Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0241/02

ADDITIONAL SCIENCE
HIGHER TIER
PHYSICS 2

A.M. THURSDAY, 24 May 2012

45 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	6	
2.	5	
3.	6	
4.	9	
5.	5	
6.	10	
7.	9	
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. Do not use gel pen or correction fluid.

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 of the examination paper. In calculations you should show all your working.

M A Y 1 2 0 2 4 1 0 2 0 1

VP*(S12-0241-02)

EQUATIONS

Voltage	=	current × resistance
Power	=	current × voltage
Speed	=	$\dfrac{\text{distance}}{\text{time}}$
Resultant force	=	mass × 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 × gravitational field strength × change in height
	=	mgh

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PLEASE DO NOT WRITE ON THIS PAGE

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Answer **all** *questions.*

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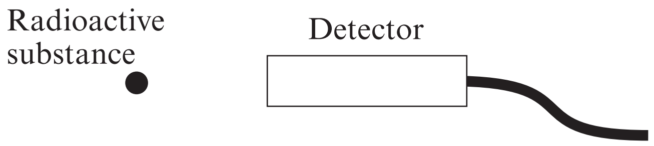
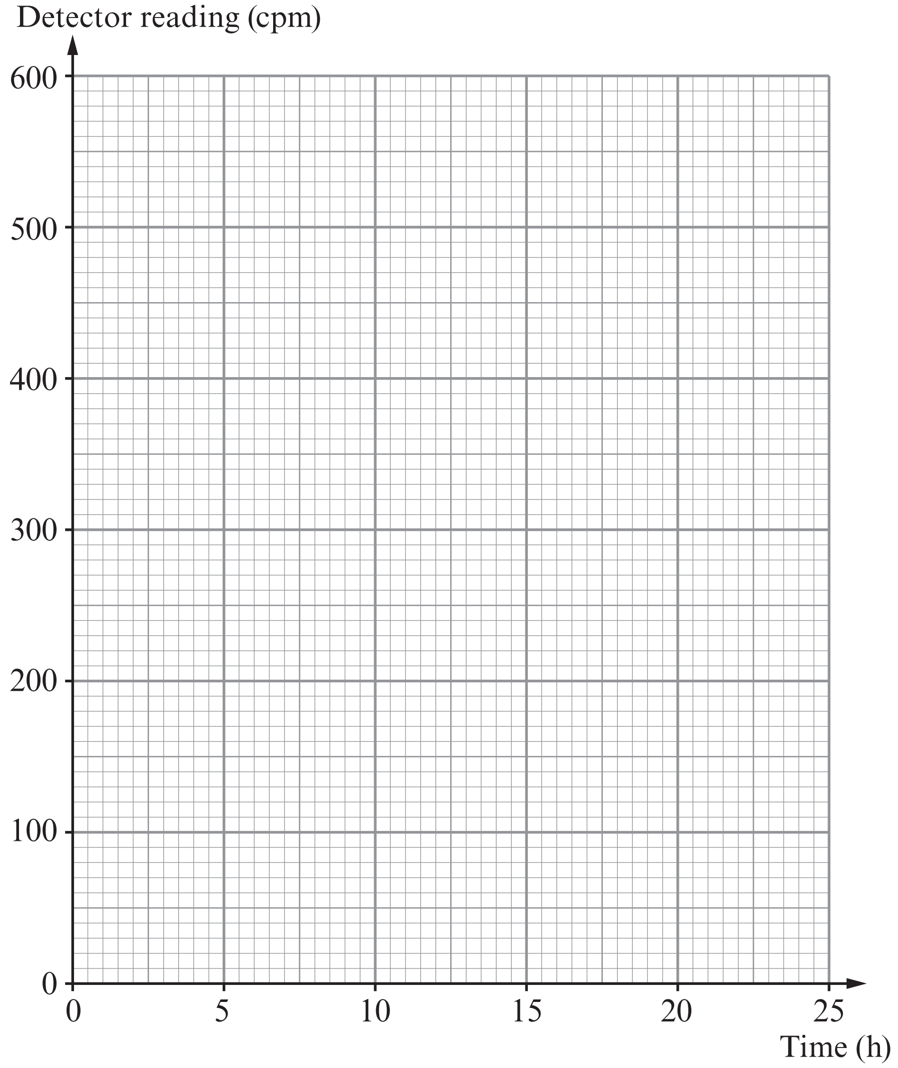
1. A radioactive substance which decays by gamma emission was placed in front of a detector.



The reading on the detector, corrected for background radiation, changed in the way shown in the table.

Time (h)	0	5	10	15	20
Reading on the detector (counts per minute)	480	290	180	110	70

(a) On the grid below, plot the points and draw a decay curve for this substance. [3]



(b) Use your graph to find the half life of this substance. [1]

Half life = ... hours

Examiner only

(c) Explain whether or not this substance may be suitable for use as a tracer in medicine. [2]

....

....

....

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2. Electrical appliances and their users are protected in the home by fuses in plugs, earth wires, residual current devices (r.c.d.) and miniature circuit breakers (m.c.b.).

