Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname

Forename(s)

Candidate signature

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	
TOTAL	

Do not write outside the box

Answer all questions in the spaces provided.

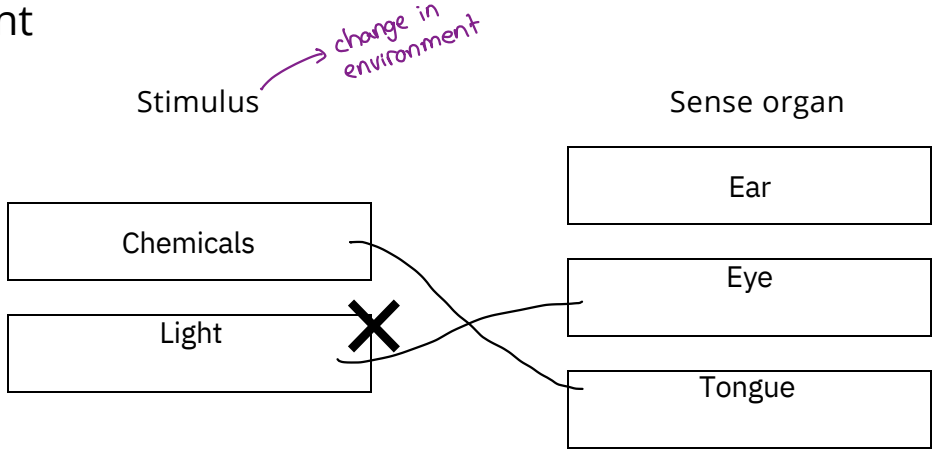
0 1 The nervous system allows a person to detect stimuli.

0 1 . 1 Draw one line from each stimulus to the sense organ that detects the stimulus.

[2 marks]

:& ent

→ In



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]

Rapid involuntary response to protect the body from harm

Do not write outside the box

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.

- [x] The muscle contracts.
- [ ] The muscle expands.
- [ ] The muscle relaxes.
- [ ] The muscle shrinks.

Question 1 continues on the next page

Do not write outside the box

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

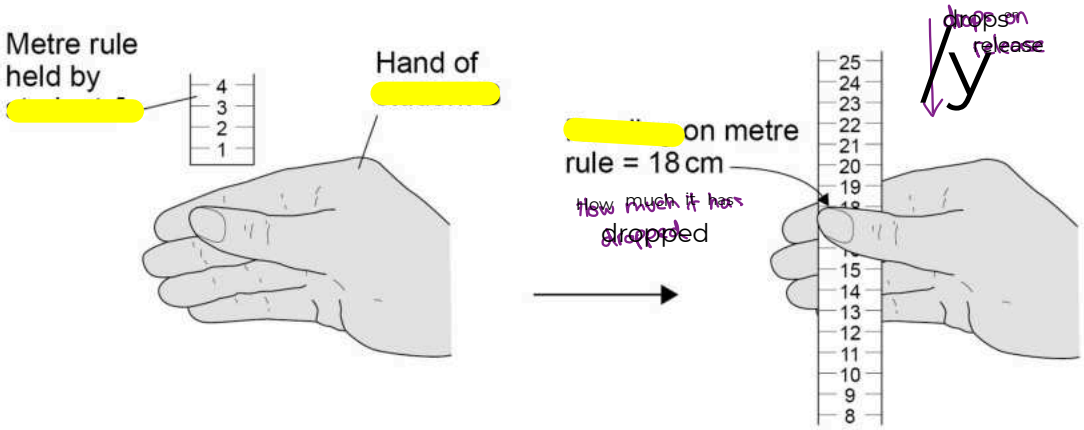


Table 1 shows some of the results.

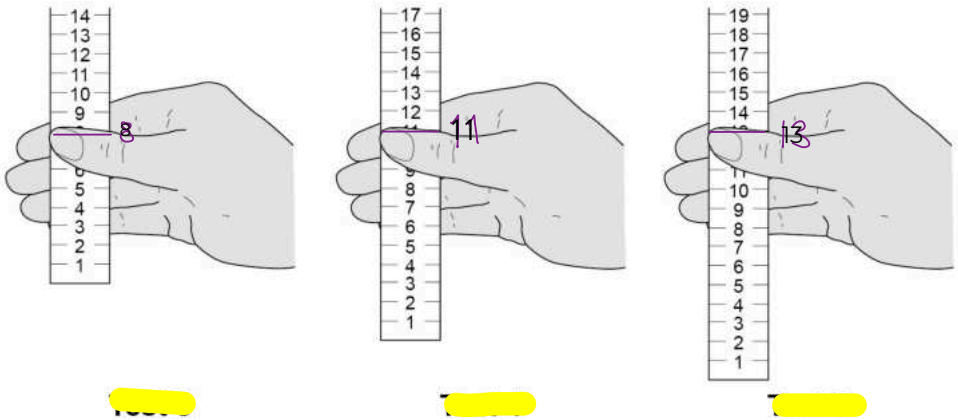
Table 1

Test	Reading from scale on metre rule in cm	
	Before drinking coffee	After drinking coffee
1	18	10
2	21	14
3	15	8
4	12	11
5	19	13

Do not write outside the box

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]

After coffee, ruler falls less far

0 1 . 6 The students' conclusion may not be valid.

Suggest two improvements the students could make to their method.

