Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2017–2018

Double Award Science: Physics

Unit P1
Higher Tier

[GSD32]

GSD32

WEDNESDAY 23 MAY 2018, 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 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 **1** and **7**.

1 Describe the structure of the atom.

In your answer state:

- the names of the particles which make up the atom;
- where these particles are located.

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

[6]

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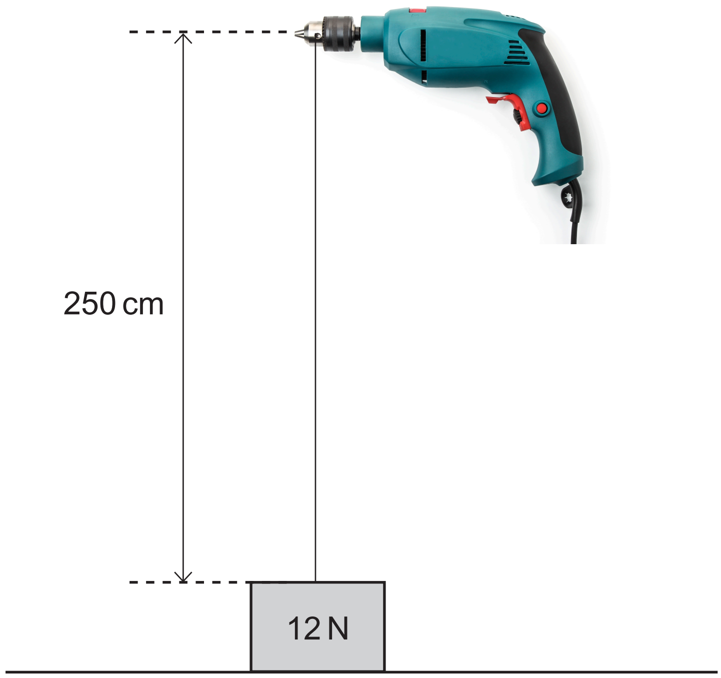
(Questions continue overleaf)

2 An electric drill is used to lift a weight of 12 N through a height of 250 cm.



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(a) **(i)** Calculate the work done.

You are advised to show your working out.

Work done = ______________ J [4]

(ii) It takes 3 seconds to raise the weight.
Calculate the power developed by the motor.
Remember to include the unit.

You are advised to show your working out.

Power developed = ______________ [4]

On another occasion the electric motor uses 3000 J of electrical energy to lift a weight. The total energy wasted is 1200 J.

(b) Calculate the efficiency of the electric drill.

You are advised to show your working out.

Efficiency = ______________ [4]

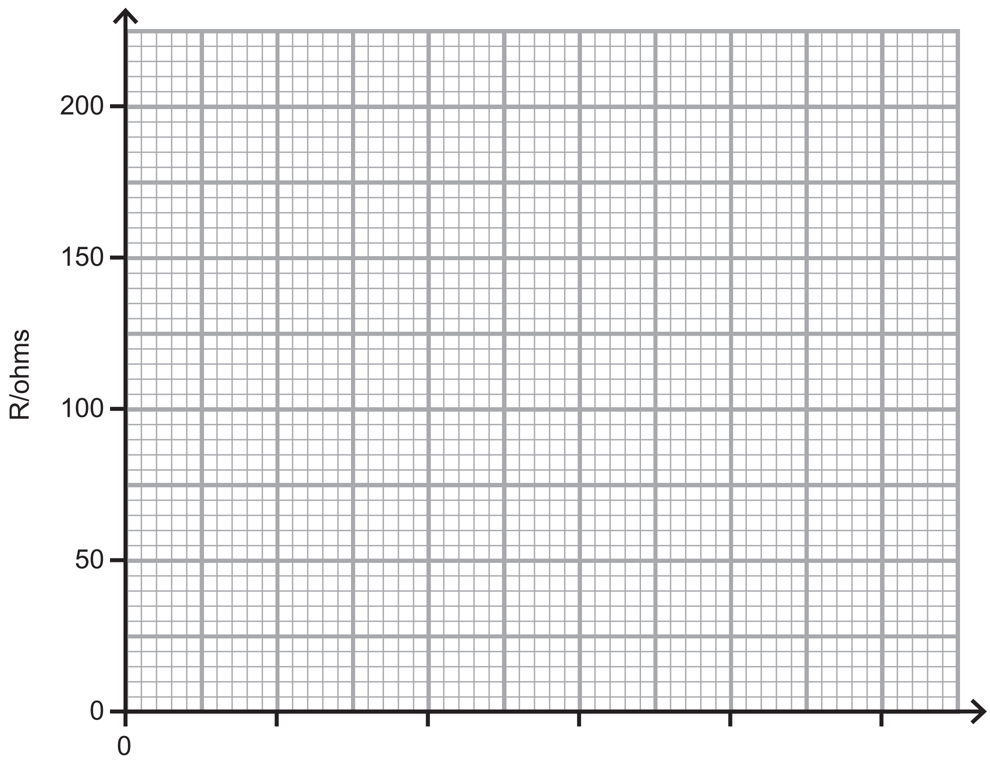
3 The electrical resistance of a piece of metal wire changes with temperature.
It is suggested that the resistance of the wire is directly proportional to its temperature in °C.
This relationship could be written in the form:

$R = kt$ **Equation 3.1**

where R is the resistance in ohms, t is the temperature in °C and k is a constant.
To test this, the resistance of the wire is found at different temperatures.

The results are recorded below.

t/°C	100	200	300	400	500
R/ohms	100	125	150	175	200



(i) Choose a scale for the horizontal axis and label it. [2]

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

(iii) Draw the line of best fit and continue the line until it cuts the vertical axis. [1]

(iv) Use the graph to find the resistance of the wire at 0 °C.

You are advised to show how you get your answer.

Resistance = ______________ ohms [2]

(v) Does your graph confirm the theory described by **Equation 3.1**?

Yes / No Circle your choice.

Explain your answer.

____ [1]

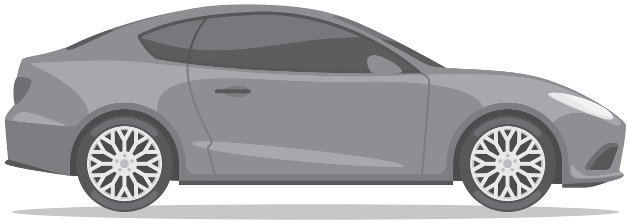
(vi) Find the gradient of your graph and include the unit.

You are advised to show your working out.

Gradient = ______________

Unit = ______________ [3]

4 The forward thrust exerted on a car by its engine is 2900 N and this results in an acceleration of 1.5 m/s^2. The car has a mass of 1500 kg.



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(a) Calculate the frictional force acting on the car.

You are advised to show your working out.

Frictional force = ______________ N [4]

At one stage in the journey the car is travelling at a constant speed of 15 m/s and then the brakes are applied. This reduces the kinetic energy of the car.

(b) (i) Calculate the amount of work done by the braking forces in bringing the car to a stop.
Remember the mass of the car is 1500 kg.
Assume no energy losses.

You are advised to show your working out.

Work done = ______________ J [3]

(ii) Express your answer to (b)(i) in kilojoules.

______________ kJ [1]

[Turn over

5 The letters A, B and C below represent three nuclei.

$$^{13}_{6}\mathrm{A} \qquad ^{14}_{6}\mathrm{B} \qquad ^{14}_{7}\mathrm{C}$$

(a) **(i)** Explain what an isotope is.

____

____ [2]

(ii) Which, if any, of the above nuclei are isotopes?

Answer: ______________________________ [1]

(b) Alpha and beta are two types of radiation emitted by radioactive materials. Complete the table below to show the properties of these radiations.

	Alpha	Beta
Charge compared with a proton		
Mass compared with a proton		$\frac{1}{1840}$

[3]

(c) The activity of a sample of wood is 1600 counts per second.
The half-life of the radioactive isotope in the wood is 10 days.

Calculate the **decrease** in activity after 30 days.

You are advised to show your working out.

Decrease in activity = ______________ counts per second [3]

6 **(i)** Where does nuclear fusion occur naturally?

_______________________________ [1]

(ii) Give one technological difficulty which must be overcome before nuclear fusion reactors can produce energy on a large scale on earth.

____ [1]

(iii) Complete the equation below for the fusion reaction.

$$^{2}_{1}H + ^{3}_{1}H \longrightarrow ^{\square}_{\square}He + ^{\square}_{\square}n$$

[4]

7 When an object moves in a circle, a force, called the centripetal force, acts towards the centre.

In your account below:

- give three variables that the centripetal force depends on;
- state how the centripetal force depends on each variable.

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

Variable 1 ____

____

How force changes as this variable **increases**. ______________________

____

____

____

Variable 2 ____

____

How force changes as this variable **increases**. ______________________

____

____

____

Variable 3 ____

____

How force changes as this variable **increases**. ______________________

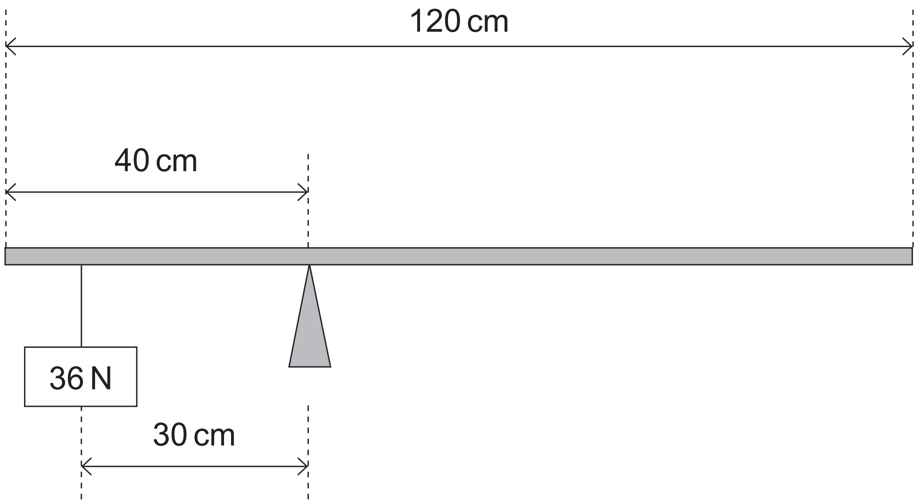
____

____

____ [6]

[Turn over

8 The uniform lever shown is balanced.



(a) (i) State the direction of the moment exerted by the 36 N load about the pivot.

_______________________________ [1]

The weight acts at the centre of gravity of the lever which is 120 cm long.

(ii) Draw an arrow on the diagram, beginning from the correct point, to represent the weight of the lever. Label this point X. [1]

(iii) State the distance between the point X and the pivot.

Distance = _____________ cm

The load of 36 N keeps the lever balanced.
Use the distance to calculate the weight of the lever.

You are advised to show your working out.

Weight = _____________ N [5]

The string holding the 36 N (3.6 kg) load snaps, the load falls and hits the ground 0.5 seconds later. Its momentum **at impact** is 16.2 kg m/s.

(b) By first finding its velocity at impact, **show that** the acceleration of the falling load is 9 m/s^2.

Velocity = ____________ m/s

[5]

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

Total Marks	

Examiner Number