



Surname _____

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I declare this is my own work.

GCSE **F**
COMBINED SCIENCE: SYNERGY

Foundation Tier Paper 1 Life and Environmental
Sciences

8465/1F

Tuesday 12 May 2020 Afternoon

Time allowed: 1 hour 45 minutes

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

[Turn over]



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.

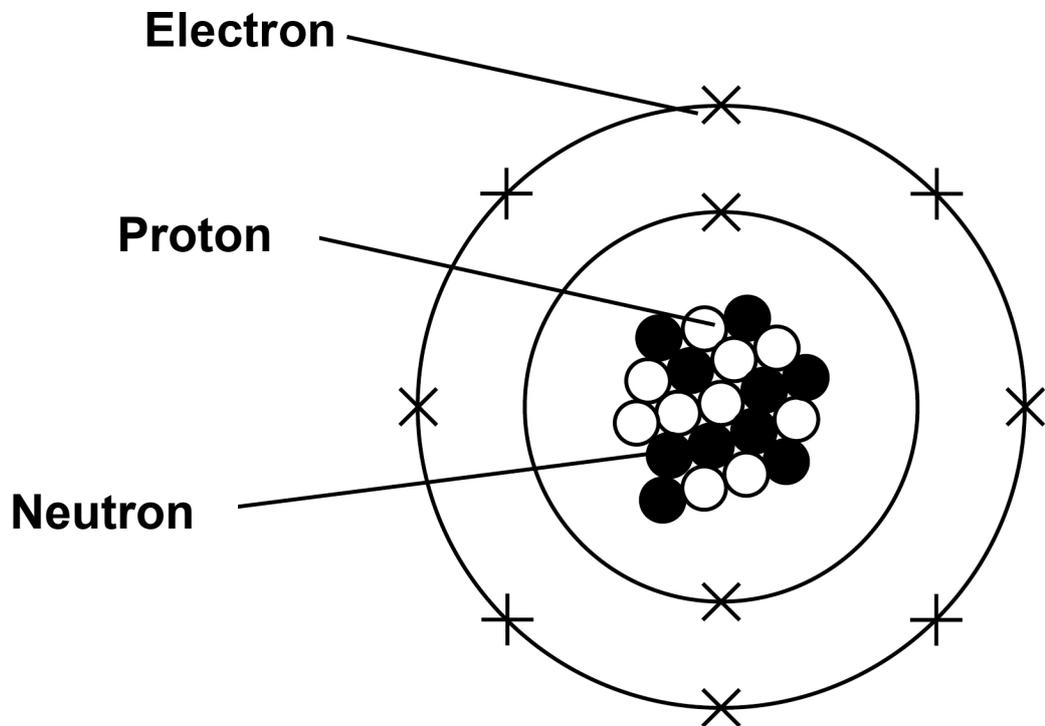


INFORMATION

- **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**FIGURE 1 represents a neon atom.****FIGURE 1****0 1 . 1****What is the name of the centre of the atom?
[1 mark]****Tick (✓) ONE box.****Energy level****Isotope****Nucleus**

0 1 . 2 Which particle has a positive charge?
[1 mark]

Tick (✓) ONE box.

Electron

Neutron

Proton

0 1 . 3 Which particle has the smallest mass?
[1 mark]

Tick (✓) ONE box.

Electron

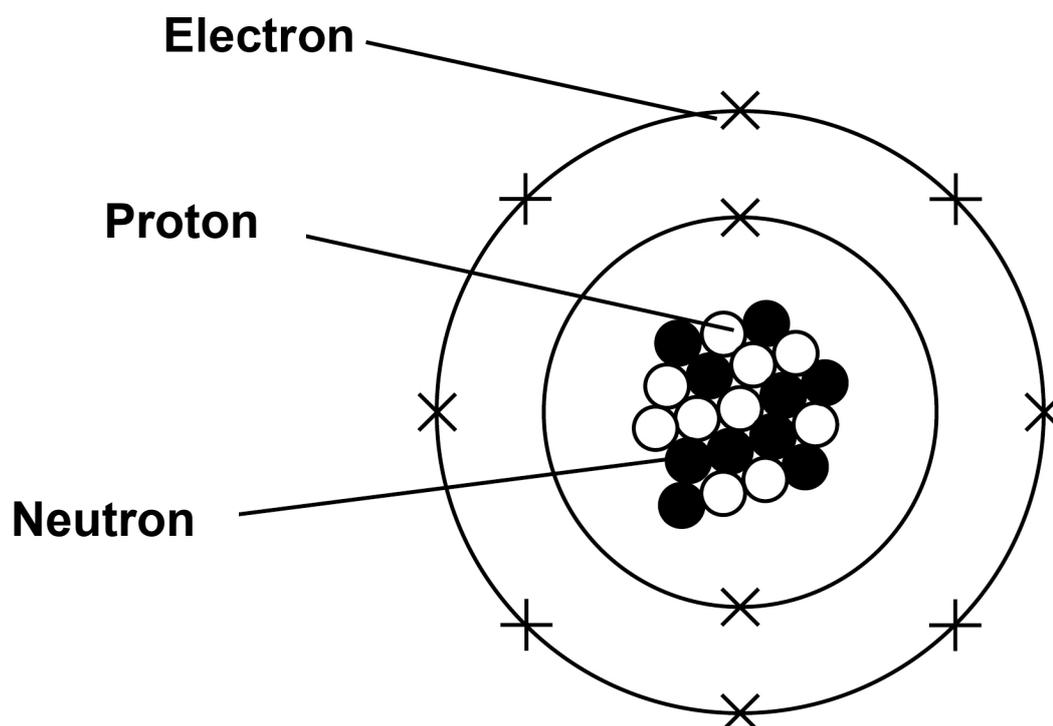
Neutron

Proton

[Turn over]



REPEAT OF FIGURE 1



0 1 . 4 What is the electronic structure of neon?

