Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014–2015

Double Award Science: Physics

Unit P1
Higher Tier

MV18

[GSD32]

THURSDAY 26 FEBRUARY 2015, 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 nine** 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 **1(a)** and **6**.

1 **(a)** Describe an experiment you would carry out to measure the density of milk. [6 marks]

In your description you should include:

- the apparatus you would use;
- the measurements you would take;
- the formula you would use to find the density.

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

(b) Metal rivets have a mass of 54 g and a volume of 20 cm^3.
Calculate the density of the metal. [2 marks]

You are advised to show your working out.

Density = _____ g/cm^3

2 **(a)** An atom is made up of protons, neutrons and electrons. Complete the table below to show the relative electrical charge and the location of each particle.
Two of the boxes have already been done for you.
[4 marks]

Particle	Relative electrical charge	Location in the atom
Proton	+1	In the nucleus
Neutron		
Electron		

(b) The symbol for the nucleus of carbon-14 is shown below.

$$^{14}_{6}C$$

(i) How many protons does the nucleus of carbon-14 contain? [1 mark]

Number of protons = _____

(ii) How many electrons does a neutral atom of carbon-14 contain? [1 mark]

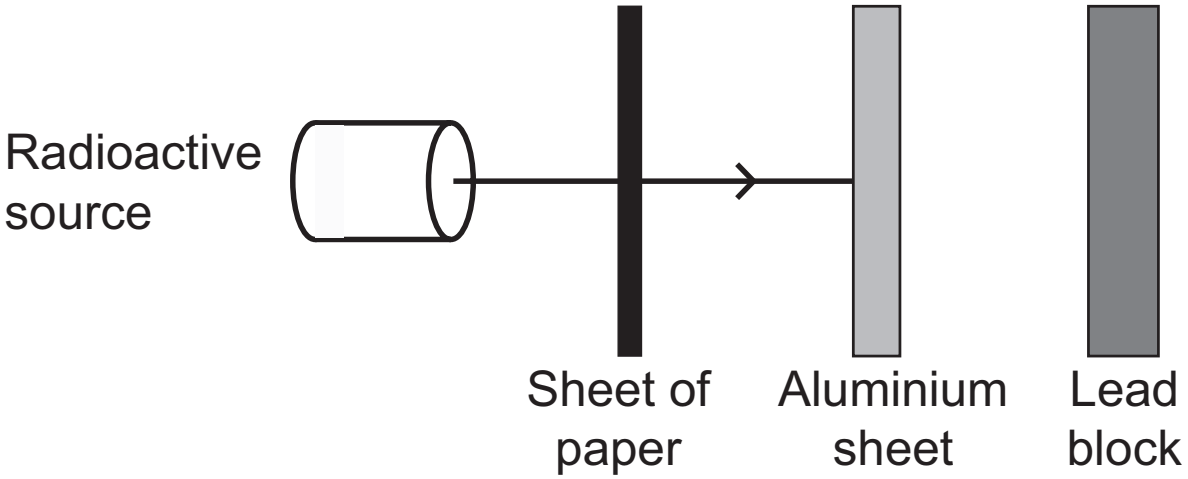
Number of electrons = _____

(iii) How many neutrons does a neutral atom of carbon-14 contain? [1 mark]

Number of neutrons = _____

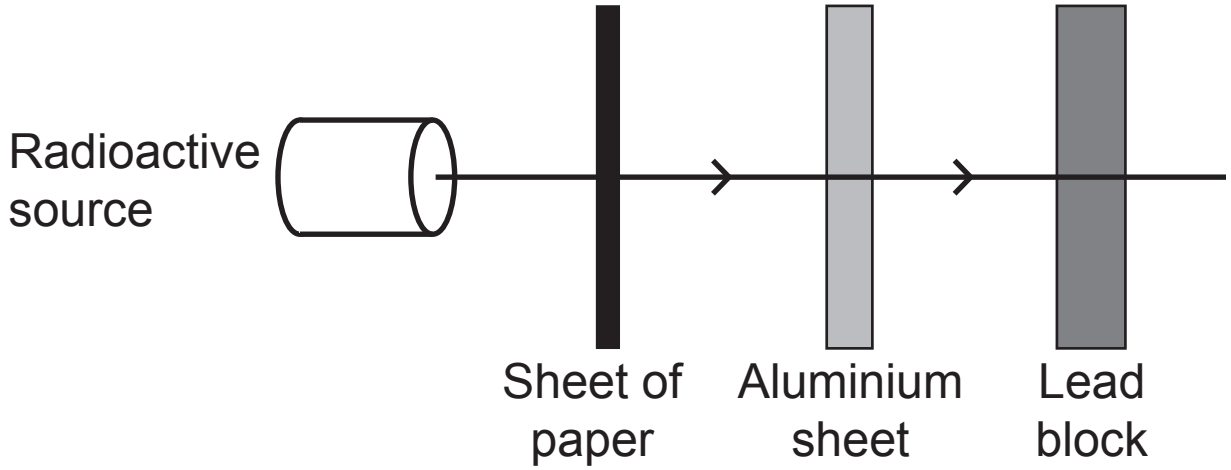
(c) The diagrams show two radiations being emitted by a radioactive substance and being absorbed by different materials.
State the name of the radiation being emitted in each case, in the appropriate space. [1 mark]/[1 mark]

(i)



Radiation = _____

(ii)

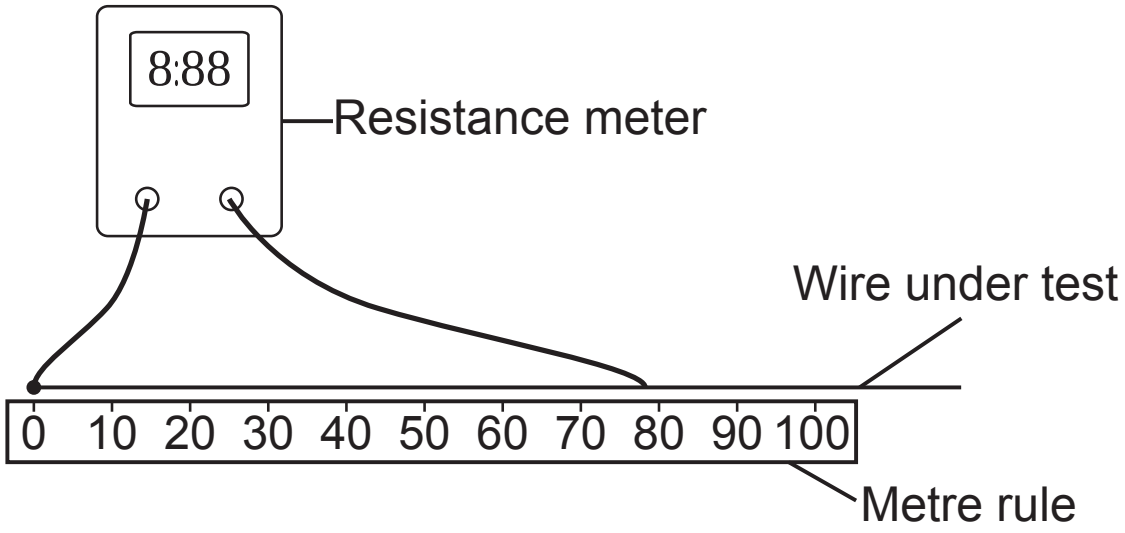


Radiation = _____

(iii) What name is given to the electromagnetic radiation which comes from the nucleus of a radioactive atom? [1 mark]

Radiation = _____

3 The apparatus required to investigate the factors affecting the resistance of copper wire is shown below.



According to theory, the resistance R of a copper wire is proportional to its length L and the relationship is given by the equation

