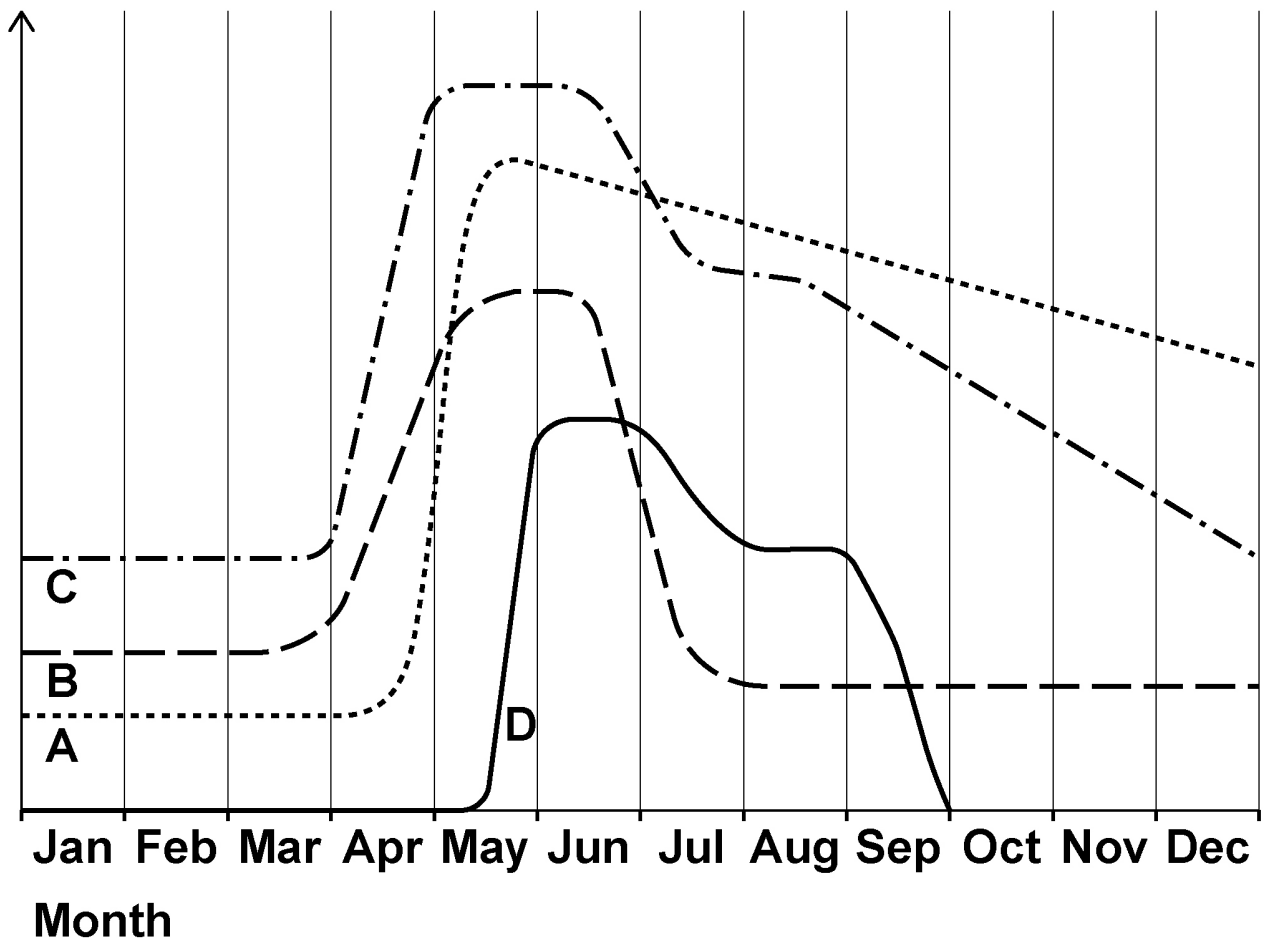


Four other species of bird (A, B, C and D) live in a habitat in the UK.

FIGURE 2 shows how the numbers of each species of bird varied during one year.

FIGURE 2

Number of birds



01.5

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**

01.6

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 _____

[Turn over]

8



0 2

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 2 . 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**

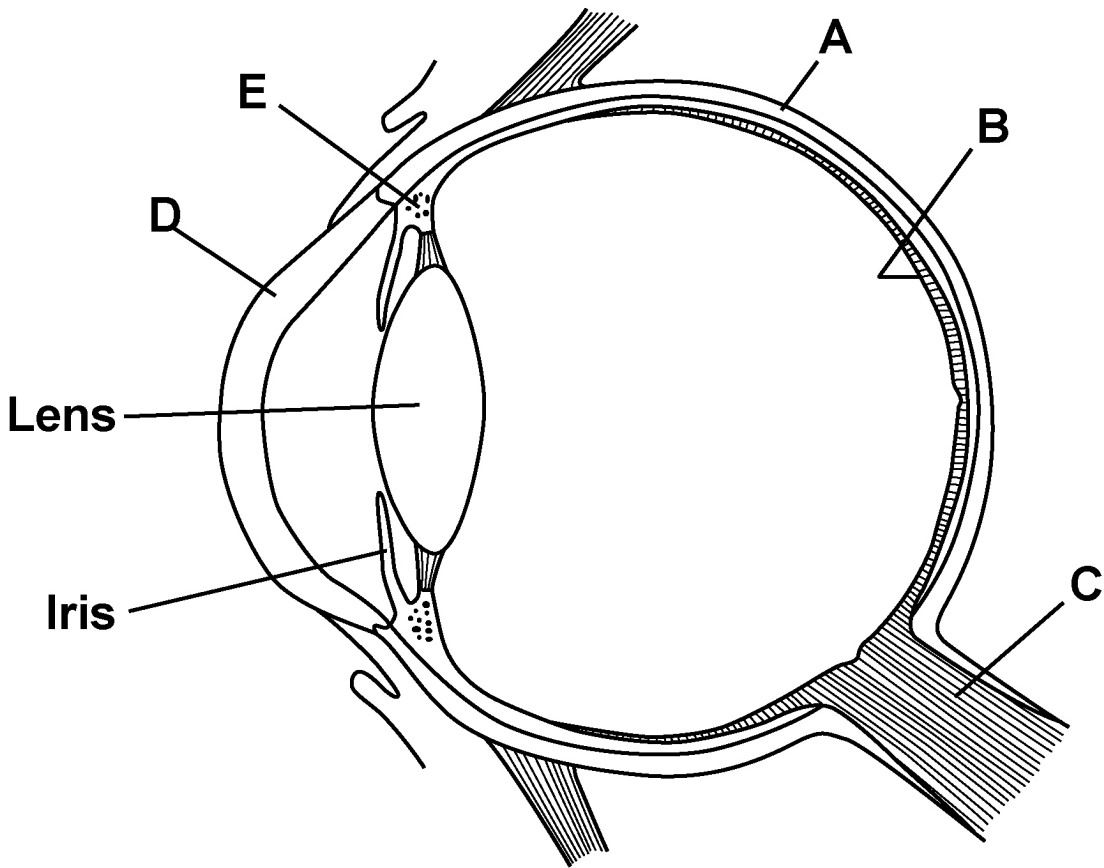
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[Turn over]



FIGURE 3 shows the eye.