Use FIGURE 1. [1 mark]

Tick (✓) ONE box.

2,8

2,10

2,8,20

10,10,10



- 0 1 . 5** There are 18 particles of neon in every 1 000 000 particles of air.

Which equation shows how to calculate the percentage of neon particles in the air?
[1 mark]

Tick (✓) ONE box.

$$\text{percentage} = \frac{18\,000\,000}{100} \times 100$$

$$\text{percentage} = \frac{1\,000\,000}{18} \times 100$$

$$\text{percentage} = \frac{18}{1\,000\,000} \times 100$$

[Turn over]



01.6 FIGURE 2 shows a sign containing neon. The sign is connected to an electrical supply.

The sign glows when the electrical supply is switched on.

FIGURE 2



What type of electromagnetic radiation is emitted by the neon atoms when the sign is switched on? [1 mark]

Tick (✓) ONE box.

Gamma rays

Microwaves

Radio waves

Visible light



0 1 . 7 Some elements emit ultraviolet (UV) radiation when electricity is supplied.

Sun tanning beds emit UV radiation.

Give TWO health risks of exposure to UV radiation. [2 marks]

1 _____

2 _____

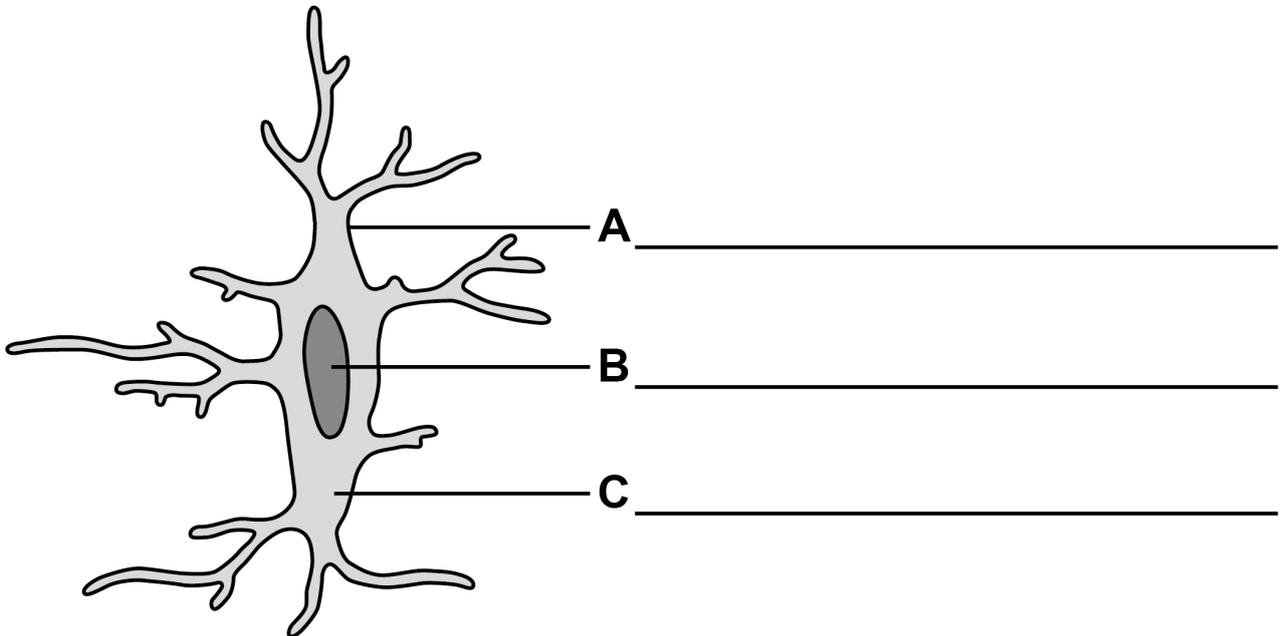
[Turn over]

8



0 2 FIGURE 3 shows a human bone cell.

FIGURE 3



0 2 . 1 Label the cell structures A, B and C on FIGURE 3. [3 marks]

0 2 . 2 Which structure in the cell contains DNA? [1 mark]

Tick (✓) ONE box.

A

B

C



0 2 . 3 A student used a microscope to view a cell.

The length of the image of the cell was 40 mm

The real length of the cell was 0.25 mm

Calculate the magnification of the image.

Use the equation:

$$\text{magnification} = \frac{\text{length of image}}{\text{length of real object}}$$

[2 marks]

Magnification = × _____

[Turn over]



0 2 . 4 Root hair cells are found on the roots of plants.

Root hair cells do NOT photosynthesise.

Give ONE structure found in a leaf cell, but NOT in a root hair cell. [1 mark]

0 2 . 5 Which TWO structures are found in plant cells but NOT in animal cells? [2 marks]

Tick (✓) TWO boxes.

