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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

WEDNESDAY 27 FEBRUARY 2013, 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 Question **2**.

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

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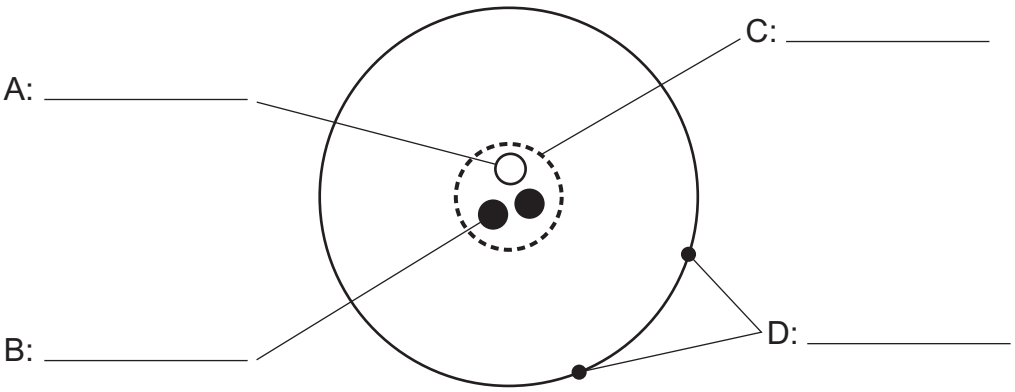
Marks	Remark

1 **(a)** The diagram illustrates a neutral atom.



(i) Complete the diagram by writing in the spaces above, the four missing labels. [4]

(ii) Explain why atoms are neutral.

_____

_____ [1]

(iii) Give two differences between the atom drawn above and an alpha particle.

1. _____

2. _____ [2]

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(b) Nuclear reactors are used in power stations to release energy through nuclear fission.

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Marks	Remark

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(i) What is meant by nuclear fission?

_____

_____

_____ [3]

(ii) Name two fissionable substances commonly used in nuclear reactors.

1. _____

2. _____ [2]

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2 Describe, in detail, an experiment to verify the Principle of Moments.

In your description you should include:

- the apparatus used;
- how the apparatus is used to test the Principle of Moments; and
- the formula you would use to test the Principle of Moments.

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

[6]

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Marks	Remark

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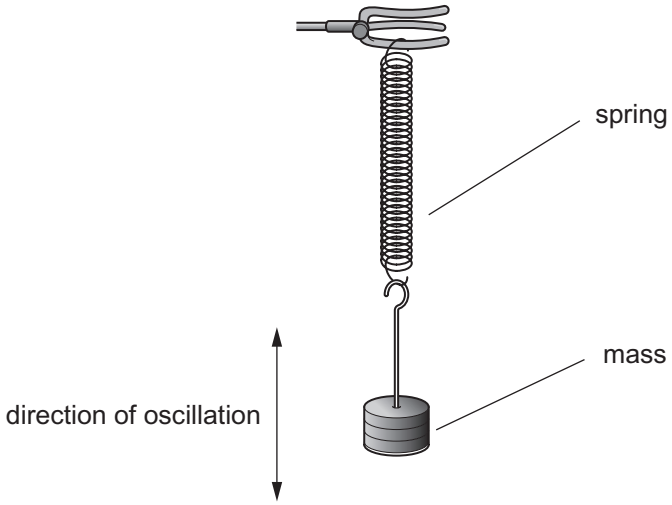
3 A mass hangs on the end of a spring. When the mass is pulled down and released then it will oscillate up and down.

When the spring carries a mass (m), the time taken (T) for one complete up and down movement is given by the relationship:

$$T^2 = K\,m \qquad \textbf{Equation 3.1}$$

where **K** is a constant.



To test the relationship, the following experimental results were recorded.

m in kg	0	0.1	0.2	0.3	0.4	0.5
T in s	0	0.63	0.90	1.10	1.26	1.41
T^2 in s^2	0			1.2		

(i) Complete the table by entering the values for T^2, to 1 decimal place.

