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**General Certificate of Secondary Education**
**2015–2016**

# Double Award Science:
# Physics

Unit P1
Higher Tier

GSD32

## [GSD32]
## FRIDAY 26 FEBRUARY 2016, MORNING

**TIME**

1 hour.

**INSTRUCTIONS TO CANDIDATES**

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all nine** questions.

**INFORMATION FOR CANDIDATES**

The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **2** and **7(a)**.

| For Examiner's use only | |
|---|---|
| Question Number | Marks |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| **Total Marks** | |

**1 (a)** Three types of radiation, alpha, beta and gamma, may be emitted from radioactive sources.

Complete the table below by writing alpha, beta or gamma in the second column.

| | |
|---|---|
| Can penetrate several cm of lead | |
| Consists of four particles | |
| Is a wave | |
| Comes from the nucleus and has a negative charge | |

[4]

**(b) (i)** Explain, in detail, what is meant by half-life.

_____

_____

_____ [3]

**(ii)** When a radioactive substance is delivered to a laboratory its activity is 6000 counts per minute.

Complete the table below.

| Activity/counts per minute | Number of half-lives |
|---|---|
| 6000 (arrives) | 0 |
| | 1 |
| 1500 | |
| | 4 |

[3]

**2** Describe, in detail, the process of nuclear fission.

Your answer must include:

- the name of the fuel used;
- the name of the particle which starts the process;
- what happens in the fission process.

**In this question you will be assessed on your written communication skills including the use of specialist scientific terms.**

_____

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_____ [6]

**3** When an object falls through the air a drag force, F, acts on the object.
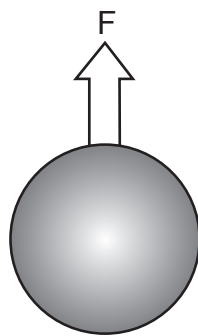
The size of the drag force, F, depends on the speed, v, of the falling object.
A scientist suggests that the drag force is proportional to the speed.

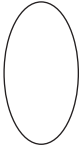This suggestion may be written:

$$F = kv \qquad \textbf{Equation 3.1}$$

where k is a constant.

