A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: SYNERGY
8465/1F

F

Foundation Tier

Paper 1   Life and Environmental Sciences

Time allowed: 1 hour 45 minutes

MATERIALS
For this paper you must have:
- a ruler
- a protractor
- a scientific calculator
- the periodic table (enclosed)
- the Physics Equations Sheet (enclosed).

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

[Turn over]

BLANK PAGE

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

BLANK PAGE

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

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 |

| To produce hormones |

| Neurone |

| 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**

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**

[Turn over]

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**

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.

Draw ONE line from each treatment to how the treatment works. [3 marks]

TREATMENT   **How the treatment works**

| Keeps coronary arteries open |

| Replacement valve |

| Makes sure blood flows in one direction |

| Statin |

| Reduces blood cholesterol concentration |

| Stent |

| Reduces blood glucose concentration |

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.**

[Turn over]

| 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.

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]

_____

_____
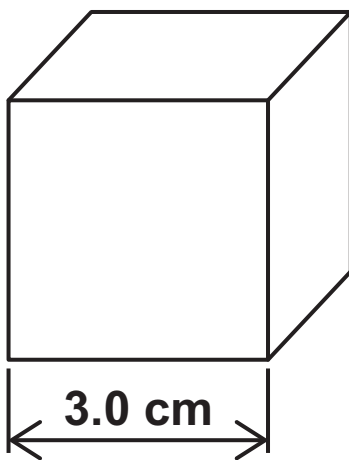
_____

8

[Turn over]

1 3

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

3.0 cm

0 3 . 1

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

_____

_____

0	3	.	2

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

Tick (✓) ONE box.

	6.0 cm^3

	9.0 cm^3

	27.0 cm^3

	54.0 cm^3

[Turn over]

0	3	.	3

A different cube has a mass of 13 g.

The volume of this cube is 8.0 cm^3.

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/cm^3

The student also investigated the density of a key.

FIGURE 3 shows the key.

FIGURE 3
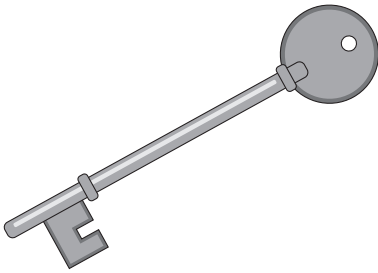
| 0 | 3 | . | 4 |

Which piece of equipment could be used to measure the mass of the key? [1 mark]
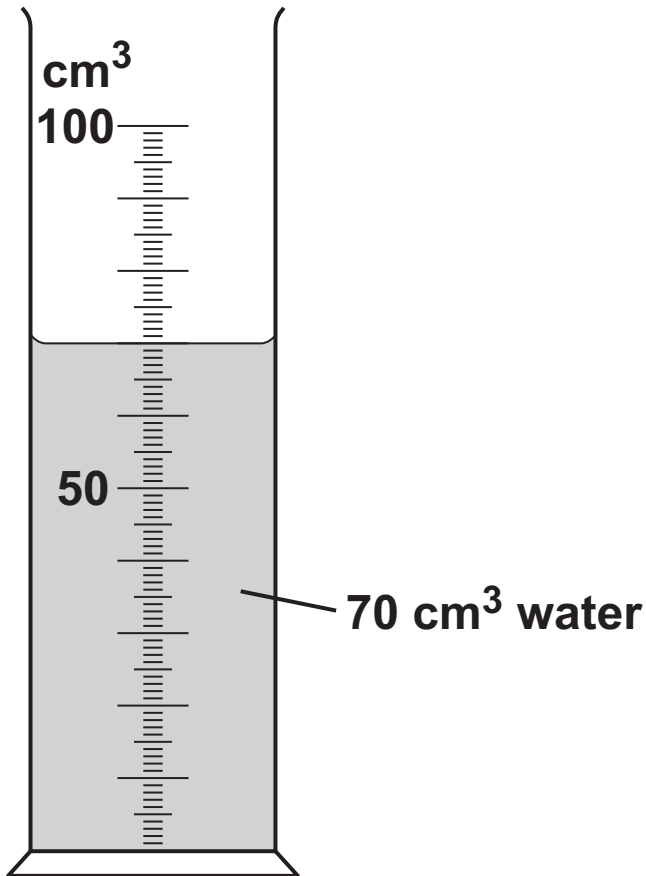
Tick (✓) ONE box.