One has been done for you. [2]

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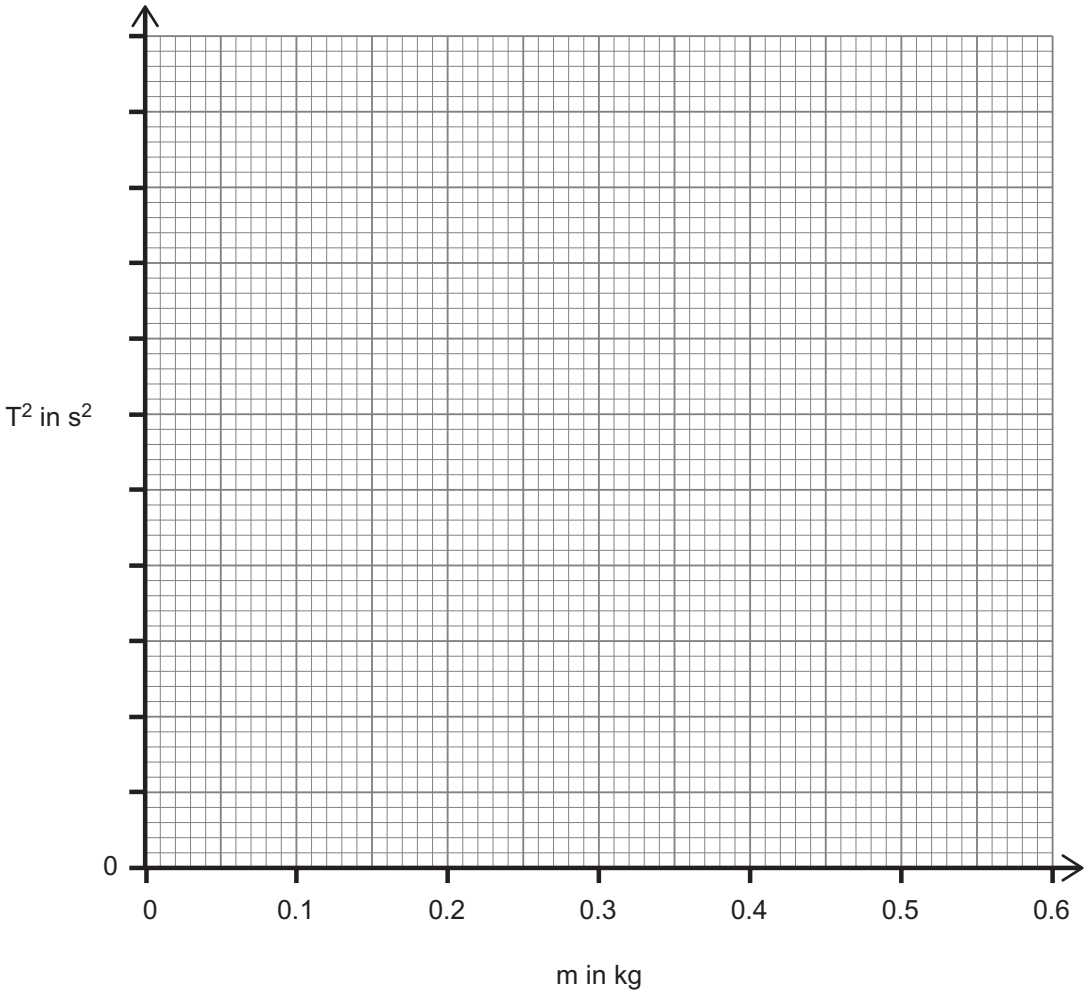
(ii) Choose a suitable scale for the vertical axis and plot a graph of T^2 on the vertical axis versus m on the horizontal axis. [3]



(iii) Draw the best fit line. [1]

(iv) Does your graph support the theory described by **Equation 3.1**?

Explain your answer.

_____

_____

_____ [2]

(v) Find the value of K from the graph.

You are advised to show your working out.

K = _____ s^2/kg [2]

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Marks	Remark

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Marks	Remark

4 **(i)** Governments continue to invest large sums of money to solve the technological difficulties associated with nuclear fusion.

Give two reasons for this investment.

1. _____

2. _____ [2]

(ii) Complete the fusion equation below.

$$\square H + \square H \longrightarrow \begin{matrix}4\\2\end{matrix} He + \square n$$

[6]

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Marks	Remark

5 **(a)** **(i)** Name the three types of radiation which may be emitted from radioactive nuclei.

1. _____ 2. _____ 3. _____ [3]

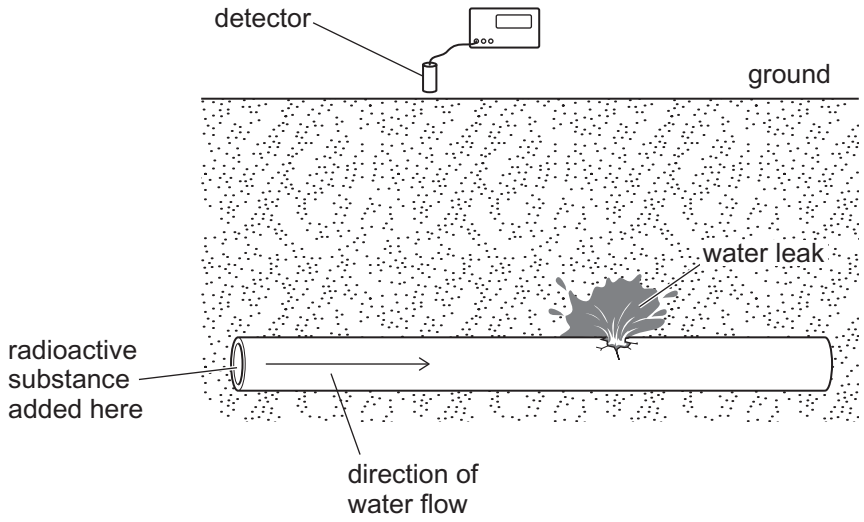
(ii) One of these radiations is not a particle. What is its nature?

_____ [1]

(iii) Why does a radioactive nucleus decay?

_____ [1]

(b) Engineers want to locate a leak in an underground water pipe. A radioactive substance is added to the water in the pipe and a detector is moved over the ground as shown.



(i) Which of the three types of radiation **must** be emitted by the radioactive substance?

_____ radiation [1]

(ii) Give a reason for your choice in **(b)(i)**.

_____ [1]

(iii) How will the engineers know when they have located the leak?

_____ [1]

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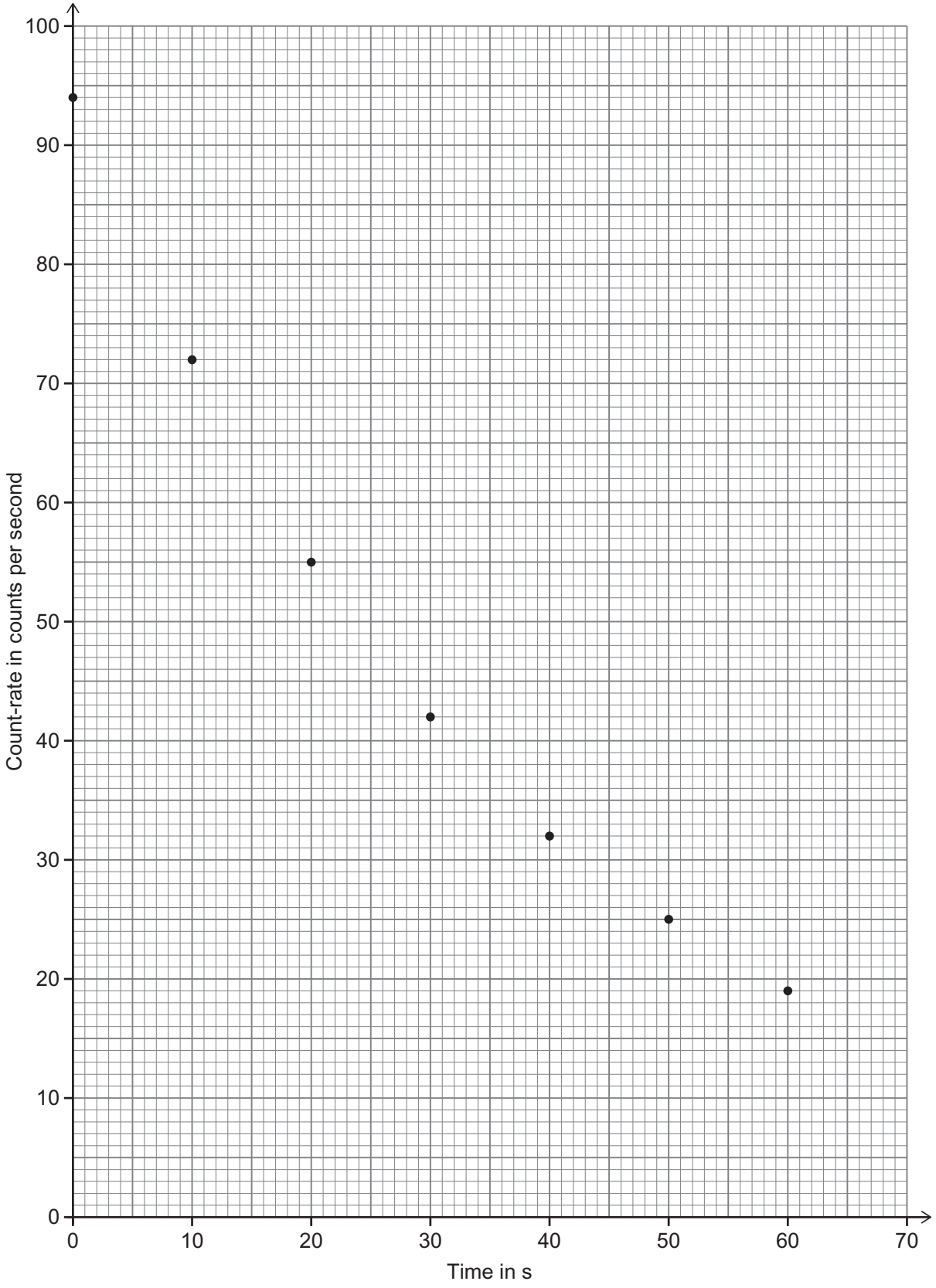
6 The count-rate from a radioactive material was measured using a GM tube and a counter.

A graph of the results obtained is shown below.



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(i) Draw a curve of best fit. [1]

(ii) Use the graph to find the half-life of the radioactive material.

You are advised to show your working out.

Half-life = _____ s [3]

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7 Christopher rows a boat at a steady speed of 3 m/s. He stops rowing and the boat comes to rest.

(i) Name the force in the water that causes the boat to slow down.

Name of force is _____ [1]

(ii) The deceleration of the boat is 0.25 m/s^2. Calculate the time for the boat to come to rest.

You are advised to show your working out.

Time = _____ s [3]

(iii) Calculate the size of the force which causes the deceleration of 0.25 m/s^2 if the total mass of Christopher and the boat is 120 kg.

You are advised to show your working out.

Force = _____ N [3]

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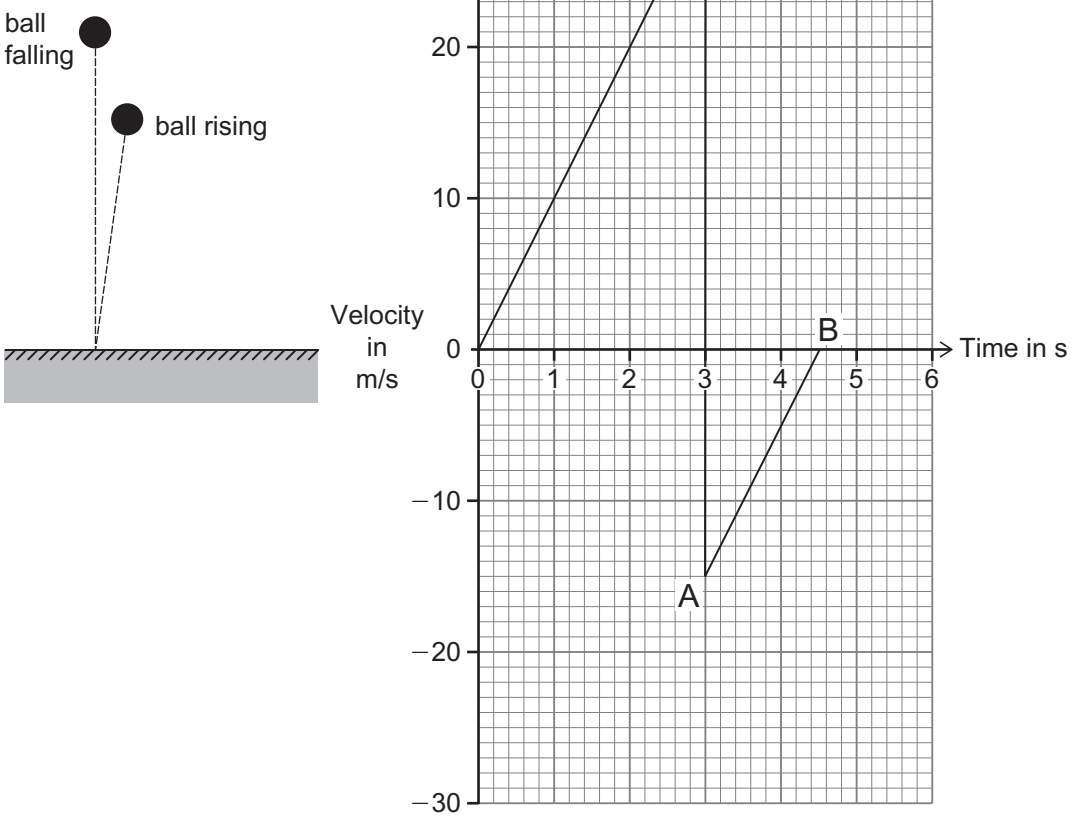
8 A sponge ball is allowed to drop from rest and hits the ground after 3.0 seconds. It rebounds to a new height after a further 1.5 seconds.

The velocity–time graph of the motion is shown.



The part of the graph AB represents the ball rebounding.

(i) Why is this part of the graph drawn below the time axis?

_____ [1]

(ii) Use the graph to find the height of rebound.

You are advised to show your working out.

Height of rebound = _____ m [3]

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(iii) When a ball falls freely under the force of gravity then its acceleration is known as the acceleration of free fall.
Use the graph to calculate the acceleration of free fall.

To get full credit you **must** show your working out.

Acceleration of free fall = _____ m/s^2 [3]

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9 A crane uses a wrecking ball to demolish an old building as shown in diagram A. The crane moves the ball from its rest position X up to position Y where it comes momentarily to rest, as shown in diagram B.

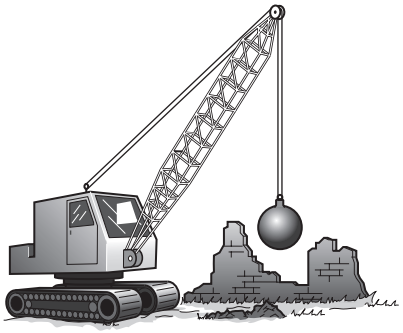

diagram A

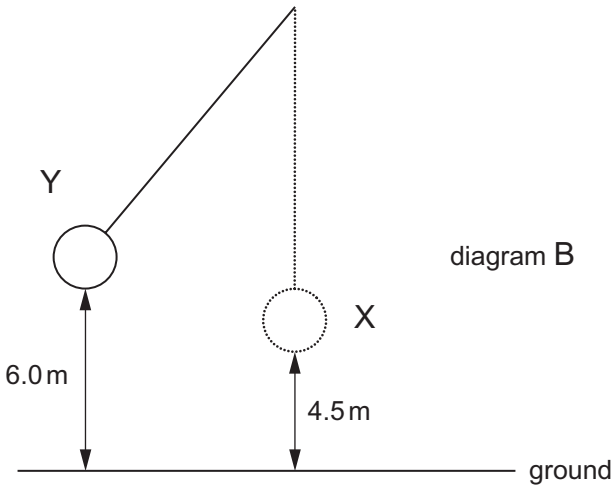

diagram B

(a) Calculate the work done on the ball to move it from its rest position X to position Y. The ball has a mass of 800 kg.

You are advised to show your working out.

Work done = _____ J [4]

(b) What is the loss in potential energy of the ball as it swings from position Y to position X?

Loss in potential energy = _____ J [1]

(c) Calculation shows that for the ball to be effective it must have a minimum kinetic energy of 4900 J. Calculate the velocity of impact for this energy.

You are advised to show your working out.

Velocity = _____ m/s [3]

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