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

F

J259/02 Depth in physics (Foundation Tier)

Sample Question Paper

Date – Morning/Afternoon

Time allowed: 1 hour 45 minutes

You must have:
- the Data Sheet

You may use:
- a scientific or graphical calculator

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First name	
Last name	

Centre number						Candidate number				

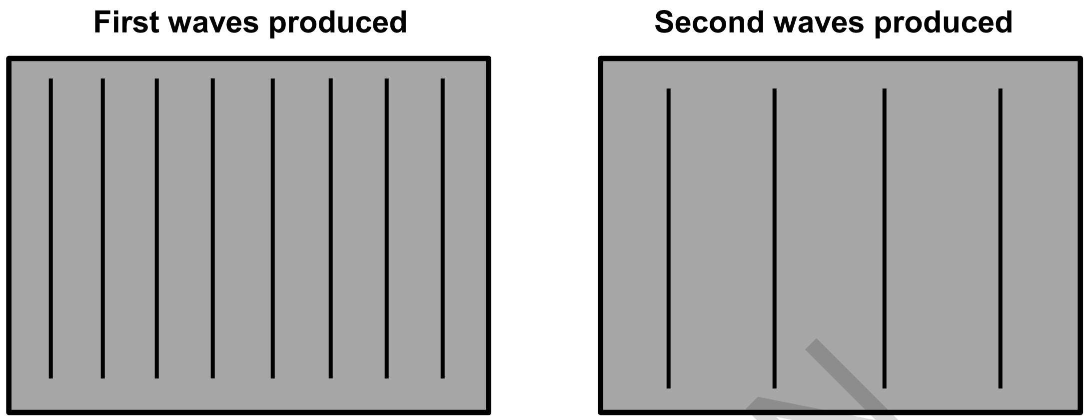
INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you 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.

QN: 601/8685/9

Answer **all** the questions.

1 Rob is experimenting with water waves. He uses a wave generator to create waves at different wavelengths and frequencies. Below are diagrams showing the waves he produced. Each line represents a wave viewed from above.

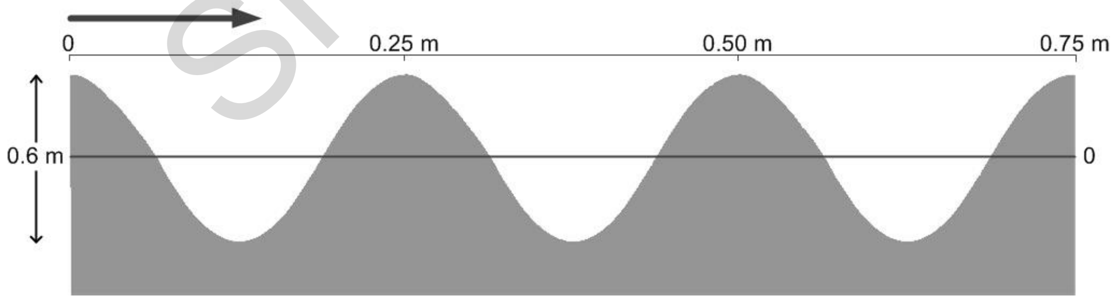


(a) Fill in the gaps below to explain how the wave has changed.

(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 image below shows the second wave produced but seen from the side



Use data from the diagram above to calculate the amplitude and the wavelength of the water waves.

Show your working.

amplitude = ……………… m wavelength = ……………… m **[3]**

(c) **(i)** Rob times 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.

.... 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 x wavelength

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

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

(a) She misses out some parts.

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

smallest $\longrightarrow$ **biggest**

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

(ii) Going from left to right, what property is **increasing** in the diagram?

Put a ring around the correct answer.

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

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

Draw straight 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.
Some of the statements are true and some are false.

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.
They are not in the correct order.
In the spaces below, put down the order in which they should come.
Two have been done for you.

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 correct order is:

3 ……. ……. ……. ……. ……. 1 …….

[4]

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

Hubble's 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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....

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....

....

.... **[6]**

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TURN OVER FOR THE NEXT QUESTION

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	50 Hz	800 W
230 V	1.2 A	50 Hz
50 Hz	230 – 240 V	3.5 A
		230 V

(i) Calculate the number of kWh of energy transferred by appliance **A** if it is on for 195 minutes. In your answer use the equation: energy transferred = power x time

……………………kWh **[3]**

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

……………….. **[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.