[2 marks]

1 more more repeats
repeats userulerwithmore

use ruler with more precise scale

drop from same height

drop from same height above hand

test more students

ensure student B's hand stationary

2 testmorestudentsensurestudentB'shand

10

There are no questions printed on this page

Do not write outside the box

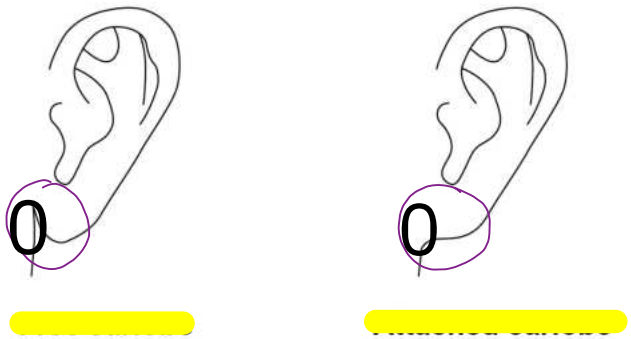
DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 2 The shape of a person's earlobes is controlled by a gene.

Figure 3 shows two types of earlobe.

Figure 3



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 ✓
- 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

Do not write outside the box

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	Ee
e	ee	ee

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 ✓

Woman

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

2/4 = 0.5

E = allele for free earlobes
e = allele for attached earlobes

Do not write outside the box

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

X
X

Man	X	X
X	XX	XX
Y	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

0.5 × 0.5 = 0.25

Probability of a girl with attached earlobes = 0.25 (25% or ¼)

E = allele for free earlobes
e = allele for attached earlobes

Man \ Woman	e	e
E	Ee	Ee
e	ee	ee

2/4 = 0.5

Man \ Woman	X	X
X	XX	XX
Y	XY	XY

2/4 = 0.5

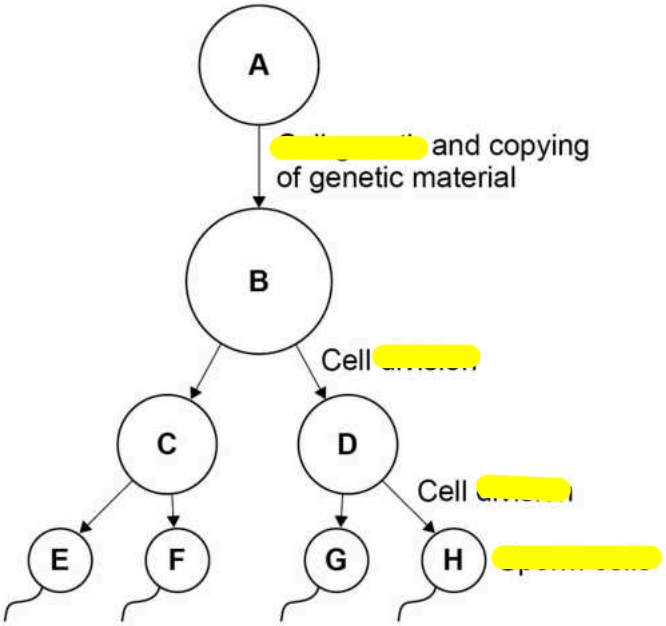
8

Turn over ►

Do not write outside the box

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.

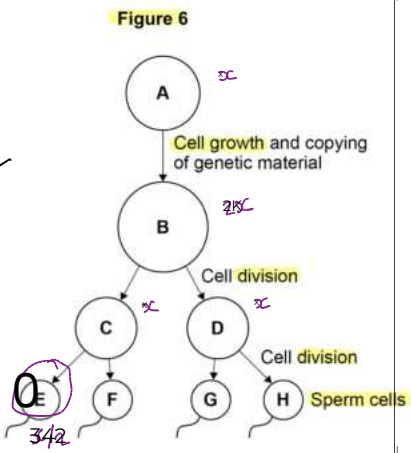
23		✓		46		48		92	

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 ☐



*

Do not write outside the box

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

[1 mark]

Tick (✓) one box.

- bacteria ← bacteria
- Binary fission
- specialisation ← specialisation of cells
- Differentiation
- cells of
- 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 ✓ ✓ change in genetic material

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

Why are the children not genetically identical?

[2 marks]

Different egg / sperm each time, each gamete has different genetic information

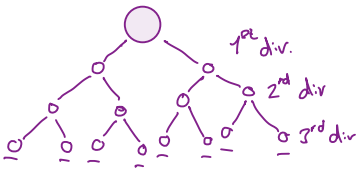
Genes from two parents

Do not write outside the box

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 1. 6 How many cells are there in the embryo after three cell divisions?

Tick (✓) one box.

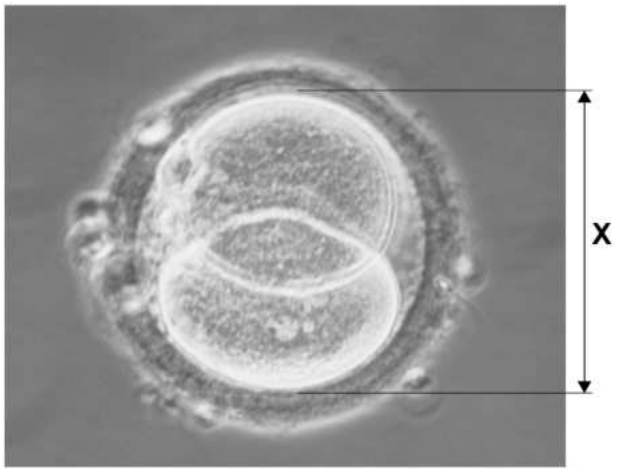
[1 mark]

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= 40 mm

Do not write outside the box

0 3 . 8 The image in Figure 7 has been magnified

×500 Calculate the real length of the embryo.

Use the equation:

image length
real length of the embryo
= magnification

Give your answer in micrometres (µm).

