**Centre Number**

71

**Candidate Number**

![CCEA Rewarding Learning logo]

**General Certificate of Secondary Education
2014–2015**

# Double Award Science: Physics

## Unit P1

## Higher Tier

**[GSD32]**

**MV18**

**FRIDAY 14 NOVEMBER 2014, MORNING**

## TIME

1 hour, plus your additional time allowance.

## 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 ten** questions.

## INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **2(a)** and **6**.

1   When radiation travels through air it causes ionisation.

   **(a)** What is ionisation? [1 mark]

   _____

   _____

   **(b)** People who work with radioactive materials must take steps to protect themselves.

   State two ways that workers can protect themselves. [2 marks]

   1. _____

   2. _____

Cobalt-60 is the name of a radioactive substance. The number 60 refers to the number of particles in the nucleus of the cobalt.

**(c) (i)** What do we call this number? [1 mark]

_____

**(ii)** Cobalt-60 has a half-life of 5 years. After how many years will its count-rate fall from 240 counts per minute to 30 counts per minute? [3 marks]

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

Time **=** _____ years

**2** **(a)** Describe an experiment you would carry out to measure personal power. Your description should include:

- the apparatus you would use;
- the measurements you would take. [6 marks]

**You will be assessed on your written communication skills including the use of specialist terms.**

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An electric motor lifts a load of 400 N through a distance of 6.0 m in 3 seconds.

**(b) (i)** Calculate the power of the motor in watts. [3 marks]
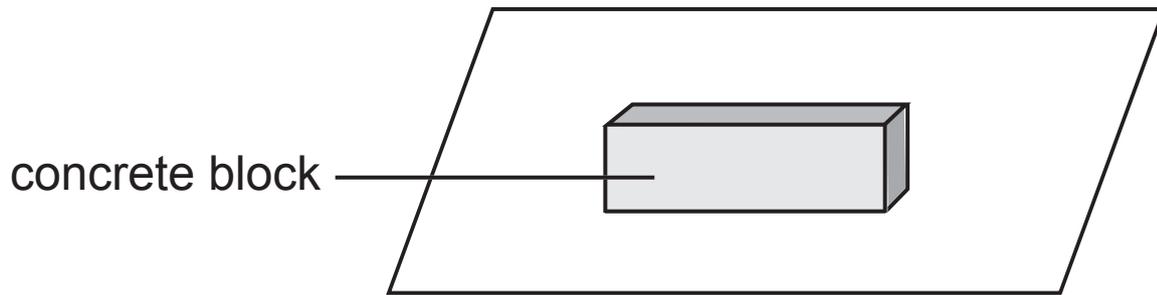
**You are advised to show your working out.**

Power **=** _____ **W**

**(ii)** Give your answer to **(b)(i)** in kilowatts. [1 mark]
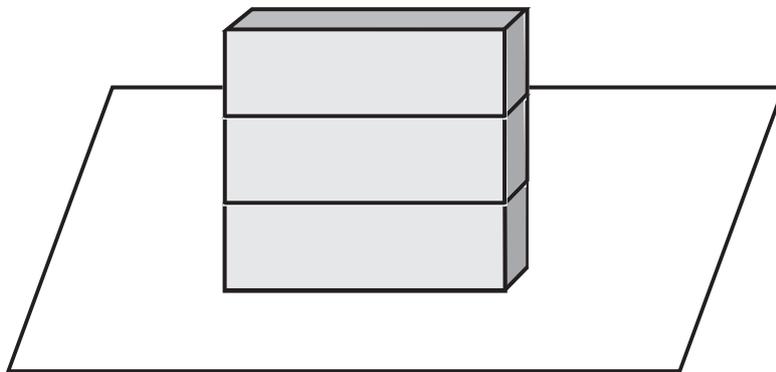
Power **=** _____ **kW**

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**3** When a block of concrete sits on a surface it exerts a pressure.



concrete block

The pressure exerted is given by the equation:

$$\text{pressure} = \frac{\text{weight}}{\text{area}}$$

The weight is changed by adding similar blocks on top as shown below.
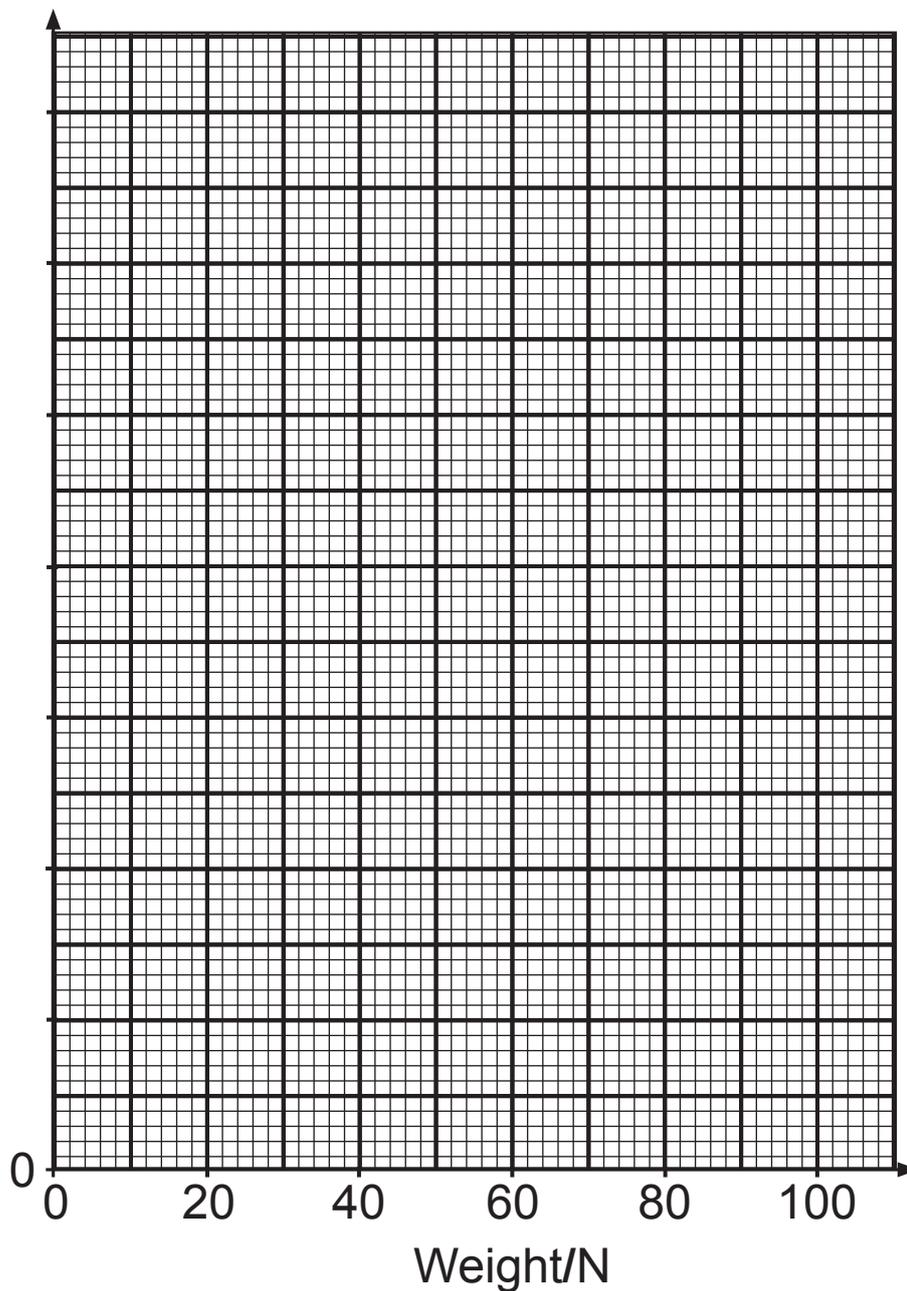


The weight of each block is 20 N and the area in contact with the surface is 1.5 m².

**(i)** Use the equation $\quad$ pressure $= \dfrac{\text{weight}}{\text{area}}$

to complete the table below.
Your values of pressure should be correct to the nearest whole number. [2 marks]

| No. of blocks | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Weight/N | 20 | 40 | 60 | 80 | 100 |
| Area/m$^2$ | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Pressure/N/m$^2$ | 13 | | | | |



Weight/N

9629.02 **MV18**

**8**

**(ii)** Choose a suitable scale for the pressure on the vertical axis of the graph (page 8) and label it. [2 marks]

**(iii)** Plot a graph of pressure against weight. [2 marks]

**(iv)** Draw the best fit line. [1 mark]

The surface that the blocks are resting on will be damaged if the pressure is greater than $45\,N/m^2$.

