SPECIMEN MATERIAL

GCSE
COMBINED SCIENCE: SYNERGY

F

Foundation Tier Paper 2F

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.
- When answering questions 05.4 and 10.1 you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

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

Please write clearly, in block capitals.

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

Surname ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

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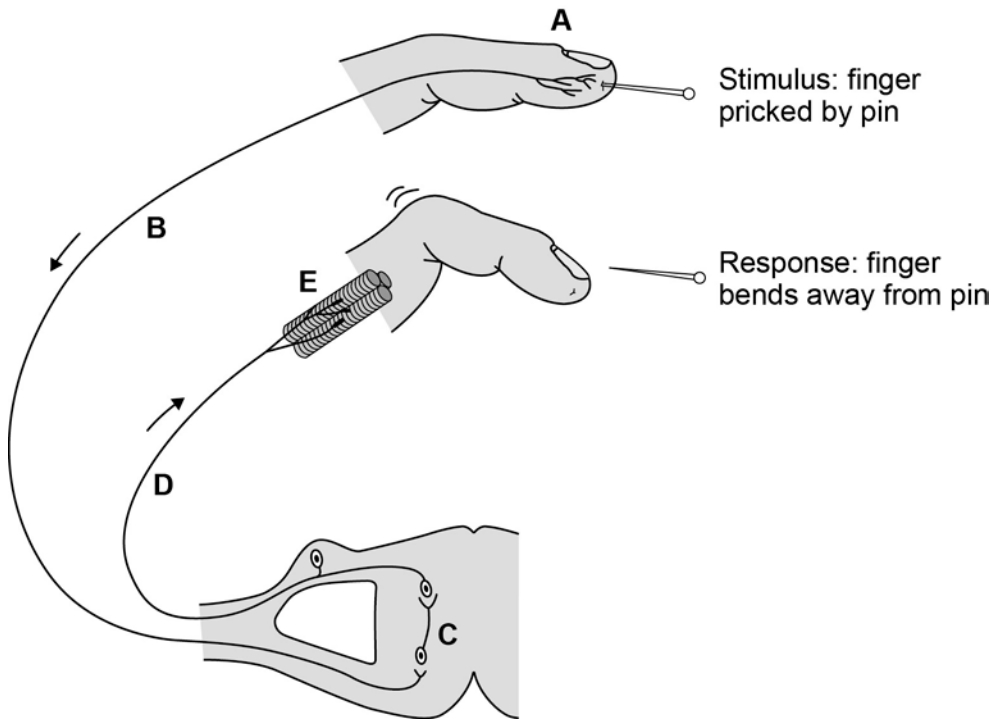
0 1 Our nervous system controls our reactions.

Figure 1 shows the part of the nervous system involved in the rapid response to a stimulus.

Figure 1



0 1 . 1 What is this type of rapid response called?

[1 mark]

Tick **one** box.

Circular action ☐

Fast action ☐

Forced action ☐

Reflex action ☐

0 1 . 2 Features of the nervous system are labelled **A**, **B**, **C**, **D** and **E** on **Figure 1**.

Draw **one** line from each feature to the correct label from **Figure 1**.

[3 marks]

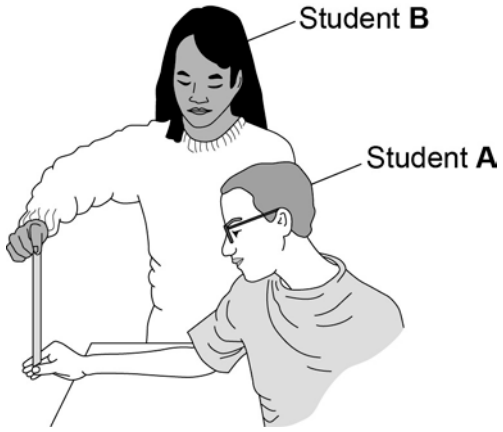
Feature	Label
	A
Effector	B
Relay neurone	C
Sensory neurone	D
	E

Question 1 continues on the next page

Two students compare their reactions using a ruler.

This is the method used.

1. Student **A** sits with his elbow on a table top.
2. Student **B** holds the ruler so the bottom of the ruler is level with the top of student **A**'s thumb.
3. Student **B** drops the ruler.
4. Student **A** catches the ruler.
5. Record the drop distance.
6. Repeat steps 1 to 5 four more times.
7. Repeat the whole experiment with student **A** dropping the ruler and student **B** catching it.



Both students are right-handed.

The students are testing the hypothesis:

the drop distance of the ruler is smaller when a right-handed person uses their right hand to catch the ruler.

Student **A** uses his right hand to catch the ruler.

Student **B** uses her left hand to catch the ruler.

0 1 . 3 Complete the sentence.

Use an answer from the box.

[1 mark]

control	**dependent**	**independent**

The drop distance was the _____ variable.

Question 1 continues on the next page

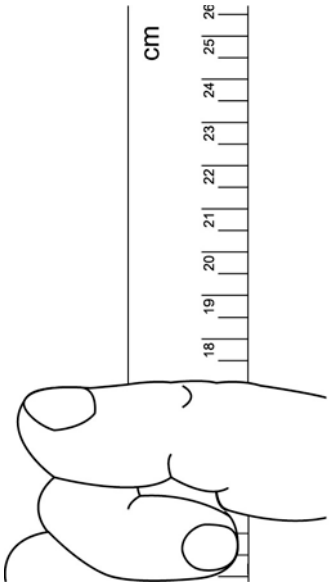
Table 1 shows the students' results.

Table 1

Student	Drop distance in cm				
	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**
Student **A**	17.5	15.5	15.0	23.5	17.0
Student **B**	20.5		19.5	21.0	19.0

0 1 . 4 **Figure 2** shows student **B**'s Test 2 result.

Figure 2



Use **Figure 2** to complete the missing result for Test 2.

Write the answer in **Table 1**.

[1 mark]

0 1 . 5 What was the resolution of the ruler the students used?

[1 mark]

Tick **one** box.

0.1 cm ☐

0.5 cm ☐

1 cm ☐

10 cm ☐

0 1 . 6 One of the results in **Table 1** is anomalous.

Identify the anomalous result.

Give the reason why you chose your answer.

[2 marks]

0 1 . 7 The students are testing the hypothesis:

the drop distance of the ruler is smaller when a right-handed person uses their right hand to catch the ruler.

The results in **Table 1** are not a good test of the hypothesis.

What is one reason why?

[1 mark]

Tick **one** box.

The drop distances are very variable ☐

The drop distance for Student **A** is sometimes bigger than the drop distance for Student **B** ☐

The results are for the left and right hands of different people ☐

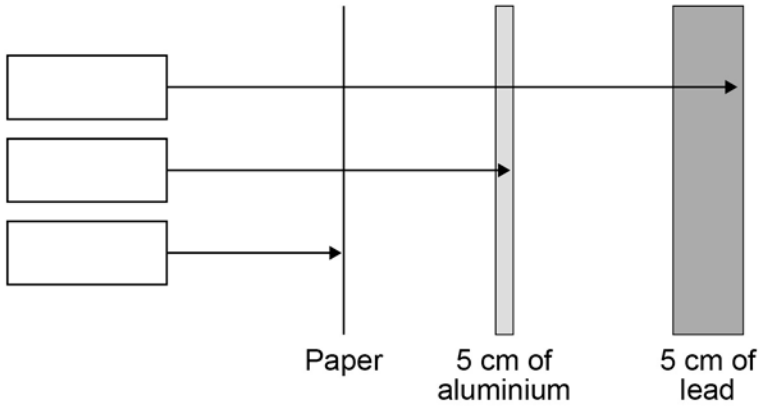
The drop distances are not measured accurately enough ☐

0 2 Alpha, beta and gamma are types of nuclear radiation.

A teacher sets up a demonstration of the penetration properties of alpha, beta and gamma radiation.

Figure 3 shows the demonstration.

Figure 3



0 2 . 1 Complete **Figure 3** by writing the name of the radiation in each box.

[2 marks]

0 2 . 2 Give **two** safety precautions the teacher should take in the demonstration.

[2 marks]

1 _____

_____

2 _____

_____

Table 2 shows how the count rate of a radioactive source changes with time.

Table 2

Time in seconds	0	40	80	120	160
Count rate in counts/second	600	463	300	221	150

0 2 . 3 Describe the relationship shown in **Table 2**.

[2 marks]

0 2 . 4 Use **Table 2** to predict the count rate after 200 seconds.

[2 marks]

Count rate = _____ counts/second

Question 2 continues on the next page

0 2 . 5 The half-life of the radioactive source is very short.

Give **one** reason why the source would be much less hazardous after 800 seconds.

[1 mark]

0 3 Blood sugar levels in the body are controlled by insulin.

0 3 . 1 How does insulin travel around the body?

[1 mark]

Question 3 continues on the next page

0 3 . 2 **Table 3** shows the blood sugar levels for two people after eating a meal.

Table 3

Time after eating in hours	Blood sugar levels in mg per 100 cm^3 of blood	
	Person A	**Person B**
0	70	130
1	150	230
2	90	185
3	80	165
4	75	140

Use data from **Table 3** to complete the graph in **Figure 4**.

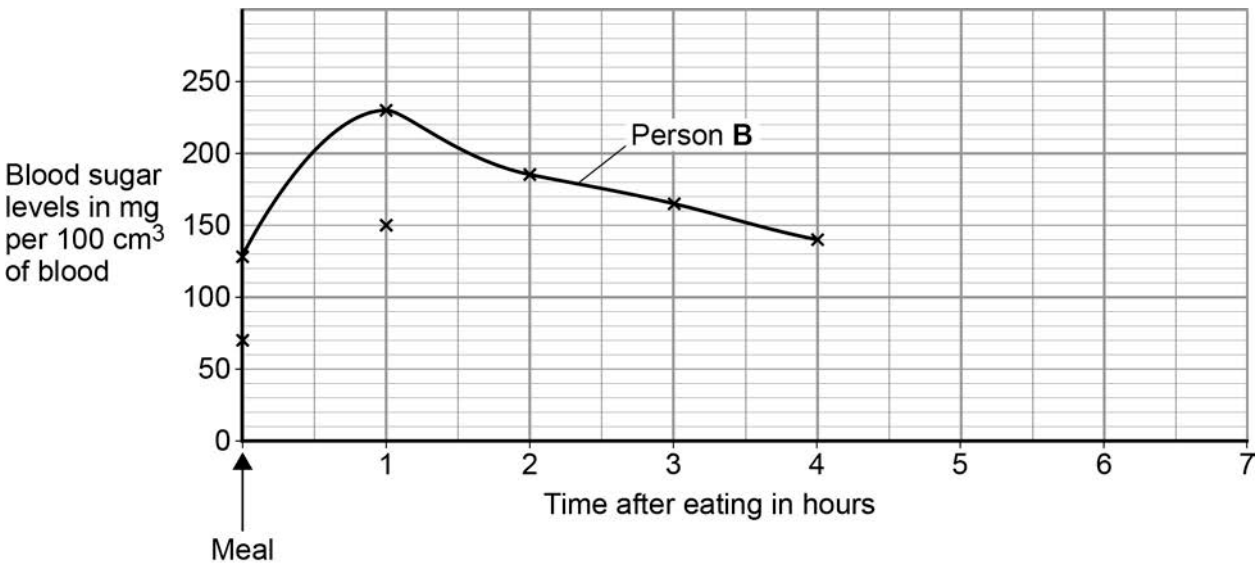
Plot the points for person **A**.

The first two points have been plotted for you.

Draw a line through all the points.

[3 marks]

Figure 4



0 3 . 3 How long after the meal is person **B**'s insulin production at its peak?

[1 mark]

0 3 . 4 What is the greatest **decrease** in the blood sugar level of person **B** in an hour?

[2 marks]

Decrease = _____ mg per 100 cm^3

0 3 . 5 Estimate how long after eating the meal it will take for person **B**'s blood sugar level to return to the level before the meal.

Show your working on **Figure 4**.

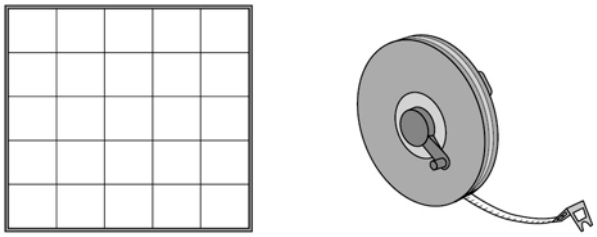
[2 marks]

Turn over for the next question

0 4 A student investigated the number of ribwort plants in a field.

The student used the apparatus shown in **Figure 5**.

Figure 5



Quadrat

Tape measure

Not drawn to scale

This is the method used.

1. Place the quadrat in an area where there are lots of ribwort plants in the field.
2. Count the number of ribwort plants inside a quadrat.
3. Repeat steps 1 and 2 four more times.

0 4 . 1 How could the student improve his method so that he can collect valid results?

[2 marks]

Tick **two** boxes.

- Count the leaves of each ribwort plant ☐
- Place more quadrats in the field ☐
- Place the quadrats randomly ☐
- Use a smaller quadrat ☐
- Weigh the ribwort plants ☐

0 4 . 2 The student calculated that the mean number of ribwort plants per m^2 was 3.2

The area of the field was 8250 m^2.

Calculate the total number of ribwort plants in the field.

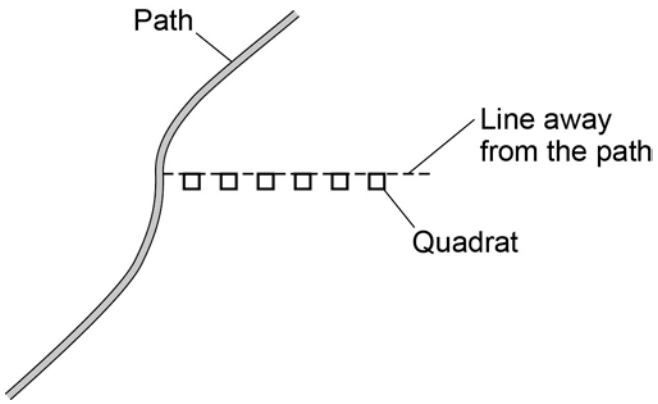
[1 mark]

Total number of ribwort plants = _____

Another group of students did an investigation in the field.

Figure 6 shows how the students placed their quadrats in this investigation.

Figure 6

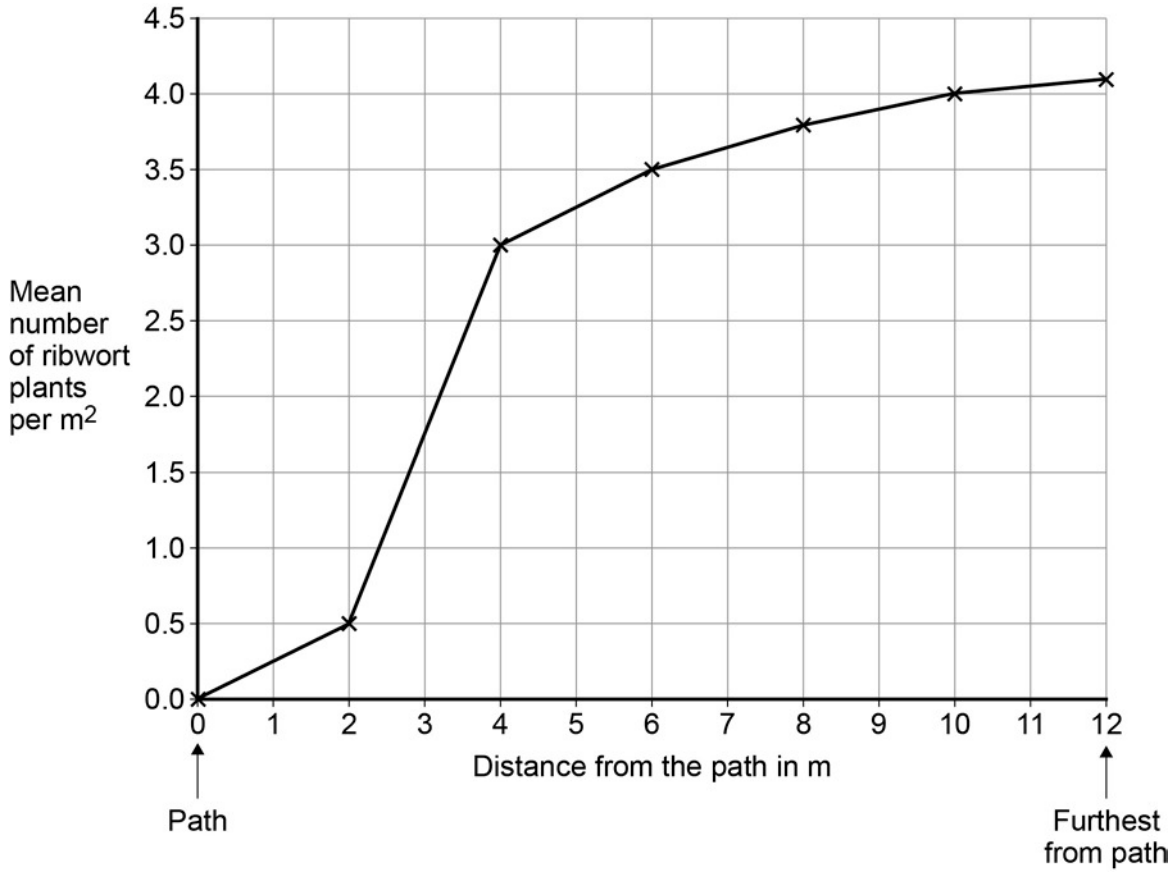


0 4 . 3 What is the name given to the line in **Figure 6**?

[1 mark]

Figure 7 shows the students' results.

Figure 7



0 4 . 4 Describe the relationship shown in **Figure 7**.

[2 marks]

0 4 . 5 What is one reason why there are no ribwort plants next to the path?

[1 mark]

Tick **one** box.

- There is less light near the path ☐
- The ribwort plants get walked on ☐
- There are more nutrients in the soil near the path ☐
- There are fewer animals near the path ☐

Turn over for the next question

There are no questions printed on this page

0 5 Millions of years ago the Earth's atmosphere was probably like the atmosphere of Mars today.

0 5 . 1 **Table 4** shows percentages of the main gases in the atmospheres of Earth and Mars today.

Table 4

Gas	Percentage in atmosphere of Mars today	Percentage in atmosphere of Earth today
Carbon dioxide	95.00	0.04
Nitrogen	3.50	78.00
Oxygen	0.50	21.00

For each gas in the table, suggest a reason for the change in the percentage of the gas in Earth's atmosphere.

[3 marks]

Carbon dioxide _____

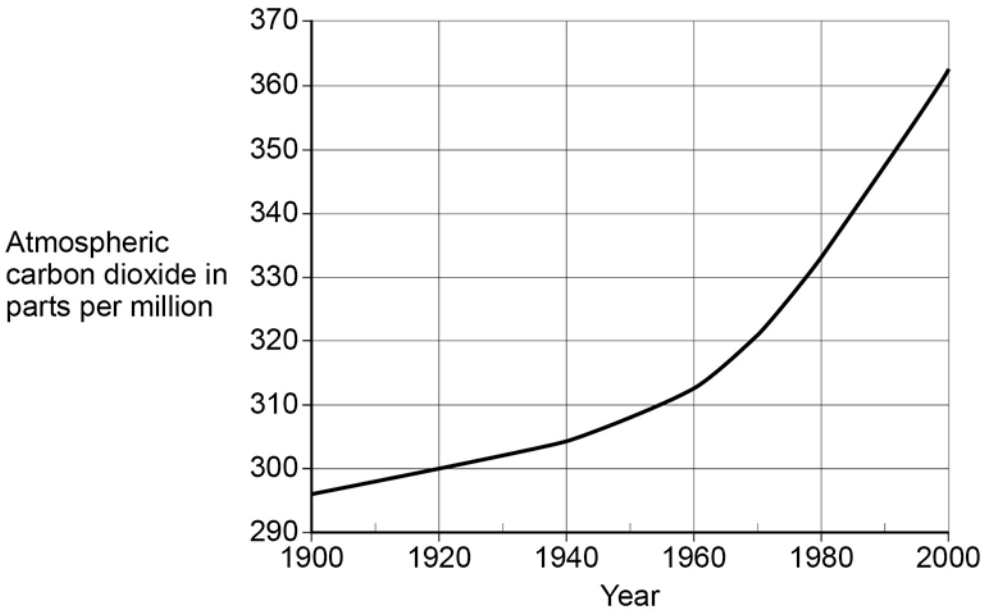
Nitrogen _____

Oxygen _____

Question 5 continues on the next page

Figure 8 shows how the concentration of carbon dioxide in the Earth's atmosphere changed between 1900 and 2000.

Figure 8



0 5 . 2 One of the causes of the increase in carbon dioxide between 1900 and 2000 is increased use of fossil fuels.

Suggest when use of fossil fuels began to increase.

Use data from **Figure 8** to explain your answer.

[2 marks]

0 5 . 3 What is the percentage increase in carbon dioxide levels between 1970 and 2000?

[3 marks]

Increase = _____ %

0 5 . 4 Explain how the changes shown in **Figure 8** can have harmful effects on the environment.

[4 marks]

Turn over for the next question

0 6 A person's characteristics can be due to:

- environmental causes
- genetic causes
- both environmental and genetic causes.

0 6 . 1 Complete **Table 5**.

Put a tick to show what each characteristic is due to.

[3 marks]

Table 5

Characteristic	Characteristic due to		
	Environmental causes	Genetic causes	Both environmental and genetic causes
Eye colour			
A scar			
Weight			

0 6 . 2 Draw **one** line from each key term to the correct definition.

[2 marks]

Key term	Definition
	The set of alleles for a characteristic
Genotype	The genus of an organism
	The inheritance of chromosomes
Phenotype	The mutation of genes
	The physical characteristics of an organism

Question 6 continues on the next page

0 6 . 3 Farmers use selective breeding to control the characteristics in cows.

Table 6 shows the stages of selective breeding in cows.

Complete **Table 6** to show the correct order of the stages.

The first stage has been numbered for you.

[2 marks]

Table 6

Stage in selective breeding	**Order of stage**
Cows are bred over many generations	
Parents are bred together	
Cows with the desired characteristics are chosen	1
Calves with the most desired characteristics are bred together	

0 6 . 4 Farmers selectively breed cows for many different reasons.

Suggest **two** characteristics that cows may be bred for.

Do **not** suggest coat colour.

[2 marks]

1 _____

_____

2 _____

_____

0 6 . 5 Selective breeding can lead to problems.

Suggest how problems caused by selective breeding in cows can have negative financial effects for the farmer.

[2 marks]

_____

_____

_____

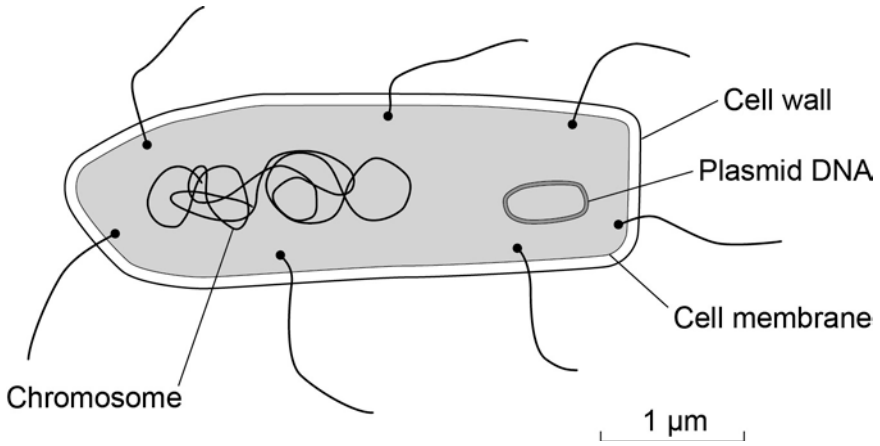
_____

Turn over for the next question

0 7 Bacteria can cause disease.

Figure 9 shows some features of a *Salmonella* bacterium.

Figure 9



0 7 . 1 Draw **one** line from each feature of the *Salmonella* bacterium to the function.

[2 marks]

Feature	Function
	Controls the movement of substances into and out of the cell
Cell membrane	Carries genetic information
Plasmid DNA	Provides support and protection
	The site of protein synthesis

0 7 . 2 How is *Salmonella* spread between people?

[1 mark]

Tick **one** box.

- Animal bites ☐
- Contaminated food ☐
- Sneezing ☐
- Sexual contact ☐

0 7 . 3 Give **two** ways you could stop *Salmonella* from spreading.

[2 marks]

1 _____

_____

2 _____

_____

Question 7 continues on the next page

Harmful bacteria can also be useful.

Scientists are doing research to find out if *Salmonella* can be used in a vaccine to treat cancer.

0 7 . 4 The *Salmonella* vaccine can be injected into the blood or swallowed in a tablet.

One benefit of injecting the vaccine is that it gets to the cancer quickly in the blood.

What is another benefit?

[1 mark]

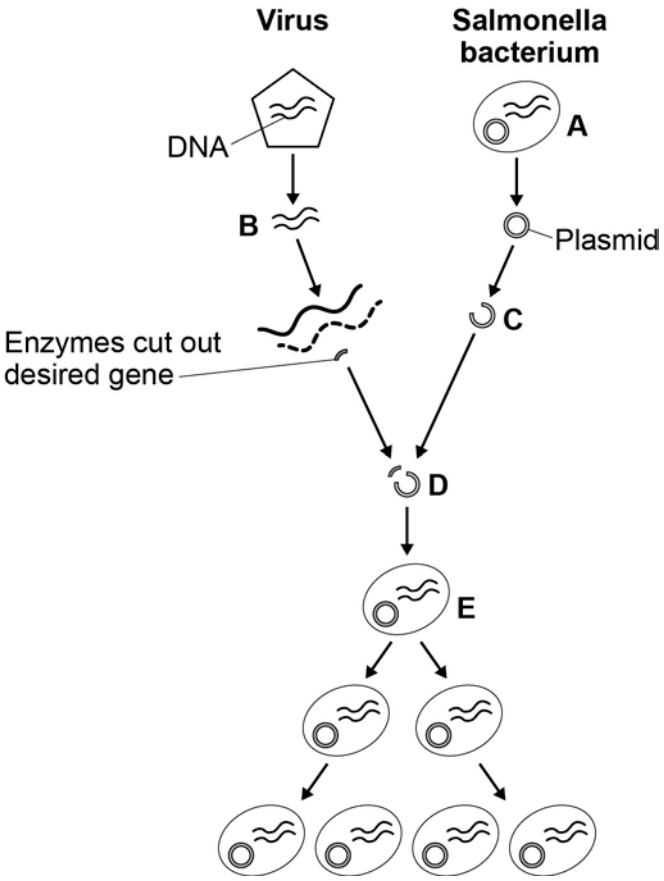
Tick **one** box.

- All cancers can be treated by the injection ☐
- It will not cause sickness and diarrhoea side effects ☐
- The injection is not painful to the patient ☐
- The injection introduces cancer cells into the body ☐

0 7 . 5 The *Salmonella* bacterium used in the vaccine is genetically modified using part of a virus.

Look at **Figure 10**.

Figure 10



Complete the sentences.

Use the letters from **Figure 10**.

[3 marks]

Bacteria reproduce quickly in part _____ .

DNA with the desired gene is removed from the virus in part _____.

The chosen gene is inserted into the plasmid in part _____ .

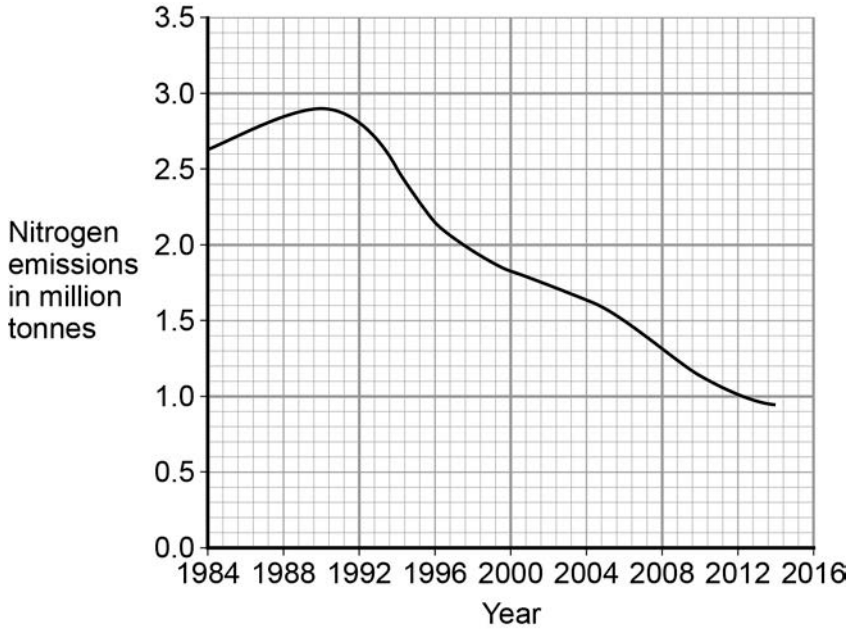
0 8 Oxides of nitrogen are produced when fuels are burnt.

0 8 . 1 Write a balanced symbol equation for the production of nitrogen dioxide (NO_2) from nitrogen and oxygen.

[2 marks]

0 8 . 2 **Figure 11** gives information about emissions of oxides of nitrogen in the UK.

Figure 11



Calculate the percentage decrease in emissions of oxides of nitrogen from 1990 to 2014.

Give your answer to three significant figures.

[3 marks]

Percentage decrease = _____ %

0 8 . 3 Give **one** advantage of reducing the emissions of oxides of nitrogen.

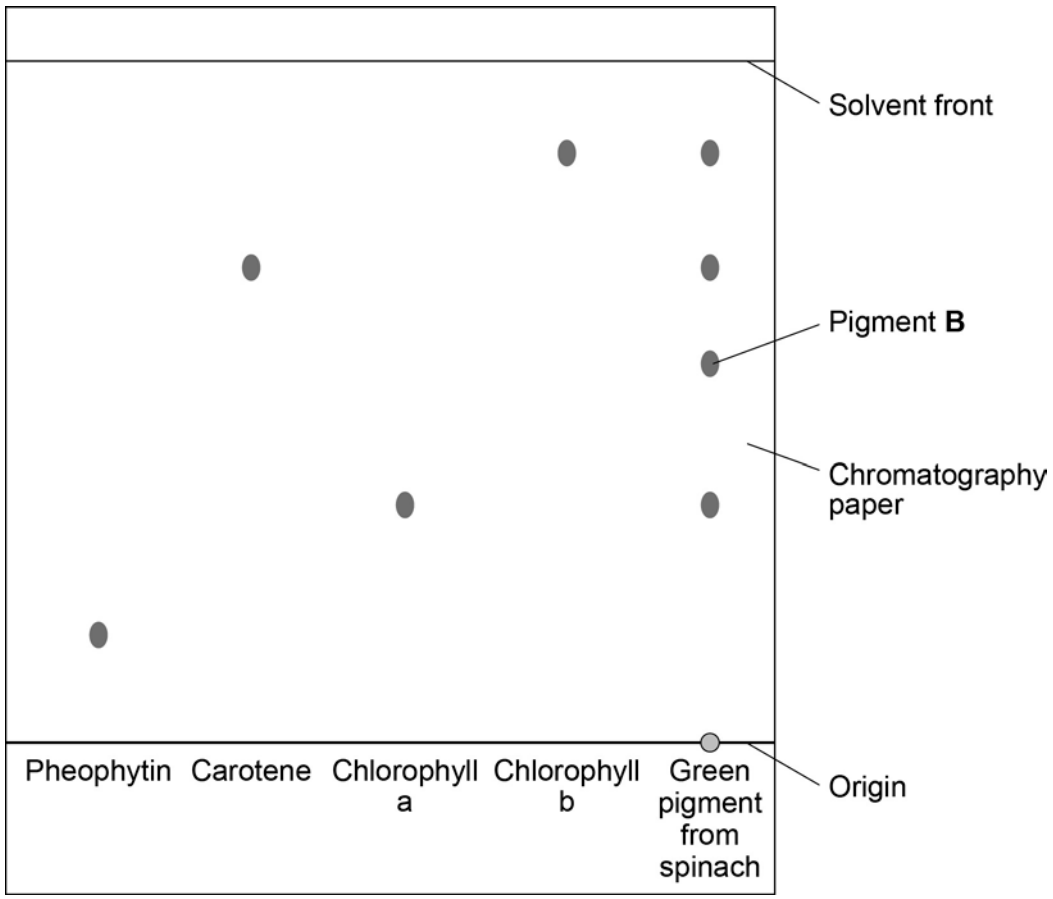
[1 mark]

0 9 A student used paper chromatography to identify the pigments in spinach leaves.

