DRAFT SPECIMEN MATERIAL

GCSE
COMBINED SCIENCE: SYNERGY

F

Foundation Tier Paper 1F

Specimen 2018 Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a ruler
- a calculator
- the periodic table (enclosed)
- the Physics equation sheet (enclosed).

Instructions
- 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.

Information
- There are 100 marks available on this paper.
- 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.

Advice
- In all calculations, show clearly how you work out your answer.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

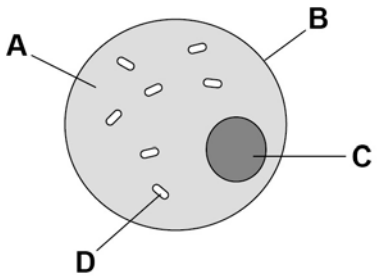
Forename(s) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Candidate signature _____

0 1 All living organisms are made of cells.

Figure 1 shows an animal cell.

Figure 1



0 1 . 1 Which part of the cell is the cytoplasm?

[1 mark]

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

0 1 . 2 Where in the cell does respiration take place?

[1 mark]

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

0 1 . 3 A student looks at a cell through a light microscope.

The size of the image she sees is 30 mm.

The size of the real cell is 0.03 mm.

What is the magnification of the microscope?

[1 mark]

Tick **one** box.

1 ☐

10 ☐

100 ☐

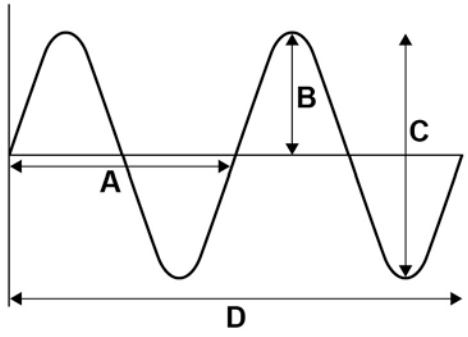
1000 ☐

Question 1 continues on the next page

A light microscope uses light waves to observe objects.

Look at **Figure 2**.

Figure 2



0 1 . 4 Which letter represents the amplitude of the wave?

[1 mark]

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

0 1 . 5 How many complete waves are shown in **Figure 2**?

[1 mark]

_____

0 1 . 6 Give the units for the frequency (f) and wavelength (λ) of a wave.

[2 marks]

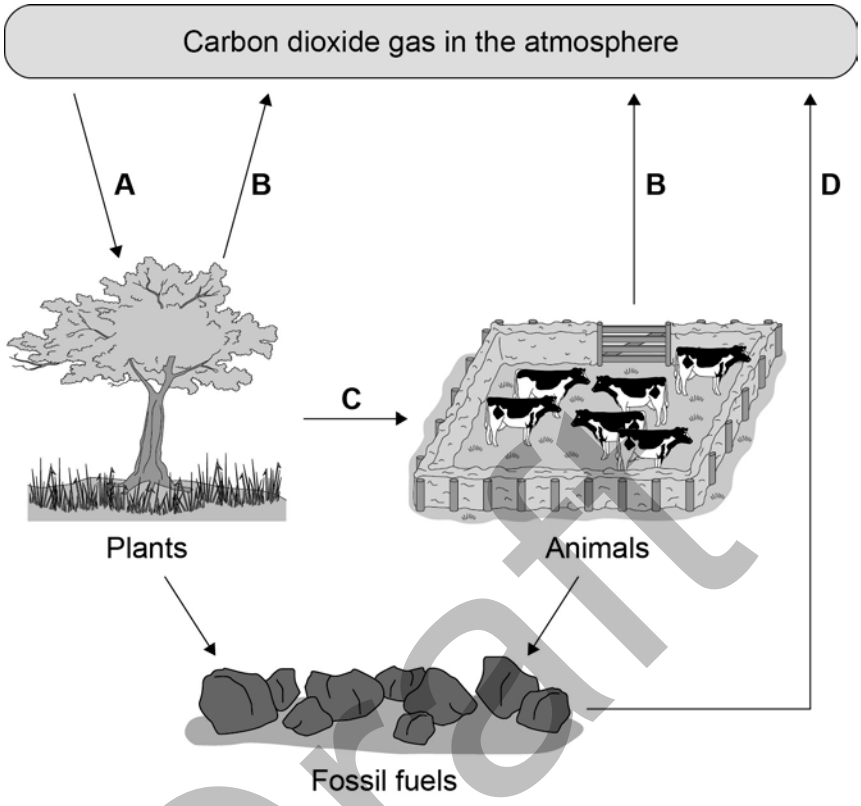
Unit for frequency _____

Unit for wavelength _____

Turn over for the next question

0 2 **Figure 3** shows the carbon cycle.