☐ Balance

☐ Stopwatch

☐ Thermometer

[Turn over]

0 3 . 5

FIGURE 4 shows a measuring cylinder containing water.

FIGURE 4

cm³

100

50

70 cm³ water

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

_____

_____

_____

_____

_____

8

| 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]
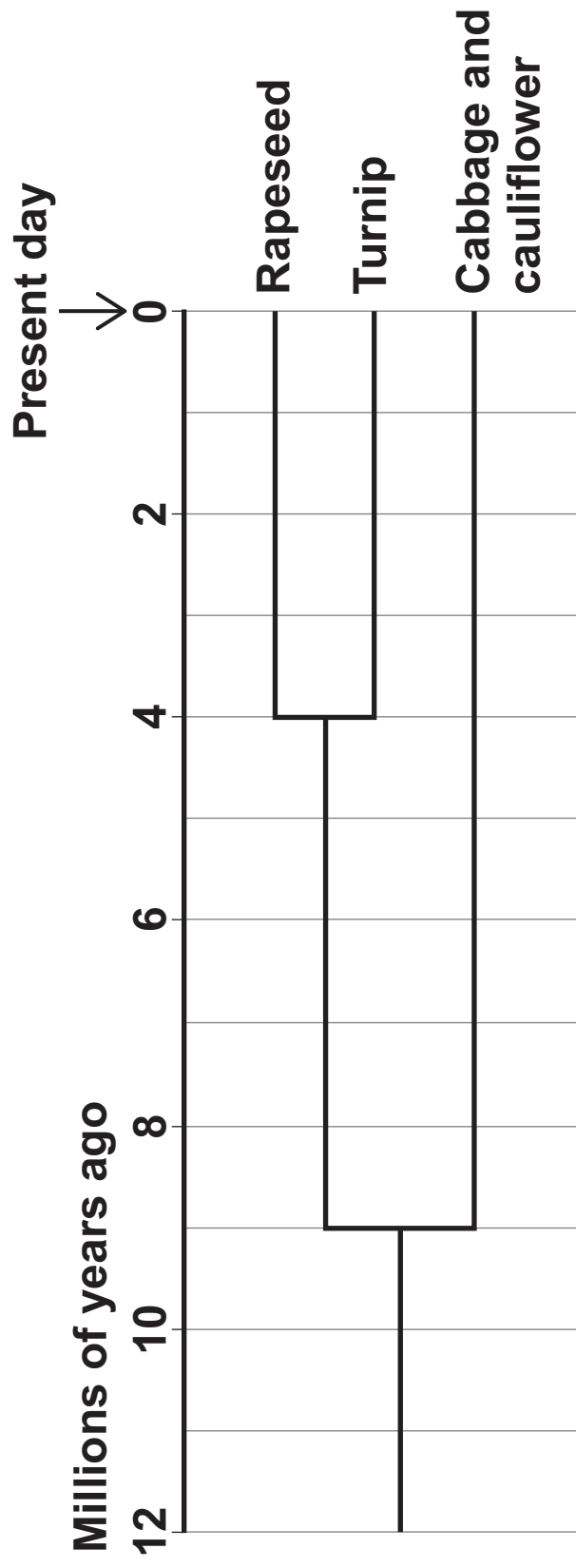
Tick (✓) ONE box.

☐ Brassica

☐ Brassica oleracea

☐ Oleracea

FIGURE 5 shows the evolution of some plants.

FIGURE 5

Present day

Rapeseed

Turnip

Cabbage and cauliflower

Millions of years ago

0   2   4   6   8   10   12

2 1

| 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 _____ .