1 mm = 1000 µm

[3 marks]

Image length = 40 mm → 40 × 1000 = 40 000

Magnification = 500 ×

40 000 / 500 = 80

Real length of the embryo = 80 µm

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]

Embryo is very small, so is not seen/felt

(or) lost in normal menstrual flow

13

SThurn oEver for thTe next quSestion

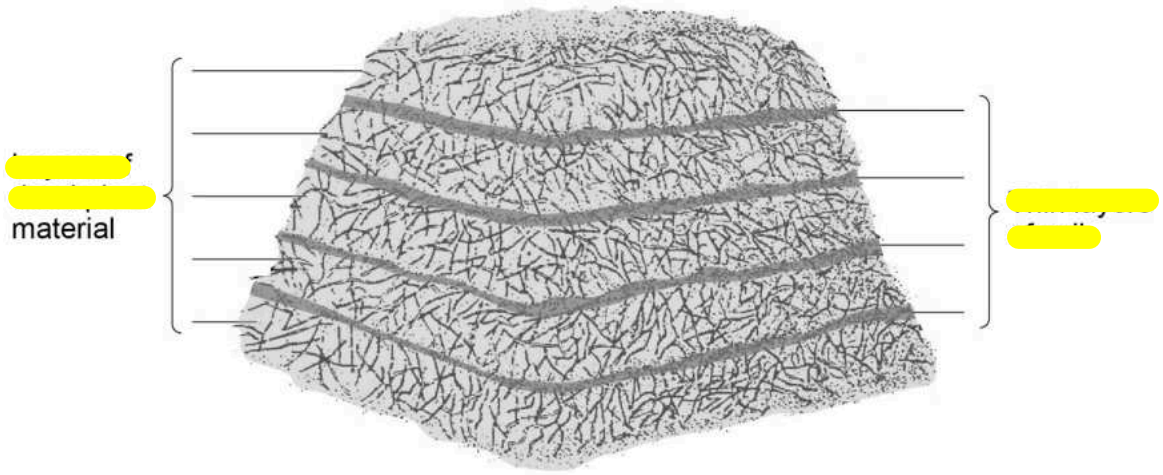
Do not write outside the box

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



m0 4 m. 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 ☐

Do not write outside the box

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]

Both increase rate

Because oxygen is needed for (aerobic) respiration

Increased temperature causes faster reactions

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

Do not refer to oxygen or temperature in your answer.

[1 mark]

water (H_2O)

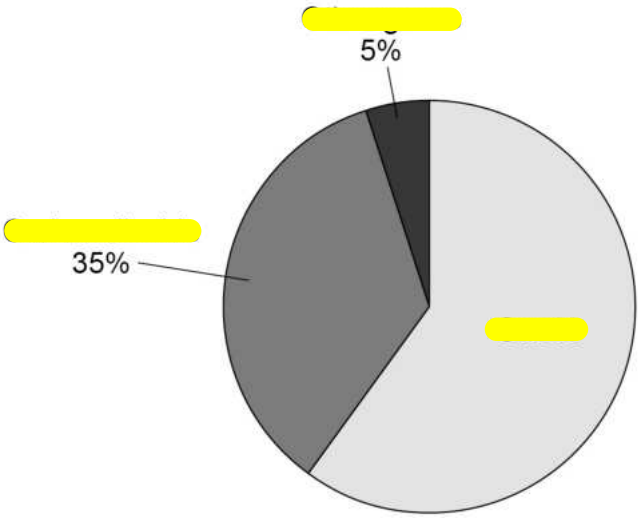
Question 4 continues on the next page

Do not write outside the

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

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 foun

What is gas X?
[1 mark]

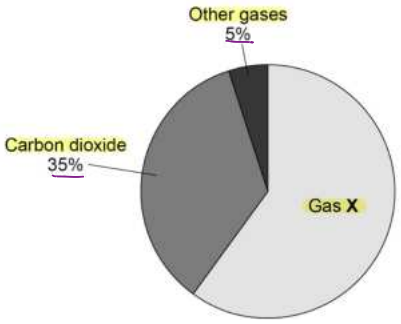
Nitrogen

Do not write outside the box

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

[1 mark]

Figure 9



Total % = 100%

100 − 5 − 35 = 60%

Percentage = 60 %

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]

So plants/crops grow faster

Dead plant material contains mineral ions

↳ fertiliser

↳ Improves drainage

↳ suppresses weed growth

↳ insulates

↳ Improves soil structure

10

Turn over for the next question

EEG

Do not write outside the box

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 ☒

Do not write outside the box

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]

or the dodo's eggs

1 Humans hunted/killed/ate the dodo / ate the dodo's eggs

2 Humans ate the dodos food

Diseases introduced by humans/by imported animals

Humans destroyed dodo habitats

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]

Growing crops / biofuels

Grazing animals

Quarrying/mining

Building houses

Dumping waste

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. ✗ ☐

animals exhale CO_2

There is less photosynthesis. ✓ ☒

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

There is less respiration. ✗ ☐

trees photosynthesise more

The soil dries out. ✗ ☐

The trees are burned. ✓ ☒

combustion produces CO_2

Turn over ▶

*

Do not write outside the box

0 5 . 5 What effect would an increase in carbon dioxide in the atmosphere have on global air temperature? [1 mark]

greenhouse gas → more greenhouse effect → heating

Tick (✓) one box.