Figure 3



Use information from **Figure 3** to answer the following questions.

0 2 . 1 In process **A**, carbon dioxide in the atmosphere is taken into plants.

What is process **A**?

[1 mark]

Tick **one** box.

Evaporation ☐

Fossilisation ☐

Photosynthesis ☐

Respiration ☐

0 2 . 2 In process **B** carbon dioxide is released from plants and animals into the atmosphere.

What is process **B**?

[1 mark]

Tick **one** box.

- Burning ☐
- Feeding ☐
- Photosynthesis ☐
- Respiration ☐

0 2 . 3 In which process is carbon passed from one organism to another?

[1 mark]

Tick **one** box.

- **A** ☐
- **B** ☐
- **C** ☐
- **D** ☐

0 2 . 4 What will happen to the concentration of carbon dioxide in the atmosphere if lots of trees are cut down?

[1 mark]

0 2 . 5 Carbon dioxide is a greenhouse gas. Greenhouse gases cause global warming.

Name **two** other greenhouse gases.

[2 marks]

1 _____

2 _____

0 2 . 6 When animals and plants die the dead material decays and is broken down.

The process of decay returns carbon dioxide to the atmosphere.

What type of organism causes decay?

[1 mark]

Tick **one** box.

Animal ☐

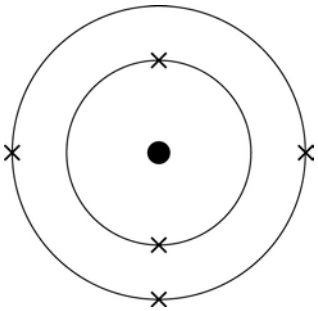
Microorganism ☐

Plant ☐

Turn over for the next question

0 3 **Figure 4** shows an atom of boron.

Figure 4



The mass number of boron is 11.

0 3 . 1 When the mass of the boron atom is calculated, the mass of the electron is ignored.

Why is the mass of the electron ignored?

[1 mark]

_____

_____

0 3 . 2 The mass number of an atom is the sum of the protons and neutrons in the atom.

Calculate the number of neutrons in the nucleus of the boron atom.

Explain how you worked out the answer.

[3 marks]

Number of neutrons = _____

Explanation _____

_____

_____

0 3 . 3 Calculate the percentage of the mass number of boron that is represented by the mass of neutrons.

Give your answer to two significant figures.

[2 marks]

Percentage = _____

0 3 . 4 What is the electrical charge on the nucleus of the boron atom?

[1 mark]

Tick **one** box.

+5 ☐

–5 ☐

+6 ☐

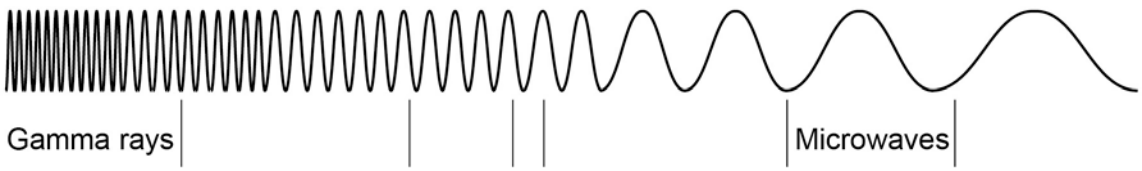
–6 ☐

Turn over for the next question

0 4 Electromagnetic waves have many uses.

Figure 5 shows gamma rays and microwaves.

Figure 5



0 4 . 1 Name **two** other types of electromagnetic wave.

[2 marks]

1 _____

2 _____

0 4 . 2 Give **one** use of microwaves.

[1 mark]

_____

_____

0 4 . 3 Gamma rays can be used to treat cancer.

Complete the sentences.

Use words from the box.

[2 marks]

benign	**controlled**	**differentiated**	**malignant**	**slow**	**uncontrolled**

Tumours form when cells divide in a way that is _____

Tumours that invade other tissues are called _____

0 4 . 4 Cancer can be caused by beta particles.

What is a beta particle?

[1 mark]

Tick **one** box.