FIGURE 3



02.2

Which structure in FIGURE 3 is where the image is focused? [1 mark]

Tick (✓) ONE box.

A**B****C****D****E**

[Turn over]



02.3

Which structure in FIGURE 3, on page 16 is a muscle that contracts when focusing on a near object?

[1 mark]

Tick (✓) ONE box.

A**B****C****D****E****02.4**

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



02.5

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]

[Turn over]

02.6

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]



03

Reproduction can produce offspring which are:

- genetically different

OR

- genetically identical.

Farmers grow tomato plants in greenhouses.

The tomatoes are sold in supermarkets.

03.1

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



03.2

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

03.3

Scientists can grow genetically identical tomato plants using tissue culture.

What is tissue culture? [1 mark]

[Turn over]



03.4

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.

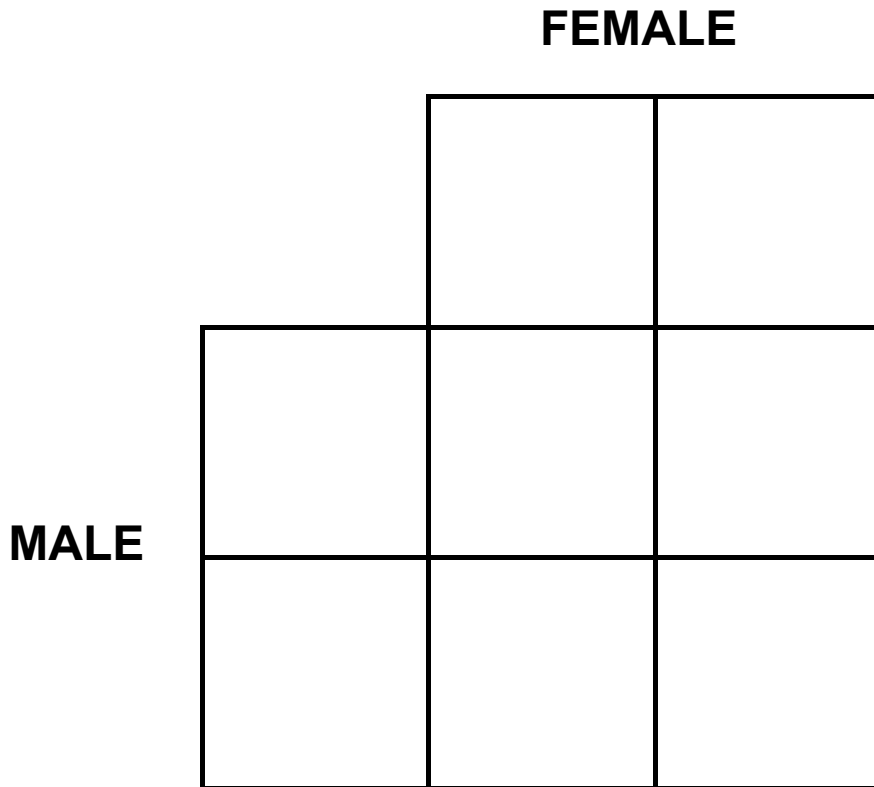
03.5

Complete the Punnett square diagram in FIGURE 4, on the opposite page, to show the inheritance of sex in dogs.

Use the symbols X and Y. [3 marks]



FIGURE 4



03.6

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 03.5. [1 mark]

[Turn over]



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.

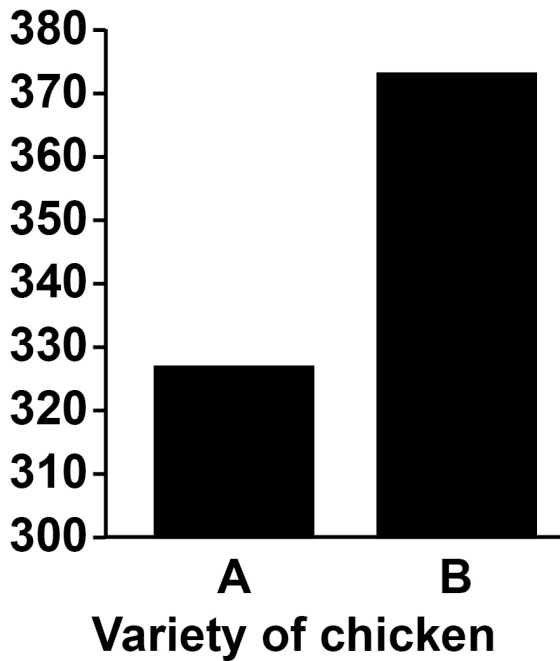
The farmer investigated the growth rates and egg-production rates of both varieties.

FIGURE 5, on the opposite page, shows the results.

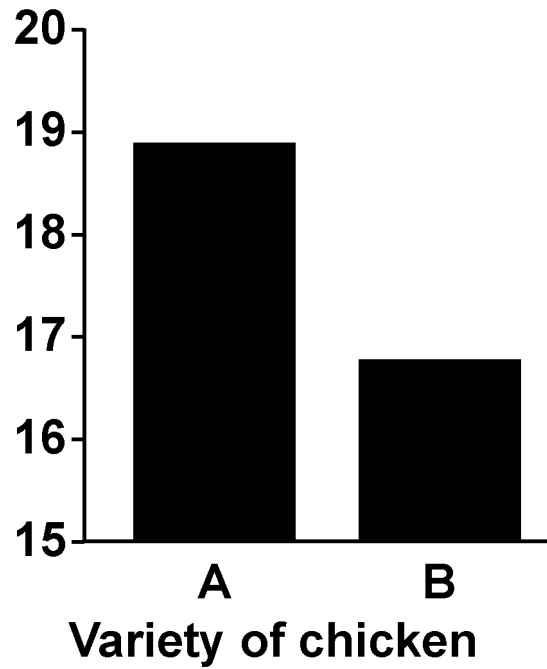


FIGURE 5**GROWTH**

Mean increase in
body mass after
5 weeks in grams

**EGG PRODUCTION**

Mean number of
eggs laid per month



[Turn over]



03.7

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

1

2



03.8

FIGURE 5, on page 27, shows mean values from 500 chickens of each variety.