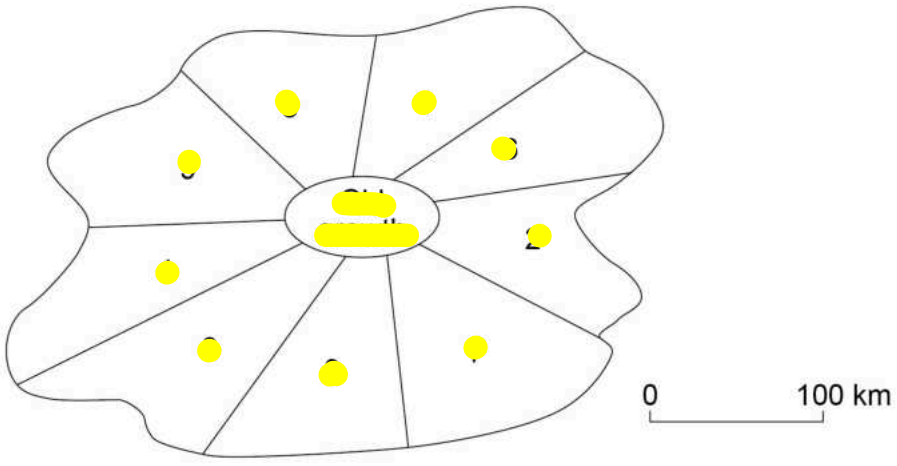
- Decrease ☐
- Increase ☑
- Stay the same ☐

'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



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.

Do not write outside the box

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]

179 → 9 30 years // area 9 × 30 = 270

Number of years = 270

0 5 . 7 The rainforest contains:

• 750 species of trees

• 400 species of birds

• 150 species of b

• many other species of plants and animals.

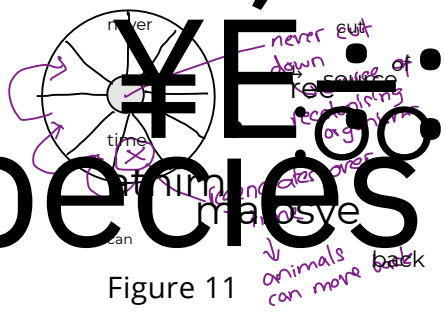


Figure 11

Explain how the pattern of cutting down trees shown in biodiversity of the rainforest being reduced.

stops the

[4 marks]

Displaced animals can move to adjacent zones where suitable habitat is present as trees not cut down. Seeds return to deforested land from other forested areas

Sufficient time for regeneration, plants/trees begin to grow back, so shelter provided (and) food for animals

Animals return to re-growing area

Old growth area source of recolonising organisms

13

Turn over ▶

Do not write outside the box

0 6 Two of the substances the body excretes are urea and carbon dioxide.

0 6 . 1 Complete the sentence.

Choose the answer from the box. [1 mark]

carbohydrate	lipid	protein	salt

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

a lot of protein.

0 6 . 2 Why must urea be excreted from the body? [1 mark]

Urea is a waste product

Urea is toxic / may damage cells / denature proteins

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	permeable	respiration

The process that makes carbon dioxide is -

respiration.

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

the rate of breathing.

*

Do not write outside the box

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 oC	Volume of water consumed in cm3	Relative amount of urine produced by the kidneys
1 30 hotter	hotter	1500	least
2 20		1500	medium
3 15		2000	most

lower temperature ≈ less sweat

Complete Table 2.

[2 marks]

Choose answers from the box.

least	medium	most

TQuesEtion 6 coSntinues oTn the nexSt page

Do not write outside the box

Some people have kidney disease.

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

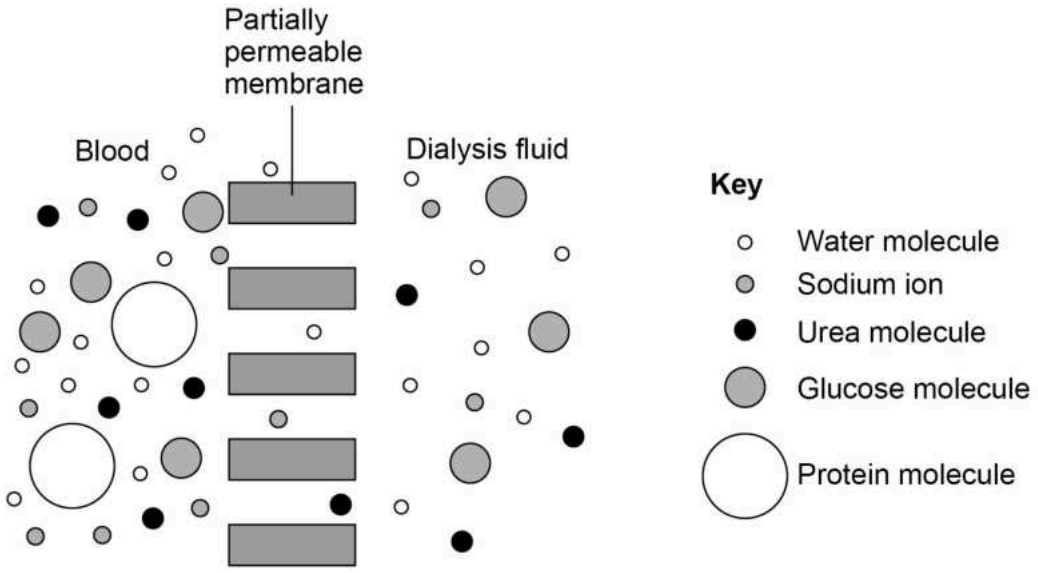
During dialysis, a person is connected to a machine that filters the blood.

• Each dialysis session lasts about 6 hours.

• The person has several dialysis sessions each week.

Figure 12 shows how dialysis works.

Figure 12

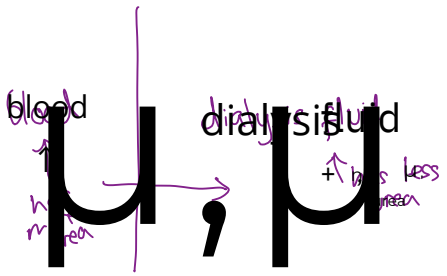


0 6 . 5 How does urea move out of the blood during dialysis? [1 mark]

Tick (✓) one box.