| 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**

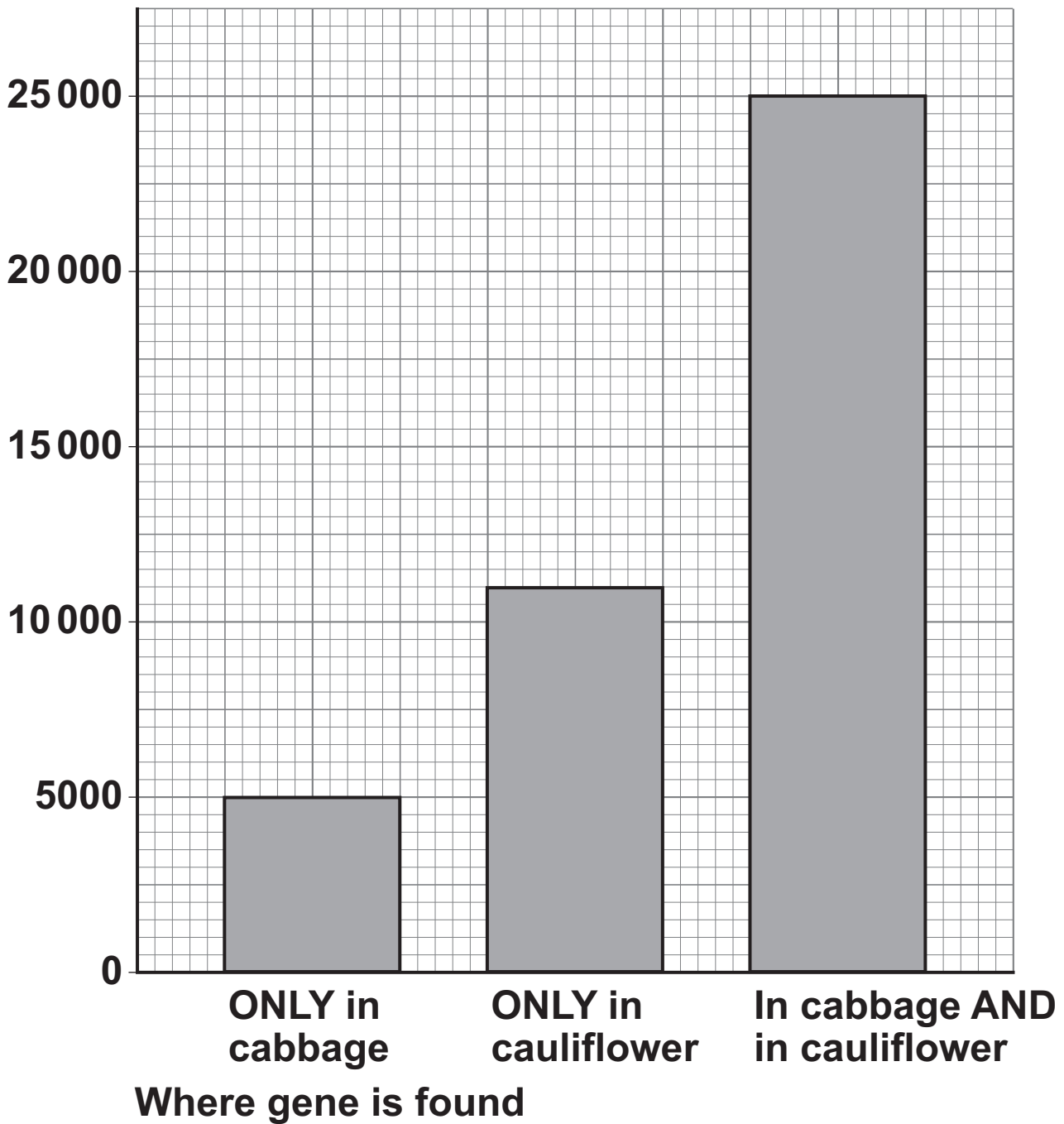☐   **The DNA in one gene**

[Turn over]

Cabbage and cauliflower have some of the same genes.

FIGURE 6, on page 25, shows the number of genes found:

- **ONLY in cabbage**

- **ONLY in cauliflower**

- **in cabbage AND in cauliflower.**

FIGURE 6

Number of genes

Bar chart showing number of genes against where gene is found. X-axis categories: "ONLY in cabbage" (approximately 5000), "ONLY in cauliflower" (approximately 11000), "In cabbage AND in cauliflower" (approximately 25000). Y-axis "Number of genes" with values 0, 5000, 10000, 15000, 20000, 25000.

Where gene is found

[Turn over]

0 4 . 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 = _____ %

| 0 | 4 | . | 8 |

How does FIGURE 6, on page 25, 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.

11

[Turn over]

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

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 29, shows the results.

FIGURE 7

Percentage (%) risk of becoming infected

KEY ▨ Estimated risk ☐ Actual risk
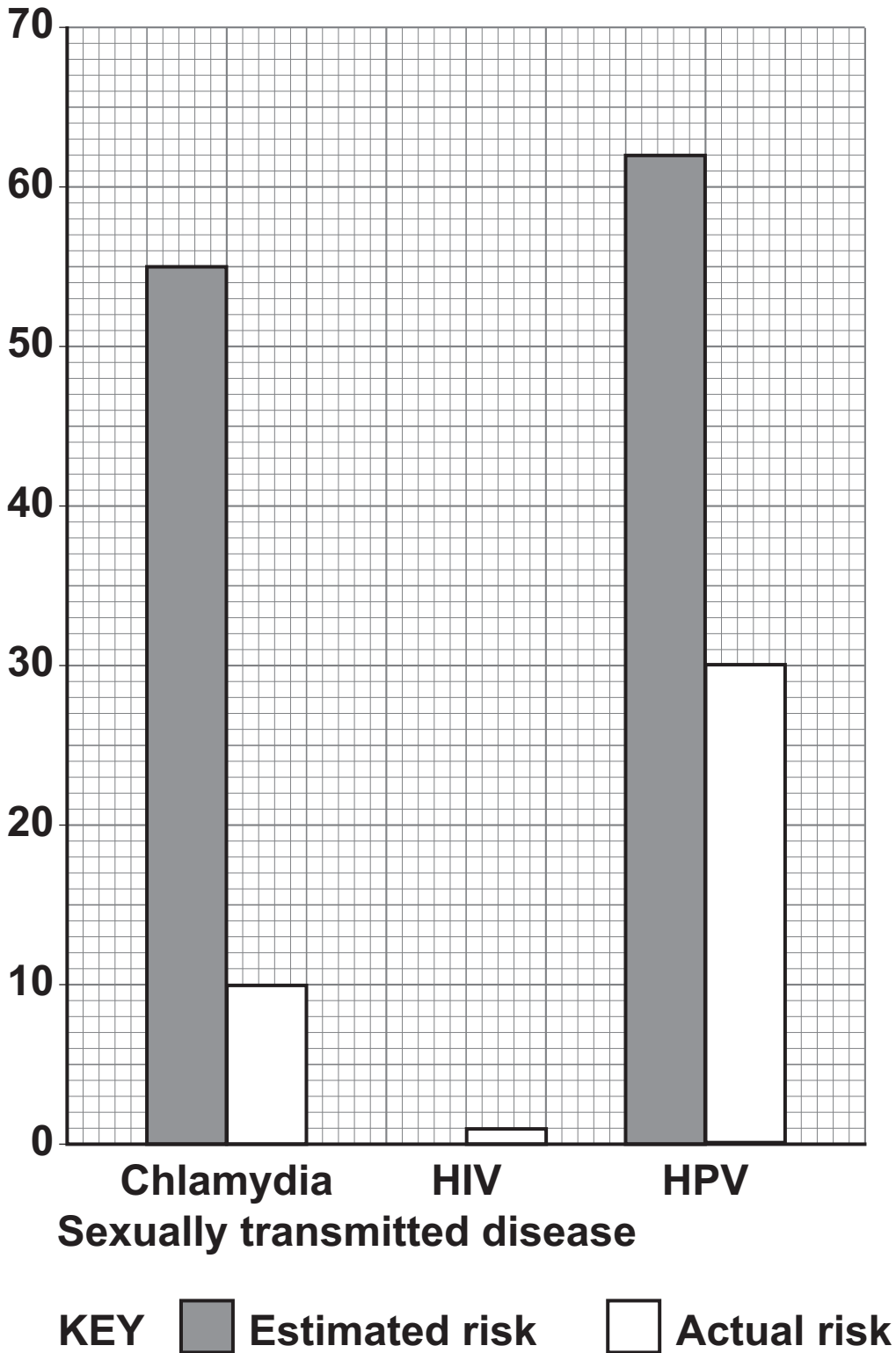
0 5 . 2

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

Plot the students' estimated risk of HIV infection on FIGURE 7 on page 29. [1 mark]

0 5 . 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 = _____ %

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.

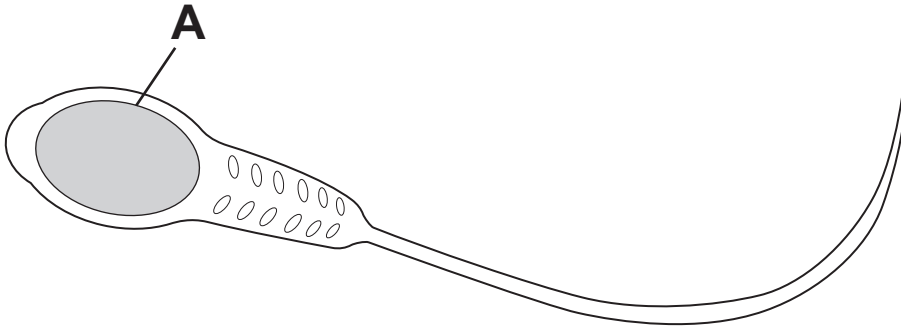**Suggest what effect HPV has on human DNA.** **[1 mark]**

_____

_____

_____

_____

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]

_____

_____

_____

_____

_____

_____

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

| 1 | 2 | 3 | 4 | 5 |

| 6 | 7 | 8 | 9 | 10 | 11 | 12 |

| 13 | 14 | 15 | 16 | 17 | 18 |

| 19 | 20 | 21 | 22 | Y |
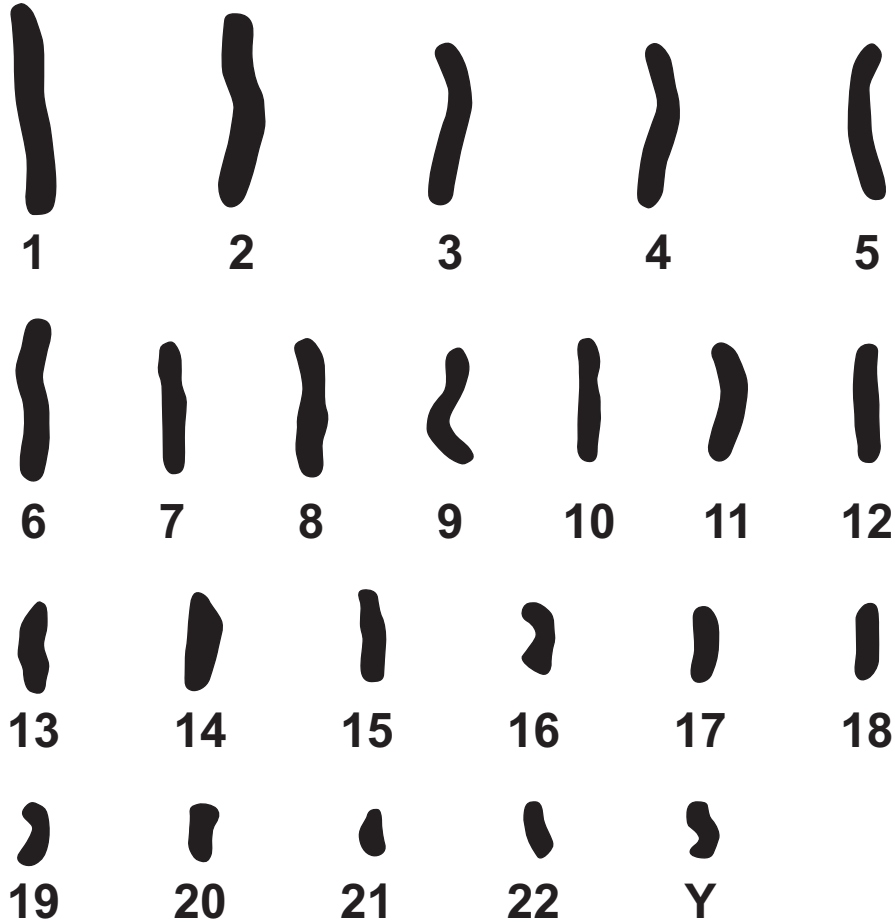
0 6 . 4

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

_____

_____

_____

0 6 . 5

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

Explain what sex the offspring would be.

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

9

[Turn over]

3 5

0 7

This question is about atomic structure.

0 7 . 1

An atom contains three types of particles.

TABLE 1 shows some information about the particles.

TABLE 1

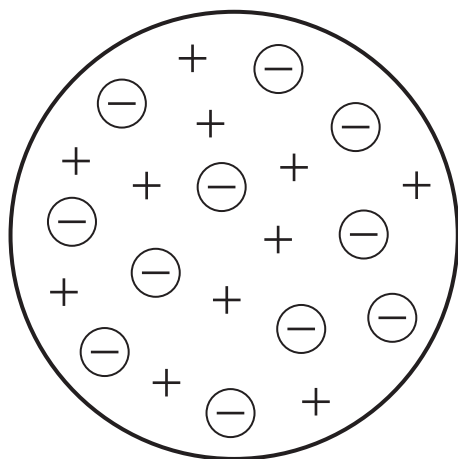| Name of particle	Charge
Electron	−1
Neutron	
Proton	

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

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**

[Turn over]

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**

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

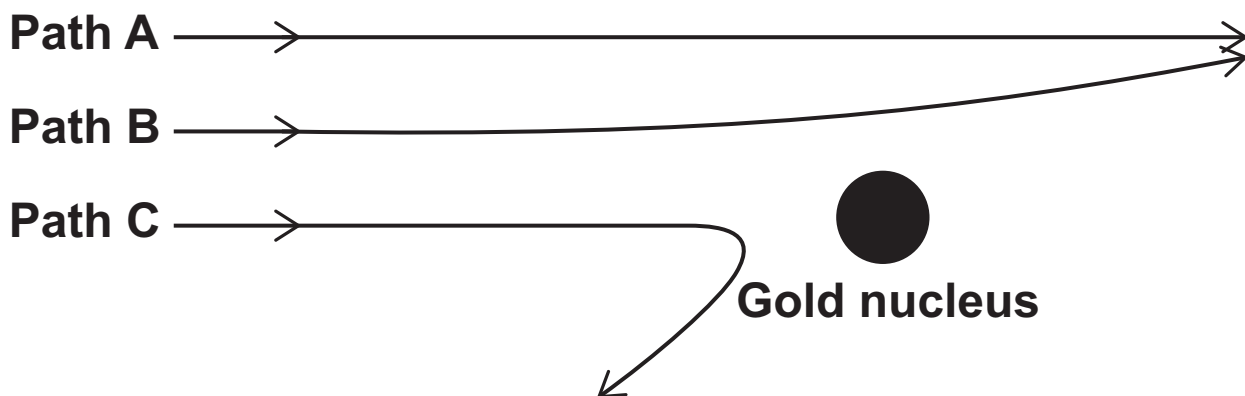FIGURE 11 shows some of the paths the alpha particles followed.

FIGURE 11

Path A
Path B
Path C
Gold nucleus

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**

0	7	.	6

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

Tick (✓) ONE box.

☐ Alpha particles following path C are bounced back.
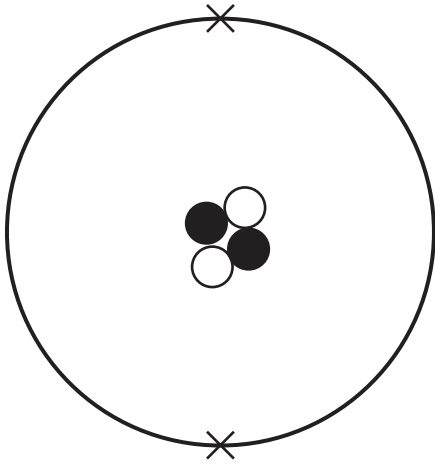
☐ Most alpha particles follow path A.