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

[Turn over]



[Turn over]

15



04

Organic substances decay into simpler substances.

04.1

The leaves fall off many trees in autumn.

The dead leaves contain carbon compounds and nitrogen compounds.

Describe how carbon AND nitrogen in compounds in the leaves are recycled and used by living trees.

You should include a description of:

- **how the leaves are broken down**
- **how substances are taken in and used by the trees.**

[6 marks]





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

This is the method used.

- 1. Place 25 cm³ of fresh milk into each of three beakers.**
- 2. Keep one beaker of milk at 5 °C.**
- 3. Keep one beaker of milk at 15 °C.**
- 4. Keep one beaker of milk at 25 °C.**
- 5. Record the pH of the milk in each beaker every day for 4 days.**

TABLE 1, on page 36, shows the results.

[Turn over]



TABLE 1

TIME IN DAYS	pH of milk		
	5 °C	15 °C	25 °C
0	6.8	6.8	6.8
1	6.5	6.1	5.3
2	6.2	5.5	4.9
3	5.9	5.1	4.8
4	5.6	4.8	4.8

04.2

Suggest ONE improvement the students could have made to the method. [1 mark]

04.3

Complete FIGURE 6, on the opposite page.

You should:

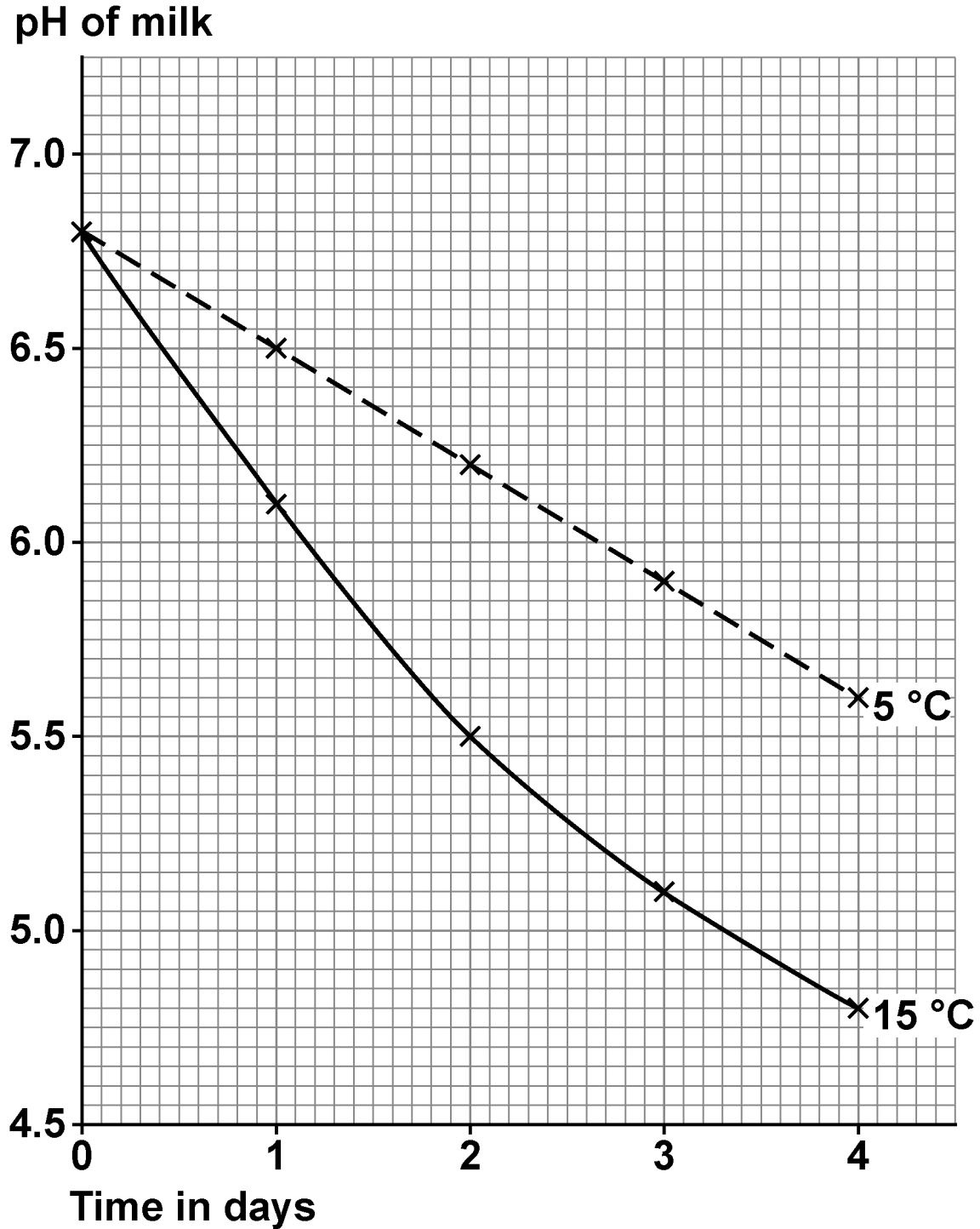
- plot the data for 25 °C from TABLE 1
- draw a line of best fit.

[3 marks]



FIGURE 6 shows the results at 5 °C and at 15 °C.

FIGURE 6



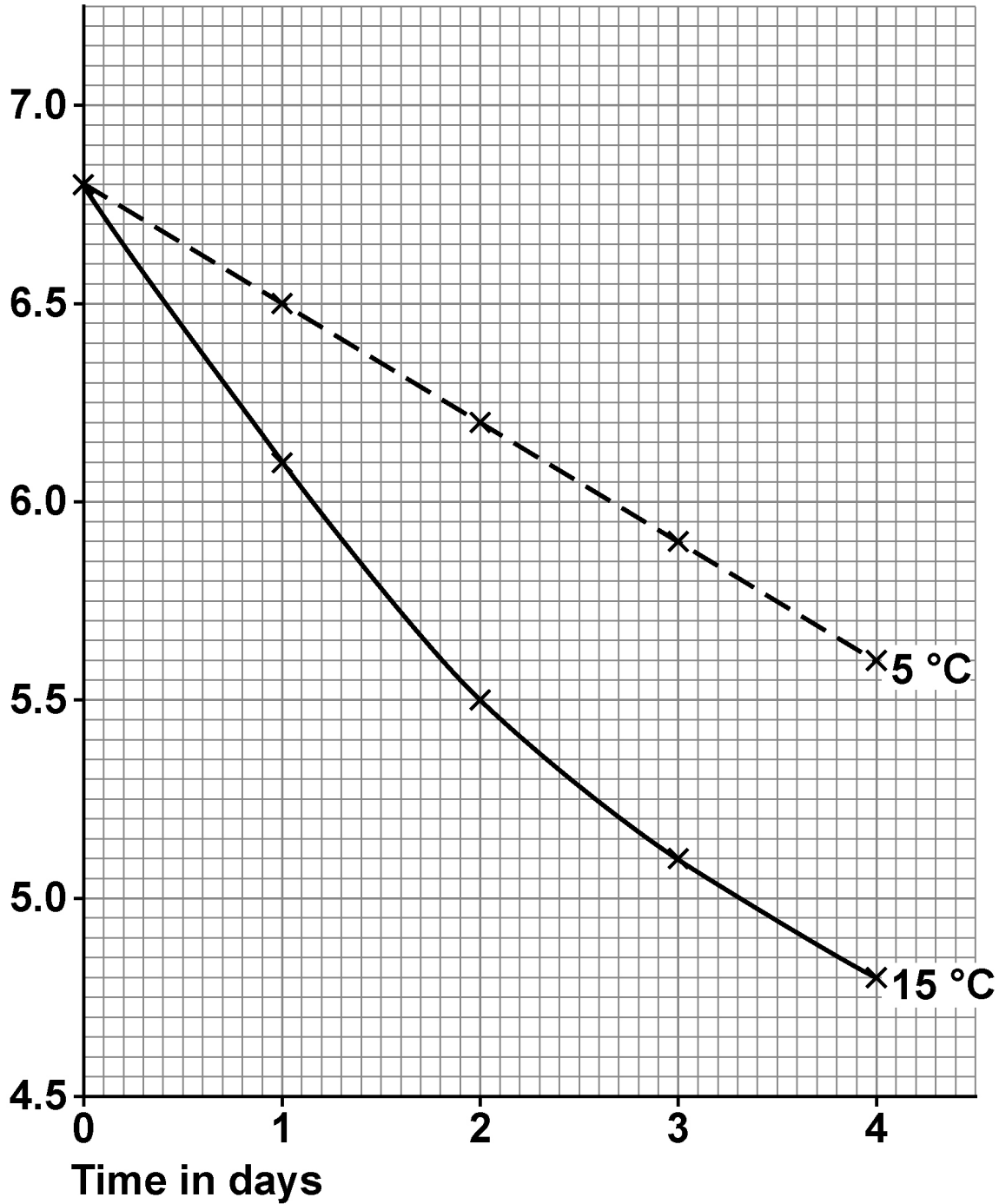
[Turn over]



FIGURE 7 shows the results for 5°C and at 15°C again.

FIGURE 7

pH of milk



Rate at 15 °C is _____ times faster.

0 4 . 5

Milk contains lipids.

The lipids are broken down when the milk decays.

Explain why the pH changes more quickly when the temperature is higher. [3 marks]



[Turn over]

17



05

Homeostasis is the regulation of the body's internal conditions.

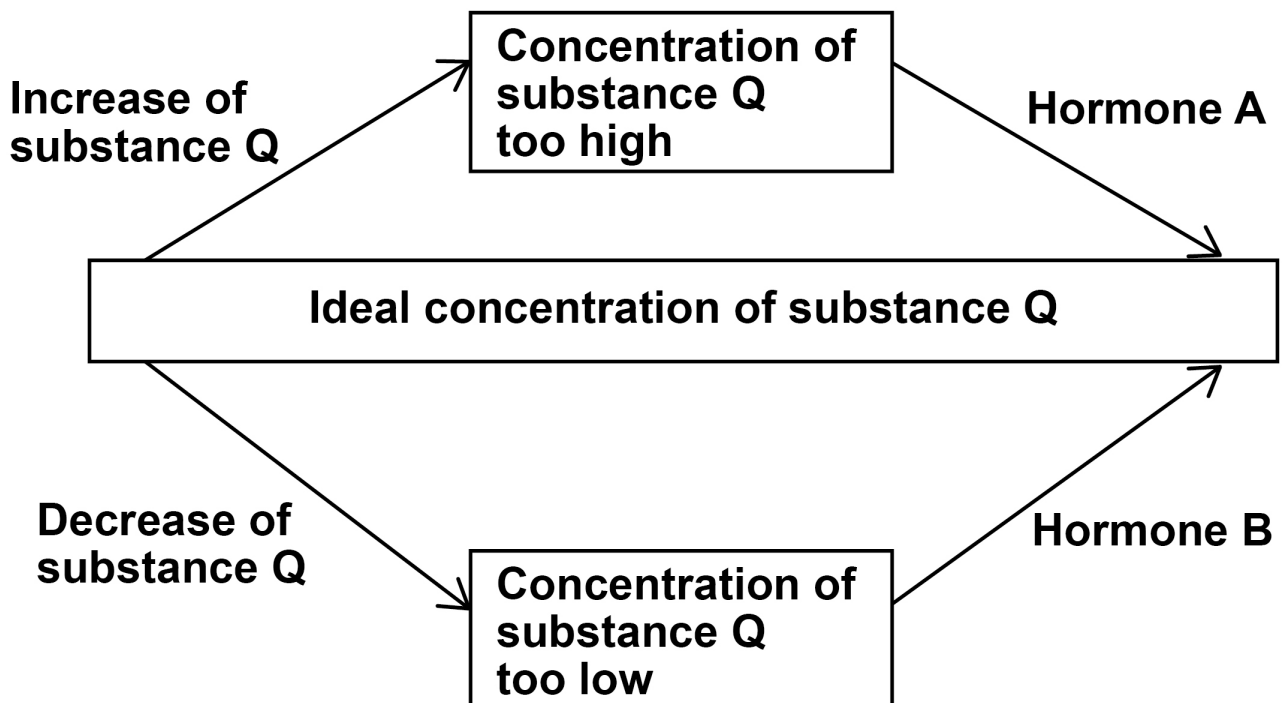
Many internal conditions are controlled by hormones.

Homeostasis works by negative feedback control.

