GCSE
BIOLOGY

F

Foundation Tier   Paper 2F

Friday 9 June 2023   Afternoon   Time allowed: 1 hour 45 minutes

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.
- Fill in the boxes at the top of this page.
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

02

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.

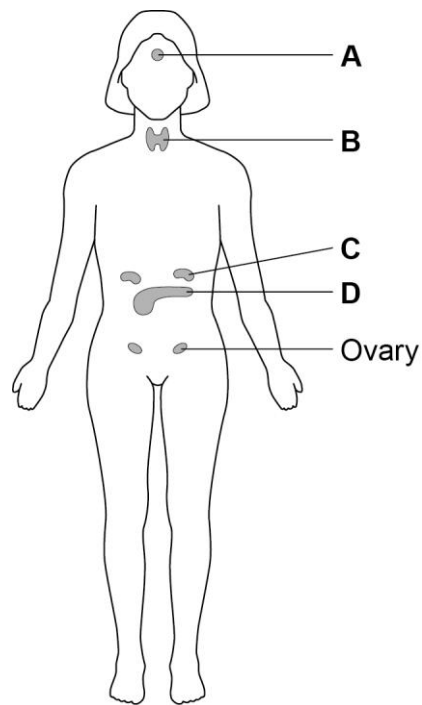By the blood ✓

By the muscles ☐

By the nerves ☐

Question 1 continues on the next page

Turn over ▶

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
		Adrenal
A		Pituitary
B		Testes
C		Thyroid

0 1 . 4 Which gland in **Figure 1** 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]

lowers (blood) glucose

Question 1 continues on the next page

Turn over ▶

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 ☐

0 1 . 9 Contraception prevents pregnancy.

Give **two** methods of contraception that use hormones.

[2 marks]

1 _____ oral contraceptive OR Injection _____

2 _____ implant _____
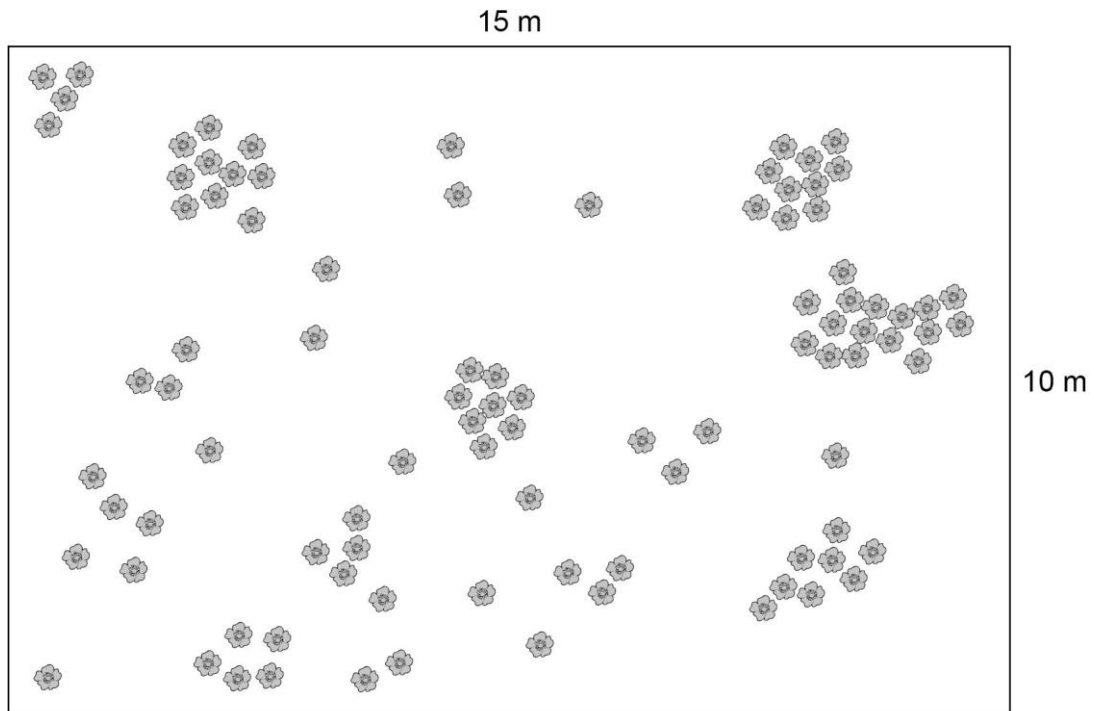
13

Turn over for the next question

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

15 m

10 m

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.

