A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

GCSE
BIOLOGY

F

Foundation Tier Paper 2F

8461/2F

Friday 7 June 2019 Afternoon

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

JUN198461 2F 01

For this paper you must have:

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

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

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	Ear
Light	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]

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.**

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 on page 8.**
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.**

[Turn over]

FIGURE 1

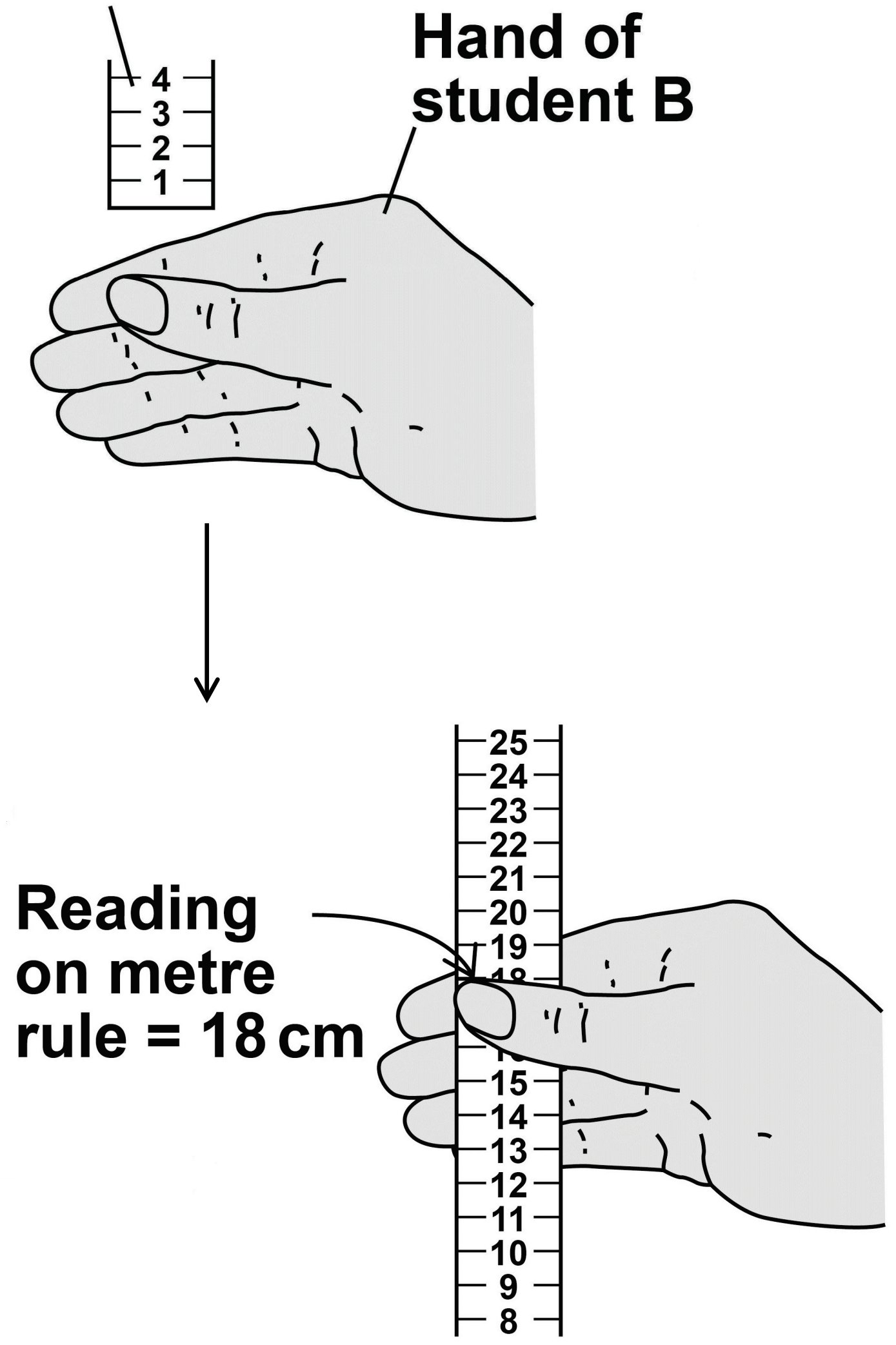

Metre rule held by student A
4
3
2
1
Hand of student B
25
24
23
22
21
20
19
15
14
13
12
11
10
9
8
Reading on metre rule = 18 cm

TABLE 1 shows some of the results.

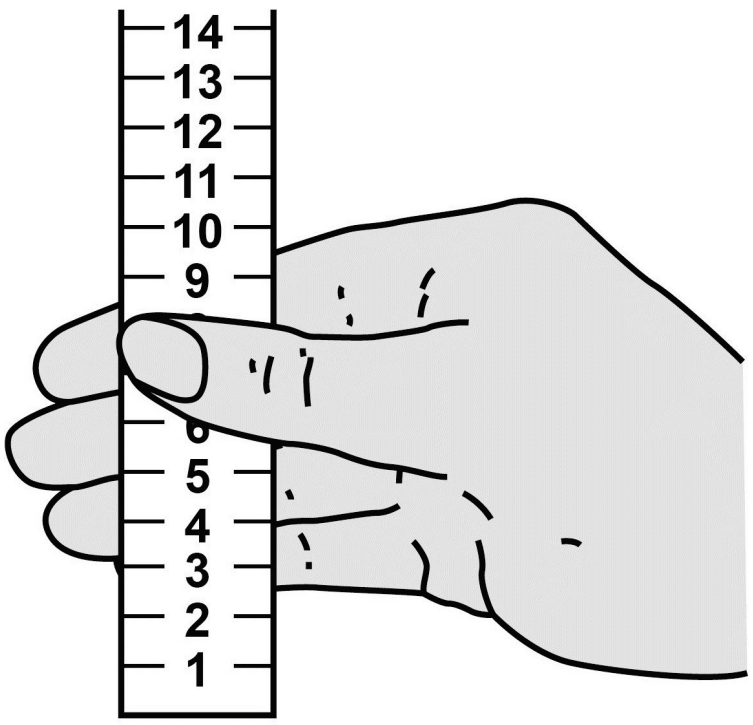
TABLE 1

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	

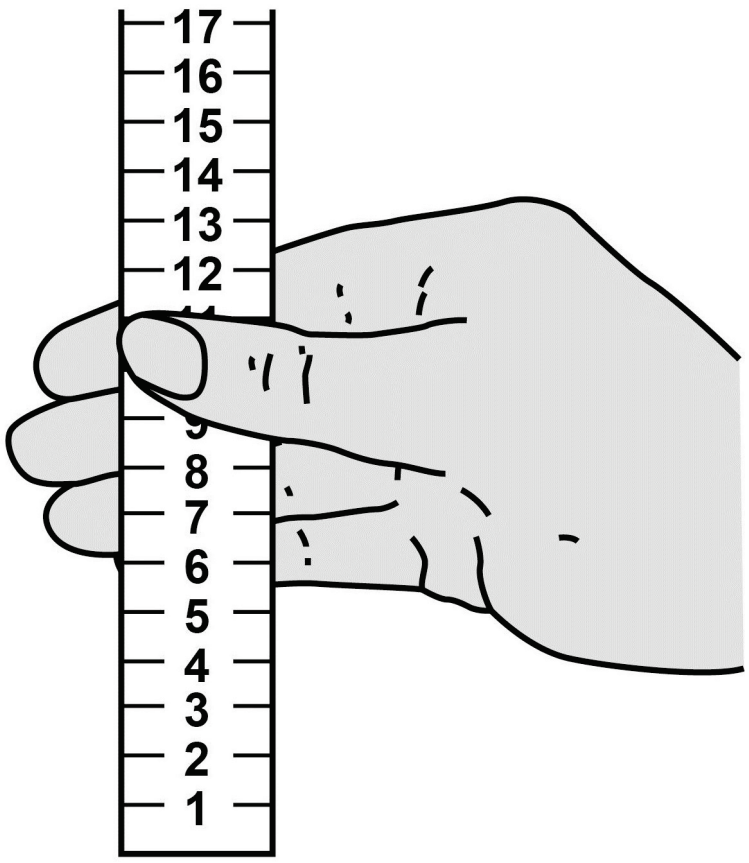
FIGURE 2, on pages 10 and 11, shows the results AFTER drinking the coffee for tests 3, 4 and 5.