**(v)** Use your graph to find the smallest number of blocks that will damage the surface. [2 marks]

Number of blocks **=** _____

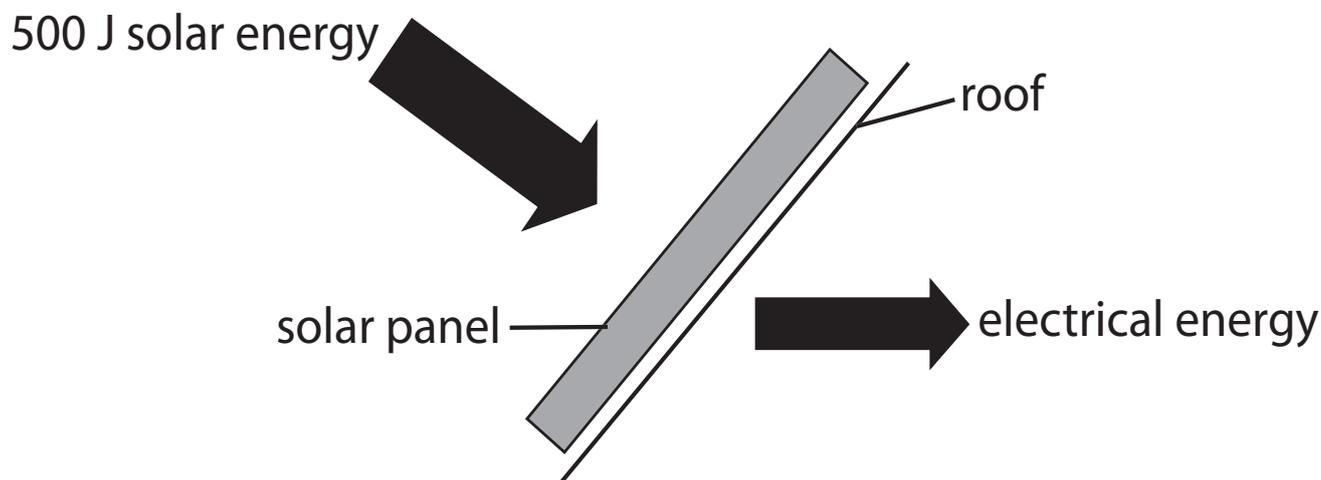**(vi)** Find the gradient of your graph. [2 marks]

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

Gradient **=** _____ **/m²**

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**4** A solar panel is designed to generate electricity directly from the Sun. Its efficiency is 0.8.

