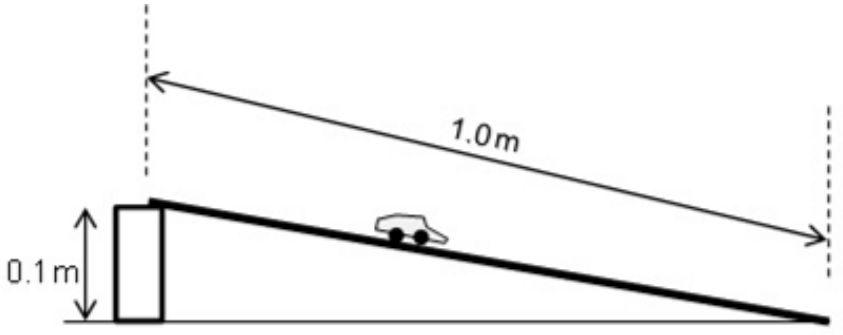
Gateway Physics A

Practical Questions

1 A student wants to find out what affects the speed of a toy car.

The diagram shows some of the apparatus she uses.



(a) The student rolls the toy car down the ramp, measuring the distance from the front of the car to the bottom of the ramp.

How can the car's average speed on the ramp be measured?

Predict how changing the distance travelled along the ramp will affect this average speed.

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……**[3]**

(b) Suggest **two** other factors that could be changed and would have an effect on the speed of
the car.

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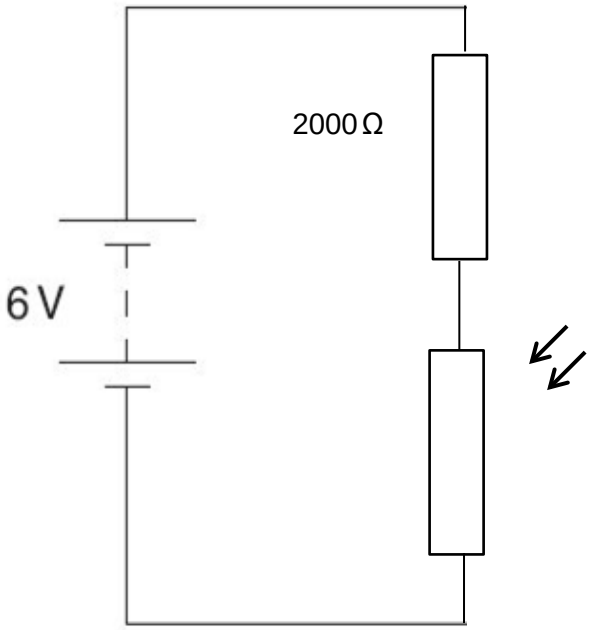
……**[2]**

2 A security light is designed to switch on automatically when it becomes dark.

Part of the circuit for the security light contains a battery, a light dependent resistor (LDR) and a

2000 Ω resistor.



(b) Calculate the current in the 2000 Ω resistor.

Show your working and state the unit.

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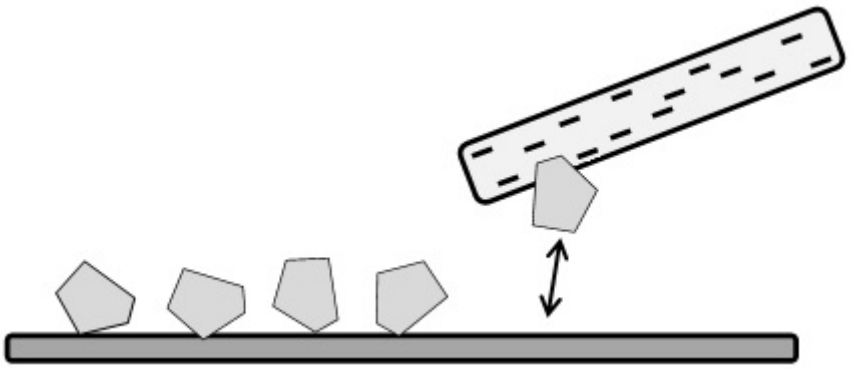
answer …… **unit** …… **[4]**

3 Some small pieces of paper are on a surface and a negatively charged rod is held near them.



(a)

(i) State what is meant by the term negatively charged?

…….. **[1]**

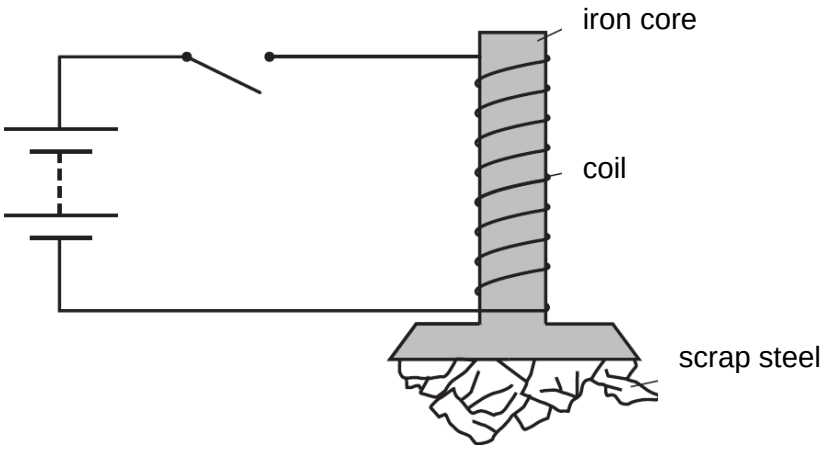
(ii) A negatively charged rod made of another type of plastic is brought near to the

pieces of paper.

Why is the plastic rod able to keep a negative charge?

……. **[1]**

4* The diagram shows a simple circuit diagram for an electromagnet used to pick up scrap steel.



When the switch is closed, the scrap steel is attracted to the electromagnet.

Explain why this happens.

What can be done to the apparatus to pick up even more steel?

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…… **[6]**

5 Police guidance on air rifles states:

"Any rifle that fires a pellet with an energy that is below 16 Joules may be held without a licence".

(c) Describe an experiment to calculate the density of the paintball pellet.

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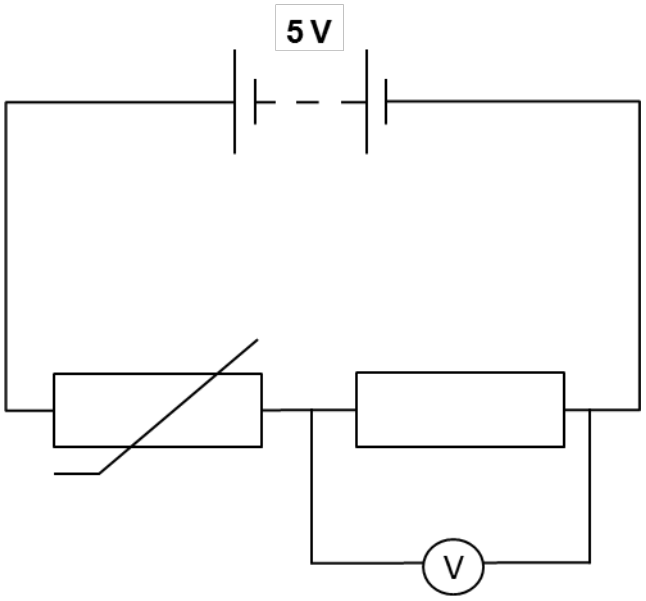
6. At room temperature, the current in a thermistor of resistance 1000 Ω is 2 mA



(c) The thermistor is cooled in iced water.

Explain how this changes the reading on the voltmeter.

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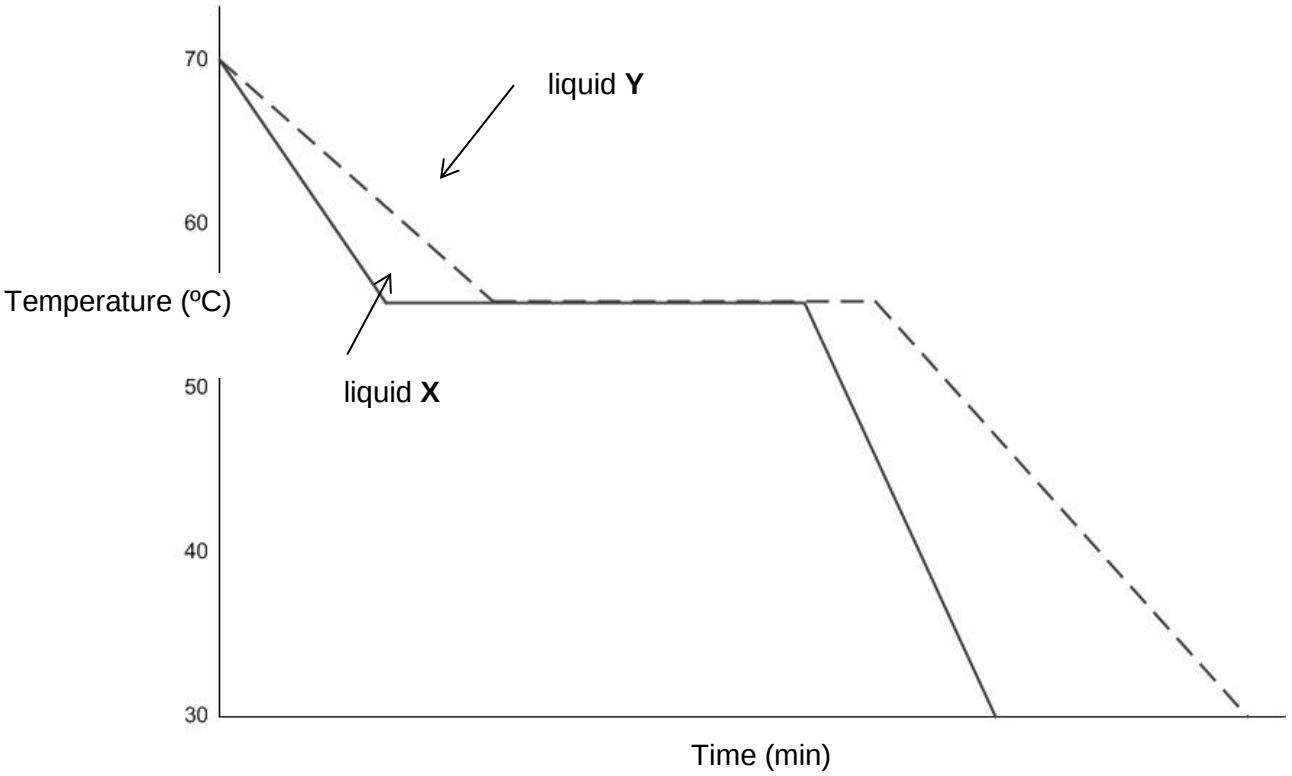
…… **[2]**

7 Two beakers are filled with equal masses of liquids **X** and **Y** at the same temperature.

The temperatures of the liquids are monitored throughout the experiment.

The variation with time of the temperature of the liquids is shown below.



(a) Using the graph to compare what happens to liquids **X** and **Y** at 55 °C.

Suggest what is happening to the liquid at this temperature

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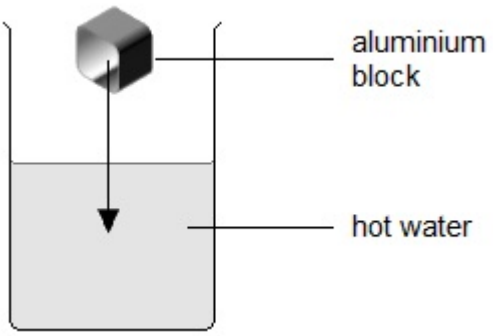
(b) A beaker contains hot water.

The pupil wants to calculate the thermal energy lost by the hot water when she puts a cold

aluminium block into it.



What information will she need to make this calculation?

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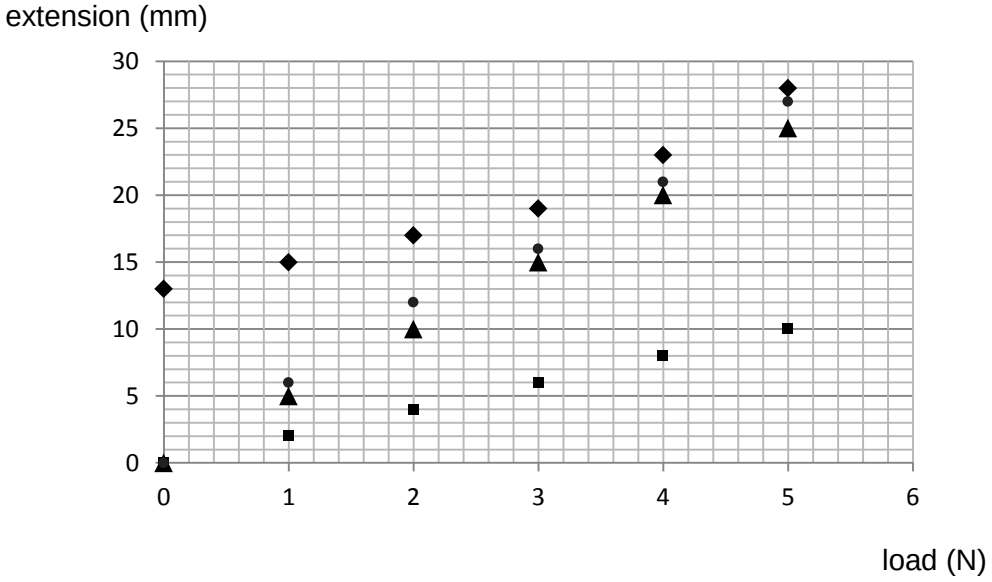
…… **[3]**

8 The graph below shows the results of an experiment to investigate the effect of load on extension

of rubber bands.

The experiment was performed by four groups of students as indicated by the symbols:

◆ Group 1 ● Group 2 ▲ Group 3 ■ Group 4



(a) Use the graph to comment on any errors made in the experiment.

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…… **[1]**

(c) How could Group 3 develop their experiment to show plastic deformation in their rubber band?

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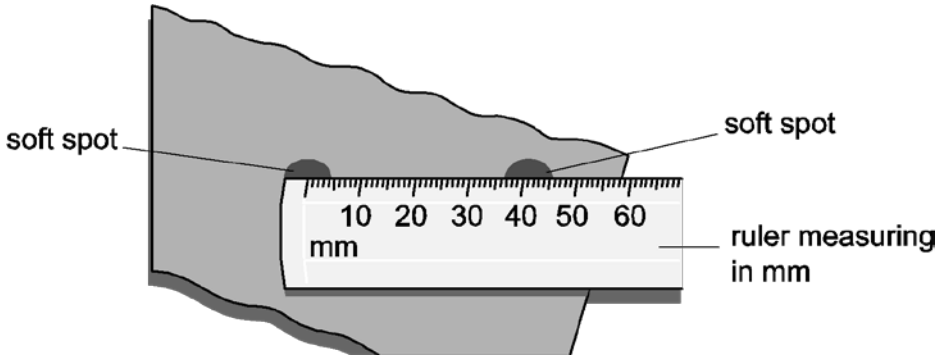
…… **[1]**

9 Microwaves are part of the electromagnetic spectrum.

(a) The wavelength of microwaves can be measured using chocolate.

The turntable is taken out of the microwave and the chocolate is put in the microwave.

The chocolate is left on full power for 10 seconds.



(i) The soft spots are half a wavelength apart.

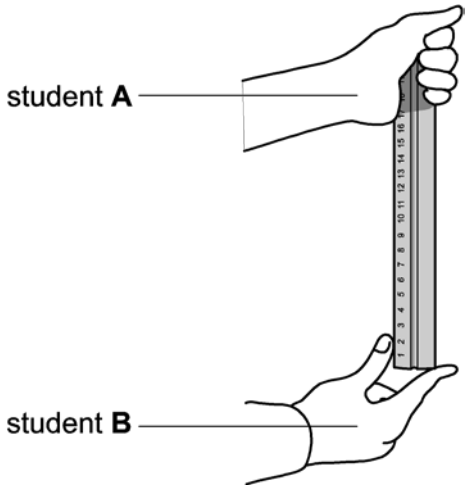
Use the picture to measure the distance between the centre of the two spots.

answer ..... mm **[1]**

10 The stopping distance of a car is important for road safety.

One factor that affects stopping distance is reaction time.

The picture shows student **A** using a rule drop test to measure the reaction time of student **B**.



(a) **(i)** Use the picture to describe how this method measures reaction time.

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…… **[2]**

(ii) Write a method to compare the reaction time of boys and girls.

In your method describe how you will make the measurements **accurate**.

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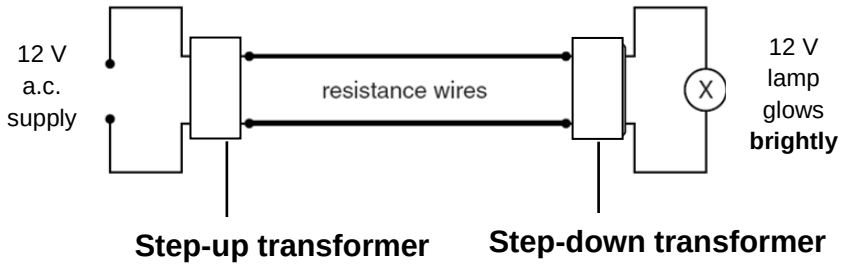
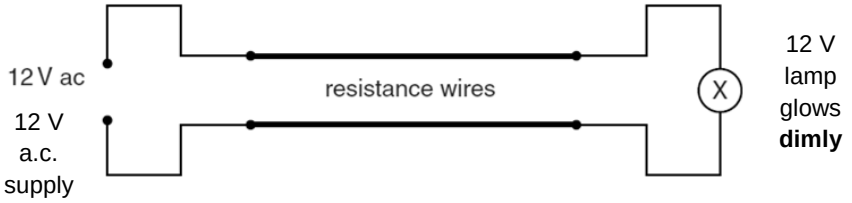
…… **[4]**

11 A student sets up two circuits to investigate the difference transformers make to circuits.

Circuit 1



Circuit 2



(a) * Compare the two circuits, including reasons why the transformers make a difference.

Suggest how **Circuit 1** could be improved to make the bulb glow more brightly.

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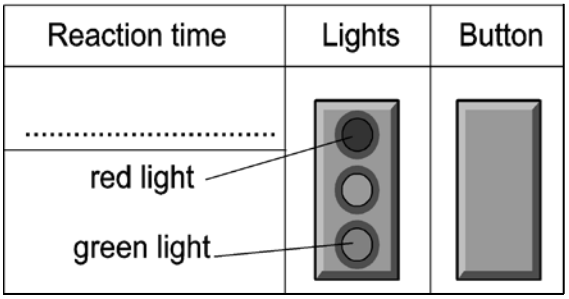
…… **[6]**

12 The stopping distance of a car is important for road safety.

One factor that affects stopping distance is reaction time.

The instructions below are for a reaction time test.

Instructions
Press button to start.
Wait for red light to go off and green light to go on. When green light is on press the button again.



(a) **(i)** Use the experiment above to write a method to compare the reaction time with different distractions.

In your method describe the variables you have controlled and how you made the test precise.

…… **[4]**

(ii) The table shows six of the results collected.

Reaction time (s)
0.60
0.97
0.88
0.67
0.99
0.71

Select the **three** reaction times from the table when there were **no** distractions and calculate the mean of these.

answer ..... s **[1]**

13 Two students study the motion of a toy train on a track.

They need distance and time measurements to calculate speed.

(a) Write down an instrument they could use to measure:

(i) distance: …….. **[1]**

(ii) time: …… **[1]**

14 Two students, **A** and **B**, use different methods to see magnetic field patterns.

(a) **(i)** Describe how student **A** can use a compass to plot a magnetic field pattern.

You may draw a diagram to help you answer this question.

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(ii) Student **B** uses iron filings to show a magnetic field pattern.

Describe how student **B** uses iron filings to show a magnetic field pattern.

You may draw a diagram to help you answer this question.

…….. **[2]**

15 Four students investigate the idea of work done.

work done = force x distance

Look at their results.

Student	Force (N)	Distance travelled (m)
A	100	5
B	50	10
C	120	12
D	40	4

(c) State **two** reasons why it is important to repeat measurements in any experiment.

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…….. **[2]**

(d) Student **C** takes 0.5 minutes to push the trolley.

How much power do they use?

Show your working.

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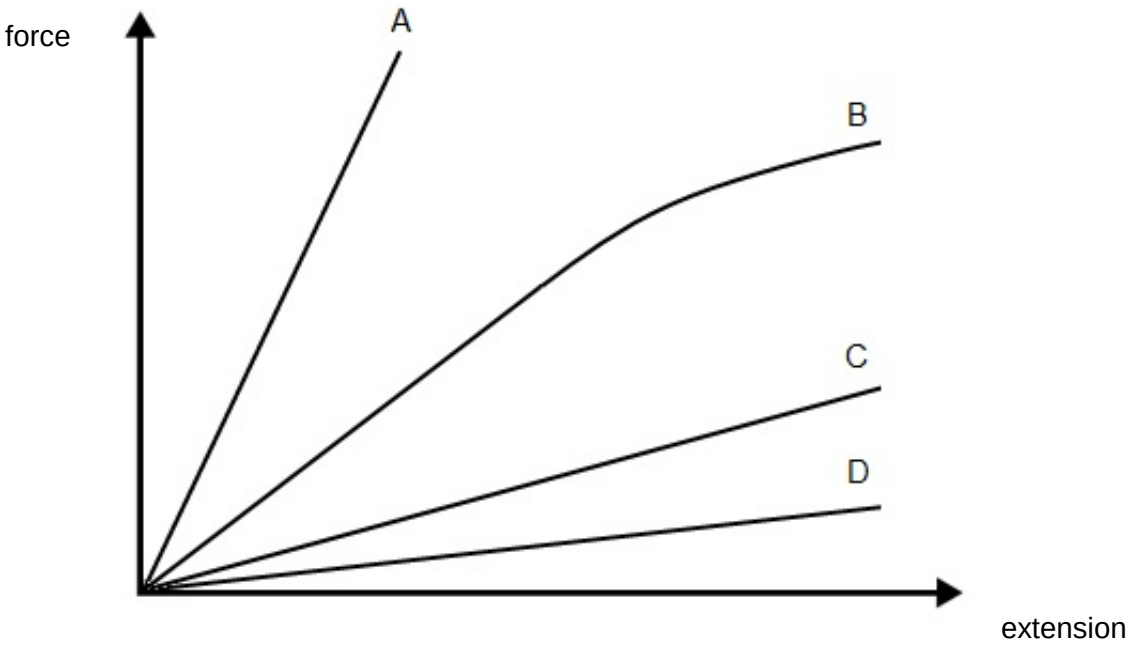
answer: .....W **[4]**

16 The extension of four different springs is shown in the graph.



(c) **(i)** A spring has a spring constant of 27 N/m.

For an extension of 25 cm, calculate the energy transferred in stretching.

Use the formula: **energy transferred = 0.5 x spring constant x extension^2**.

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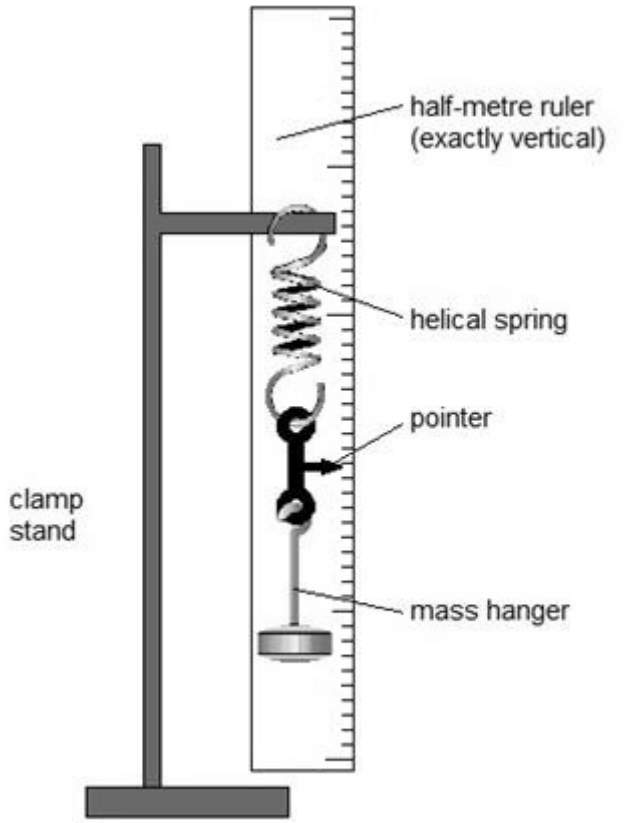
answer: ..... J **[2]**

(ii) A student set up the apparatus shown in the diagram.



Describe how they could use this apparatus to collect data to draw a force/extension graph for this spring.

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…….. **[4]**

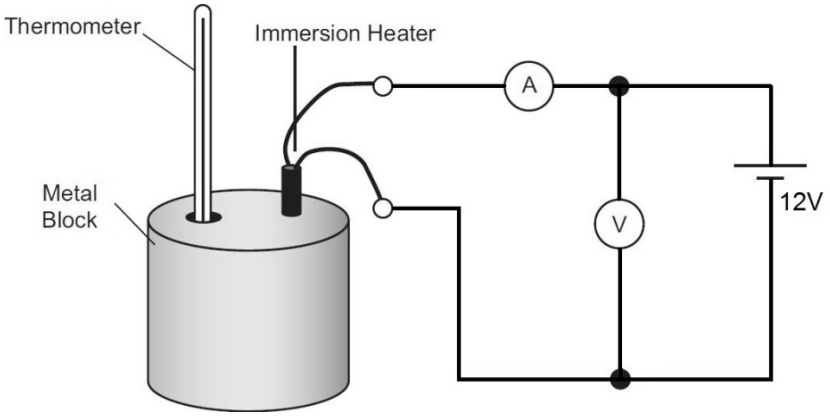
17 A student finds a resistor which has no markings on it.

The student uses a voltmeter, an ammeter and a cell to find the resistance of the resistor.

(a) Draw a circuit diagram the student could use to find the resistance of the resistor.

[3]

18 A student completes an experiment to find the specific heat capacity of a metal.



(a) **(i)** The student takes voltage and current measurements.

Suggest **three** other measurements they need to take?

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(ii) Describe how these measurements could be used to determine the specific heat capacity of the metal.

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…… **[2]**

(b) The value obtained from the experiment is much higher than expected.

Suggest **two** reasons how this could have occurred and suggest **two** improvements to the experimental procedure.

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…… **[4]**

19 A student rubs a balloon against a scarf.

(a)* Describe how the balloon has become charged.

Suggest a way to show that the balloon is charged. What would you expect to see and why?

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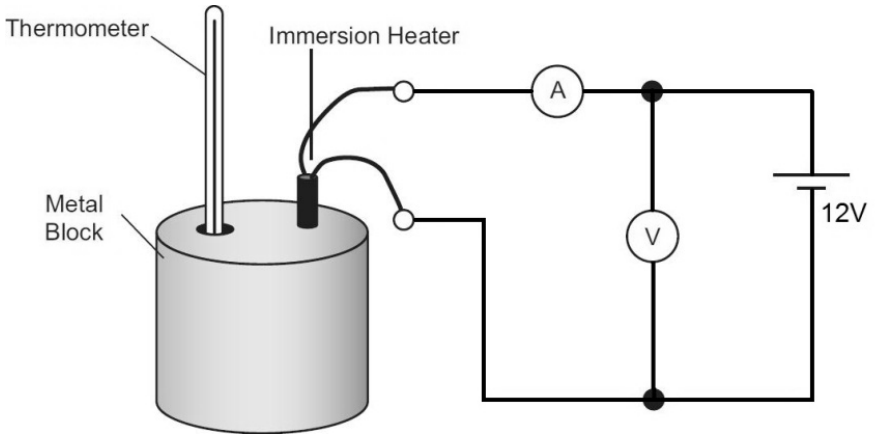
…… **[6]**

20 A student completes an experiment to find the specific heat capacity of a metal.



(a) **(i)** The student takes voltage and current measurements.

Suggest **three** other measurements they need to take?

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…… **[3]**

(ii) Describe how these measurements could be used to determine the specific heat capacity of the metal.

……

……

…… **[2]**

(b) The value obtained from the experiment is much higher than expected.

Suggest **two** reasons how this could have occurred and **two** improvements to the experimental procedure.

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…… **[4]**

21 A student takes voltage and current measurements for four resistors.

The table shows the results from this experiment.

Resistor	Voltage (V)	Current (A)	Resistance (Ω)
A	12.0	2.0	
B	6.0	1.5	
C	7.5	1.5	
D	8.0	2.0	

(c) (i) Draw a circuit diagram that could be used to find out how the resistance of a filament bulb changes with current.

Describe the readings you need to take.

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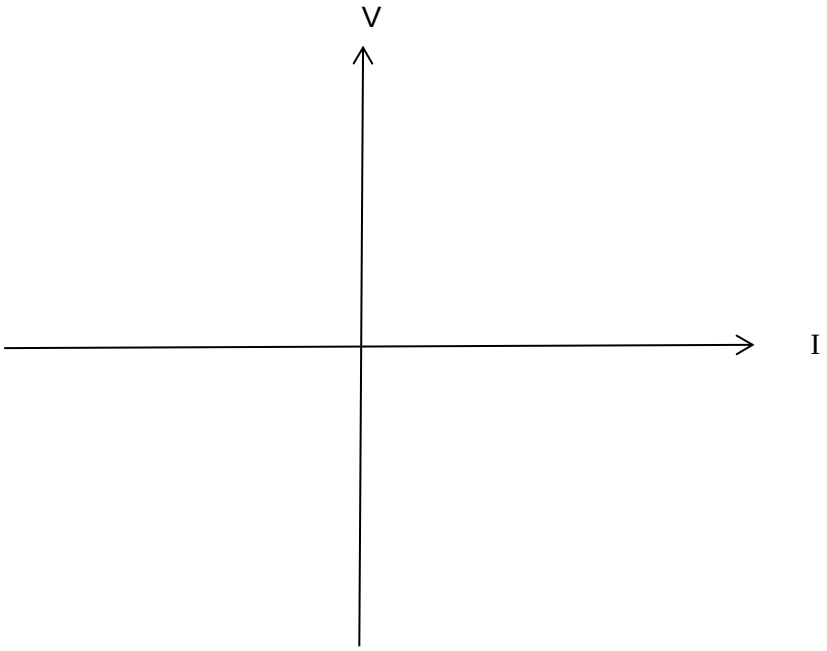
…… **[4]**

(ii) Sketch the shape of the graph using the axes below.



State how this graph can be used to calculate resistance at any specific value of current.

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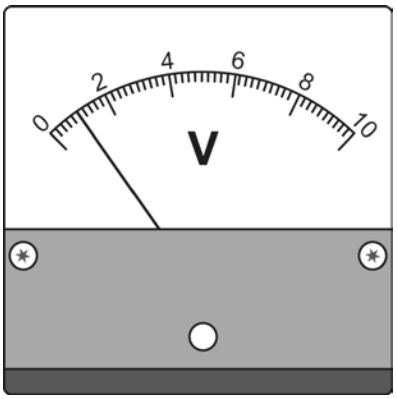
…… **[2]**

(d) A voltmeter is used to measure the output voltages produced from the circuit.

The voltmeter is not connected to a circuit and not recording a voltage.



Name the error on the voltmeter and suggest how it should be dealt with.

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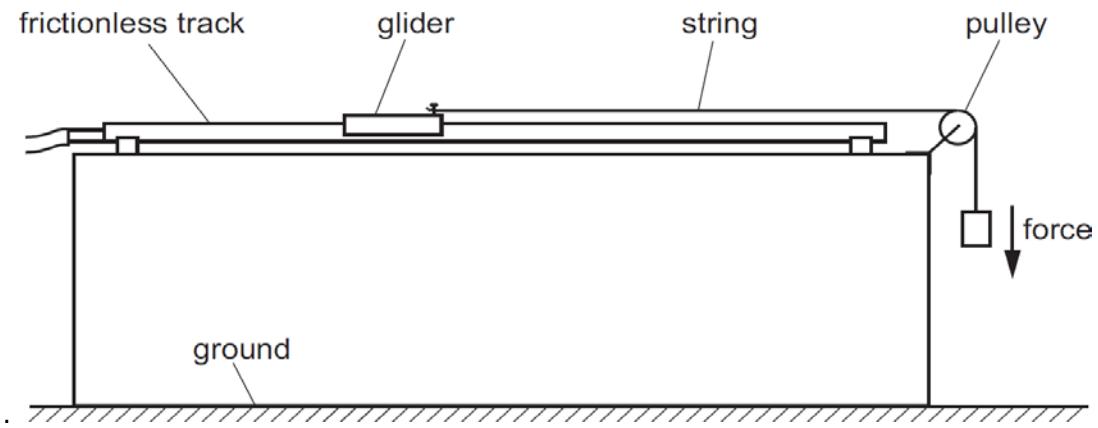
…… **[2]**

22 A student investigates the motion of a glider on a frictionless air track using the apparatus shown in the picture.



(a) **(i)** Explain how the student can use this apparatus to demonstrate Newton's Second Law.

Include details of any additional equipment required.

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…… **[3]**

(iii) Suggest reasons why the recorded value was less than your calculated value.

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…… **[2]**

(b) The student repeats the experiment for 4 more forces.

Force (N)	Acceleration (m/s^2)			
	Attempt 1	**Attempt 2**	**Attempt 3**	**Mean**
1.0	3.8	3.9	3.7	3.8
2.0	7.8	7.7	7.7	7.7
3.0	11.2	11.4	11.6	11.4
4.0	12.0	14.9	15.1	13.8
5.0	19.0	18.9	19.1	19.0

There is an anomaly in the results.

Identify the anomaly and explain how the student could have dealt with it.

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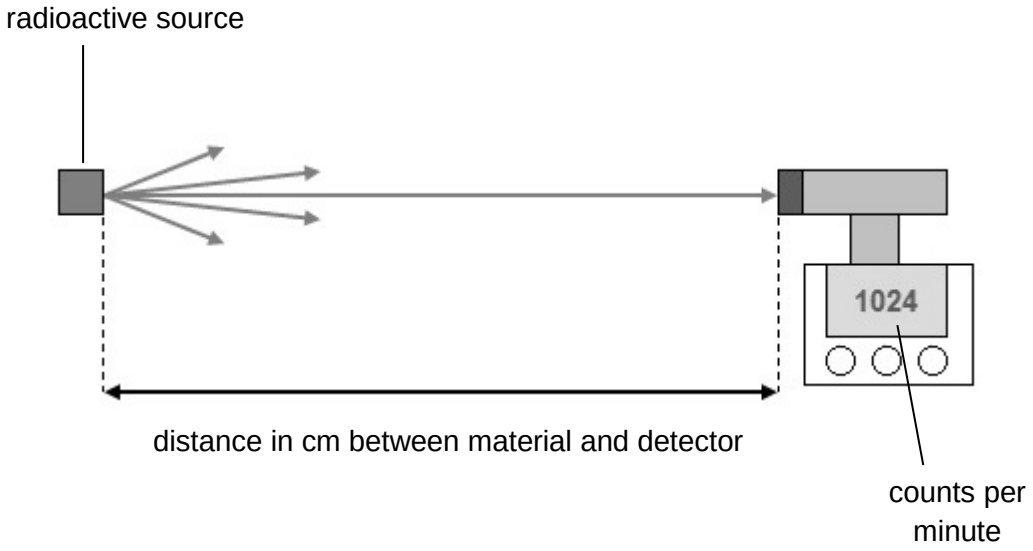
23 Matt experiments with radioactive materials.

He investigates how the activity of radiation changes with distance.

The radiation moves from the source to a detector.

He measures the counts per minute from a radioactive source.

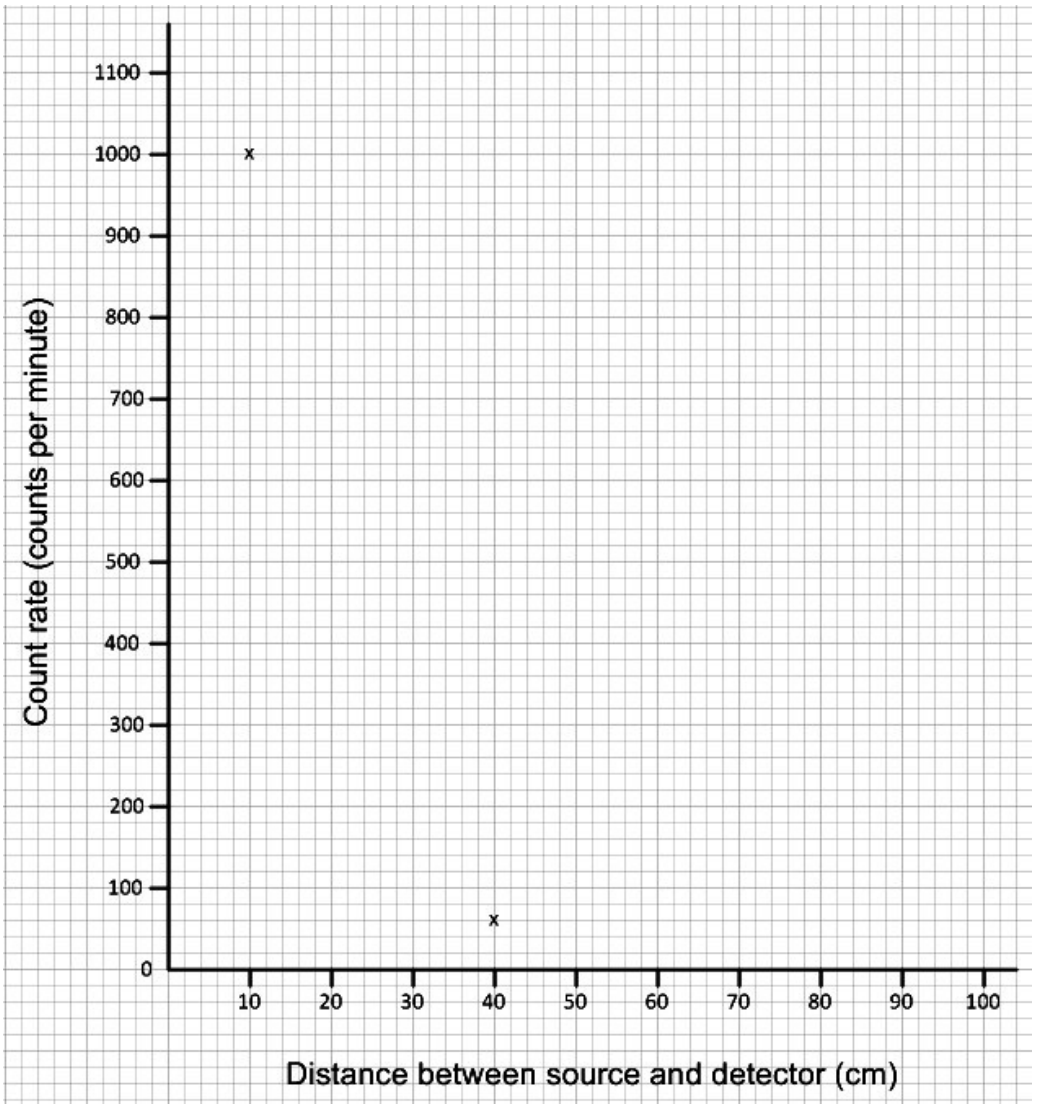


The table shows the results from the experiment.

Distance between the source and the detector (cm)	Count rate (counts per minute)
10	1000
20	240
40	60
80	20

(b) (i) Two points for 10 cm and 40 cm have been plotted on the graph below.

Plot the rest of Matt's results and join the points with a smooth curve.



[2]

(ii) Use the graph to estimate the reading at **30 cm**.

answer: …….. counts per minute **[1]**

(c) (ii) Matt wants to find the count rate at 5 cm.

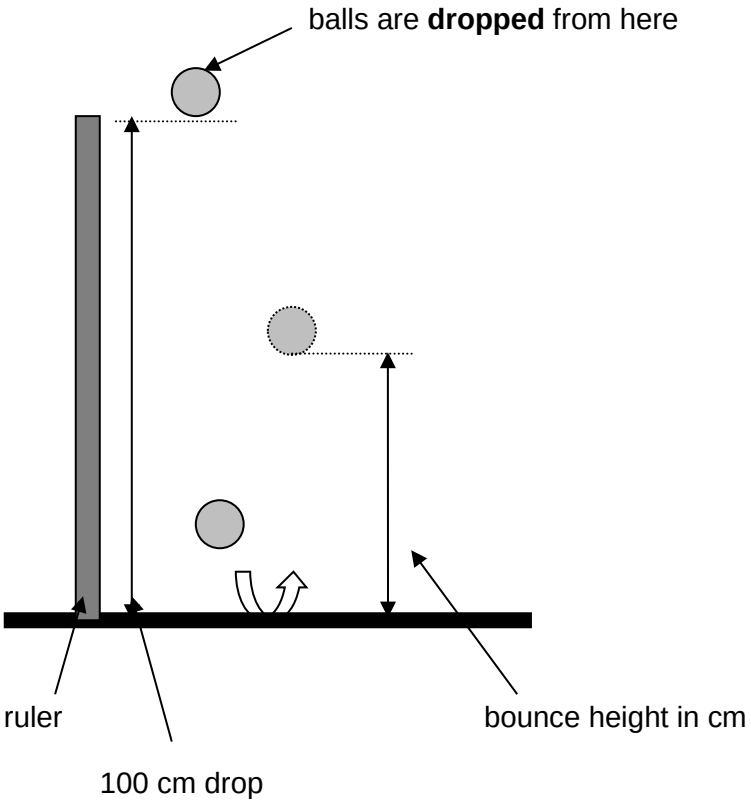
Estimate the count rate at a distance of 5 cm.

answer: …….. counts per minute **[1]**

24 Kate investigates how well different balls bounce.

She drops different balls from the same height and measures the height the balls bounce.

She repeats the experiment 3 times for each ball.



Her results are shown in the table.

Ball	Drop height (cm)	1st reading bounce height (cm)	2nd reading bounce height (cm)	3rd reading bounce height (cm)	Mean bounce height (cm)
Red	100	75	77	73	75
Blue	100	61	62	60	61
Green	100	60	31	58	
White	100	84	86	85	85
Yellow	100	26	24		26

(a) Calculate the **mean** bounce height for the **green** ball.

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[1]

answer:…… cm

(b) Kate forgot to write down one of the results for the **yellow** ball.

Suggest the value of the **missing** result for the **yellow** ball.

[1]

answer: …… cm

(c) Evaluate the reliability of the results

Suggest how she could have improved her experiment.

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…… **[3]**

(d) **(i)** Kate suggests that 15% of the **white** ball's initial energy was not transferred usefully. Use calculations to show that this is correct and suggest where the energy was transferred to.

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…… **[2]**

25 The table below shows the stopping distances for a car.

Speed of car (m/s)	Thinking distance (m)	Braking distance (m)	Total stopping distance (m)
8	6	6	12
16	12	24	
32		96	120

(a)* Analyse the data in the table and use it to describe the trends shown.

Suggest reasons for the differences in the patterns in the data.

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…… **[6]**

26 **(a)** A crowd makes a Mexican wave.

A Mexican wave **starts** with people lifting and lowering their arms.

The Mexican wave **continues** by people, next to them, lifting and lowering their arms.

Why is a Mexican wave an example of a transverse wave?

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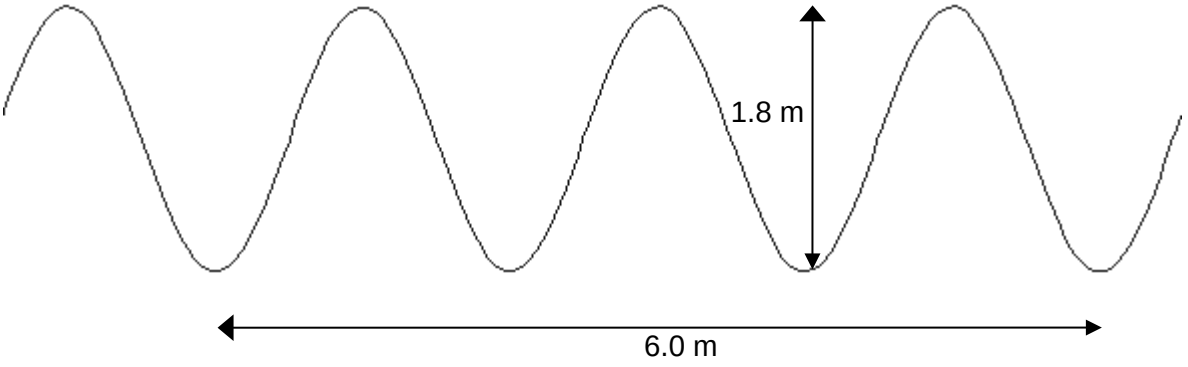
…… **[1]**

(b) In the classroom a teacher demonstrates waves using a rope.

Look at the diagram of the wave.



(i) The frequency of the wave is 2 Hz.

What does this statement mean?

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…… **[2]**

(ii) How many seconds will it take this wave to travel 12 m?

Show your working.

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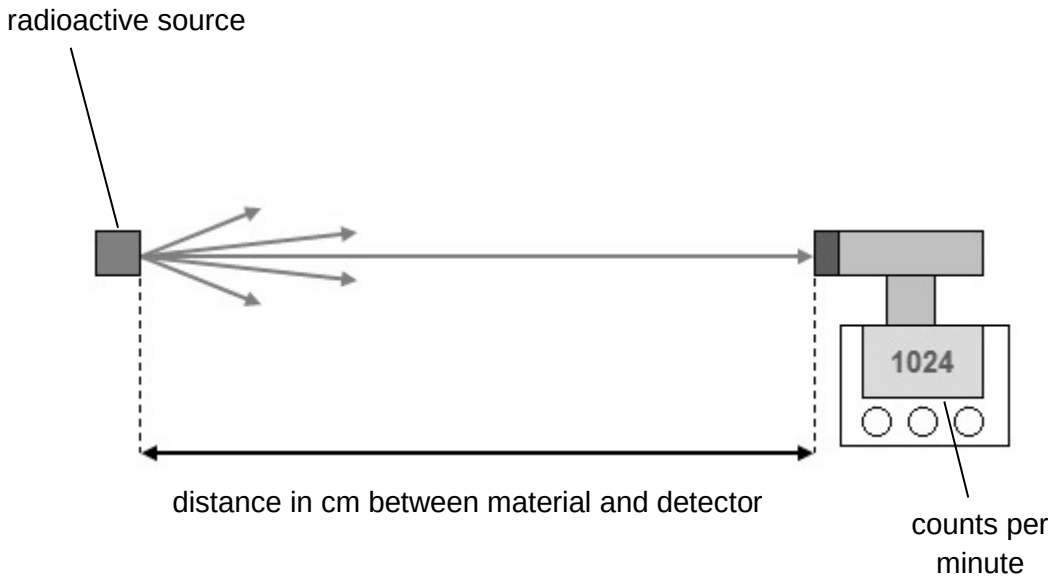
answer: ..... seconds **[3]**

27 Matt experiments with radioactive materials.

He investigates how the activity of radiation changes with distance.

The radiation moves from the source to the detector.

He measures the counts per minute from a radioactive source.



The table shows the results from the experiment.

Distance between the source and the detector (cm)	Count rate (counts per minute)
10	1024
20	256
40	64
80	16

(a) Describe using the data in the table how the count rate changes as the detector is moved away from the source.

…… **[2]**

(b) Matt does two further readings at 160 cm and 320 cm.

His results are in the table below.

Distance between the source and the detector (cm)	Count rate (counts per minute)
10	1024
20	256
40	64
80	16
160	**6**
320	**0**

As the distance is increased to 160 cm and 320 cm the results do not follow the same pattern as the other results.

What do you think these results should have been?

Explain the anomalies in the last two results.

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…… **[3]**