



Surname _____

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Candidate Number _____

Candidate Signature _____

I declare this is my own work.

**GCSE
COMBINED SCIENCE: SYNERGY**

F

8465/1F

Foundation Tier

Paper 1 Life and Environmental Sciences

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]



J U N 2 2 8 4 6 5 1 F 0 1

MATERIALS

For this paper you must have:

- **a ruler**
- **a protractor**
- **a scientific calculator**
- **the periodic table (enclosed)**
- **the Physics Equations Sheet (enclosed).**

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Pencil should only be used for drawing.**
- **Answer ALL questions in the spaces provided. Do not write on blank pages.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **In all calculations, show clearly how you work out your answer.**



INFORMATION

- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

DO NOT TURN OVER UNTIL TOLD TO DO SO



0	1
---	---

There are many different types of cell in the human body.

Each type of body cell is specialised for a different function.

0	1	.	1
---	---	---	---

**On page 5, draw ONE line from each type of cell to the function of that cell.
[3 marks]**

TYPE OF
CELL

FUNCTION

Gland

To carry impulses

Muscle

To contract

Neurone

To produce hormones

To transport oxygen

[Turn over]



FIGURE 1 shows a doctor testing a reflex action of a patient.

FIGURE 1



When the doctor touches the patient's foot with a blunt rod, the patient's toes curl.

0	1	.	2
---	---	---	---

Where are the receptors in this reflex action? [1 mark]

Tick (✓) ONE box.

☐

In the brain

☐

In the foot

☐

In the leg

[Turn over]



0	1	.	3
---	---	---	---

What is the coordinator in this reflex action? [1 mark]

Tick (✓) ONE box.

☐

The blunt rod

☐

The central nervous system

☐

The sensory neurone



0	1	.	4
---	---	---	---

What is the response in this reflex action? [1 mark]

Tick (✓) ONE box.

☐

Feeling the blunt rod

☐

The blunt rod touching the skin

☐

The toes curling

[Turn over]



0	1	.	5
---	---	---	---

Muscle cells use oxygen for respiration.

Explain why muscle cells need to respire. [2 marks]

8



0	2
---	---

Fatty material can build up in coronary arteries.

The flow of blood through coronary arteries may be reduced.

0	2	.	1
---	---	---	---

Which organ contains coronary arteries?
[1 mark]

[Turn over]



0	2	.	2
---	---	---	---

There are different treatments for coronary diseases.

**On page 13, draw ONE line from each treatment to how the treatment works.
[3 marks]**



TREATMENT

**Replacement
valve**

Statin

Stent

How the treatment works

**Keeps coronary
arteries open**

**Makes sure blood
flows in one
direction**

**Reduces blood
cholesterol
concentration**

**Reduces blood
glucose
concentration**

[Turn over]



0	2	.	3
---	---	---	---

Some medical drugs can be produced using genetically modified (GM) bacteria.

How are GM bacteria produced?
[1 mark]

Tick (✓) ONE box.

☐

All genes are removed from the bacteria.

☐

Bacteria are grown in a solution of the drug.

☐

Genes are transferred into the bacteria.



0	2	.	4
---	---	---	---

What is ONE benefit of producing drugs using GM bacteria? [1 mark]

Tick (✓) ONE box.

☐ **Large quantities of the drug can be produced.**

☐ **Non-GM bacteria live longer than GM bacteria.**

☐ **The GM bacteria that produce the drug are very infectious.**

[Turn over]



Scientists are investigating the production of organs from GM animals for transplanting into humans.

0 2 . 5

What is an advantage of using organs from GM animals compared with using organs from human donors? [1 mark]

Tick (✓) ONE box.

☐

Organs from GM animals are less likely to be rejected by the human immune system.

☐

Organs from GM animals are not likely to function correctly.

☐

There are more human donors than the number of people who need a transplant.



0	2	.	6
---	---	---	---

Suggest ONE reason why some people disagree with the use of GM animals.
[1 mark]

8

[Turn over]

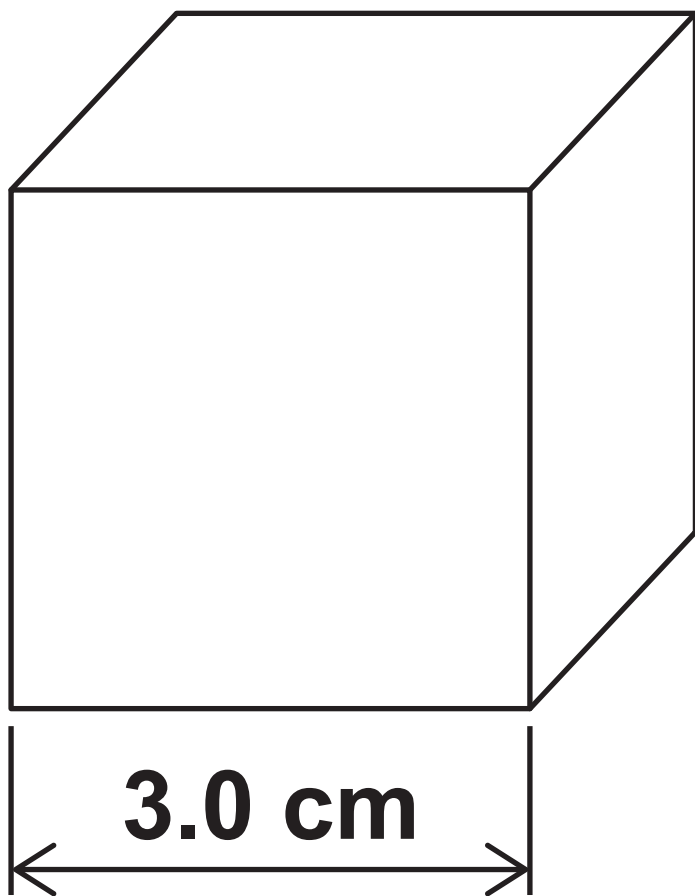


0	3
---	---

A student investigated the mass, volume and density of some solid metal cubes.

**FIGURE 2 shows one of the cubes.
The length of one side is shown.**

FIGURE 2



0	3	.	1
---	---	---	---

Name a piece of equipment the student could use to measure the length of one side of the cube. [1 mark]

[Turn over]

0	3	.	2
---	---	---	---

**What is the volume of the cube in
FIGURE 2? [1 mark]**

Tick (✓) ONE box.

☐

6.0 cm³

☐

9.0 cm³

☐

27.0 cm³

☐

54.0 cm³



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[Turn over]



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

A different cube has a mass of 13 g.

The volume of this cube is 8.0 cm³.

Calculate the density of the cube.

Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Give your answer to 2 significant figures.
[3 marks]



Density (2 significant figures) =

 g/cm³

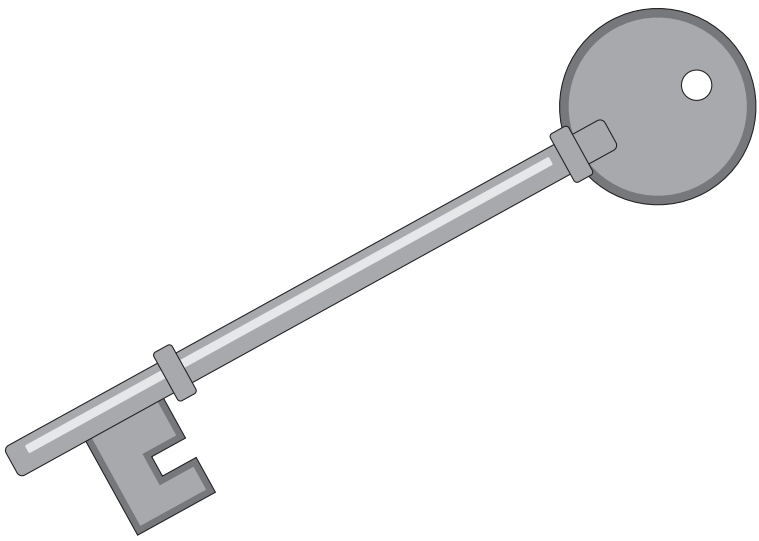
[Turn over]



The student also investigated the density of a key.