A high-speed electron ☐

A neutron and an electron ☐

A neutron and a proton ☐

A helium nucleus ☐

Question 4 continues on the next page

When an atom of uranium (U) decays, two new elements are formed.

Look at **Figure 6**.

Figure 6

$$^{235}_{92}U \longrightarrow {}^{231}_{90}Th + {}^{4}_{2}He$$

0 4 . 5 Use information from **Figure 6** to complete **Table 1**.

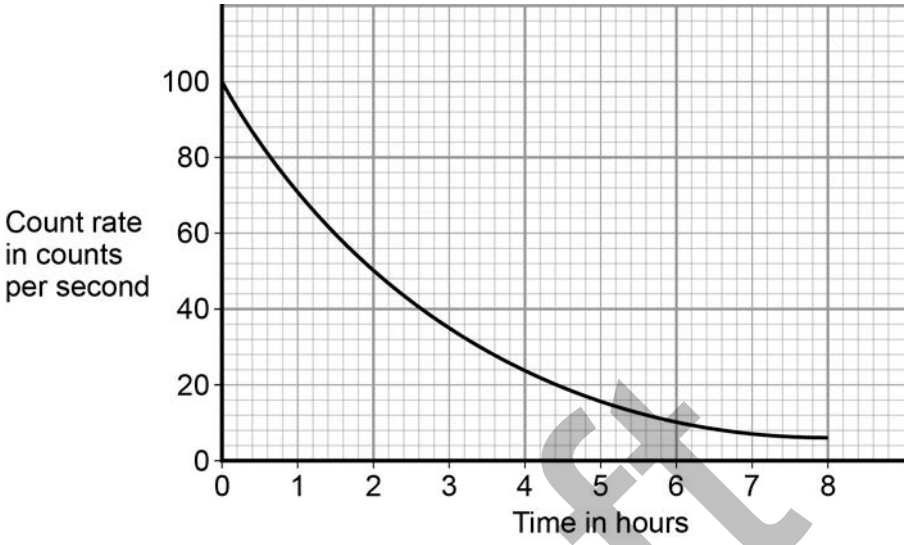
[3 marks]

Table 1

	U	**Th**
Mass number	235	
Number of protons		90
Number of neutrons	143	

Figure 7 shows how the count rate from a radioactive isotope changes with time.

Figure 7



0 4 . 6 What is the half-life of the radioactive isotope?

Explain why you chose that value.

[2 marks]

Half-life = _____ hours

Explanation _____

_____

Turn over for the next question

There are no questions printed on this page

0 5 Pathogens are microorganisms that cause infectious disease.

0 5 . 1 Draw **one** line from each disease to the way the disease is spread.

[3 marks]

Disease	Way the disease is spread
	Animals that draw blood
Cholera	Drinking contaminated water
Cold	Droplets in the air when people cough or sneeze
Malaria	Eating food that is contaminated
	Breathing air polluted with carbon dioxide

0 5 . 2 One way the human body protects itself against the entry of pathogens is by producing antimicrobial chemicals.

Antimicrobial chemicals kill pathogens.

Give **two** other ways the human body protects itself against the entry of pathogens.

[2 marks]

1 _____

_____

2 _____

_____

0 5 . 3 Measles is a childhood disease caused by a microorganism.

What type of microorganism causes measles?

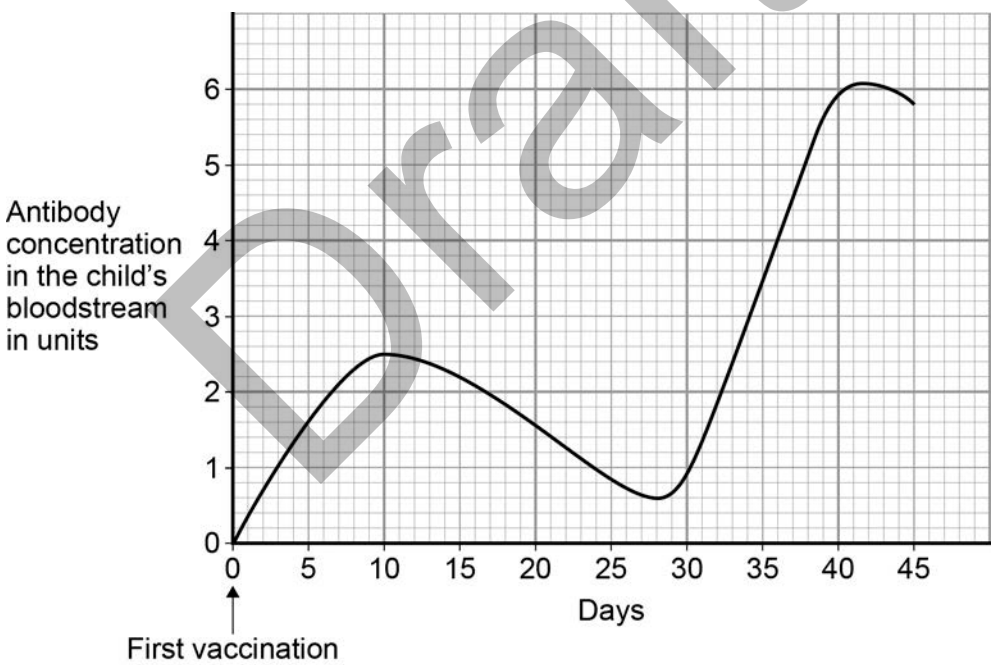
[1 mark]

