

Candidate Name	Centre Number	Candidate Number
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GCSE

241/02

ADDITIONAL SCIENCE

HIGHER TIER

PHYSICS 2

A.M. WEDNESDAY, 19 January 2011

45 minutes

For Examiner's use only		
Question	Maximum Mark	Mark awarded
1.	9	
2.	10	
3.	7	
4.	8	
5.	8	
6.	8	
Total	50	

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02/0001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2. In calculations you should show all your working.

EQUATIONS

$$\text{Resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\text{Power} = \text{current} \times \text{voltage}$$

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{Resultant force} = \text{mass} \times \text{acceleration}$$

$$\text{Acceleration} = \frac{\text{change in speed}}{\text{time}}$$

$$\text{Force} = \frac{\text{Work done}}{\text{distance}}$$

$$\text{Kinetic Energy} = \frac{\text{mass} \times \text{speed}^2}{2}$$

$$= \frac{1}{2} mv^2$$

$$\text{Change in potential energy} = \text{mass} \times \text{gravitational field strength} \times \text{change in height}$$

$$= mgh$$

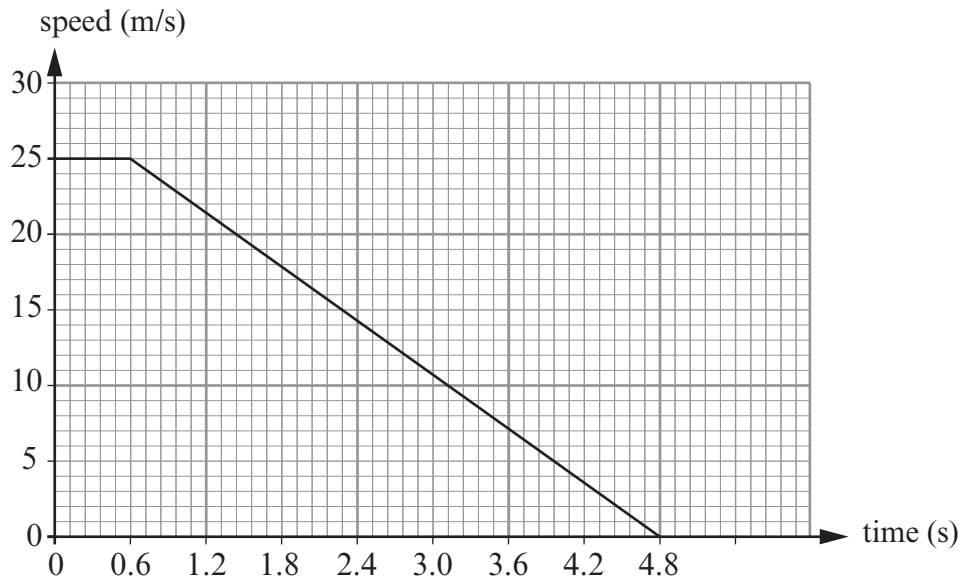
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Answer all questions.

1. The overall stopping distance for a car is given by the equation below:

$$\text{Overall stopping distance} = \text{Thinking distance} + \text{Braking distance}$$

The graph below is the speed-time graph for a car initially travelling at a constant speed. The time starts from the moment the driver sees an obstacle on the road.



- (i) What is the reaction (thinking) time of the driver of this car? [1]

- (ii) Use the equation

$$\text{distance} = \text{speed} \times \text{time}$$

to calculate the distance travelled by the car during the driver's thinking time. [2]

$$\text{distance} = \dots\dots\dots \text{ m}$$

- (iii) Calculate the total stopping distance for the car if the braking distance is 52.5 m. [1]

$$\text{Total stopping distance} = \dots\dots\dots \text{ m}$$

- (iv) How long does it take the car to come to a stop after the brakes have been applied? [1]

$$\text{Time} = \dots\dots\dots \text{ s}$$

- (v) Use the equation

$$\text{deceleration} = \frac{\text{change in speed}}{\text{time}}$$

to calculate the deceleration of the car during the time when the brakes are applied. [2]

$$\text{Deceleration} = \dots\dots\dots \text{ m/s}^2$$

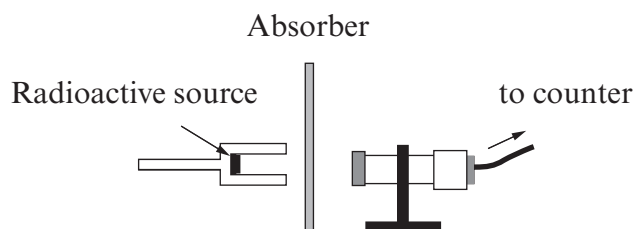
- (vi) The mass of the car is 1200 kg.
Use the equation

$$\text{deceleration} = \frac{\text{resultant force}}{\text{mass}}$$

to calculate the size of the resultant force that causes the car to decelerate. [2]

$$\text{Resultant force} = \dots\dots\dots \text{ N}$$

2. (a) The diagram shows the apparatus used to investigate the radiation emitted from two sources, **Y** and **Z**.



The table below shows the **counts per minute** obtained when different materials were placed between the sources and the detector. All the readings do not include background radiation.

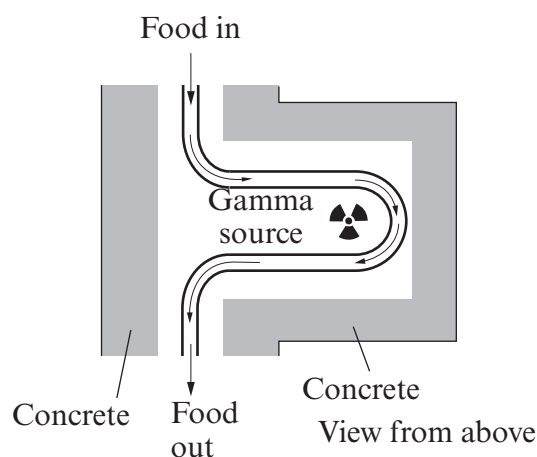
Radioactive Source	No absorber Present (counts/min)	Paper Absorber (counts/min)	Aluminium absorber 4 mm thick (counts/min)	Lead absorber 3 cm thick (counts/min)
Y	320	320	320	50
Z	315	180	180	0

Use the information in the table above to answer the following questions.

- (i) How can you tell that source **Y** only emits one type of radiation? [1]

- (ii) Explain how you can tell that source **Z** emits alpha and gamma radiation but not beta. [2]

- (b) Fresh fruit and vegetables can be treated with gamma radiation to kill the bacteria that make them rot. The diagram shows how the food on a conveyor belt passes a gamma source.



- (i) The food is packed in crates. Give a reason why a gamma source must be used rather than alpha or beta. [1]

- (ii) Explain why the food treatment area must be enclosed with thick concrete. [2]

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- (iii) Describe how the dose of gamma radiation received by the food can be varied. [1]

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- (c) The use of radiation to treat food is controversial. Some people mistakenly believe that the food will become radioactive.

- (i) What evidence could scientists provide to show that food treated with radiation is safe to eat? [2]

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- (ii) In shops, radiation treated food is labelled with a sign.



Sign for irradiated food

- Give a reason it is important to identify food in this way. [1]

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3. Domestic circuits have live, neutral and earth wires and either fuses or circuit breakers.

(a) (i) Describe the purpose of the neutral wire. [1]

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(ii) In modern homes, fuses have been replaced with miniature circuit breakers (mcb).
What are the advantages of using mcb instead of fuses? [2]

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(iii) State the type of fault that would cause an mcb to break a circuit. [1]

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(b) Explain how the earth wire and fuse together protect consumers from fire and electric shocks. [3]

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4. Astatine 211 (At-211) is an alpha-emitting radioisotope with a half-life of 7.2 hours. It is used in the treatment of cancer.

(a) The nuclei of At-211 are unstable. Explain why. [2]

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(b) Explain why At-211 is only effective at treating cancer tumours when injected into them. [2]

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(c) (i) Explain what is meant by the statement, "The half-life of At-211 is 7.2 hours." [2]

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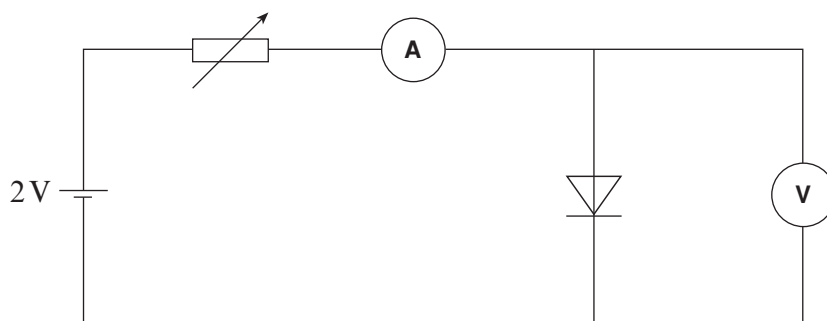
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(ii) The radiation from At-211 is undetectable after 36 h. Calculate the fraction of the initial activity remaining after this time. [2]

Fraction remaining =

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5. Students used the following circuit to investigate how the current through a diode changed as they altered the voltage.



- (a) The students adjusted the variable resistor. Explain how this allowed a series of readings to be taken. [2]

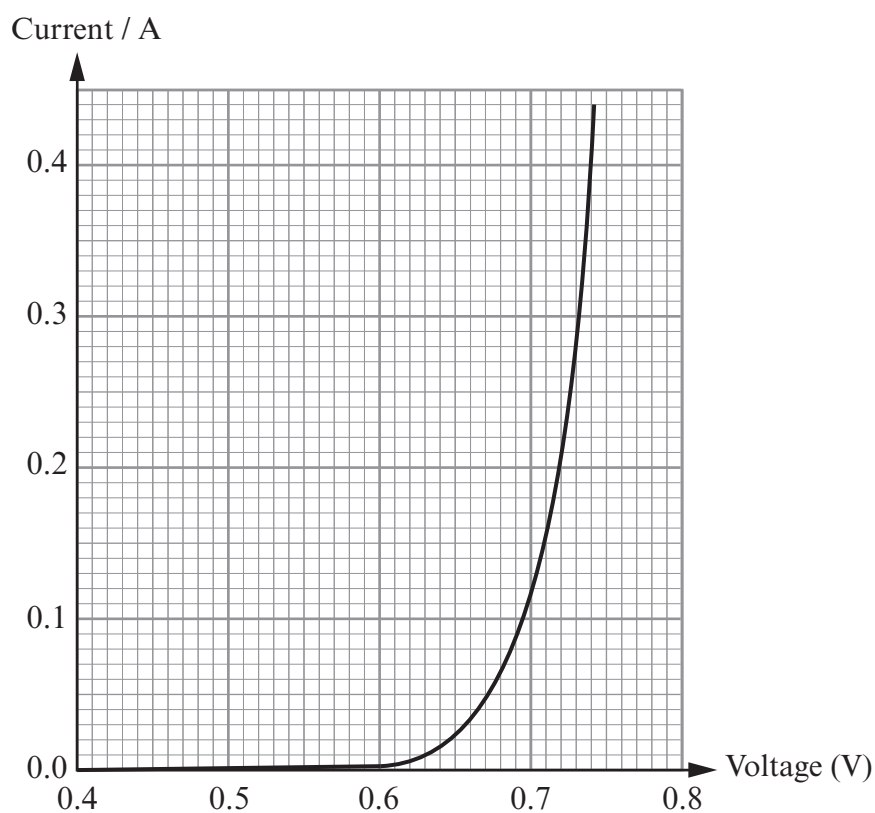
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- (b) The students plotted the results as a graph.



- (i) Use the students' graph to find the lowest voltage for which the diode conducted a measurable current. [1]

Lowest voltage = V

- (ii) Use the equation

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

to calculate the resistance of the diode at 0.7 V.

[2]

Resistance = Ω

- (c) The voltage on the diode was decreased from 0.7 V to 0.6 V.

- (i) Use the graph in (b) to find the effect this change had on the current flowing through the diode.

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- (ii) Use the equation in (b) to find the effect this change had on the resistance of the diode.

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[3]

6. A ski lift carries a skier of mass 60 kg from the bottom to the top of a ski-slope. The skier gains 75 000 J of potential energy.

(a) The skier then slides down the slope starting from rest at the top.

- (i) Write down an equation connecting kinetic energy, speed and mass as it appears on page 2 and use it to calculate the skier's maximum possible speed when she reaches the bottom of the slope.

Equation:

..... [1]

Calculation: [2]

Maximum possible speed = m/s

- (ii) When her actual speed at the bottom of the hill is measured it is found to be 30 m/s. Explain in detail why her actual speed is less than the one you calculated in part (i). [2]

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- (b) At the bottom of the hill the skier slows down from a speed of 30 m/s and stops in a distance of 20 m.

Calculate the average (braking) force needed to stop her in this distance. [3]

You will find the following equation useful in your calculation:

$$\text{work done} = \text{force} \times \text{distance}$$

Force = N

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