OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL GCSE

PHYSICS

Paper 1

Tuesday 9 November 2021 07:00 GMT Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a pencil and a ruler
- a scientific calculator
- the Physics Equations Sheet (enclosed).

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you worked out your answer.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

Information

- The maximum mark for this paper is 90.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.

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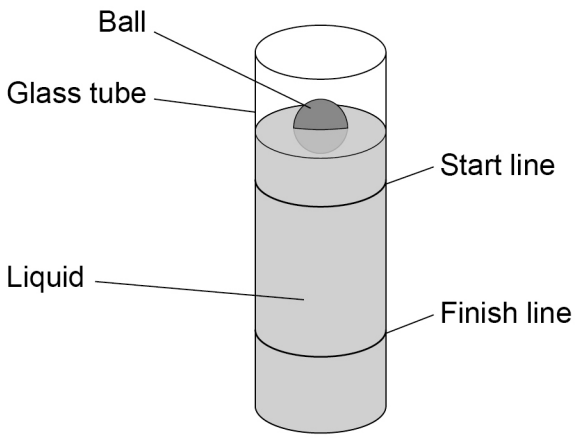
Answer **all** questions in the spaces provided.

0 1 A student investigated the time taken for a ball to fall through different liquids.

Figure 1 shows some of the equipment the student used.

Figure 1



The student released the ball at the top of the liquid. The student measured the time taken for the ball to fall between the start line and the finish line.

0 1 . 1 Name the piece of equipment the student should have used to measure the time taken.

[1 mark]

0 1 . 2 Which type of variable is the time taken?

[1 mark]

Tick (✓) **one** box.

Categoric ☐

Dependent ☐

Independent ☐

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0 1 . 3 Give **two** control variables for this investigation.

[2 marks]

1 _____

_____

2 _____

_____

Question 1 continues on the next page

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Table 1 shows the results of the investigation.

Table 1

Liquid	Time taken for the ball to fall in seconds			
	Test 1	**Test 2**	**Test 3**	**Mean**
Oil	2.3	2.4	2.0	2.2
Honey	3.2	3.7	**X**	3.4
Water	1.6	1.5	1.4	1.5

0 1 . 4 Calculate value **X** in **Table 1**.

[2 marks]

X = _____

0 1 . 5 What is the most appropriate way to show the results of this investigation?

[2 marks]

Tick (✓) **one** box.

Bar chart ☐

Line graph ☐

Pie chart ☐

Scatter graph ☐

Give a reason for your answer.

_____

_____

8

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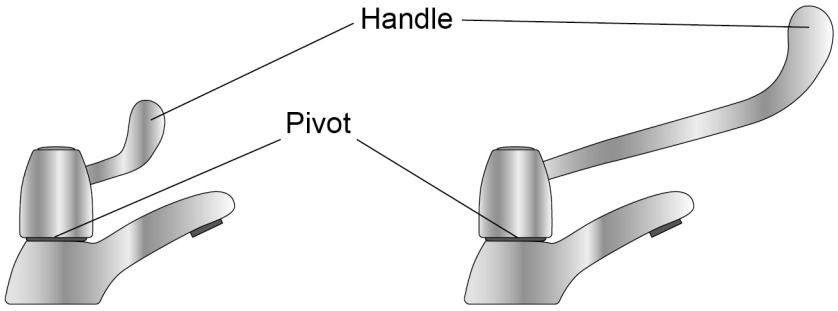
0 2 **Figure 2** shows two taps, with handles of different lengths.

Figure 2



Tap A **Tap B**

0 2 . 1 A force of 15 N was applied to the handle of **tap A**.

The force was applied at a perpendicular distance of 0.050 m from the pivot.

Calculate the moment of the force about the pivot.

Use the Physics Equations Sheet.

[2 marks]

Moment = _____ N m

0 2 . 2 The moment needed to turn on **tap A** and **tap B** is the same.

Tap B has a longer handle.

Explain why it is easier to turn on **tap B**.

[2 marks]

Question 2 continues on the next page

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Sensor taps turn the water on without a person needing to touch the tap.