Vaccinations help our body become immune to infections.

Most children in the UK have two vaccination injections against measles.

Figure 8 shows how the concentration of antibodies in the blood changes after each measles vaccination.

Figure 8



0 5 . 4 What is the highest concentration of antibodies produced by the first vaccination?

[1 mark]

_____

0 5 . 5 Suggest what day the second vaccination was given.

[1 mark]

_____

0 5 . 6 How will the number of children getting measles change as more children are vaccinated against measles?

Give a reason for your answer.

[2 marks]

Change _____

Reason _____

_____

Turn over for the next question

0 6 Sexual reproduction in humans involves the joining together of an egg cell and a sperm cell.

The sex of an embryo is decided by the chromosomes they inherit from their mother and father.

0 6 . 1 How many chromosomes does one human sperm cell contain?

[1 mark]

Tick **one** box.

22 ☐

23 ☐

46 ☐

44 ☐

0 6 . 2 How many chromosomes does one embryo cell contain?

[1 mark]

0 6 . 3 Where in the cell are the chromosomes?

[1 mark]

Tick **one** box.

Cell membrane ☐

Cytoplasm ☐

Nucleus ☐

Ribosomes ☐

0 6 . 4 A man and a woman decide to have a child.

Complete the genetic diagram in **Figure 9.**

[2 marks]

Figure 9

		Parent	
		X	**X**
Parent	**X**	XX	
	Y		

0 6 . 5 Circle **one** of the male children shown in **Figure 9.**

[1 mark]

0 6 . 6 What is the chance of the man and woman having a boy?

[1 mark]

Tick **one** box.

1 in 2 ☐

1 in 3 ☐

1 in 4 ☐

1 in 8 ☐

0 7 Density can be explained using the particle model.

0 7 . 1 What is the unit of density (ρ)?

[1 mark]

Tick **one** box.

joules, J ☐

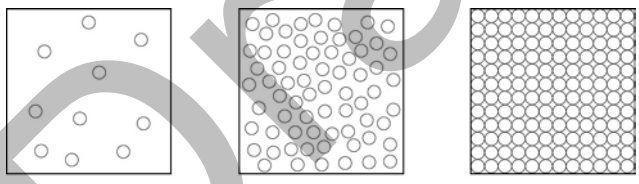
joules per kilogram, J/kg ☐

kilograms, kg ☐

kilograms per metre cubed, kg/m^3 ☐

Look at **Figure 10**.

Figure 10



0 7 . 2 Use **Figure 10** to explain why **C** has the highest density.

[2 marks]

0 7 . 3 Complete the sentences.

Use answers from the box.

[2 marks]

nuclear	**kinetic**	**randomly**	**slowly**	**potential**	**downwards**

The particles in box **A** are constantly moving.

The particles move _____ .

When the temperature of the particles in box **A** is, increased

the particles have more _____ energy .

0 7 . 4 In **Figure 10**, box **A** shows particles of a gas in a box.

The box and the gas inside the box are heated.

What happens to the pressure inside the box?

