Specimen Paper

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

AQA Level 1/2 Certificate in Physics
Specimen Paper

Physics

Paper 2

For this paper you must have:
- a ruler
- a calculator
- the Physics Equations Sheet (enclosed).

Time allowed
- 1 hour 30 minutes

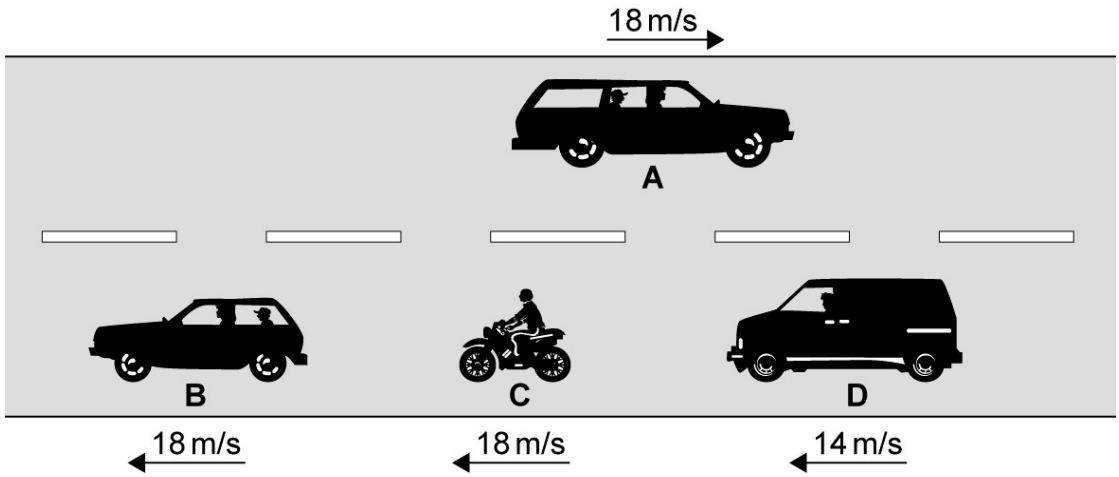
Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 4(b)(ii) should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

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

Answer **all** questions in the spaces provided.

1 (a) The diagram shows four vehicles, **A**, **B**, **C** and **D**, travelling along a road.



1 (a) (i) Which **two** of the vehicles, **A**, **B**, **C** or **D**, have the same velocity?

Write your answers in the boxes.

☐ and ☐

Give the reason for your answer.

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(2 marks)

1 (a) (ii) Each of the quantities in the box is either a scalar or a vector quantity.

acceleration	**distance**	**force**	**kinetic energy**
momentum	**time**	**weight**	

Complete the table by writing each of the quantities in the box in the correct column.

One has already been done for you.

Vector quantity	**Scalar quantity**
force	.....
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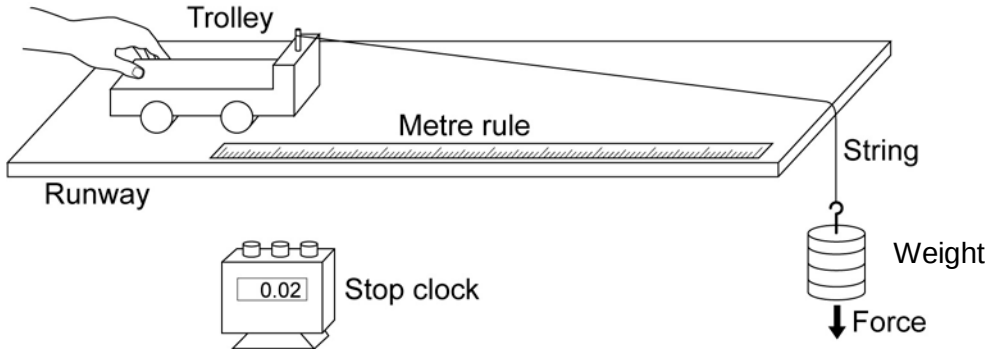
(6 marks)

Question 1 continues on the next page

1 (b) A student investigated how the average speed of a trolley depends on the force applied to it.

The diagram shows the trolley just before the student released it.



After releasing the trolley the student measured the time it took for the trolley to travel 1 metre.

The student repeated this with different weights attached to the string.

1 (b) (i) The measurements taken by the student were not accurate.

Which **two** of the following would cause an error in the student's measurements?

Tick (✓) **two** boxes.