Cell wall

Mitochondria

Permanent vacuole

Plasmid

Ribosome

9



0 3**FIGURE 4 shows a mosquito on human skin.****FIGURE 4****Malaria is a communicable disease.****Mosquitos can transmit malaria when they bite.****0 3 . 1** What is a communicable disease? [1 mark]

Tick (✓) ONE box.

A disease caused by a faulty allele**A disease caused by a pathogen****A disease caused by obesity****[Turn over]**

- 03.2** Humans have adaptations to defend the body against pathogens.

Draw **ONE** line from each body part to the adaptation that defends against pathogens.
[3 marks]

BODY PART

ADAPTATION

Skin

Has a large surface area

Is a physical barrier

Stomach

Produces acid to kill pathogens

Trachea

Secretes mucus to trap pathogens



03.3 What type of chemical is used to kill mosquitos? [1 mark]

Tick (✓) ONE box.

Fungicide

Herbicide

Pesticide

[Turn over]



Scientists are trying to reduce the number of people developing malaria by using genetically modified (GM) mosquitos.

03.4 Mosquitos have 6 chromosomes in each normal body cell.

How many chromosomes are in each egg cell from a mosquito? [1 mark]

Tick (✓) ONE box.

3

6

9

12



0 3 . 5 Which statement describes genetic modification? [1 mark]

Tick (✓) ONE box.

A species evolving in two different areas

Genes from one organism being transferred to another organism

Male gametes and female gametes fusing during fertilisation

[Turn over]



03.6

GM mosquitos can be produced in large numbers in laboratories.

These GM mosquitos can be released to reduce the population of wild mosquitos.

What is ONE advantage of using GM technology to reduce the population of wild mosquitos? [1 mark]

Tick (✓) ONE box.

Decreases the use of chemicals to kill mosquitos

Genes may spread to other insects

Has unknown impacts on the mosquito food web

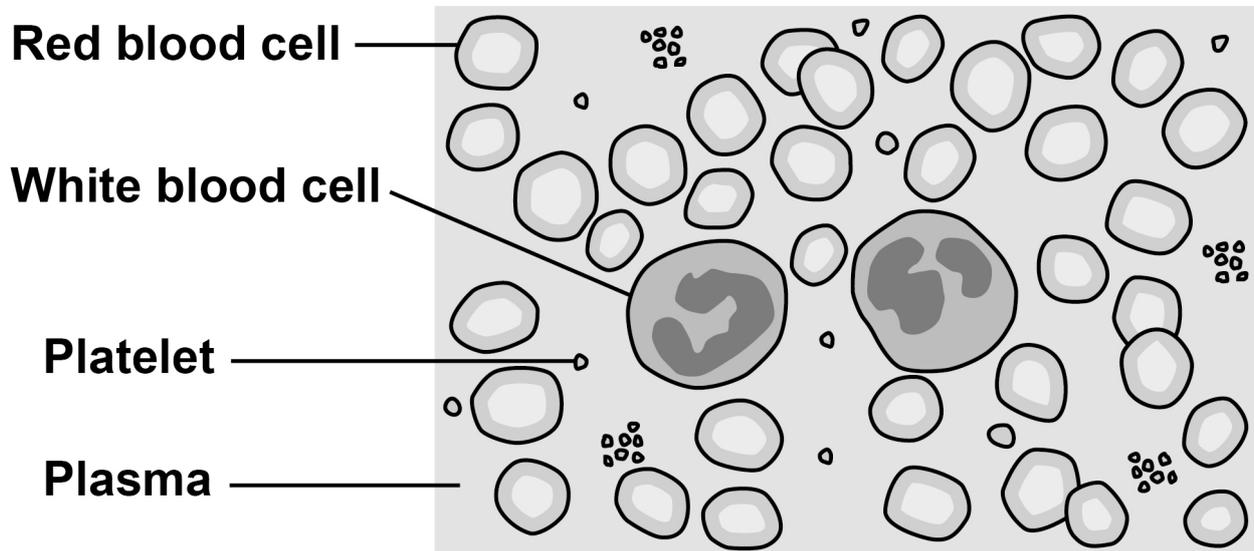
The high cost of GM technology

8



0 4 FIGURE 5 shows a diagram of blood.

FIGURE 5



0 4 . 1 Cells in the blood are specialised to have particular functions.

What process produces specialised cells?
[1 mark]

Tick (✓) ONE box.

Classification

Differentiation

Fertilisation

[Turn over]



0 4 . 2 Draw ONE line from each blood component to a function of the component. [3 marks]

**BLOOD
COMPONENT**

FUNCTION

Carries nitrogen

Platelet

Carries oxygen

Red blood cell

Defends against
infection

White blood cell

Helps blood to
clot



0 4 . 3 Some blood cells carry out phagocytosis.

What is phagocytosis? [1 mark]

Tick (✓) ONE box.

Engulfing pathogens

Producing antibodies

Releasing antitoxins

[Turn over]



Cystic fibrosis is an inherited condition.

The allele for NOT having cystic fibrosis is dominant, R.

The recessive allele is r.

0 4 . 4 What term describes the genotype Rr?
[1 mark]

Tick (✓) ONE box.

Genome

Heterozygous

Variation



0 4 . 5

Having symptoms of cystic fibrosis is a person's phenotype.