0 2 . 1 Complete the sentences.

Choose answers from the box.

[2 marks]

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

The length and width of the lawn should be measured

using a _____(30 m) tape measure_____ .

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

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. ☐

Question 2 continues on the next page

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 box.

[2 marks]

area	mean	median	perimeter	volume

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

lawn's _____area_____ .

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

the ____mean____ .

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]

multiply mean by area

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]
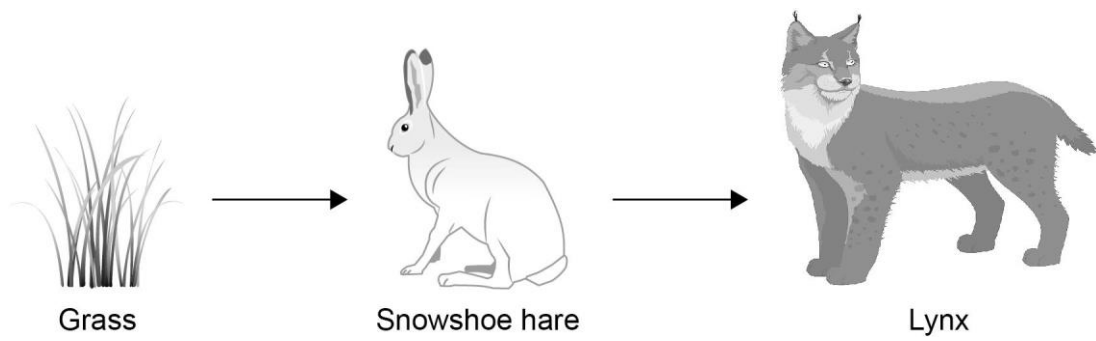
water / moisture

8

Turn over for the next question

0 3 Different species in a habitat may depend on each other for food.

Figure 3 shows a food chain.

Figure 3

Grass   Snowshoe hare   Lynx

0 3 . 1 The grass needs energy to grow.

What is the source of energy for the grass?

[1 mark]

sun OR light

0 3 . 2 **Table 2** lists different types of feeding relationship.

Table 2

Feeding relationship	Organism
Secondary consumer	Lynx
Primary consumer	(snowshoe) hare
Producer	grass
Herbivore	(snowshoe) hare
Carnivore	Lynx
Prey	(snowshoe) hare
Predator	lynx

Write the name of **one** organism from **Figure 3** 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.

Question 3 continues on the next page

Turn over ▶

Question 3 continues on the next page

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ANSWER IN THE SPACES PROVIDED**

1 3

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**

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]

Camouflaged / hidden or not (easily) seen
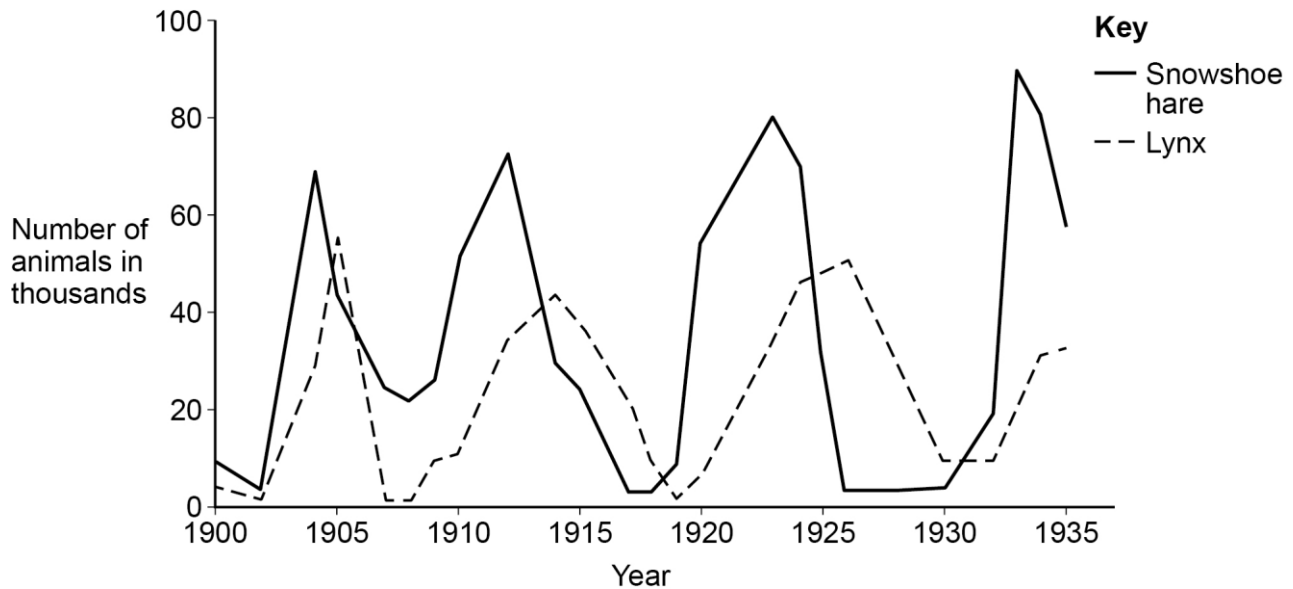
from lynx / predator / carnivore not killed / eaten