Using a sensor tap reduces the amount of water used each day by 40%.

0 2 . 3 A family uses a volume of 340 litres of water from a tap with a handle each day.

The family replaced the tap with a sensor tap.

Calculate the decrease in volume of water used by the family each day.

[2 marks]

Decrease in volume of water = _____ litres

0 2 . 4 Suggest **one other** advantage of using a sensor tap rather than a tap with a handle.

[1 mark]

7

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0 3 The stopping distance of a car depends on the thinking distance and the braking distance.

0 3 . 1 What is the thinking distance?

[1 mark]

Tick (✓) **one** box.

- The distance travelled from when the brakes are applied until the car stops. ☐
- The distance travelled from when the driver sees a hazard until the brakes are applied. ☐
- The distance travelled from when the driver sees a hazard until the car stops. ☐

0 3 . 2 Give **two** factors that affect the thinking distance.

[2 marks]

1 _____

_____

2 _____

_____

Question 3 continues on the next page

Car tyres become worn as they are used.

A worn tyre has a smaller depth of tread.

Figure 3 shows three tyres with different depths of tread.

Figure 3

6 mm depth of tread

4 mm depth of tread

2 mm depth of tread

Scientists measured the stopping distance for a car with tyres of different depths of tread.

The car travelled at the same speed each time on a wet road.

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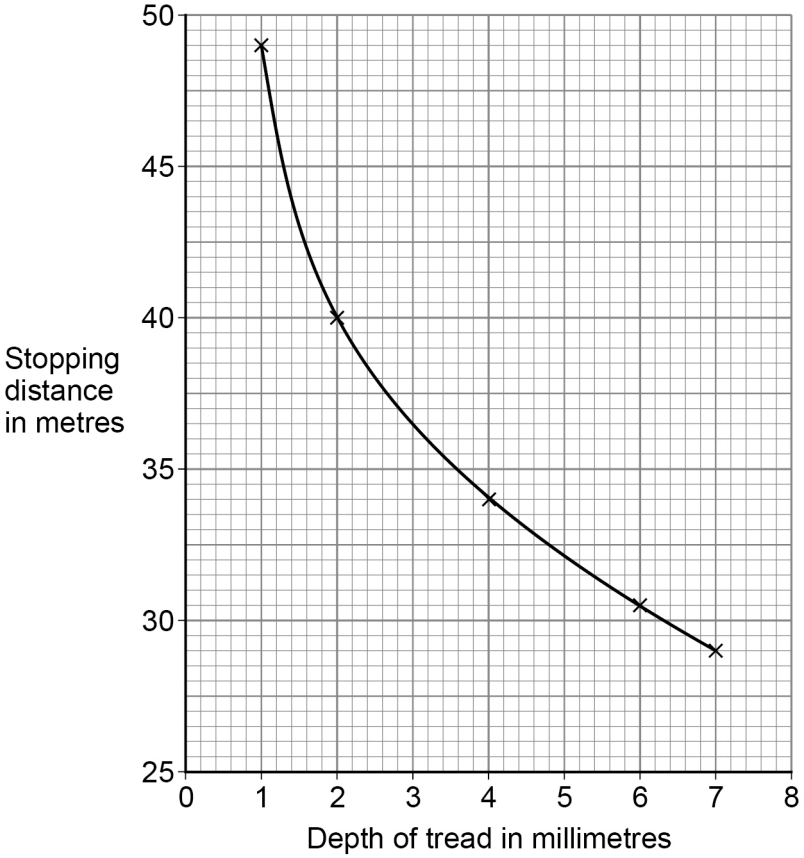
Figure 4 shows how the depth of tread on the tyres affects the stopping distance on a wet road.

Figure 4



0 3 . 3 What would the stopping distance of the car be if the tyres had a depth of tread of 5.0 mm?

Use **Figure 4**.

[1 mark]

Stopping distance = _____ m

0 3 . 4 Describe the relationship between the depth of tread and the stopping distance of the car.