[Turn over]

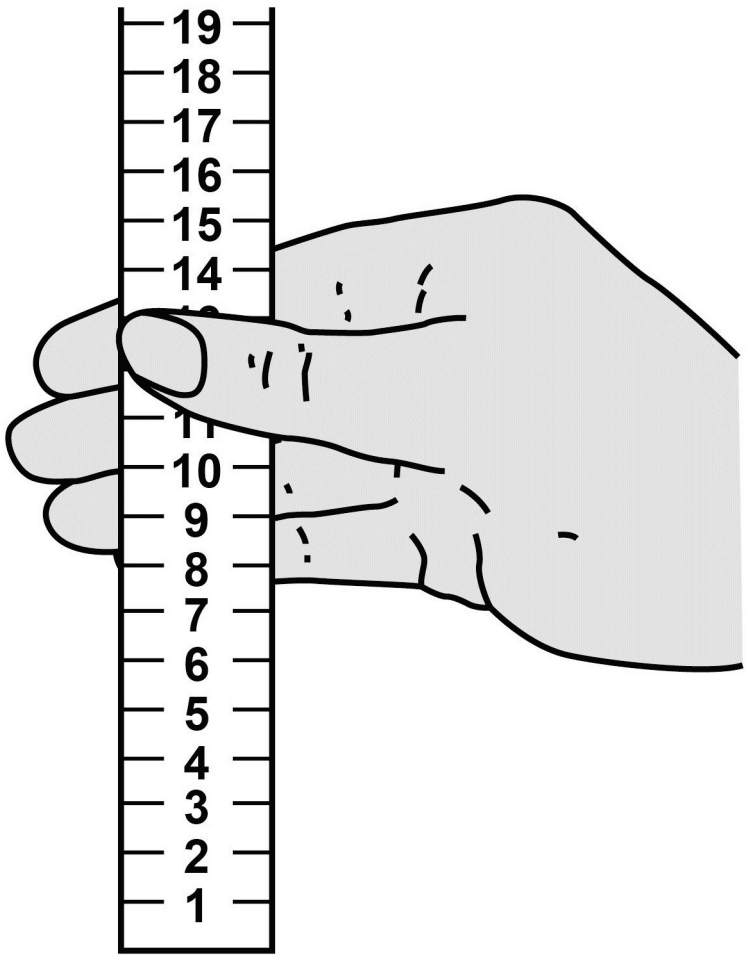
FIGURE 2



Test 3



Test 4



Test 5

0 1 . 4

Complete TABLE 1 on page 9.

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, on page 9, to support the students’ conclusion.
[1 mark]

0 1 . 6

The students' conclusion may NOT be valid.

Suggest TWO improvements the students could make to their method. [2 marks]

1

2

10

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**

[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

Woman

		e	e
Man	**E**	**Ee**	
	e		

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**

[Turn over]

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

		Woman	
Man		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

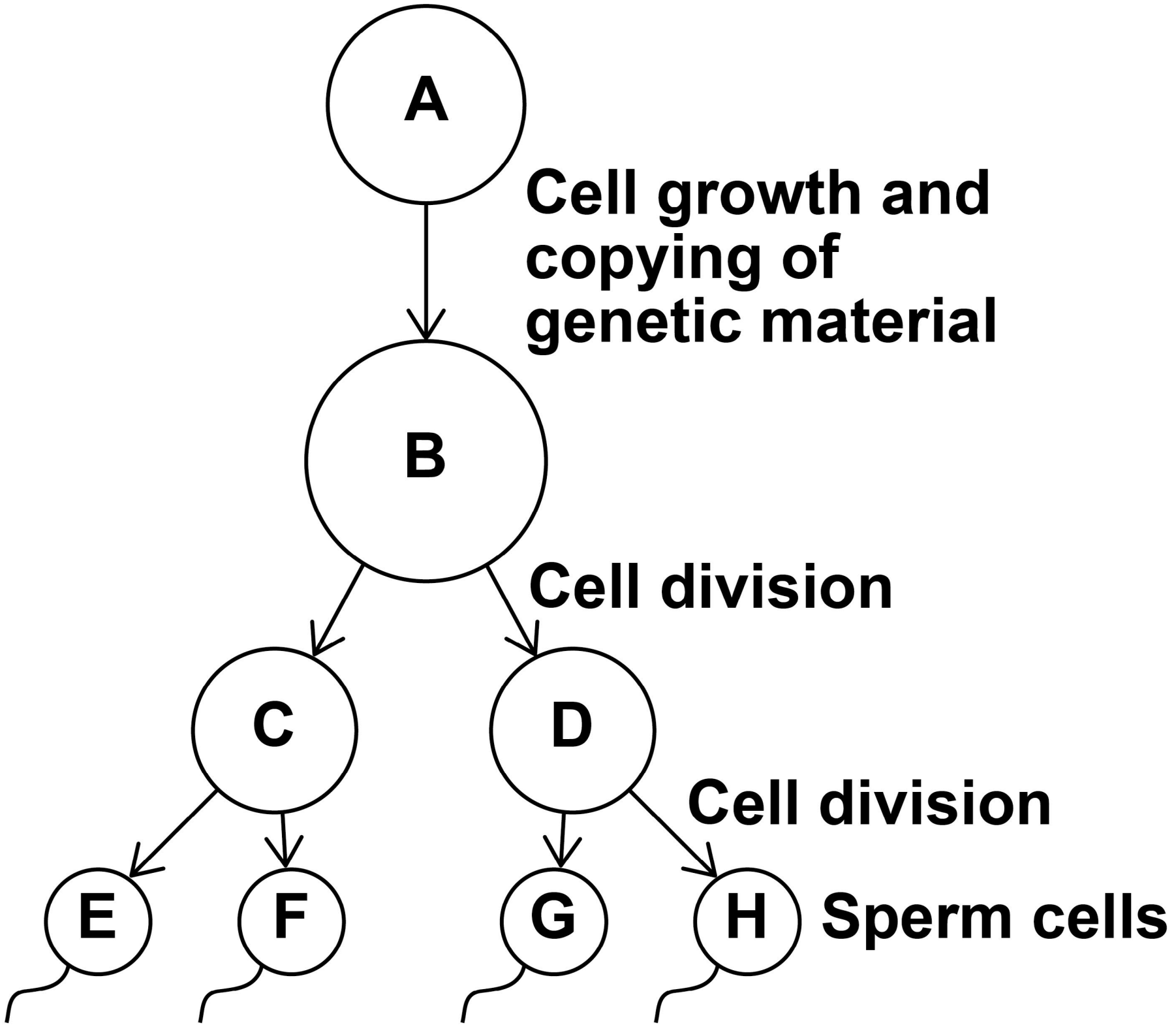
Probability of a girl with attached earlobes = _____

8

0 3

FIGURE 6 shows the production of sperm cells in humans.

FIGURE 6



0 3 . 1

Cell A is a normal body cell.