FIGURE 3 shows the key.

FIGURE 3



0	3	.	4
---	---	---	---

Which piece of equipment could be used to measure the mass of the key?
[1 mark]

Tick (✓) ONE box.

☐

Balance

☐

Stopwatch

☐

Thermometer

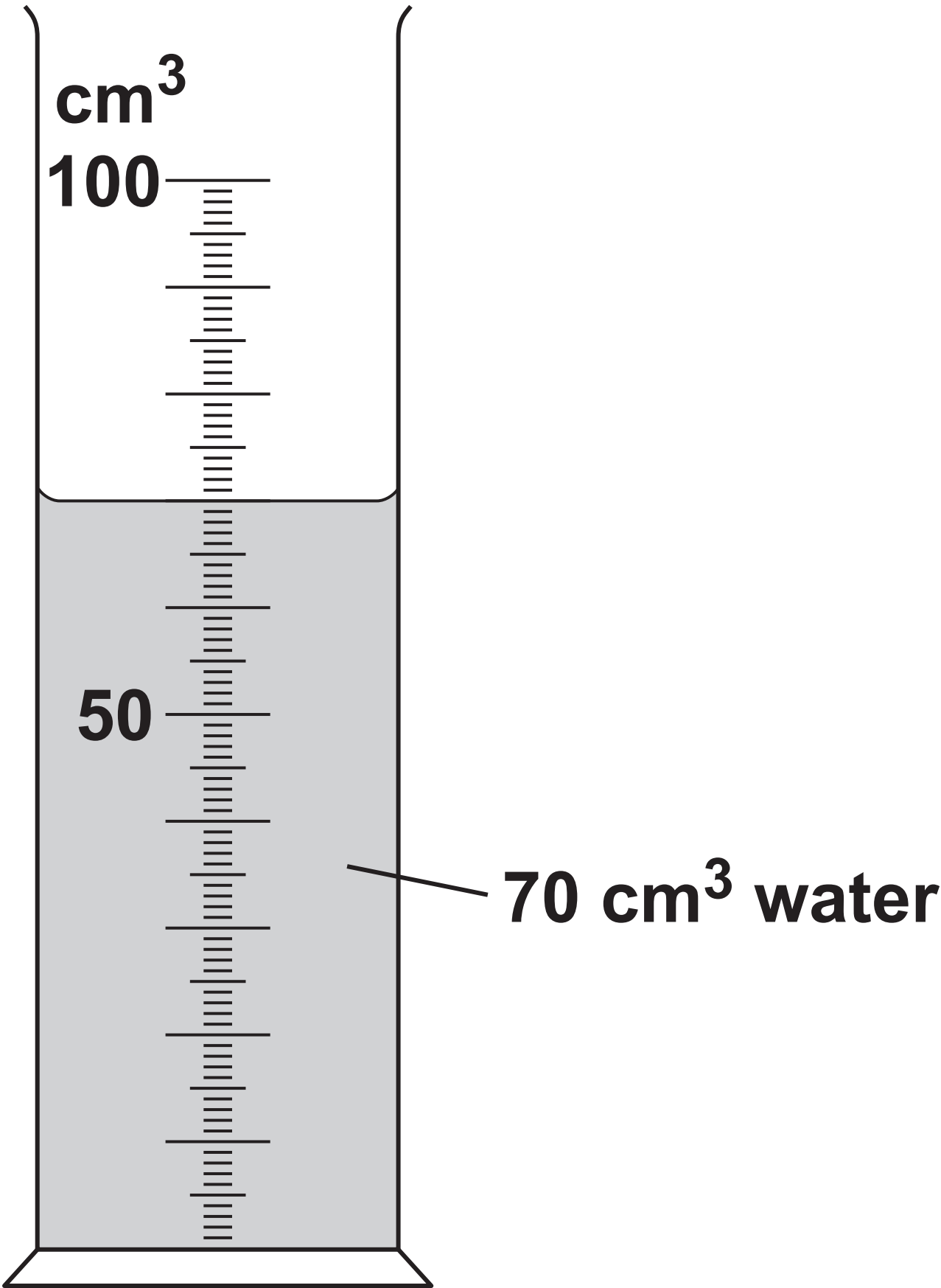
[Turn over]



03 . 5

FIGURE 4 shows a measuring cylinder containing water.

FIGURE 4



**Describe how the equipment in
FIGURE 4 could be used to measure the
volume of the key. [2 marks]**

8

[Turn over]



0	4
---	---

Classification of living organisms has changed over time.

0	4	.	1
---	---	---	---

Complete the sentences about classification.

Choose answers from the list. [2 marks]

age

appearance

DNA

mass



Traditional classification placed organisms in groups based on

Modern classification places organisms in groups based on

[Turn over]





Cabbage and cauliflower plants are both the same species, ‘Brassica oleracea’.

0 4 . 2

**What is the genus name of cabbage and cauliflower?
[1 mark]**

30

Tick (✓) ONE box.

☐

Brassica

☐

Brassica oleracea

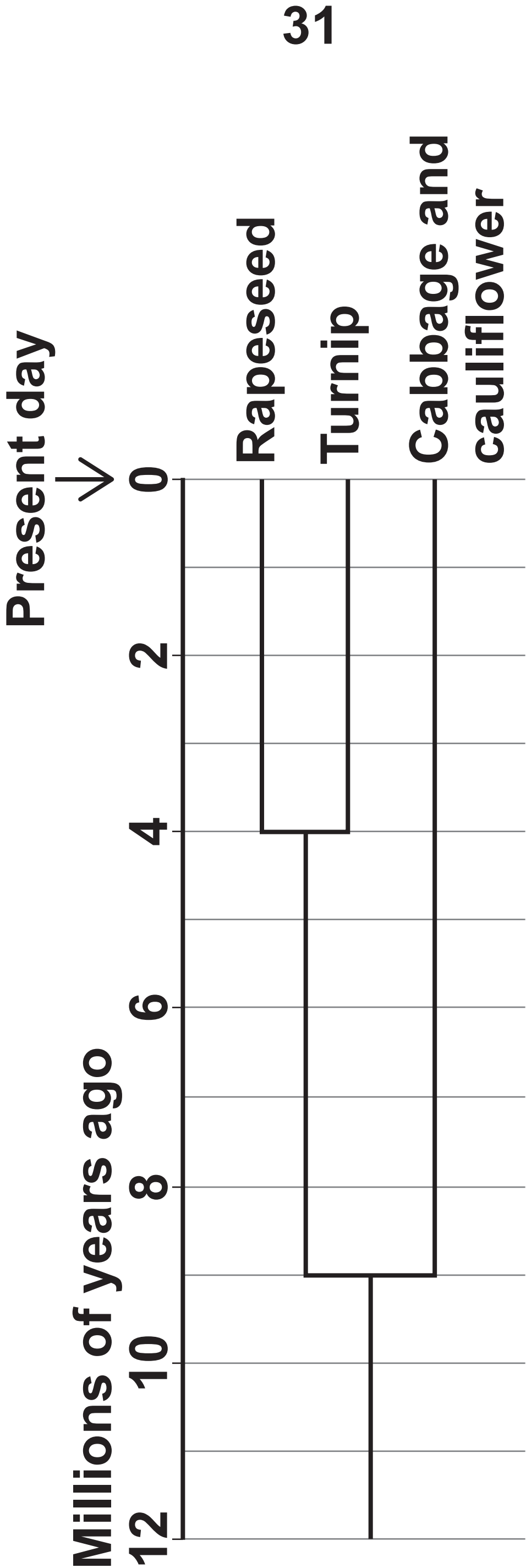
☐

Oleracea



FIGURE 5 shows the evolution of some plants.

FIGURE 5



[Turn over]

0	4	.	3
---	---	---	---

Cabbage and cauliflower evolved into a new species 9 million years ago.