Question 3 continues on the next page

Turn over ▶

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   fewer lynx to eat them OR more food / grass (available)

2   Hares reproduce / breed / multiply

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]

number of lynx increases

0 3 . 6 Suggest **one** reason why the number of lynx decreased from 1915 to 1919.

Use information from **Figure 5**.

[1 mark]

Less food or fewer (snowshoe) hares (to eat) or fewer prey

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 lost in respiration of snowshoe hare

2 egestion / faeces

13

Turn over for the next question

Turn over ▶

0 4 Some farmers keep cows indoors in large sheds.

Other farmers keep cows outdoors in fields of grass.

Figure 6 shows cows being kept indoors and outdoors.

Figure 6

Cows kept indoors   Cows kept outdoors

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

Table 3

	Energy in kJ/m²/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]

6000 (kJ/m2/year)

Total energy input = _____ kJ/m²/year

0 4 . 2 The total energy input for keeping cows **indoors** is 16 000 kJ/m²/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]

40/16 000 × 100

=0.25 (%)

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. ☐

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]

Cows are closer together

Turn over ▶

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 shows what the Petri dish looked like after 2 days.

Figure 7
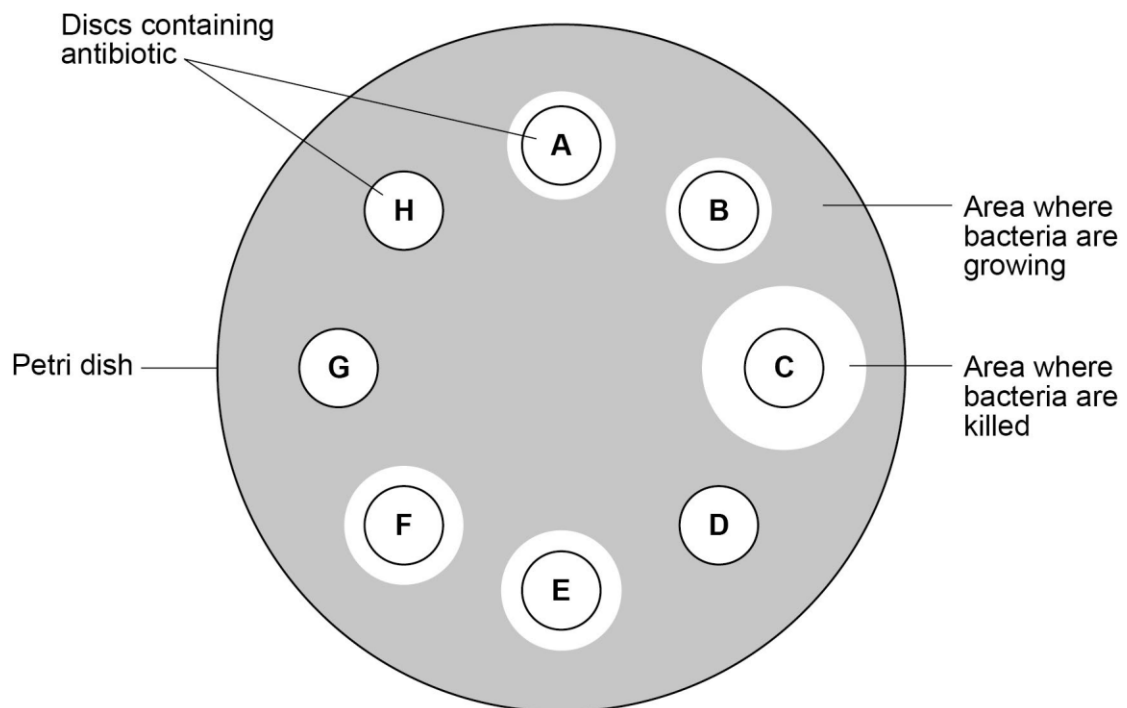
0 4 . 5 This species of bacterium is resistant to some of the antibiotics.