**What does the term 'phenotype' mean?
[1 mark]**

Tick (✓) ONE box.

All the genetic material of an organism

The observable characteristics of an organism

The effect of only the environment on an organism

[Turn over]



0 4 . 6 Two people are planning to have a child.

Complete **FIGURE 6** to show the possible genotypes of the child. [2 marks]

FIGURE 6

		MOTHER	
		R	r
FATHER	R		
	r	R r	r r

0 4 . 7 Draw a ring around **ONE** of the offspring in **FIGURE 6** that would have cystic fibrosis. [1 mark]



0 4 . 8 What is the percentage chance of the child having cystic fibrosis? [1 mark]

Tick (✓) ONE box.

25%

50%

75%

100%

0 4 . 9 New drugs are being developed to treat the symptoms of cystic fibrosis.

Trials of new drugs are needed to work out the correct dose of the drug to use.

Give ONE other reason why drugs are trialled before they are used by patients.

Do NOT refer to dosage in your answer. [1 mark]

[Turn over]



0 5

TABLE 1 shows the concentration of some substances outside a cell and inside a cell.

TABLE 1

Substance	Concentration in arbitrary units	
	Outside the cell	Inside the cell
Chloride ions	116	4
Potassium ions	4	120
Sodium ions	145	12

0 5

. 1

Complete the sentences.

Choose answers from the list below.

Use information from TABLE 1. [2 marks]

- active transport
- diffusion
- osmosis

Chloride ions move into the cell by

_____ .

Potassium ions move into the cell by

_____ .



0 5 . 2 Why do sodium ions move INTO the cell?

Use information from TABLE 1. [1 mark]

0 5 . 3 Calculate how many times greater the potassium ion concentration is inside the cell compared with outside the cell. [1 mark]

Number of times greater =

0 5 . 4 Name the process that releases energy in cells. [1 mark]

[Turn over]



05.5 Which process needs energy to move a substance into a cell? [1 mark]

Tick (✓) ONE box.

Active transport

Diffusion

Osmosis

05.6 Give TWO factors that affect the rate of diffusion. [2 marks]

1

2



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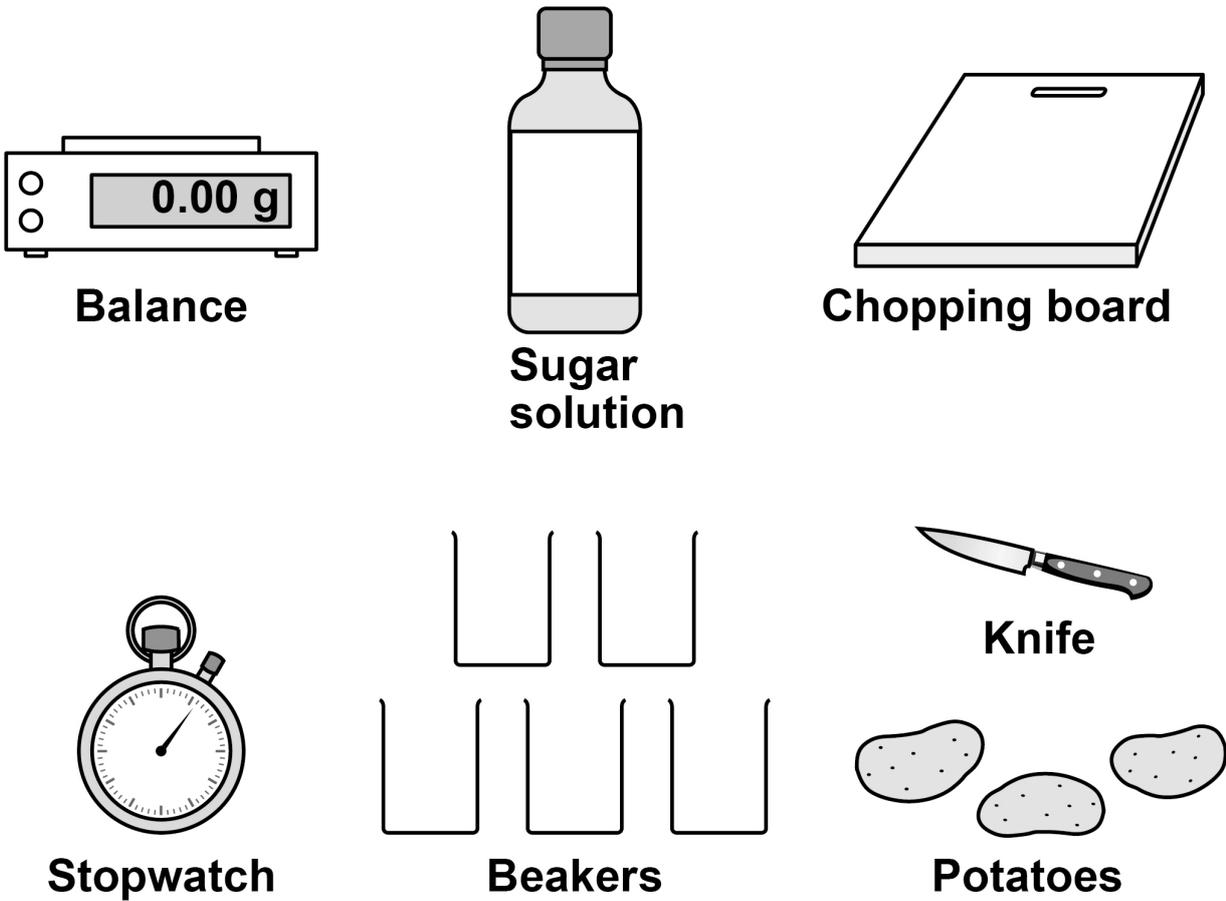
[Turn over]



05.7 Students investigated the change in mass of potato pieces in different concentrations of sugar solution.

FIGURE 7 shows some of the equipment used.