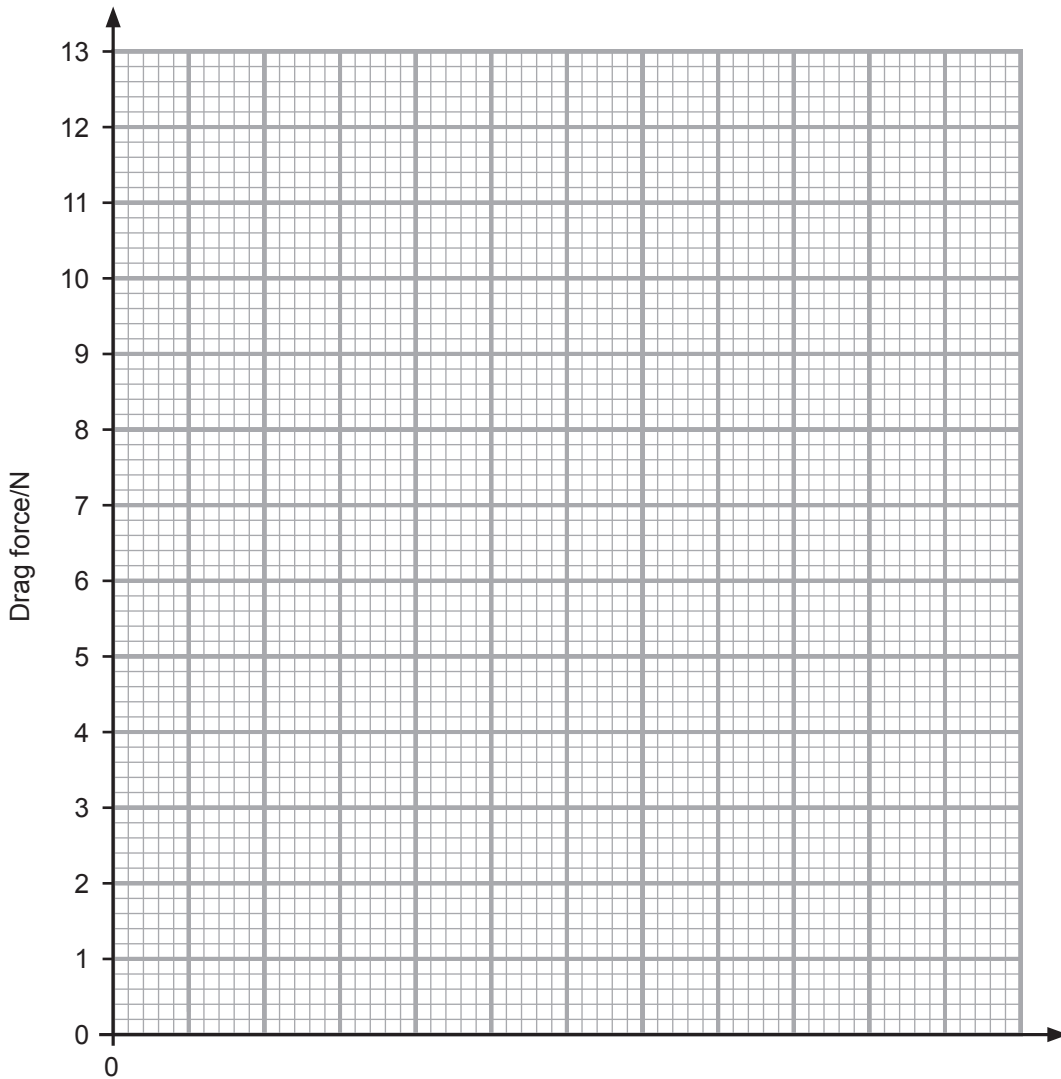To test her theory she obtains a set of results and these are shown.

| F/N | 0.0 | 0.5 | 2.0 | 4.5 | 8.0 | 12.5 |
|-----|-----|-----|-----|-----|-----|------|
| v/ m/s | 0 | 1 | 2 | 3 | 4 | 5 |

You are asked to plot a graph of drag force F against speed, v.

**(i)** Choose a suitable horizontal scale and label the horizontal axis.  [2]

Drag force/N

**(ii)** Plot a graph of force against speed. [3]

**(iii)** From your graph, estimate the drag force when the speed is 4.5 m/s.

Drag force = _____ N [2]

**(iv)** Is the scientist correct to say that the force and speed are directly proportional? Circle the correct answer.

YES            NO

Give a reason for your answer.

_____ [1]

**4**   Nuclear fusion could help solve our energy needs.

   **(a) (i)**   Give one technical difficulty which must be overcome if we are to make use of fusion to supply energy.
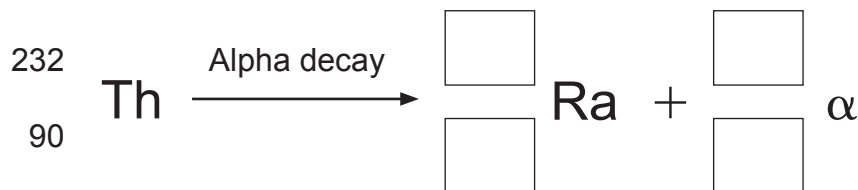
   _____ [1]

   **(ii)**   Where does fusion occur naturally?

   _____ [1]

This part of the question is about a nuclear disintegration involving alpha ($\alpha$) decay.