Give the letter of **one** antibiotic the bacterium is resistant to.

[1 mark]

D

0 4 . 6 Complete the sentence.

Choose the answer from the box.

[1 mark]

carbohydrate	DNA	lipid

Antibiotic resistance in a single bacterium is caused by a change in the

bacterium's _____DNA_____ .

0 4 . 7 Complete the sentence.

Choose the answer from the box.

[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 _____ .

0 4 . 8 Suggest why the production of millions of antibiotic-resistant bacteria is a problem
for farmers.

[2 marks]

Many animals will become ill OR resistant bacteria passed from animal to animal OR animals cannot

be cured (by the antibiotic) OR animals may be less productive / efficient OR farmer may lose

profit / money

11

Turn over for the next question

Turn over ▶

0 5 Bacteria are one type of organism that cause decay.

0 5 . 1 Which other type of organism causes decay?

[1 mark]

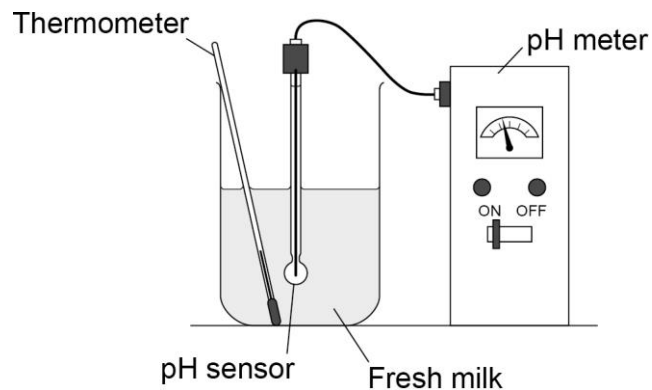Tick (✓) **one** box.

Fungi ☐ ✓

Plants ☐

Viruses ☐

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]

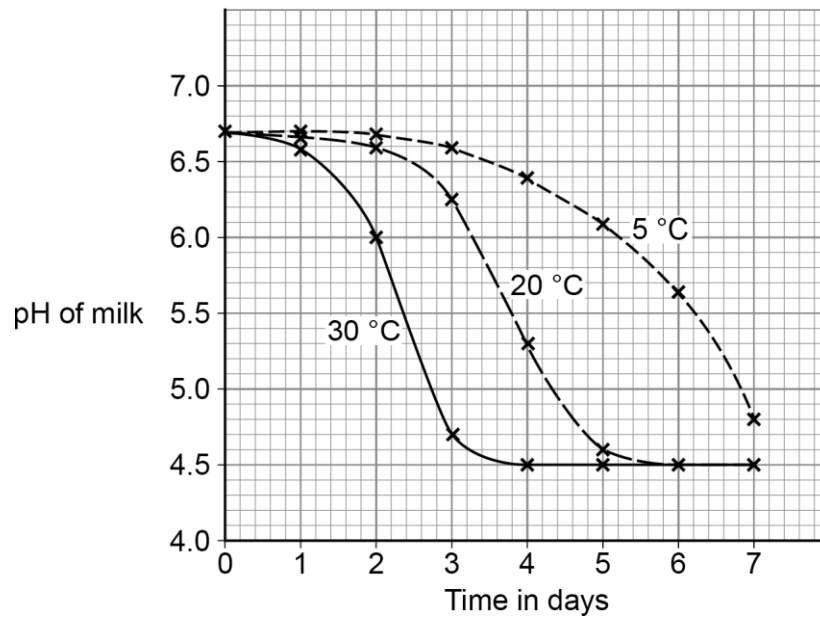Tick (✓) **one** box.