FIGURE 7



0 6 The electromagnetic spectrum is made up of waves with different wavelengths and frequencies.

0 6 . 1 Draw ONE line from each type of electromagnetic wave to a use of that type of wave. [3 marks]

**ELECTROMAGNETIC
WAVE**

USE

Cooking food

Radio waves

Detecting broken
bones

Visible light

Fibre optic
communications

X-rays

Transmitting TV
programmes

[Turn over]



A student investigated how the type of surface affects the amount of infrared the surface radiates.

The student used a hollow metal cube.

Four of the surfaces of the cube were different.

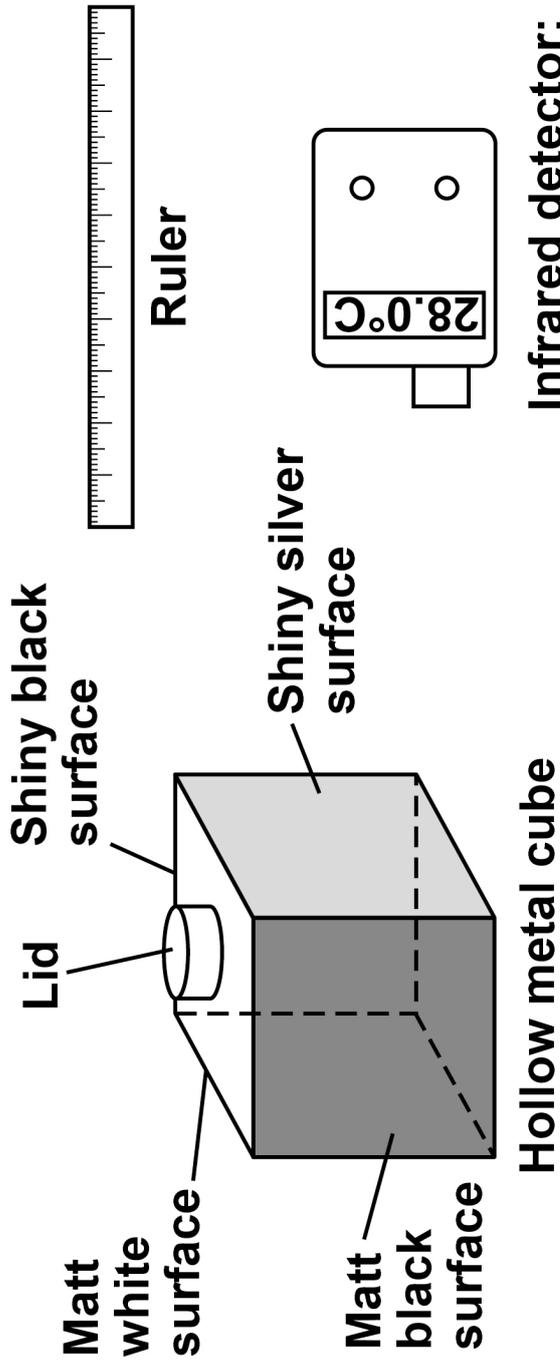
This is the method used.

- 1. Fill the cube with hot water and seal it with a lid.**
- 2. Measure the infrared radiation emitted from each surface using an infrared detector.**

FIGURE 8, on the opposite page, shows the equipment used.



FIGURE 8



**Infrared detector:
uses infrared to
give a temperature**

[Turn over]



06.2

TABLE 2, on the opposite page, shows some of the variables in this investigation.

Identify each variable as an independent, dependent or control variable.

Tick (✓) ONE box in each row on TABLE 2.

One row has been completed for you. [3 marks]



TABLE 2

Variable	Independent	Dependent	Control
Distance between infrared detector and surface of cube			✓
Starting temperature of water inside cube			
Temperature measured by infrared detector			
Type of surface			

[Turn over]



TABLE 3 shows the results.

TABLE 3

Type of surface	Temperature in °C
Shiny black	66.5
Matt white	61.0
Matt black	69.0
Shiny silver	26.0

06.3 What was the resolution of the infrared detector? [1 mark]

Tick (✓) ONE box.