Rapeseed and turnip evolved more recently.

How many million years ago did rapeseed and turnip evolve into two species? [1 mark]

_____ million years ago



0	4	.	4
---	---	---	---

Rapeseed is grown to produce rapeseed oil for cooking.

Complete the sentence.

Choose the answer from the list.
[1 mark]

carbohydrate

lipid

protein

Rapeseed oil is a type of

_____ .

[Turn over]



0	4	.	5
---	---	---	---

Farmers have gradually changed ‘Brassica oleracea’ over thousands of years to produce different varieties.

Which process produced the different varieties of ‘Brassica oleracea’?
[1 mark]

Tick (✓) ONE box.

☐

Active transport

☐

Selective breeding

☐

Transpiration



Scientists investigated the genome of cabbage and the genome of cauliflower.

0 4 . 6

What does genome mean? [1 mark]

Tick (✓) ONE box.

☐

A mutation in the DNA

☐

All of the DNA in an organism

☐

The DNA in one gene

[Turn over]

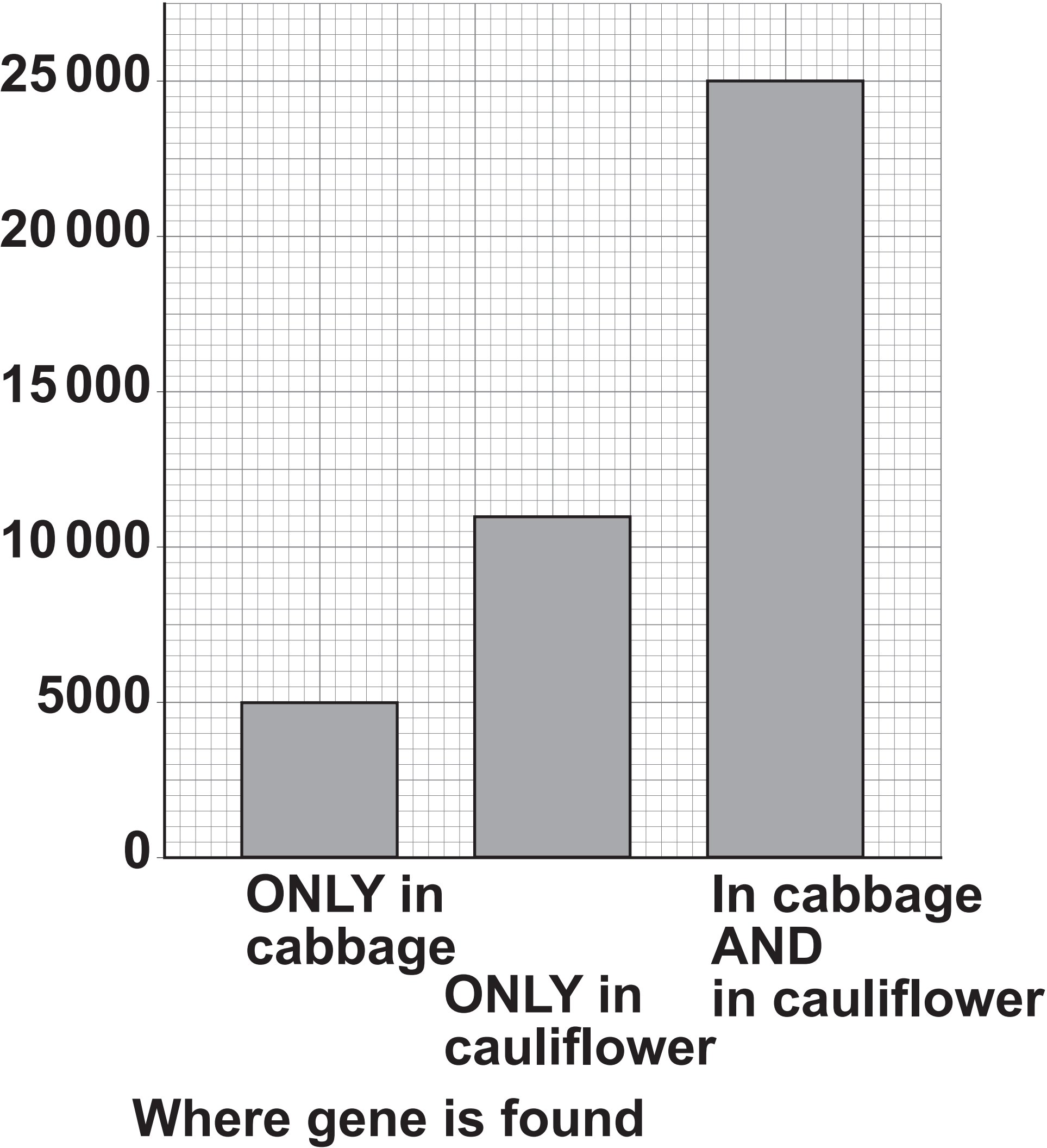


Cabbage and cauliflower have some of the same genes.

FIGURE 6, on page 37, shows the number of genes found:

- **ONLY in cabbage**
- **ONLY in cauliflower**
- **in cabbage AND in cauliflower.**

FIGURE 6
Number of genes



[Turn over]



04 . 7

Cabbage contains a total of 30 000 genes.

Calculate the percentage of genes in cabbage that are found in both cabbage AND cauliflower.

Use the equation:

$$\text{percentage} = \frac{\text{number of genes found in cabbage AND in cauliflower}}{\text{total number of genes in cabbage}} \times 100$$

[3 marks]



Percentage = _____ %

[Turn over]

0	4	.	8
---	---	---	---

How does FIGURE 6, on page 37, provide evidence that cabbage and cauliflower are closely related? [1 mark]

Tick (✓) ONE box.

☐

Cabbage and cauliflower contain the same number of genes.

☐

More genes are only found in cauliflower than only in cabbage.

☐

Most genes are the same in cabbage and in cauliflower.

0	5
---	---

Chlamydia, HIV and human papillomavirus (HPV) are sexually transmitted diseases (STDs).

0	5	.	1
---	---	---	---

Which other disease is sexually transmitted? [1 mark]

Tick (✓) ONE box.

☐

Flu

☐

Gonorrhoea

☐

Malaria

☐

Measles

[Turn over]



Students were asked to estimate the percentage risk of a person becoming infected with different STDs.