$R = k \times L$ **Equation 3.1**

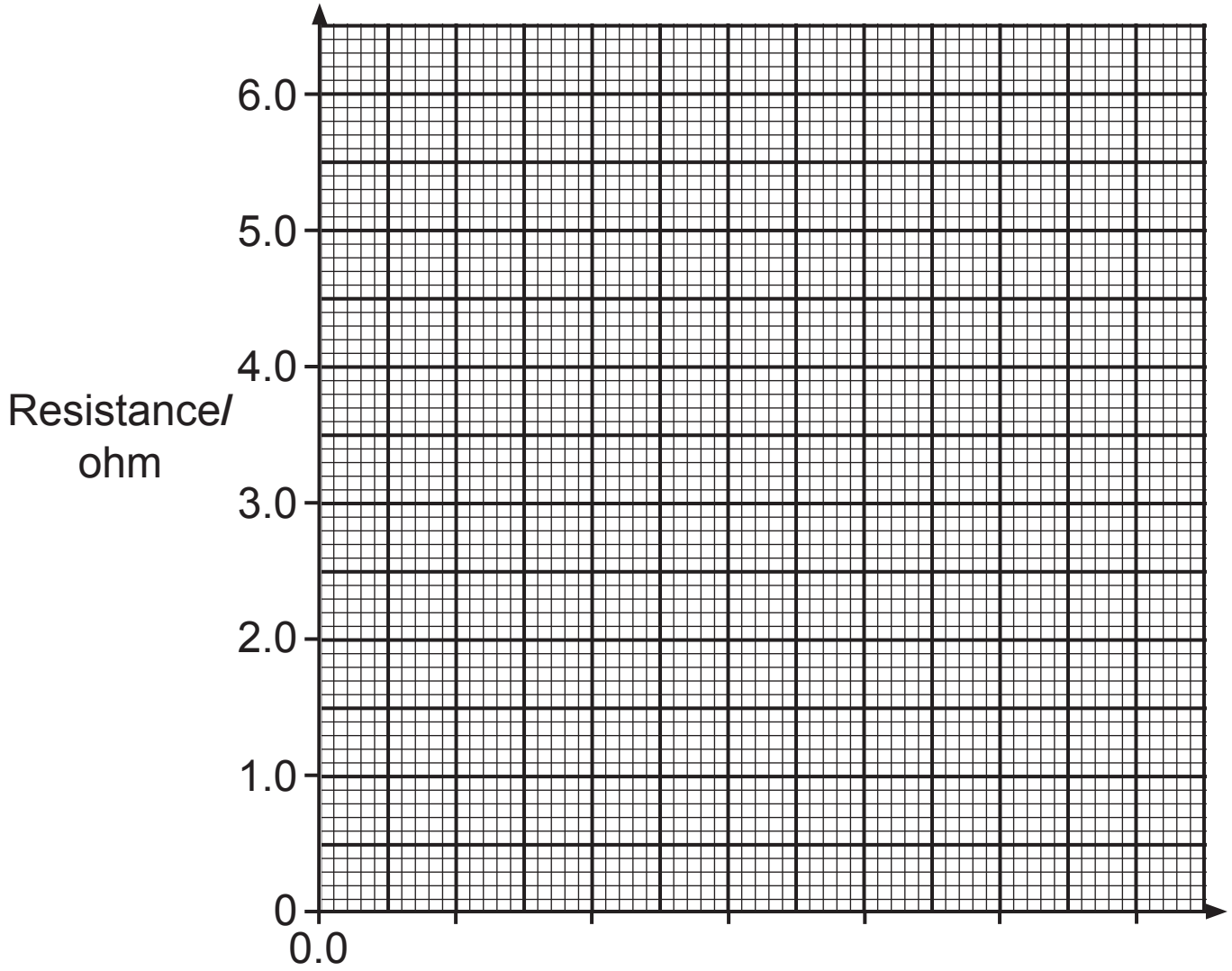
where k is a constant.

The results recorded in an experiment to verify the above relationship are in the table below.

Length/m	0.0	0.2	0.4	0.6	0.8	1.0
Resistance/ohm	0.0	1.2	2.4	3.6	4.5	6.0

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

(b) Plot the points on the grid of resistance against length. [2 marks]



(c) Draw the line of best fit. [1 mark]

(d) Draw a circle around the point which does **not** show the trend in the graph. [1 mark]

(e) Use your graph to determine the constant k, in **Equation 3.1**.
Remember to include the units for k. [4 marks]

You are advised to show your working out.

k **=** _____: Units **=** _____

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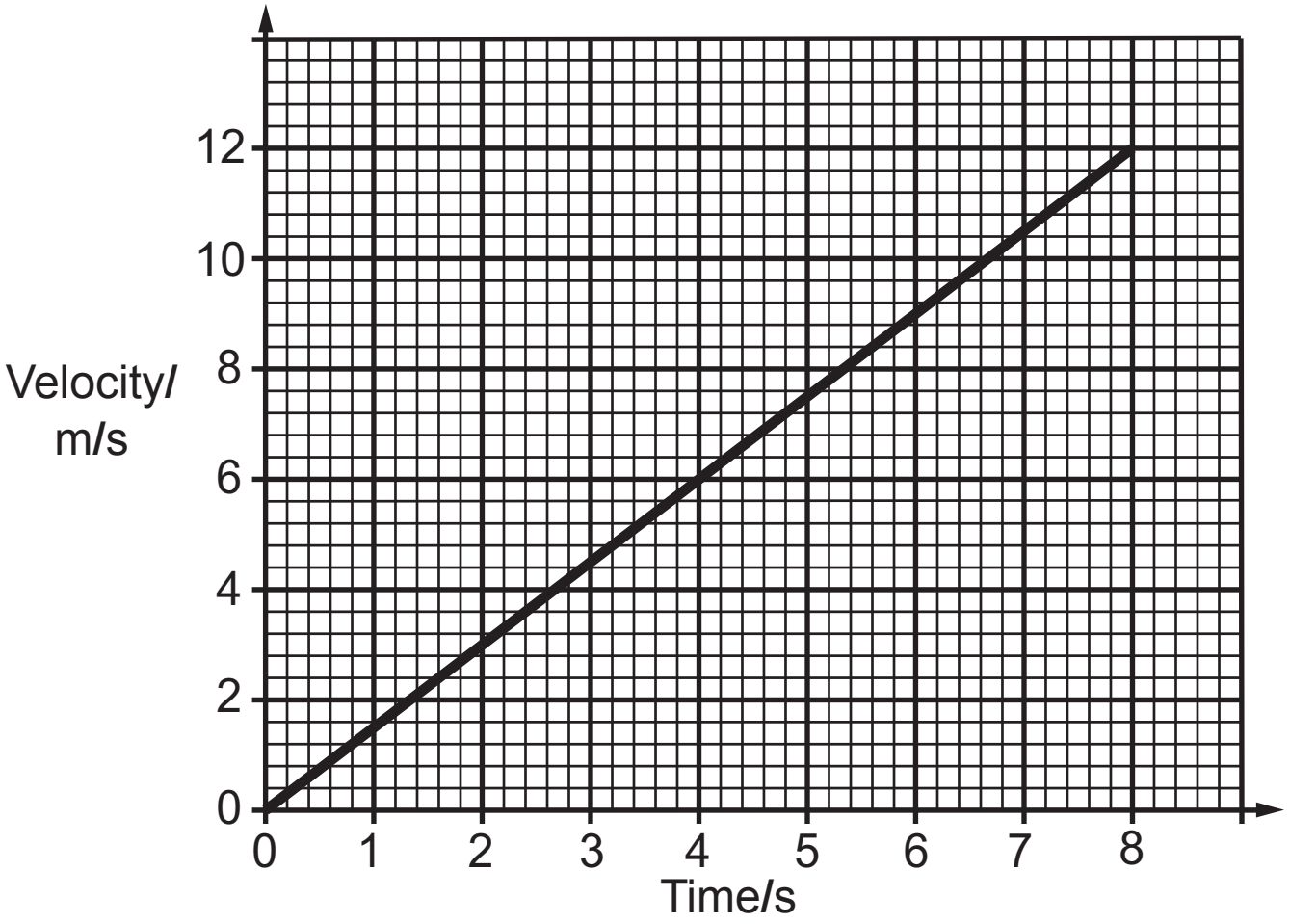
(Questions continue overleaf)

4 The graph below shows how the velocity of a car, of mass 1200 kg, changes with time.



(a) Calculate the maximum momentum of the car.
Remember to include the unit with your answer.
[4 marks]
You are advised to show your working out.

Momentum = _____

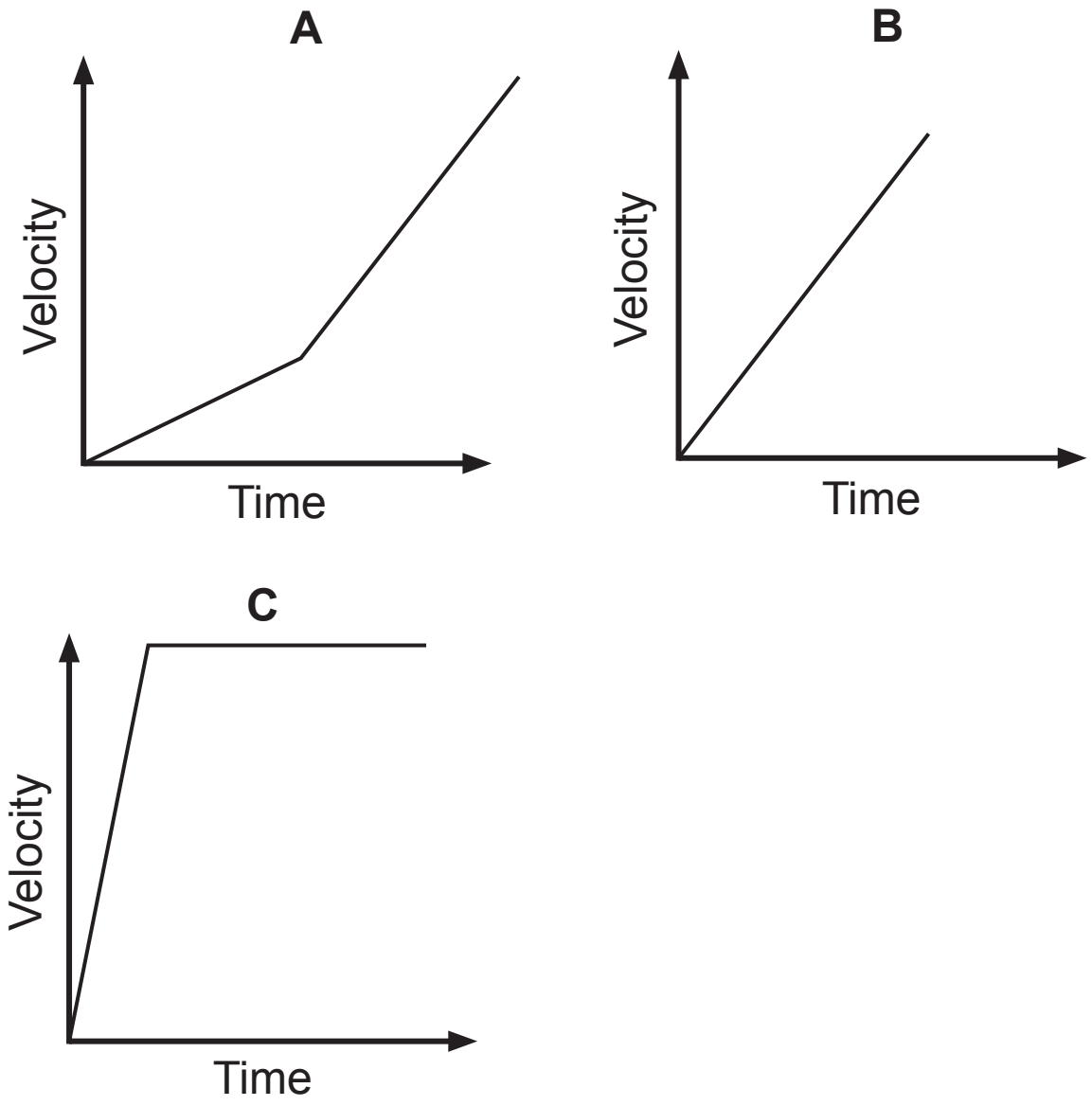
(b) Use the graph opposite to find the acceleration of the car.
Then use your answer to calculate the resultant force acting on it.
Remember the mass of the car is 1200 kg.
[3 marks]/[3 marks]

You are advised to show your working out.

Acceleration **=** _____ **m/s^2**

Resultant force **=** _____ **N**

5 An athlete takes part in a 200 m race. The athlete accelerates at first and then runs at constant velocity for the remainder of the race.



(a) (i) Which of the graphs above, **A**, **B** or **C**, could represent his velocity–time graph? [1 mark]

Graph _____

(ii) Give a reason for your answer. [1 mark]

_____

(b) A motorbike is travelling at an initial constant velocity. The motorbike then accelerates at 4 **m/s^2** for 5 s to a velocity of 30 **m/s**.
Calculate the initial velocity of the motorbike. [3 marks]

You are advised to show your working out.

Initial velocity **=** _____ **m/s**

6 Give an account of nuclear fusion. [6 marks]

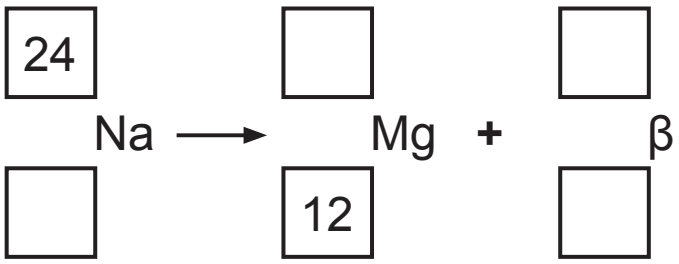
Your answer should include:

- a description of the process of nuclear fusion;
- a technological difficulty which must be overcome;
- an instance where fusion occurs naturally.

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

7 A sodium nucleus, Na, decays to form magnesium, Mg, with the emission of a beta (β) particle.

(a) Write the appropriate numbers in the boxes below. [4 marks]



A radioactive isotope has a half-life of 10 minutes.

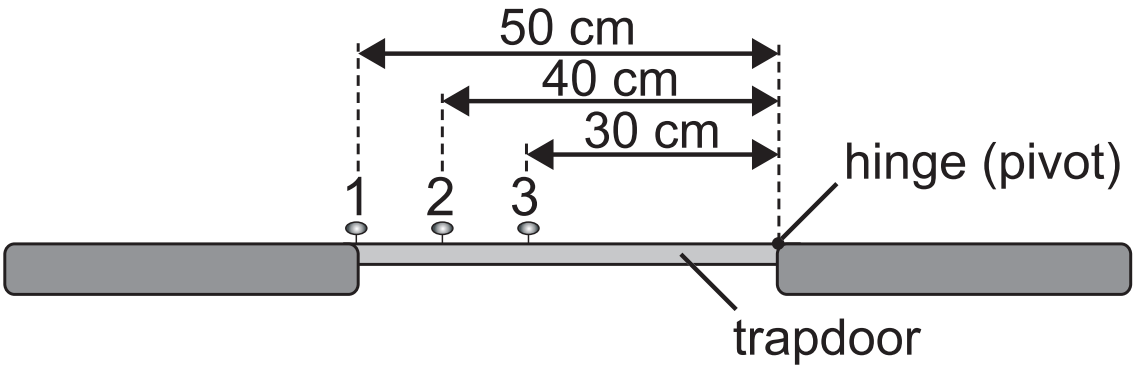
(b) This radioactive isotope contains 1.6×10^6 radioactive nuclei.

How many radioactive nuclei will be left after 30 minutes? [3 marks]

You are advised to show your working out.

Number of radioactive nuclei remaining **=** _____

8 The diagram shows a uniform trapdoor of weight 8 N.



(i) Draw an arrow, acting at the correct point, to represent the weight of the trapdoor. [2 marks]

Three hooks, 1, 2 and 3 are shown. A vertical upward force could be exerted at any one of these points to open the trapdoor.

(ii) At which of these points, 1, 2 or 3 would the force needed to open the trapdoor be **largest**? [2 marks]

Give a reason for your answer.

Force largest at hook _____

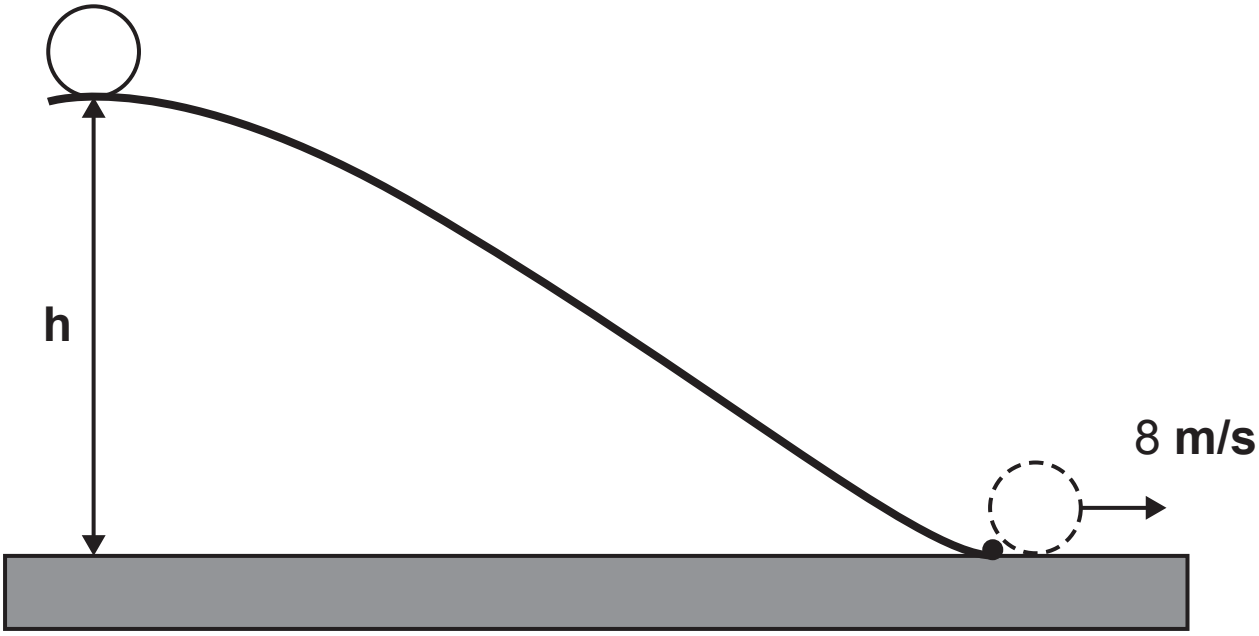
Reason _____

(iii) Use the principle of moments to calculate the smallest force which must be applied at **hook 2** to open the trapdoor.
Remember the weight of the trapdoor is 8 N. [4 marks]

You are advised to show your working out.

Smallest force **=** _____ N

9 A ball, of mass 800 g, rolls from rest down a slope to the bottom where its velocity is 8 m/s.



Use the law of conservation of energy to calculate the height, **h**, of the slope.
Assume no energy losses. [6 marks]

You are advised to show your working out.

Height, **h =** _____ **m**

THIS IS THE END OF THE QUESTION PAPER

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