05.1

FIGURE 8 shows how the concentration of substance Q in the blood is controlled by negative feedback.

FIGURE 8



05.2

Thyroxine is a hormone produced by the thyroid gland.

A decrease in body temperature causes an increase in thyroxine production.

Explain how the production of thyroxine causes an INCREASE in body temperature. [2 marks]



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[Turn over]



05.3

ADH is a hormone made by the pituitary gland.

ADH controls how much water is reabsorbed from the kidney tubules.

TABLE 2 shows effects of ADH.

TABLE 2

Concentration of ADH in the blood in nanograms/dm ³	Concentration of dissolved substances in urine in arbitrary units	Rate of urine production in cm ³ /minute
0.0	50	20.0
1.25	700	8.8
2.50	980	3.9
3.75	1110	1.8
5.00	1170	0.9

The concentration of ADH in a man's blood was 3.75 nanograms/dm³.

The concentration of ADH in his blood decreased to 1.25 nanograms/dm³.





06

This question is about the effects of deforestation and agriculture.

The processes of photosynthesis and respiration affect the carbon dioxide concentration in the air.

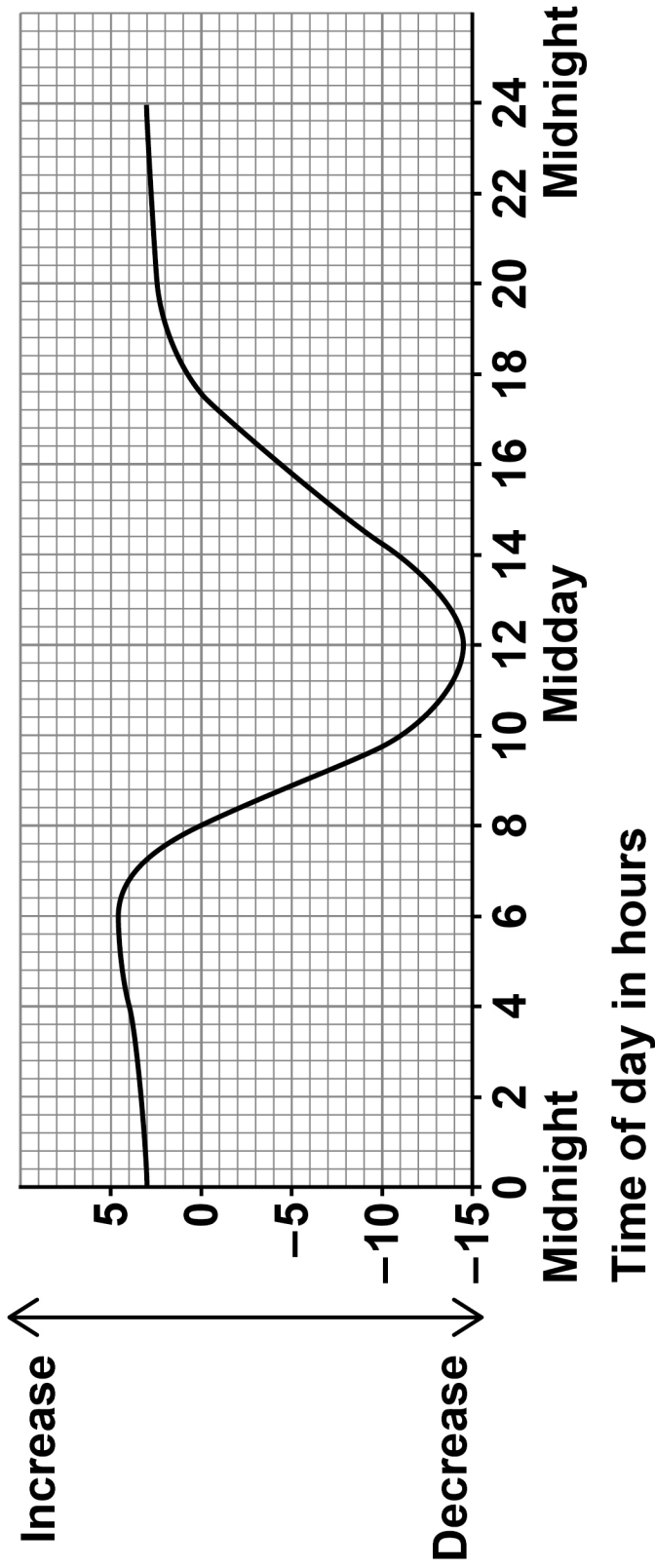
FIGURE 9, on the opposite page, shows the changes in the carbon dioxide concentration in the air in a tropical rainforest during one day.

The data are mean daily values over a whole year.



FIGURE 9

**Change in CO₂ concentration
in the air in arbitrary units**



Question 6 continues on page 51.

[Turn over]

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06.1

Explain what causes the changes in the carbon dioxide concentration in the air:

- from 0 to 6 hours
- from 8 to 12 hours.

Use information from FIGURE 9, on page 49. [4 marks]

0 to 6 hours _____

[Turn over]

8 to 12 hours



5 2



06.2

An area of rainforest is cut down and replaced with a field of maize plants.

Only one crop of maize is grown each year.

FIGURE 10, on page 54, shows the changes in the carbon dioxide concentration in the air in the field of maize during one day.