The front of the trolley is not level with the end of the metre rule. ☐

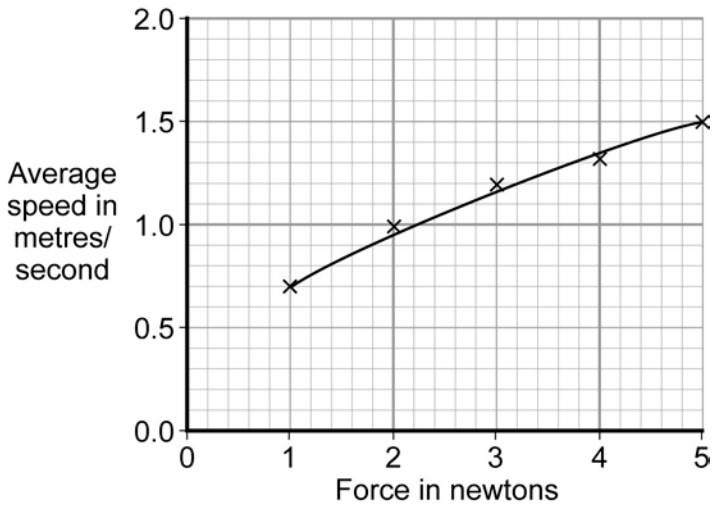
The string is rubbing against the front of the runway. ☐

The stop clock has not been reset to zero. ☐

The force is found by counting the weights tied to the string. ☐

(2 marks)

1 (b) (ii) Having calculated the average speed, the student plotted the graph shown below.



Describe the pattern that links the average speed of the trolley and the force applied to the trolley.

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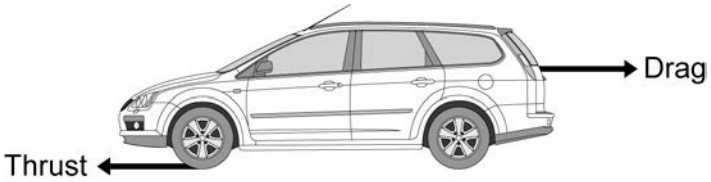
(2 marks)

Question 1 continues on the next page

1 (c) The diagram shows the horizontal forces acting on a car as it moves along a straight road.

The *resultant force* on the car is zero.



1 (c) (i) What is meant by the term *resultant force*?

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(1 mark)

1 (c) (ii) Describe the movement of the car when the resultant force is zero.

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(1 mark)

1 (d) A resultant force of 3600 N, acting on a car and its driver, causes the car to accelerate at 3 m/s^2.

Calculate the mass, in kilograms, of the car and the driver.

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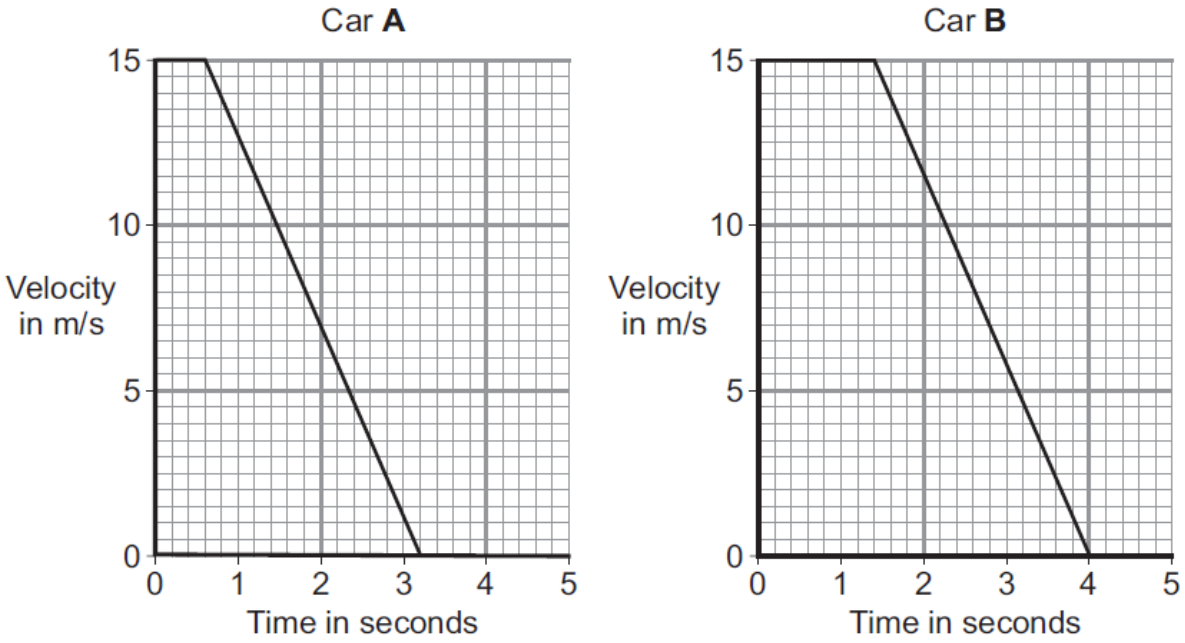
Mass = ... kg

(2 marks)

1 (e) The graphs show how the velocities of two cars, **A** and **B**, change from the moment the car drivers see an obstacle blocking the road.



Compare and evaluate the information shown in the two graphs.