Amino acid

Fatty acid ✓

Hydrochloric acid

Question 5 continues on the next page

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. ☐

Do not write outside the box

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]

There is more (kinetic) energy OR enzyme activity is higher

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 = _____6_____

At 30 °C, the pH at day 3 = _____4.7_____

Therefore the fall in pH at 30 °C from day 2 to day 3 = __1.3__ pH units/day

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**.

1.3/ 0.1

-=13

Rate at 30 °C is __13__ times faster

10

Turn over for the next question
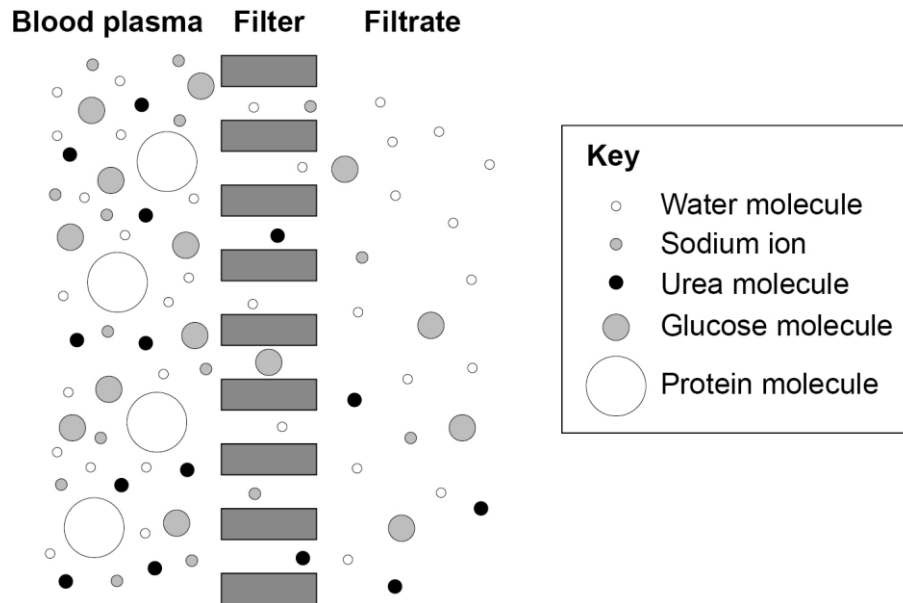
Turn over ▶

0 6   The kidneys filter the blood.

Figure 10 shows filtration in the kidney.

Figure 10

Key

○ Water molecule

• Sodium ion

● Urea molecule

⬤ Glucose molecule

◯ Protein molecule

0 6 . 1   Glucose molecules are found in the blood plasma **and** in the filtrate.

Protein molecules are **only** found in the blood plasma.

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

| 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 = _____158.1_____ dm^3

Question 6 continues on the next 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.

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**.

[6 marks]

points for transplant:
• transplant is cheaper
• numerical comparison, eg £18 000 cheaper in first year and £30 000 cheaper in subsequent years
• less / no inconvenience, eg time or cost for hospital visits
• less / no restriction on lifestyle
• less / no restriction on diet or fluid intake
• no danger of infection from eg puncturing skin or blood in contact with machine
• less / no possibility of blood clots
• no need to take anti-clotting drugs
• transplanted kidney keeps water / urea / ions in blood at correct level at all times
• feel well all the time

points against transplant:
• danger of rejection
• need tissue match for transplant
• donors in short supply
• possibility of organ damage due to anaesthetic
• possibility of infection in surgery
• possibility of damage due to surgery
• need to take immunosuppressant drugs
• may suffer other infections due to suppressed immune system
• may need repeat operation (after about 10 years)

Question 6 continues on the next page

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]

4 × 5 000 = 20 000

=20 000 + 17 000

=(£) 37 000

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 ☐

Question 7 continues on the next page

Turn over ▶

Figure 12 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*)