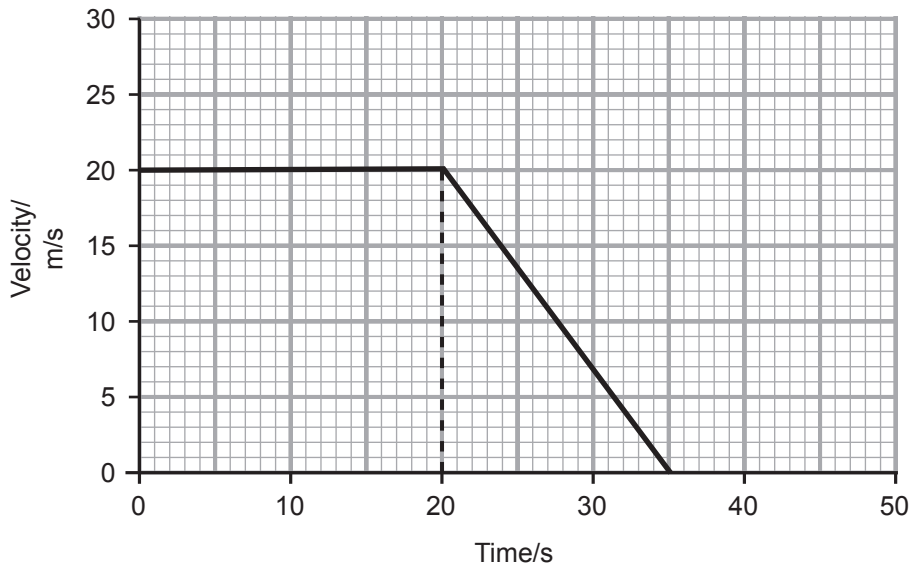**(b)**   Thorium undergoes alpha decay to radium.

   Complete the nuclear equation for this disintegration.

$$^{232}_{90}\text{Th} \xrightarrow{\text{Alpha decay}} {}^{\square}_{\square}\text{Ra} + {}^{\square}_{\square}\alpha$$

[4]

**5** Frank is driving a van at a constant velocity of 20 m/s and after 20 seconds he applies the brakes until the vehicle comes to rest.

**(i)** Calculate the displacement of the van from the instant the brakes are applied until it comes to rest.

**You are advised to show your working out.**

Displacement = _____ m  [3]

**(ii)** State the acceleration of the van during the time interval 0 to 20 s.
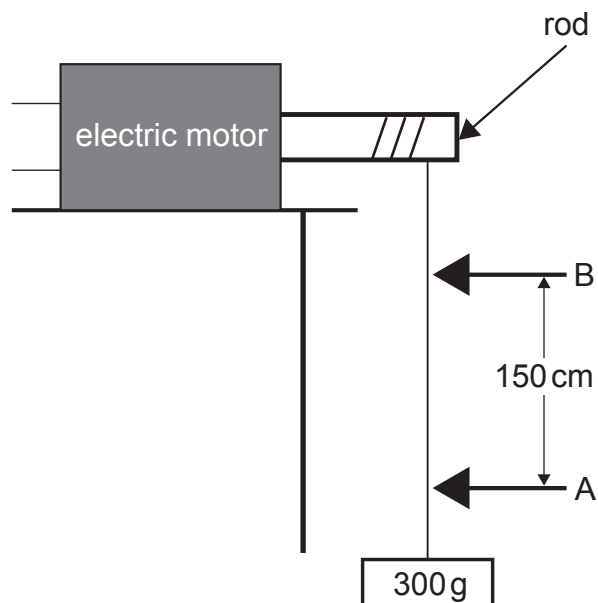
_____ m/s$^2$  [1]

**(iii)** Calculate the acceleration of the van during the 20 to 35 s time interval.

**You are advised to show your working out.**

Acceleration = _____ m/s$^2$  [3]

**6**  In an experiment with an electric motor, the apparatus below was set up.

rod

electric motor

B

150 cm

A

300 g

*Source: CCEA*

As the rod turns, a mass of 300 g moves upwards at a steady speed.

**(a)**  Find the tension in the string.

**You are advised to show your working out.**

Tension = _____ N  [2]

**(b) (i)**  Calculate the change in the potential energy of the 300 g mass as it rises through 150 cm, from marker A to marker B.

