Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

THURSDAY 23 MAY 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 **1(a)**.

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)** Describe an experiment you would carry out to measure the power output of an electric motor.

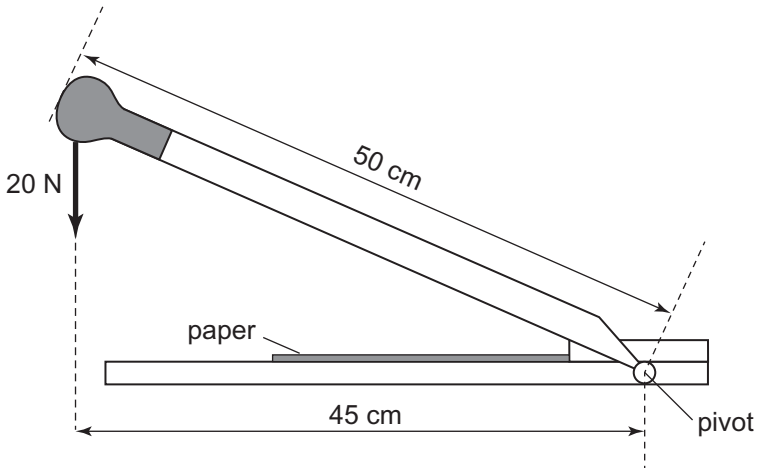
In your description you should include:

- the apparatus used,
- the measurements you take,
- the formula you would use to find the power.

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

[6]

(b) A guillotine is used to cut sheets of paper. A constant downward force of 20 N is exerted on the handle.



Calculate the moment of the 20 N force about the pivot.

Remember to include the unit in your answer.

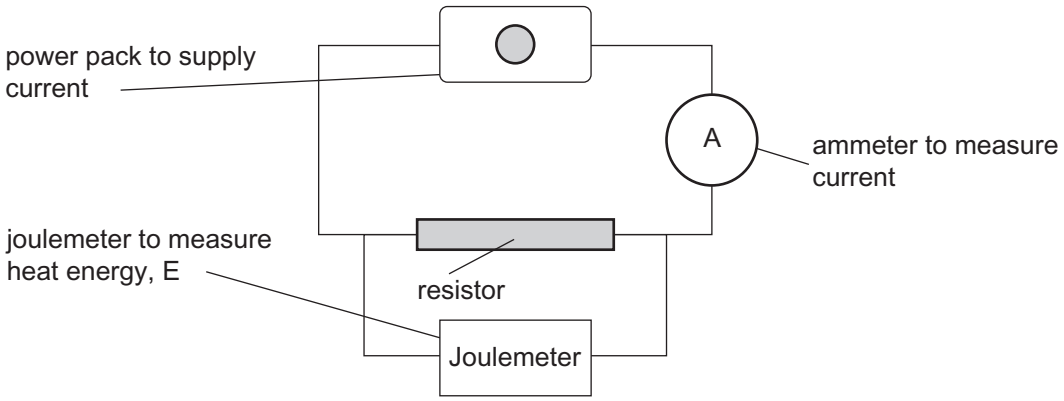
You are advised to show your working out.

Moment = _____ [4]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 When a battery passes a current through a resistor then heat energy is produced in the resistor.



David suspects that the heat energy, E, produced depends on the square of the current, I. This relationship could be written as:

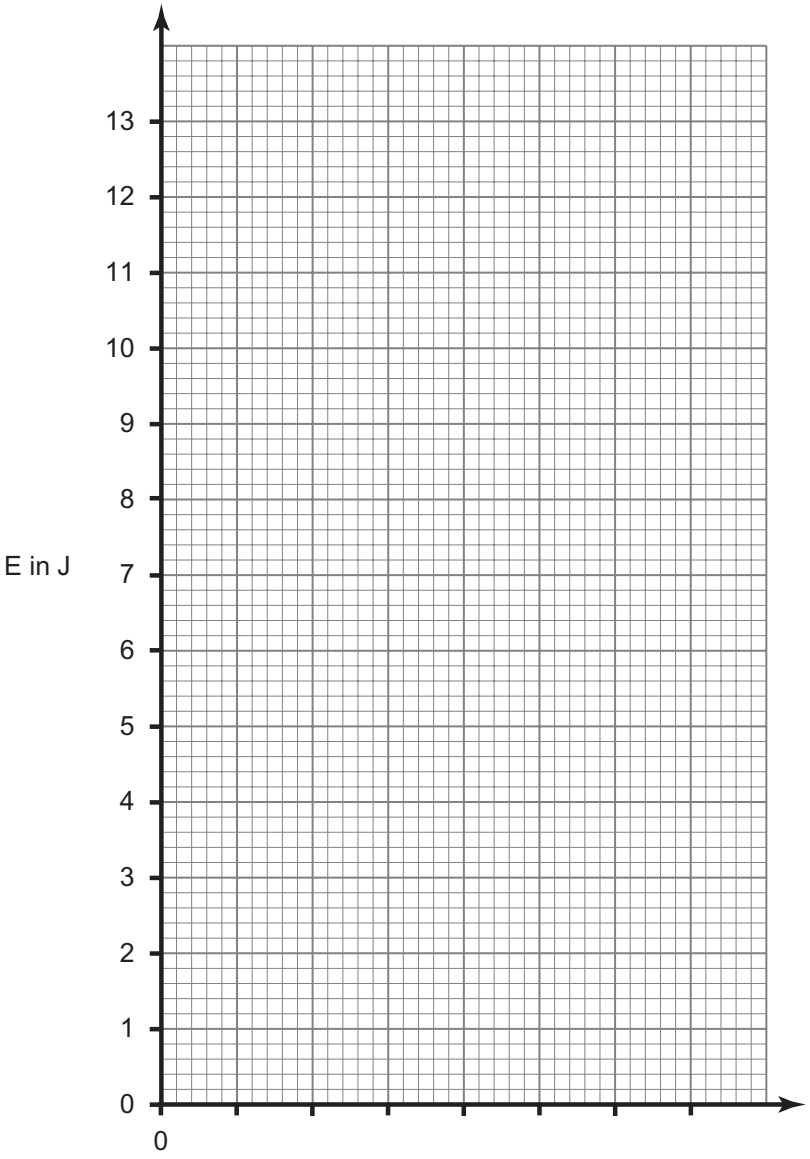
$$E = k\,I^2$$

He obtains a series of readings of current and energy and these are shown in the table.

I in A	0.0	0.5	1.0	1.5	2.0	2.5
I^2 in A^2					4.0	
E in J	0.0	0.5	2.0	4.5	8.0	12.5

(a) Complete the table by entering the values of I^2, correct to 1 decimal place. One entry has been recorded for you. [2]

(b) Choose a suitable scale and label the *x*-axis. Plot a graph of energy, E, on the vertical axis versus I^2 on the horizontal axis. [4]



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

(d) Use your graph to find the constant k.

Remember to include the unit for k.

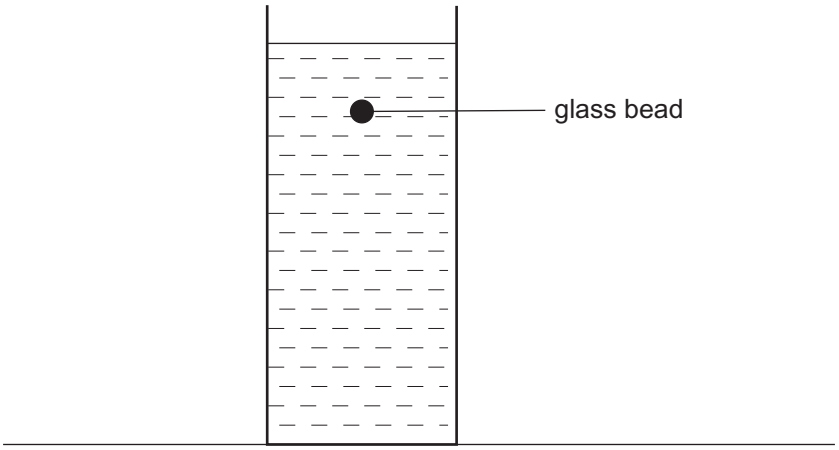
You are advised to show your working out.

k = _____

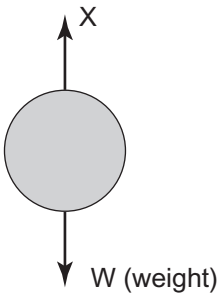
Unit = _____ [4]

Examiner Only	
Marks	Remark

3 Kyle is interested in how quickly a glass bead falls through water.



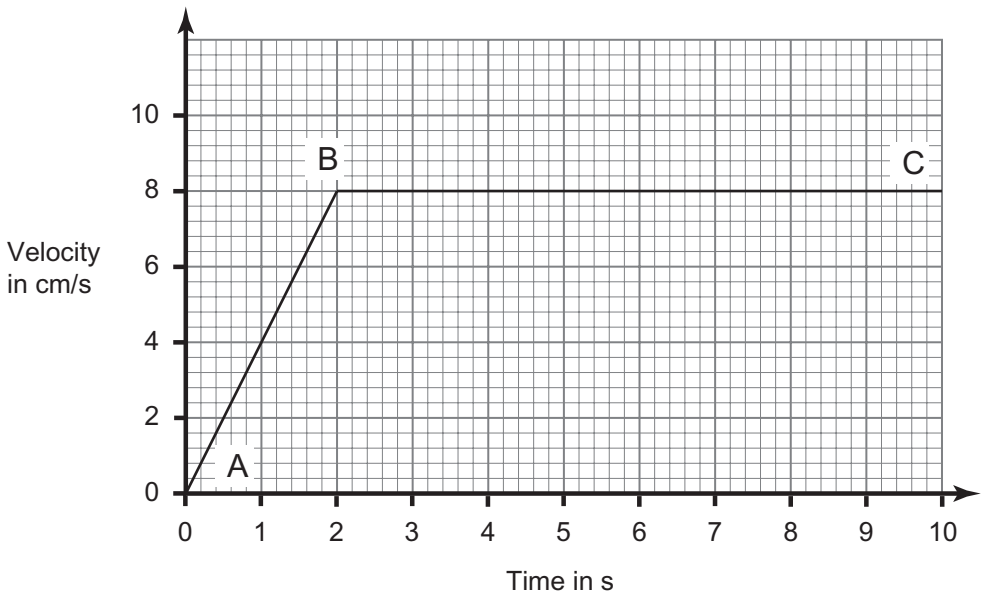
(a) Two forces, W and X, act on the bead as it falls. W is the weight.



(i) What is the name of the other force X?

Force X is called _____ [1]

Kyle plots a velocity–time graph of the bead's motion.



Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

(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]

The bead hits the bottom of the cylinder after 10 s.

(b) (i) Use the graph on page 6 to calculate the depth of water in the container.

You are advised to show your working out.

Depth of water = _____ cm [3]

(ii) The bead has a mass of 0.2 g. Calculate its maximum momentum in g cm/s.

You are advised to show your working out.

Maximum momentum = _____ g cm/s [3]

Examiner Only	
Marks	Remark

4 **(a)** 1 g of water has a volume of 1 cm^3.

There are 1 000 000 cm^3 in 1 m^3 of water.

(i) What is the mass, in g, of 1 m^3 of water?

Mass = _____ g [1]

(ii) What is the mass, in kg, of 1 m^3 of water?

Mass = _____ kg [1]

(iii) What is the density of water in kg/m^3?

Density = _____ kg/m^3 [1]

(b) A balloon is made from a material which has a mass of 150 kg. Its volume when filled with helium is 500 m^3.

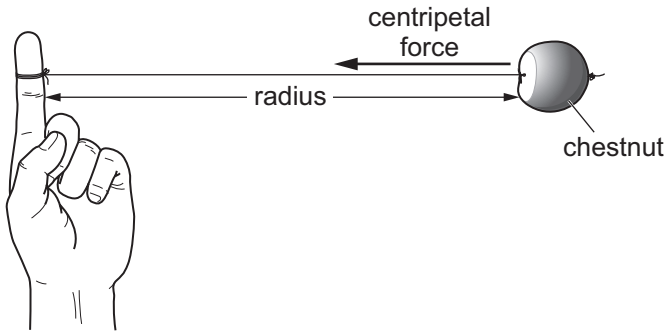
The density of helium is 0.18 kg/m^3.

Calculate the total mass of the helium-filled balloon.

You are advised to show your working out.

Total mass = _____ kg [4]

5



(a) A chestnut is whirled in a horizontal circle.

How is the centripetal force acting on the chestnut affected by the changes to the following physical quantities?

Complete the table by inserting a tick (✓) in the correct boxes.

Physical Quantity	Centripetal force		
	Decreases	**Increases**	**Unaffected**
Increasing Mass			
Decreasing Radius			
Increasing Speed			
Reversing the Direction of rotation			

[4]

(b) Explain, fully, how the centripetal force acting on the chestnut causes the chestnut to move in a curved path.

_____

_____

_____

_____

_____ [2]

Examiner Only

Marks	Remark

Examiner Only

Marks	Remark

6 **(a)** Describe how the electrons are arranged:

(i) in the "Plum-Pudding" model of the atom.

_____

_____ [1]

(ii) in the Rutherford–Bohr model of the atom.

_____

_____ [1]

(b) Which of the following, if any, could change the rate of decay of a radioactive substance?

Tick (✓) the correct box.

Increase the temperature of the radioactive substance.	☐
Decrease the temperature of the radioactive substance.	☐
Immerse in water.	☐
The rate of decay cannot be changed.	☐

[1]

(c) To monitor a patient's thyroid gland, the patient is injected with 96 μg of radioactive iodine. The half-life of iodine is 8 days.

(i) Calculate the mass of iodine remaining after 32 days.

You are advised to show your working out.

Mass remaining = _____ μg [3]

(ii) What mass of iodine has decayed in 32 days?

Mass decayed = _____ μg [1]

Examiner Only	
Marks	Remark

7 **(a)** The symbols for two of the isotopes of hydrogen are:

$$^{2}_{1}H \qquad ^{3}_{1}H$$

(i) What do both nuclear isotopes have in common?

_____ [1]

(ii) How do the two nuclear isotopes differ?

_____ [1]

(b) Complete the equation for the following fusion reaction.

$$^{2}_{1}H + ^{3}_{1}H \rightarrow \square\!\!\square He + ^{1}_{0}n$$

[2]

(c) State a technological difficulty associated with the production of electricity using the fusion process.

_____ [1]

Examiner Only	
Marks	Remark

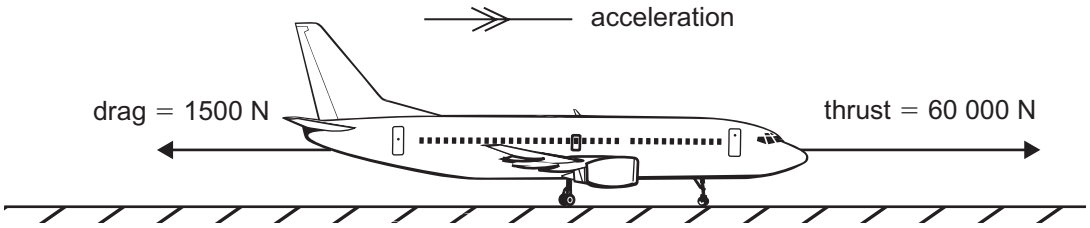
8 **(a)** A Boeing 737 accelerates **from rest** to a velocity of 50 m/s in 25 s, just before take-off.

Calculate its acceleration.

You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

(b) Some of the forces acting on the Boeing 737 before take-off are shown in the diagram below.

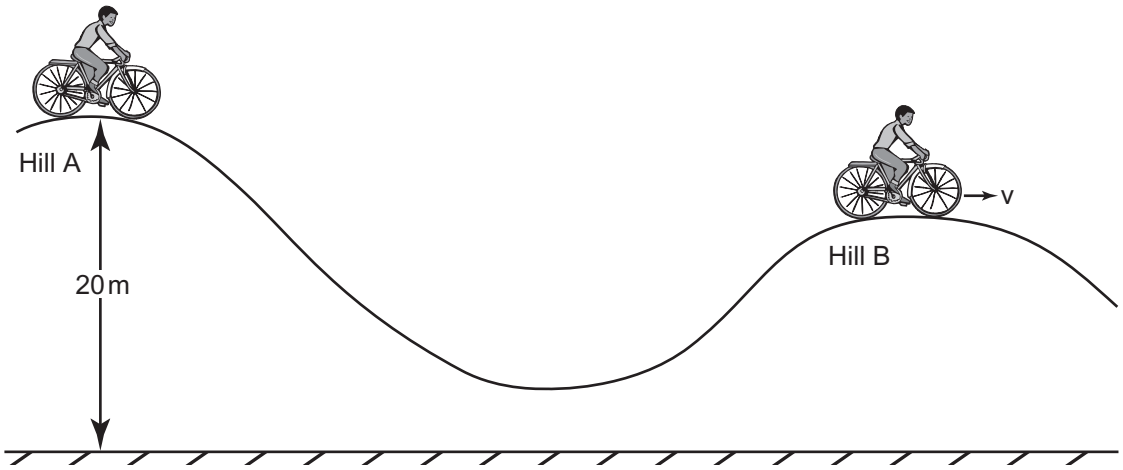


Use your answer to part **(a)**, to find the mass of the Boeing 737.

You are advised to show your working out.

Mass = _____ kg [4]

9 Part of the journey of a cyclist is shown below.



(a) The total mass of the cyclist and his bicycle is 50 kg. The cyclist is initially at rest on hill A.

Calculate the potential energy of the cyclist at the top of hill A which is 20 m above sea level.

You are advised to show your working out.

Potential energy = _____ J [3]

(b) The potential energy of the cyclist at the top of hill B is 5100 J.

(i) Assuming that all of the loss of potential energy is converted into kinetic energy, use your answer to part **(a)** to calculate the velocity of the cyclist at the top of hill B.

You are advised to show your working out.

Velocity = _____ m/s [4]

(ii) In practice, not all of the loss in potential energy is converted into kinetic energy.
Explain why this is so.

_____ [1]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER