AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: SYNERGY

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).

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. Do not write outside the box around each page or 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.

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

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.

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ANSWER IN THE SPACES PROVIDED

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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
Neurone	To produce hormones
	To transport oxygen

Question 1 continues on the next page

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 ☐

Do not write outside the box

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 ☐

0 1 . 5 Muscle cells use oxygen for respiration.

Explain why muscle cells need to respire.

[2 marks]

_____

_____

_____

_____

8

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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]

_____

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
Replacement valve	Keeps coronary arteries open
Statin	Makes sure blood flows in one direction
Stent	Reduces blood cholesterol concentration
	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. ☐

Do not write outside the box

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

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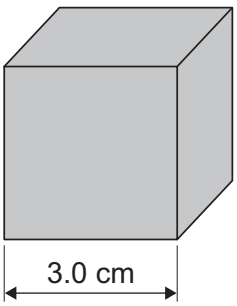
0 3 A student investigated the mass, volume and density of some solid metal cubes.

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]

_____

0 3 . 2 What is the volume of the cube in **Figure 2**?

[1 mark]

Tick (✓) **one** box.

$6.0\ cm^3$ ☐

$9.0\ cm^3$ ☐

$27.0\ cm^3$ ☐

$54.0\ cm^3$ ☐

Do not write outside the box

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]

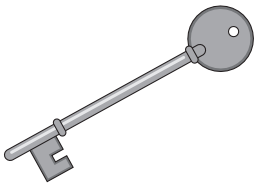
Density (2 significant figures) = _____ g/cm^3

Question 3 continues on the next page

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.

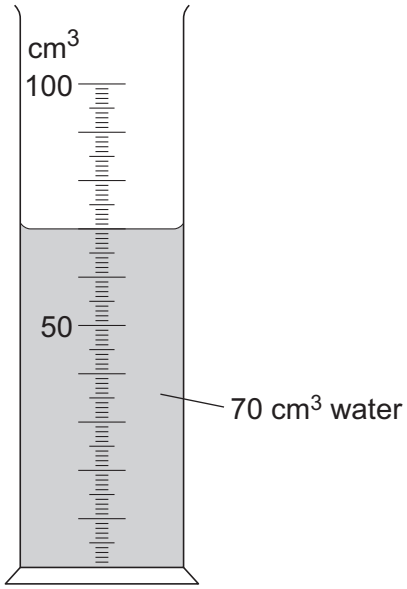
Balance ☐

Stopwatch ☐

Thermometer ☐

0 3 . 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

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0 4 Classification of living organisms has changed over time.

0 4 . 1 Complete the sentences about classification.

Choose answers from the box.

[2 marks]

age	**appearance**	**DNA**	**mass**

Traditional classification placed organisms in groups based on _____ .

Modern classification places organisms in groups based on _____ .

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 ☐

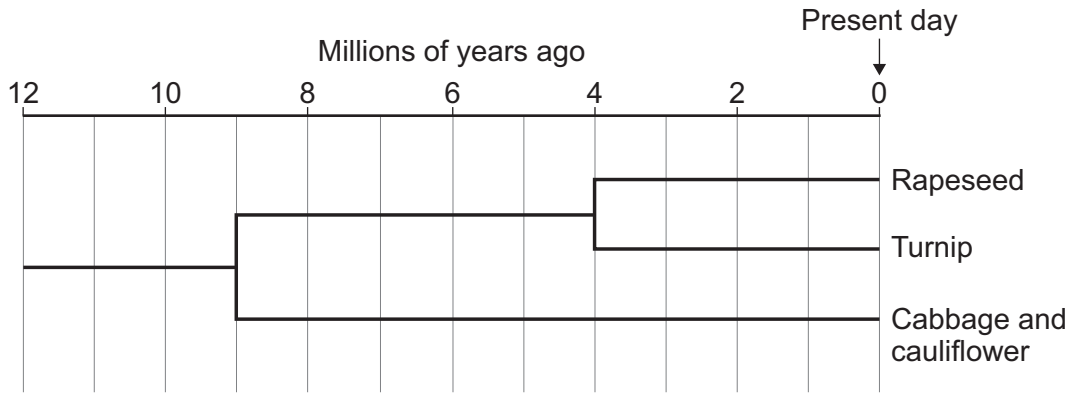
Brassica oleracea ☐

Oleracea ☐

Question 4 continues on the next page

Figure 5 shows the evolution of some plants.

Figure 5



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 box.

[1 mark]

carbohydrate	**lipid**	**protein**

Rapeseed oil is a type of _____ .

Do not write outside the box

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 ☐

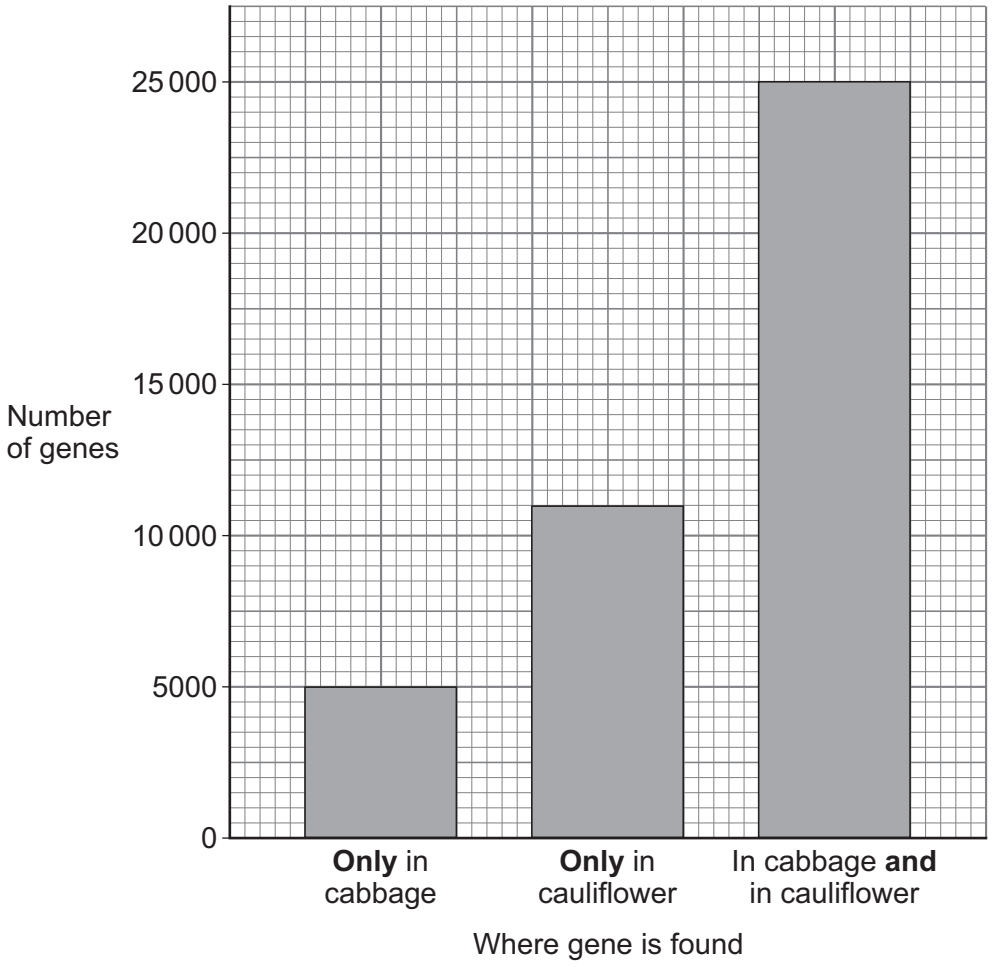
Question 4 continues on the next page

Cabbage and cauliflower have some of the same genes.

Figure 6 shows the number of genes found:

- **only** in cabbage
- **only** in cauliflower
- in cabbage **and** in cauliflower.

Figure 6



Do not write outside the box

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:

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

[3 marks]

Percentage = _____ %

0 4 . 8 How does **Figure 6** 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

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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 ☐

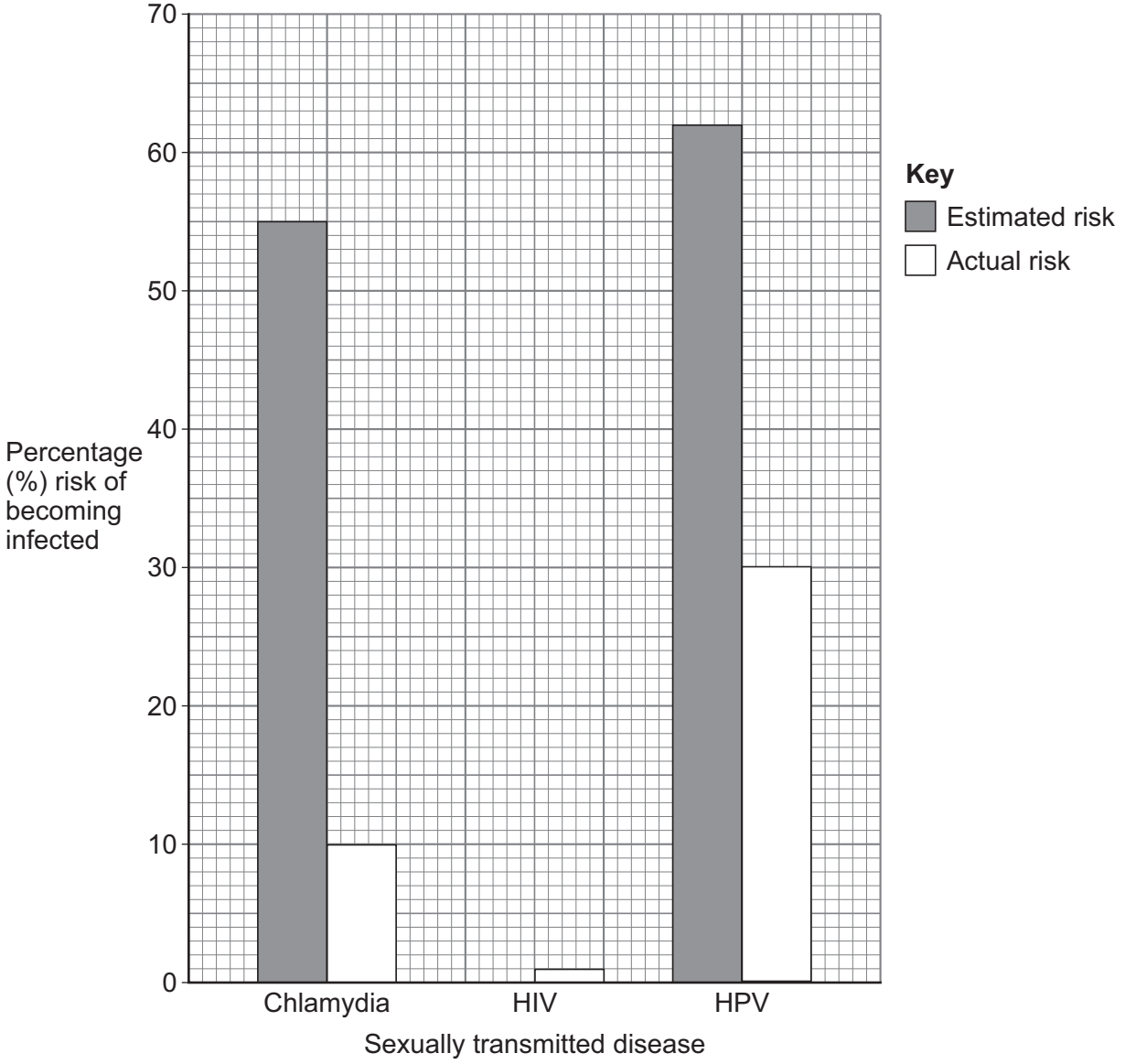
Question 5 continues on the next page

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 shows the results.

Figure 7



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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**.

[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]

_____

_____

Question 5 continues on the next page

Do not write outside the box

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

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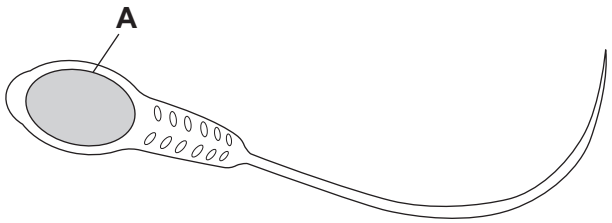
0 6 **Figure 8** shows a human sperm cell.

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?

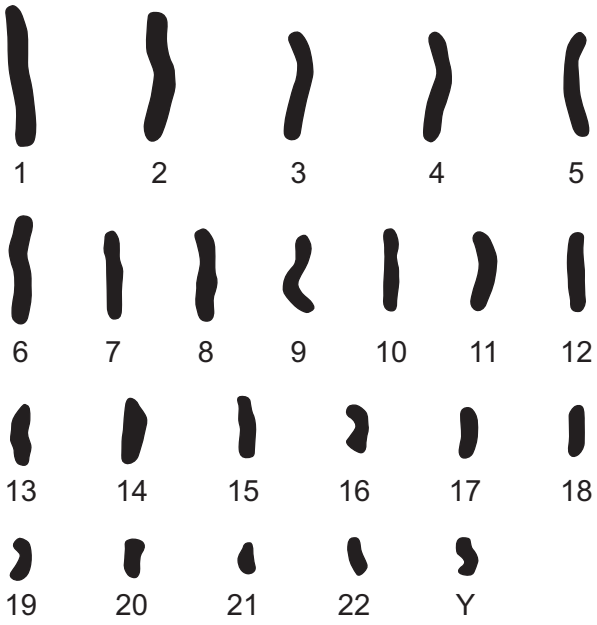
[1 mark]

_____

Question 6 continues on the next page

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]

Do not write outside the box

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 for the next question

Do not write outside the box

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	

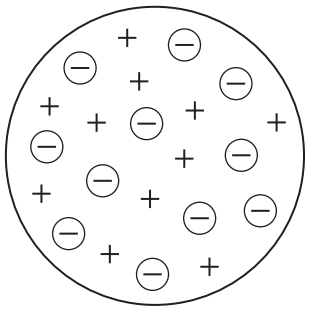
Complete **Table 1**.

[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 ☐

Do not write outside the box

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 ☐

Question 7 continues on the next page

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

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

Figure 11

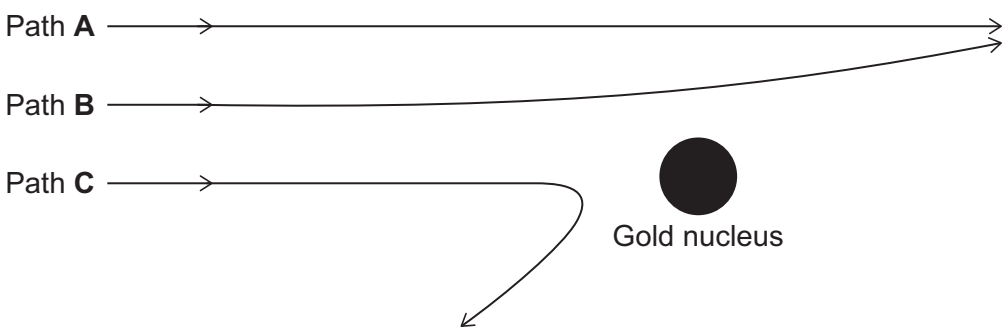


Table 2 shows the number of alpha particles that followed paths **A**, **B** and **C**.

Table 2

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

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 = _____

Do not write outside the box

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. ☐

Question 7 continues on the next page

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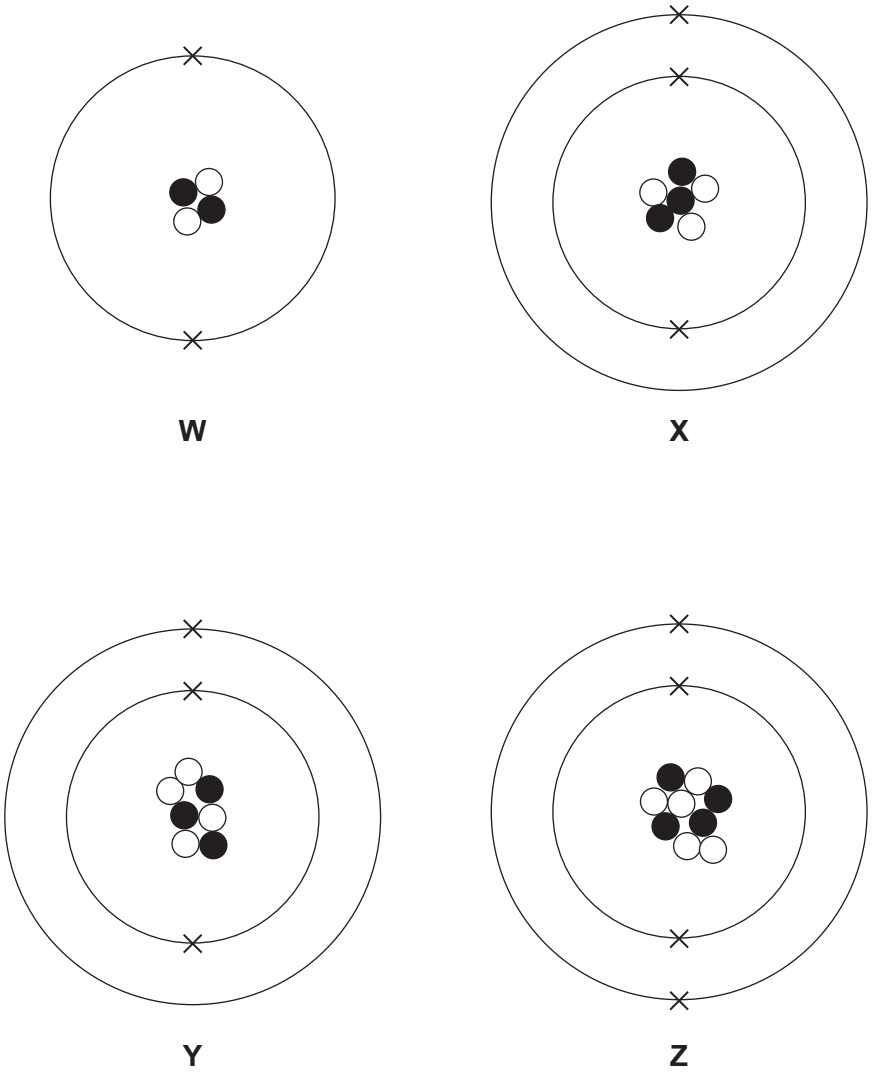
Figure 12 represents four atoms.

Figure 12



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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** ☐

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

Turn over ▶

Do not write outside the box

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]

_____

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
	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 _____

_____

Question 8 continues on the next page

Do not write outside the box

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

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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 _____

_____

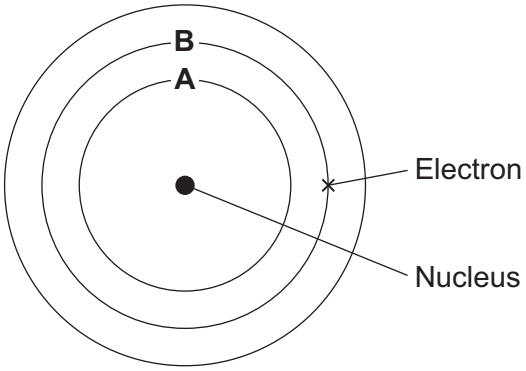
Question 9 continues on the next page

Do not write outside the box

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 ☐

Do not write outside the box

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 ☐

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

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**

Do not write outside the box

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**.

[3 marks]

_____

_____

_____

_____

_____

X = _____ g

Question 10 continues on the next page

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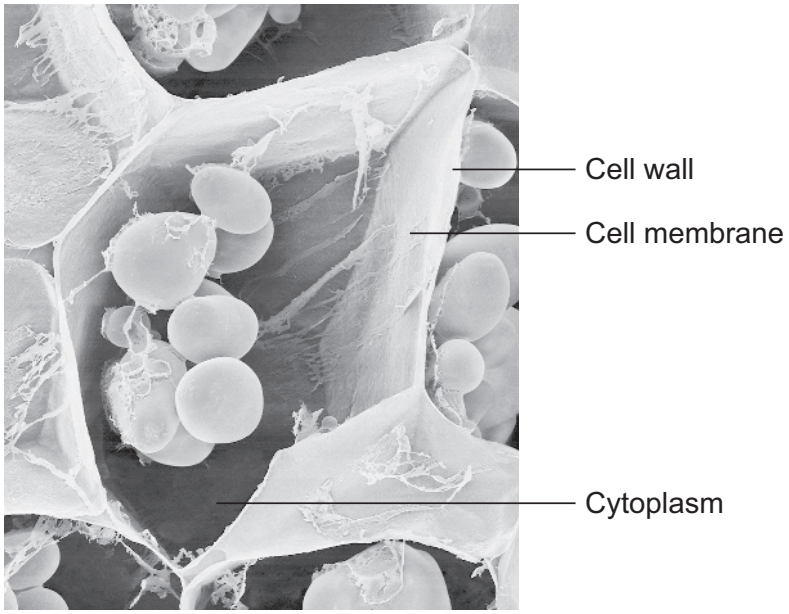
Figure 14 shows a potato cell.

Figure 14



1 0 . 3 Explain why the mass of the pieces of potato increased in the 0.2 mol/dm^3 salt solution.

You should refer to the cell parts labelled in **Figure 14**.

[6 marks]

Do not write outside the box

1 0 . 4 The image in **Figure 14** 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 = × _____

Question 10 continues on the next page

Do not write outside the box

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

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