**You are advised to show your working out.**

Change in potential energy = _____ J  [4]

**(ii)** How much work is done in raising this mass from marker A to marker B?

Work done = _____ J  [1]

**(c)** The output power of a different motor is 0.9 W.

Calculate the time taken for this motor to do 36 J of work.

**You are advised to show your working out.**

Time = _____ s  [3]

**9**

**[Turn over**

**7 (a)** Describe an experiment to measure the density of a stone. In your description you must:

- list the apparatus you would use;
- state what you would do;
- state what measurements you need to take.

**In this question you will be assessed on your written communication skills including the use of specialist scientific terms.**

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_____ [6]

**(b)** Calculate the mass of a 1.60 m$^3$ block of iron, the density of which is 7.95 $\times$ 10$^3$ kg/m$^3$.

**You are advised to show your working out.**

Mass = _____ kg  [3]

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**(Questions continue overleaf)**

**8** A skydiver falls from a very tall building and during the first 4 seconds his average speed is 19 m/s.

**(a)** How far does the skydiver fall during this 4 second interval?

**You are advised to show your working out.**

Distance = _____ m  [3]

**(b)** The skydiver accelerates downwards. The forces on the skydiver are shown in the diagram below.

drag force



600 N

*© joggiebotma / iStock / Thinkstock*

**(i)** Why does the skydiver accelerate downwards?

_____ [1]

**(ii)** The skydiver, who has a mass of 60 kg, accelerates downwards at 8 m/s$^2$. Calculate the size of the drag force.

**You are advised to show your working out.**

Drag force = _____ N [4]

**13**

**[Turn over**

**9** A quarry worker has to lift a marble slab of weight W, so that it is level with a platform.

*Source: CCEA*
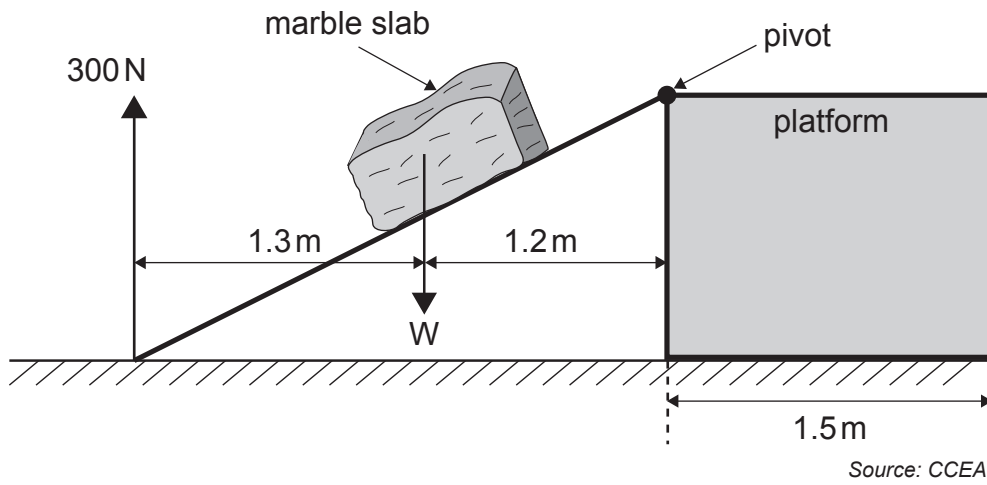
The quarry worker can exert a maximum force of 300 N, as shown in the diagram above.

**(a)** Calculate the maximum moment, about the pivot, that the quarry worker can produce with this 300 N force. Include the unit in your answer.

**You are advised to show your working out.**

Maximum moment = _____ [3]

**(b)** Use the Principle of Moments to calculate the maximum weight of the marble slab that the quarry worker can lift, when it is in the position shown in the diagram.

**You are advised to show your working out.**

Maximum weight = _____ N  [3]

_____

## THIS IS THE END OF THE QUESTION PAPER

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