**(i)** This panel receives 500 J of solar energy. Calculate how much electrical energy it produces. [3 marks]

500 J solar energy

solar panel —

roof

electrical energy

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

Electrical energy produced **= _____ J**

**(ii)** State two advantages of the use of solar panels. [2 marks]

1. _____

_____

2. _____

_____

9629.02 **MV18**                    **11**                    **[Turn over**

**5** The graph below shows how the velocity of a car changes with time.
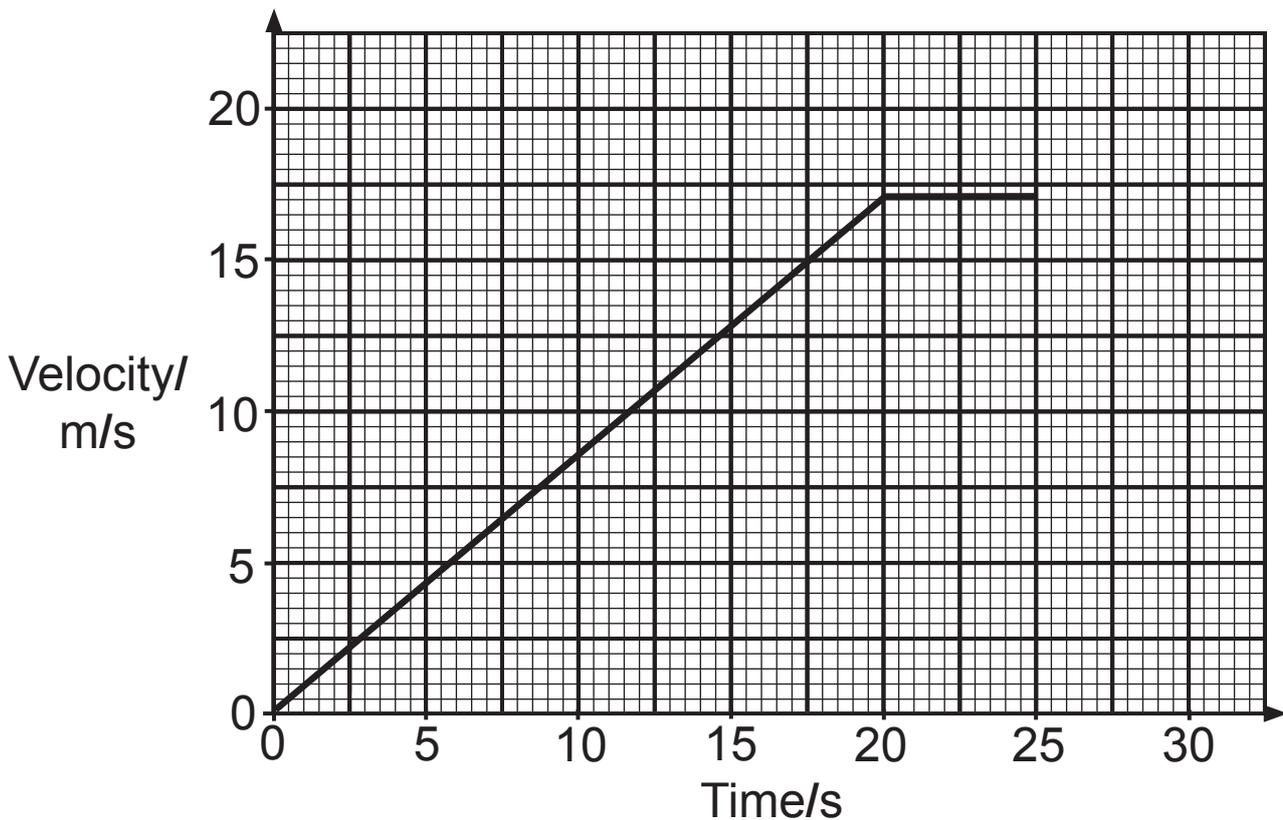


**(a)** Describe the motion of the car during the following times. [2 marks]

0 to 20 s _____

20 s to 25 s _____

**(b)** Calculate the total displacement of the car. [4 marks]

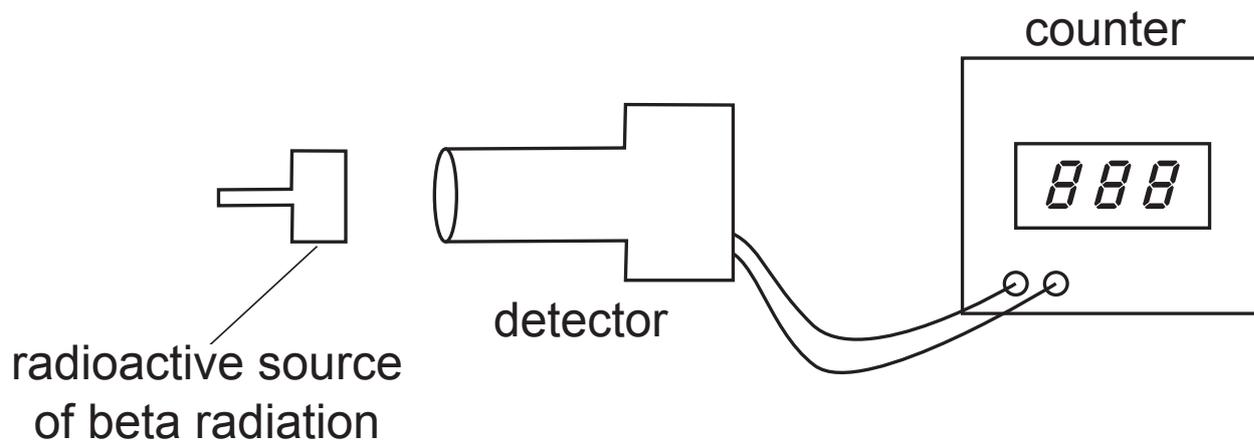**You are advised to show your working out.**

Total displacement **= _____ m**

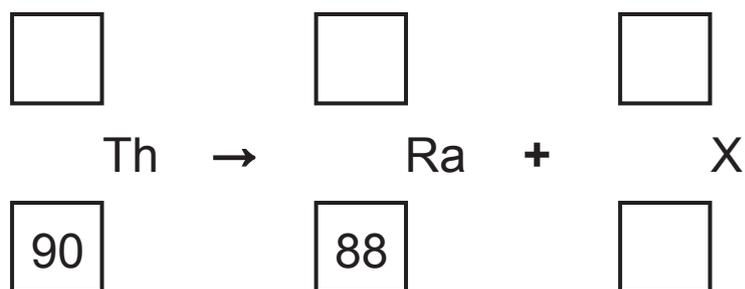**(c)** Use your answer to part **(b)** to find the average velocity of the car. [3 marks]

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

Average velocity **= _____ m/s**

**6** Describe a demonstration or a computer simulation to find the range of beta radiation in aluminium.

In your description you should include:

- the method used;
- the measurements taken. [6 marks]

**You will be assessed on your written communication skills including the use of specialist scientific terms.**

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**7** Thorium (Th) has 140 neutrons in its nucleus. It decays to radium (Ra), as shown below.

$$\boxed{\phantom{000}}\text{Th} \rightarrow \boxed{\phantom{000}}\text{Ra} + \boxed{\phantom{000}}\text{X}$$
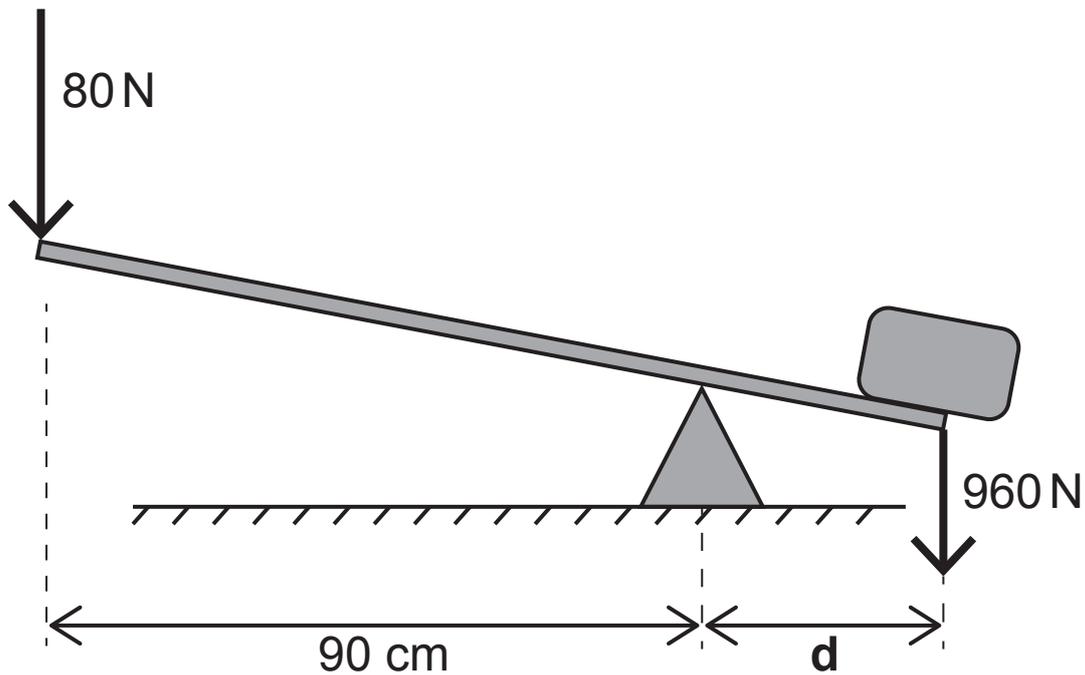$$\boxed{90}\qquad\qquad\boxed{88}\qquad\qquad\boxed{\phantom{000}}$$

**(i)** Complete the equation by writing numbers in the boxes. [4 marks]

**(ii)** X is one of the radiations emitted by radioactive substances.
Name this radiation. [1 mark]

X is _____

**8** A workman exerts a force of 80 N and just manages to lift the concrete block of weight 960 N.



**(i)** Calculate the distance **d**, in cm. [4 marks]

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

**d =** _____ **cm**

**(ii)** Suggest how the workman could lift the concrete block with a smaller force. [1 mark]

_____

_____

**17**

**[Turn over**

**9** When travelling at a **steady velocity**, the engine of a boat of mass 2500 kg exerts a force of 15 000 N.



**(a)** What is the size of the frictional force on the boat?
[1 mark]

Frictional force **= _____ N**

**(b)** The boat has a mass of 2500 kg. Calculate the total force exerted by the engine to give the boat an acceleration of 3 m/s$^2$, assuming the frictional force remains the same as that in part **(a)**. [4 marks]

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

Total force **= _____ N**

**10** Rory hits a golf ball of mass 160 g.



**(a)** The golf ball has a kinetic energy of 72 J when it leaves the clubhead. Calculate the initial velocity of the golf ball. [4 marks]

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

Initial velocity **= _____ m/s**

**(b)** On another occasion, Rory hits a ball of mass 0.15 kg.
He gives it a momentum of 3 kg m/s.
Calculate the initial velocity of the golf ball. [3 marks]

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

Initial velocity **= _____ m/s**

**SOURCES**

Pg 18, Q9 - Image of a speedboat, © Creative_Outlet/iStock/Thinkstock

Pg 20, Q10 - Image of a golf club and ball, © Catuncia/iStock/Thinkstock

| For Examiner's use only | |
|---|---|
| Question Number | Marks |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| Total Marks | |

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