[1 mark]

_____

_____

Question 3 continues on the next page

Do not write outside the box

0 3 . 5 The brakes apply a mean force of 2500 N to stop the car.

The work done to stop the car is 90 000 J.

Calculate the braking distance of the car.

Use the Physics Equations Sheet.

[3 marks]

Braking distance = _____ m

0 3 . 6 Explain why the temperature of the brakes increases during braking.

[3 marks]

11

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Turn over for the next question

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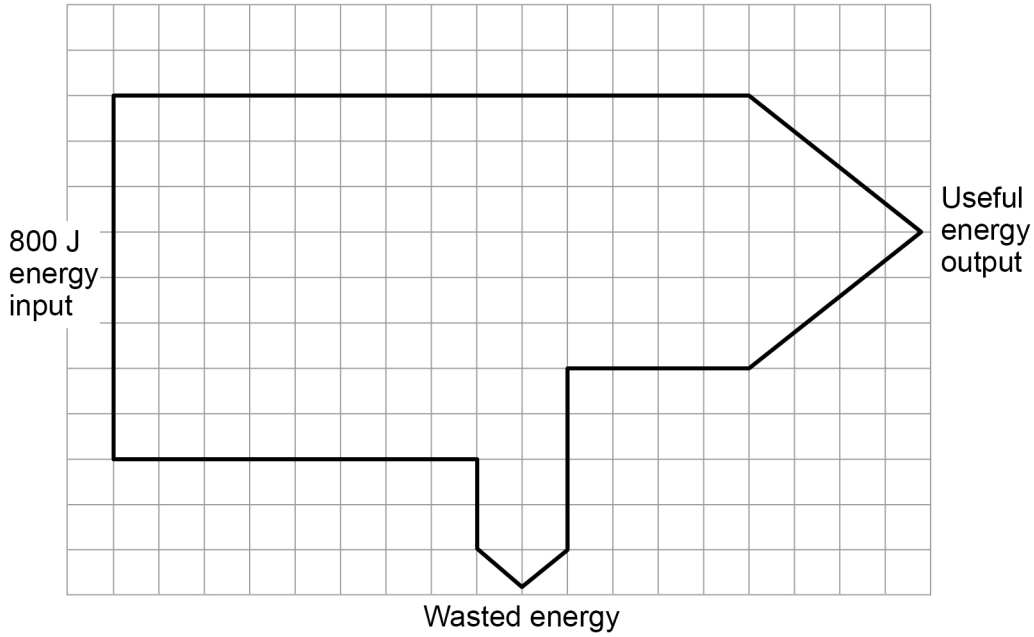
ANSWER IN THE SPACES PROVIDED

0 4 **Figure 5** shows a Sankey diagram for a battery-operated fan.

Figure 5



0 4 . 1 Determine the useful energy output of the fan.

[1 mark]

Useful energy output = _____ J

0 4 . 2 Determine the efficiency of the fan.

Use **Figure 5** and your answer from Question **04.1**.

Use the Physics Equations Sheet.

[2 marks]

Efficiency = _____

Do not write outside the box

0 4 . 3 What happens to the energy wasted by the fan?

[1 mark]

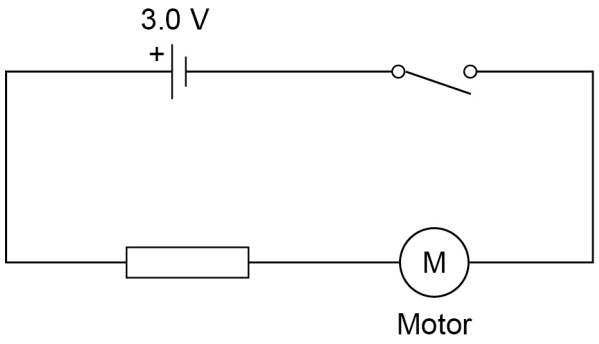
Question 4 continues on the next page

Do not write outside the box

The fan contains a resistor and a motor.

Figure 6 shows a circuit diagram for the fan.

Figure 6



The resistance of the resistor is 40 Ω.

The resistance of the motor is 20 Ω.

0 4 . 4 What is the total resistance of the circuit in **Figure 6**?

[1 mark]

Tick (✓) **one** box.

20 Ω ☐ 40 Ω ☐ 60 Ω ☐ 800 Ω ☐

0 4 . 5 Determine the current in the circuit when the switch is closed.

Use **Figure 6** and your answer from Question **04.4**.

Use the Physics Equations Sheet.

[3 marks]

Current = _____ A

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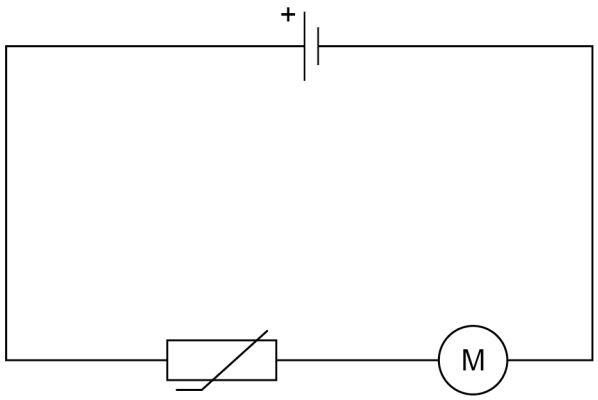
0 4 . 6 A different fan has a thermistor connected in series with a motor.

Figure 7 shows the circuit diagram for this fan.

Figure 7



Explain the effect of increasing the temperature of the thermistor on the speed of the motor.

[3 marks]

11

Turn over for the next question

0 5 A student carried out an investigation to determine the refractive index of glass.

The student measured the angle of incidence (i) and the angle of refraction (r).

Table 2 shows the results.

Table 2

Angle of incidence in degrees	Angle of refraction in degrees
10	7
20	14
30	20
40	26
50	32
60	37
70	40
80	43

Do not write outside the box

0 5 . 1 Describe how a student could take measurements to obtain the results in **Table 2**.

You should include a labelled diagram in your answer.

[6 marks]

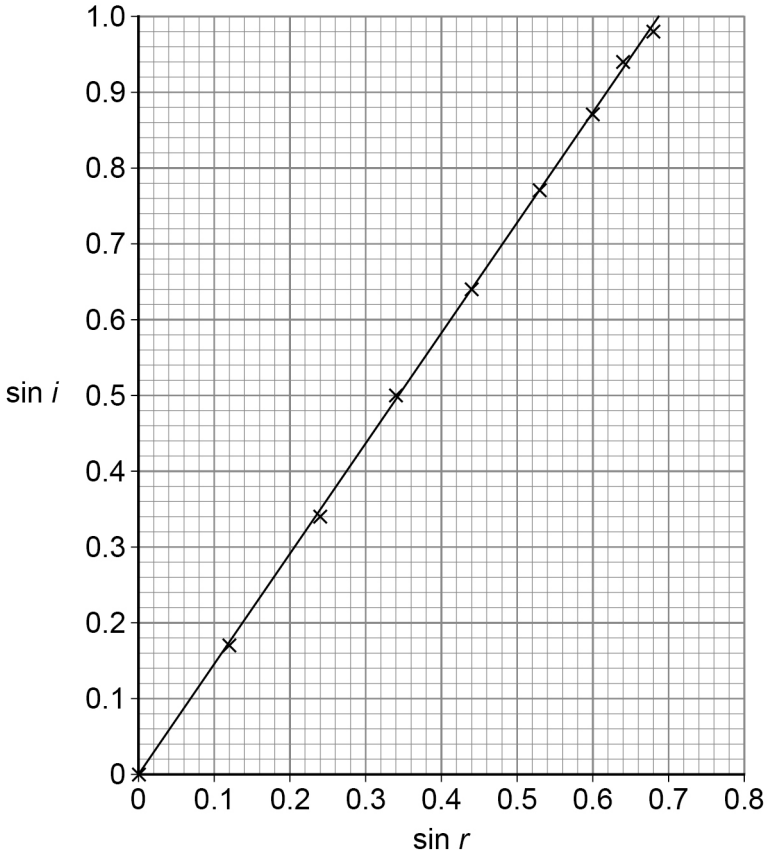
Question 5 continues on the next page

0 5 . 2 The student calculated the sine of each angle given in **Table 2**.

