

Please write clearly in block capitals.

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Candidate number

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Surname

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Candidate signature

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# GCSE BIOLOGY

# F

Foundation Tier

Paper 2F

Friday 7 June 2019

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.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- 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	
<b>TOTAL</b>	



Answer **all** questions in the spaces provided.

0 1

The nervous system allows a person to detect stimuli.

0 1 . 1

Draw **one** line from each stimulus to the sense organ that detects the stimulus.

[2 marks]

**Stimulus**

**Sense organ**

Chemicals

Light

Ear

Eye

Tongue

Moving a hand away from a hot object is an example of a reflex action.

0 1 . 2

What is a reflex action?

[2 marks]

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**0 1 . 3** A muscle in the arm moves the hand away from the hot object.

How does the arm muscle do this?

**[1 mark]**

Tick (✓) **one** box.

The muscle contracts.

The muscle expands.

The muscle relaxes.

The muscle shrinks.

**Question 1 continues on the next page**

**Turn over ►**

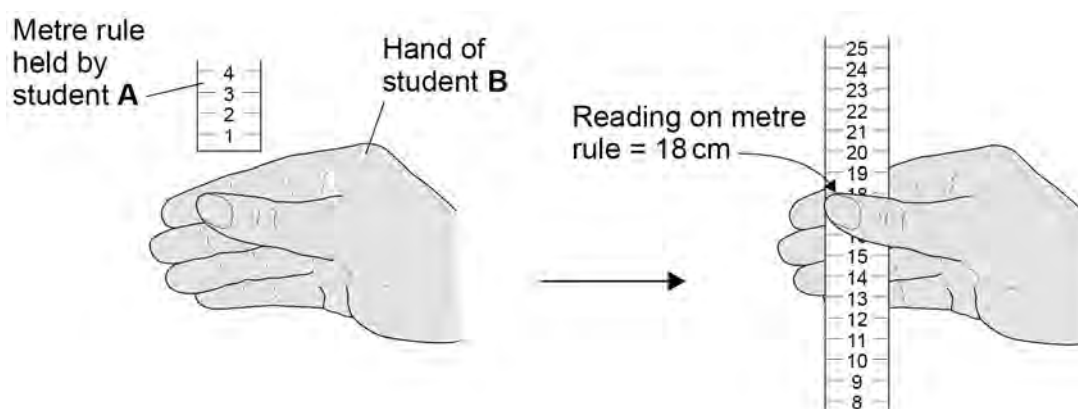


Two students investigated the effect of drinking coffee on reaction time.

This is the method used.

1. Student **A** holds a metre rule just above student **B**'s hand, as shown in **Figure 1**.
2. Student **A** lets go of the metre rule.
3. Student **B** catches the metre rule as quickly as possible.
4. Student **A** writes down the reading from the scale on the metre rule.
5. Students **A** and **B** repeat steps 1–4 another four times.
6. Student **B** then drinks a cup of coffee.
7. After 15 minutes, students **A** and **B** repeat steps 1–5.

**Figure 1**



**Table 1** shows some of the results.

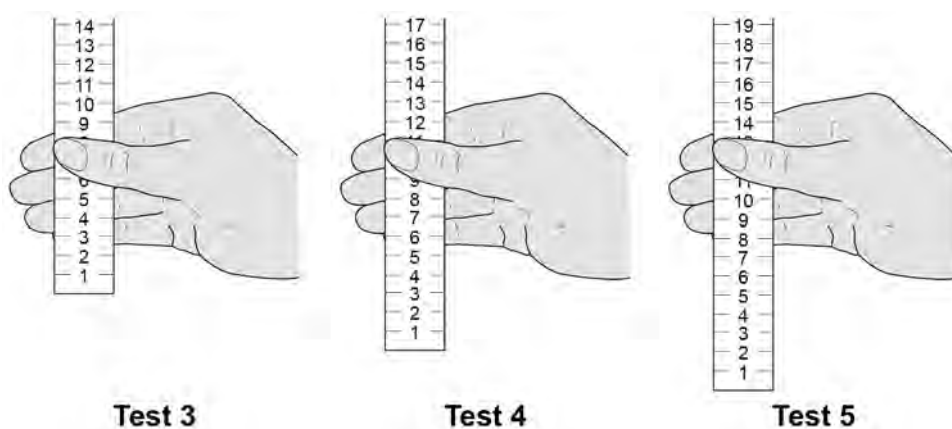
**Table 1**

Test	Reading from scale on metre rule in cm	
	Before drinking coffee	After drinking coffee
1	18	10
2	21	14
3	15	
4	12	
5	19	



Figure 2 shows the results **after** drinking the coffee for tests 3, 4 and 5.

Figure 2



0 1 . 4 Complete **Table 1**.

Use results from **Figure 2**.

[2 marks]

The students made the following conclusion:

‘Drinking coffee speeds up reactions.’

0 1 . 5 Give evidence from **Table 1** to support the students’ conclusion.

[1 mark]

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0 1 . 6 The students’ conclusion may **not** be valid.

Suggest **two** improvements the students could make to their method.

[2 marks]

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_



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0 2

The shape of a person's earlobes is controlled by a gene.

**Figure 3** shows two types of earlobe.

**Figure 3**



**Free earlobe**



**Attached earlobe**

A dominant allele codes for free earlobes.

0 2 . 1

What is a dominant allele?

**[1 mark]**

Tick (✓) **one** box.

An allele expressed even if a person only has one copy of the allele

An allele expressed only if a person has two copies of the allele

An allele expressed only if a person has no recessive allele

An allele expressed only if it is inherited from the male parent

**Question 2 continues on the next page**

**Turn over ►**



**0 2 . 2** A man with free earlobes and a woman with attached earlobes have children together.

Complete **Figure 4** to show the possible genotypes of the children.

Use the symbols:

**E** = allele for free earlobes

**e** = allele for attached earlobes

**[2 marks]**

**Figure 4**

		<b>Woman</b>	
		e	e
<b>Man</b>	<b>E</b>	Ee	
	<b>e</b>		

**0 2 . 3** What is the probability that one of the children would have attached earlobes?

Use **Figure 4**.

**[1 mark]**

Tick (✓) **one** box.

0.125

0.25

0.5

0.75





0 2 . 4

**Figure 5** shows the inheritance of the sex chromosomes, **X** and **Y**.

Complete **Figure 5** to show the sex chromosomes in the gametes of the man and the woman.

[2 marks]

**Figure 5**

		<b>Woman</b>	
<b>Man</b>		XX	XX
		XY	XY

0 2 . 5

Calculate the probability that the man and the woman's next child will be a girl with attached earlobes.

[2 marks]

Use the equation:

probability of a girl with attached earlobes

= probability of attached earlobes × probability of being a girl

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Probability of a girl with attached earlobes = \_\_\_\_\_

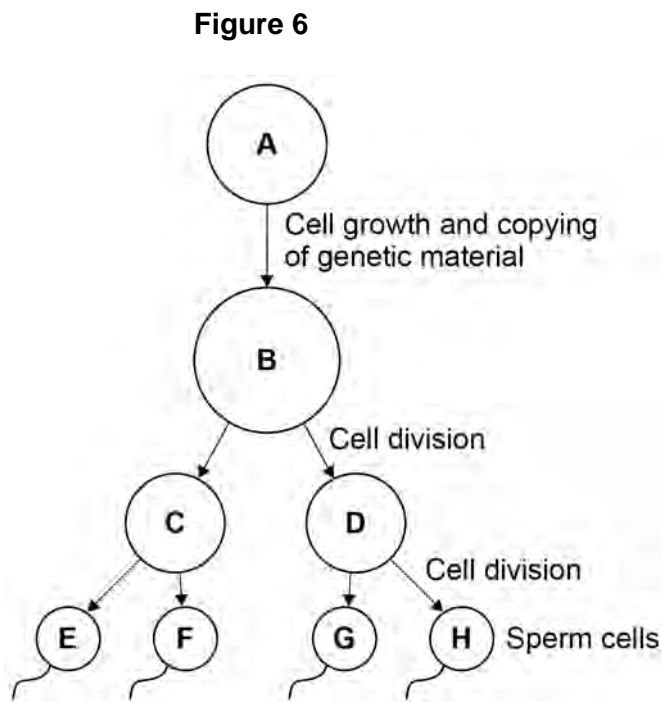
8

Turn over ►



0 3

Figure 6 shows the production of sperm cells in humans.



0 3 . 1

Cell A is a normal body cell.

How many chromosomes are there in cell A?

[1 mark]

Tick (✓) **one** box.

23       46       48       92

0 3 . 2

What is the mass of DNA in cell E?

[1 mark]

Tick (✓) **one** box.

A quarter of the mass of the DNA in cell A

Half the mass of the DNA in cell A

The same mass as the DNA in cell A

Twice the mass of the DNA in cell A



**0 3 . 3** What type of cell division produces sperm cells?

**[1 mark]**

Tick (✓) **one** box.

Binary fission

Differentiation

Meiosis

**0 3 . 4** Sometimes there are errors in copying the genetic material.

What term describes an error in the genetic material?

**[1 mark]**

Tick (✓) **one** box.

Absorption

Fertilisation

Mitosis

Mutation

**0 3 . 5** A woman has three children, aged 4, 6 and 9 years.

Why are the children **not** genetically identical?

**[2 marks]**

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Turn over ►



In sexual reproduction, a sperm cell fuses with an egg cell to form a new single cell.

An embryo develops from the single cell.

The cell divides three times to produce the embryo.

**0 3 . 6** How many cells are there in the embryo after three cell divisions?

**[1 mark]**

Tick (✓) **one** box.

3

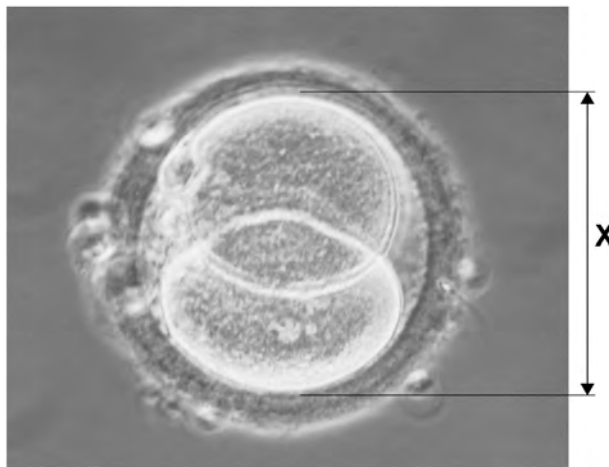
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8

9

**Figure 7** shows a different human embryo.

**Figure 7**



**0 3 . 7** Measure image length **X** on **Figure 7**.

**[1 mark]**

Give your answer in millimetres (mm).

X = \_\_\_\_\_ mm



**0 3 . 8** The image in **Figure 7** has been magnified  $\times 500$

Calculate the real length of the embryo.

Use the equation:

$$\text{real length of the embryo} = \frac{\text{image length}}{\text{magnification}}$$

Give your answer in micrometres ( $\mu\text{m}$ ).

1 mm = 1000  $\mu\text{m}$

**[3 marks]**

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Real length of the embryo = \_\_\_\_\_  $\mu\text{m}$

**0 3 . 9** The embryo may **not** implant in the lining of the uterus.

The embryo will then be lost from the woman's body several days later.

Explain why the woman may **not** notice this has happened.

**[2 marks]**

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13

**Turn over for the next question**

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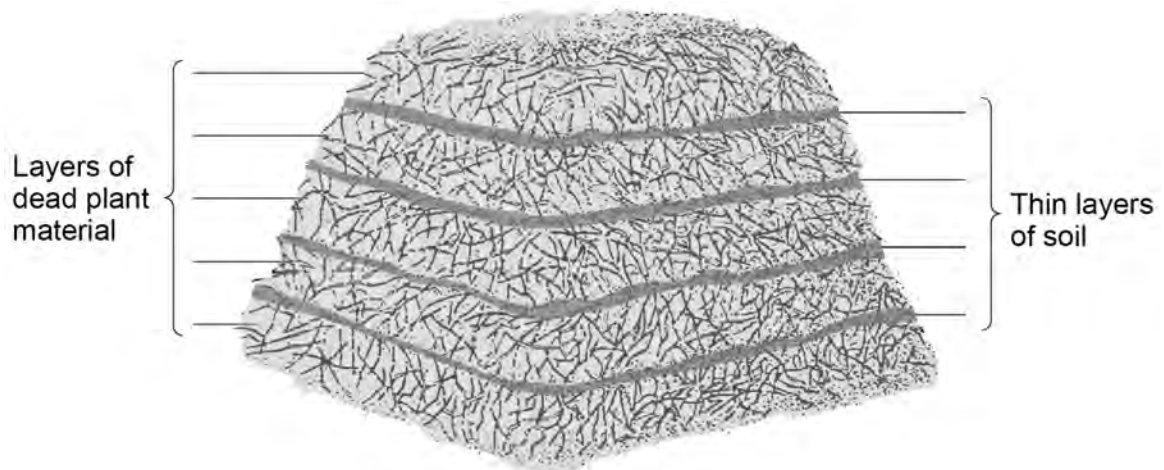
0 4

Gardeners sometimes make compost heaps from dead plant material.

The dead plants decay in the compost heap.

**Figure 8** shows a compost heap.

**Figure 8**



0 4 . 1

The thin layers of soil contain organisms that cause decay.

Which **two** types of organism cause decay?

**[2 marks]**

Tick (✓) **two** boxes.

- |          |                          |
|----------|--------------------------|
| Bacteria | <input type="checkbox"/> |
| Fungi    | <input type="checkbox"/> |
| Grass    | <input type="checkbox"/> |
| Insects  | <input type="checkbox"/> |
| Worms    | <input type="checkbox"/> |



The rate of decay in the compost heap depends on several environmental factors.

**0 4 . 2** Explain how the rate of decay would be affected by:

- an increase in oxygen concentration
- a temperature increase from 5 °C to 25 °C

**[3 marks]**

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**0 4 . 3** Give **one** environmental factor needed for decay.

Do **not** refer to oxygen or temperature in your answer.

**[1 mark]**

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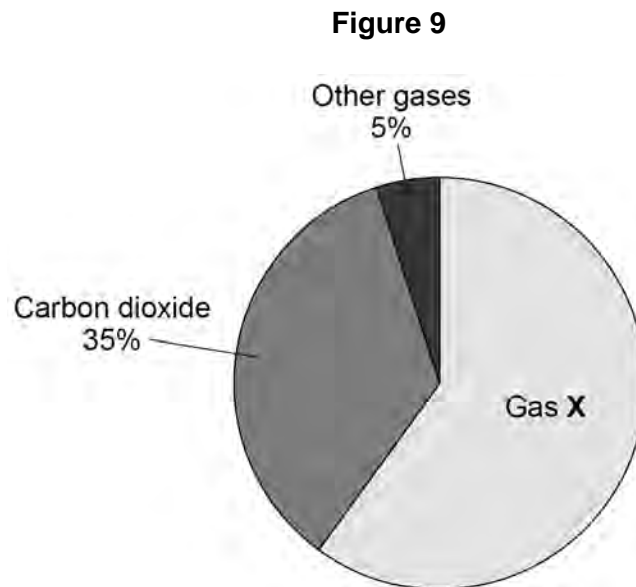
**Question 4 continues on the next page**

**Turn over ►**



Dead plant material can also be decayed in a biogas generator.

**Figure 9** shows the percentages of the gases found in a sample of biogas.



**0 4 . 4** Gas X is the main fuel gas found in the biogas.

What is gas X?

**[1 mark]**

Tick (✓) **one** box.

Carbon monoxide

Hydrogen

Methane

Nitrogen





0 4 . 5 What is the percentage of gas X in the biogas?

[1 mark]

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Percentage = \_\_\_\_\_ %

0 4 . 6 The dead plant material in the compost heap and biogas generator does **not** decay completely.

Explain why a farmer might spread the remaining dead plant material onto his fields.

[2 marks]

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10

Turn over for the next question

Turn over ►



0 5

Figure 10 shows a flightless bird called the dodo (*Raphus cucullatus*).

Figure 10



The dodo:

- was 1 m tall
- had a mass of 20 kg
- lived in rainforests on a tropical island
- ate fruits
- made its nest on the ground.

A female dodo laid only one egg each year.

Humans arrived on the island in the year 1507. By 1681 the dodo was extinct.

0 5 . 1

What is the genus of the dodo?

[1 mark]

Tick (✓) **one** box.

Animal

Bird

Raphus



**0 5 . 2** Before the arrival of humans, there were no other large animals living on the island.

Suggest **two** reasons why the dodo became extinct soon after the arrival of humans.

**[2 marks]**

1 \_\_\_\_\_

2 \_\_\_\_\_

Today, humans are cutting down large areas of tropical rainforests.

**0 5 . 3** Suggest **one** use of the land after the trees have been removed.

**[1 mark]**

\_\_\_\_\_

\_\_\_\_\_

**0 5 . 4** Why does the removal of trees cause an increase in carbon dioxide in the atmosphere?

**[2 marks]**

Tick (✓) **two** boxes.

There are fewer animals.

There is less photosynthesis.

There is less respiration.

The soil dries out.

The trees are burned.

**Turn over ►**



**0 5 . 5** What effect would an increase in carbon dioxide in the atmosphere have on global air temperature?

**[1 mark]**

Tick (✓) **one** box.

Decrease

Increase

Stay the same

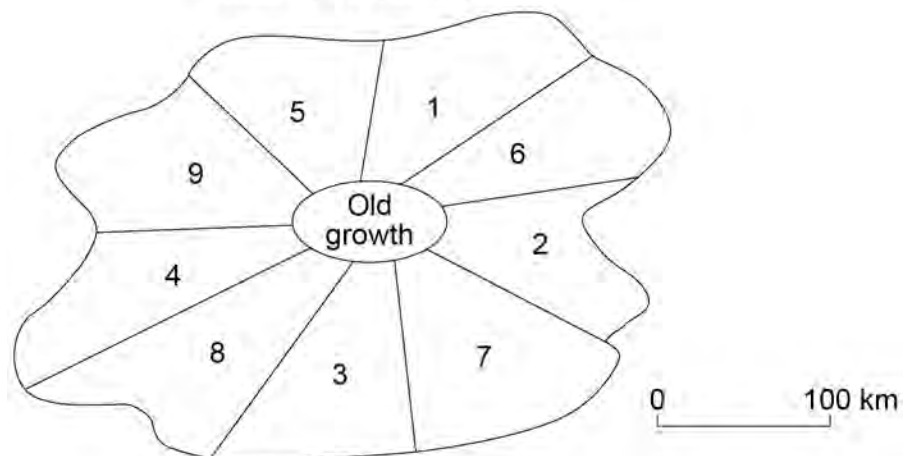
‘Sustainable forestry’ reduces the harmful effects of cutting down trees on the environment.

**Figure 11** shows a method of ‘sustainable forestry’.

Numbers 1–9 show different parts of a rainforest.

**Figure 11**

**Map of the rainforest**



The trees are cut down in the sequence 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9

- The trees are cut down in only one area at any one time.
- It takes 30 years to cut down the trees in each area.
- The trees in the ‘Old growth’ area are never cut down.



**0 5 . 6**

How many years would it take to cut down the trees in all of the numbered areas in **Figure 11**?

**[2 marks]**

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Number of years = \_\_\_\_\_

**0 5 . 7**

The rainforest contains:

- 750 species of trees
- 400 species of birds
- 150 species of butterflies
- many other species of plants and animals.

Explain how the pattern of cutting down trees shown in **Figure 11** stops the biodiversity of the rainforest being reduced.

**[4 marks]**

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13

**Turn over ►**



0 6

Two of the substances the body excretes are urea and carbon dioxide.

0 6 . 1

Complete the sentence.

[1 mark]

Choose the answer from the box.

carbohydrate

lipid

protein

salt

A person makes a lot of urea if the person's diet contains

a lot of \_\_\_\_\_.

0 6 . 2

Why must urea be excreted from the body?

[1 mark]

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0 6 . 3

A person produces more carbon dioxide during exercise than when resting.

Complete the sentences.

[2 marks]

Choose answers from the box.

breathing

digestion

egestion

osmosis

respiration

The process that makes carbon dioxide is \_\_\_\_\_.

During exercise, extra carbon dioxide can be removed from the body by increasing

the rate of \_\_\_\_\_.



0 6 . 4

Excess water must also be removed from the body.

If a person sweats a lot, less water will be excreted in the urine.

A healthy person did the same amount of exercise on each of 3 days.

**Table 2** shows information for the 3 days.

**Table 2**

Day	Air temperature in °C	Volume of water consumed in cm <sup>3</sup>	Relative amount of urine produced by the kidneys
1	30	1500	
2	20	1500	
3	15	2000	

Complete **Table 2**.

**[2 marks]**

Choose answers from the box.

least	medium	most
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**Question 6 continues on the next page**

**Turn over ►**



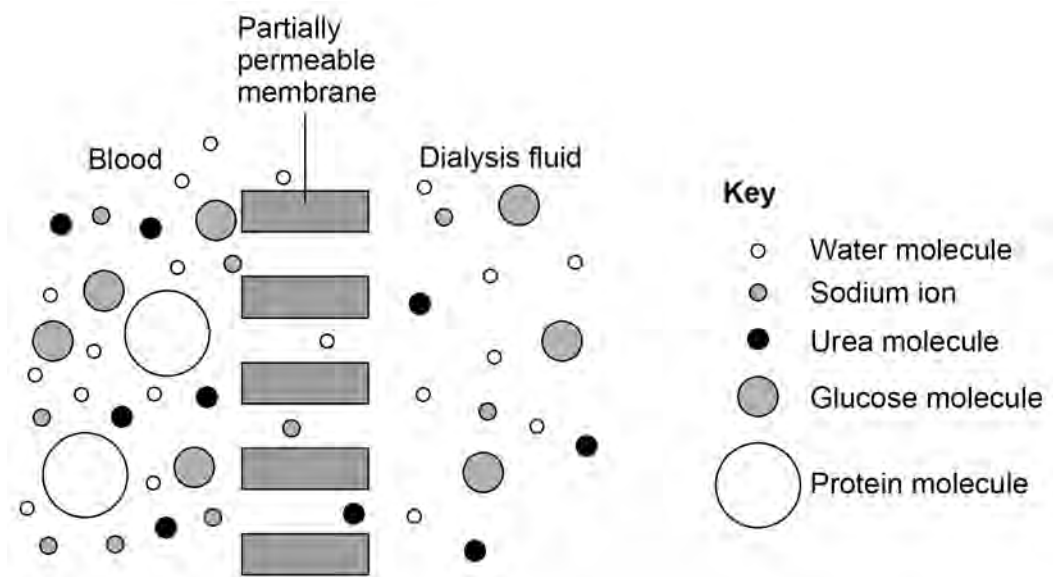
Some people have kidney disease.

Kidney disease may be treated by dialysis or by having a kidney transplant operation.

- During dialysis, a person is connected to a machine that filters the blood.
- Each dialysis session lasts about 6 hours.
- The person has several dialysis sessions each week.

**Figure 12** shows how dialysis works.

**Figure 12**



**0 6 . 5** How does urea move out of the blood during dialysis?

**[1 mark]**

Tick (✓) **one** box.

Diffusion

Digestion

Osmosis

Respiration





0	6	.	6
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Which substance in **Figure 12** does **not** pass from the blood into the dialysis fluid?

Give the reason for your answer.

**[2 marks]**

Substance \_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_

**Question 6 continues on the next page**

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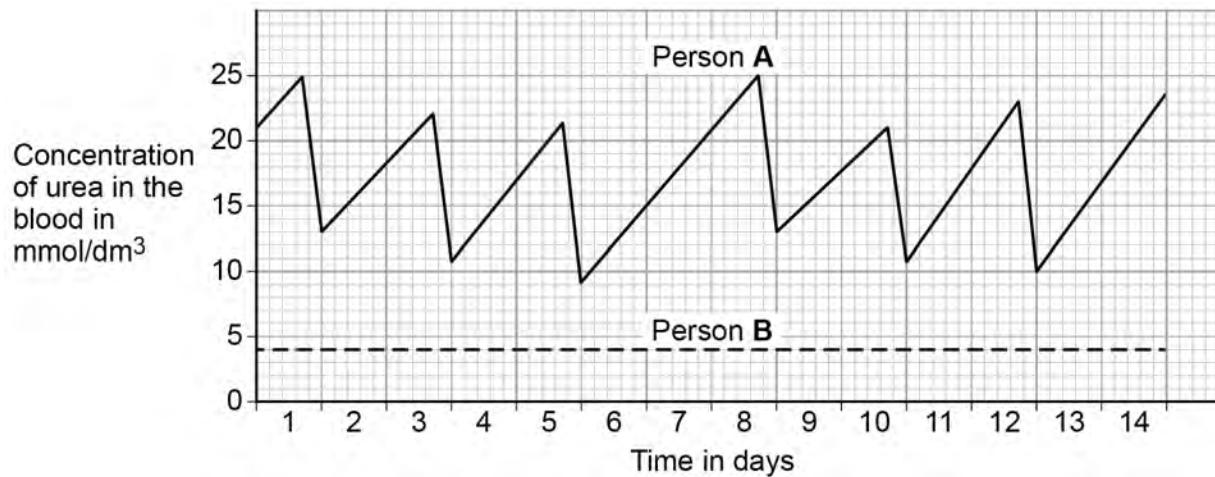


Two people have kidney disease.

- Person **A** is treated by dialysis.
- Person **B** has had a kidney transplant.

**Figure 13** shows changes in the urea concentration in the blood of each person over 2 weeks.

**Figure 13**



**0 6 . 7** How many dialysis sessions did person **A** have **each week**?

[1 mark]

\_\_\_\_\_

**0 6 . 8** What happens to the concentration of urea in the blood between dialysis sessions?

[1 mark]

\_\_\_\_\_

**0 6 . 9** Give **two** reasons why a kidney transplant is a better method for treating kidney disease than dialysis.

[2 marks]

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_



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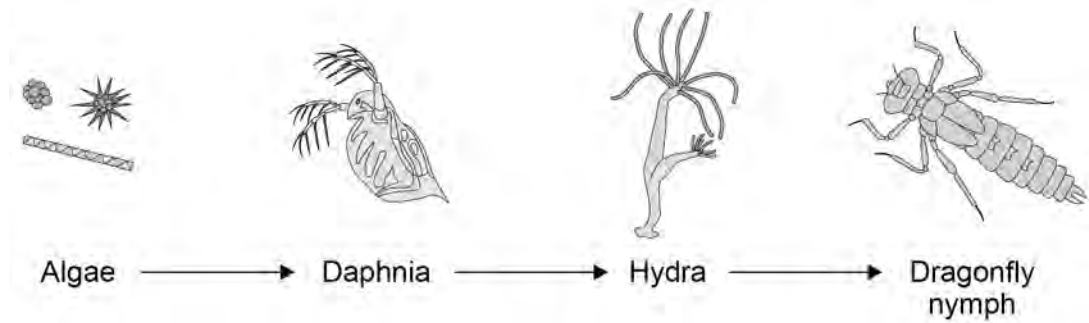
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07

Figure 14 shows a food chain in a pond.

Figure 14



07.1

Which term describes the Daphnia in this food chain?

[1 mark]

Tick (✓) **one** box.

Apex predator

Primary consumer

Producer

Secondary consumer



**0 7 . 2** Draw a pyramid of biomass for the food chain.

Label each trophic level.

**[2 marks]**

**0 7 . 3** Give **one** reason why the total biomass of the Daphnia in the pond is different from the total biomass of the algae.

**[1 mark]**

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**Question 7 continues on the next page**

**Turn over ►**



Students investigated the size of the population of Daphnia in the pond.

This is the method used.

1. Collect 1 dm<sup>3</sup> of pond water from near the edge of the pond.
2. Pour the water through a fine net.
3. Count the number of Daphnia caught in the net.
4. Repeat steps 1–3 four more times.

**Table 3** shows the results.

**Table 3**

Sample number	Number of Daphnia in 1 dm <sup>3</sup> water
1	5
2	21
3	0
4	16
5	28

**0 7 . 4** Calculate the mean number of Daphnia in 1 m<sup>3</sup> of pond water.

$$1 \text{ m}^3 = 1000 \text{ dm}^3$$

**[2 marks]**

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Mean number of Daphnia in 1 m<sup>3</sup> of pond water = \_\_\_\_\_



**07.5** The pond was a rectangular shape, measuring:

- length = 2.5 metres
- width = 1.5 metres
- depth = 0.5 metres.

Calculate the estimated number of Daphnia in the pond.

Use your answer from Question **07.4**.

Give your answer in standard form.

**[4 marks]**

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Number of Daphnia in the pond = \_\_\_\_\_

**Question 7 continues on the next page**

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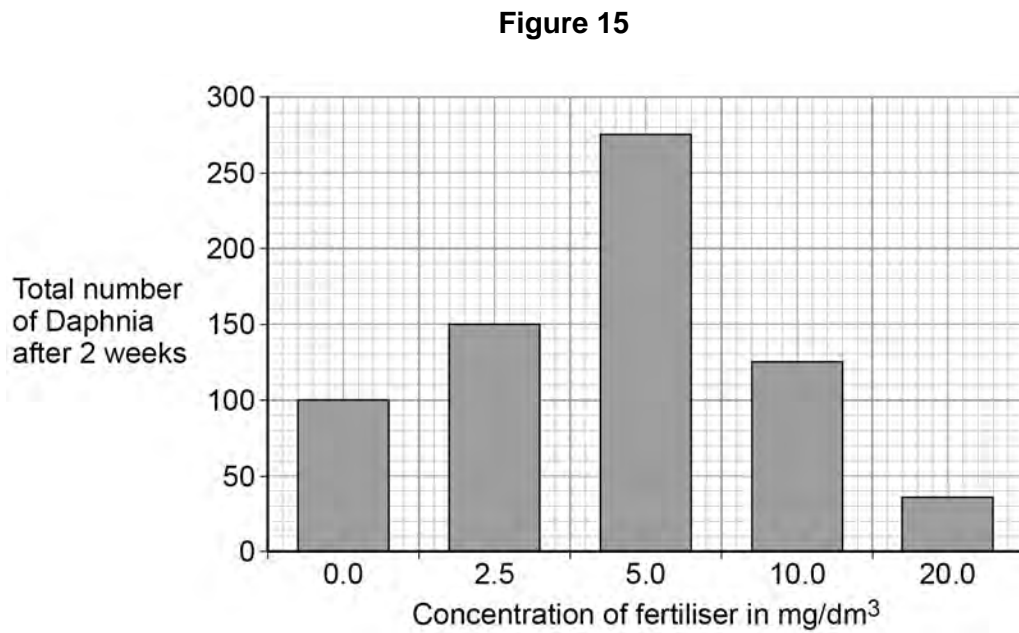


Rainfall can cause fertiliser to be washed from farmland into a pond.

The students investigated the effect of fertiliser on the population of Daphnia in water from the pond.

- The students put 20 Daphnia in each of five different concentrations of fertiliser.
- The students counted the total number of Daphnia in each concentration of fertiliser after 2 weeks.

**Figure 15** shows the results.



**0 7 . 6**

A concentration of 5.0 mg/dm<sup>3</sup> of fertiliser caused a large increase in the population of Daphnia.

Explain why.

**[2 marks]**

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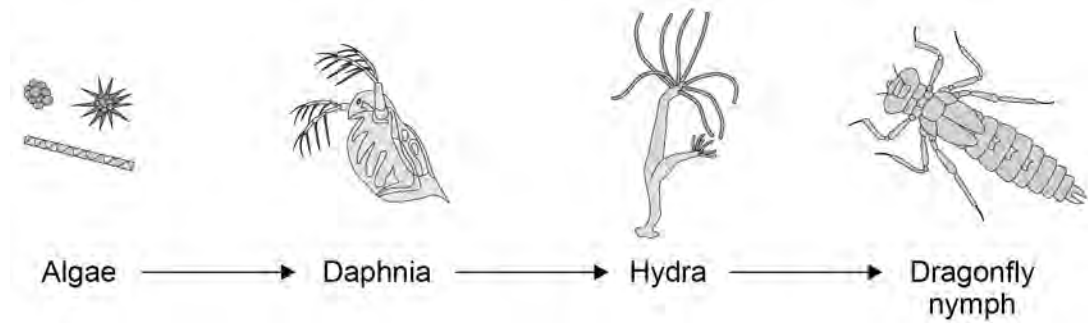
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0 7 . 7 Figure 14 is repeated below.

Figure 14



The population of **Hydra** will decrease when  $20 \text{ mg/dm}^3$  of fertiliser is added to the pond.

Explain why.

[2 marks]

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14

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Turn over ►



0 8

Genetic material is made of DNA.

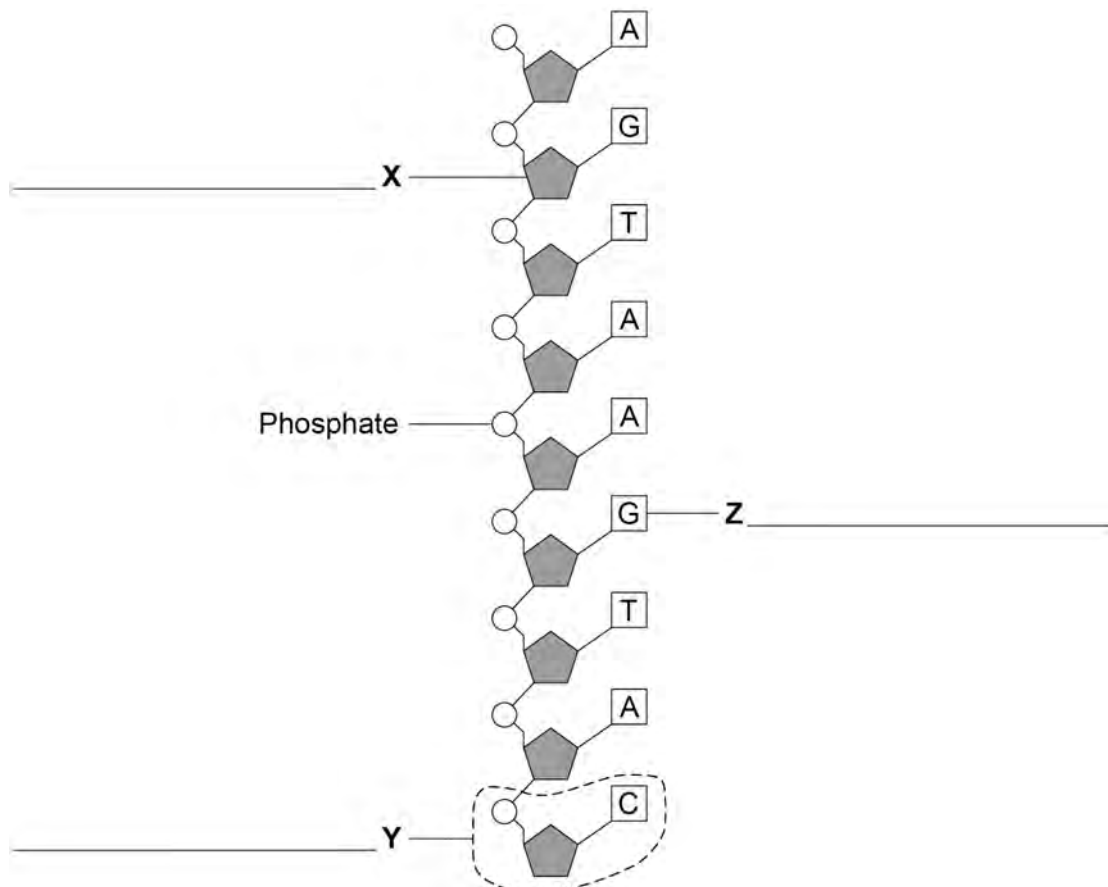
0 8 . 1

Which structures in the nucleus of a human cell contain DNA?

[1 mark]

Figure 16 shows part of one strand of a DNA molecule.

Figure 16



0 8 . 2

Label parts X, Y and Z on Figure 16.

[3 marks]

Choose answers from the box.

Base

Fatty acid

Nucleotide

Sugar

Glycerol



**0 8 . 3** A complete DNA molecule is made of two strands twisted around each other.

What scientific term describes this structure?

[1 mark]

---

**0 8 . 4** DNA codes for the production of proteins.

A protein molecule is a long chain of amino acids.

How many amino acids could be coded for by the piece of DNA shown in **Figure 16**?

[1 mark]

Tick (✓) **one** box.

2       3       9       18

**0 8 . 5** Scientists have now studied the whole human genome.

Give **two** benefits of understanding the human genome.

[2 marks]

1 \_\_\_\_\_

2 \_\_\_\_\_

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**8**

**Turn over for the next question**

**Turn over ►**



0 9

Phototropism is a growth response by part of a plant to light.

0 9 . 1

Name **one** other tropism.

Give the stimulus the plant responds to in the tropism you have named.

[2 marks]

Tropism \_\_\_\_\_

Stimulus \_\_\_\_\_

0 9 . 2

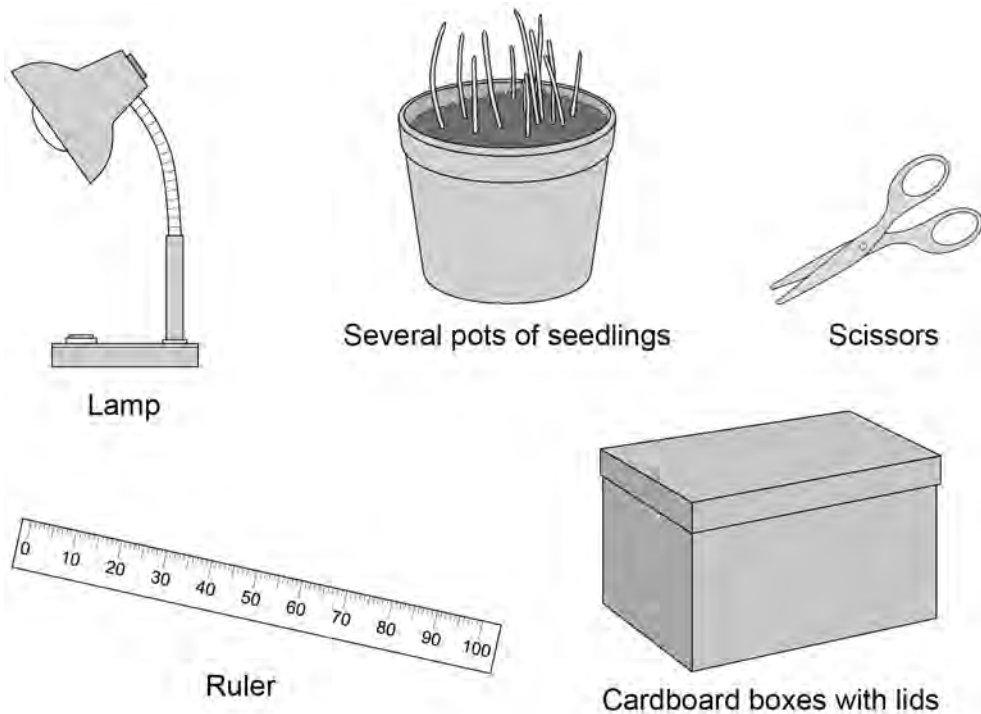
Plan an investigation to show the effect of light from one direction on the growth of plant seedlings.

Include details of any controls needed.

You may use some of the equipment shown in **Figure 17** and any other laboratory apparatus.

[6 marks]

**Figure 17**



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0 9 . 3

Explain how phototropism in a plant shoot helps the plant to survive.

**[3 marks]**

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11

**END OF QUESTIONS**



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