0.5 °C

1.0 °C

26.0 °C

66.5 °C



0 6 . 4 What was the range of temperatures recorded? [1 mark]

Range = _____ °C

to _____ °C

[Turn over]



REPEAT OF TABLE 3

Type of surface	Temperature in °C
Shiny black	66.5
Matt white	61.0
Matt black	69.0
Shiny silver	26.0

06.5 Complete FIGURE 9, on the opposite page.

You should:

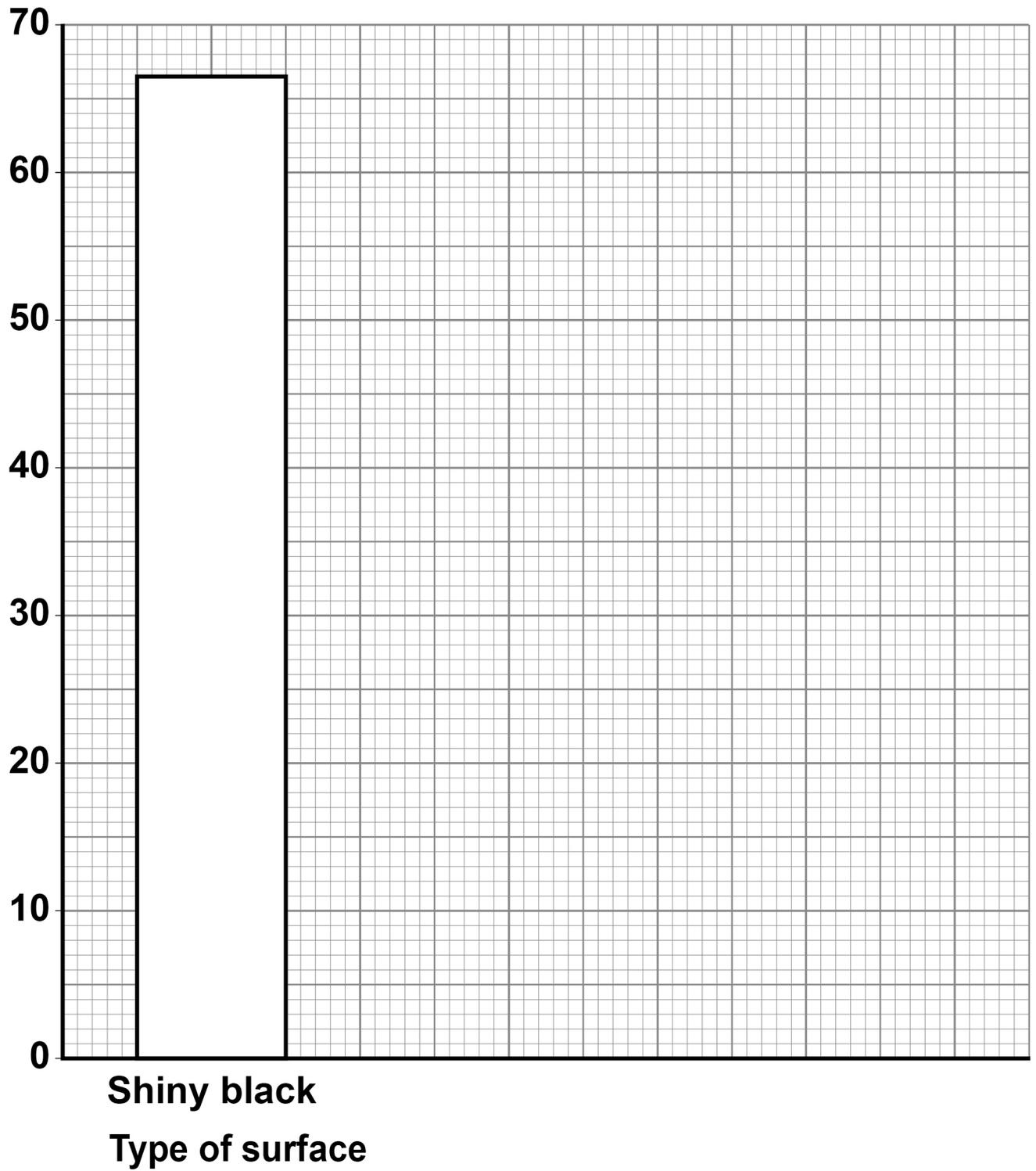
- plot the data from TABLE 3 as a bar chart
- label each bar.

[3 marks]



FIGURE 9

Temperature
in °C



[Turn over]



REPEAT OF TABLE 3

Type of surface	Temperature in °C
Shiny black	66.5
Matt white	61.0
Matt black	69.0
Shiny silver	26.0

06.6

Give ONE conclusion that can be made from the results in TABLE 3. [1 mark]



06.7 Which equation links frequency (f), wavelength (λ) and wave speed (v)?
[1 mark]

Tick (✓) ONE box.

$$f = v \times \lambda$$

$$v = f \times \lambda$$

$$v = \frac{f}{\lambda}$$

[Turn over]



0 6 . 8 A radio wave has:

- a speed of 300 000 000 m/s
- a wavelength of 500 m

Calculate the frequency of the radio wave.

Give the unit.

Choose the unit from the list below. [4 marks]

- hertz
- kilograms
- metres
- seconds

Frequency = _____

Unit _____



07

'Escherichia coli' ('E. coli') is a species of bacteria that can cause food poisoning.

07**.1**

**Which term describes 'E. coli' cells?
[1 mark]**

Tick (✓) ONE box.

Algal cells

Fungal cells

Prokaryotic cells

[Turn over]



Some strains of 'E. coli' are resistant to antibiotics.

TABLE 4 shows the number of infections caused by antibiotic resistant 'E. coli'.

TABLE 4

Year	Number of infections
2014	9 000
2015	10 800
2016	11 400
2017	12 100
2018	13 500



07.2

Calculate the percentage increase in the number of infections caused by antibiotic resistant 'E. coli' between 2014 and 2018.

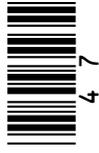
Use the equation:

$$\text{percentage increase} = \frac{\text{number of infections in 2018} - \text{number of infections in 2014}}{\text{number of infections in 2014}} \times 100$$

[2 marks]

47

Percentage increase = _____ %



[Turn over]

Antibiotics are used to treat many different bacterial infections.

The government wants scientists to research and develop a new ‘antibiotic test’ that:

- **takes less than 30 minutes**
- **shows doctors if an antibiotic is needed for an infection**
- **shows doctors which antibiotic to use.**

07.3 Suggest TWO reasons why research into antibiotics is needed. [2 marks]

1 _____

2 _____



07.4

The new test should mean that fewer people take antibiotics.

What are TWO effects of fewer people taking antibiotics? [2 marks]

Tick (✓) TWO boxes.

Antibiotic resistant bacteria are less likely to evolve.

Bacteria will be killed by all types of antibiotic.

Fewer bacteria will be exposed to antibiotics.

Fungi and viruses will NOT be killed by antibiotics.

Natural selection in bacteria will be faster.

07.5

A vaccine against 'E. coli' is being trialled.

Suggest what this vaccine contains to cause immunity to 'E. coli'. [1 mark]



0 8

This question is about solids and liquids.

0 8 . 1

Describe **TWO** ways the arrangement of particles in a solid is different from the arrangement of particles in a liquid.

You should answer in terms of the particle model. [2 marks]

1

2



Liquid water can freeze to form solid ice.

Grit is spread on roads to reduce the formation of ice.

Grit contains a mixture of salt and sand.

0 8 . 2 Explain why less ice is formed when salt is spread on roads. [2 marks]

[Turn over]



FIGURE 10, on the opposite page, shows the mass of ice melted by 1 kg of grit at different temperatures.

0 8 . 3 Draw a line of best fit on FIGURE 10.
[1 mark]

0 8 . 4 Predict the mass of ice that 1 kg of grit would melt at $-20\text{ }^{\circ}\text{C}$

Use FIGURE 10. [1 mark]

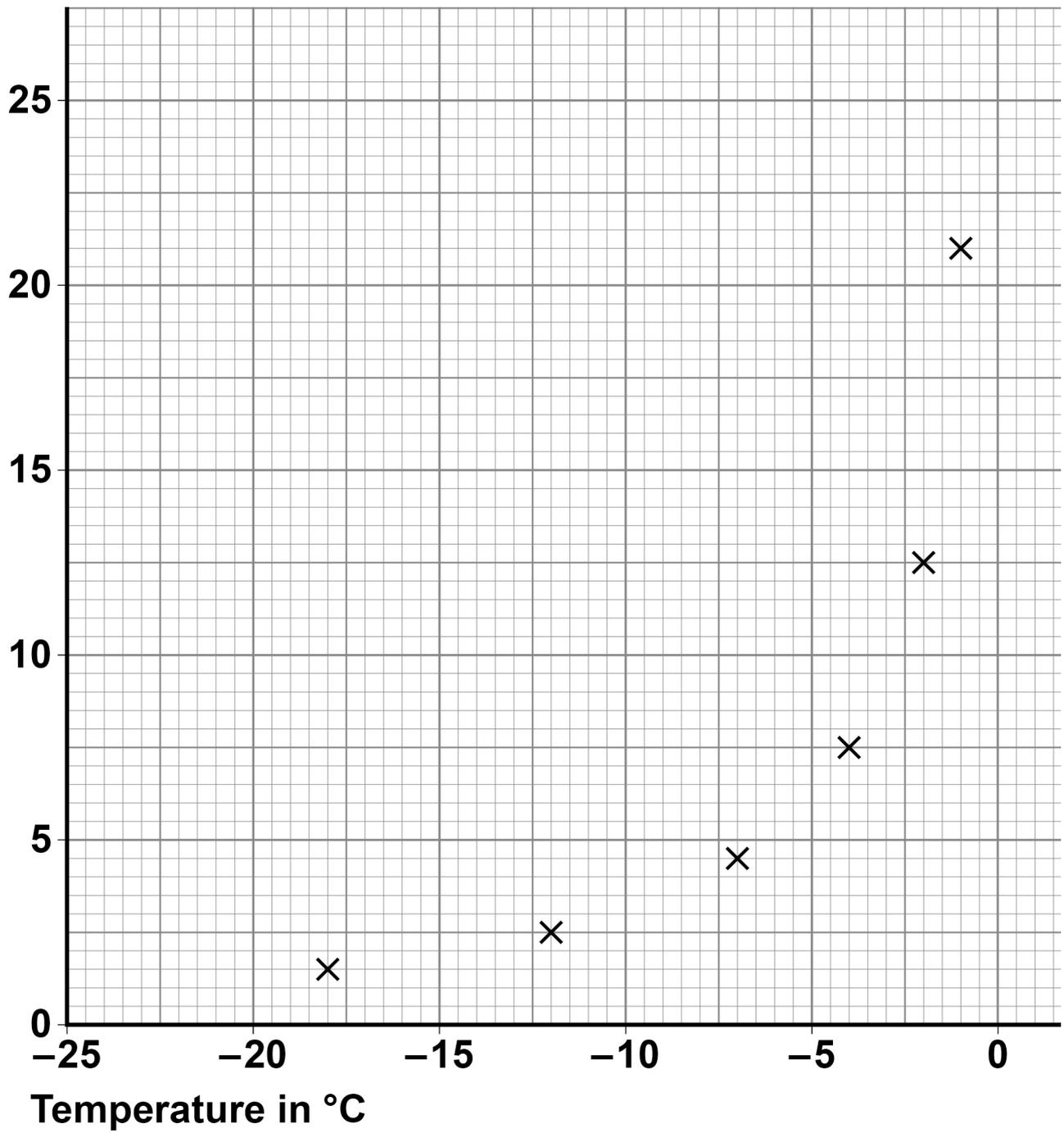
Mass of ice = _____ kg

0 8 . 5 Describe the effect of changing temperature on the mass of ice that 1 kg of grit can melt.

Use FIGURE 10. [2 marks]

FIGURE 10

Mass
of ice
melted
in kg



[Turn over]



0 8 . 6 Grit is spread on roads when low temperatures are expected.

Some roads are built with temperature sensors in the surface.

The sensors indicate when to spread grit on the roads.

Suggest ONE advantage of having temperature sensors in roads rather than relying on weather forecasts. [1 mark]

9



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[Turn over]



0 9

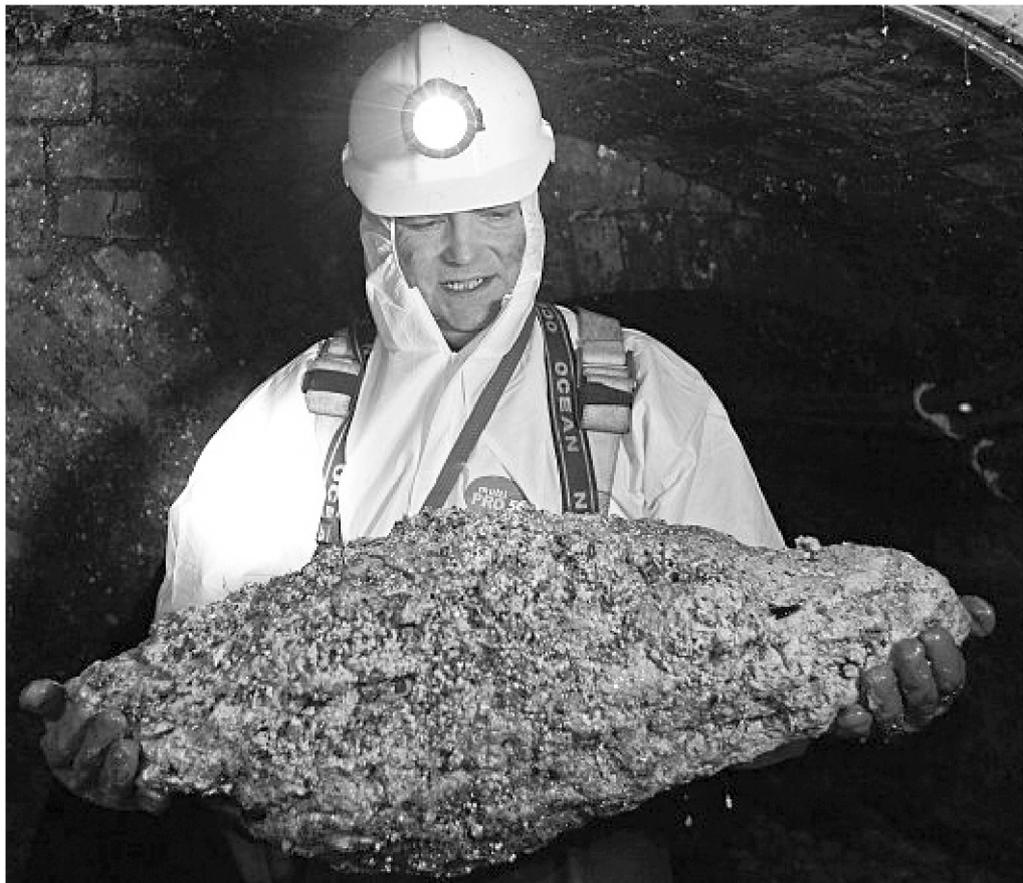
Sewers are often blocked by ‘fatbergs’.

Fatbergs are made of very large lumps of fat and other solids.

The fat and solids come from waste being washed down drains and flushed down toilets.

FIGURE 11 shows a person holding a small fatberg.

FIGURE 11



0 9 . 1 The chemical composition of fatbergs can be tested.

Describe how a sample from a fatberg could be tested for fat and for protein. [4 marks]

Test for fat _____

Positive result for fat _____

Test for protein _____

Positive result for protein _____

[Turn over]



0 9 . 2 Some fats in fatbergs come from undigested food in faeces.

Most fat that humans eat is digested.

Give the TWO products of fat digestion.
[2 marks]

1 _____

2 _____

It may be possible to use fatbergs as a fuel in power stations.

0 9 . 3 Burning 1.0 kg of fatbergs transfers 40 MJ of energy.

A power station could burn 1250 kg of fatbergs each hour.

Calculate the energy output from the power station in 1 year.

1 year = 8760 hours [3 marks]



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Question	Mark
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2	
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9	
TOTAL	

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