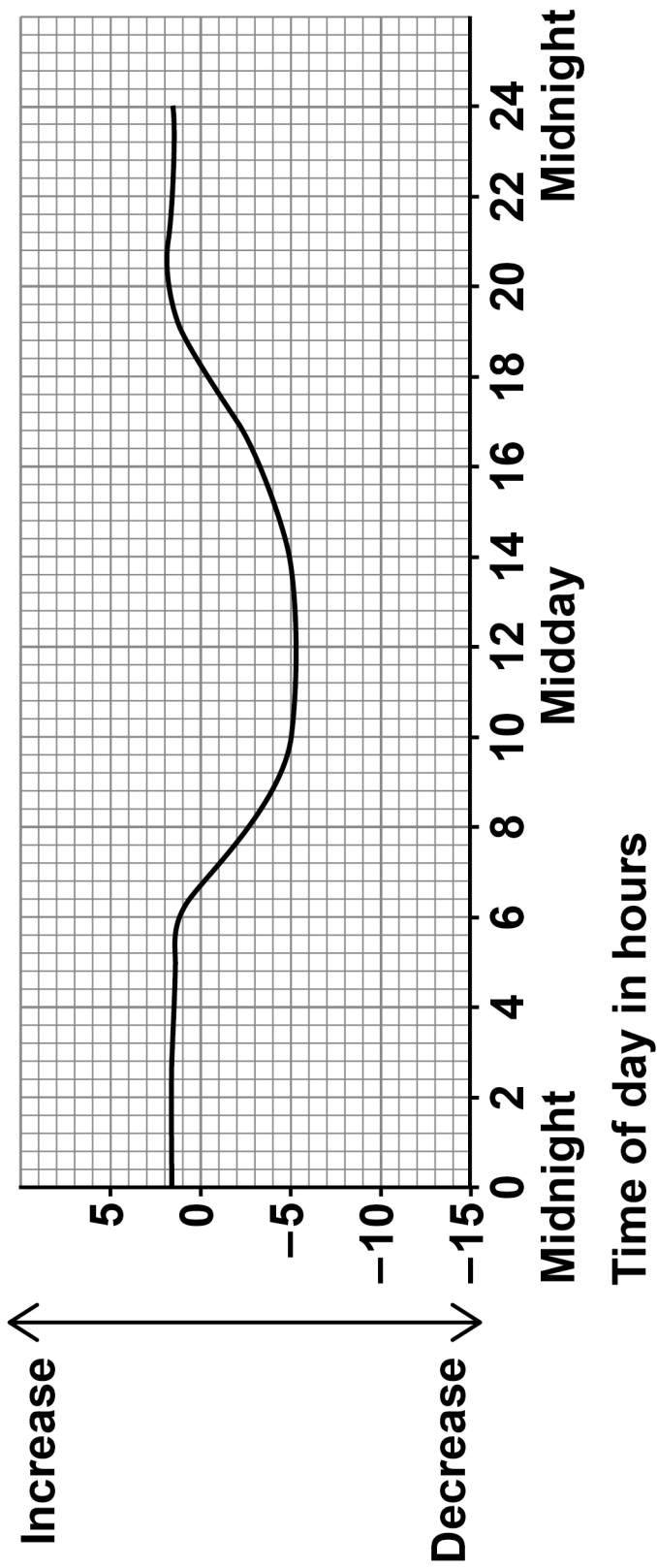
The data are mean daily values over the 6-month growing period.

[Turn over]



FIGURE 10

**Change in CO₂ concentration
in the air in arbitrary units**





The maize grows for only 6 months of the year.

Explain why replacing rainforest with maize will increase the carbon dioxide concentration in the air after one year.

Use information from FIGURE 9, on page 49, and FIGURE 10. [2 marks]

[Turn over]

A tropical rainforest can contain over 1000 different tree species.

Large areas of tropical rainforest have been cut down during the last 100 years so crops can be grown.

Scientists studied the regeneration of different areas of tropical rainforest.

The scientists:

- **investigated areas of rainforest that had been cut down at different times during the previous 100 years**
- **recorded the number of tree species that re-grew in each area**
- **compared each area with a control area next to it. The control areas were undisturbed rainforest which had never been cut down.**

FIGURE 11, on page 58, shows the scientists' results.



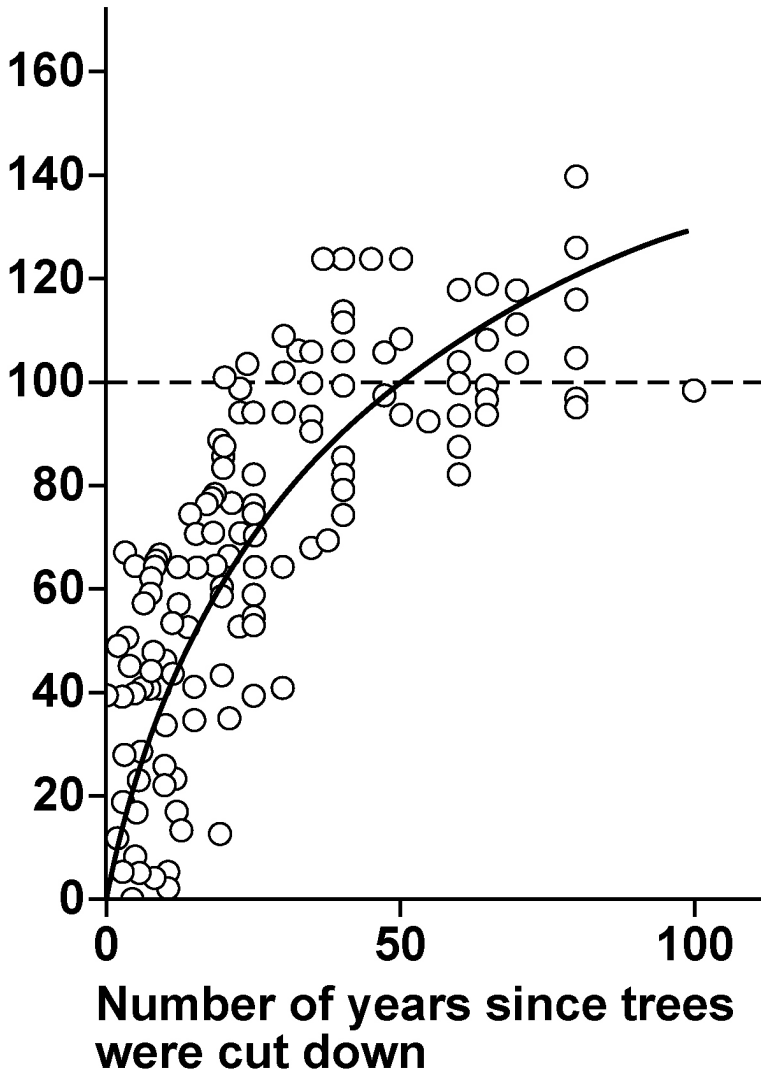
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[Turn over]



FIGURE 11

Percentage of the number of tree species compared to control area

**KEY**

○ Result for each study area



06.3

The values plotted in FIGURE 11 are percentages of the results for the control areas.

Explain why the scientists presented their results as PERCENTAGES. [2 marks]

[Turn over]



During the 100 years, the biodiversity of trees in the regenerating rainforest increases.

06.4

Give ONE other conclusion you can make from FIGURE 11, on page 58. [1 mark]



0	6	.	5
---	---	---	---

Give TWO reasons why an increase in the diversity of trees in the rainforest leads to an increase in animal diversity. [2 marks]

1

2

[Turn over]

11



0	7
---	---

Hormones are important for regulating the menstrual cycle.

During the menstrual cycle, eggs mature inside follicles in the ovaries.

A 27-year-old woman was infertile.

