Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014–2015

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

WEDNESDAY 20 MAY 2015, AFTERNOON

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

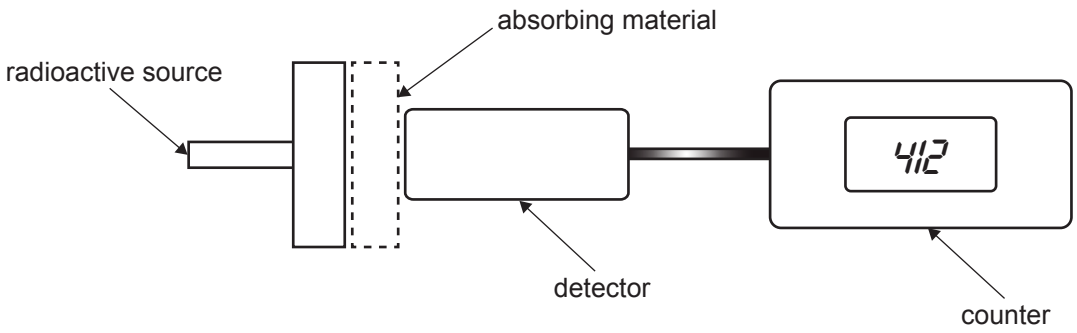
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen.**
Answer **all eight** 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 **8(b)**.

9836

1 **(a)** The apparatus shown is used to investigate how different materials absorb gamma radiation.



The absorbing material is either aluminium, lead or air.

Examine the table below and insert the names of the material in the last column.

Count rate/ Counts per minute	Absorbing material (aluminium, lead or air)
802	
45	
412	

[3]

Technetium is an isotope widely used in medical imaging and has the symbol $^{99}_{43}Tc$.

(b) **(i)** How many particles are in the nucleus of technetium?

_____ [1]

(ii) How many of these particles are neutrons?

_____ [1]

This isotope has a half-life of 211 000 years.

(iii) Beginning with 8 grams of technetium, calculate how long it would take before only 1 gram remains.

You are advised to show your working out.

_____ years [3]

[Turn over

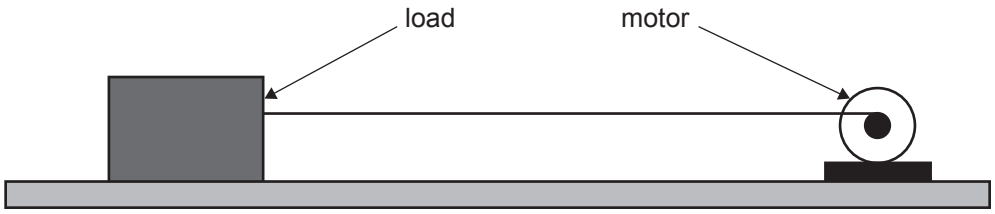
2 **(a)** Describe an experiment to measure your personal power.

Your account should include:

- the apparatus you use;
- the measurements you make.

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

[6]



An electric motor pulls a load across a rough surface at a constant speed. The motor exerts a resultant force of 30 N and moves the load a distance of 1.5 m in a time interval of 5 seconds.