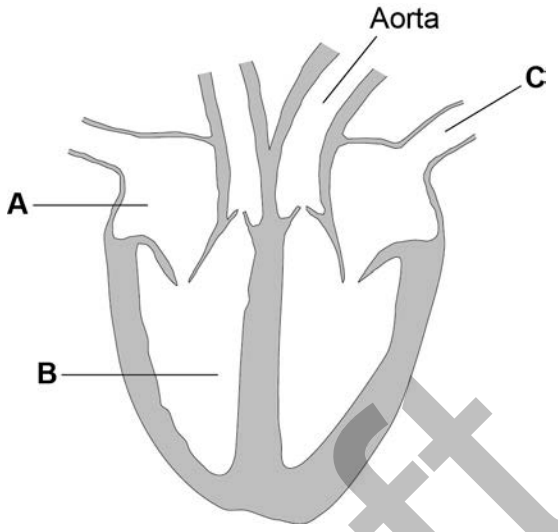
[1 mark]

_____

Turn over for the next question

0 8 **Figure 11** shows a diagram of the human heart.

Figure 11



0 8 . 1 Name parts **A** and **B**.

[2 marks]

A _____

B _____

0 8 . 2 What is blood vessel **C**?

[1 mark]

Tick **one** box.

Aorta ☐

Coronary artery ☐

Pulmonary artery ☐

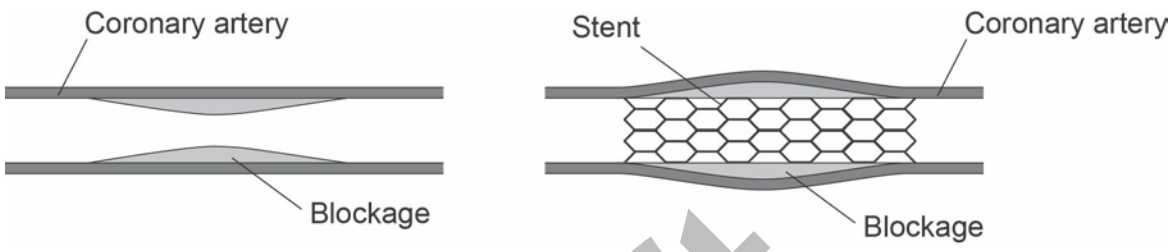
Vena cava ☐

Coronary heart disease (CHD) develops when layers of fatty material build up in the coronary artery.

One treatment for CHD is to insert a stent into the coronary artery.

Figure 12 shows a stent in a coronary artery.

Figure 12



0 8 . 3 Describe how the stent helps to prevent a heart attack.

[3 marks]

Question 8 continues on the next page

Look at **Table 2**.

Table 2

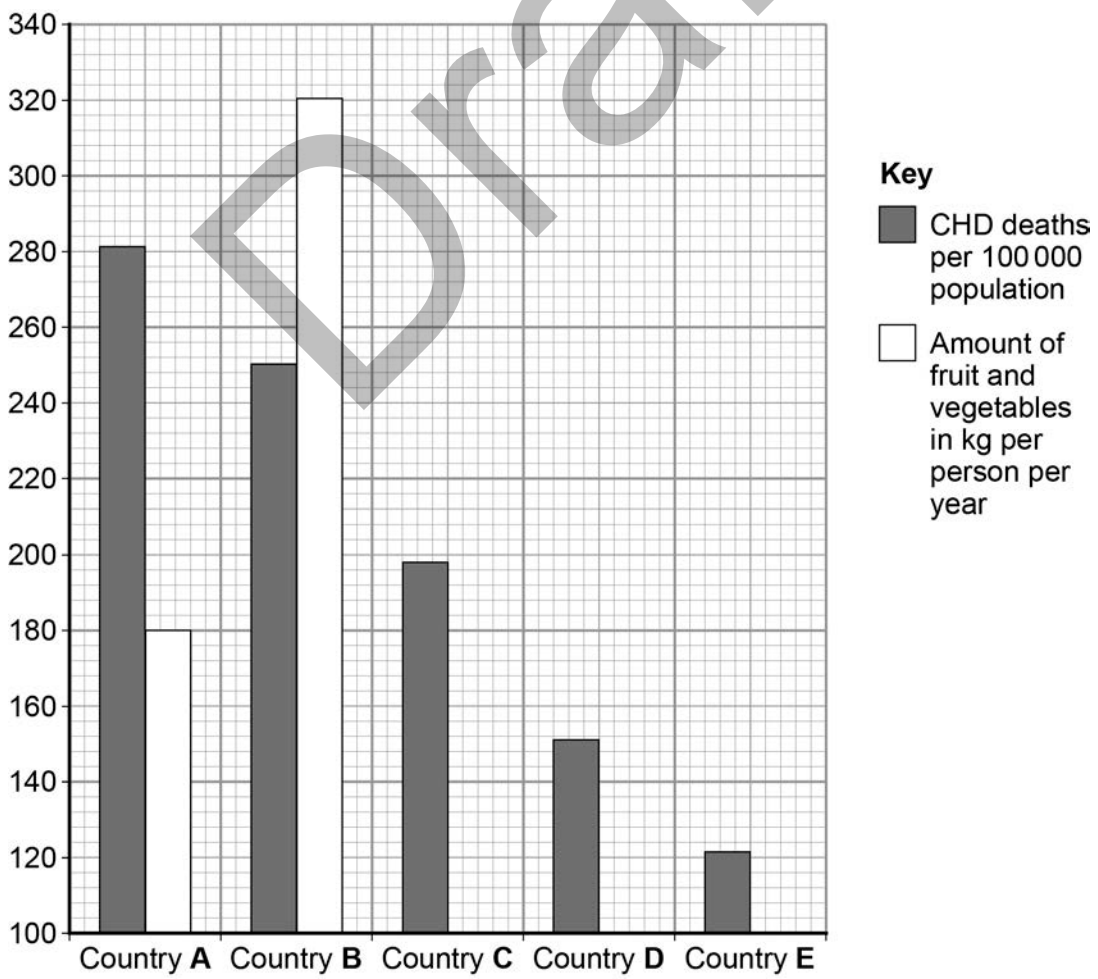
Country	Number of deaths from CHD per 100 000 population per year	Amount of fruit and vegetables eaten in kg per person per year
A	285	180
B	250	320
C	198	250
D	151	220
E	122	222

