Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Double Award Science: Physics

MV18

Unit P1
Foundation Tier

[GSD31]

FRIDAY 13 NOVEMBER 2015, MORNING

Time

1 hour, plus your additional time allowance.

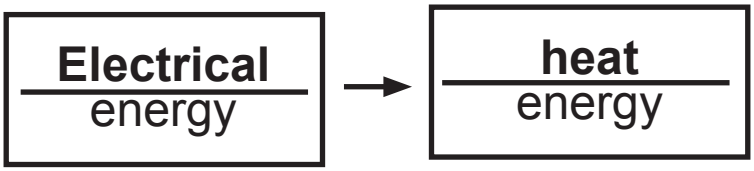
Instructions to Candidates

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 ten** questions.

Information for Candidates

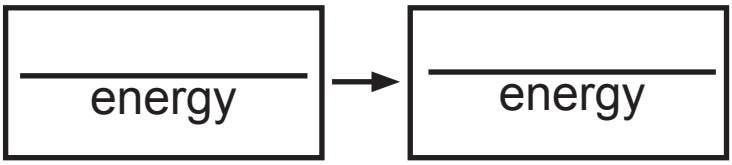
The total mark for this paper is 70.
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **9(a)**.

1 An electric heater is designed to change **electrical** energy into **heat** energy.

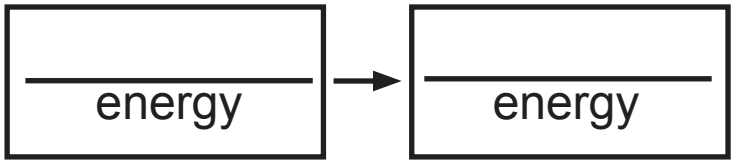


Fill in the spaces below to show the energy change each device is **designed** to bring about.

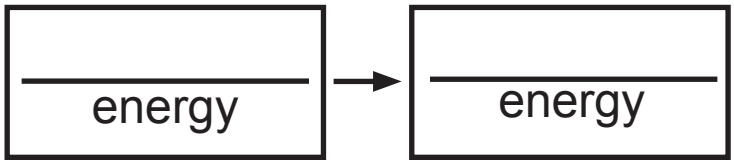
(i) Microphone [2 marks]



(ii) Bulb [2 marks]



(iii) Battery [2 marks]



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2 The list below contains examples of energy resources used in the United Kingdom to generate electricity.

Coal **Nuclear** **Oil** **Solar** **Wind**

(i) Write down two examples of **non-renewable** energy resources from the list above. [2 marks]

1. _____ 2. _____

(ii) Write down an example of a **renewable** energy resource from the list above. [1 mark]

_____

(iii) Write down a resource from the list above which does not cause air pollution. [1 mark]

_____

3 **(a)** When a lawnmower is supplied with 1200 J of chemical energy, the useful work done is 240 J.

(i) Calculate the efficiency of the lawnmower.
[3 marks]

You are advised to show your working out.

Efficiency = _____

(ii) Calculate the amount of energy wasted. [1 mark]

Energy wasted **=** _____ J

On another occasion a gardener uses an ordinary push mower. He pushes with a force of 50 N over a total distance of 120 m.

(b) Calculate the amount of work done. Give your answer in J [3 marks] and in kJ [1 mark].

You are advised to show your working out.

Work done **=** _____ J

Work done **=** _____ kJ

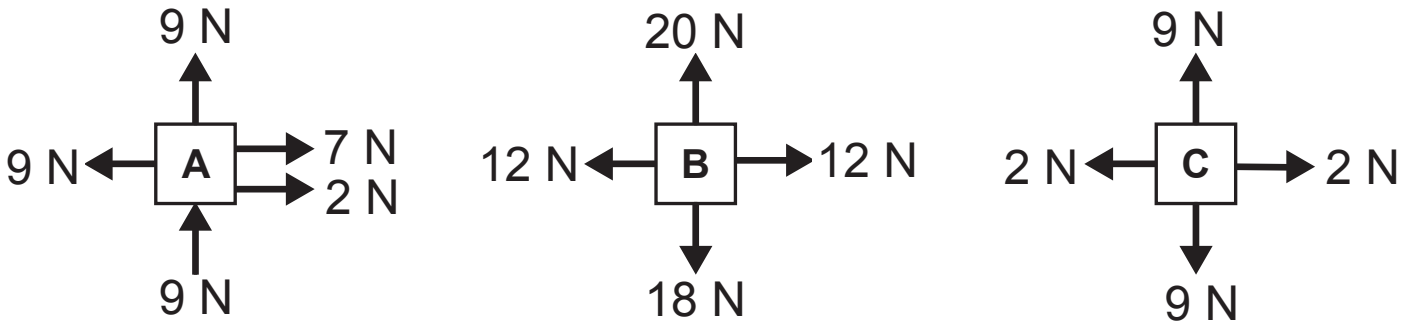
4 A cyclist can travel 4800 m in a time of 1200 s.

(a) Calculate the average speed of the cyclist. [3 marks]

You are advised to show your working out.

Average speed **=** _____ m/s

(b) The diagrams below show identical objects with different forces acting on them.



(i) Which object could be permanently at rest?
[1 mark]

Object _____

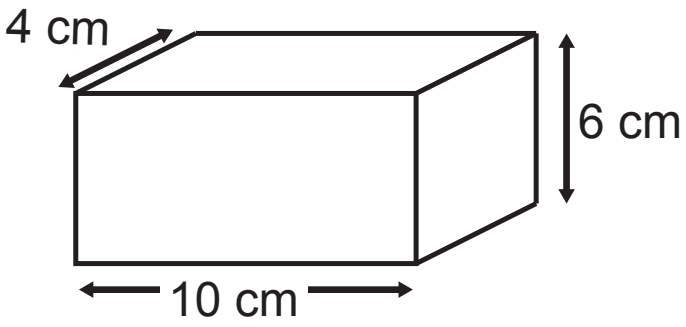
(ii) Which object has an unbalanced force of 2 N?
[1 mark]

Object _____

(iii) Which object could be moving at constant velocity?
[1 mark]

Object _____

5 The diagram shows a block of wood.



(a) (i) Calculate the volume of the block of wood.
[2 marks]

You are advised to show your working out.

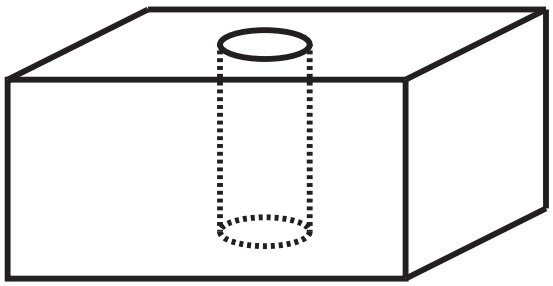
Volume of block of wood **=** _____ cm^3

(ii) The mass of the wood is 120 g.
Use your answer to **(a)(i)** to find the density of the wood. [3 marks]

You are advised to show your working out.

Density of wood **=** _____ g/cm^3

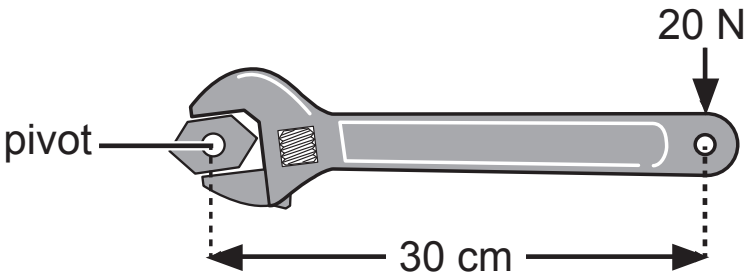
(b) A large hole is drilled through the block of wood.



Is the density of the block of wood smaller, larger or unchanged? [1 mark]
Tick (✓) the correct answer.

Smaller ☐ Larger ☐ Unchanged ☐

6 A mechanic uses a spanner, of length 30 cm, to loosen a nut.
The mechanic applies a force of 20 N vertically downwards at the end of the spanner.

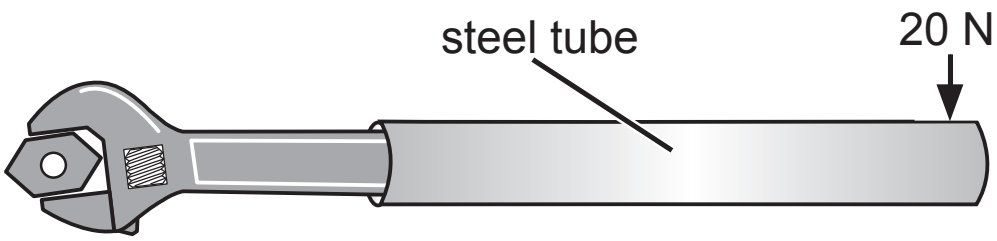


(i) Calculate the moment of the force, **in Nm**, applied to the spanner. [4 marks]

You are advised to show your working out.

Moment = _____ Nm

The nut is too difficult to turn. The mechanic attaches a long steel tube to the handle of the spanner, and then applies the same force of 20 N.



(ii) Explain fully why the mechanic has done this.
[2 marks]

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7 An electric drill does 15 000 J of work in 25 seconds.

Calculate the output power.
Include the unit for power in your answer. [4 marks]

You are advised to show your working out.

Power = _____

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

(a) (i) How many protons does a nucleus of uranium-238 contain? [1 mark]

Number of protons = _____

(ii) How many neutrons does a nucleus of uranium-238 contain? [1 mark]

Number of neutrons = _____

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

Explain fully what is meant by the words in bold.

Isotope [2 marks]

_____

_____

Radioactive [2 marks]

_____

_____

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

Calculate the half-life of this isotope. [3 marks]

You are advised to show your working out.

Half-life = _____ hours

9 **(a)** 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. [6 marks]

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.

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

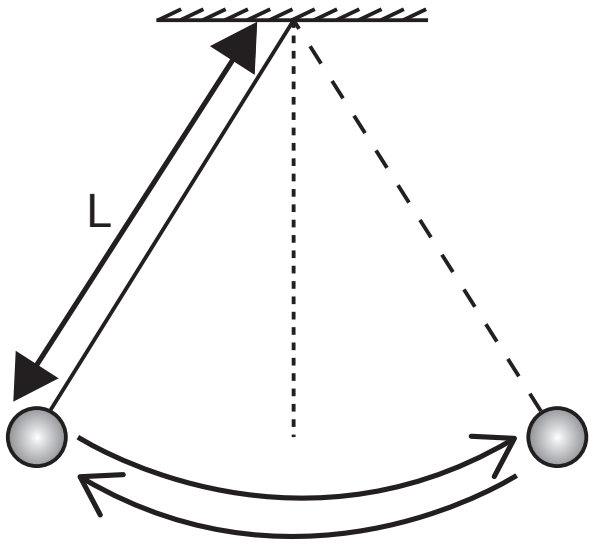
Calculate its momentum in kg m/s. [4 marks]

You are advised to show your working out.

Momentum = _____ kg m/s

10 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:

$$T^2 = kL \qquad \textbf{Equation 10.1}$$



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			

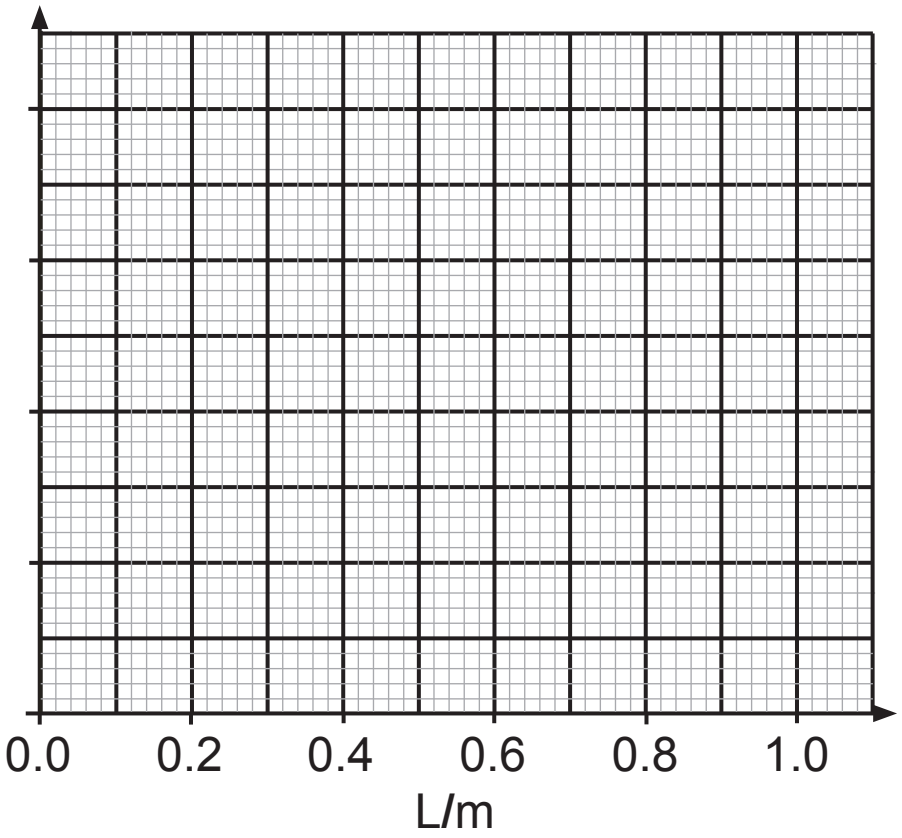
(i) Complete the table by entering the values for T^2, **to 1 decimal place**.
One has been done for you. [2 marks]

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 marks]

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

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



(v) Does your graph support the theory described by **Equation 10.1**?

Yes / No Circle your choice.

Explain your answer. [2 marks]

_____

_____

(vi) Find the value of k from your graph. [2 marks]

k = _____ s^2/m

THIS IS THE END OF THE QUESTION PAPER

Sources:

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Q3 Image of a lawnmower, © ginosphotos/ iStock/ Thinkstock
Q4 Image of a cyclist, © m-gucci/ iStock/ Thinkstock
Q6(i) Image of a spanner, © CCEA
Q6(ii) Image of spanner with steel tube, © CCEA
Q7 Image of an electric drill, © Grzegorz Petryowski/ iStock/ Thinkstock

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Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	