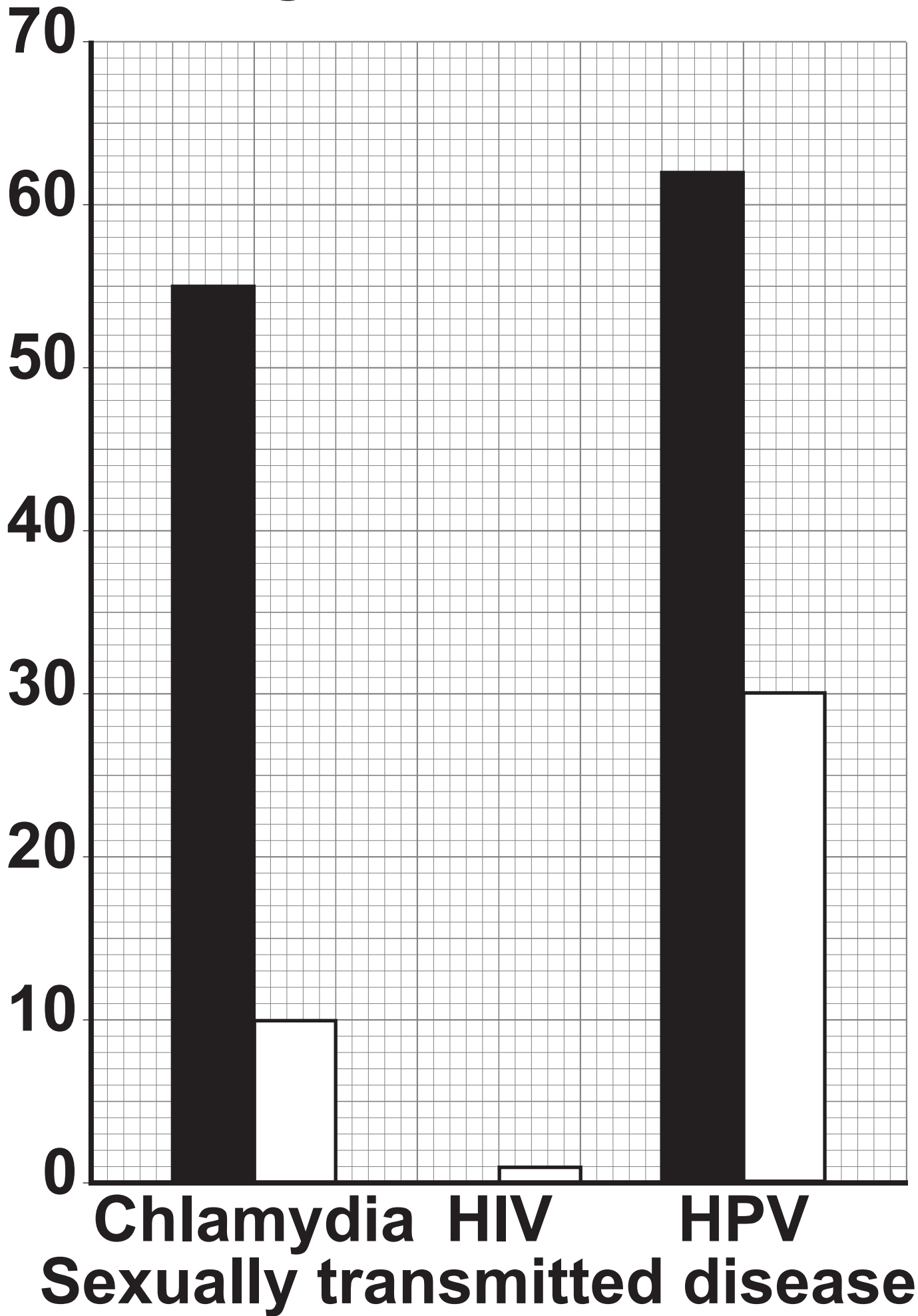
The estimate was compared to the actual percentage risk of infection.

FIGURE 7, on page 43, shows the results.



FIGURE 7

Percentage (%) risk of becoming infected

**KEY**

■ **Estimated risk** □ **Actual risk**

[Turn over]



05 . 2

The students estimated that the risk of HIV infection was 60%.

**Plot the students' estimated risk of HIV infection on FIGURE 7 on page 43.
[1 mark]**

05 . 3

Which STD in FIGURE 7 shows the greatest ACTUAL risk? [1 mark]



0	5	.	4
---	---	---	---

Calculate the difference between the estimated risk and the actual risk of becoming infected with chlamydia.
[2 marks]

Difference = _____ %

[Turn over]



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

What conclusion can be made about the estimated risk of infection compared to the actual risk of infection with STDs?
[1 mark]

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

Name ONE type of contraception that can control the spread of chlamydia.
[1 mark]



0	5	.	7
---	---	---	---

Patients with HPV infections are at increased risk of cancer.

Suggest what effect HPV has on human DNA. [1 mark]

8

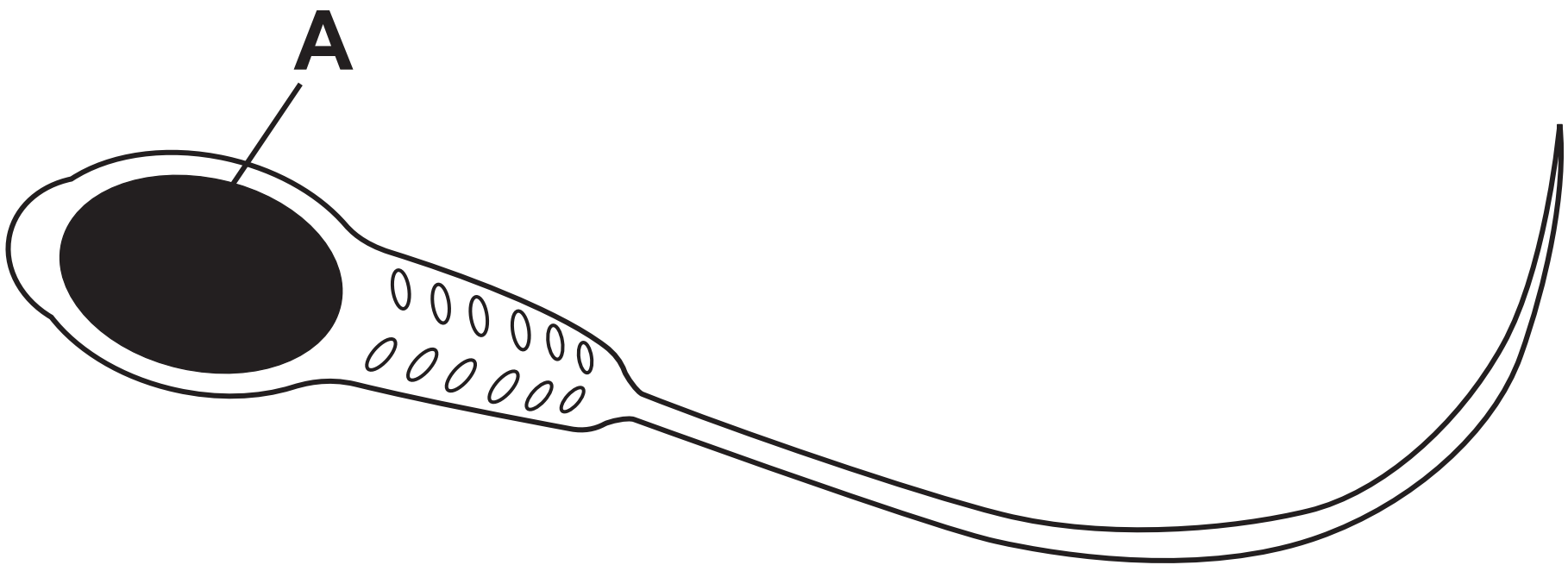
[Turn over]



0	6
---	---

FIGURE 8 shows a human sperm cell.

FIGURE 8



0	6	.	1
---	---	---	---

Cell part A contains DNA.

Name part A. [1 mark]

0	6	.	2
---	---	---	---

Describe the structure of DNA.
[2 marks]

[Turn over]



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0	6	.	3
---	---	---	---

Sperm cells are male gametes.