……………………………………………………………………………………………………......

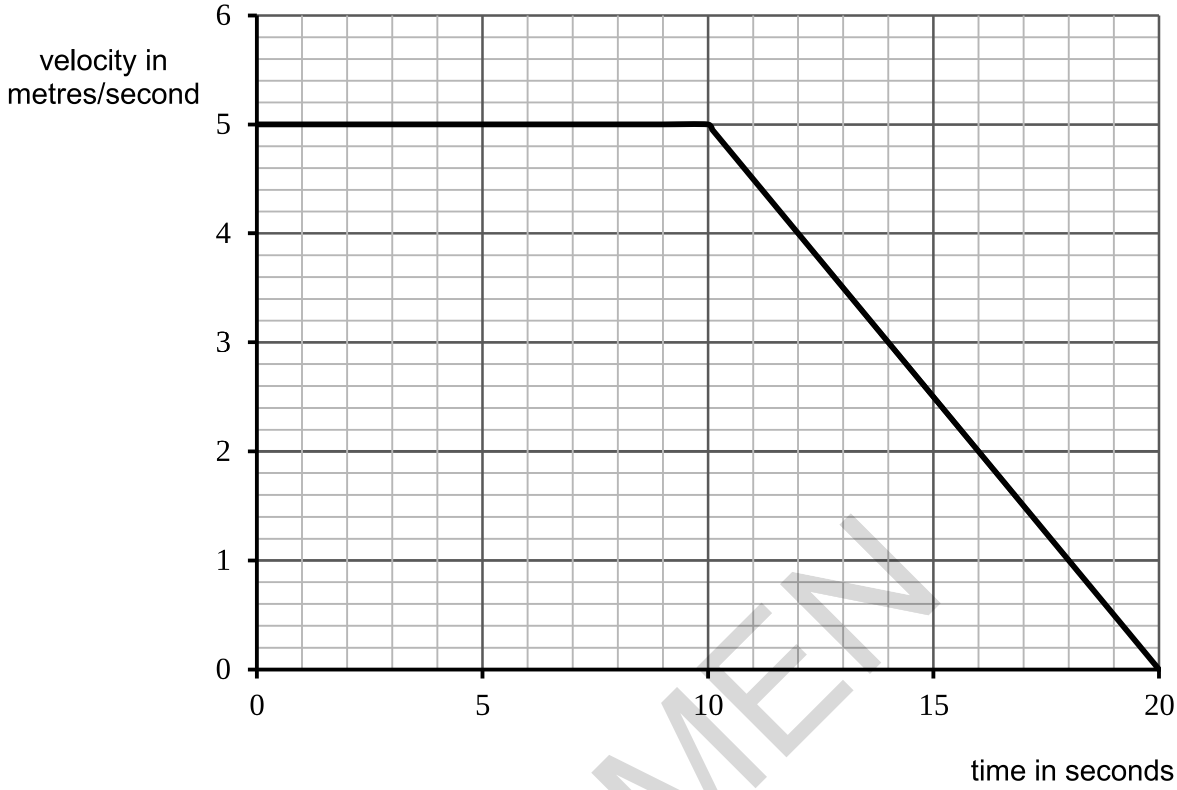
……………………………………………………………………………………………………......

…………………………………………………………………………………………… **[2]**

(c) The cost of electricity is 16p per kWh. Appliance C transfers 3.2 kWh when on for 4hrs. Calculate the cost in pounds.

£……………….. **[2]**

5 This is a velocity-time graph for a short car journey.



(a) Use the graph 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.

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

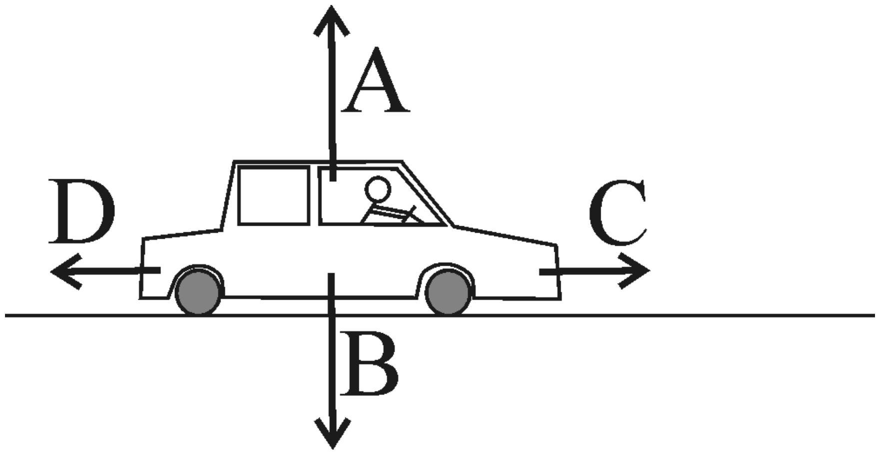
(c) A second car starts out at the same time as the car above. It accelerates uniformly from rest at a rate of 0.4 m/s^2 for 10 seconds, and then decelerates to rest over the next 8 seconds.

(i) Calculate the change in velocity of the car in the first 10 seconds.
In your answer use the equation: acceleration = change in velocity ÷ time.

…………………..m/s **[3]**

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

6 Below is a diagram showing a car moving at a steady speed along a straight, flat road.



(a) For each of the four forces labelled in the diagram above, 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.

(i) State which one of the four forces has changed.

……………….. **[1]**

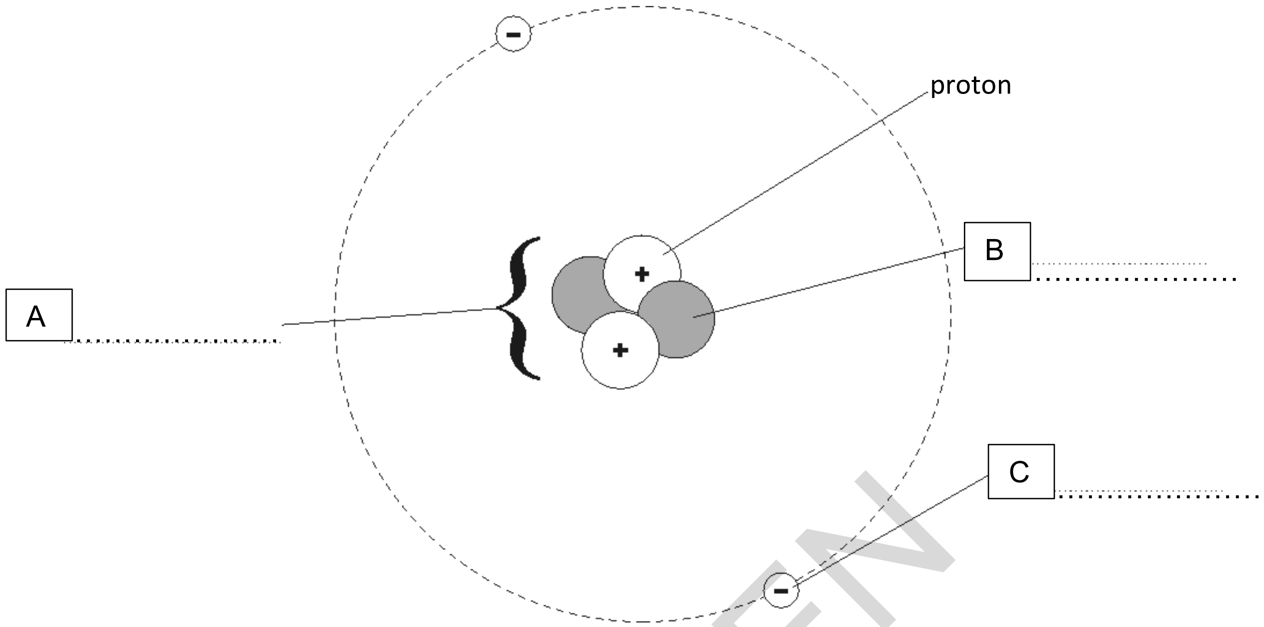
(ii) Calculate the acceleration of the car if the resultant force is now 800 N.
Mass of car, together with the driver = 1000 kg

………………….m/s² **[3]**

(iii) The car travels a distance of 830m, 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 x distance.

…………………………………….J **[2]**

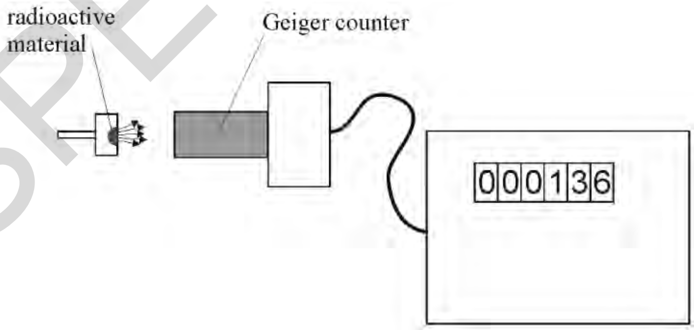
7 **(a)** Below is a simple model of the atom, with one part labelled. Label the other three parts (A, B and C) shown.



[3]

(b) Radioactive materials give off three types of radiation: alpha particles, beta particles and 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 source 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** hazardous effect associated with collecting the results from this experiment and explain how you would complete the experiment in order to reduce this risk.

……......

……......

……......

…… **[2]**

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

Pam
I think a nuclear power station would be a good thing. It's much better than burning coal or oil, and it will bring work to the area.

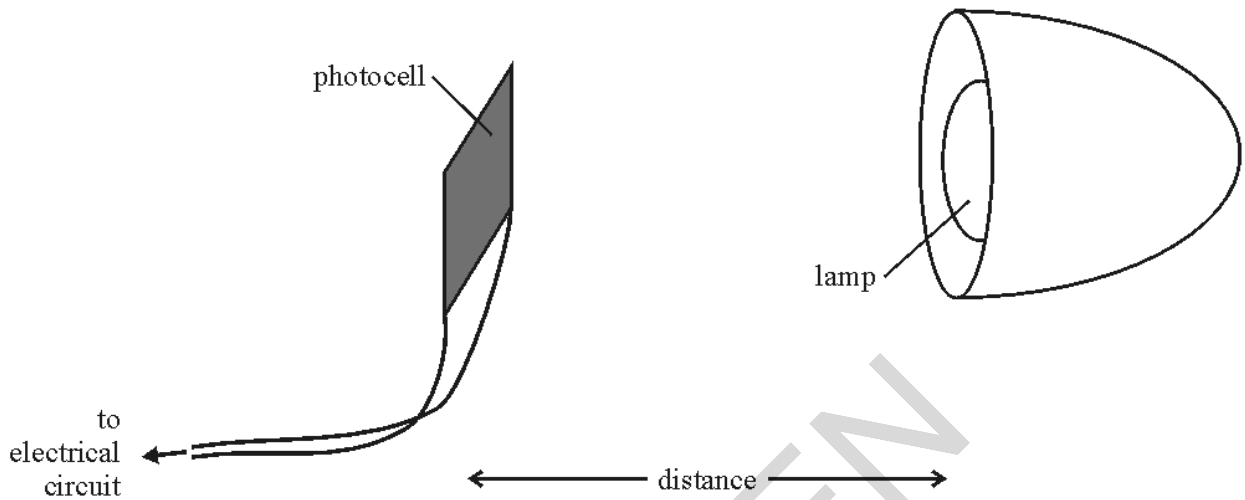
Suraiya
I disagree with you. Renewable ways of providing energy would be much better. I'm also worried about the dangerous nuclear waste produced.

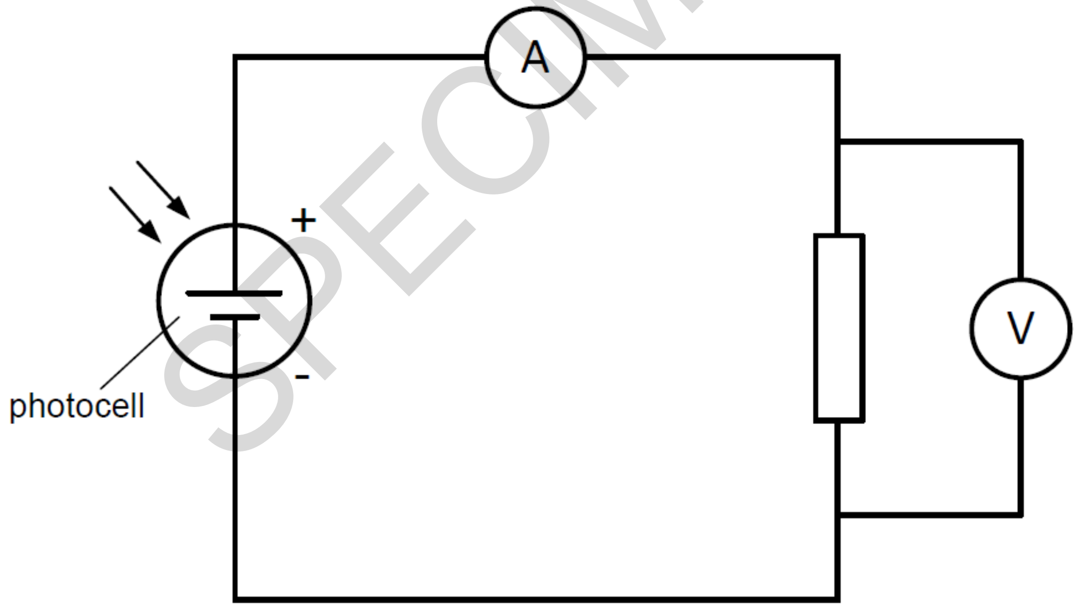
Explain the different points of view put forward by these two people, and state, with reasons, which of the two you think has the better argument.

[6]

9 Sam is doing an experiment to investigate the output of a solar panel. She is using a small photocell to model the panel.

She is measuring the power output of the photocell when it is at different distances from a lamp, as shown below.



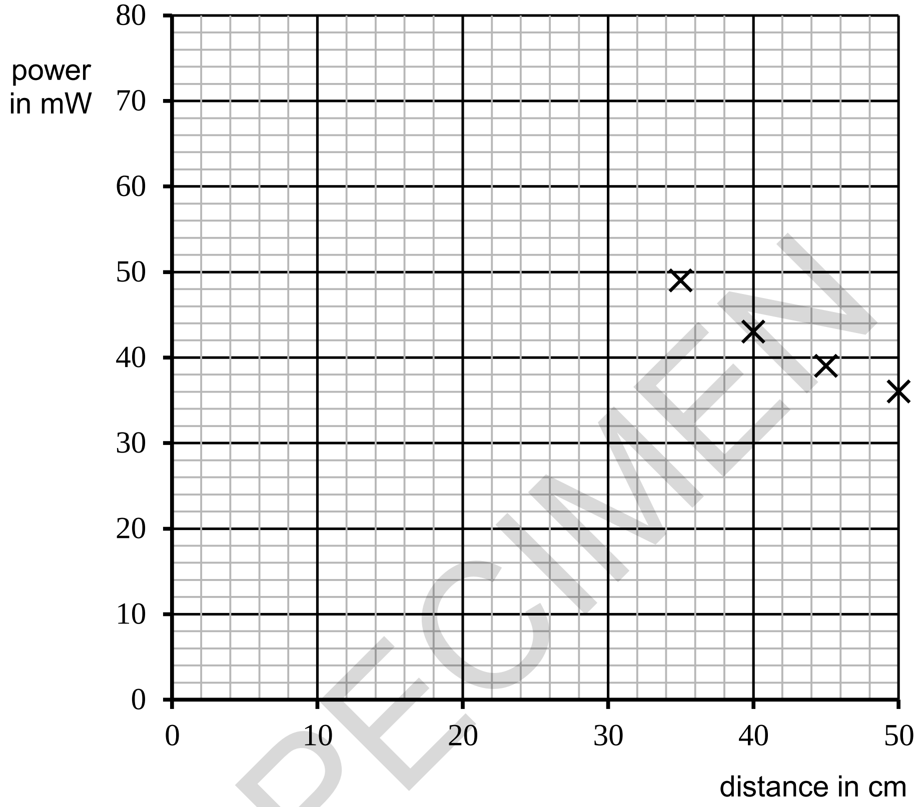


(a) Sam obtained a range of values of power at different distances, as shown in the table below.

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

Four data points have been plotted on the graph axes below.

(i) Plot the remaining two data 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. In your answer use the equation: power = potential difference x current.
Calculate the current through the photocell.

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

(iv) Calculate the resistance in ohms of the resistor using the equation:
potential difference = current x resistance.

………………………Ω **[3]**

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

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

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

(c) Tom has done an identical experiment to Sam'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 Sam's for the same distances.

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

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

……………………………………………………………………………………………………..

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…………………………………………………………………………………………………… **[2]**

END OF QUESTION PAPER

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