Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Double Award Science: Physics

Unit P1
Higher Tier

ML

[GSD32]

FRIDAY 13 NOVEMBER 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

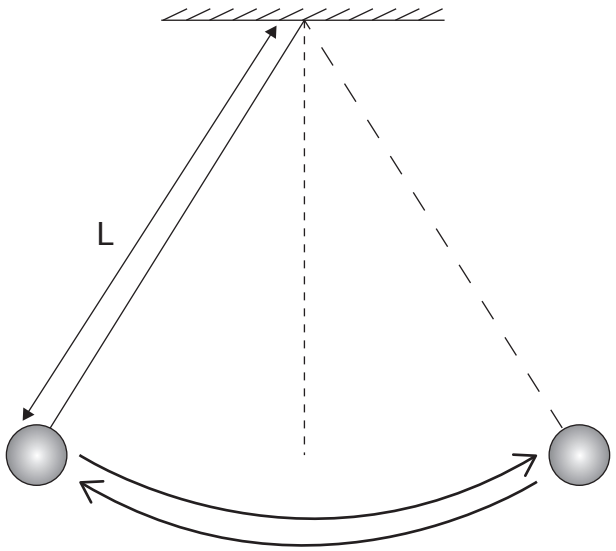
The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **2(a)** and **7**.

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

Examiner Only	
Marks	Remark

1 A pendulum consists of a mass hanging on a string.
When the pendulum has a length (L), the time (T) for one complete back and forth swing of the mass is given by the relationship:

$$T^2 = kL \qquad \textbf{Equation 1.1}$$



To test this relationship the following results were recorded.

L/m	0.0	0.2	0.4	0.6	0.8	1.0
T/s	0.0	0.90	1.27	1.55	1.79	2.00
T^2/s^2			1.6			

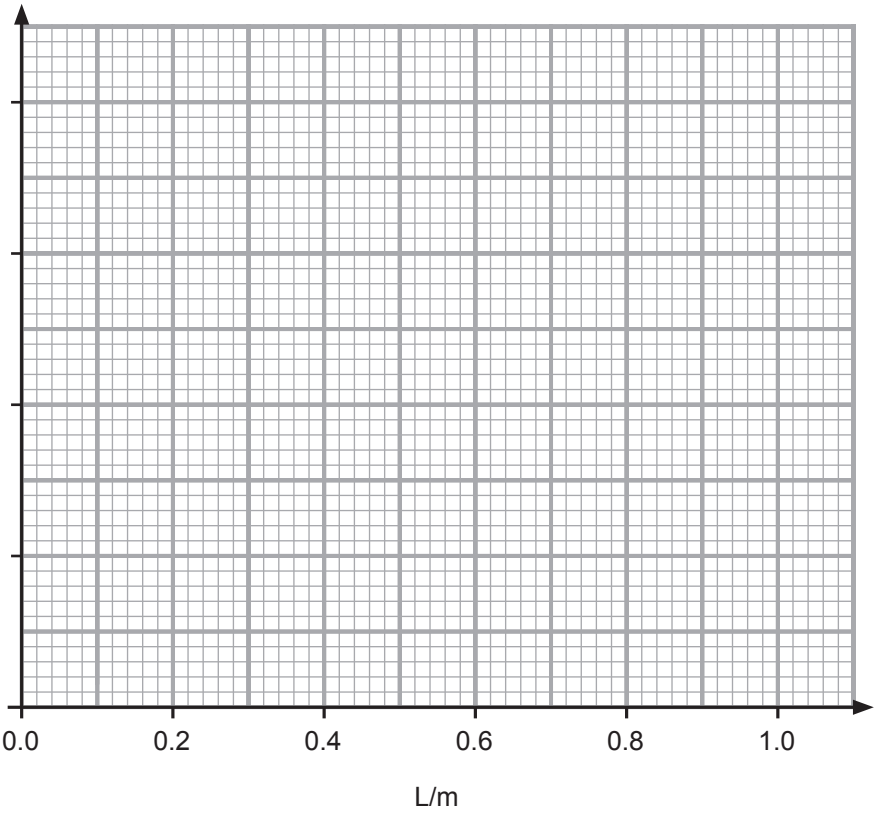
(i) Complete the table by entering the values for T^2, **to 1 decimal place**. One has been done for you. [2]

You are asked to plot a graph of T^2 against L.

(ii) Choose a suitable scale for the vertical axis and label it. [2]

(iii) Plot the points on the grid. [2]

(iv) Draw a line of best fit. [1]



(v) Does your graph support the theory described by **Equation 1.1**?

YES / NO Circle your choice.

Explain your answer.

_____

_____ [2]

(vi) Find the value of k from your graph.

k = _____ s^2/m [2]

Examiner Only

Marks	Remark

2 **(a)** Centripetal force causes a body to move in a circle. Give an account of the factors that the centripetal force depends on. How does centripetal force depend on these factors?

Your account must:

- state the direction of the centripetal force;
- state the three factors affecting the size of the centripetal force;
- state how the centripetal force depends on each of these three factors.

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

[6]

Examiner Only

Marks	Remark

(b) A body of weight 2 N moves in a circle. At a given instant its velocity is 3 m/s.

Calculate its momentum in kg m/s.

Show your working out.

Momentum = _____ kg m/s [4]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 The symbol for uranium-238 is $^{238}_{92}U$.

(a) (i) How many protons does a nucleus of uranium-238 contain?

Number of protons = _____ [1]

(ii) How many neutrons does a nucleus of uranium-238 contain?

Number of neutrons = _____ [1]

(b) An **isotope** of sodium is **radioactive**.

Explain fully what is meant by **Isotope**.

_____

_____ [2]

Explain fully what is meant by **Radioactive**.

_____

_____ [2]

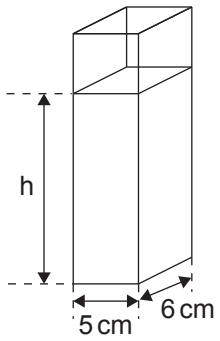
(c) Thirty hours after a sample of radioactive sodium had been prepared, only 25% of it remained.

Calculate the half-life of this isotope.

Show your working out.

Half-life = _____ hours [3]

4 A liquid has a density of 0.8 g/cm^3. 576 g of the liquid is poured into a glass container. The base of the glass container measures 6 cm by 5 cm.



(a) (i) Calculate the volume of liquid in the container.

Show your working out.

Volume = _____ cm^3 [3]

(ii) Use your answer to **(a)(i)** to find the height, h, of the liquid.

Show your working out.

Height = _____ cm [2]

(b) How does the density of the glass compare with the density of the liquid?

Tick (✓) the correct box below.

Glass has a smaller density	☐	Glass has a larger density	☐	Glass has the same density	☐

Use the kinetic theory to explain your choice.

_____

_____

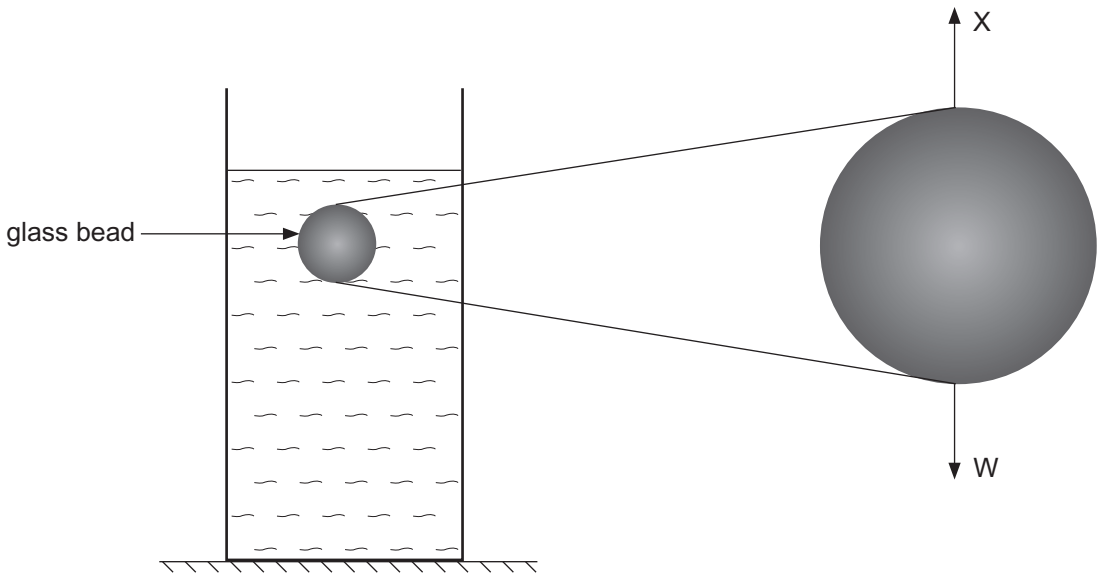
_____ [2]

Examiner Only

Marks	Remark

5 Gavin is interested in how quickly a glass bead falls through water.

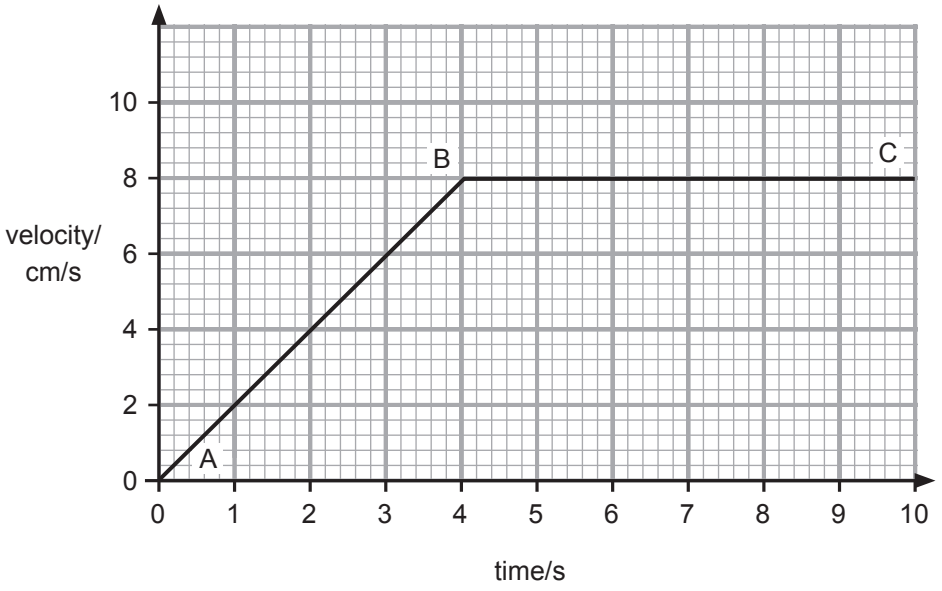
Examiner Only	
Marks	Remark



(a) (i) Two forces, W and X, act on the glass bead as it falls. W is the weight. What is the name of the other force X?

X is _____ [1]

Gavin plots a velocity–time graph of the glass bead's motion from entry into the water until it hits the bottom of the container.



(ii) How do the sizes of these forces compare during the regions AB and BC? Give your answer by ticking (✓) the correct box in each case.

During AB,

W is less than X. ☐

the two forces are equal. ☐

X is less than W. ☐

During BC,

W is less than X. ☐

the two forces are equal. ☐

X is less than W. ☐ [2]

(b) (i) Use the graph to calculate the distance the glass bead falls in 10 seconds.

Show your working out.

Distance = _____ cm [4]

(ii) Find the acceleration of the glass bead during the first four seconds of its fall.

Show your working out.

Acceleration = _____ cm/s^2 [3]

Examiner Only	
Marks	Remark

6 The table below contains a number of statements. For each statement insert one tick (✓).

Tick T if the statement is true.
Tick F if the statement is false.
Tick I if it is impossible to decide.

	T	F	I
Atomic number is given the symbol A.			
In a neutral atom the number of protons equals the number of electrons.			
Beta particles are negatively charged electrons.			
An alpha particle is a helium atom.			
A beta particle comes from the nucleus of an atom.			
Radiation is stopped by a few mm of aluminium.			

[6]

Examiner Only

Marks	Remark

7 Describe an experiment to verify the Principle of Moments.

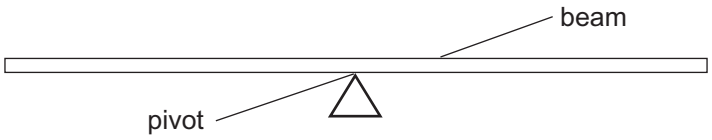
Examiner Only	
Marks	Remark

In your description you should:

- describe how you would carry out the experiment;
- state the measurements you would make;
- state how you would use these measurements to verify the Principle of Moments.

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

The following diagram may help you.



[6]

8 An acrobat grips a rope loosely as he slides down it.

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A force acting on the acrobat leads to heat energy being produced.

(a) In the box draw an arrow to indicate the direction of this force. [1]

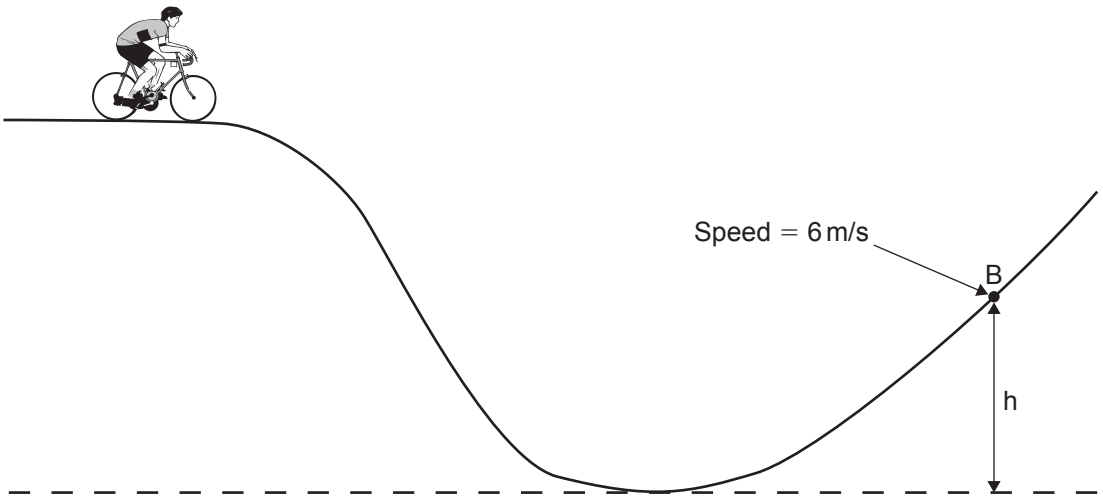
(b) The acrobat has a mass of 70 kg and slides down the rope with an acceleration of 4 m/s^2. Calculate the value of the force referred to in part **(a)**.

Show your working out.

Force = _____ N [4]

Examiner Only	
Marks	Remark

9 Jim and his bicycle have a total mass of 80 kg. At the top of a hill they have a potential energy of 4640 J. Jim freewheels **from rest** down the hill and part of the way up a second hill. At point B he has a speed of 6 m/s.



(i) Calculate the kinetic energy of Jim and his bicycle at point B.

Show your working out.

Kinetic energy = _____ J [3]

(ii) Use the Principle of Conservation of Energy to calculate the height, h. Assume no energy losses.

Show your working out.

Height = _____ m [3]

Examiner Only

Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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