Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
January 2019

GCSE Physics

Unit 1

Higher Tier

[GPH12]

GPH12

THURSDAY 17 JANUARY, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
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 **1(b)** and **6(a)**.

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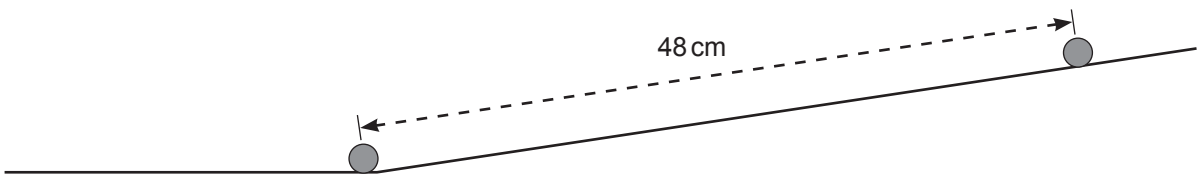
1 **(a)** A marble is rolled up a smooth slope as shown in the diagram below.



Source: Chief Examiner

From the moment it leaves the person's hand it takes 4 seconds to come to rest. In this time it travels a distance of 48 cm.

(i) Calculate the average velocity of the marble.
Show clearly how you get your answer, starting with the equation you plan to use.

Average velocity = _____ cm/s [3]

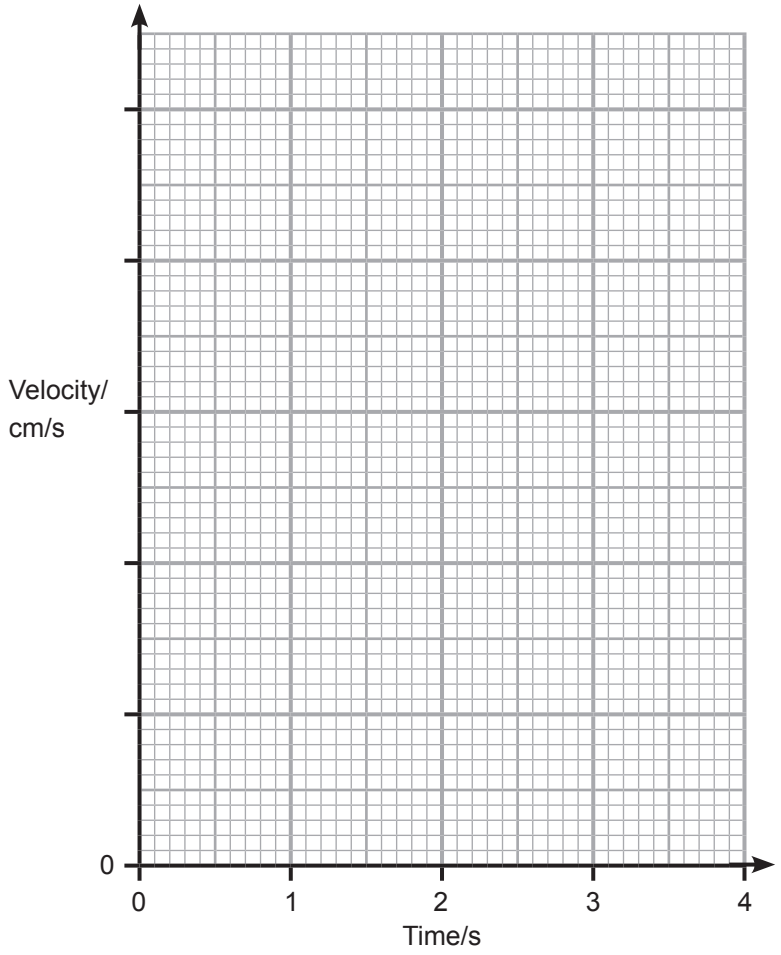
During this motion, the marble moves with uniform acceleration.

(ii) Use your answer to part **(i)** to calculate the initial velocity of the marble.
Show clearly how you get your answer, starting with the equation you plan to use.

Initial velocity = _____ cm/s [2]

[Turn over

(iii) On the grid below, draw carefully the velocity–time graph for the marble during the four seconds of its motion.



[3]

(iv) Use the graph to calculate the acceleration of the marble.
Show clearly how you get your answer, starting with the equation you plan to use.

Acceleration = _____ cm/s^2 [2]

(v) On another occasion a marble of mass **80 g** has an acceleration of $-$**0.09 m/s^2**.
Calculate the size of the force slowing the marble down.
Show clearly how you get your answer, starting with the equation you plan to use.

Force = _____ N [4]

[Turn over

(b) A force, called the centripetal force, causes a body to move in a circle.
Give an account of the factors that the centripetal force depends on and how it depends on them.

Your account must state:

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

You do not have to state any mathematical equations.

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

Direction:

Three factors affecting the size of the centripetal force:

How centripetal force depends on each factor:

[6]

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(Questions continue overleaf)

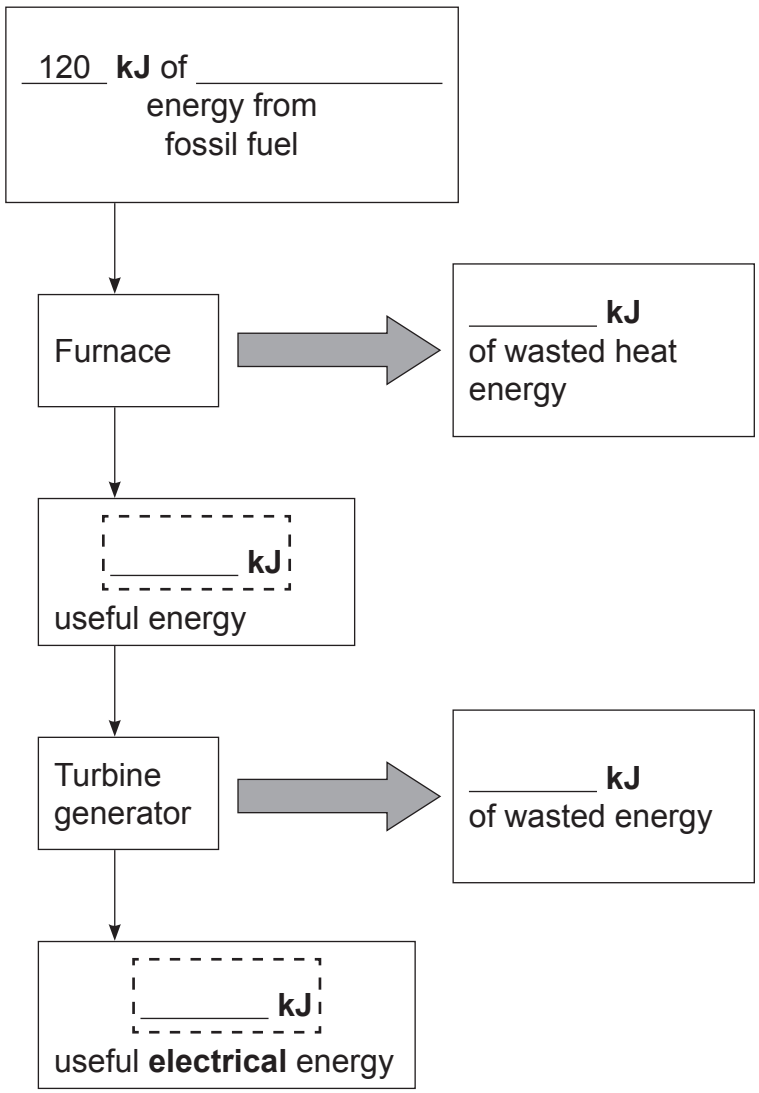
[Turn over

2 **(a)** Electrical energy can be obtained by burning fossil fuels.
The simplified diagram below illustrates the energy changes that take place during this process.

For every 120 kJ of input energy, $\frac{2}{3}$ of it are wasted as heat from the furnace.

Of the remaining useful energy, 16 kJ are lost as heat and sound in the turbine.
The remainder of the useful heat energy is converted to electrical energy.

(i) Complete the diagram below by adding the appropriate numbers to the boxes.
You should also name the type of input energy used in this process by adding the name to the first box.



[5]

(ii) State, in full, the principle that allowed you to answer part **(a)(i)**.

_____

_____ [2]

(b) Every second a different fossil fuel power station produces 840 MJ of electrical energy.
The efficiency of this power station is 0.35 (35%).

(i) Calculate the amount of fossil fuel energy this power station uses per second.
Show clearly how you get your answer, starting with the equation you plan to use.

Fossil fuel energy used per second = _____ MJ [4]

One of the major disadvantages of fossil fuel power stations is that they all produce gases which pollute the atmosphere.

(ii) State the common polluting gas produced by **all** fossil fuel power stations.

_____ [1]

(iii) In what way is this gas particularly harmful to the global environment?

_____

_____ [1]

(iv) All fossil fuels are non-renewable. Explain what this means.

_____

_____ [1]

[Turn over

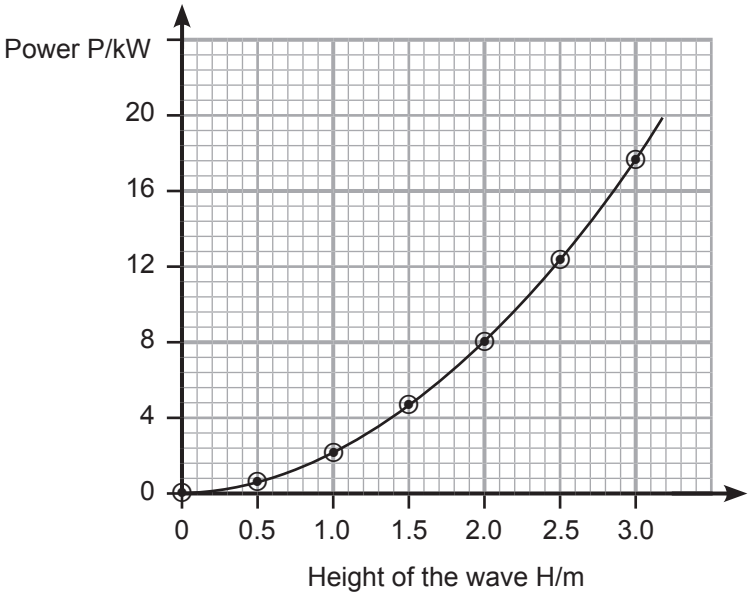
(c) Many scientists are investigating the use of water waves to produce electrical energy. In one investigation the electrical power P extracted from water waves was measured when waves of different height H were used.

(i) The power P is **directly proportional to the square of the height H** of the wave. Using this information, circle the correct equation from the three shown linking the power P, the height of the wave H and the constant of proportionality k.

$$P = kH \qquad P = kH^2 \qquad P = \frac{k}{H^2}$$

[1]

The graph below shows the results obtained from the investigation.



(ii) Using the appropriate equation and the graph, find the value of the constant of proportionality k and state its unit.
Show clearly how you get your answer, starting with the equation you plan to use.

Value of k = _____ [3]

Unit for k = _____ [1]

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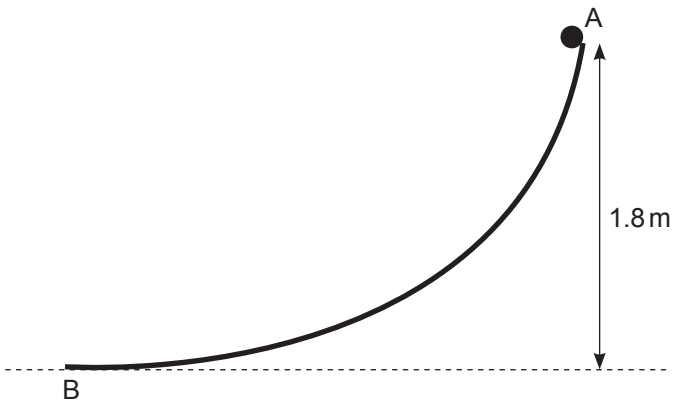
(Questions continue overleaf)

[Turn over

3 **(a)** When studying the **Principle of Conservation of Energy** a student carried out an investigation by allowing small ball bearings to run, from rest, down a curved plastic track as shown in the diagram below.
You can assume the force of friction is negligible and thus no energy losses.
Each ball bearing has a mass of 0.02 kg.
The ball bearing is released from the point A which is 1.8 m vertically above the horizontal, as shown in the diagram.



(i) Calculate the loss in gravitational potential energy as the ball bearing moves from A to B.
Show clearly how you get your answer, starting with the equation you plan to use.

Loss in gravitational potential energy = _____ J [3]

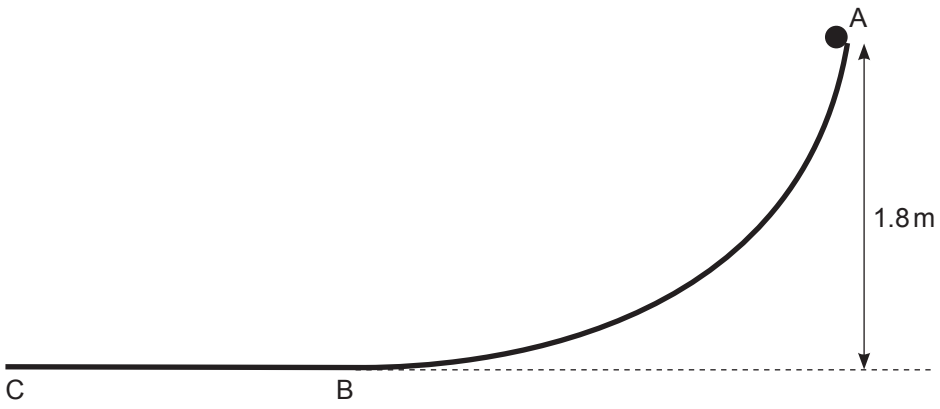
(ii) What is the kinetic energy of the ball bearing at point B?

Kinetic energy = _____ J [1]

(iii) Calculate the speed of the ball bearing at point B.
Show clearly how you get your answer, starting with the equation you plan to use.

Speed at B = _____ m/s [4]

(b) When the ball bearing reaches the point B it travels along a horizontal track where friction does act.

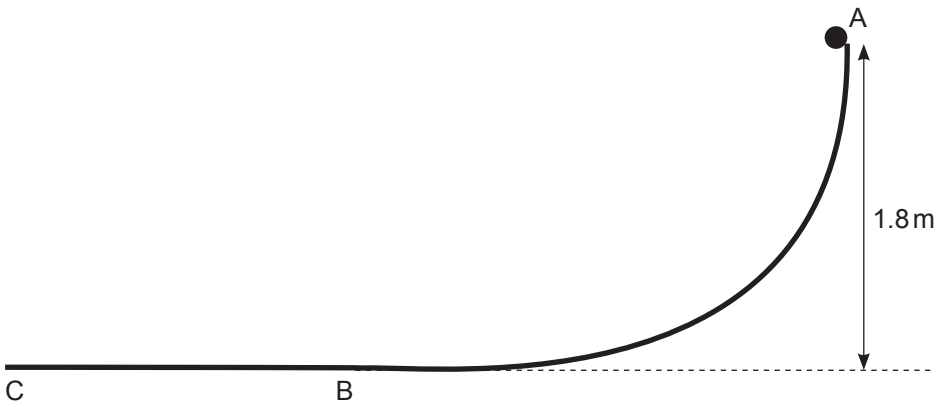


(i) The ball bearing travels 0.9 m from point B before coming to rest at C.
Calculate the frictional force acting on the ball bearing.
Show clearly how you get your answer, starting with the equation you plan to use.

Frictional force = _____ N [3]

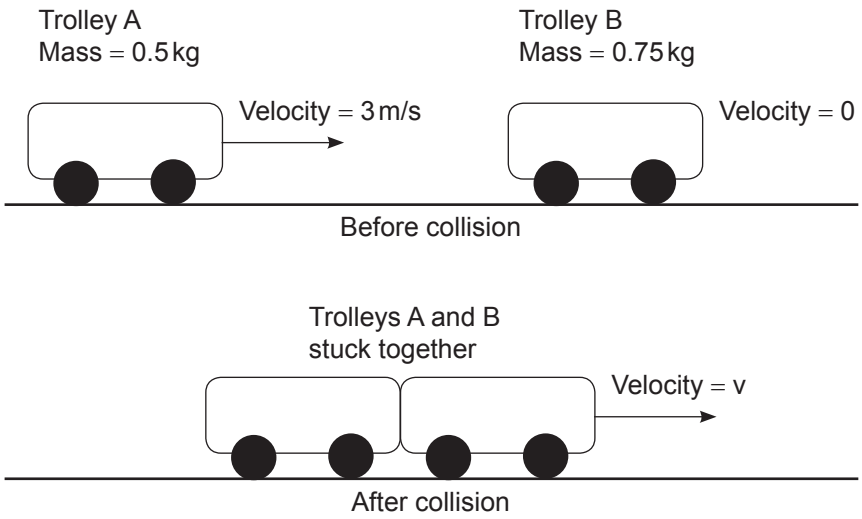
[Turn over

(ii) If the track between A and B was made steeper how would this affect, if at all, the distance the ball bearing travels from B towards C? Explain your answer.



[2]

(c) In a school laboratory small trolleys are often used to investigate momentum. The diagrams below represent what happens when two trolleys collide. After the collision the trolleys stick together.



Using the Principle of Conservation of Momentum, calculate the velocity v of the combined trolleys after they collide.
Show clearly how you get your answer, starting with the equation you plan to use.

Velocity v after collision = _____ m/s [5]

[Turn over

4 **(a)** The terms mass and weight are often used in everyday instances as having the same meaning. Scientifically they have different meanings.
Explain, without using an equation, the scientific meanings of mass and weight.

_____

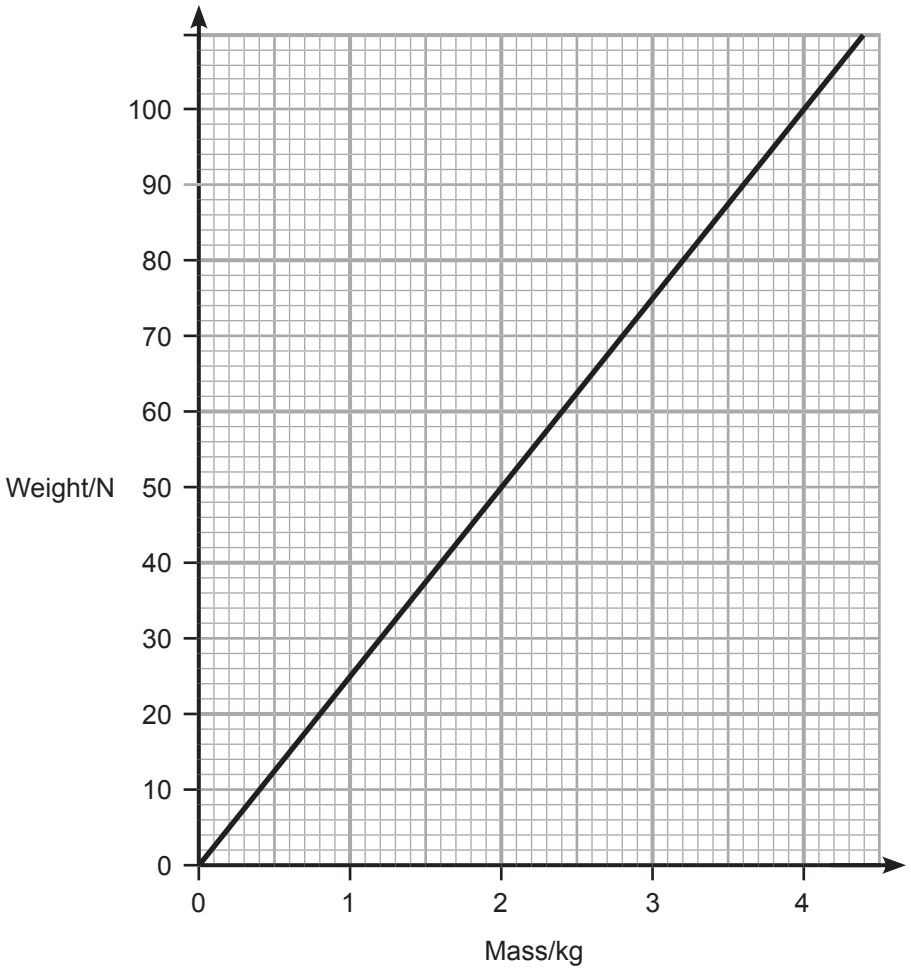
_____

_____

_____

_____ [2]

(b) The graph below shows how the weight of an object would vary with its mass on the planet Jupiter.



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(i) Using the graph and your knowledge, find **the difference** between the weight of a 4 kg object on the Earth and on Jupiter.

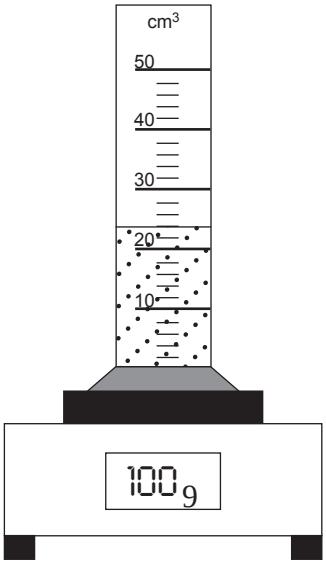
Difference in weight = _____ N [3]

(ii) On a different planet the weight of a 1 kg object is 15 N. On the grid opposite draw the graph which shows how the weight varies with mass on this planet.

[1]

[Turn over

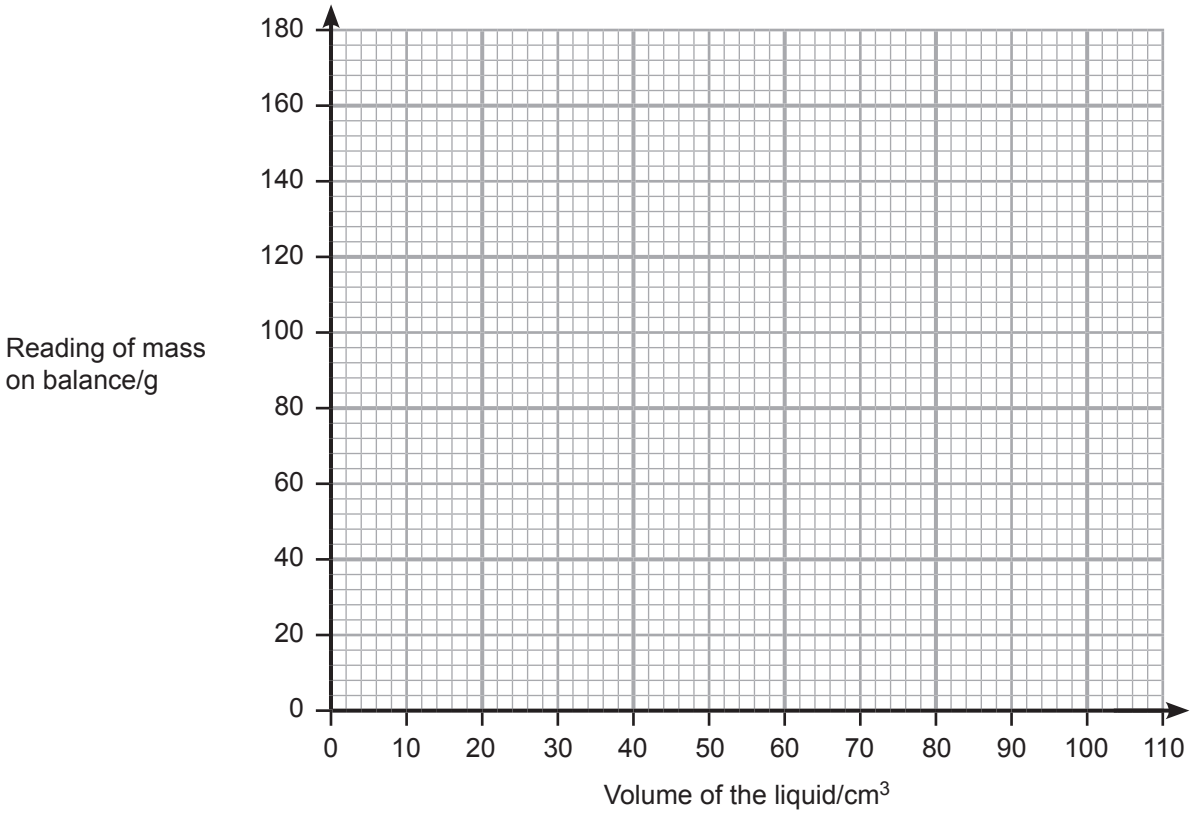
(c) A student was given a measuring cylinder and an electronic balance.
The student placed the cylinder on the balance and added known volumes of a liquid. For each volume reading she also recorded the reading of mass on the electronic balance.



The results are as shown in the table below.

Reading of mass on balance/g	Volume of liquid/cm^3
96	20
112	40
128	60
144	80
160	100

(i) On the grid below, plot the points and rule the line of best fit through them.



[3]

(ii) What is the mass of the empty measuring cylinder?

Mass of empty cylinder = _____ g [1]

[Turn over

(iii) The table below shows four different liquids and their densities.

Liquid	Density/ g/cm^3
Petrol	0.7
Ethanol	0.8
Castor Oil	0.9
Water	1.0

Using your graph on page 19 and the data above identify the liquid used.
In this question you must support your answer with appropriate calculations.

Liquid was _____ [4]

(iv) The procedure was repeated using the **same** measuring cylinder but with a liquid of **greater density**.
On the grid on page 19 draw the graph you would expect to see. [1]

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[Turn over

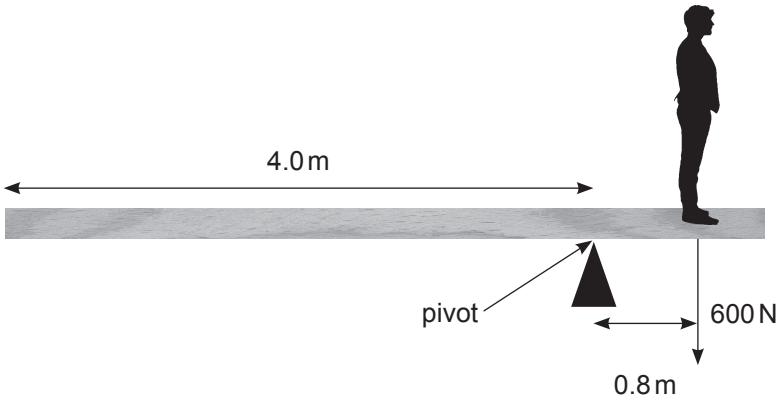
5 **(a)** State the Principle of Moments.

_____

_____

_____ [2]

(b) A man stands close to the end of a uniform plank so that it is balanced.



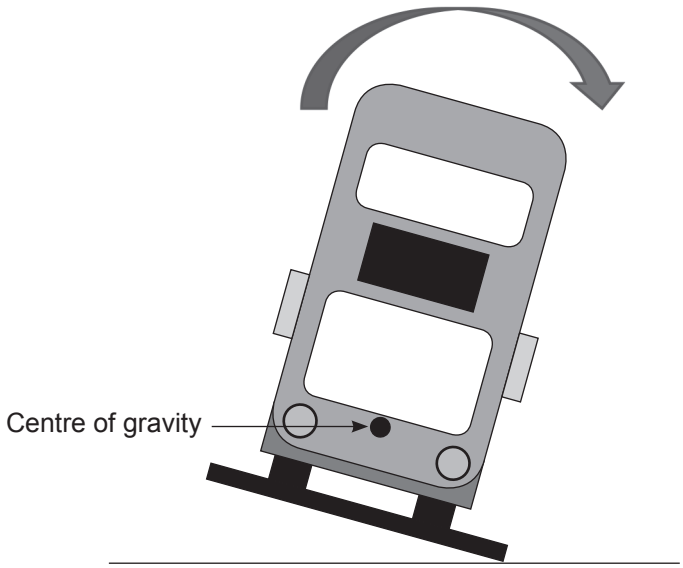
(i) The plank is 5.0 m long.
Calculate the distance from the centre of gravity of the plank to the pivot.

Distance = _____ m [1]

(ii) The man weighs 600 N.
Calculate the weight of the plank.
Show clearly how you get your answer, starting with the equation you plan to use.

Weight of the plank = _____ N [3]

(c) The stability of double-decker buses is checked by placing them on a tilting platform as shown in the diagram. The centre of gravity of the bus is marked.



(i) Is the bus shown about to topple?
Explain your answer.

_____

_____

_____ [2]

(ii) When all the seats are taken, passengers are allowed to stand on the lower deck. However, bus companies do not allow passengers to stand on the upper deck.
Explain why standing on the upper deck is not allowed.

_____

_____

_____ [2]

[Turn over

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6 **(a)** Describe the structure of the atom and the decay of unstable nuclei which is known as radioactivity.

In your answer you should:

- name the particles that make up an atom, describing their location in the atom and their electric charge;
- name and state the nature of the radiations that unstable nuclei emit when they decay.

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

Particles that make up the atom:

Three radiations emitted by a radioactive atom:

[6]

(b) In an experiment to measure the half-life of a radioactive source, the activity of the source was measured at regular intervals. The results are shown below. Before the measurements were taken the background activity in the room was measured.
(cps means counts per second)

Background activity = 2 cps

Time/hours	0	2	4	6	8	10
Activity of the source/cps	122	62	32	17	10	6
Corrected activity of the source/cps						

(i) Explain how the activity of the source is corrected for background activity.

_____

_____ [1]

(ii) Complete the table by adding the values of the corrected activity of the source. [1]

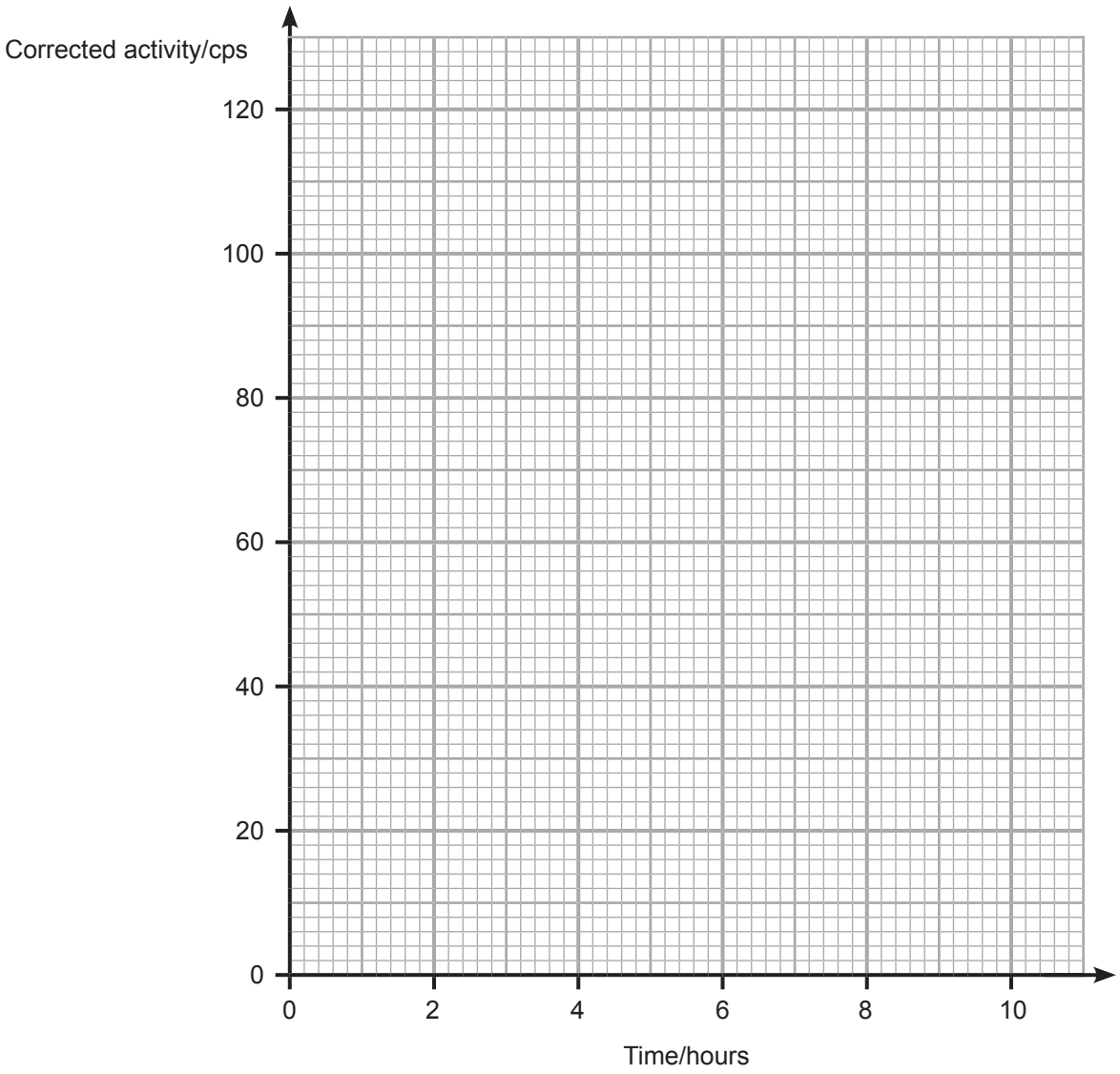
(iii) Using the grid opposite, plot the data from the table above and draw a smooth curve through the points. [2]

(iv) Using the graph you have drawn, determine the half-life of the radioactive source.

Half-life = _____ hours [2]

(v) Using your value for the half-life, calculate the corrected activity of the source **4 hours before** the experiment began.

Corrected activity = _____ cps [2]



[Turn over

(c) Nuclear fission and fusion are two nuclear reactions which release large amounts of energy.
Describe, **briefly**, what happens in each case.

Nuclear fission _____

_____

_____

Nuclear fusion _____

_____

_____ [4]

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For Examiner's use only	
Question Number	**Marks**
1	
2	
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Total Marks	

Examiner Number