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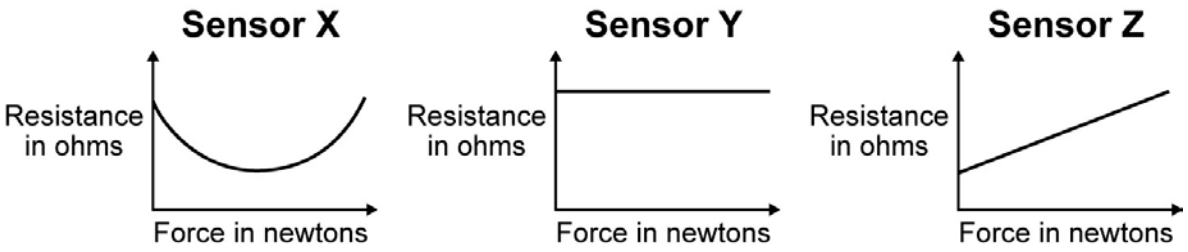
(6 marks)

Question 1 continues on the next page

1 (f) In a road accident test laboratory, scientists use sensors to measure the forces exerted during collisions.

The graphs show how the electrical resistance of 3 experimental types of sensor, **X**, **Y** and **Z**, change with the force applied to the sensor.



Which of the sensors, **X**, **Y** or **Z**, would be the best one to use as a force sensor?

Write your answer in the box. ☐

Give reasons for your answer.

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(3 marks)

25

Turn over for the next question

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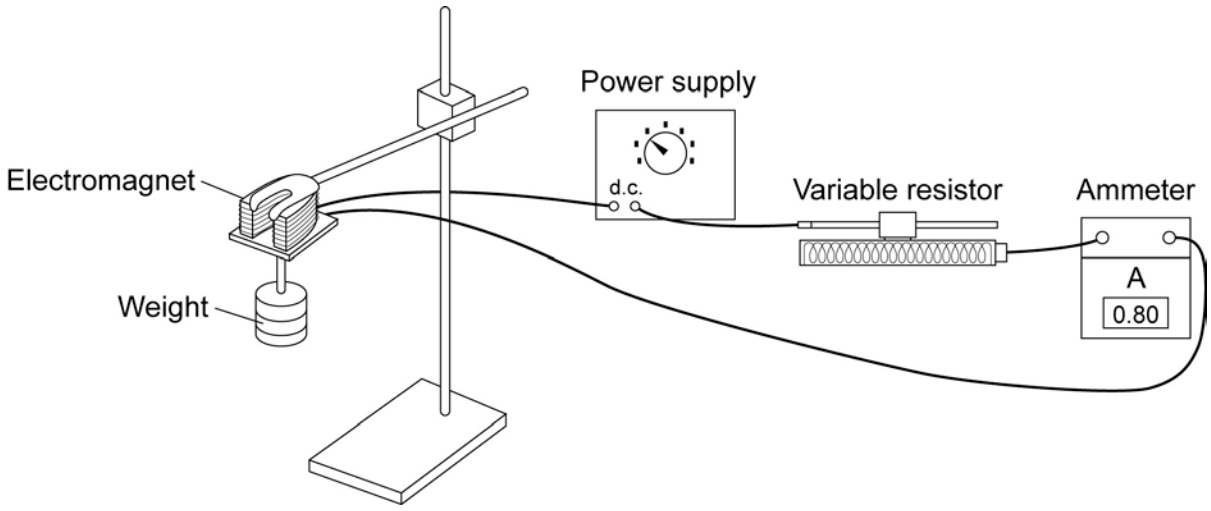
ANSWER IN THE SPACES PROVIDED

2 A student used the apparatus shown in the diagram to investigate how the weight supported by an electromagnet depends on:

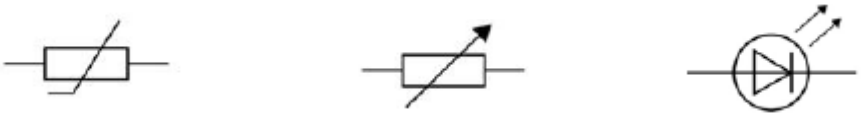
- the current, *I*, flowing through the wire
- the number of turns of wire, *n*, wrapped around the iron core.



For different values of *I* and *n* the student measured the maximum weight supported by the electromagnet.

2 (a) Which **one** of the following is the circuit symbol for a variable resistor?

Draw a ring around **one** answer.



(1 mark)

2 (b) The student obtained the three sets of results given below.

I = 2.5 A n = 20 W = 6.4 N	I = 1.0 A n = 30 W = 6.5 N	I = 2.0 A n = 10 W = 3.7 N

Considering **only** these results, explain why it is not possible to come to any conclusion about how I and n separately affect the strength of the electromagnet.

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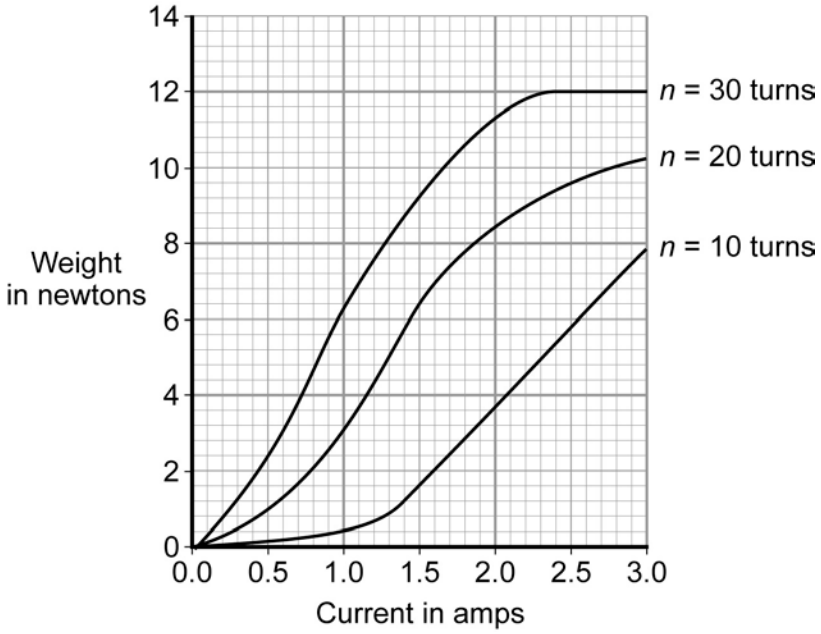
(2 marks)

Question 2 continues on the next page

2 (c) The student obtained more results, and plotted the graph shown below.



Analyse **all** the results on the graph to draw conclusions for this investigation.

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(5 marks)

2 (d) The greater the weight supported, the stronger the electromagnet.

The smallest current that gives an electromagnet maximum strength is called the *saturation current.*

What is the saturation current for the electromagnet with 30 turns of wire?

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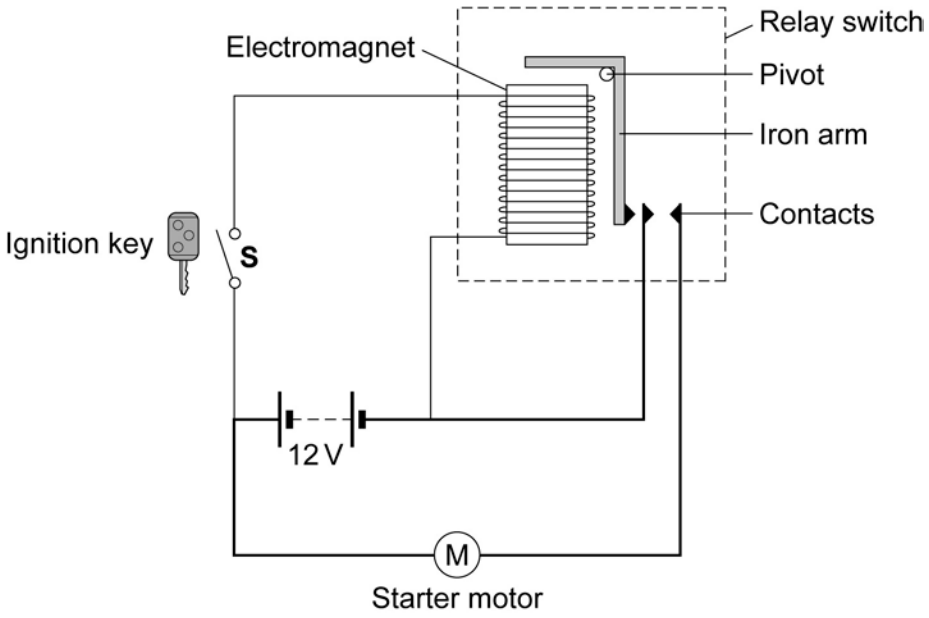
(1 mark)

2 (e) The diagram shows the circuit for the electric starter motor of a car. The circuit includes a relay switch, which is a switch closed by an electromagnet.



2 (e) (i) Explain how turning the ignition key causes the starter motor to work.

The explanation has been started for you.

When the ignition key is turned the switch S closes and .....

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(4 marks)

Question 2 continues on the next page

2 (e) (ii) Electric starter motors are always less than 100 % efficient.

Explain why.

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(3 marks)

16

Turn over for the next question

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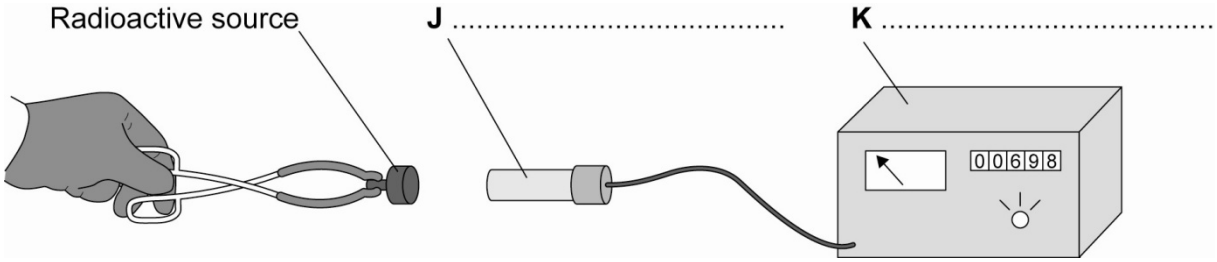
ANSWER IN THE SPACES PROVIDED

3 The diagram shows the apparatus used by a teacher to measure the half-life of a radioactive source.

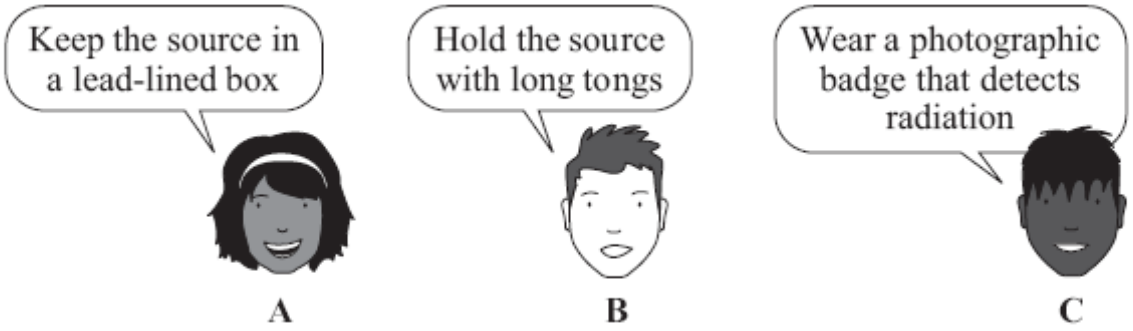


3 (a) Use words from the box to label the items **J** and **K** on the diagram.

control rod	**Geiger–Müller tube**	**ratemeter**	**voltmeter**

(2 marks)

3 (b) Before using a radioactive source, a teacher asked her students to suggest procedures that would reduce the risk of her exposure to radiation. The students made the following suggestions.



Which suggestion **A**, **B** or **C**, would reduce the health risk to the teacher while she is using the radioactive source?

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(1 mark)

3 (c) (i) Before the source is put in place, the teacher takes three readings of the background count rate, in counts per minute, at one-minute intervals.

The readings are given in the table.

Count rate reading 1	25
Count rate reading 2	22
Count rate reading 3	43

Calculate the average background count rate.

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Average background count rate = ... counts per minute

(1 mark)

3 (c) (ii) At one point during the experiment, the count rate is 54 counts per minute.

Calculate how much of this reading is due to the radioactive source.

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..... counts per minute

(1 mark)

3 (d) The count rate recorded by the teacher varied a lot. This is because radioactive decay is a random process.
Suggest **one** way that the teacher could obtain a more accurate value for the average background count rate.

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(1 mark)

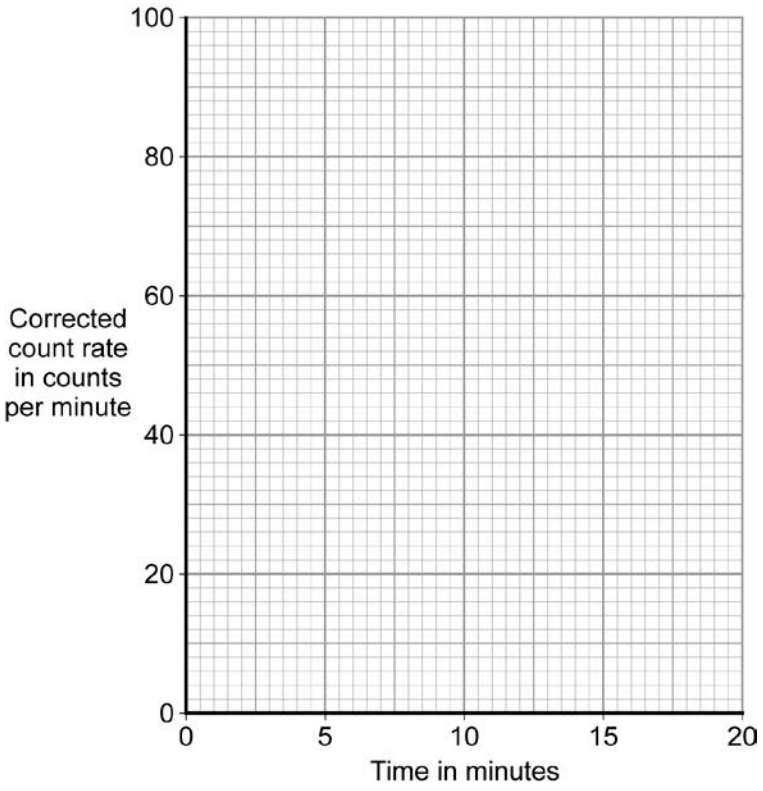
Question 3 continues on the next page

3 (e) A group of students recorded readings at five-minute intervals.

They corrected their data for background count rate and put it in a table, as shown below.

Reading	Time in minutes	Corrected count rate in counts per minute
A	0	90
B	5	52
C	10	33
D	15	28
E	20	12

3 (e) (i) Use the grid below to plot a graph of corrected count rate against time.



(2 marks)

3 (e) (ii) Use your graph to calculate the half-life of the radioactive source.

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(2 marks)

3 (f) Carbon-14 is a radioactive isotope of carbon, with a half-life of 5600 years, and is used for dating historical objects. 0.2g of carbon-14 is found in a sample today.
How many grams of the isotope would have been present 16,800 years ago?

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(3 marks)

13

Turn over for the next question

Turn over for the next question

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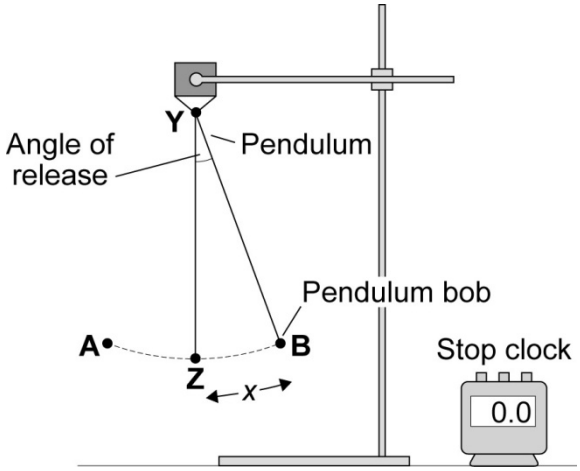
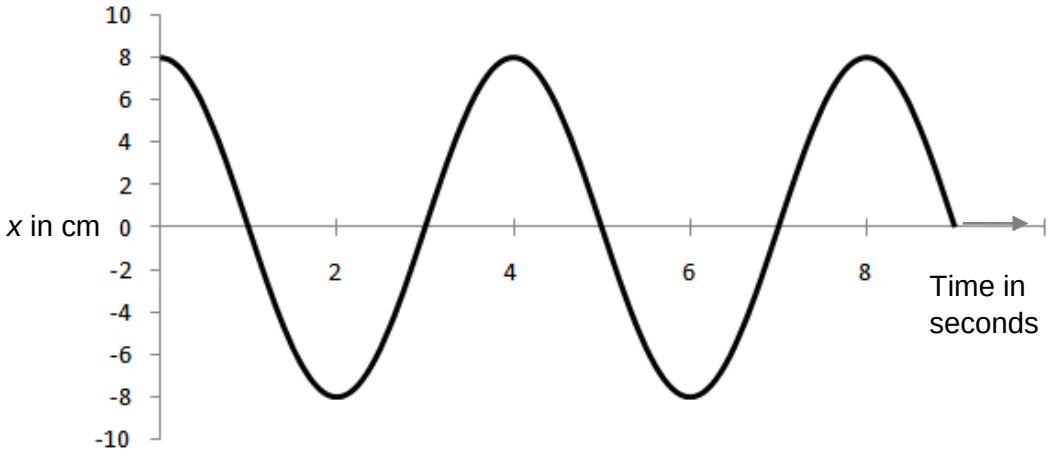
ANSWER IN THE SPACES PROVIDED

4 (a) A pendulum is a device that can be used for timing. Some clocks rely on the swing of a pendulum to keep time.
The pendulum shown in the diagram below is suspended from point **Y** and swings from **A** to **B**, through the centre point **Z**.



The displacement *x* of the pendulum bob was plotted against time as shown in the graph below.



By analysing the evidence in the graph, find the amplitude of the oscillation of the pendulum and the time period of the pendulum.

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(2 marks)

Turn over ▶

4 (b) A student carried out an investigation to find out how the time period of the pendulum depends on the length of the pendulum.

During the investigation she kept the mass of the pendulum bob and the angle of release constant. Her data is recorded in **Table 1**.

Table 1

	Length of pendulum in metres	**Time for 10 swings in seconds**	**Time period in seconds**
1	0.20	9.2	0.92
2	0.40	12.8	1.28
3	0.60	15.0	1.50
4	0.80	18.0	1.80
5	1.00	20.0	2.00

4 (b) (i) Explain why the student timed ten swings, rather than just timing one swing, for each length of pendulum.

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(2 marks)

4 (b) (ii) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Describe the steps that the student would take to obtain the data shown in **Table 1**.

In your description, comment on the number of decimal places and significant figures the student has used in each column.

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(6 marks)

Question 4 continues on the next page

4 (b) (iii) The student also carried out two more pendulum investigations.
During the second investigation she kept the length of the pendulum and the angle of release constant. The data for this investigation is recorded in **Table 2**.

Table 2

	Mass of pendulum bob in grams	Time for 10 swings in seconds	Time period in seconds
1	2.5	20.0	2.00
2	5.0	20.3	2.03
3	7.5	20.1	2.01
4	10.0	20.0	2.00
5	12.5	20.2	2.02

During the third investigation she kept the length of the pendulum and the mass of the pendulum bob constant. The data for this investigation is recorded in **Table 3**.

Table 3

	Angle of release in degrees	Time for 10 swings in seconds	Time period in seconds
1	2	20.4	2.04
2	4	20.2	2.02
3	6	20.0	2.00
4	8	20.3	2.03
5	10	20.1	2.01

What conclusions can be made from the data recorded in **Table 1**, **Table 2** and **Table 3**? Your answer should include a comment on the quality of the evidence.

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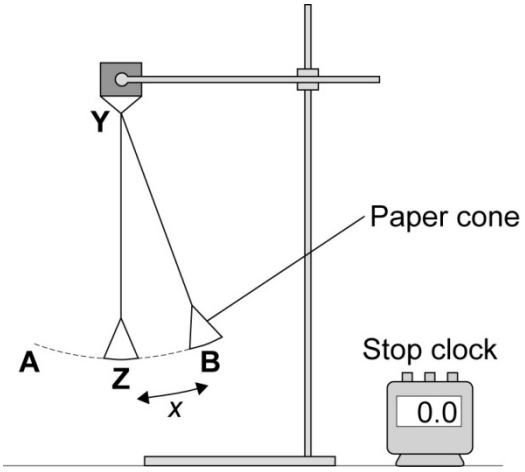
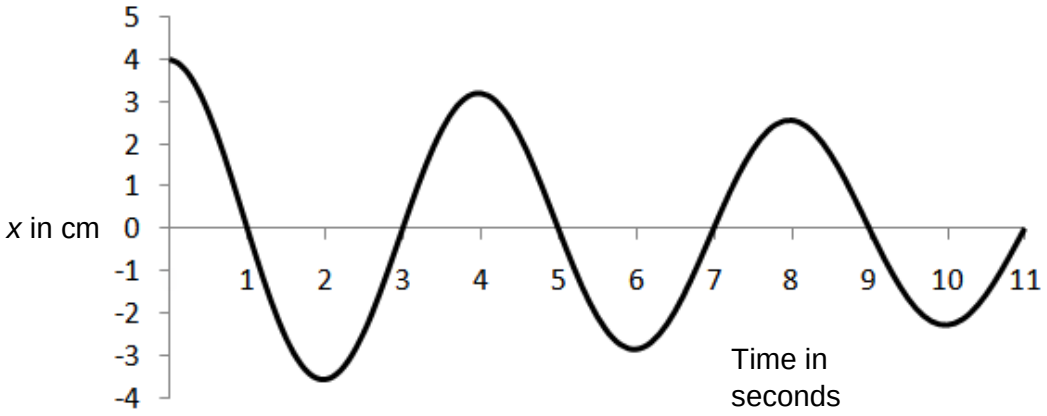
(3 marks)

4 (c) The student replaced the pendulum bob with a light paper cone as shown in the diagram.



She plotted the displacement *x* of the pendulum bob against time as shown in the graph below.



The student concluded that the frequency of this pendulum decreased with time.
Does the graph support her conclusion?

Explain the reason for your answer.

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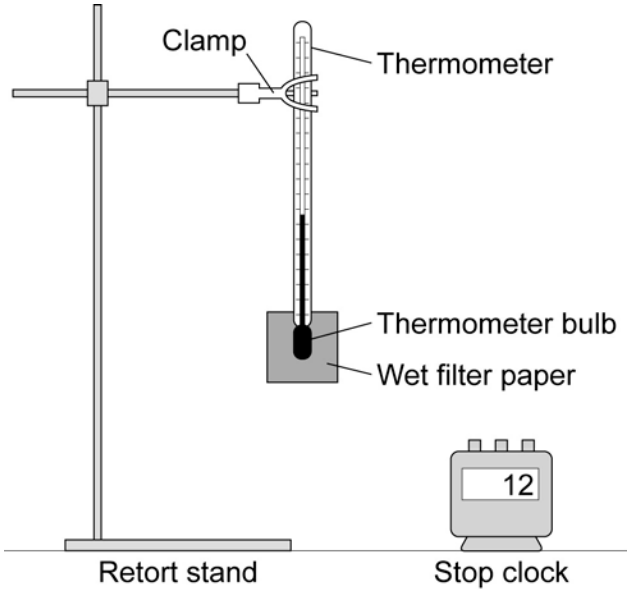
(2 marks)

15

5 The diagram shows the apparatus used by a student to investigate the cooling effect produced by evaporation.



After wetting the paper with water, the student took a temperature reading every 30 seconds.

The student's results are given in the table.

Time in seconds	0	30	60	90	120	150
Temperature in °C	21.0	16.0	12.5	11.5	12.5	10.5

5 (a) (i) One of the student's results is anomalous.

Draw a ring around the anomalous result in the table.

Suggest **one** reason why the anomalous result may have occurred.

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(2 marks)

*__5 (a) (ii)__ What should the student have done when she realised that one of the results was anomalous?

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(2 marks)

__5 (a) (iii)__ Explain the advantage in this investigation of using a temperature sensor and a data logger rather than a thermometer and a stop clock.