☐ The alpha particles from the source travel in straight lines.
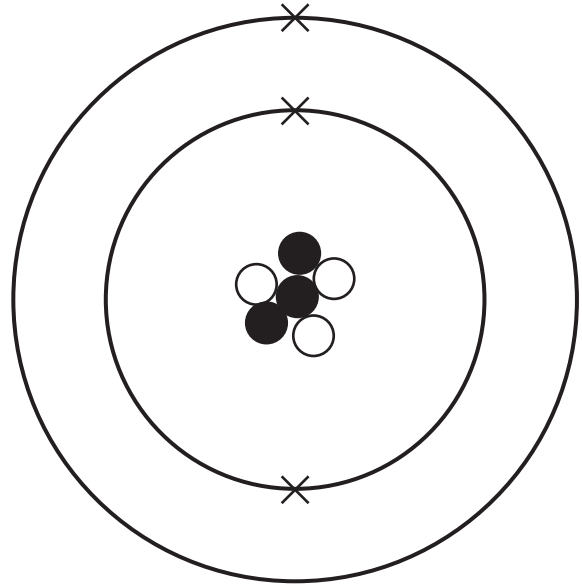
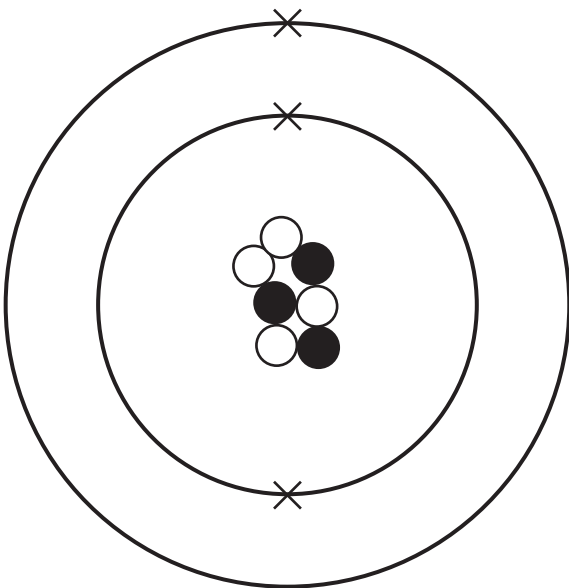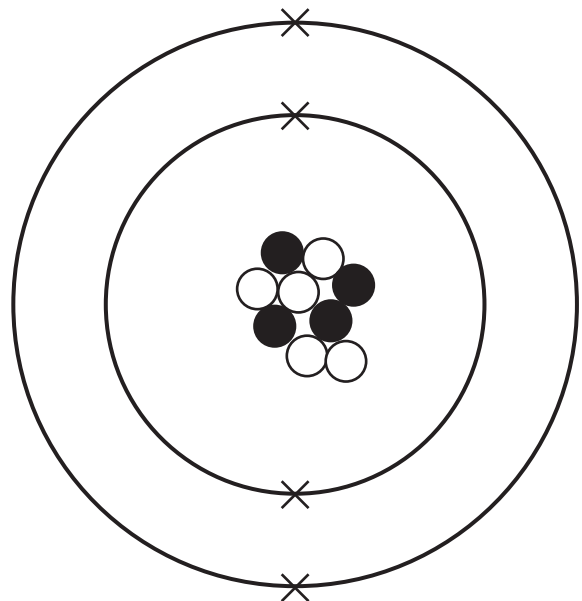[Turn over]

FIGURE 12 represents four atoms.

FIGURE 12

W

X

Y

Z

0	7	.	7

On the periodic table, helium is shown as:

4
He
helium
2

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

Tick (✓) ONE box.

☐ **W**

☐ **X**

☐ **Y**

☐ **Z**

[Turn over]

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**

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

| 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

A sticky liquid
that can trap pollen

Cilia

A type of acid
that can destroy pollen

Mucus

Hair-like structures
that can move pollen

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 _____

_____

_____

[Turn over]

0 8 . 6

An allergy to pollen CANNOT be treated using antibiotics.

Suggest why. [1 mark]

_____

_____

_____

0 8 . 7

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

_____

_____

_____

_____

_____

10

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 _____

_____

_____

[Turn over]

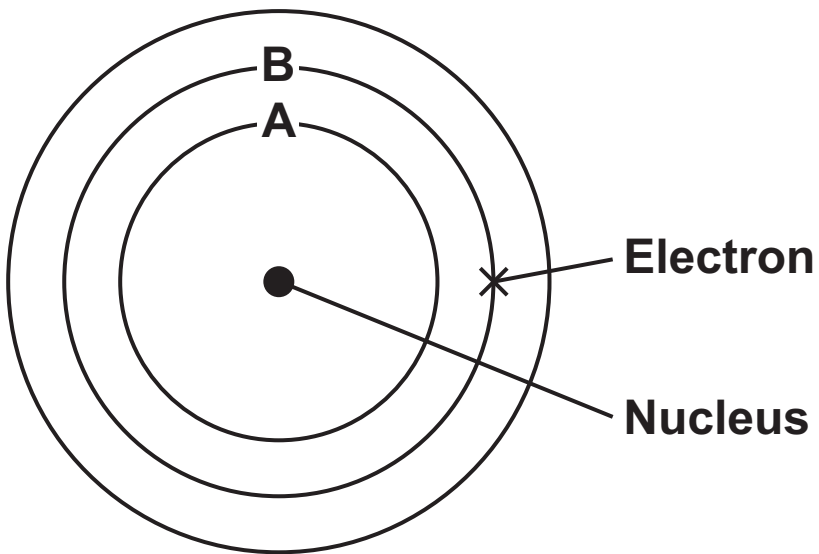| 0	9	.	2

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.

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.

| 0 | 9 | . | 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]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Wavelength = _____ Unit _____

9

[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/dm^3.**

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/dm^3	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 55. [3 marks]

_____

_____

_____

_____

_____

_____

_____

X = _____ g

[Turn over]

FIGURE 14 shows a potato cell.