0 7 . 2 Which species of bird in **Figure 12** 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. ☐
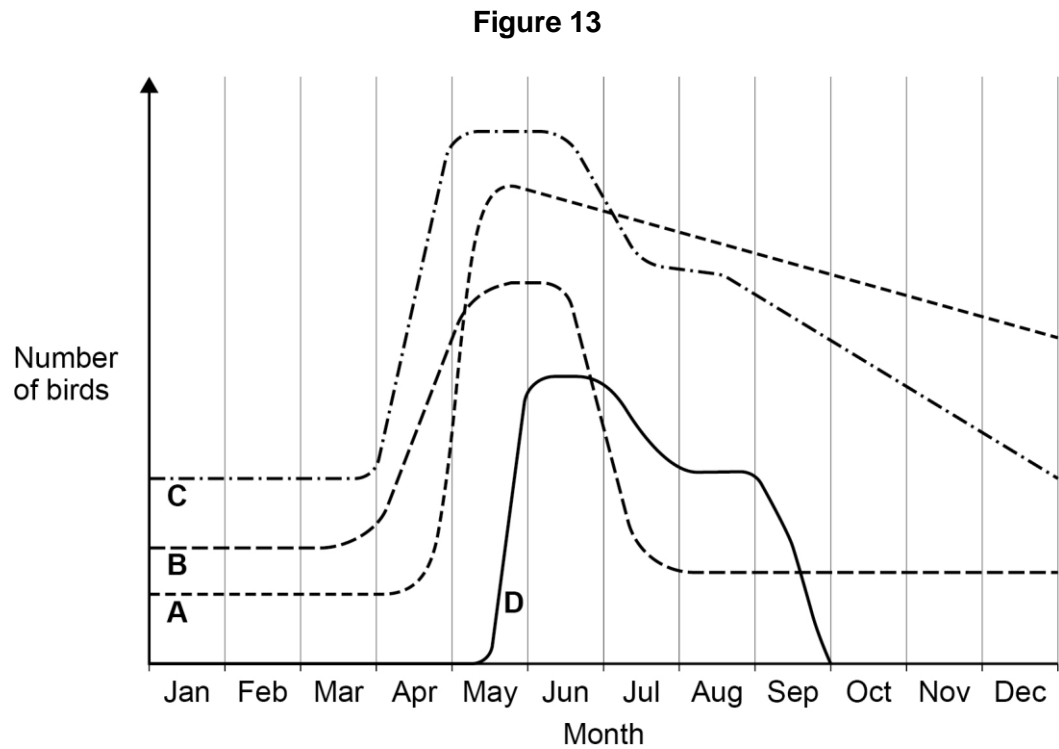
The brambling eats mainly seeds and the bullfinch eats mainly insects. ☐

Question 7 continues on the next page

Turn over ▶

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

Figure 13 shows how the numbers of each species of bird varied during one year.

Figure 13

Use information from **Figure 13** 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]

· constant (from Jan) to Mar / (mid-)Apr

increases (from mid-)Apr to / and May

decreases from May / Jun to Dec

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   D

Reason   (because) present only May to Sep

Turn over for the next question

Turn over ▶

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 ☑
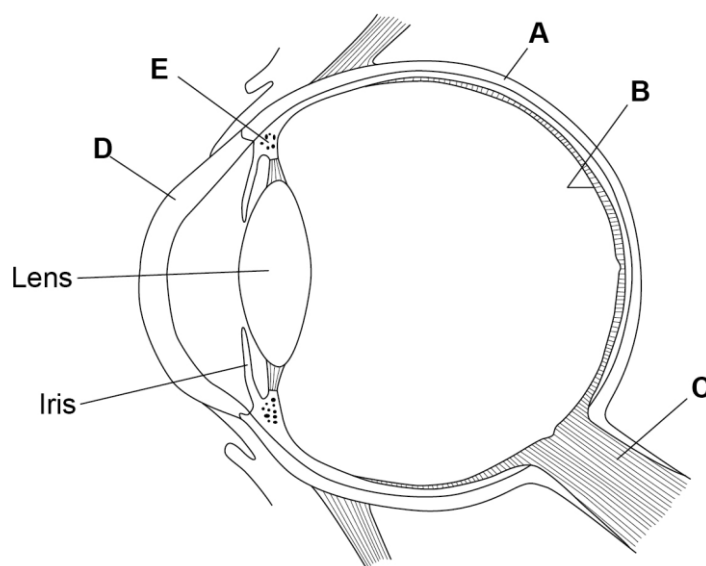
Adaptation ☐

Hyperopia ☐

Myopia ☐

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 ☐

0 8 . 3 Which structure in **Figure 14** 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]

Becomes fatter / thicker / wider

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]

~~Muscles in the iris contract and reduce size of pupil this reduces (amount of) light entering.~~

Question 8 continues on the next 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]

• identification of method eg ruler drop
• correct details of method chosen eg hold ruler above thumb
• repetitions – at least two more times
• repeat with (at least 2 more) other students

• tested without coffee and with coffee or with different amounts of coffee
• calculate mean value with coffee and without coffee
• compare results with and without coffee

• correct control variables for method chosen, eg:
o same age
o sex
o BMI
o amount of sleep
o volume / concentration / type of coffee
o time interval between drinking and testing
o control variable within method described

10

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

Turn over ▶

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]

Not all susceptible to the same disease

0 9 . 2 Suggest **one** advantage of growing tomato plants that are genetically identical.