- Movemen ifusn✓tDfio of concentration to along
- Digestion (food)
- Osmosis (water)
- Respiration (breathing)

Movement of substance from area of higher concentration to area of lower concentration along concentration gradient



Do not write outside the box

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

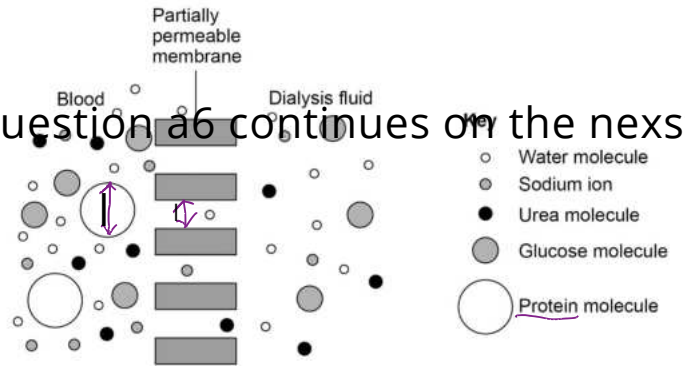
Give the reason for your answer.

[2 marks]

Substance Protein

Reason Molecules too large /allows pores too small in membrane

Figure 12



LQuestion a6 continues on the nexst page

Do not write outside the box

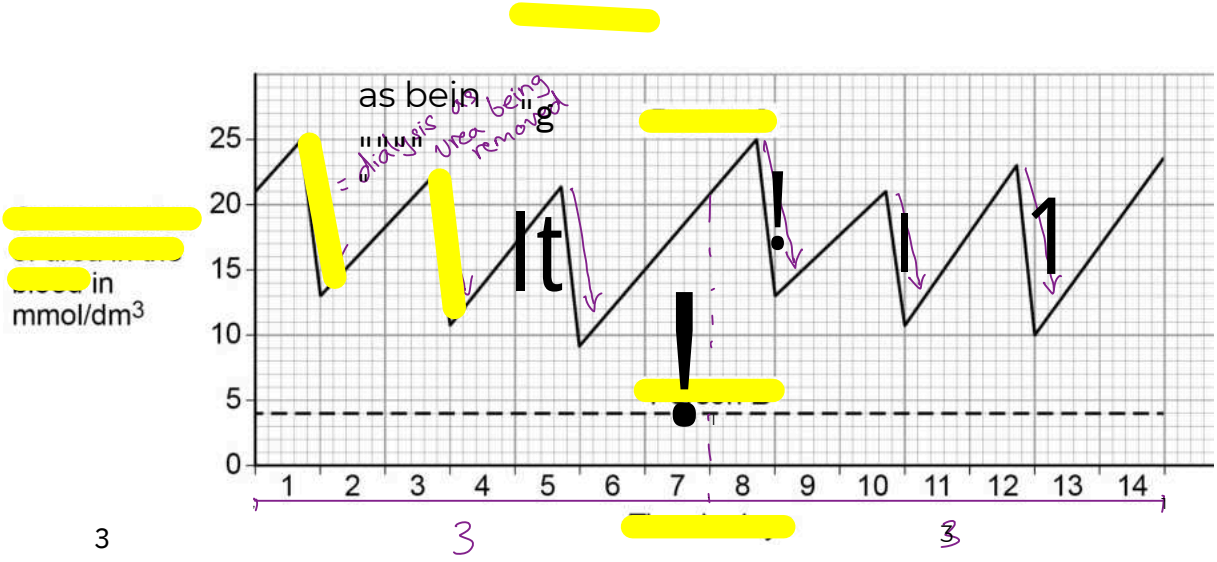
Two people have kidney disease.

• 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



3

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

[1 mark]

3

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

[1 mark]

Increase

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

[2 marks]

1 lowerconcentration of urea ofurea lesshospitalvisits/timeon less restriction on travel

2 constantureaconcentrationno diet restrictions repeated piercing of skin

less hospital visits/time on machine

less restriction on travel

constant urea concentration

no diet restrictions

no repeated piercing of skin

13

*

Do not write outside the box

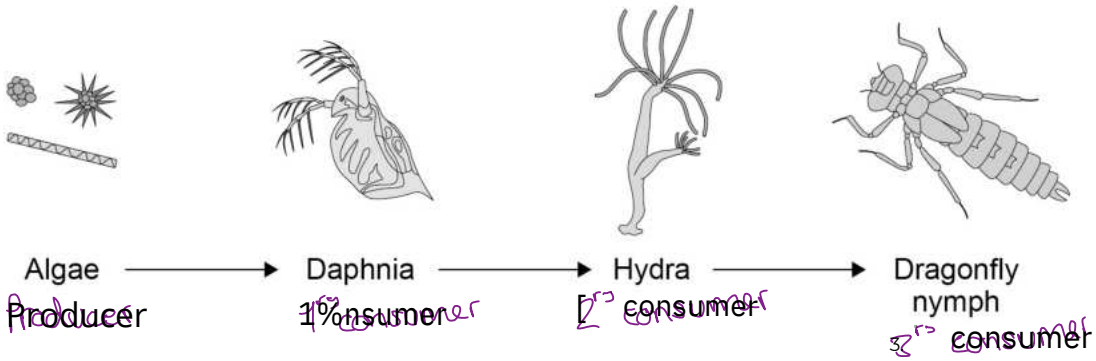
Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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 ☐