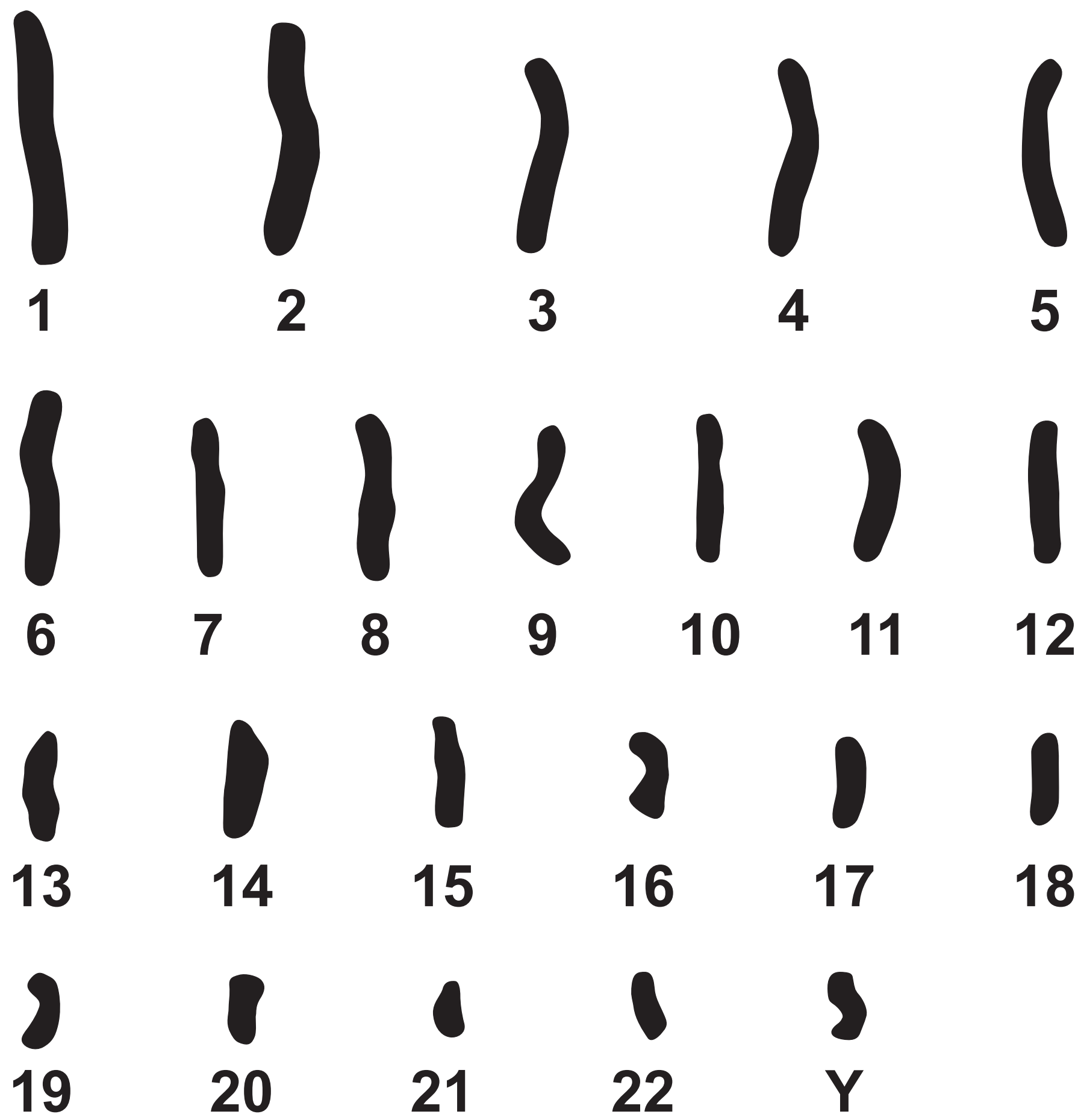
What are female gametes called?
[1 mark]

[Turn over]



FIGURE 9 shows the chromosomes in a sperm cell.

FIGURE 9



0	6	.	4
---	---	---	---

Describe ONE difference between the chromosomes in a sperm cell and the chromosomes in a liver cell. [1 mark]

[Turn over]



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

A sperm with the same chromosomes as those in FIGURE 9, on page 52, fertilises a female gamete.

Explain what sex the offspring would be.

Use information from FIGURE 9 in your answer. [4 marks]

[Turn over]



07

This question is about atomic structure.

07 . 1

An atom contains three types of particles.

TABLE 1 shows some information about the particles.

TABLE 1

Name of particle	Charge
Electron	−1
Neutron	
Proton	

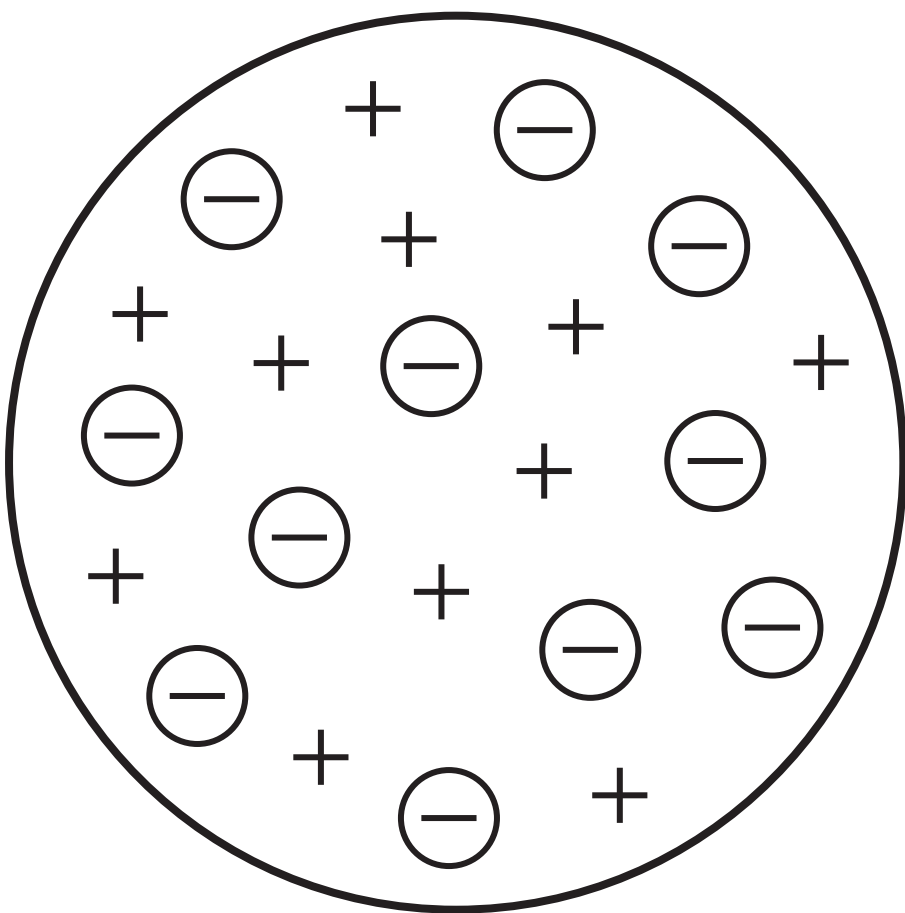
Complete TABLE 1. [2 marks]

0	7	.	2
---	---	---	---

Models of the atom have changed over time.

FIGURE 10 shows an early model of the atom.

FIGURE 10



[Turn over]



What is the name of the model of the atom in FIGURE 10? [1 mark]

Tick (✓) ONE box.

☐

Dalton's model

☐

Nuclear model

☐

Plum pudding model



Alpha particles can be used to investigate the structure of atoms.

0 7 . 3

Alpha particles have a relative mass of 4.

What is an alpha particle? [1 mark]

Tick (✓) ONE box.

☐

Two electrons and two neutrons

☐

Two neutrons and two protons

☐

Two protons and two electrons

[Turn over]





Alpha particles from a source were directed at thin gold foil.

FIGURE 11 shows some of the paths the alpha particles followed.

FIGURE 11

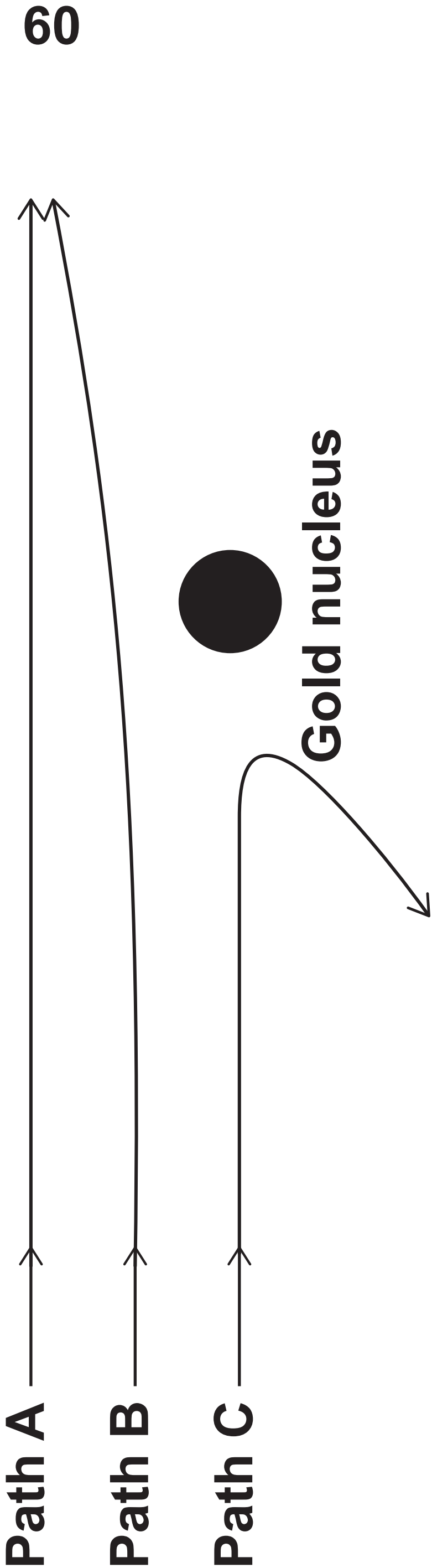


TABLE 2 shows the number of alpha particles that followed paths A, B and C.