A doctor tested a sample of the woman's blood.

The test did NOT detect any follicle stimulating hormone (FSH) in the woman's blood.

The doctor gave the woman daily injections of FSH for 7 days.

The doctor measured:

- **the concentration of FSH in the woman's blood**
- **the concentration of oestrogen in the woman's blood**
- **the volumes of developing follicles in the ovaries.**

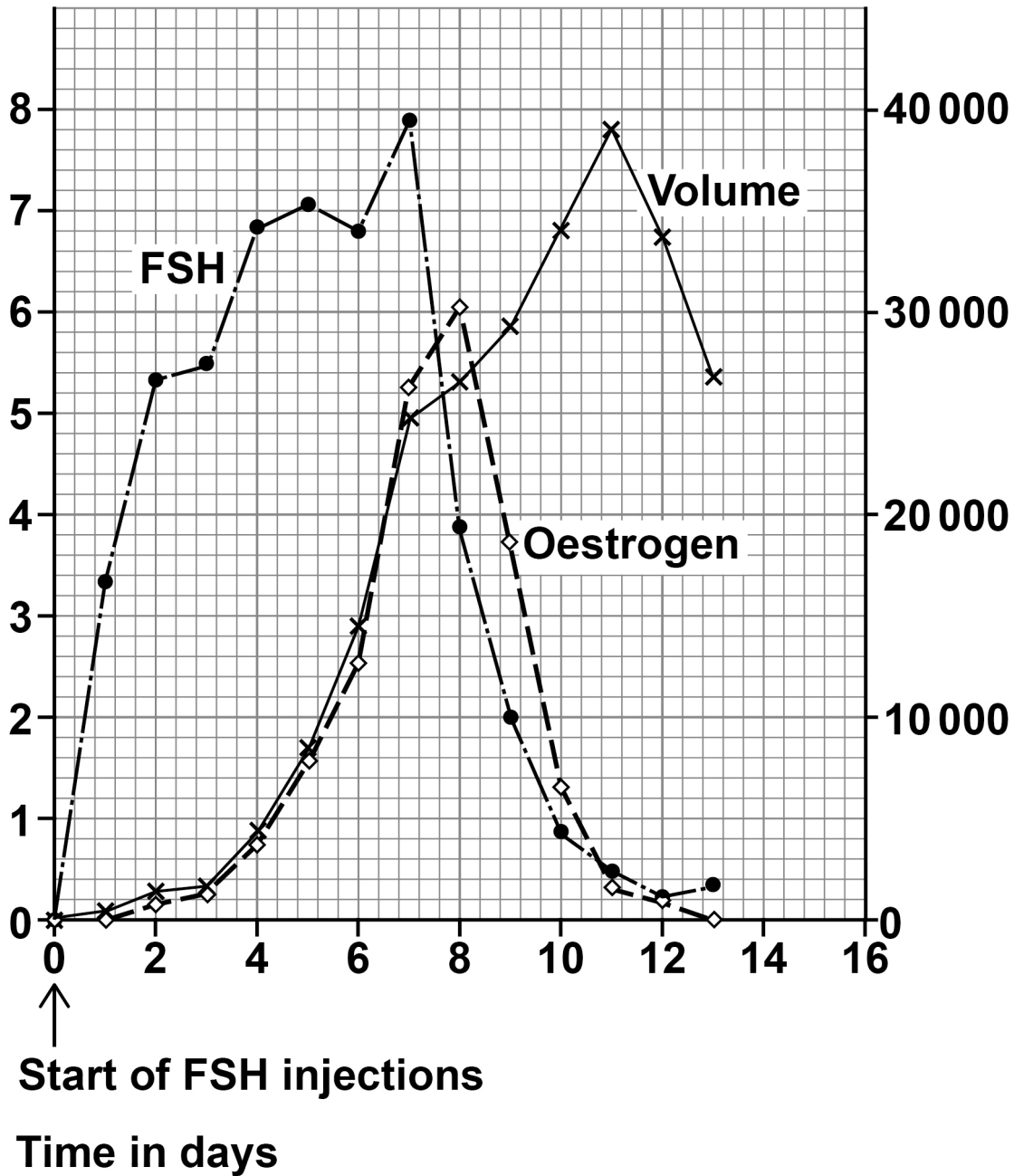
FIGURE 12, on the opposite page, shows the results.



FIGURE 12

Concentration of
hormones in
arbitrary units

Total volume
of follicles in mm^3



[Turn over]



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07.1

Give evidence from FIGURE 12, on page 63, that the follicles in the ovaries release oestrogen. [1 mark]

[Turn over]



07.2

Injection of FSH caused the development of a number of follicles.

The mean diameter of the follicles on day 11 was 22 millimetres.

Calculate the number of follicles in the woman's ovaries on day 11.

Assume each follicle is a sphere.

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

r = radius

$$\pi = 3.14$$

**Give your answer to the nearest whole number.
[5 marks]**



07.3

Before treatment with FSH, the woman had underdeveloped breasts.

Explain why the lack of FSH in the woman's blood caused underdeveloped breasts. [2 marks]

07.4

Usually males and females both produce FSH.

The woman had inherited a faulty gene for FSH production from each of her parents.

The woman's parents both produce FSH.



Show how the **WOMAN'S PARENTS** could have a child that does **NOT** produce FSH.

You should:

- draw a Punnett square diagram
- identify the phenotype of each offspring genotype
- use the symbols below:
H = allele for making FSH
h = allele for NOT making FSH

[3 marks]

[Turn over]