0 8 . 4 Use **Table 2** to complete the bar chart in **Figure 13**.

Plot the bars for countries **C**, **D** and **E**.

[2 marks]

Figure 13



0 8 . 5 People in country **B** are more likely to die from CHD than people in country **E**.

How many more times as likely are people to die from CHD in country **B** than in country **E**?

[1 mark]

0 8 . 6 A student concluded:

'not eating enough fruit and vegetables causes CHD.'

Evaluate the student's conclusion.

Use data from **Figure 13**, and your own knowledge, in your answer.

[3 marks]

0 8 . 7 Give **two** factors other than diet that could be causing the higher death rate from CHD in country **A**.

[2 marks]

1

2

0 9 This question is about respiration.

0 9 . 1 Complete the word equation for respiration.

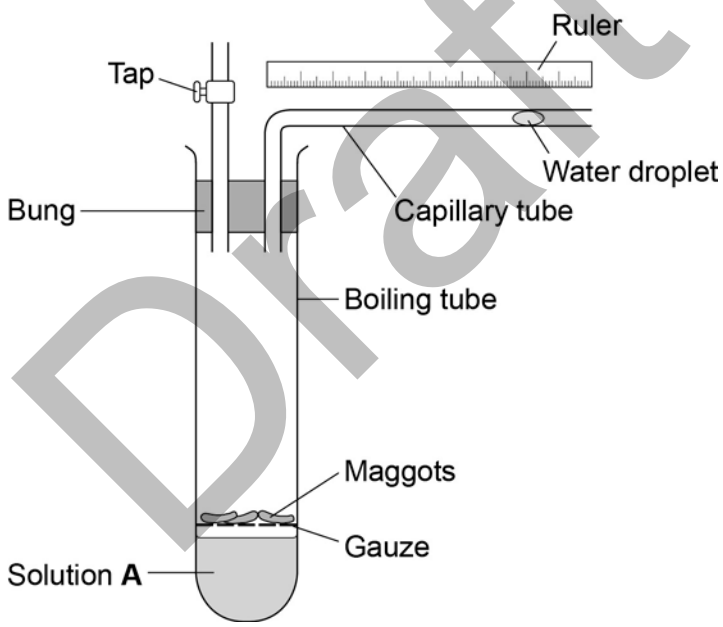
[2 marks]

_____ + _____ → _____ + water

A student investigates the rate of respiration in maggots.

Figure 14 shows the equipment he uses.

Figure 14



0 9 . 2 Why does the student put the maggots on gauze?

[1 mark]

_____

_____

0 9 . 3 When maggots respire they take in a gas from the air and release a different gas.

Solution **A** absorbs the gas released.

At the start of the investigation the student records the distance of the water droplet from the bend in the capillary tube.

What happens to the water droplet as the maggots respire?

Give reasons for your answer.

[3 marks]

Question 9 continues on the next page

Table 3 shows the student's results.