TABLE 2

PATH	Number of alpha particles
A	8 289 864
B	7 920
C	198

[Turn over]

0	7	.	4
---	---	---	---

The number of alpha particles on path A was greater than the number of alpha particles on path B.

Calculate how many times greater.
[2 marks]

Number of times greater =



0	7
---	---

 .

5

The ratio of alpha particles on path B to alpha particles on path C can be shown as:

7920 : 198

What is 7920 : 198 written as its simplest ratio? [1 mark]

Tick (✓) ONE box.

☐

40 : 1

☐

500 : 1

☐

8000 : 1

[Turn over]



0	7	.	6
---	---	---	---

How does FIGURE 11, on page 60, provide evidence for a nucleus in a gold atom? [1 mark]

Tick (✓) ONE box.

☐

Alpha particles following path C are bounced back.

☐

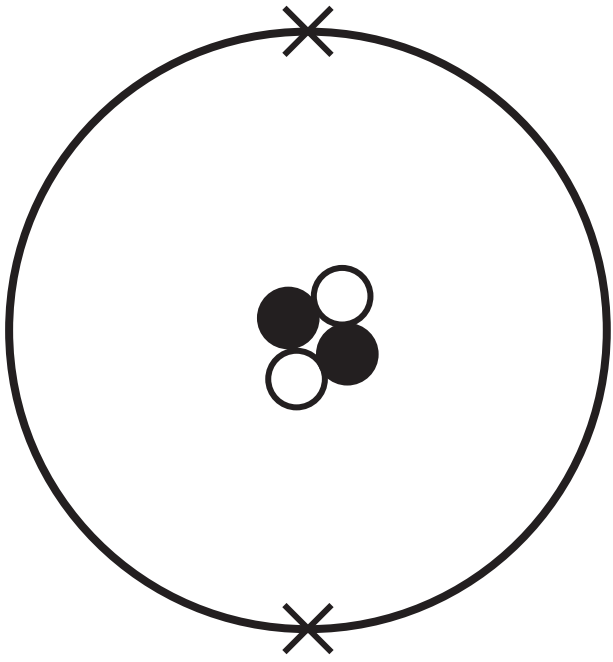
Most alpha particles follow path A.

☐

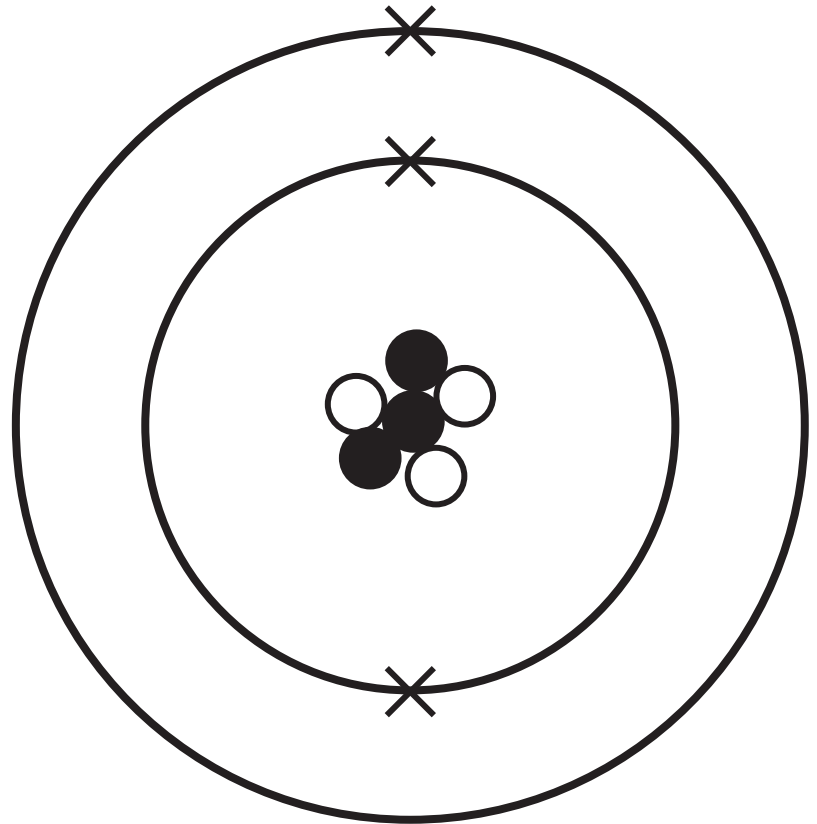
The alpha particles from the source travel in straight lines.

FIGURE 12 represents four atoms.