She used propanone as a solvent.

Figure 12 shows the student's results.

Figure 12



0 9 . 1 Name the mobile phase and the stationary phase in the student's experiment.

[2 marks]

Mobile phase _____

Stationary phase _____

0 9 . 2 What does **Figure 12** tell you about the green pigment from spinach?

[3 marks]

0 9 . 3 Write the equation that links distance moved by solvent, distance moved by solute and R_f value.

[1 mark]

0 9 . 4 Use **Figure 12** to calculate the R_f value for pigment **B**.

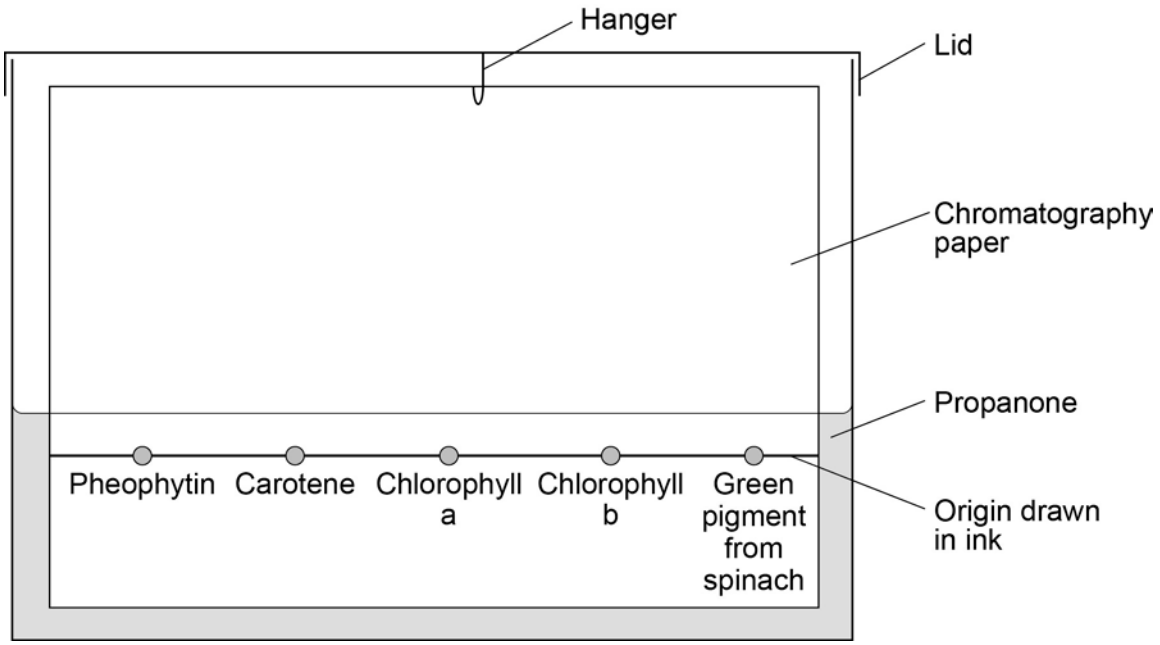
[3 marks]

R_f value = _____

Question 9 continues on the next page

0 9 . 5 Another student set up the apparatus shown in **Figure 13**.

Figure 13



This student did not set up the apparatus correctly.

Identify the errors the student made.

Explain how the errors she made would affect her results.

[4 marks]

Turn over for the next question

1 0 A student investigated the specific heat capacity of metals.

1 0 . 1 Describe an experiment the student could do to measure the specific heat capacity of a metal.

[6 marks]

The student calculated the specific heat capacity of four metals.

Table 7 shows the student's results.

Table 7

Metal	Mass of material in kg	Time in minutes	Temperature change in °C	Change in thermal energy in J	Calculated specific heat capacity of material in J/kg °C
Aluminium	1	10	2	4 780	2 390
Brass	1	10	4	4 660	1 165
Copper	1	10		4 600	657
Steel	1	10	5	4 690	938

1 0 . 2 Use data from **Table 7** to calculate the temperature change for copper.

Use the correct equation from the Physics Equation Sheet.

[3 marks]

Temperature change = _____ °C

1 0 . 3 What is the independent variable in the student's investigation?

[1 mark]

Tick **one** box.

- Mass of material ☐
- Power used ☐
- Time in minutes ☐
- Type of material ☐

1 0 . 4 The student calculated the specific heat capacity of aluminium to be 2390 J/kg °C.

The 'true' specific heat capacity of aluminium is 900 J/kg °C.

Suggest why the student's result for aluminium is different from the 'true' value.

[2 marks]

1 0 . 5 The teacher suggested that putting bubble wrap round the metal block would change the results.

How would using bubble wrap change the results?

Give a reason for your answer.

[2 marks]

END OF QUESTIONS

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