Table 3

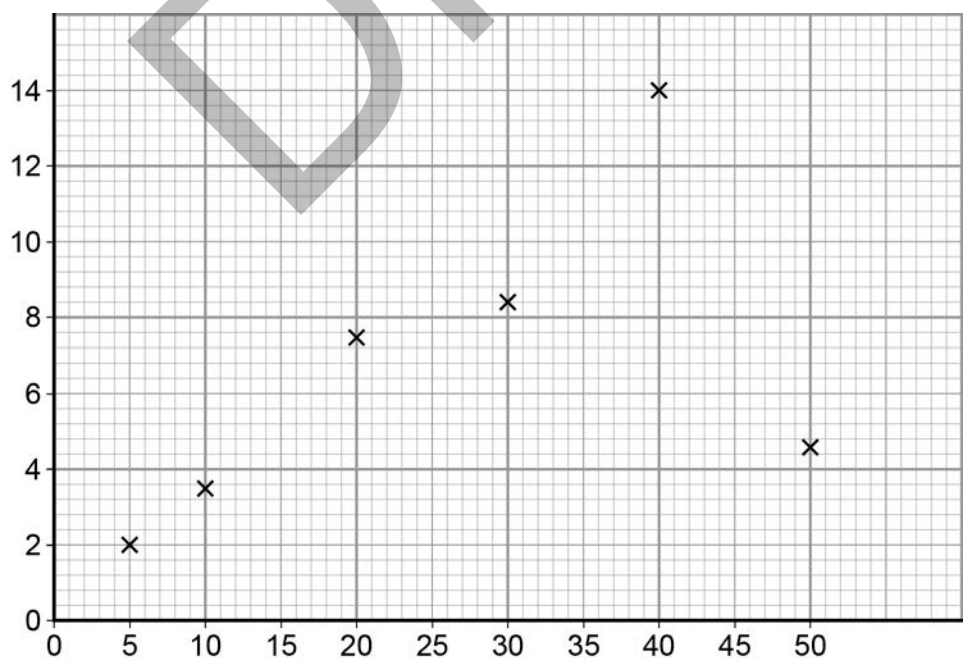
Temperature in °C	Rate of respiration in arbitrary units
5	2.2
10	3.5
20	7.5
30	8.4
40	14.0
50	4.6

0 9 . 4 The student uses his results to plot the graph in **Figure 15**.

Put the correct labels on the *x* and *y* axis.

[1 mark]

Figure 15



0 9 . 5 How could the student find out if the result at 30 °C is anomalous?

[1 mark]

0 9 . 6 Suggest what the value at 30 °C should be to fit the pattern of the graph.

[1 mark]

0 9 . 7 The results show that the rate of respiration increases between 5 °C and 40 °C.

Metabolism also increases between 5 °C and 40 °C.

What is metabolism?

[1 mark]

Turn over for the next question

1 0 Feeding relationships within communities can be shown using food chains.

Figure 16 shows an ocean food chain.

Figure 16

Phytoplankton → Zooplankton → Cod → Seal → Shark

1 0 . 1 Which organism in the food chain carries out photosynthesis?

[1 mark]

1 0 . 2 Which organism in the food chain is a tertiary consumer?

[1 mark]

1 0 . 3 Scientists often state that only 10% of the energy transferred into the food chain passes to the end of the food chain.

The shark in **Figure 16** receives 4000 J of energy.

Calculate how much energy entered the food chain if the shark received only 10% of this energy.

[2 marks]

Energy = _____ J

1 0 . 4 In one year, a disease infects and kills many of the seals.

Explain what might happen to the number of cod.

[2 marks]

Turn over for the next question

1 1 This question is about water treatment.