(a) State how the earth wire protects the user. [1]

....

....

(b) Explain how an r.c.d. protects household circuits when a fault causes a current to flow to earth. [2]

....

....

....

(c) One advantage of miniature circuit breakers over fuses in circuits is they can be reset after breaking a circuit.
State **two** *other* advantages. [2]

1. ....

....

2. ....

....

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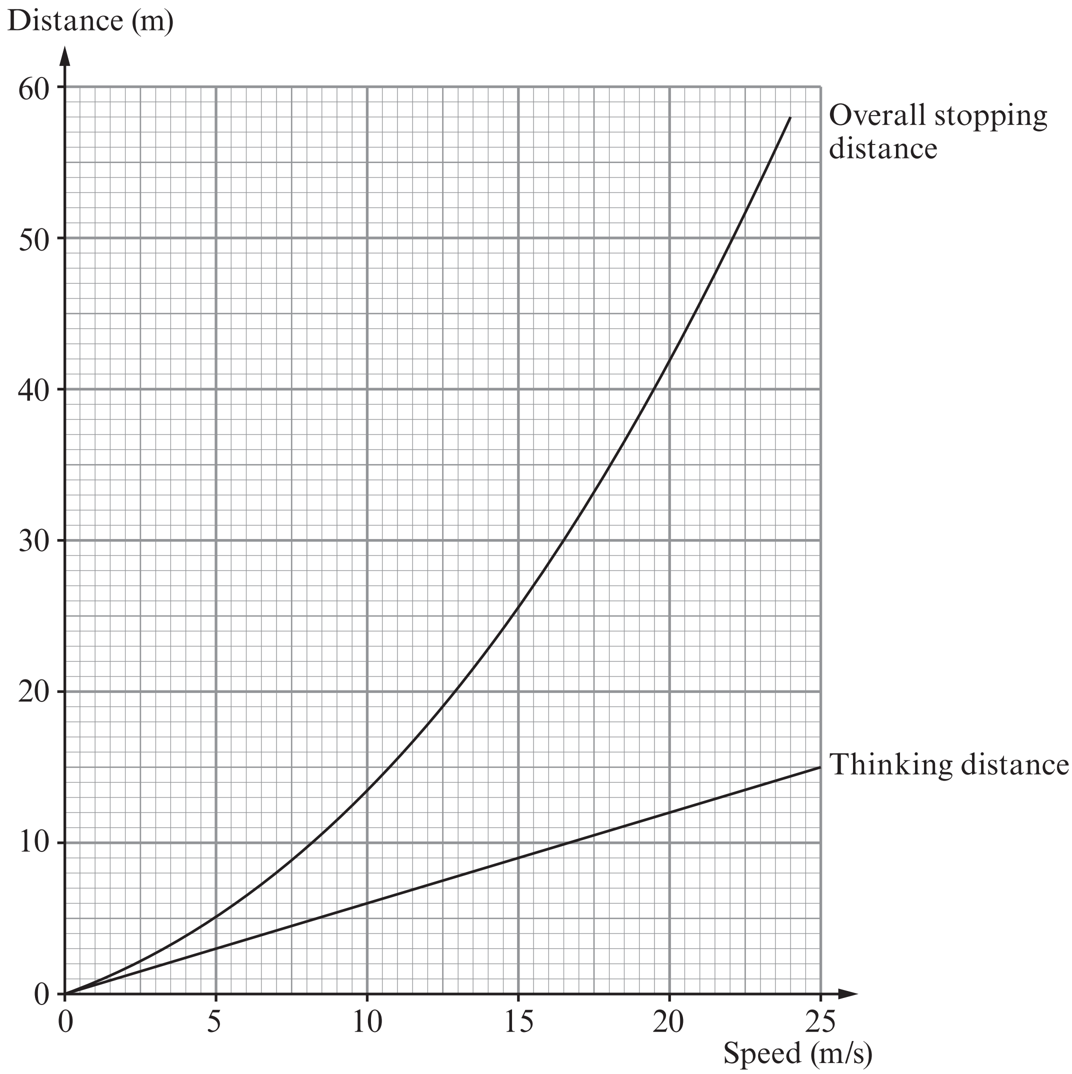
3. The graph below shows how the **overall stopping distance** for a car and the **driver's thinking distance** change with the speed of the car.



(a) Use information from the graph and the equation

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

to calculate the **thinking time** for the driver of a car travelling at 15 m/s. [2]

Time = ... s

Examiner only

(b) (i) Use information from the graph to find the braking distance when the car travels at 20 m/s. [2]

Braking distance = ... m

(ii) Use the graph to give a reason why the braking distance at 10 m/s is not half of your answer to *(b)*(i). [1]

....

....

(c) Name **one** factor that could make the thinking distance graph steeper. [1]

....

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Examiner only

4. *(a)* Henri Bequerel discovered radioactivity. He left a uranium compound in a steel box in his drawer, which also contained a photographic film. When he developed the film he found that it had been exposed to something, even though it hadn't been opened to any light. He realised that the uranium had given off invisible rays that could darken film.