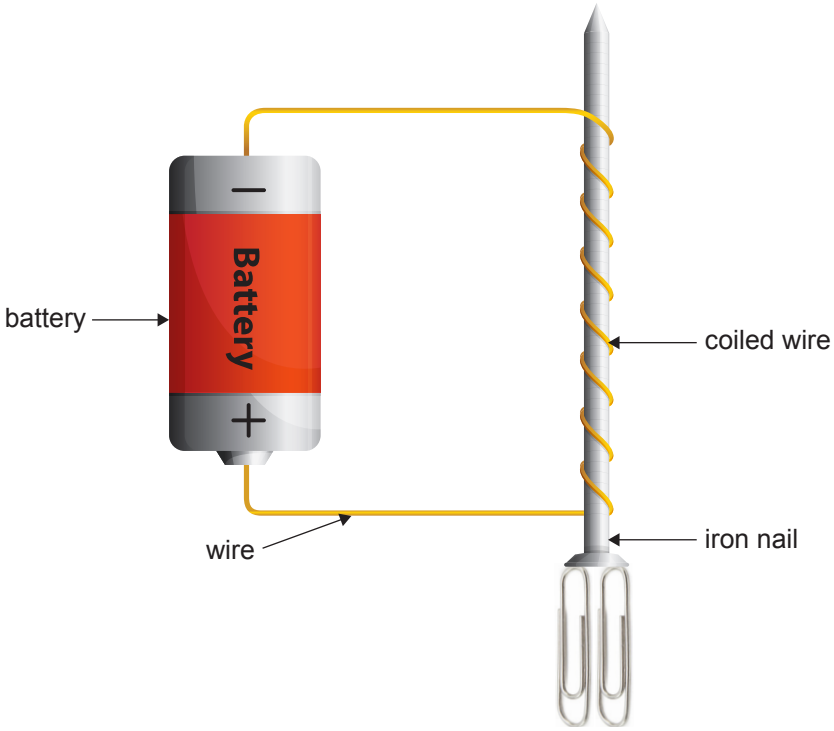
(b) Calculate the power developed by the motor.

You are advised to show your working out.

Power developed = _____ W [3]

[Turn over

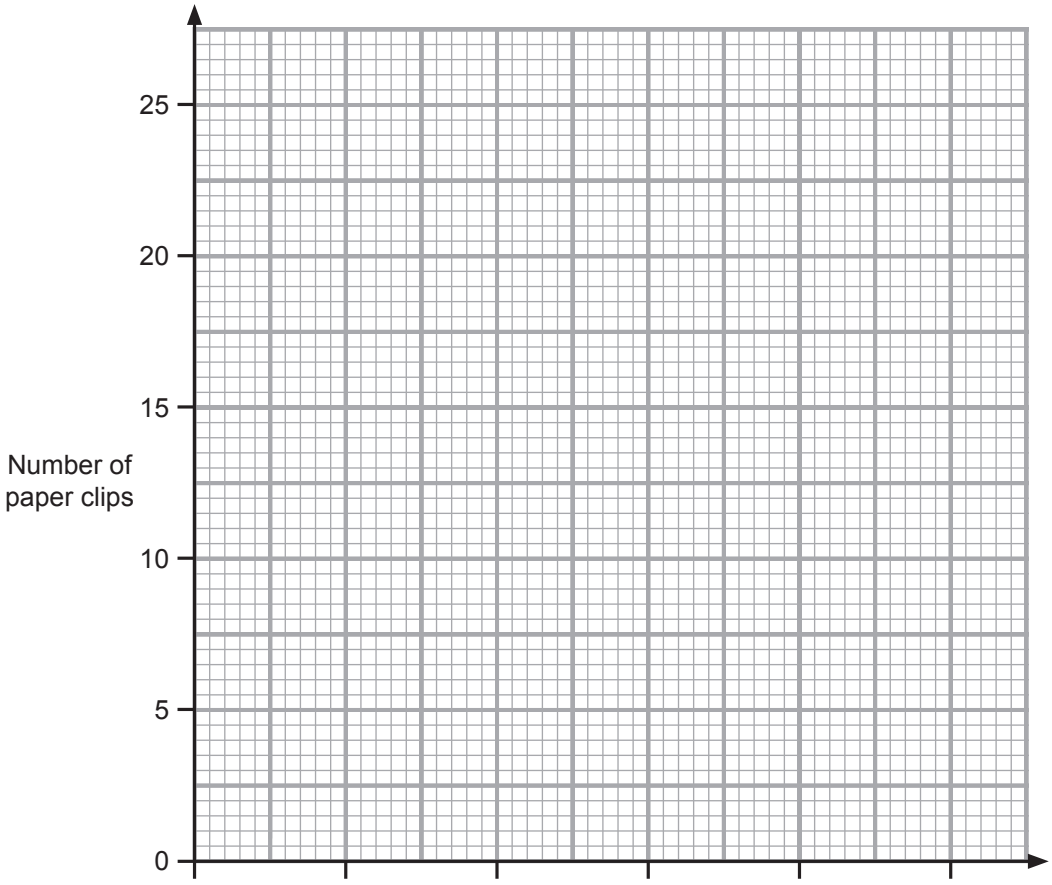
3 A large iron nail can be made into a magnet by wrapping a coil around it, as shown, and passing a current through the wire.



A student wanted to see how the number of paper clips the magnet was able to pick up depended on the size of the current passing through the wire. The current was changed to different values and the number of paper clips counted each time.

A table of results is shown below.

Current/mA	Number of paper clips
0	0
200	5
400	10
600	15
800	20
1000	25



You are asked to plot a graph of 'number of paper clips' against current.

(i) Choose a suitable scale for the horizontal axis, label it and include the correct unit. [3]

(ii) Plot the points of 'number of paper clips' against current. [2]

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

[Turn over

(iv) Is it true to say that the number of paper clips that can be lifted is directly proportional to the current? Circle your answer.

Yes No

Give **two** reasons for your answer.

1. _____

2. _____ [2]

(v) Use your graph to find the maximum number of paper clips that the magnet would lift when a current of 0.7 A is flowing.
(Hint: 1.0 A = 1000 mA)

You are advised to show your working out.

Number of paper clips = _____ [4]

4 **(a)** Radium is a radioactive material which disintegrates, emitting alpha particles as it decays to form radon gas. This process is illustrated by the equation below.

$$^{226}_{88}\text{Ra} \rightarrow {}^{222}_{86}\text{Rn} + {}^{4}_{2}\alpha$$

Explain, in terms of nuclear **particles**, what has happened to the radium nucleus.

_____

_____ [2]

(b) Radium decays naturally but it is possible to force heavy nuclei, like those of uranium, to split into two lighter nuclei.

(i) What is the name of this process?

_____ [1]

(ii) Complete the equation below which represents the forced splitting of uranium.

$$^{235}_{92}\text{U} + {}^{1}_{0}\text{n} \rightarrow {}^{\square}_{52}\text{Te} + {}^{97}_{\square}\text{Zr} + 2\ {}^{1}_{0}\text{n}$$

[2]

[Turn over

5 The blades of a helicopter exert an upwards force of 25 000 N. The mass of the helicopter is 2000 kg.

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(a) What is the weight of the helicopter?

Weight = _____ N [2]

(b) Calculate the acceleration of the helicopter.
Remember to include the unit.

You are advised to show your working out.

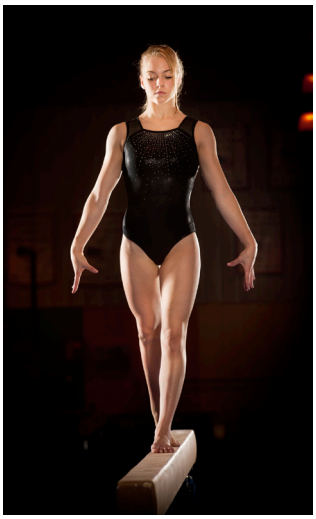
Acceleration = _____ [5]

(c) On another occasion, the helicopter travels 1.5 km at an average speed of 3 m/s. Find the time taken for this journey.

You are advised to show your working out.

Time = _____ s [3]

6 The photograph shows a gymnast on a horizontal beam.

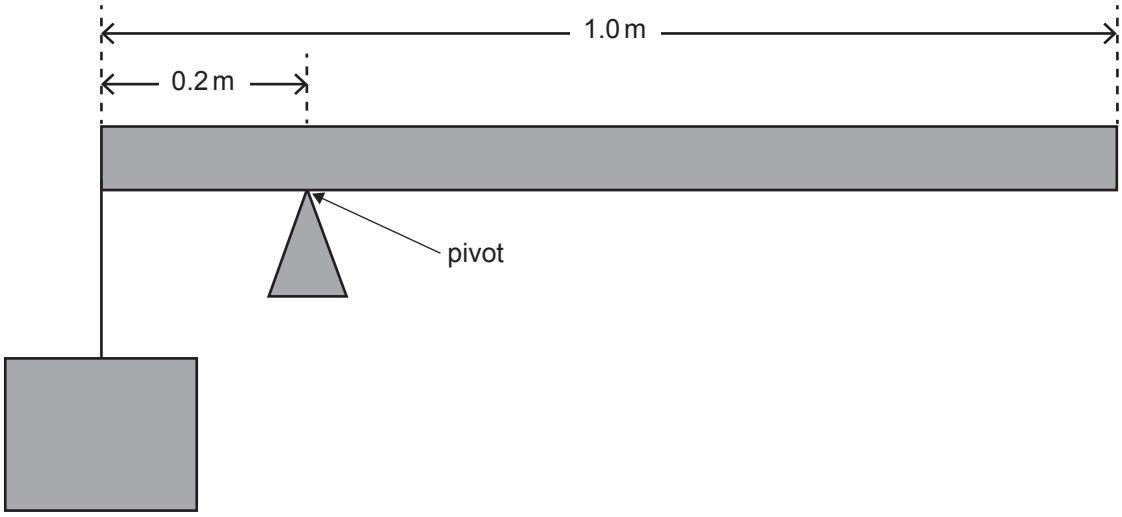


(a) Explain why the gymnast stays balanced.

_____

_____ [1]

(b) A uniform bar, of length 1.0 m, balances with a 15 N weight attached to the left hand end.



(i) On the diagram draw and label arrows to show the positions and directions of the following forces:

- the 15 N weight;
- the weight of the bar labelled W;
- the force at the pivot labelled F. [3]

(ii) Calculate the distance between the centre of gravity of the bar and the pivot.

Distance = _____ m [1]

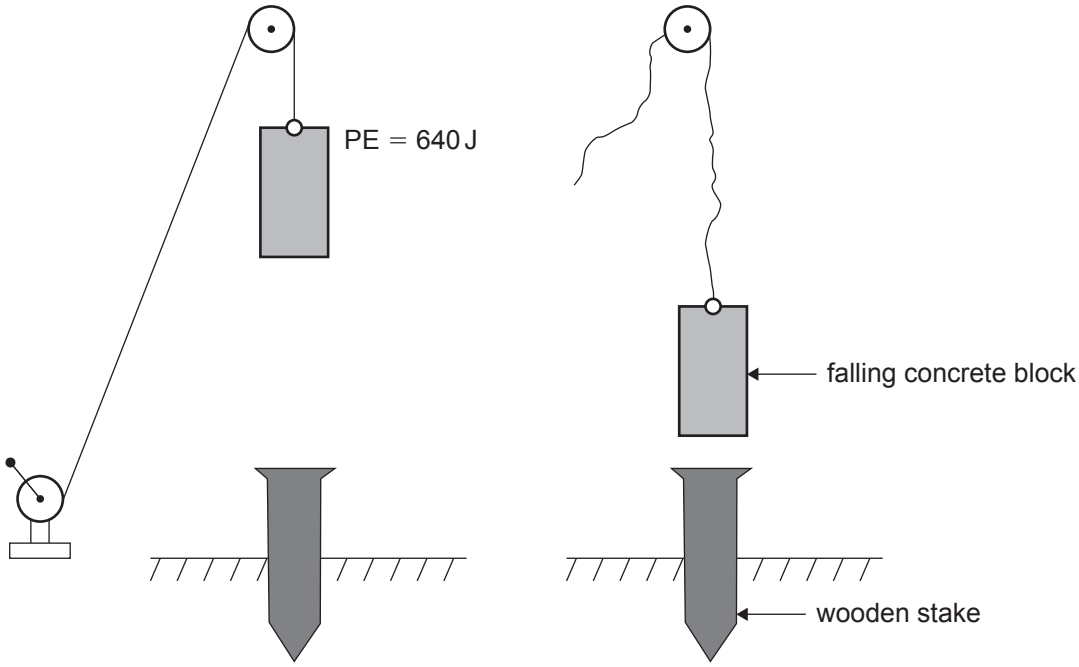
Now use the principle of moments to find the weight of the bar.

You are advised to show your working out.

Weight = _____ N [4]

[Turn over

7 A concrete block is used to drive a wooden stake into the ground.



Before being released the concrete block has 640 J of potential energy relative to the top of the wooden stake.

(i) Write down the kinetic energy of the concrete block as it hits the wooden stake.

Assume no energy losses.

Kinetic energy = _____ J [1]

(ii) The concrete block has a mass of 80 kg. Calculate the velocity of the concrete block as it hits the wooden stake.

You are advised to show your working out.

Velocity = _____ m/s [4]

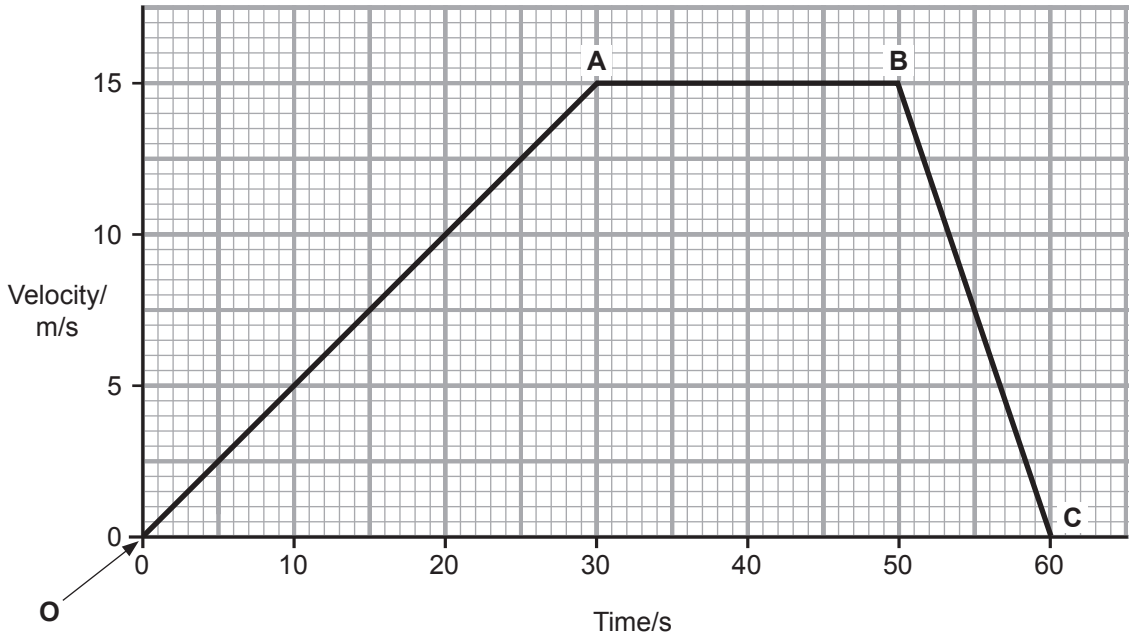
(iii) On another occasion, with a different concrete block, the momentum at impact is 510 kgm/s and the velocity is 6 m/s. Calculate the mass of this concrete block.

You are advised to show your working out.

Mass = _____ kg [3]

[Turn over

8 A bus travels in a straight line. Its velocity-time graph is shown below.



(a) Use the graph to find the distance travelled in the first 30 s of the motion.

You are advised to show your working out.

Distance travelled = _____ m [3]

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

(b) With the aid of the graph describe, in detail, the movement of the bus.

OA _____

_____

_____

_____

_____

AB _____

_____

_____

_____

_____

BC _____

_____

_____

_____

_____ [6]

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For Examiner's use only	
Question Number	Marks
1	
2	
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8	
Total Marks	

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