FIGURE 14

Cell wall

Cell membrane

Cytoplasm
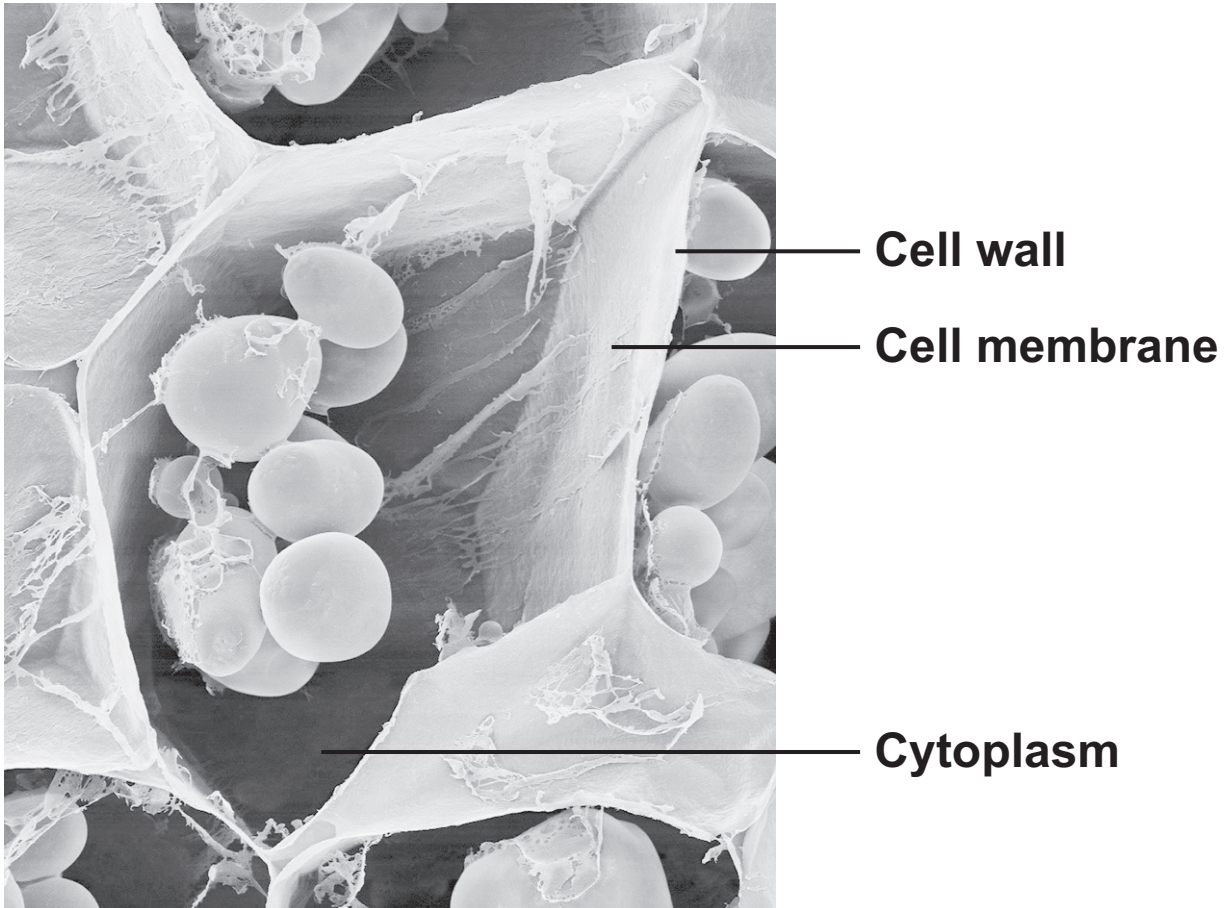
| 1 | 0 | . | 3 |

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]

_____

_____

_____

5 8

| 1 | 0 | . | 4 |

The image in FIGURE 14, on page 58, was made using an electron microscope and NOT a light microscope.

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

_____

_____

_____

| 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.

1 0 . 6

Why is digestion of starch needed? [1 mark]

Tick (✓) ONE box.

☐ **Starch is a carbohydrate.**

☐ **Starch molecules are insoluble.**

☐ **Starch molecules are small.**

1 0 . 7

Describe the process of starch digestion. [2 marks]

_____

_____

_____

_____

_____

18

END OF QUESTIONS

BLANK PAGE

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

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

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

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

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68

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