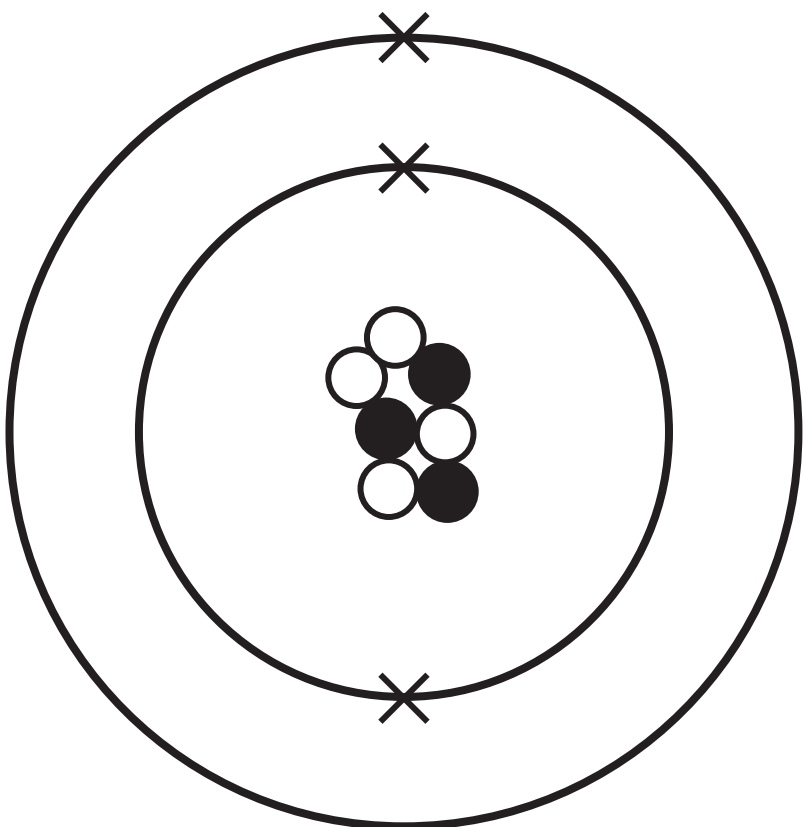
FIGURE 12



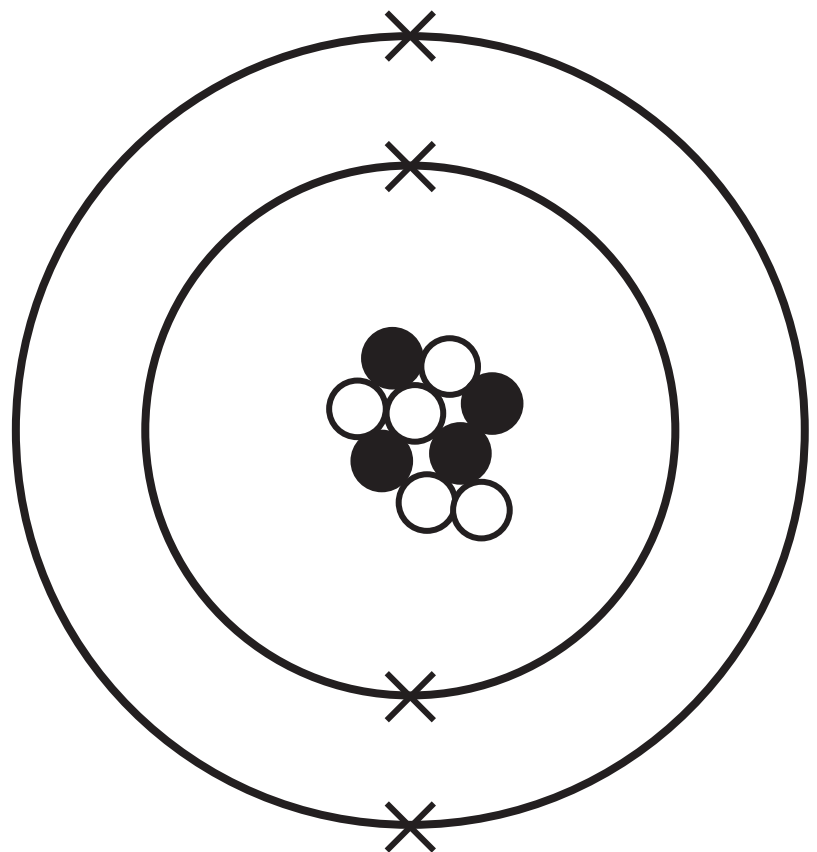
W



X



Y



Z

[Turn over]



0 7 . 7

On the periodic table, helium is shown as:



Which atom in FIGURE 12 represents an atom of helium? [1 mark]

Tick (✓) ONE box.

☐

W

☐

X

☐

Y

☐

Z



0	7
---	---

 .

8

Which TWO atoms in FIGURE 12 represent isotopes of the same element?
[1 mark]

Tick (✓) ONE box.

☐

W and X

☐

W and Z

☐

X and Y

☐

Y and Z

[Turn over]



0	7	.	9
---	---	---	---

An atom has a radius of 0.182 nm.

Calculate the radius of the atom in metres.

1 m = 1 000 000 000 nm [1 mark]

Radius = _____ m

11



BLANK PAGE

[Turn over]



0	8
---	---

The human immune system responds to pathogens entering the body.

0	8	.	1
---	---	---	---

Which part of the blood is responsible for an immune response? [1 mark]

Tick (✓) ONE box.

☐

Platelets

☐

Red blood cells

☐

White blood cells



0	8	.	2
---	---	---	---

Some pathogens release toxins in the body.

Name the type of substance produced in the body that destroys the toxins.

[1 mark]

[Turn over]



0 8 . 3

Cells in the immune system engulf pathogens.

**What is the name of this process?
[1 mark]**

Plants release pollen.

0 8 . 4

The human breathing system has defences against the entry of pollen and pathogens.

Draw ONE line from each adaptation of the breathing system to the description of that adaptation. [2 marks]



ADAPTATION

DESCRIPTION

Cilia

A sticky liquid that can trap pollen

Mucus

A type of acid that can destroy pollen

Hair-like structures that can move pollen

[Turn over]



0	8	.	5
---	---	---	---

The immune response to pollen is an example of an allergy.

Suggest TWO symptoms of an allergy to pollen. [2 marks]

1 _____

2 _____



0	8	.	6
---	---	---	---

An allergy to pollen CANNOT be treated using antibiotics.

Suggest why. [1 mark]

[Turn over]



08 . 7

Explain ONE problem caused by the overuse of antibiotics. [2 marks]



BLANK PAGE

[Turn over]



0	9
---	---

Ultraviolet, infrared and visible light are part of the electromagnetic spectrum.

0	9	.	1
---	---	---	---

Ultraviolet radiation and infrared radiation are emitted by some objects.

Give ONE use of ultraviolet radiation and ONE use of infrared radiation. [2 marks]

Ultraviolet radiation _____

Infrared radiation _____

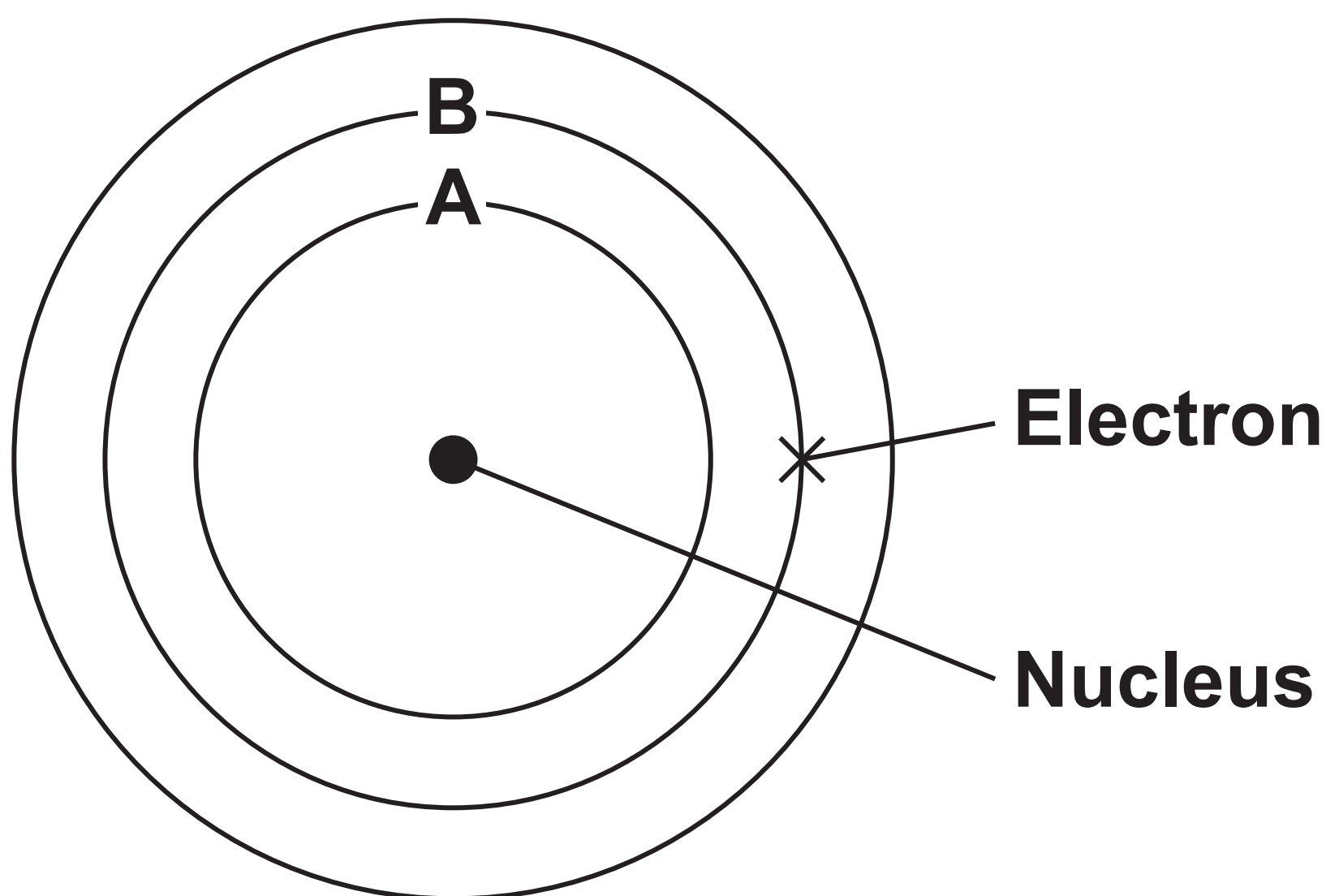


0	9	.	2
---	---	---	---

Neon atoms can absorb electromagnetic radiation.

FIGURE 13 shows three of the energy levels around the nucleus of a neon atom.

FIGURE 13



The atom in FIGURE 13 has absorbed electromagnetic radiation.

[Turn over]



**What happens as an electron moves from energy level B to energy level A?
[1 mark]**

Tick (✓) ONE box.

☐

Light is absorbed

☐

Light is emitted

☐

Light is reflected



An electromagnetic wave has a speed of 300 000 000 m/s.

0 9 . 3

What is the speed of the wave in standard form? [1 mark]

Tick (✓) ONE box.

☐ **3.0×10^7 m/s**

☐ **3.0×10^8 m/s**

☐ **3.0×10^9 m/s**

[Turn over]



Use the Physics Equations Sheet to answer questions 09.4 and 09.5.

09 . 4

Write down the equation that links frequency (f), wavelength (λ) and wave speed (v). [1 mark]



0 9 . 5

The electromagnetic wave has a frequency of 750 000 Hz.

Calculate the wavelength of the electromagnetic wave.

Give the unit. [4 marks]

[Turn over]



Wavelength = _____

Unit _____



BLANK PAGE

[Turn over]



1	0
---	---

Students investigated the effect of different concentrations of salt solution on the mass of pieces of potato.

This is the method used.

- 1. Cut three pieces of potato, each with a mass of 2.00 g.**
- 2. Place the pieces of potato into a salt solution with a concentration of 0.2 mol/dm³.**
- 3. After 30 minutes, measure the mass of each piece of potato.**
- 4. Calculate the change in mass.**
- 5. Repeat steps 1 to 4 for five other concentrations of salt solution.**



TABLE 3 shows the results.

TABLE 3

Concentration of salt solution in mol/dm³	Change in mass in g			Mean change in mass in g
0.2	0.31	0.34	0.25	0.30
0.4	-0.07	-0.08	-0.13	-0.09
0.6	-0.18	-0.13	-0.11	-0.14
0.8	-0.24	-0.19	-0.17	-0.20
1.0	-0.22	-0.30	-0.32	-0.28
1.2	-0.26	-0.35	-0.32	X

[Turn over]



1	0
---	---

 .

1

Give TWO control variables the students should have used in the investigation.

Do NOT refer to mass or time in your answer. [2 marks]

1 _____

2 _____



1	0
---	---

 .

2

Calculate value *X* in TABLE 3, on page 87.
[3 marks]

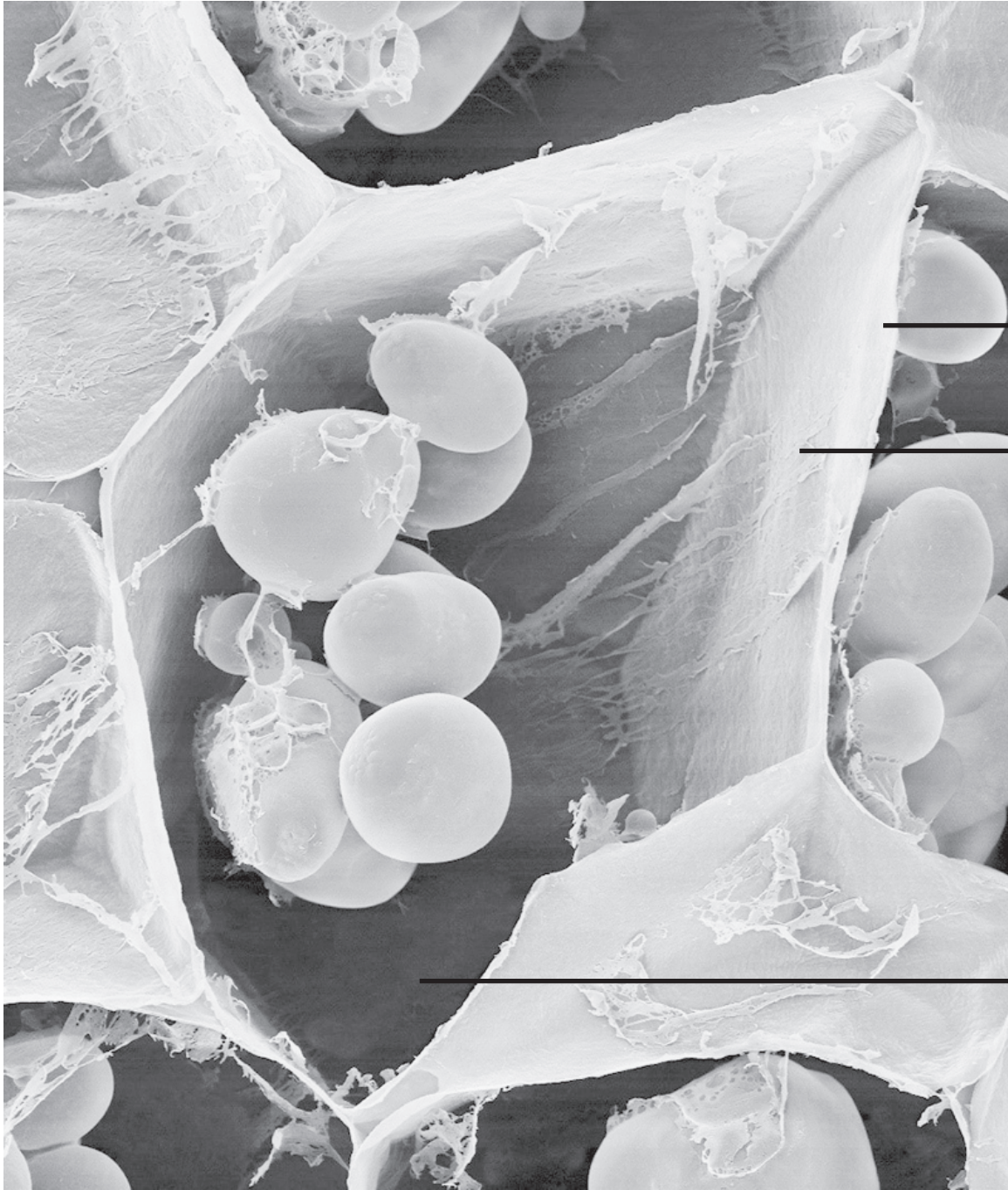
X = _____ g

[Turn over]



FIGURE 14 shows a potato cell.

FIGURE 14



Cell wall

**Cell
membrane**

Cytoplasm



1	0	.	3
---	---	---	---

Explain why the mass of the pieces of potato increased in the 0.2 mol/dm³ salt solution.

You should refer to the cell parts labelled in FIGURE 14. [6 marks]

[Turn over]



[illegible]

1	0	.	4
---	---	---	---

The image in FIGURE 14, on page 90, was made using an electron microscope and NOT a light microscope.

Give ONE piece of evidence to support this. [1 mark]

[Turn over]

1	0
---	---

 .

5

The potato cell in FIGURE 14 contains starch grains.

A starch grain on a different image had a diameter of 1.2 cm.

The starch grain had a real diameter of 0.008 mm.

**Calculate the magnification of the image.
[3 marks]**



Magnification = ×

[Turn over]

Starch is digested in the gut.

10 . 6

**Why is digestion of starch needed?
[1 mark]**

Tick (✓) ONE box.

☐

Starch is a carbohydrate.

☐

Starch molecules are insoluble.

☐

Starch molecules are small.



10 . 7

**Describe the process of starch digestion.
[2 marks]**

END OF QUESTIONS



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

[illegible]

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

[illegible]

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

[illegible]

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

[illegible]

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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

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