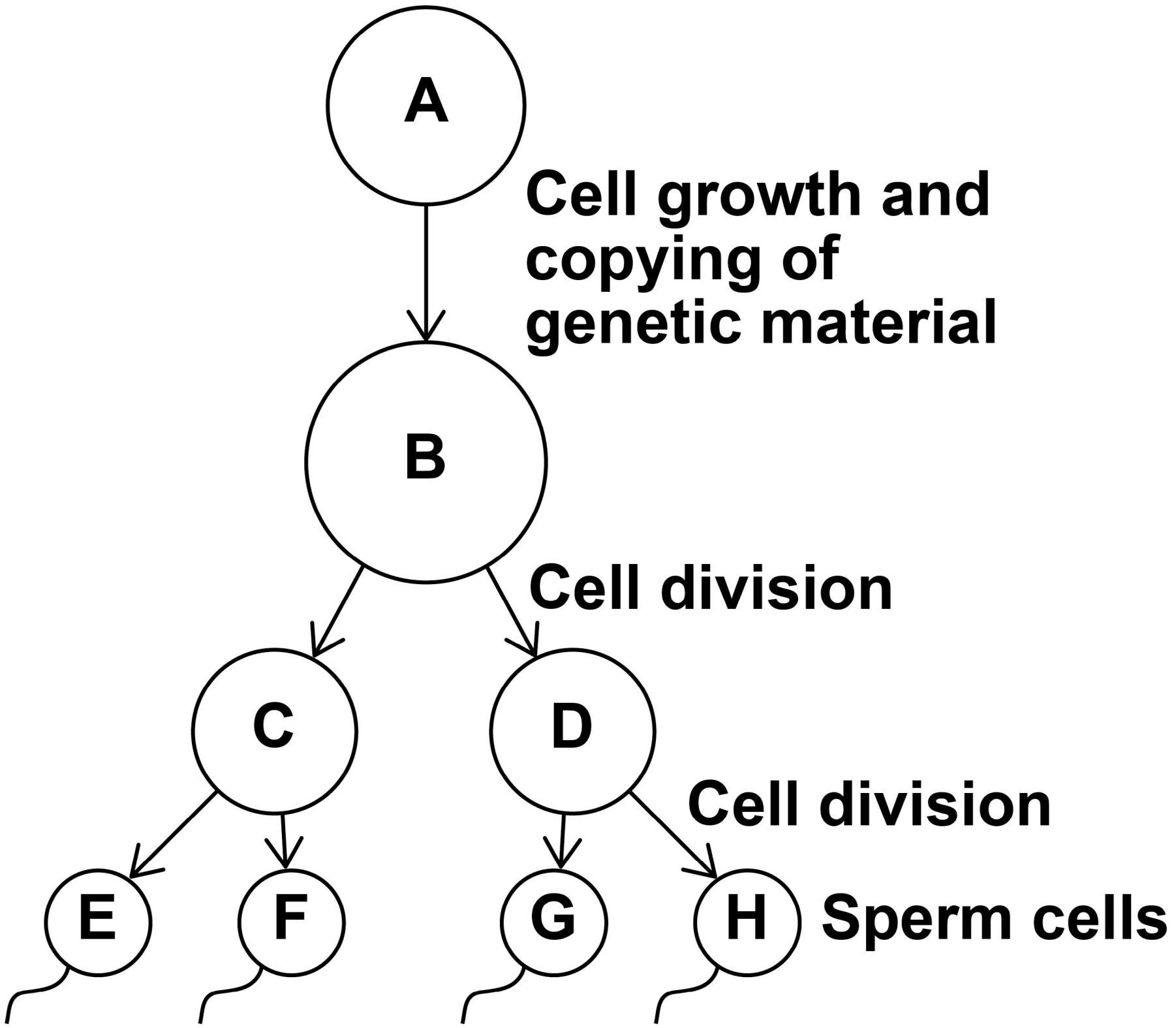
How many chromosomes are there in cell A? [1 mark]

Tick (✓) ONE box.

- ☐ **23**
- ☐ **46**
- ☐ **48**
- ☐ **92**

[Turn over]

Repeat of FIGURE 6



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**

[Turn over]

0 3 . 5

A woman has three children, aged 4, 6 and 9 years.

Why are the children NOT genetically identical? [2 marks]

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

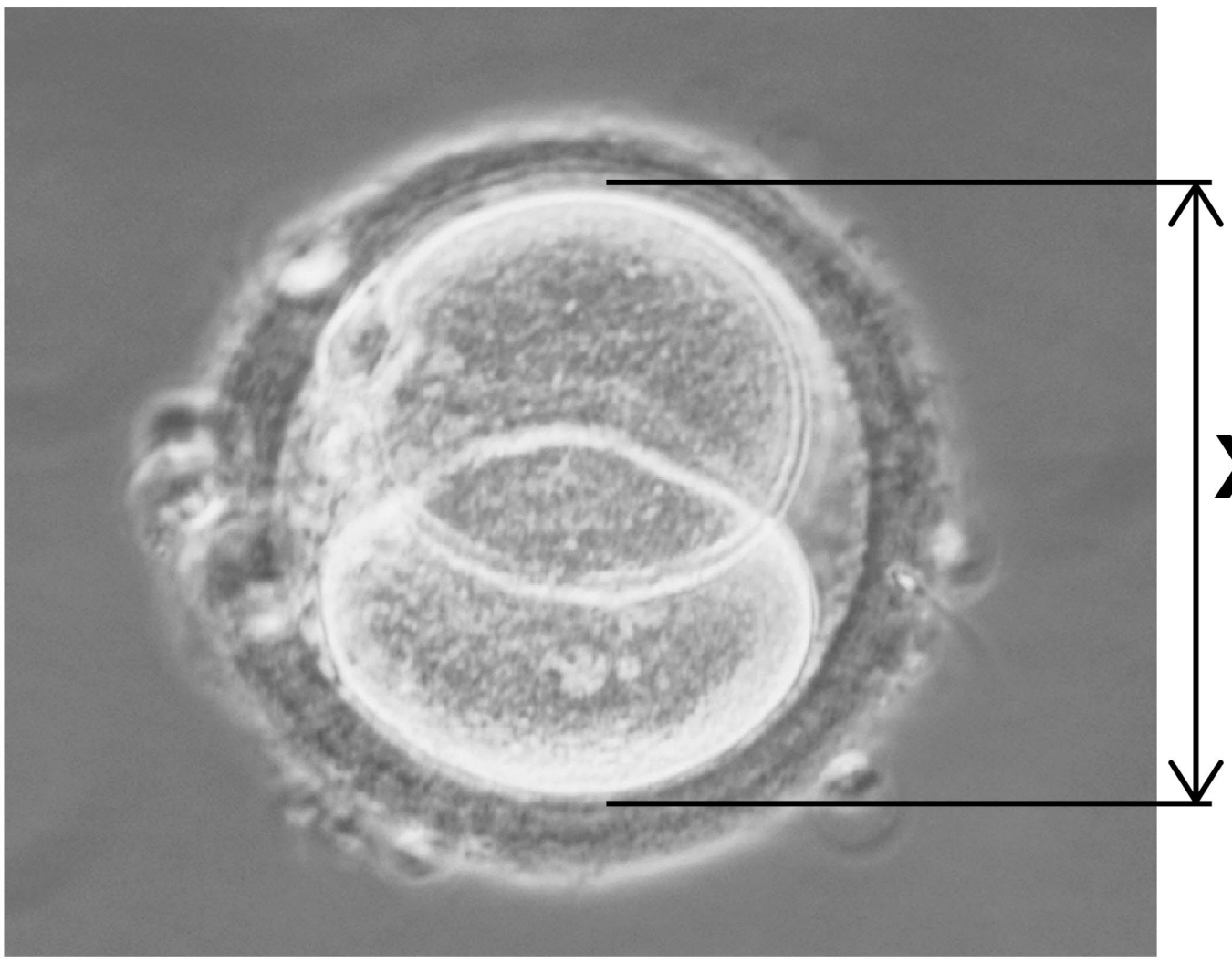
How many cells are there in the embryo after three cell divisions? [1 mark]

Tick (✓) ONE box.

- ☐ 3
- ☐ 6
- ☐ 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 ×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 (μm).

1 mm = 1000 μm [3 marks]

Real length of the embryo =

_____ μm

[Turn over]

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]

13

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[Turn over]

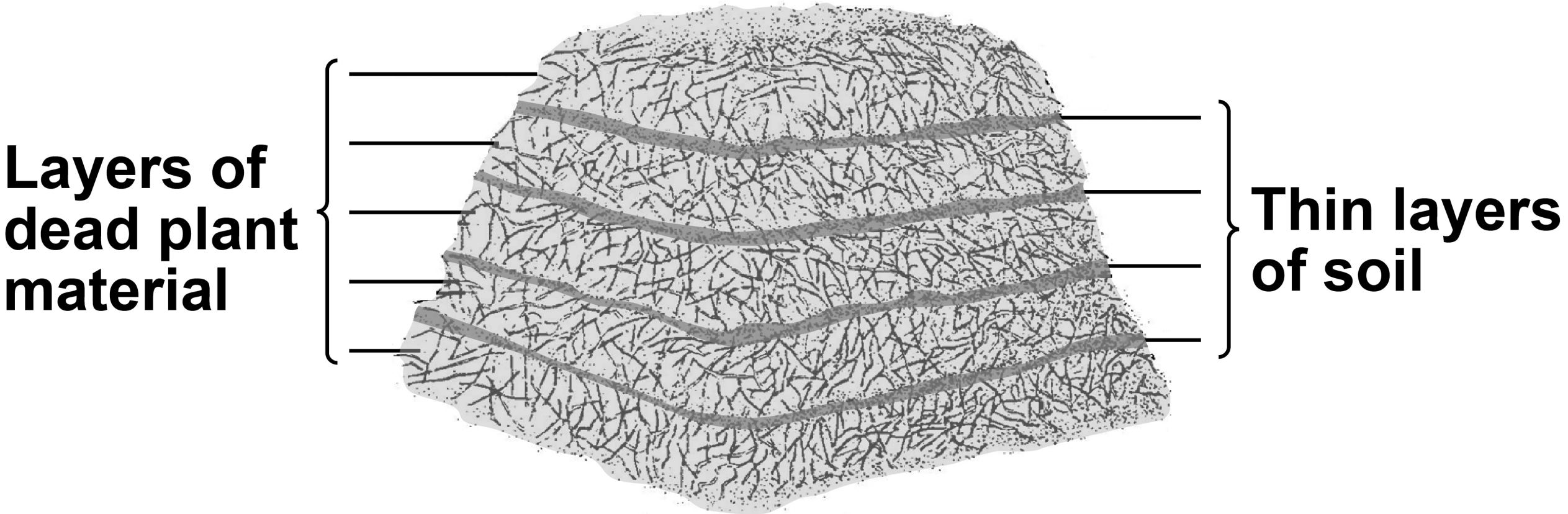
0 4

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**
- ☐ **Fungi**
- ☐ **Grass**
- ☐ **Insects**
- ☐ **Worms**

[Turn over]

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]

0 4 . 3

Give ONE environmental factor needed for decay.

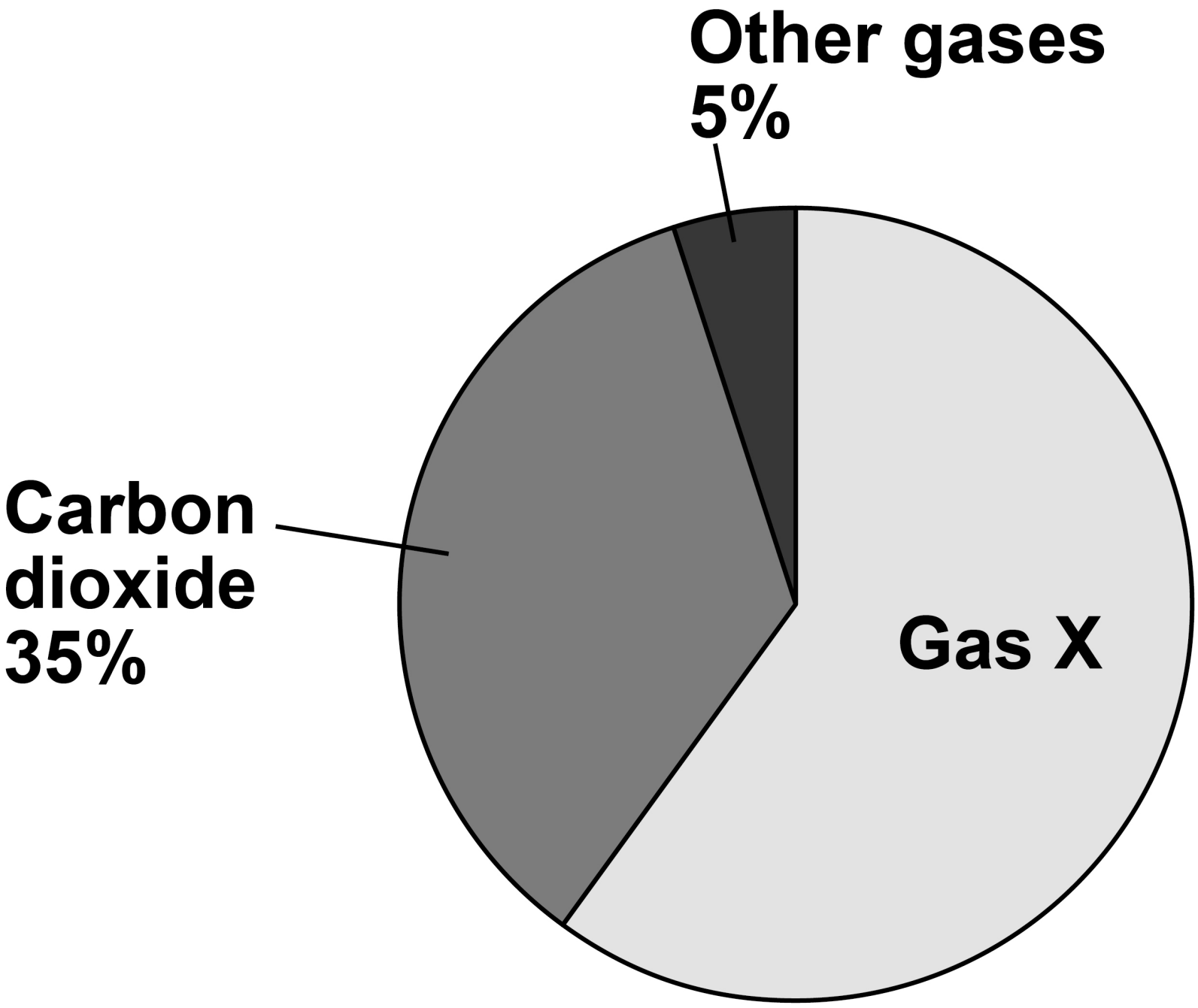
Do NOT refer to oxygen or temperature in your answer. [1 mark]

[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.

FIGURE 9



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**

[Turn over]

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0 4 . 5

What is the percentage of gas X in the biogas? [1 mark]

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]

10

BLANK PAGE

[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**

[Turn over]

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.

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**

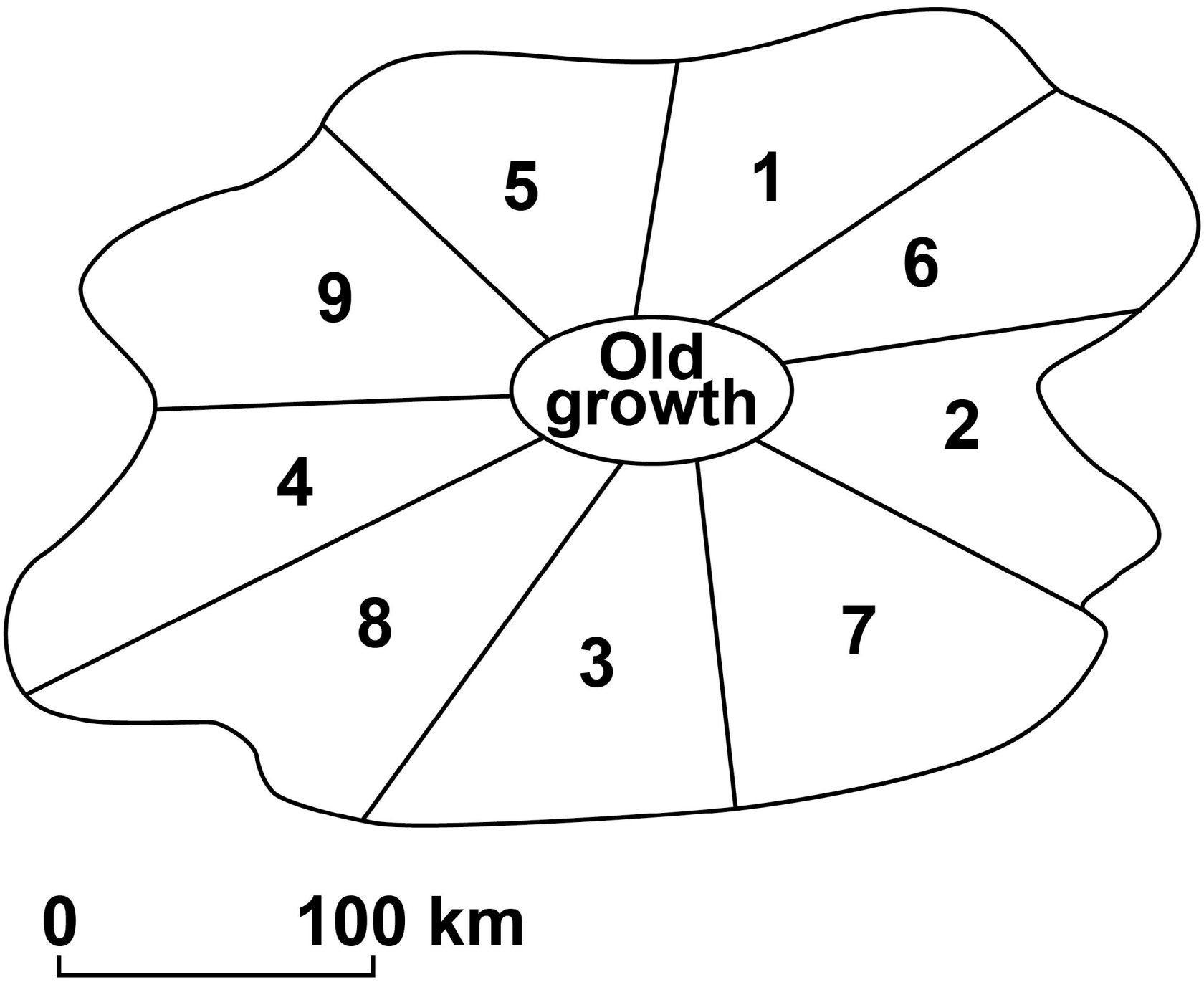
‘Sustainable forestry’ reduces the harmful effects of cutting down trees on the environment.

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

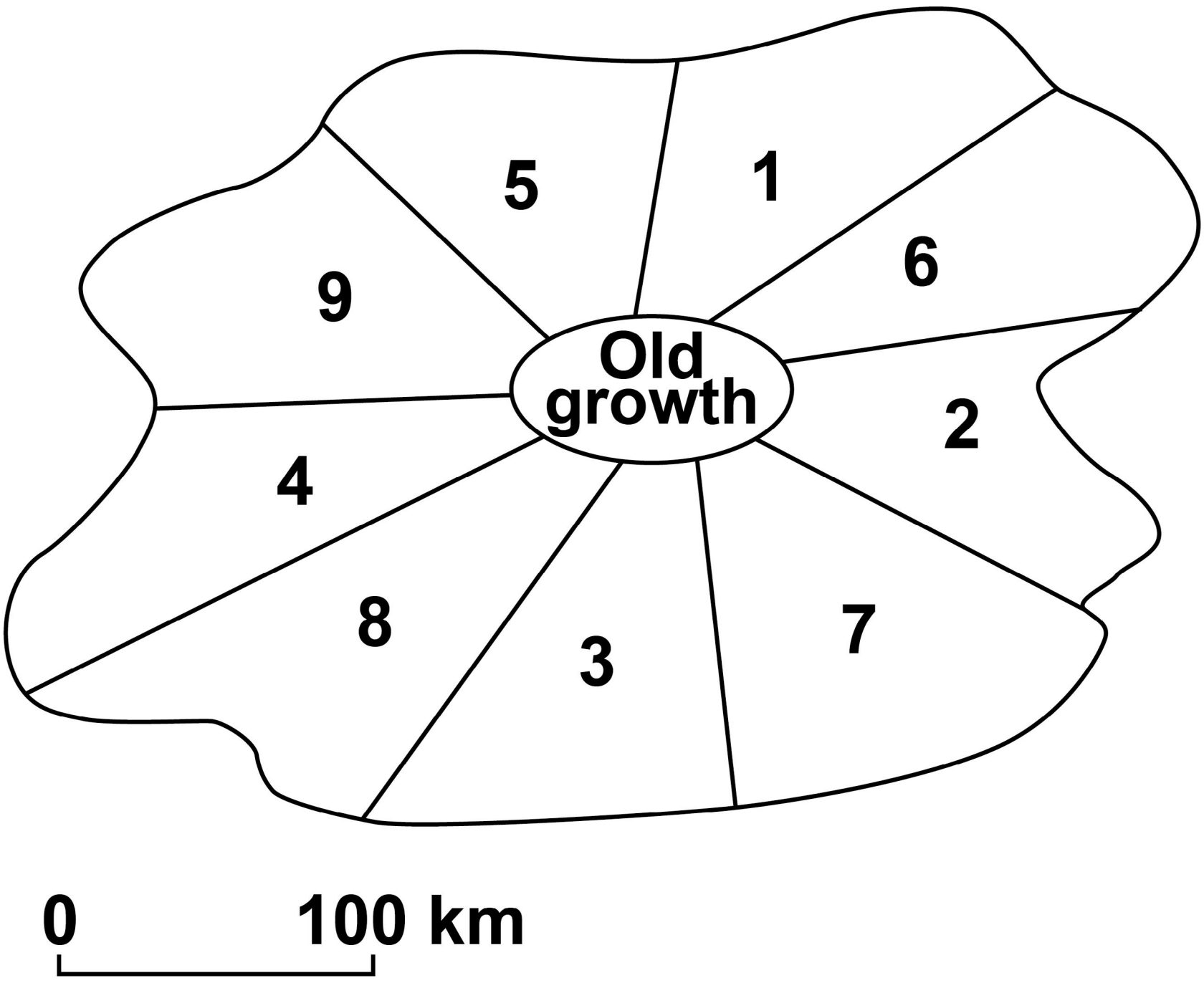
- **The trees are cut down in only one area at any one time.**
- **It takes 30 years to cut down the trees in each area.**
- **The trees in the 'Old growth' area are never cut down.**

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]

Number of years = _____

Repeat of FIGURE 11



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]

13

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 list below.

- **carbohydrate**
- **lipid**
- **protein**
- **salt**

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

_____ .

[Turn over]

0 6 . 2

Why must urea be excreted from the body? [1 mark]

0 6 . 3

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

Complete the sentences. [2 marks]

Choose answers from the list below.

- **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 _____.

[Turn over]

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, on page 57, shows information for the 3 days.

Complete TABLE 2. [2 marks]

Choose answers from the list below.

- **least**
- **medium**
- **most**

TABLE 2

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

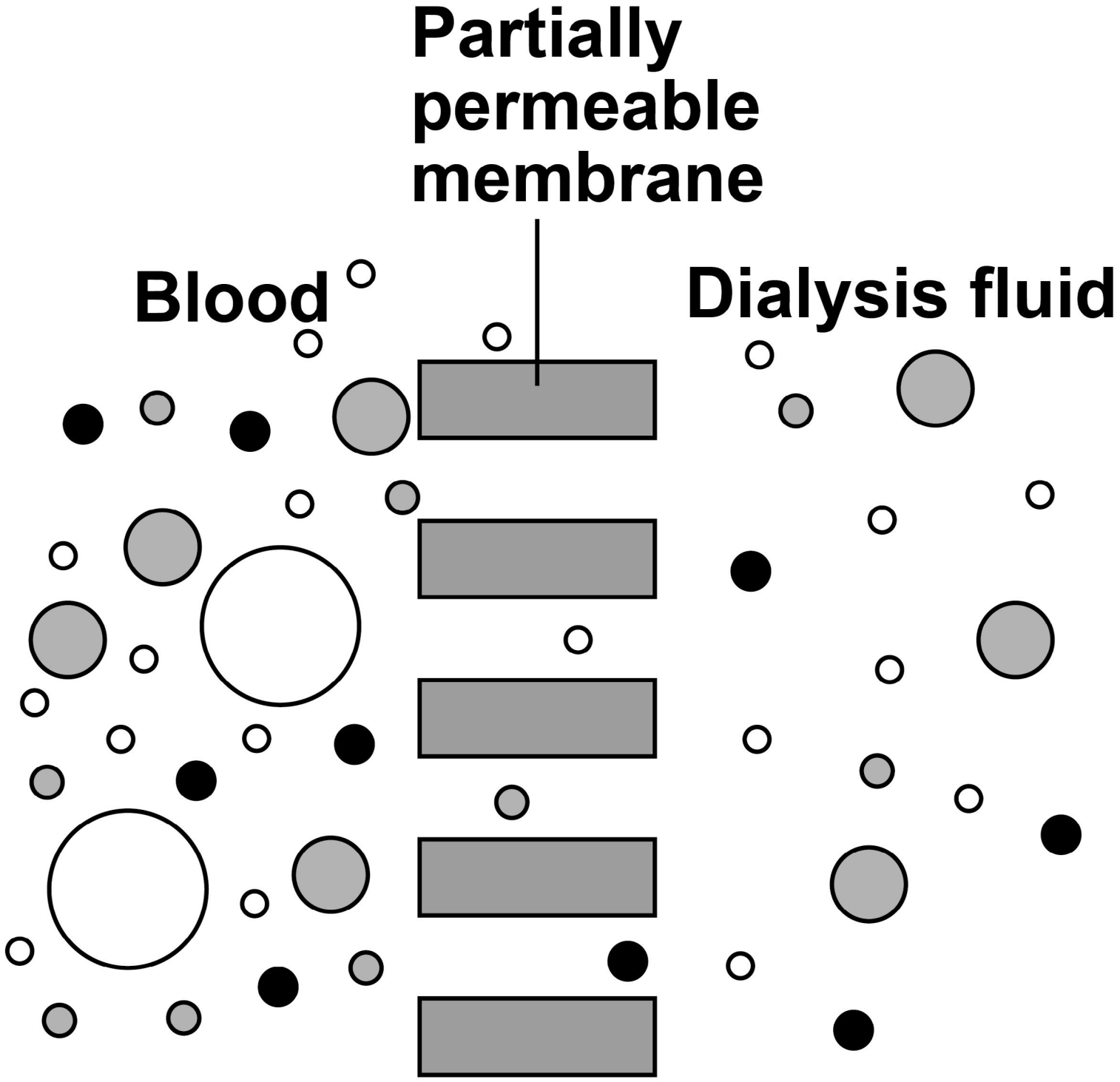
Some people have kidney disease.

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, on the opposite page, shows how dialysis works.

FIGURE 12



KEY

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

[Turn over]

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

Which substance in FIGURE 12, on page 59, does NOT pass from the blood into the dialysis fluid?

Give the reason for your answer.
[2 marks]

Substance _____

Reason _____

_____

_____

_____

[Turn over]

Two people have kidney disease.

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

FIGURE 13, on the opposite page, shows changes in the urea concentration in the blood of each person over 2 weeks.

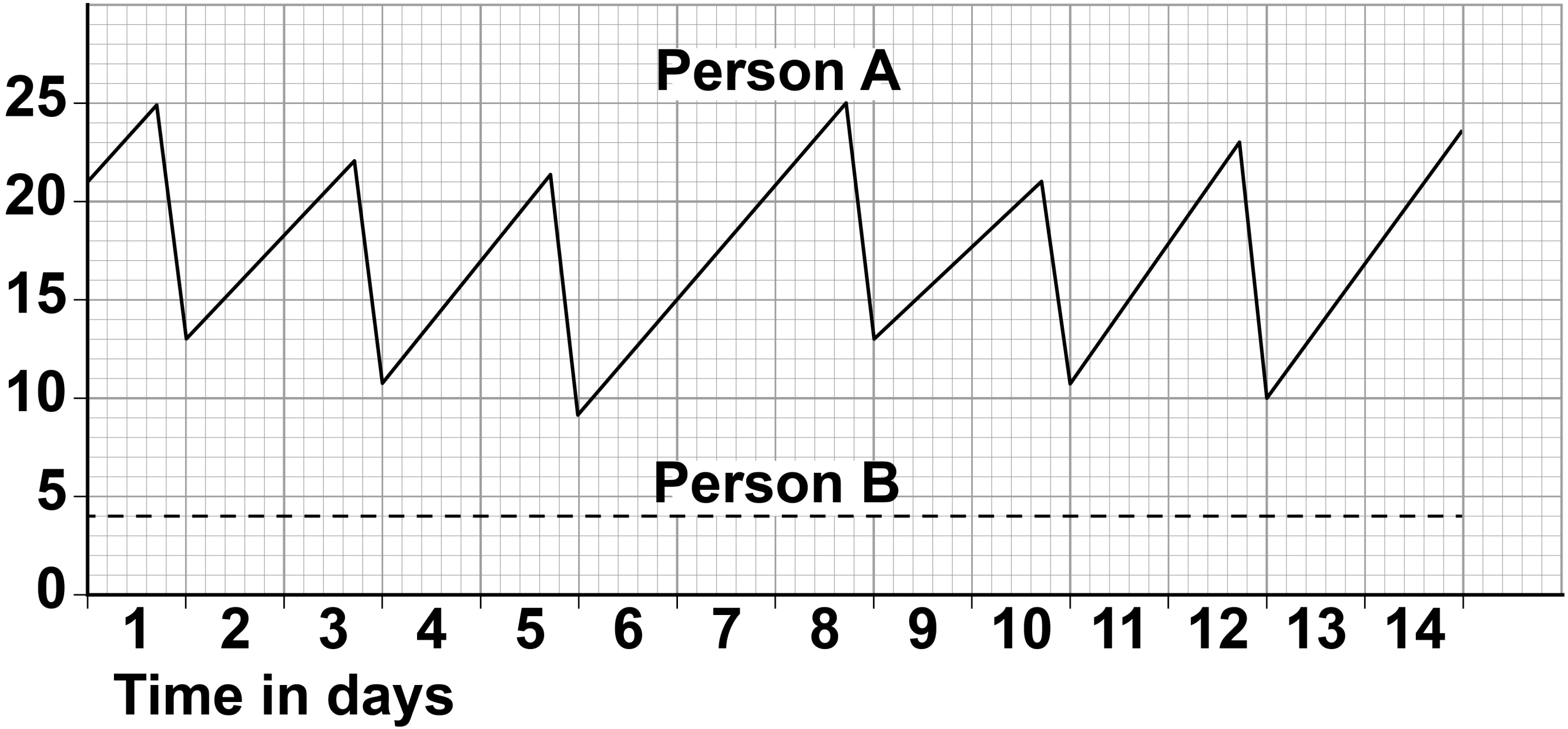
0 6 . 7

How many dialysis sessions did person A have EACH WEEK? [1 mark]

_____

FIGURE 13

Concentration of urea in the blood in mmol/dm^3



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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. _____

_____

_____

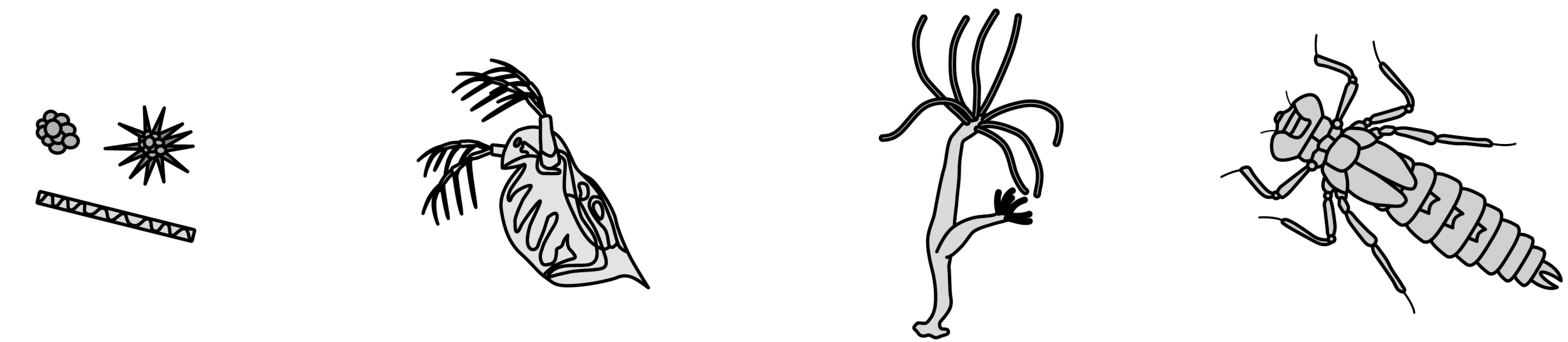
13

BLANK PAGE

[Turn over]

0 7 **FIGURE 14 shows a food chain in a pond.**

FIGURE 14



0 7 . 1

Which term describes the Daphnia in this food chain?
[1 mark]

Tick (✓) ONE box.

☐ **Apex predator**

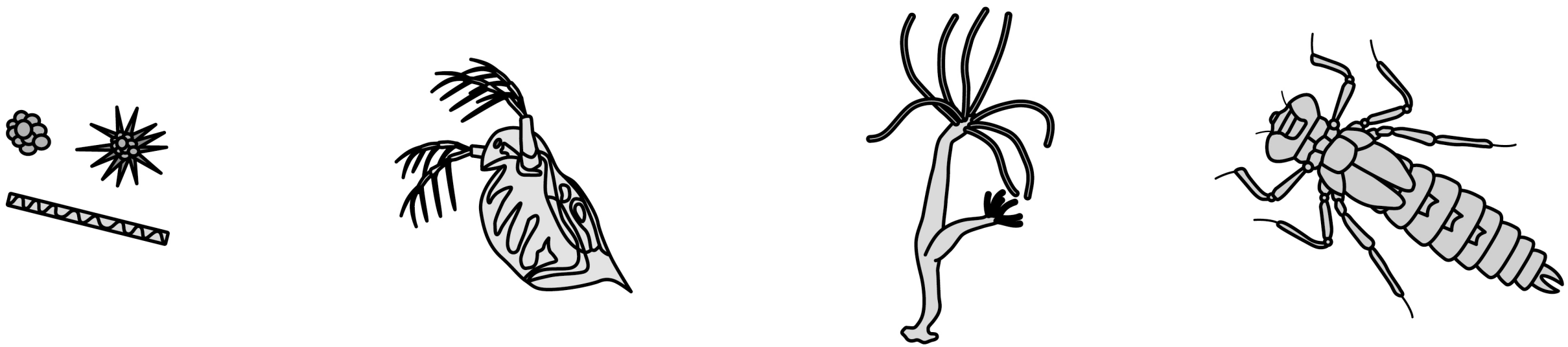
☐ **Primary consumer**

☐ **Producer**

☐ **Secondary consumer**

[Turn over]

Repeat of FIGURE 14



0 7 . 2

Draw a pyramid of biomass for the food chain.

Label each trophic level. [2 marks]

[Turn over]

BLANK PAGE

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]

[Turn over]

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

This is the method used.

1. Collect 1 dm^3 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^3 water
1	5
2	21
3	0
4	16
5	28

0 7 . 4

Calculate the mean number of Daphnia in 1 m^3 of pond water.

1 m^3 = 1000 dm^3

[2 marks]

Mean number of Daphnia in 1 m^3 of pond water = _____

[Turn over]

0 7 . 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 on page 75.

Give your answer in standard form.

[4 marks]

Number of Daphnia in the pond =

_____

[Turn over]

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

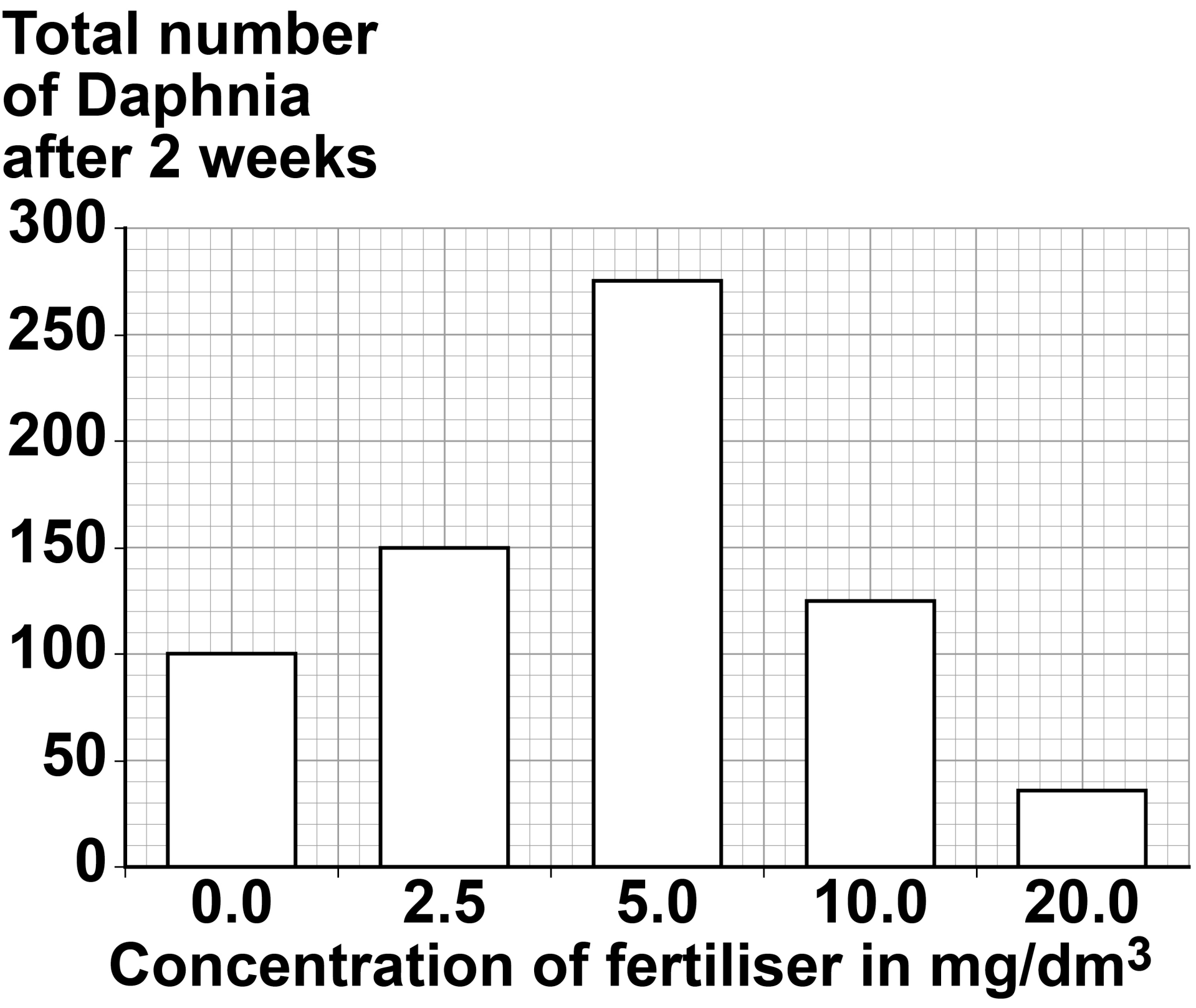
The students investigated the effect of fertiliser on the population of Daphnia in water from the pond.

- 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, on the opposite page, shows the results.

FIGURE 15



[Turn over]

BLANK PAGE

0 7 . 6

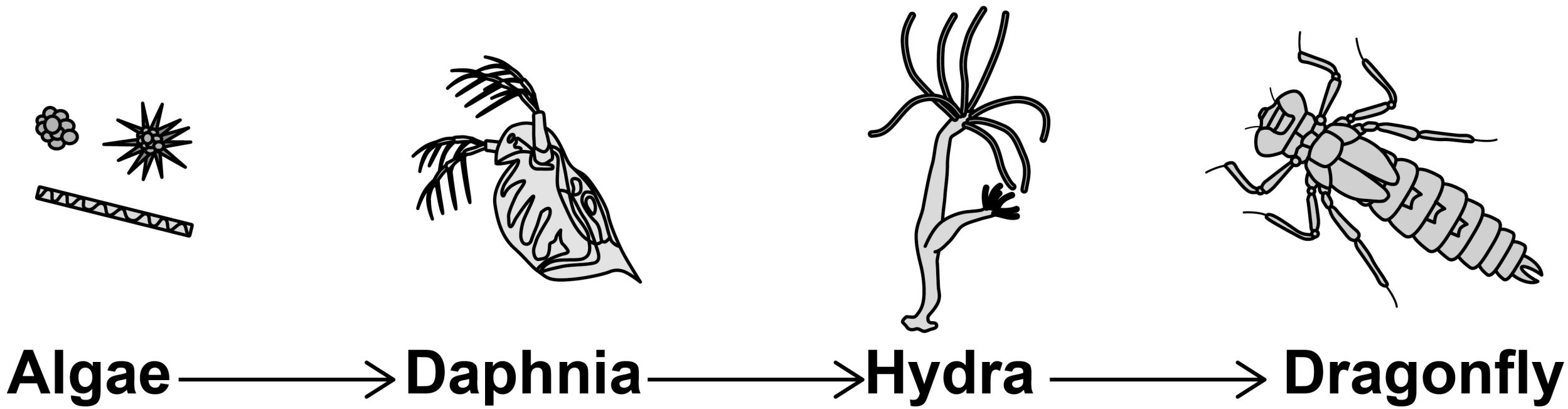
A concentration of 5.0 mg/dm^3 of fertiliser caused a large increase in the population of Daphnia.

Explain why. [2 marks]

0 7 . 7

FIGURE 14 is repeated below.

FIGURE 14



The population of HYDRA will decrease when 20 mg/dm^3 of fertiliser is added to the pond.

Explain why. [2 marks]

_____

_____

_____

_____

_____

_____

14

[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, on the opposite page, shows part of one strand of a DNA molecule.

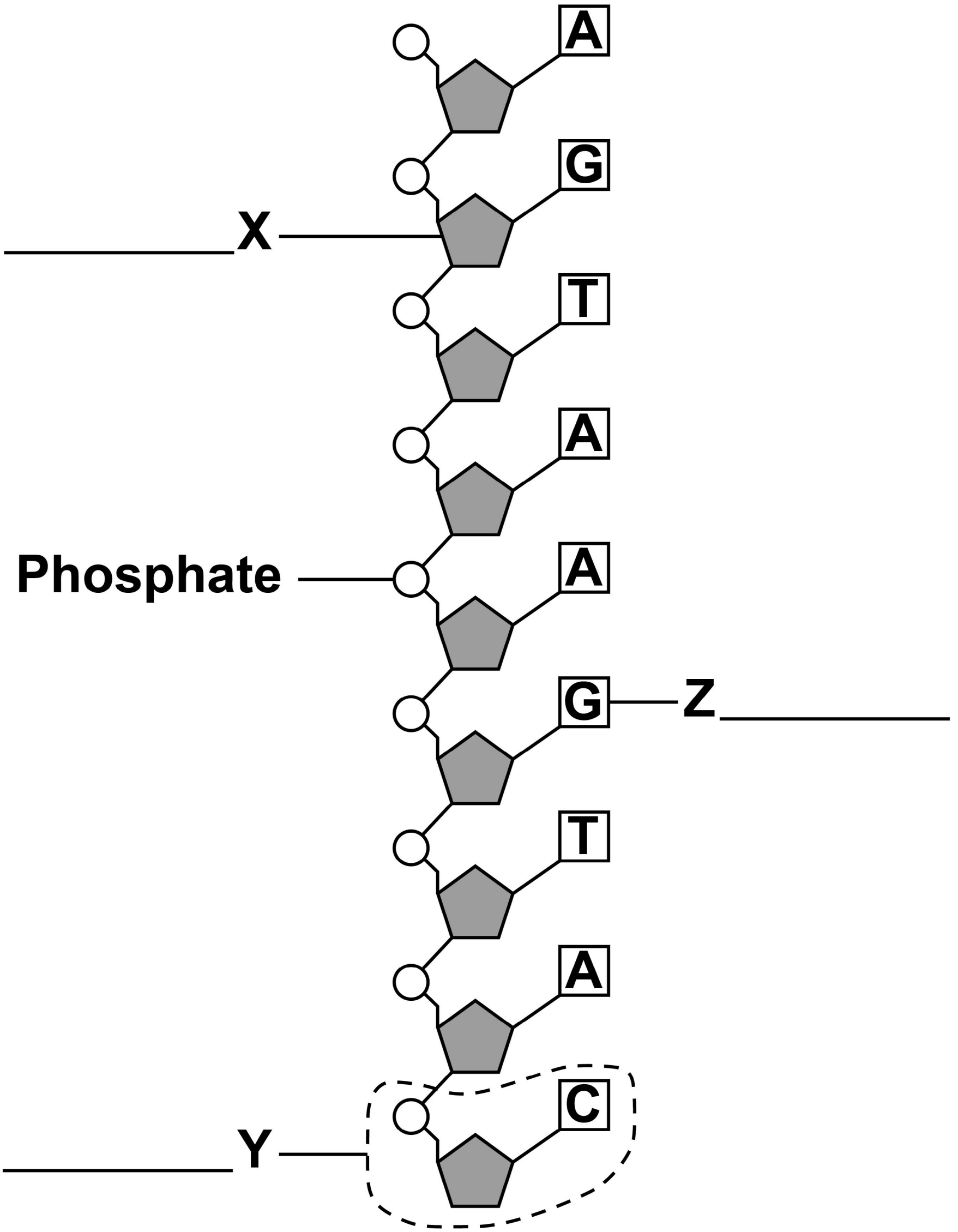
0 8 . 2

Label parts X, Y and Z on FIGURE 16. [3 marks]

Choose answers from the list below.

- **Base**
- **Fatty acid**
- **Nucleotide**
- **Sugar**
- **Glycerol**

FIGURE 16



[Turn over]

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 (on page 85)? [1 mark]

Tick (✓) ONE box.

☐ **2**

☐ **3**

☐ **9**

☐ **18**

[Turn over]

0 8 . 5

Scientists have now studied the whole human genome.

Give TWO benefits of understanding the human genome. [2 marks]

1

2

8

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 _____

_____

[Turn over]

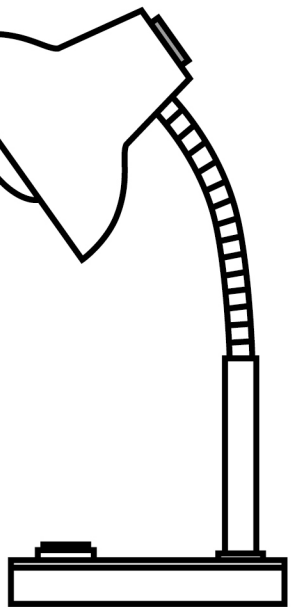
0 9 . 2

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

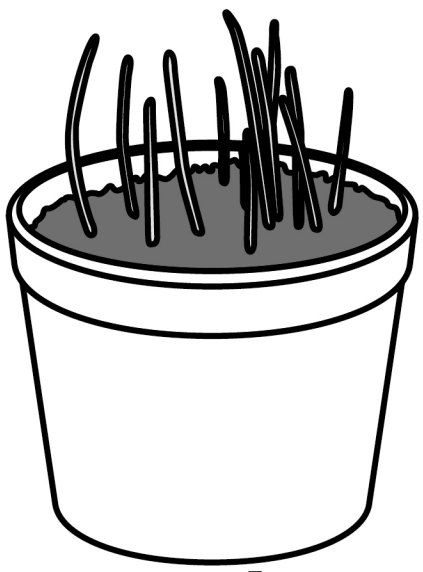
Include details of any controls needed.

You may use some of the equipment shown in FIGURE 17 and any other laboratory apparatus. [6 marks]

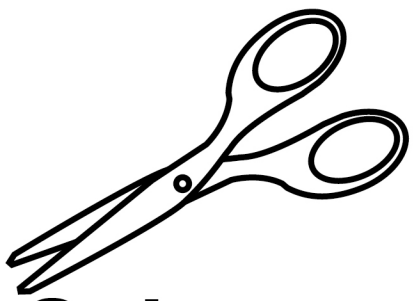
FIGURE 17



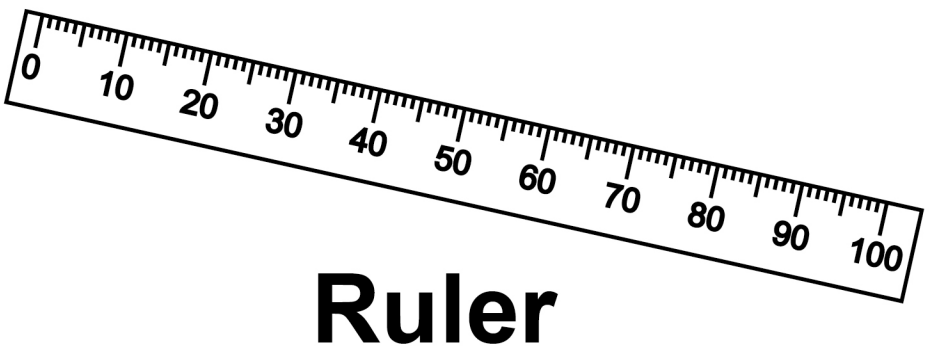
Lamp



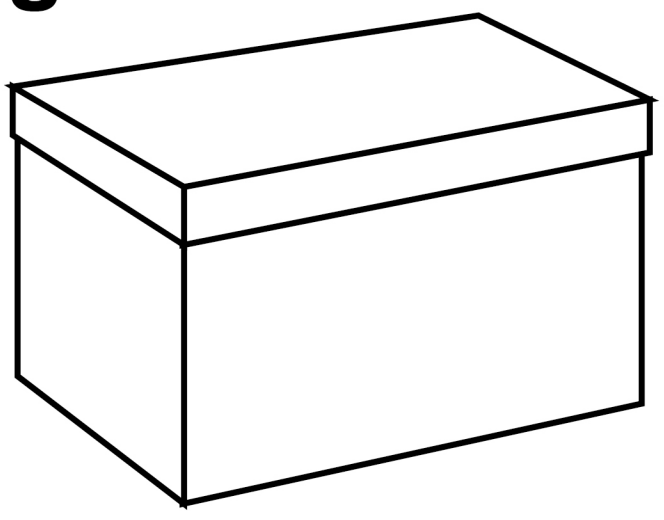
Several pots of seedlings



Scissors



Ruler



Cardboard boxes with lids

[Turn over]

0 9 . 3

Explain how phototropism in a plant shoot helps the plant to survive.
[3 marks]

END OF QUESTIONS

11

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For Examiner's Use	
Question	Mark
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