[1 mark]

They have the same named (desirable) characteristic OR they grow at the same rate

OR they ready to harvest at same time

0 9 . 3 Scientists can grow genetically identical tomato plants using tissue culture.

What is tissue culture?

[1 mark]

A group of cells are grown into a new organism

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]

Because of different water OR minerals / ions OR light OR herbivores OR disease

OR plant density OR soil pH

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** to show the inheritance of sex in dogs.

Use the symbols **X** and **Y**.

[3 marks]

Figure 15

Female

	X	X
X	XX	XX
Y	XY	XY

Male

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**.

[1 mark]

Half are XX and half are XY, equal probability of X or Y   sperm fertilising an egg

Question 9 continues on the next page

Turn over ▶

Farmers keep chickens for:

• meat production

• egg production.

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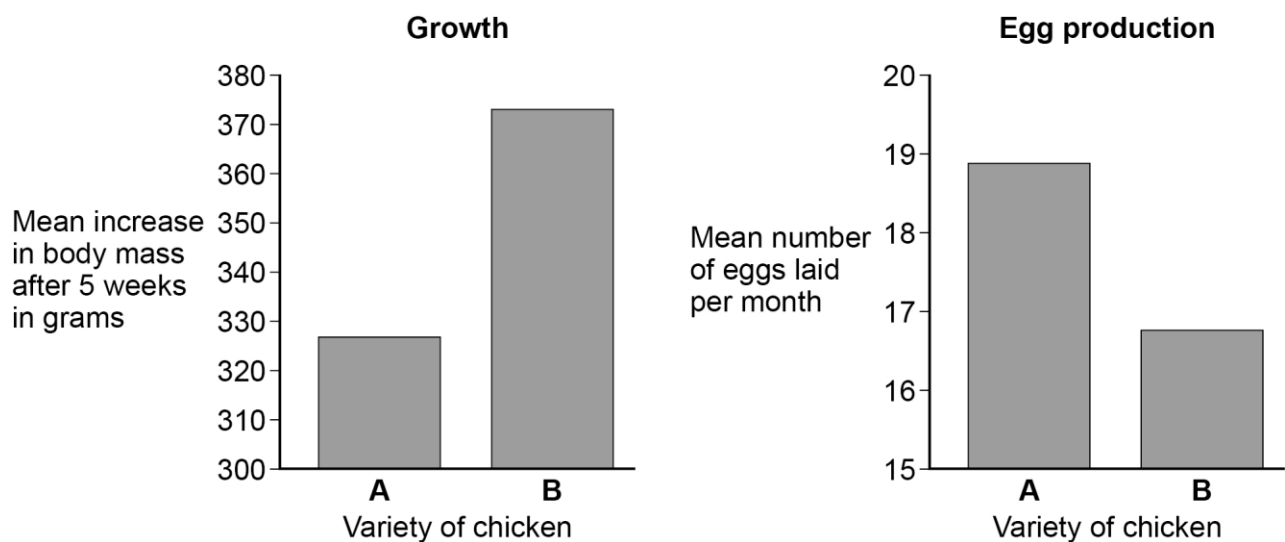
Other varieties of chicken produce more eggs.

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

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

Figure 16 shows the results.

Figure 16

0 9 . 7 Suggest **two** control variables the farmer should have used in this investigation.

[2 marks]

1 Temperature

2 Type / amount of food

0 9 . 8 **Figure 16** shows mean values from 500 chickens of each variety.

Give the reason the farmer used a large number of chickens.

[1 mark]

Reduce the effect of anomalies to get more accurate mean

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]

Breed best of A and B, select offspring with highest egg numbers and heaviest

/ fastest growing then breed (these) offspring together. repeat over many / several

generations.

END OF QUESTIONS

15

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Question number	Additional page, if required. Write the question numbers in the left-hand margin.

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

4 5

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