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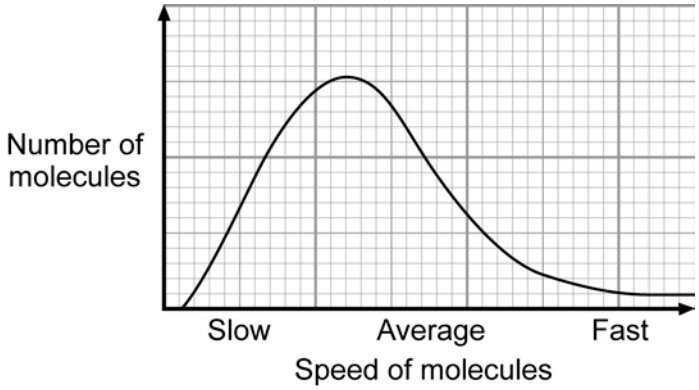
(2 marks)

Question 5 continues on the next page

5 (b) The graph shows that the molecules in a liquid do not all have the same speed.



Use the information in the graph to explain why a liquid cools down when it evaporates.

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(5 marks)

5 (c) Evaporation helps to regulate body temperature. The evaporation of sweat from the body transfers energy, producing a cooling effect.

State and explain the effect of an increase in humidity on the cooling effect produced by the evaporation of sweat.

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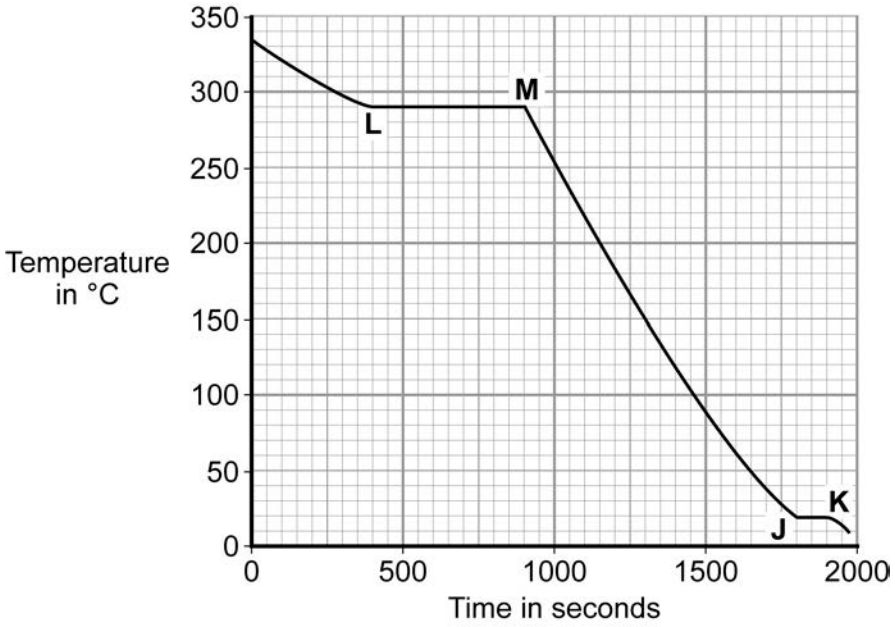
(2 marks)

13

Turn over for the next question

6 (a) The graph shows how the temperature of a pure substance changes as it cools from 330 °C.



Explain why the temperature of the substance is constant between the points marked **J** and **K**.

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(2 marks)

6 (b) A book of scientific data contains the statement:

'The specific latent heat of fusion of pure ice is 3.3×10^5 J/kg'.

What does this statement mean?

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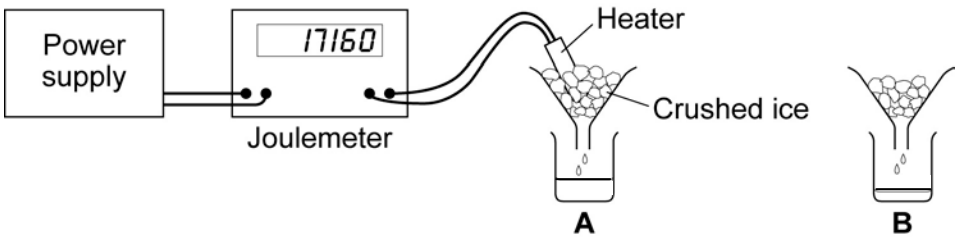
(1 mark)

6 (c) The diagram shows one method of measuring the specific latent heat of fusion of ice in a laboratory where the temperature is 20°C. Two funnels, **A** and **B**, contain equal amounts of crushed ice at 0 °C.

The mass of melted ice from each funnel is measured after 12 minutes.

The joulemeter measures the energy supplied to the heater.



6 (c) (i) Why is it necessary to set up funnel **B** to obtain an accurate result?

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(2 marks)

6 (c) (ii) The measurements taken are given in the table.

Mass of melted ice collected from funnel **A**	63 g
Mass of melted ice collected from funnel **B**	24 g
Joulemeter reading	17160

Use the data in the table to calculate the specific latent heat of fusion of ice.

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Specific latent heat of fusion of ice = ... J/kg

(2 marks)

6 (c) (iii) Suggest **one** reason why the value obtained by this method and the value given in the data book are not the same.

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(1 mark)

END OF QUESTIONS

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* This question has been amended and is awaiting approval.