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GCSE (9–1) Physics B (Twenty First Century Science) F

J259/02 Depth in physics (Foundation Tier)

Sample Question Paper

Date – Morning/Afternoon

Version 2

Time allowed: 1 hour 45 minutes

You must have:
- the Data Sheet

You may use:
- a scientific or graphical calculator

First name									
Last name									
Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **20** pages.

Answer **all** the questions.

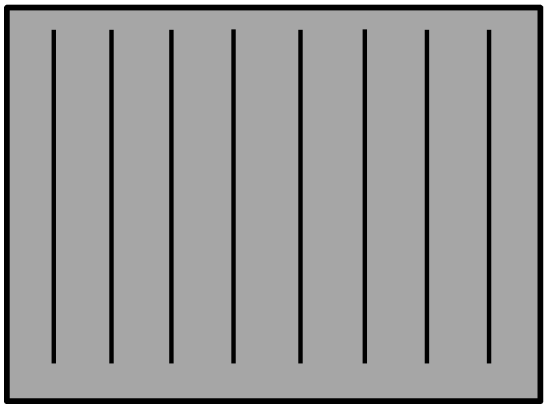
1 Li is experimenting with water waves.

He uses a wave generator to create waves at different wavelengths and frequencies.

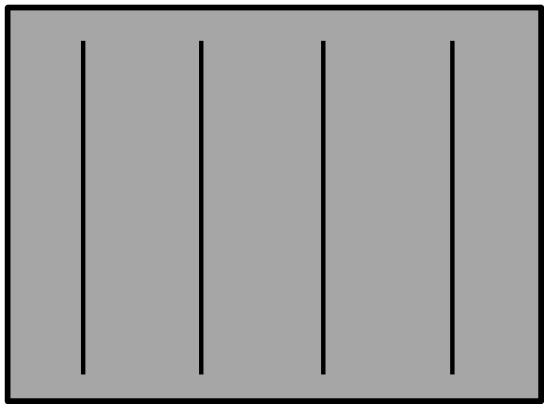
The diagrams show the waves he produced.

Each line represents a wave viewed from above.

First waves produced



Second waves produced

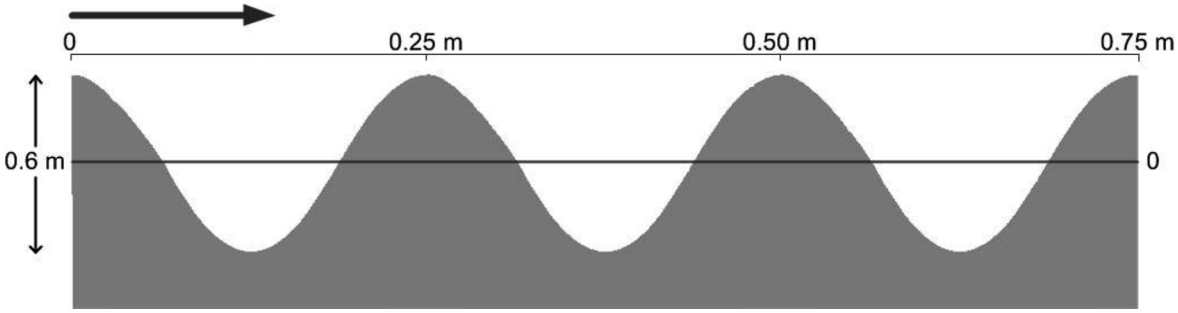


(a) Fill in the gaps to explain how the wave has changed.

(i) The wavelength of the second wave produced is ..... than the first wave. **[1]**

(ii) The frequency of the second wave produced is ..... than the first wave. **[1]**

(b) The diagram shows the second wave produced but seen from the side.



Using the diagram, calculate the amplitude and the wavelength of the water waves.

Show your working.

Amplitude = ...m

Wavelength = ... m **[3]**

(c) **(i)** Li counts the waves as they pass in front of him.

He finds that 5 waves pass him in 10 seconds.