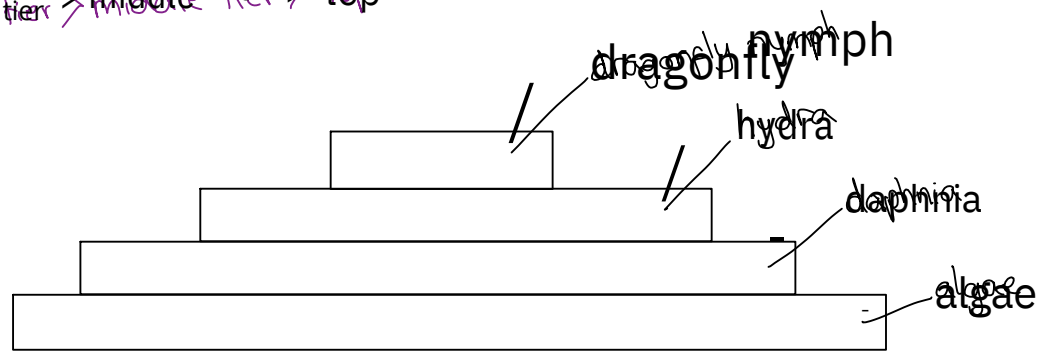
Do not write outside the box

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

Label each trophic level

[2 marks]

- Tiers = number of different organisms (or different levels)
- Bottom tier > middle tier > top tier



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]

Not all absorbed

- Use in respiration / lost as CO_2
- Non-digestible parts lost in faeces
- Lost in urine
- Algae not all eaten

Question 7 continues on the next page

Do not write outside the box

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

This is the method used.

1. Collect 1 dm3 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 dm3 water
1	5
2	21
3	0
4	16
5	28

0 7 . 4 Calculate the mean number of Daphnia in 1 m3 of pond water.

1 m = 1000 dm

sum of values / no. values

no. values

[2 marks]

$\frac{5+21+16+28}{5} = 14$

$14 \times 1000 = 14000$

Mean number of Daphnia in 1 m3 of pond water = 14000

Do not write outside the box

0 7 . 5 The pond was a rectangular shape, measuring:

• length = 2.5 metres

• width = 1.5 metres

Volume =

• depth = 0.5 metres.

Volume = length × width × depth

Mean no. daphnia in 1m² = 14000

Calculate the estimated number of Daphnia in the pond.

Use your answer from Question 07.4.

Give your answer in ~~standard form.~~ ← $y \times 10^x$ $0 < y < 10$

[4 marks]

Volume of pond $2.5 \times 1.5 \times 0.5 = 1.875\ m^3$ ✓

Daphnia in $1.875\ m^3$ = $1.875 \times 14000 = 26250$ ✓

2.625×10^4 ✓

Number of Daphnia in the pond = 2.625×10^4

Question 7 continues on the next page

Do not write outside the box

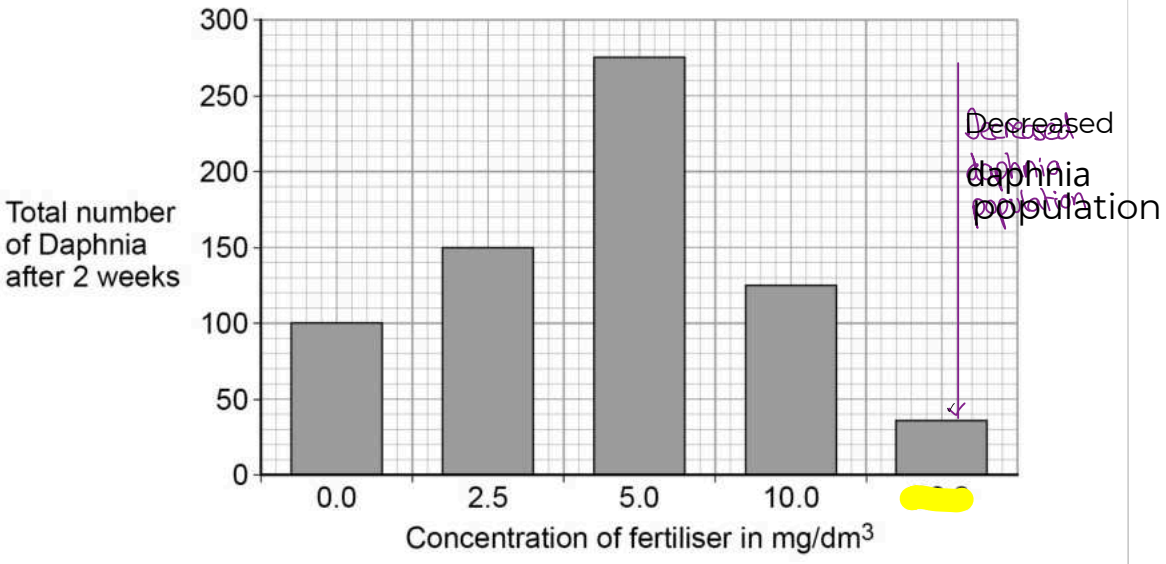
Rainfall can cause fertiliser to be washed from farmland into a pond.

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.

Figure 15



0 7 . 6 A concentration of 5.0 mg/dm3 of fertiliser caused a large increase in the population of Daphnia.

Explain why.

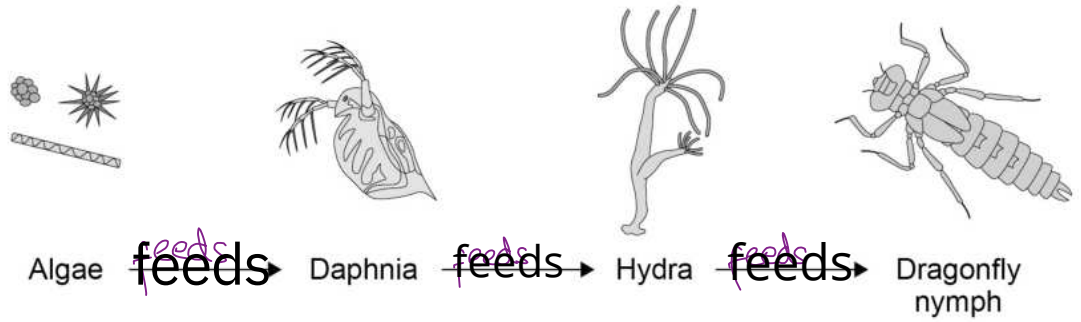
[2 marks]

- Increased growth of algae, so more food for Daphnia

Do not write outside the box

0 7 . 7 Figure 14 is repeated below.

Figure 14



The population of Hydra will decrease when 20 mg/dm3 of fertiliser is added to the pond.

Explain why.

[2 marks]

Hydra have less food because there are fewer Daphnia

14

Turn over for the next question

Do not write outside the box

0 8 Genetic material is made of DNA.

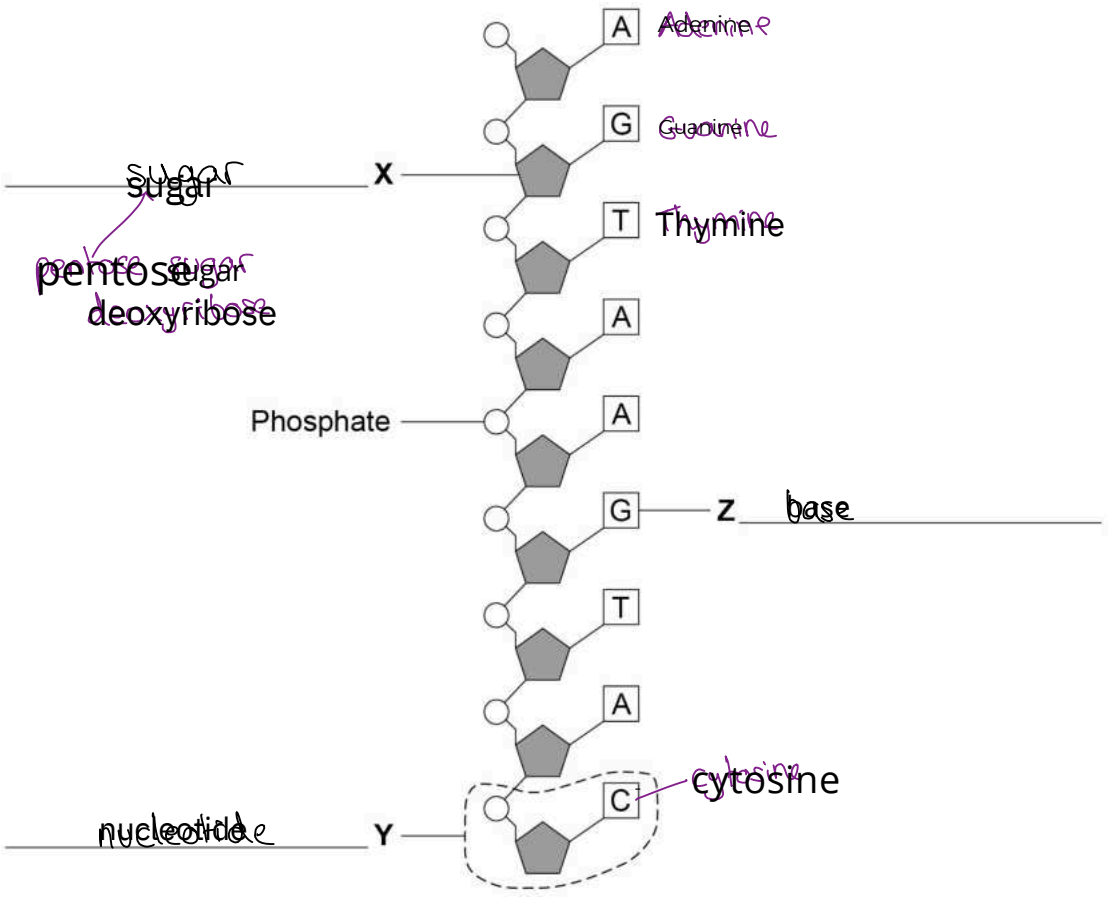
0 8 . 1 Which structures in the nucleus of a human cell contain DNA?

[1 mark]

chromosomes

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

*

Do not write outside the box

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

What scientific term describes this structure?

[1 mark]

double helix

~~amino acid~~ = ~~three~~ bases

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 diagnosis of genetic disorders

understanding evolution / ancestry

diagnosis of genetic disorders

2 treatment for inherited disorders

tracing human migration patterns

for inherited disorders

8

Turn over for the next question

Do not write outside the box

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

geotropism hydrotropism thermotropism

Stimulus

gravity water heat

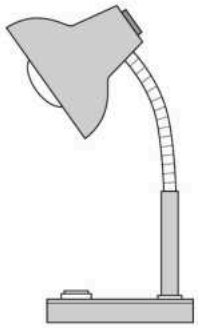
0 9 . 2 Plan an investigation to show the effect of light from one direction on the growth of plant seedlings.

Include details of any controls needed.

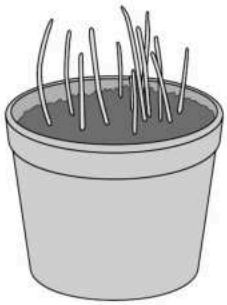
You may use some of the equipment shown in Figure 17 and any other laboratory apparatus.

[6 marks]

Figure 17

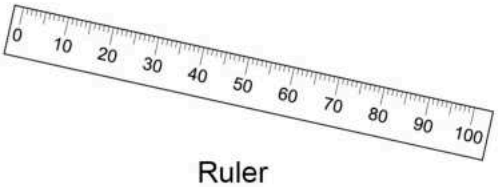


Lamp

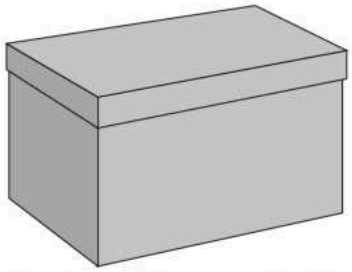


Several pots of seedlings

Scissors



Ruler



Cardboard boxes with lids

Do not write outside the box

Method must lead to a valid outcome
Must be sequenced in a logical order

- Use several pots of seedlings that will be given the same amount of water and the same temperature and soil type
- Have one pot of seedlings in an area where there is light all around
- Have other pots of seedlings in boxes with lids and a hole in one with lamp light shining through
- Measure seedling height at the beginning of the experiment, straightening them out against a ruler and calculate an average for each pot and measure again three days later using the same method
- Calculate the mean height increase for each group
- Use a protractor to measure the angle of bending and compare with the direction of light entry

0 9 . 1

[3 marks]

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

IB/M/Jun19/8461/2F

Plant leaves receive more light so photosynthesis occurs and the plant produces more glucose

starch/carbohydrate/organic material

*

3 7 *

11

END OF QUESTIONS

Do not write outside the box

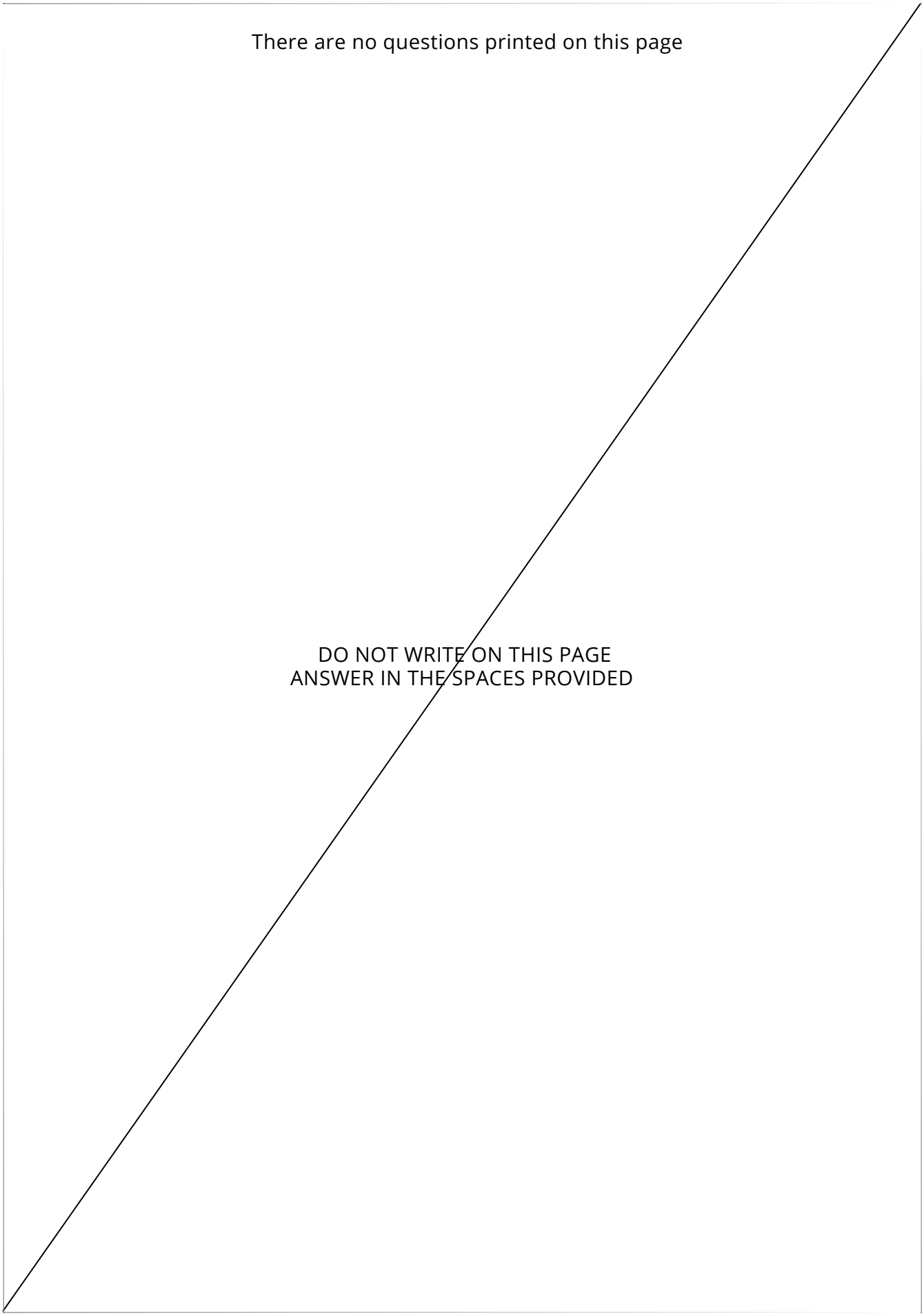
There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED



Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED