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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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

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

Power $=$ current $\times$ voltage

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

Resultant force $=$ mass $\times$ acceleration

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

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

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

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

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

$= mgh$

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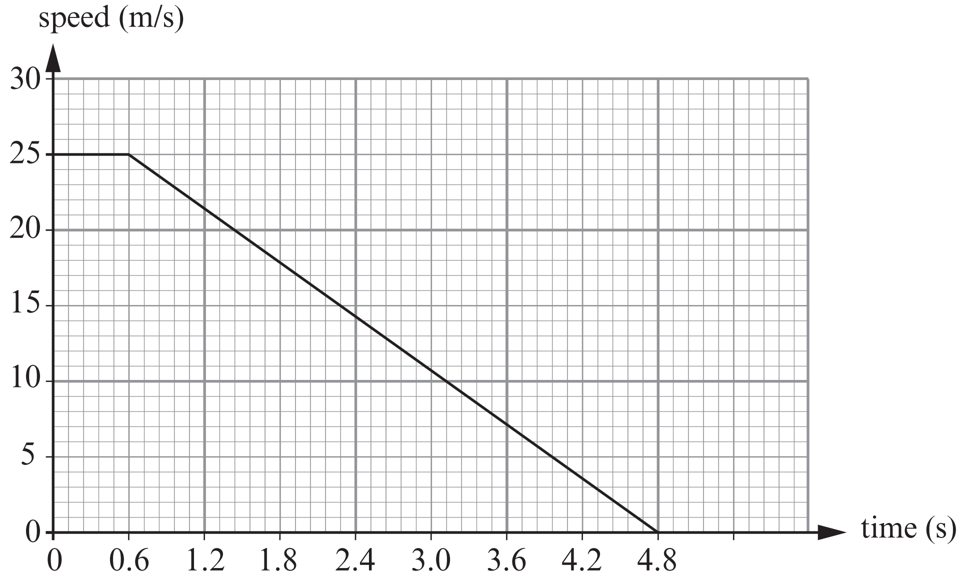
Answer **all** *questions.*

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

Overall stopping distance = Thinking distance + 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

distance = speed × time

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

distance = ... m

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

Total stopping distance = ... m

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

Time = ... 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]

Deceleration = ... 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]

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Resultant force = ... N

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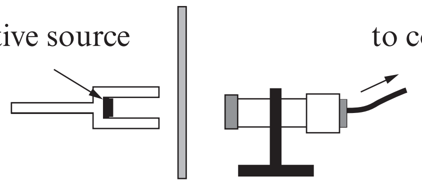
2. *(a)* The diagram shows the apparatus used to investigate the radiation emitted from two sources, **Y** and **Z**.



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]

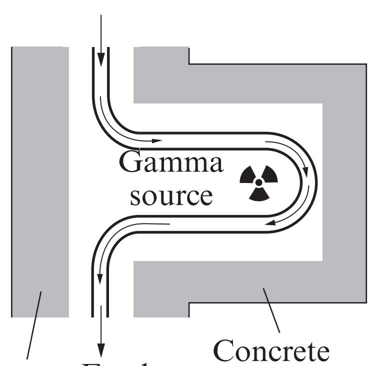
....

(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]

....

....

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

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

(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]

(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]

....

....

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

....

....

....

....

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

....

....

(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]

....

....

....

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

....

....

....

....

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

....

....

....

....

(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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Turn over.

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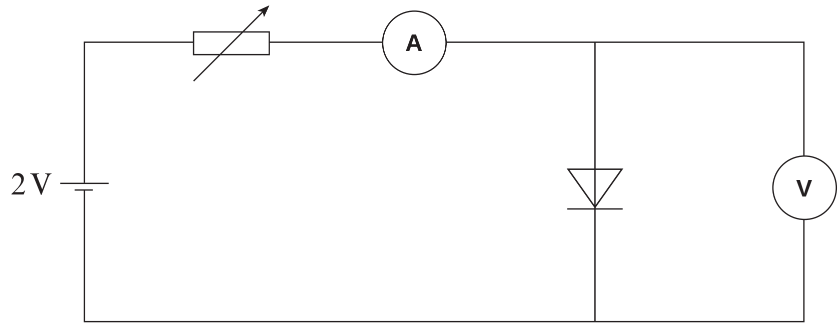
5. Students used the following circuit to investigate how the current through a diode changed as they altered the voltage.



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

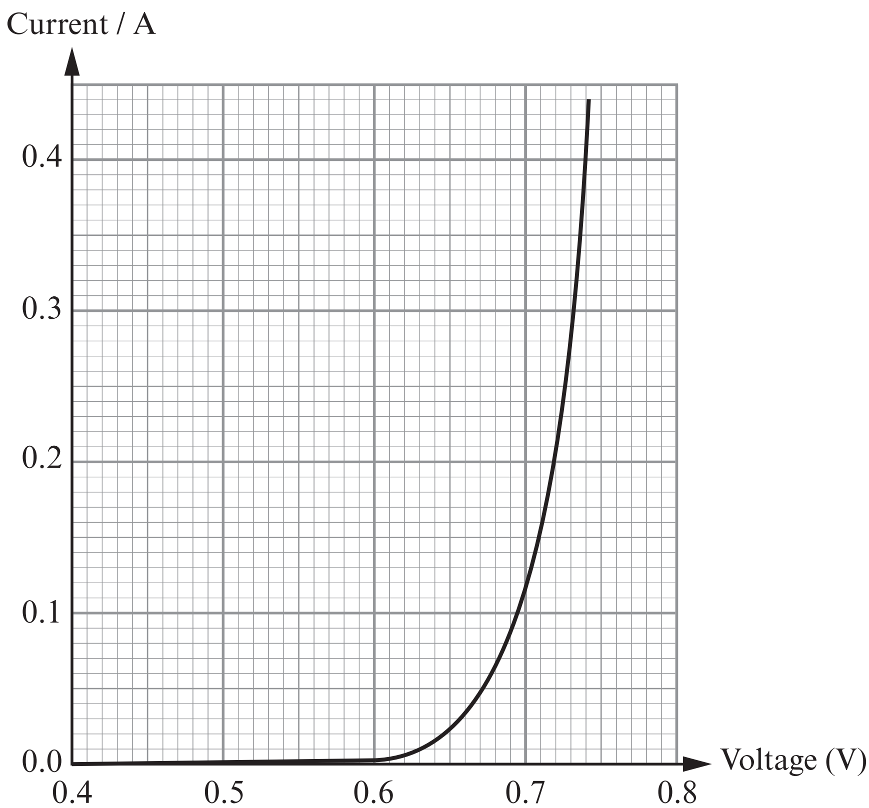
....

....

....

....

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



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(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.

....

....

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

....

....

....

....

[3]

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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]

....

....

....

....

(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:

work done = force × distance

Force = ... N

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