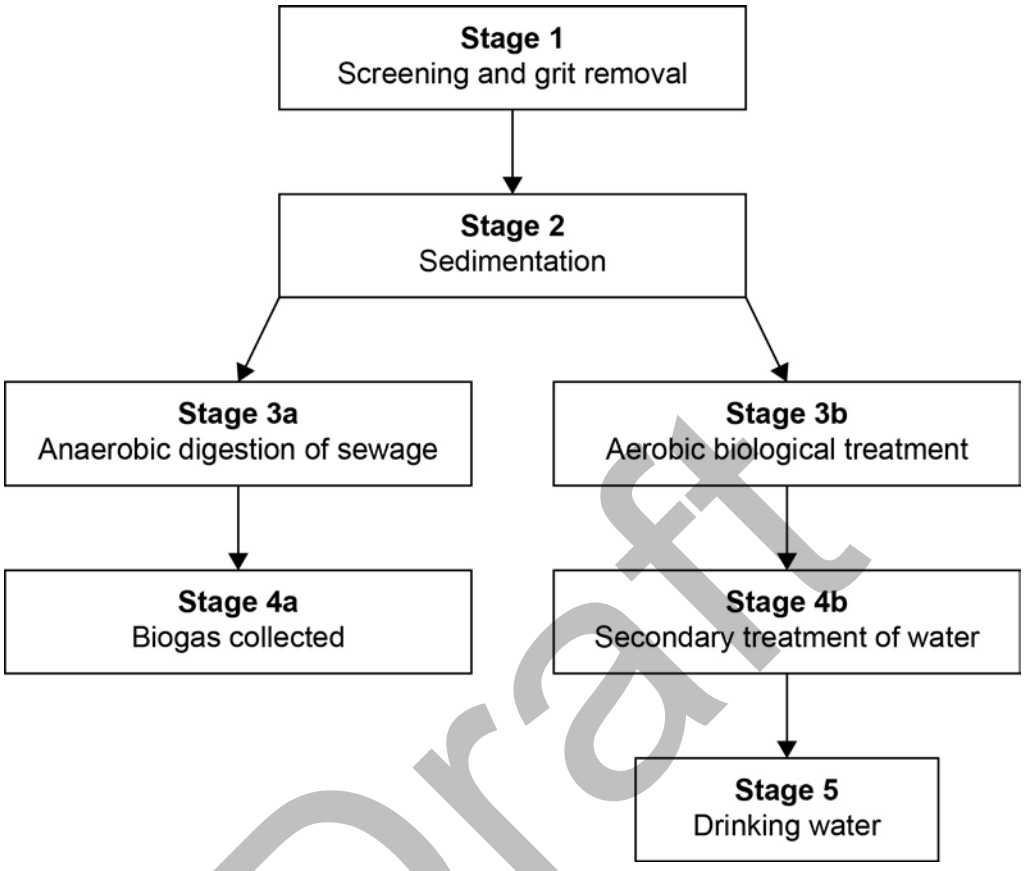
1 1 . 1 Rainwater collects in the ground in rivers and lakes.

How is water from rivers and lakes treated before it is piped into our homes for drinking?

[4 marks]

Figure 17 shows a sewage treatment process.

Figure 17



1 1 . 2 What does **anaerobic** in stage **3a** mean?

[1 mark]

1 1 . 3 What type of organism is used in stage **3a**?

[1 mark]

1 2 Drug companies develop new drugs to treat disease.

New drugs are trialled before they are licensed for use.

During drug trials the new drugs are tested for side effects.

1 2 . 1 Give **two** other factors that new drugs are tested for during trials.

[2 marks]

1 _____

_____

2 _____

_____

1 2 . 2 What is a double-blind trial?

[2 marks]

_____

_____

_____

_____

Statins are used to treat coronary heart disease (CHD).

Some scientists trialled two different types of statin.

The scientists:
- conducted the trial on 325 patients with a history of CHD in their family
- used a double-blind trial method
- measured the change in blood cholesterol levels over two years
- measured the change in thickness of an artery wall over two years.

Table 4 shows the results.

Table 4

	Drug A	**Drug B**
Number of patients who died during the trial	1	2
Number of patients who reported aching muscles	16	17
Number of patients who reported mild abdominal cramps	18	16
Change in blood cholesterol level in percentage	–50.5	–41.2
Change in thickness of artery in mm	–0.0033	+0.032

1 2 . 3 A student suggested that Drug **A** was more effective than Drug **B**.

She thought this because half the number of Drug **A** patients died during the trial compared to Drug **B** patients.

Give **two** other reasons that support the student's conclusion.

Use information from **Table 4**.

[2 marks]

1 _____

_____

2 _____

_____

1 2 . 4 Another student suggested that Drug **A** was a safer drug than Drug **B.**

Give reasons why this is **not** a valid conclusion.

[2 marks]

1 2 . 5 The results of drug trials are peer reviewed before they are published.

Why are peer reviews important in drug trials?

[1 mark]

Tick **one** box.

To calculate the best dose ☐

To check the drug works ☐

To make sure the scientist gets credit ☐

To prevent false claims ☐

END OF QUESTIONS