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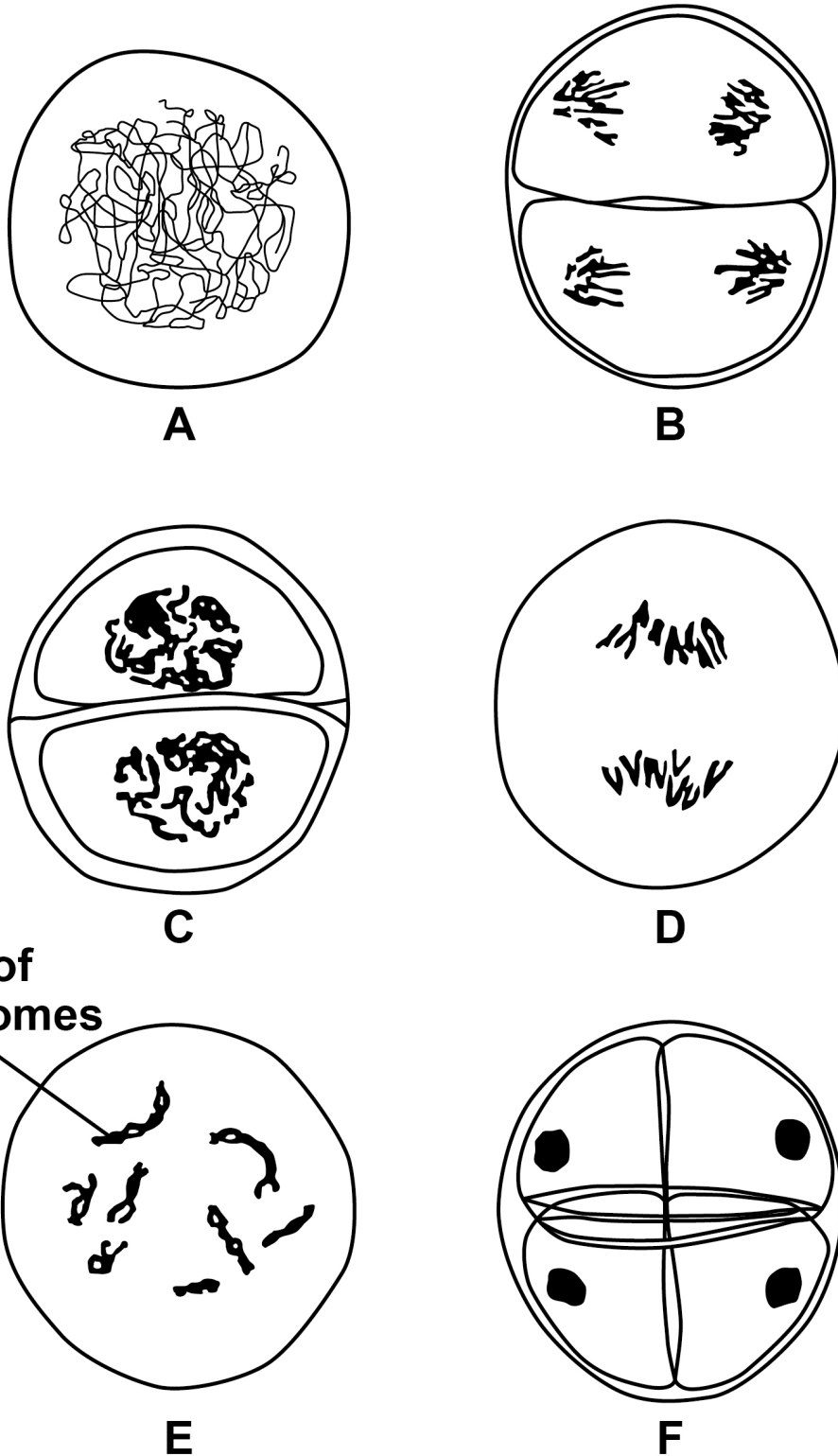
[Turn over]



08

FIGURE 13 shows six stages in the process of meiosis.

FIGURE 13



One pair of
chromosomes



08.1

In FIGURE 13, A is the first stage and F is the final stage.

Stages B to E are NOT in the correct order.

Give the correct order of stages A to F. [1 mark]

A → _____ → _____ → _____ → _____ → F

At the end of meiosis the number of chromosomes is different from the number of chromosomes at the start of meiosis.

08.2

Give the number of chromosomes in ONE cell in FIGURE 13:

- at the start of meiosis
- at the end of meiosis.

[2 marks]

Start _____

End _____

[Turn over]



0	8	.	3
---	---	---	---

Explain why the change in the number of chromosomes is important. [3 marks]



08.4

Meiosis produces cells that are genetically different.

Describe how meiosis produces cells that are genetically different. [2 marks]

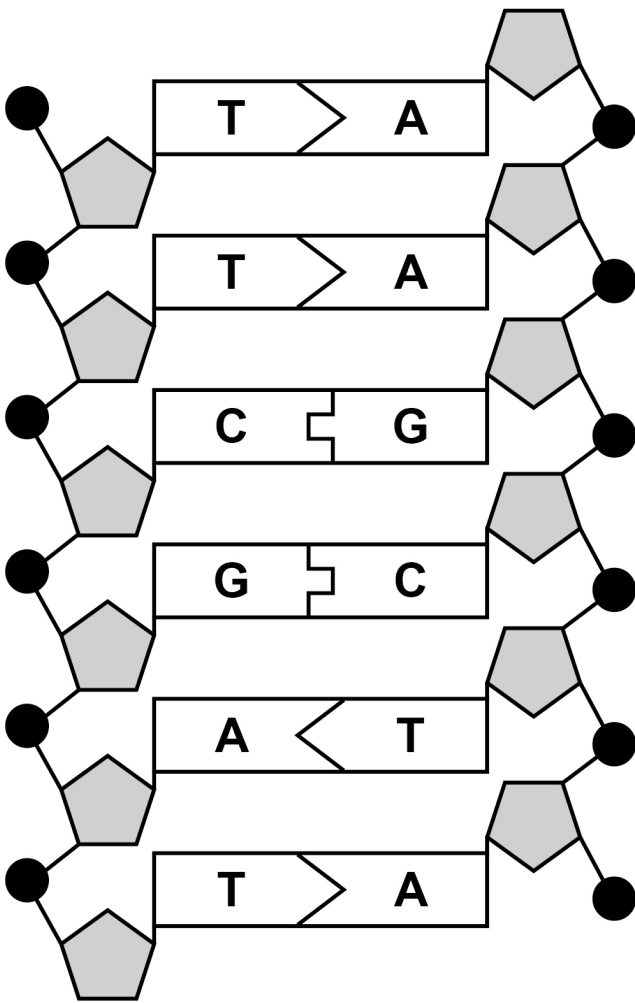
[Turn over]



Chromosomes contain DNA.

FIGURE 14 shows part of a DNA molecule.

FIGURE 14



08.5

What type of substances are labelled A, C, G and T in FIGURE 14? [1 mark]

08.6

DNA is made of nucleotides.

How many nucleotides are shown in FIGURE 14?
[1 mark]

[Turn over]

10



0	9
---	---

A wide variety of species exists on Earth.

Most scientists accept Darwin's theory of evolution by natural selection as the explanation for this variety of species.

Explain how our understanding of evolution has developed due to:

- **fossil evidence**
- **increased understanding of the mechanisms of genetics.**

[6 marks]



END OF QUESTIONS

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6



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Question	Mark
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8	
9	
TOTAL	

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