Calculate the frequency of the wave.

Frequency = ... Hz **[2]**

(ii) Using your answers to parts **(b)** and **(c)(i)**, calculate the speed of the wave.

In your answer use the equation:

wave speed = frequency × wavelength

Speed = ... m/s **[2]**

2 Amaya draws a diagram of parts of the electromagnetic spectrum.

(a) She misses out some parts.

.....	**X-rays**	**ultraviolet**	**visible light**	.....	**microwaves**	.....

smallest ⟶ **biggest**

(i) Add the missing parts of the spectrum to the diagram above. **[3]**

(ii) In the diagram, one property is **increasing** from left to right.

Put a (ring) around this property in the list below.

energy **frequency** **wavelength** **wave speed** **[1]**

(b) Different parts of the electromagnetic spectrum are used fordifferent purposes.

Draw lines to link each **part of the electromagnetic spectrum** to its **use**.

Part of the electromagnetic spectrum	**Use**
X-rays	to produce images of bones
microwaves	to carry information along optical fibres
infra-red	to carry satellite signals

[2]

3 This question is about astronomy.

(a) The statements below are all about the planets in our solar system.

Put a tick (✓) in the correct box after each statement.

	True	**False**
All planets are the same size.	☐	☐
The Sun's gravity keeps all the planets in their orbits.	☐	☐

[2]

(b) The following statements describe how the solar system formed.

1 and denser areas of the dust cloud condensed into the planets.

2 was pulled together by gravity

3 A large cloud of dust and gas in space

4 when fusion reactions started, and the Sun was born

5 the gas was compressed and heated up

6 until the centre part had a temperature of millions of degrees

The statements are **not** in the correct order.

In the spaces below, write down the correct order of the statements.

Two have been done for you.

3 .... **1** ..... **[4]**

(c)* In the 1920s, astronomer Edwin Hubble made observations of the light coming from many galaxies.

Hubbles observations made other scientists accept a new theory about how the Universe began.

Describe what galaxies are, and how Hubble's observations of red shift led to the idea of an expanding Universe.

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..... **[6]**

4 This question is about energy transfers in electrical appliances.

(a) The plates on the back of three electrical appliances are shown below.

Appliance **A**	Appliance **B**	Appliance **C**
2.0 kW 230 V 50 Hz	50 Hz 1.2 A 230 – 240 V	800 W 50 Hz 3.5 A 230 V

(i) Appliance **A** is switched on for 195 minutes.

Calculate the number of kWh of energy transferred.

In your answer use the equation:

energy transferred = power × time

Energy transferred = ... kWh **[3]**

(ii) Calculate which appliance (**A**, **B** or **C**) takes the biggest electric current from the mains power supply.

Appliance = ... **[4]**

(b) A householder heats water with an electric heater.

The water is then stored in a large storage tank until it is needed.

If the water is **not** used for some hours, it will cool down and the electric heater must be put on again.

Suggest and explain **one** way in which the householder can reduce the energy wasted in this way, and so save money on the electricity bills.

.....

.....

..... **[2]**

(c) The cost of electricity is 16 p per kWh.

Appliance **C** transfers 3.2 kWh when left on for 4 hrs.

Calculate the cost in pounds.

Cost = £..... **[2]**

5 **Fig. 5.1** is a velocity–time graph for a short car journey.

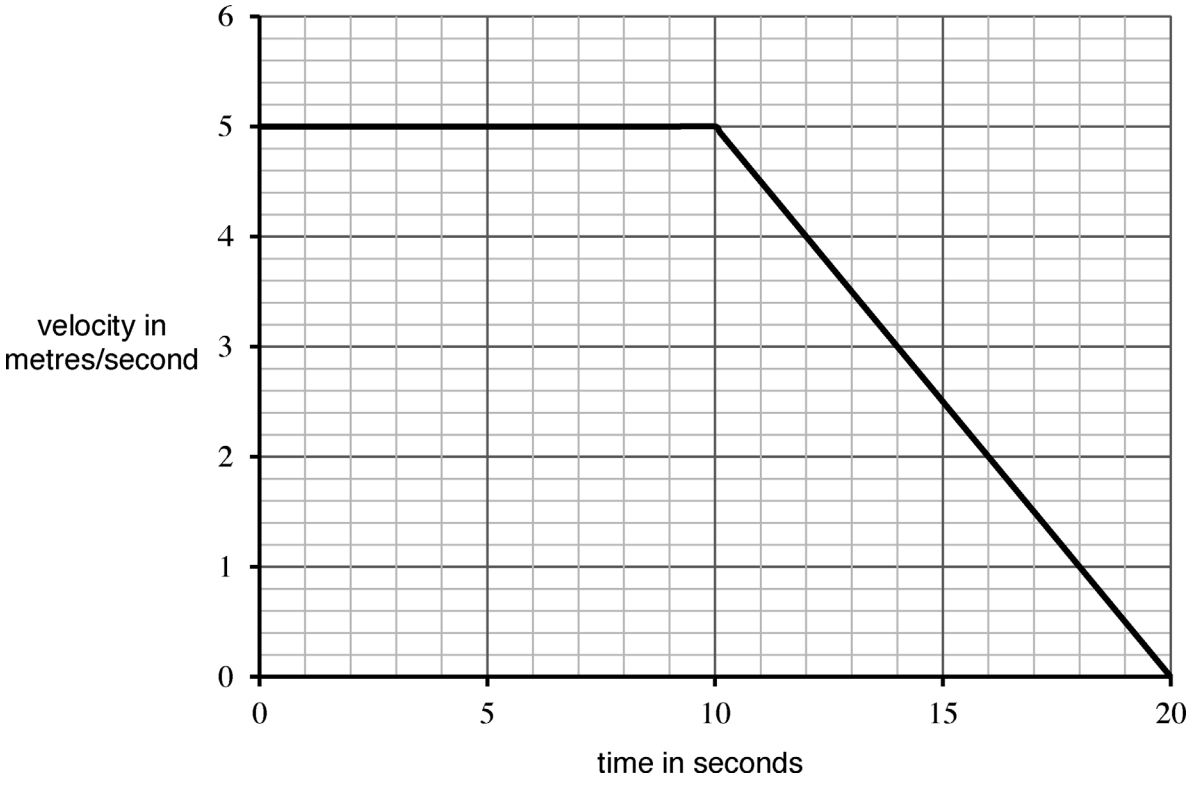


Fig. 5.1

(a) Use the graph in **Fig. 5.1** to describe the car journey in words.

.....

.....

.....

..... **[3]**

(b) Calculate the total distance moved by the car in the 20 seconds.

Show your working clearly.

Total distance moved = ... m **[4]**

(c) A second car starts a journey at the same time as the car shown on the graph in **Fig. 5.1**.

- The car accelerates uniformly from rest at a rate of 0.4 m/s^2 for 10 seconds.
- It then decelerates to rest over the next 8 seconds.

(i) Calculate the change in velocity of the second car in the first 10 seconds.

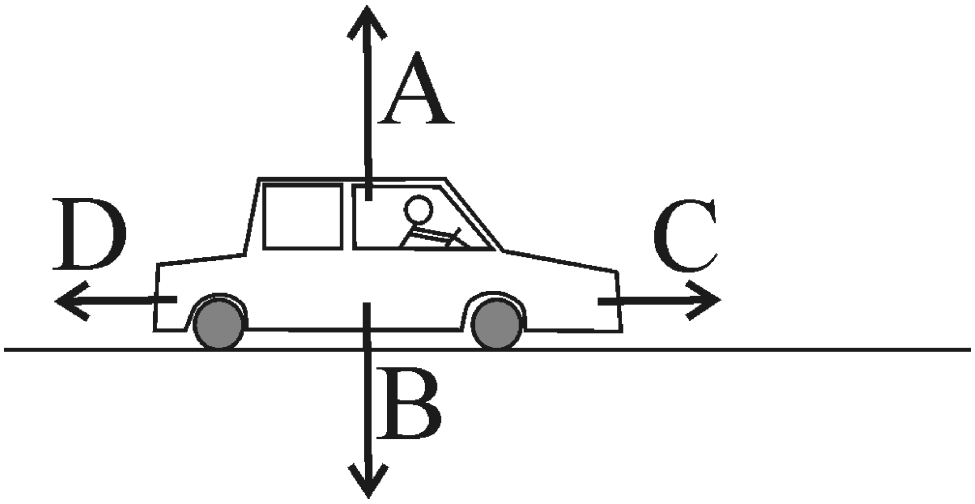
In your answer use the equation:

acceleration = change in velocity ÷ time.

Change in velocity = ... m/s **[3]**

(ii) Draw a line on the graph in **Fig. 5.1** to show the journey of the second car. **[3]**

6 The diagram shows a car moving at a steady speed along a straight, flat road.



(a) For each force (**A**, **B**, **C** and **D**), state what is pushing or pulling the car in the direction shown.

A .....

B .....

C .....

D ..... **[4]**

(b) The driver suddenly pushes his foot down on the accelerator pedal.

The resultant force is 800 N.

(i) State which **one** of the four forces (**A**, **B**, **C** or **D**) has changed.

..... **[1]**

(ii) The mass of car and driver = 1 000 kg

Calculate the acceleration of the car. (Resultant force = 800 N)

Acceleration = ...m/s^2 **[3]**

(iii) The car travels a distance of 830 m, when the force of 800 N is applied.

Calculate the work done by the car engine.

In your answer use the equation:

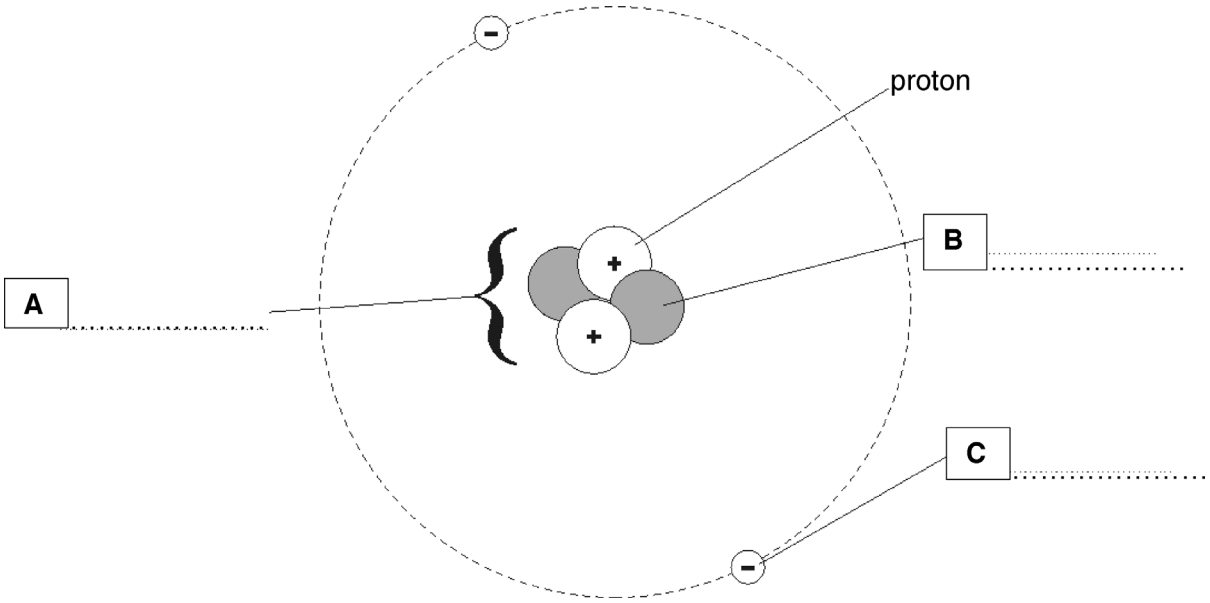
work done = force × distance.

Work done = ……J **[2]**

7 **(a)** The diagram shows a simple model of the atom.

One part of the atom has been labelled.

Label the other three parts (**A**, **B** and **C**).



[3]

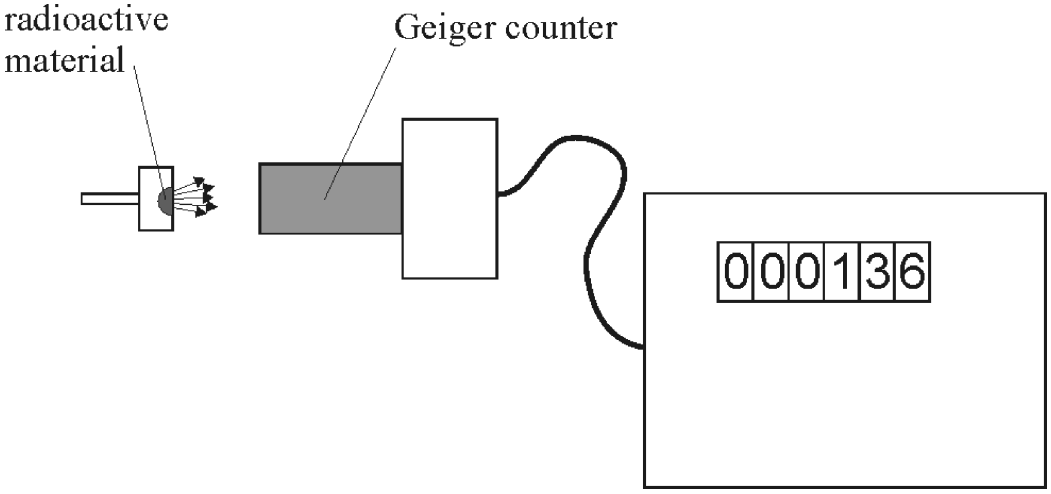
(b) Radioactive materials give off three types of radiation:

alpha particles beta particles gamma rays

These have different penetrating powers.

You are given a sample of radioactive material which gives out one of the three types of radiation, but you do not know which one.

You also have a Geiger counter to detect radiation, as shown below.



You place a thin sheet of paper between the radioactive material and the Geiger counter.

You then replace the paper with a sheet of aluminium metal about 2 mm thick.

Explain how the results tell you which sort of radiation is given out by the material.

.....

.....

..... **[2]**

(c) Identify **one** risk from collecting the results from the experiment in **(b)**.

Explain how you would complete the experiment to reduce this risk.

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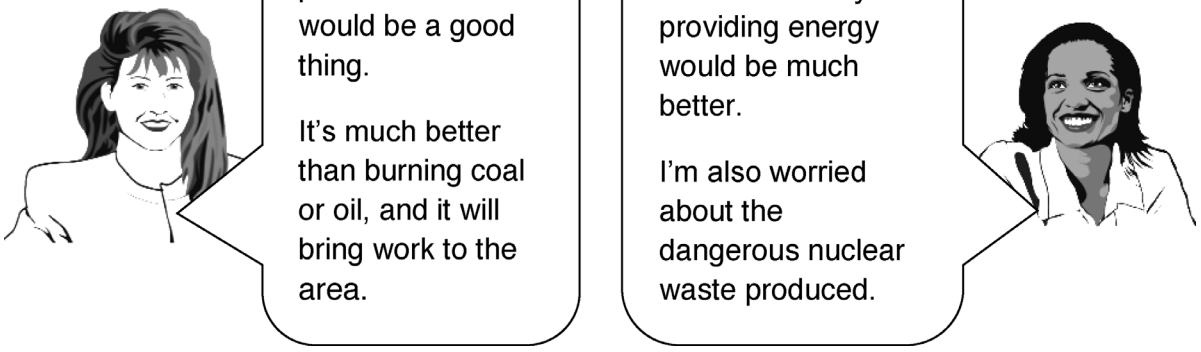
..... **[2]**

8* Two people are discussing plans to build a nuclear power station near their town.



Explain the different points of view put forward by Mia and Sundip, and state, with reasons, which person you think has the better argument.

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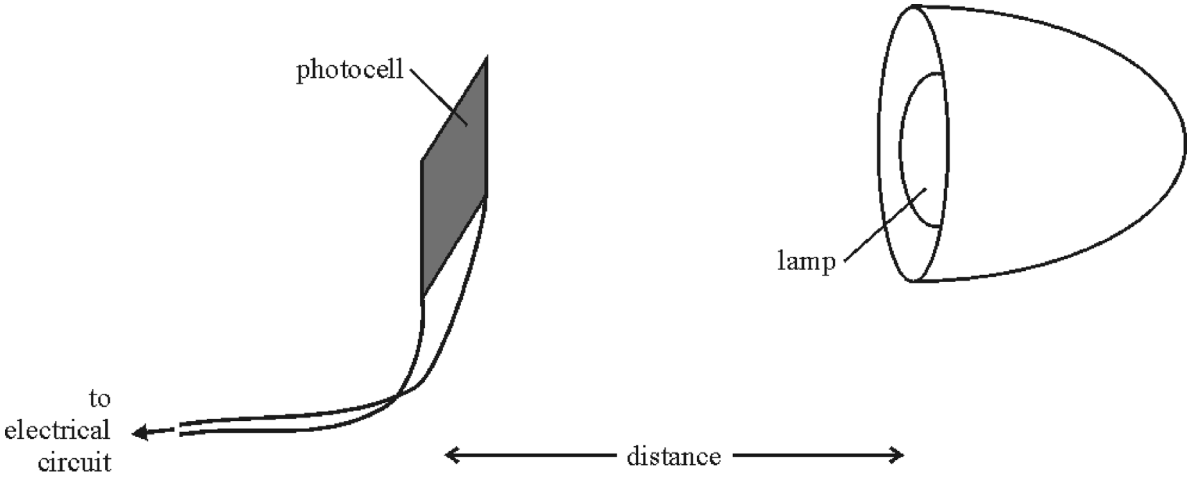
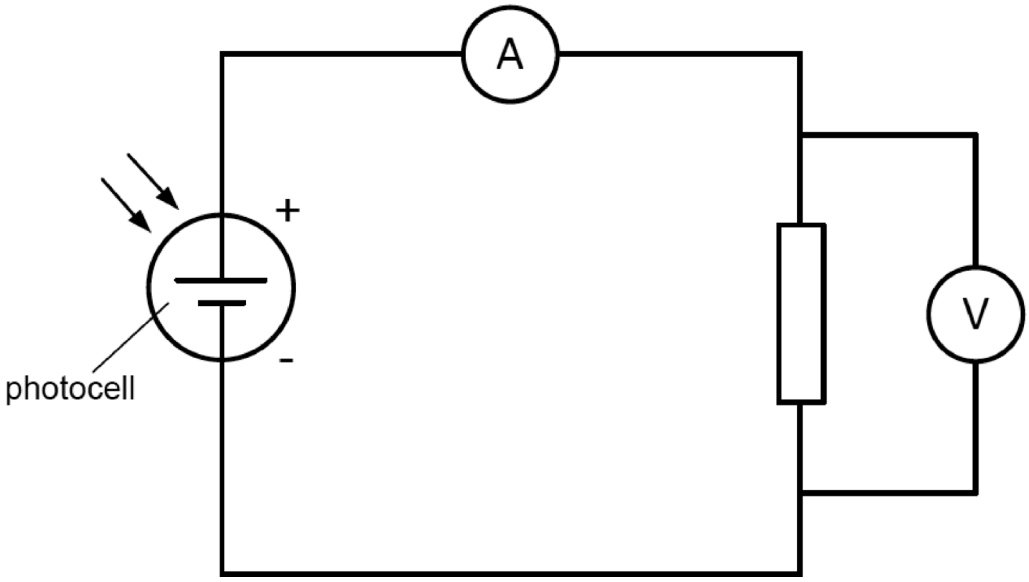
..... **[6]**

9 Beth is doing an experiment to investigate the output of a solar panel.

She is using a small photocell to model the panel.

She measures the power output of the photocell at different distances from a lamp, as shown below.



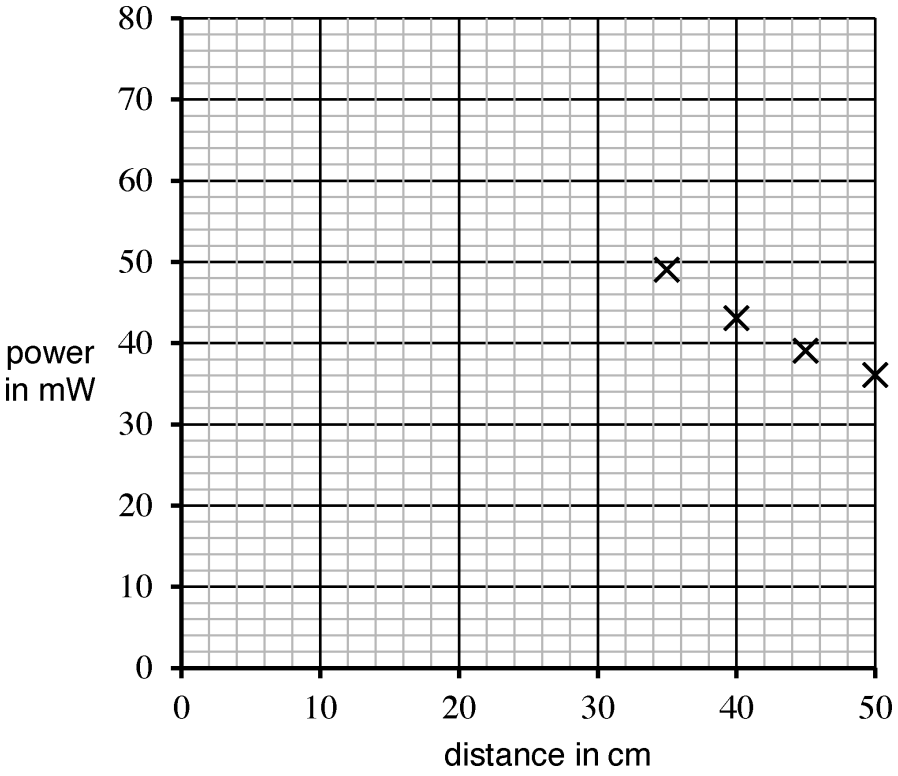


(a) Beth obtained values of power at different distances, as shown in the table.

Distance (cm)	25	30	35	40	45	50
Power (mW)	72	57	49	43	39	36

(i) Four points have been plotted on the graph axes below.

Plot the remaining two points and add a best-fit curve. **[2]**



(ii) What does the graph show?

.....

..... **[1]**

(iii) At a distance of 25cm the power was 72 mW. The voltage across the photocell was recorded as 12 V.

Calculate the current through the photocell.

Use the equation:

power = potential difference × current.

Current = ... A **[4]**

(iv) Calculate the resistance in ohms of the resistor.

Use the information in **(iii)** and the equation:

potential difference = current × resistance.

Resistance = ... Ω **[3]**

(b) Describe how this experiment should be completed to get a valid set of data.

.....

.....

.....

..... **[4]**

(c) James has done an identical experiment to Beth's in a **different part** of the same lab.

He used an identical lamp, photocell and resistor, but his values of power were much lower than Beth's for the same distances.

He thinks that his part of the lab must have been different from Beth's.

Suggest and explain a reason for the difference in their results.

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..... **[2]**

END OF QUESTION PAPER