(i) Name the radiation that the film was exposed to. [1]

....

(ii) State how Bequerel could have made sure that his findings were **reliable**. [1]

....

(iii) State what he could have done in order to get his findings accepted by other scientists. [1]

....

(b) Marie Curie continued research into radioactive materials, discovering radioactive elements that included radium which decays to produce radon gas. Radon gas undergoes alpha particle decay. Marie Curie died from a disease linked to radiation exposure.

(i) Explain why exposure to radon gas is so dangerous to human beings. [3]

....

....

....

....

....

(ii) State **one** way that exposure to radon gas in the home could be minimised. [1]

....

....

(iii) Name **two** precautions that are taken by people who now work with radioactive materials. [2]

....

....

....

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Examiner only

5. Before opening the parachute, a free fall parachutist reaches terminal speed.

(a) Explain in terms of the forces acting, why the parachutist reaches terminal speed. [3]

....

....

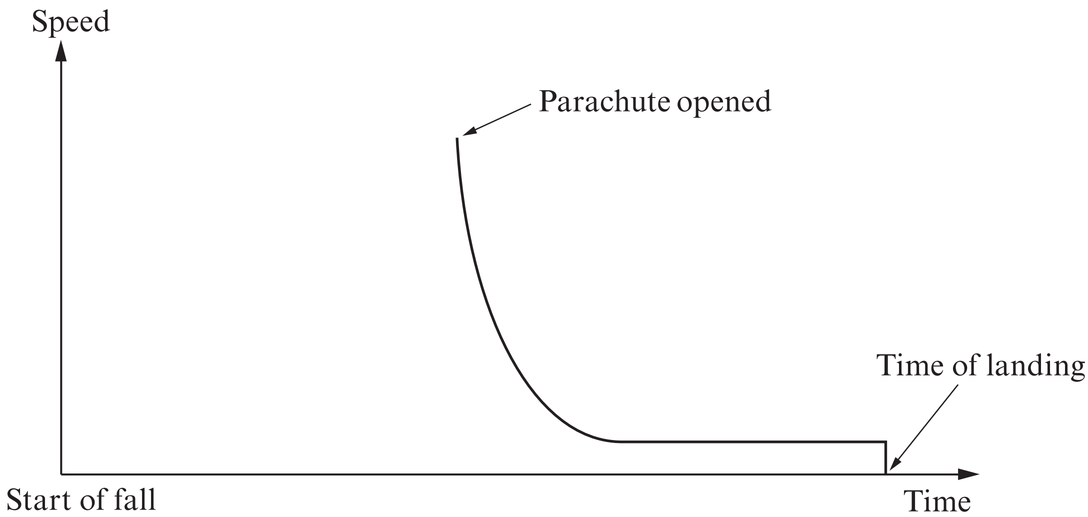
....

....

....

....

(b) After opening the parachute, she decelerates to a low speed from which she can land safely. Complete the shape of the speed – time graph below from the start of her fall to the point at which the parachute is opened. [2]



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Examiner only

6. *(a)* A 2 kW electric kettle is connected to the 230 V mains electricity supply in the U.K. Its resistance is constant at 26.45 Ω.

(i) Use the equation

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

to find the current that passes through its wires. [2]

Current = ... A

(ii) The same electric kettle was taken to the U.S.A. where the voltage is 110 V. Use the equation

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

to calculate the current that would flow through the kettle in the U.S.A. [3]

Current = ... A

(iii) This kettle's power in the U.S.A. is about a quarter of its U.K. power. State the difference that would be noticed when a kettle full of water is boiled in the U.S.A. compared with its use in the U.K. [1]

....

....

(iv) A kettle designed to work on 110 V in the U.S.A. is brought to the U.K. What will happen if it is connected to the U.K. supply? [1]

....

....

Examiner only

(b) State and explain **one** advantage and **one** disadvantage that the mains electricity supply in the U.S.A. at 110 V has over the U.K.'s 230 V. [3]

Advantage: ....

....

....

Disadvantage: ....

....

....

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TURN OVER FOR QUESTION 7.

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7. A cruise ship's engines produce a constant thrust of 1.6×10^6 N. It has a mass of 1.2×10^8 kg.

(a) Use the equation

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

to calculate the ship's initial acceleration. [2]

Acceleration = ... m/s^2

(b) Once at sea, the ship's speed increases from 5 m/s to 9 m/s over a distance of 2400 m. By using the equations

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

$$\text{kinetic energy} = \frac{\text{mass} \times \text{speed}^2}{2}$$

(i) calculate the work done by the ship's engines over the 2400 m travelled at sea, [2]

Work done = ... J

(ii) calculate the increase in the ship's kinetic energy. [2]

K.E. increase = ... J

(iii) Use your answers to parts (i) and (ii) to calculate the mean work done against the ship as its speed increases. Hence find the value of the mean drag force acting against the ship. [3]

Mean work done = ... J

Mean drag force = ... N

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