The student plotted a graph of sin *i* against sin *r*.

Figure 8 shows the results.

Figure 8



The gradient of the graph gives the refractive index of the glass.

Determine the refractive index of the glass.

Give your answer to 2 significant figures.

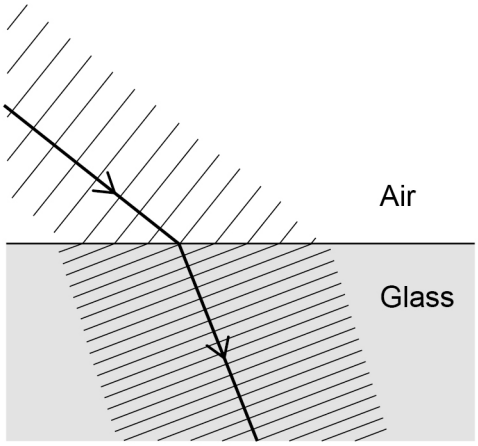
[3 marks]

Refractive index (2 significant figures) = _____

0 5 . 3 A ray of light passes from air into glass.

Figure 9 shows a wavefront diagram for the light.

Figure 9



Explain why the light refracts as it passes from air into glass.

You should refer to wavefronts in your answer.

[3 marks]

12

Turn over for the next question

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0 6 Radioactive isotopes are produced during the nuclear fission of uranium-235.

0 6 . 1 Describe the process of nuclear fission.

[3 marks]

0 6 . 2 The radioactive isotope promethium-147 undergoes beta decay.

Describe what happens in a nucleus during beta decay.

[2 marks]

0 6 . 3 When promethium-147 (Pm) emits beta particles it decays into samarium (Sm).

Complete the nuclear equation for the beta decay of promethium-147.

[2 marks]

$$^{147}_{61}\mathrm{Pm} \rightarrow \underline{\quad}^{\underline{\quad}}\mathrm{Sm} + \underline{\quad}^{\underline{\quad}}\beta$$

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Fire exit signs are used to show the way out of a building in an emergency.

Promethium-147 may be mixed into paint used in fire exit signs.

0 6 . 4 The initial count-rate of the promethium-147 used in a fire exit sign is 360 counts per second.

half-life of promethium-147 = 2.6 years

Calculate the count-rate of the promethium-147 after 7.8 years.

[3 marks]

Count-rate = _____ counts per second

0 6 . 5 The beta particles released by the promethium-147 cause other chemicals in the paint to emit light.

Suggest **one** advantage and **one** disadvantage of using promethium-147 in fire exit signs.

[2 marks]

Advantage _____

Disadvantage _____

12

Turn over for the next question

0 7 **Figure 10** shows a robot vacuum cleaner, used to clean floors.

The robot vacuum cleaner contains an electric motor.

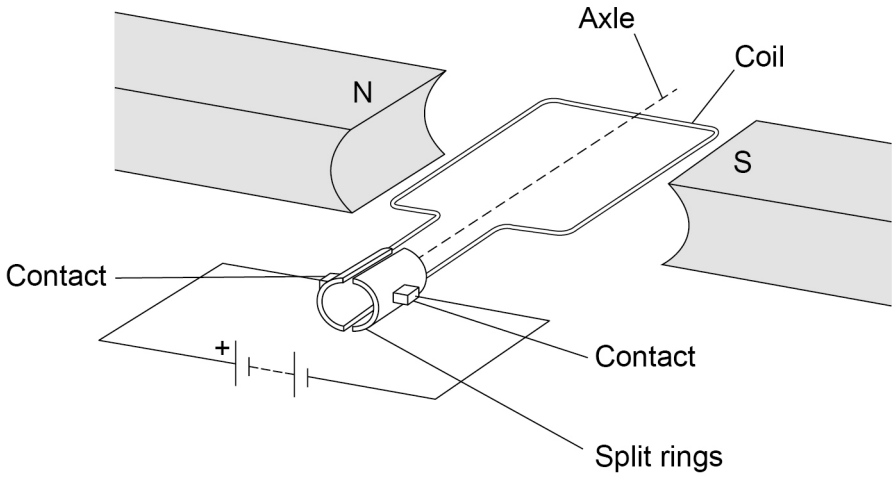
The electric motor moves the wheels of the robot vacuum cleaner so that it can move.

Figure 10

Do not write outside the box

0 7 . 1 **Figure 11** shows a simplified diagram of the electric motor.

Figure 11



Explain why the coil rotates continuously when there is a current in the coil.

[4 marks]

0 7 . 2 Explain how the speed at which the coil in the robot vacuum cleaner rotates can be increased.

[2 marks]

Question 7 continues on the next page

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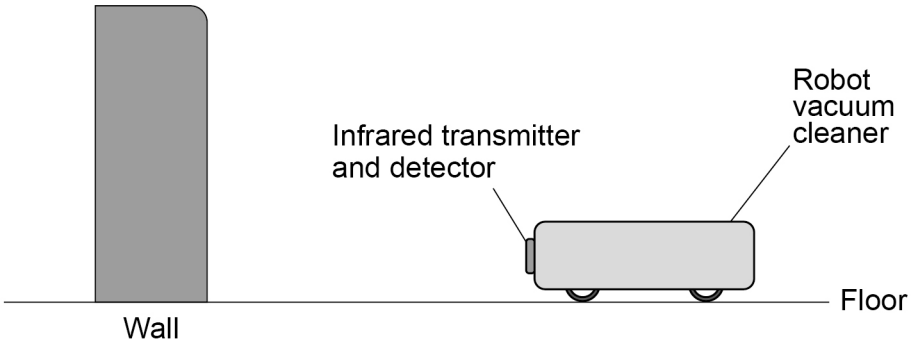
0 7 . 3 **Figure 12** shows the robot vacuum cleaner approaching a wall.

The robot vacuum cleaner uses infrared radiation to determine its distance from the wall.

The infrared radiation is reflected from the wall.

Figure 12



The time between the infrared wave being emitted by the transmitter and being received by the detector is 1.5×10^{-9} s.

speed of infrared wave = 3.0×10^{8} m/s

Calculate the distance between the robot vacuum cleaner and the wall.

Give your answer in mm.

Use the Physics Equations Sheet.

[4 marks]

Distance to the wall = _____ mm

10

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 8 **Figure 13** shows two electric kettles with different casings.

Figure 13

Kettle with plastic casing

Kettle with metal casing

0 8 . 1 A fuse is used as a safety device inside the plug of each kettle.

Explain how the fuse prevents the kettle becoming damaged if there is a fault.

[3 marks]

0 8 . 2 A circuit breaker is another type of safety device.

Give **two** advantages of using a circuit breaker rather than a fuse.

[2 marks]

1

2

Do not write outside the box

0 8 . 3 Explain why the kettle with the plastic casing does **not** need an earth wire.

[2 marks]

0 8 . 4 Water in an electric kettle is heated by a heating element.

Explain why the heating element is positioned at the bottom of an electric kettle.

[3 marks]

Question 8 continues on the next page

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0 8 . 5 A heating element in a kettle is connected to a 230 V supply. The current in the heating element is 11 A.

The kettle contains 1.2 kg of water at a temperature of 20 °C.

It takes 180 s to increase the temperature of the water to 100 °C.

specific heat capacity of water = 4200 J / kg °C

Calculate the energy wasted by the kettle when heating the water.

Use the Physics Equations Sheet.

[6 marks]

Energy wasted = _____ J

Do not write outside the box

0 8 . 6 Some hot water is poured from the kettle into a cup.

Explain why evaporation causes the temperature of the water in the cup to decrease.

[3 marks]

19

END OF QUESTIONS

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Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

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