Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

3430U30-1

S17-3430U30-1

SCIENCE (Double Award)

Unit 3: PHYSICS 1
FOUNDATION TIER

MONDAY, 19 JUNE 2017 – MORNING

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**8**	
3.	**12**	
4.	**8**	
5.	**9**	
6.	**15**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this examination paper, you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space use the continuation page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question **5***(a)* is a quality of extended response (QER) question where your writing skills will be assessed.

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Equations

current = $\frac{\text{voltage}}{\text{resistance}}$	$I = \frac{V}{R}$
total resistance in a series circuit	$R = R_1 + R_2$
energy transferred = power × time	$E = Pt$
power = voltage × current	$P = VI$
% efficiency = $\frac{\text{energy [or power] usefully transferred}}{\text{total energy [or power] supplied}} \times 100$	
density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$
units used (kWh) = power (kW) × time (h) cost = units used × cost per unit	
wave speed = wavelength × frequency	$v = \lambda f$
speed = $\frac{\text{distance}}{\text{time}}$	

SI multipliers

Prefix	Multiplier
m	1×10^{-3}
k	1×10^{3}
M	1×10^{6}

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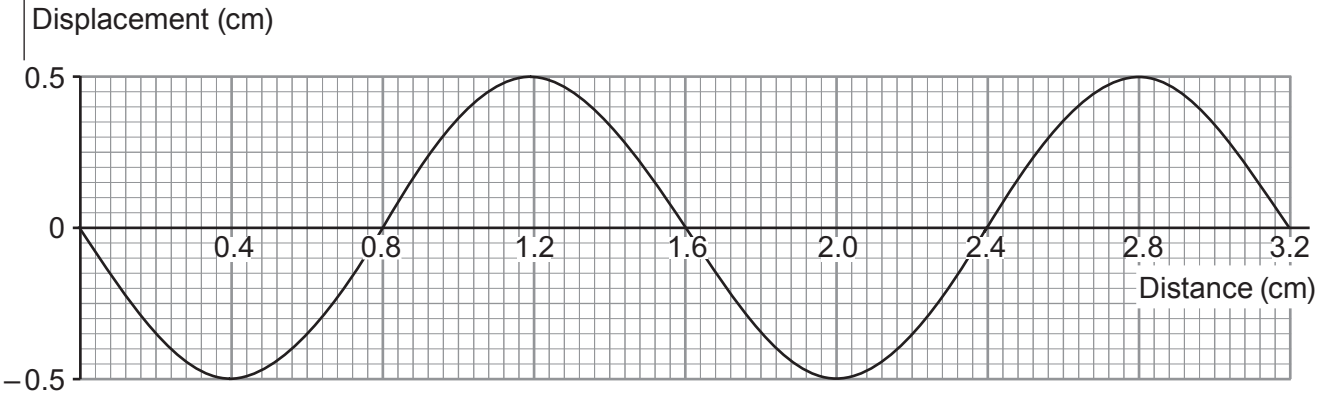
Answer **all** *questions.*

1. A teacher demonstrates water waves in a ripple tank. The diagram represents the waves.



(a) (i) State the wavelength of the wave. ..... cm [1]

(ii) State the amplitude of the wave. ..... cm [1]

(b) It is observed that 10 waves pass a point in the tank in 2 s.

(i) Underline the correct value for the frequency of the waves.

2 Hz 5 Hz 10 Hz 20 Hz [1]

(ii) Select an equation from page 2 and use it to calculate the wave speed. [3]

Wave speed = ... cm / s

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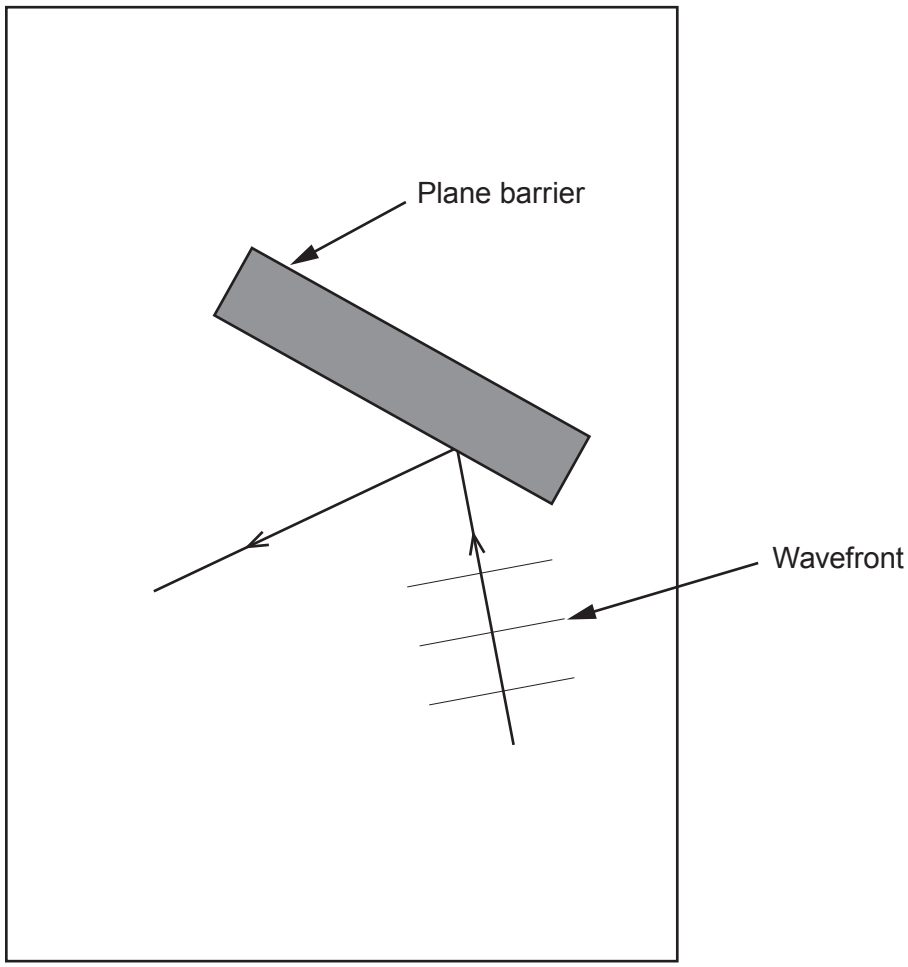
(c) The waves are made to reflect off a plane barrier. **Complete the diagram** to show the reflected wavefronts. [2]



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2. Electromagnetic (em) waves are widely used in a variety of ways. Satellites rely on microwaves to communicate with Earth as the microwaves penetrate through the upper layers of our atmosphere. Infra-red waves have a higher frequency than microwaves and are used widely in communications. X-rays and gamma rays are ionising radiation and are both used in medicine; gamma rays can be used in cancer treatment, shrinking tumours. Radio waves are used to transmit TV and radio signals.

(a) The diagram shows an incomplete em spectrum. **Complete the diagram** to show the em spectrum in order. [2]

Radio waves	.....	.....	Visible light	UV light	.....	Gamma rays

(b) All em waves are transverse. Describe what is meant by a transverse wave. [2]

.....

.....

.....

(c) Tick (✓) the boxes alongside the **two** correct statements about em waves below. [2]

Only radio waves and microwaves transmit information ☐

All em waves travel at the same speed in a vacuum ☐

All em waves are a form of radiation ☐

All em waves have the same frequency ☐

Radio waves have the smallest wavelength ☐

(d) A student suggests that radio waves are just as harmful to humans as gamma rays. Explain whether or not you agree with this statement. [2]

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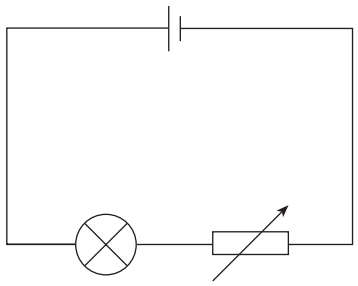
3. *(a)* Students are investigating the current-voltage characteristic of a filament lamp. An incomplete diagram of their circuit is shown below.



(i) **Add to the diagram** a correctly connected ammeter and voltmeter. [2]

(ii) Describe how the circuit is used to obtain a series of measurements of current and voltage. [3]

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(b) The following data were collected using the circuit.

Voltage (V)	Current (A)
0.0	0.00
2.0	0.46
4.0	0.76
6.0	0.94
8.0	1.02
10.0	1.06
12.0	1.08

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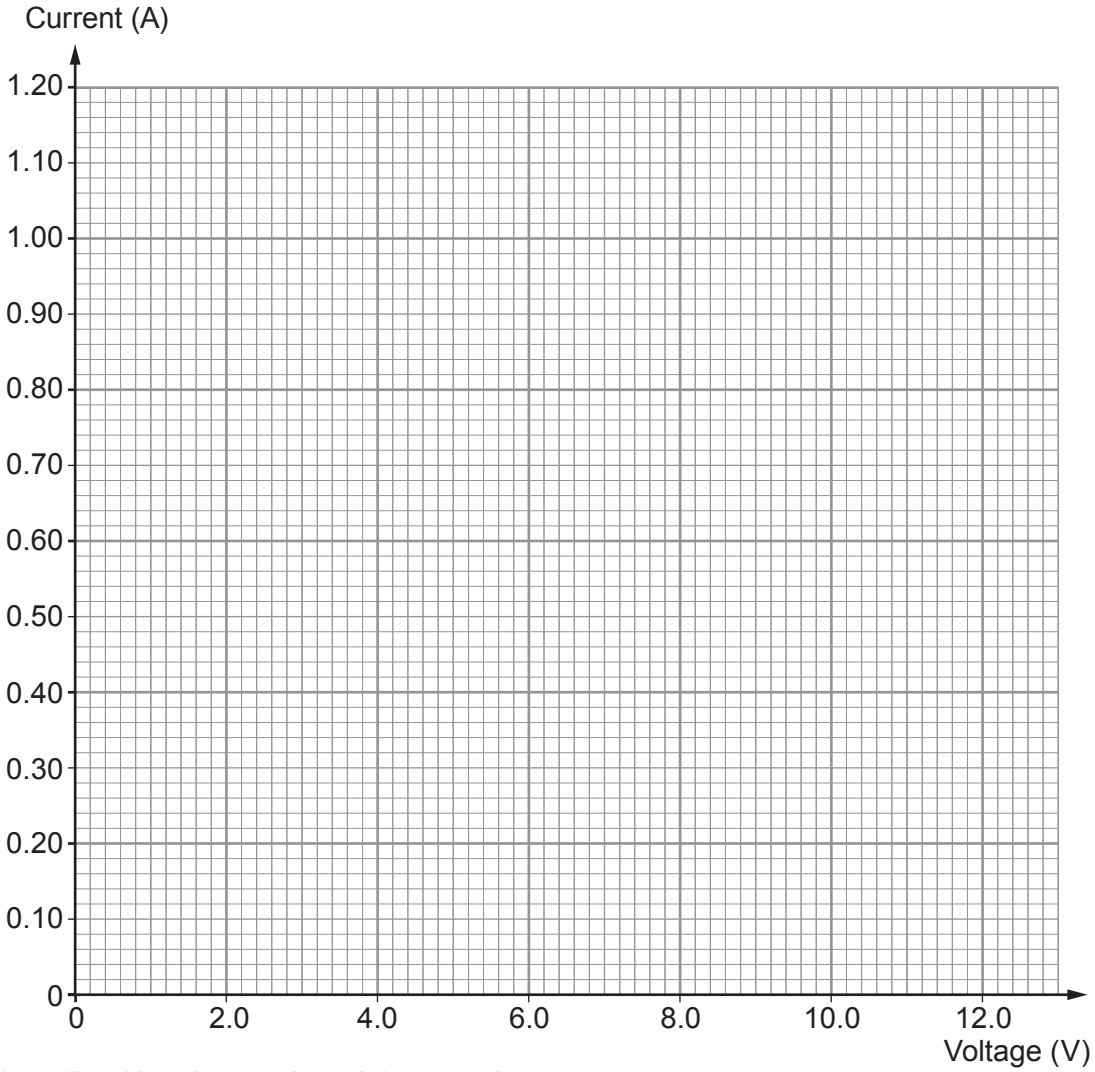
Plot the data on the grid below and draw a suitable line. [3]



(c) (i) Use the graph and the equation:

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

to calculate the resistance of the lamp when the voltage across it is 3 V. [2]

Resistance = ... Ω

(ii) The students conclude that the **resistance** of the lamp increases as voltage increases. Explain how the data support this conclusion. [2]

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4. The UK relies on a continuous supply of electricity which is provided by a variety of different power stations. Electricity can be generated in power stations and transmitted to users through the National Grid.

One concern with electricity production is the amount of greenhouse gases produced. Increased levels of these gases in our atmosphere is leading to climate change. Renewable energy resources produce less greenhouse gases but are not able to provide a constant supply of electricity.

(a) (i) **Draw a line** from each method of electricity generation on the left to the most likely disadvantage on the right. [2]

Method of generating electricity	**Disadvantage**
Nuclear power station	High CO_2 emissions
Wind farm	High decommissioning cost
Coal-fired power station	Unreliable

(ii) The energy input to a nuclear power station is 20 MJ and its efficiency is 40%. The energy input to a coal-fired power station is 20 MJ and its useful output energy is 8 MJ.
A student suggests that the nuclear power station is more efficient than the coal-fired power station as it wastes less energy. Explain whether or not you agree with this conclusion. (You may wish to use an equation from page 2.) [2]

Space for calculations

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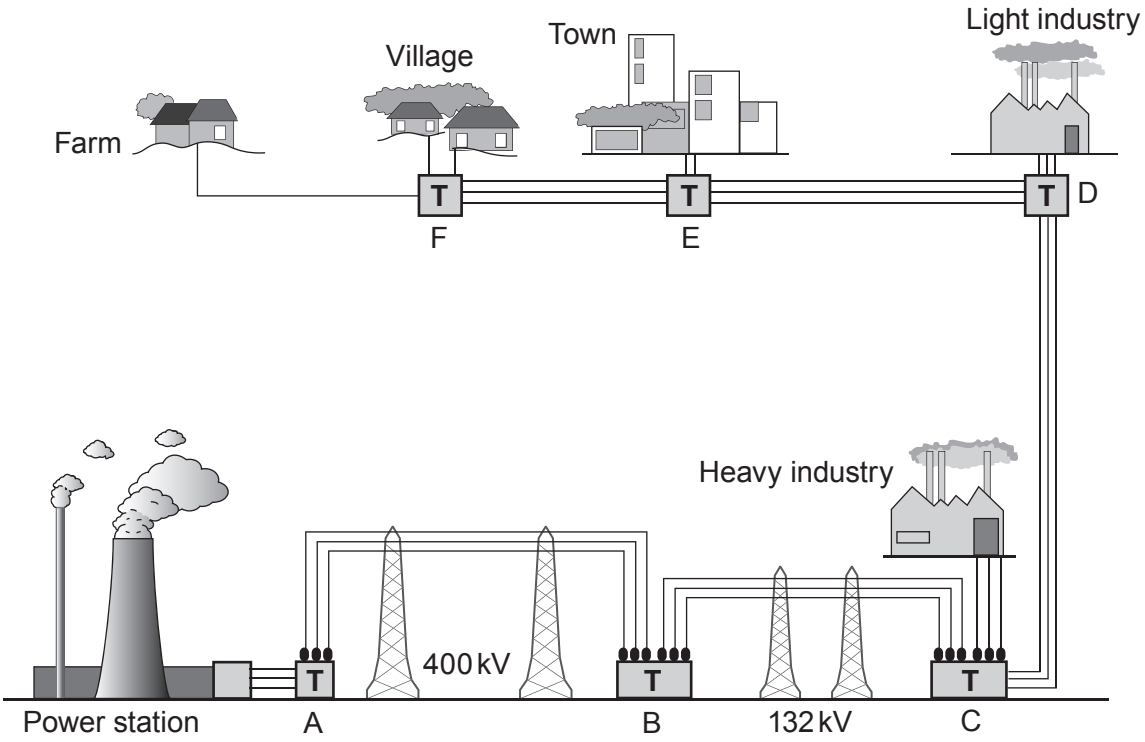
(b) The diagram shows a part of the National Grid.

Key

T – transformer



(i) State **one** advantage of the National Grid. [1]

.....

.....

(ii) Which of the transformers A, B, C, D, E or F is a step-up transformer? ..... [1]

(iii) Explain why step-up transformers are used in the National Grid. [2]

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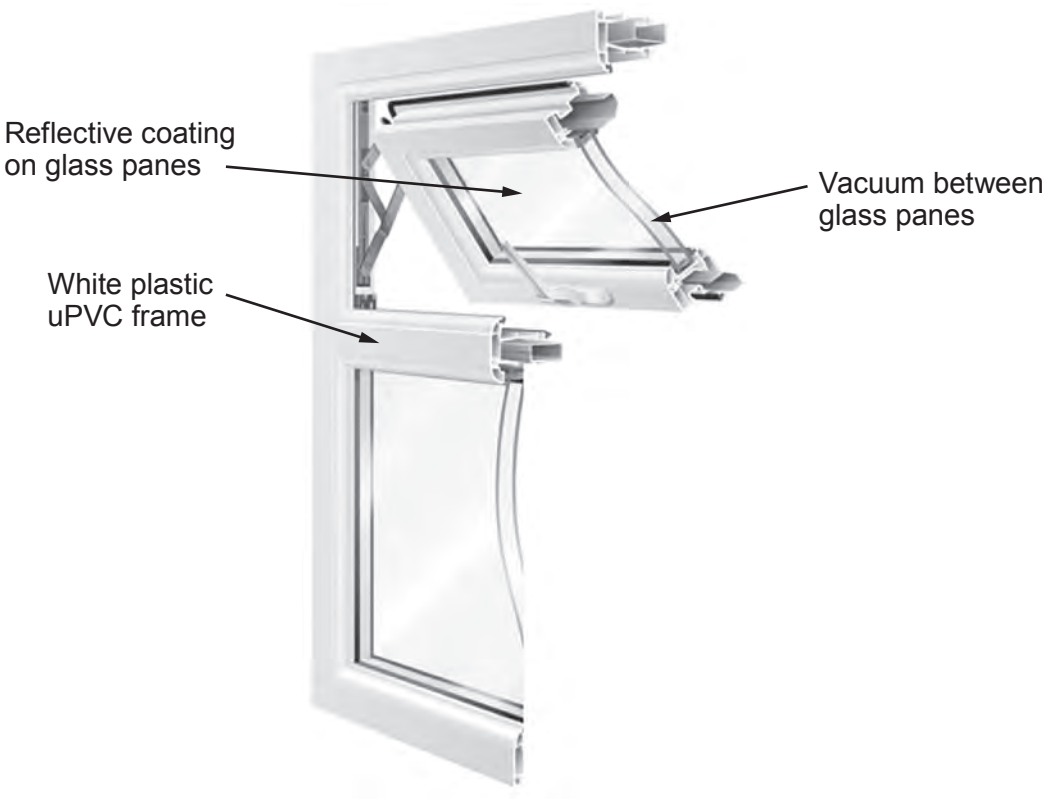
5. *(a)* A householder decides to replace his single glazed, aluminium framed windows. A company recommends fitting 'Energy Windows' like the one shown below.



Explain in terms of conduction, convection and radiation how the labelled features will help to reduce energy losses from the house. [6 QER]

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(b) A family fits double glazing to their house at a cost of £4 000. They save £80 per year on their heating bill.

(i) Calculate the payback time. [1]

Payback time = ... years

(ii) Suggest **two** reasons why this payback time may change. [2]

1. .....

2. .....

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6. The Energy Saving Trust aims to help everyone save energy every day in order to reduce the environmental damage that energy production does to the environment. It provides advice to households and businesses and gives tips for energy savings such as not leaving appliances on standby and choosing the most energy efficient appliances.

The efficiency of washing machines depends on how they are used as they can wash clothes at a variety of temperatures. Many clothes retailers and washing detergent manufacturers recommend washing clothes at 30°C in order to be more energy efficient. According to the Energy Saving Trust *"Washing clothes at 30°C rather than at higher temperatures uses around 40% less energy."*

The table below gives data for different washing temperatures for a particular washing machine.

Washing temperature (°C)	Mean power (W)	Wash time (minutes)
30	500	60
40	500	90
50	500	120

(a) (i) Use equations from page 2 to calculate the cost of washing clothes at 40°C. The cost of one unit of electricity is 16 p. [4]

Cost = ... p

(ii) The Energy Saving Trust suggests that washing clothes at 30°C reduces energy use by at least 40% compared to washing at higher temperatures. Use the data in the table to investigate the validity of this claim. [3]

Space for calculations

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(iii) Washing clothes at 30°C saves money on household bills. Explain why reducing energy consumption also helps the environment. [2]

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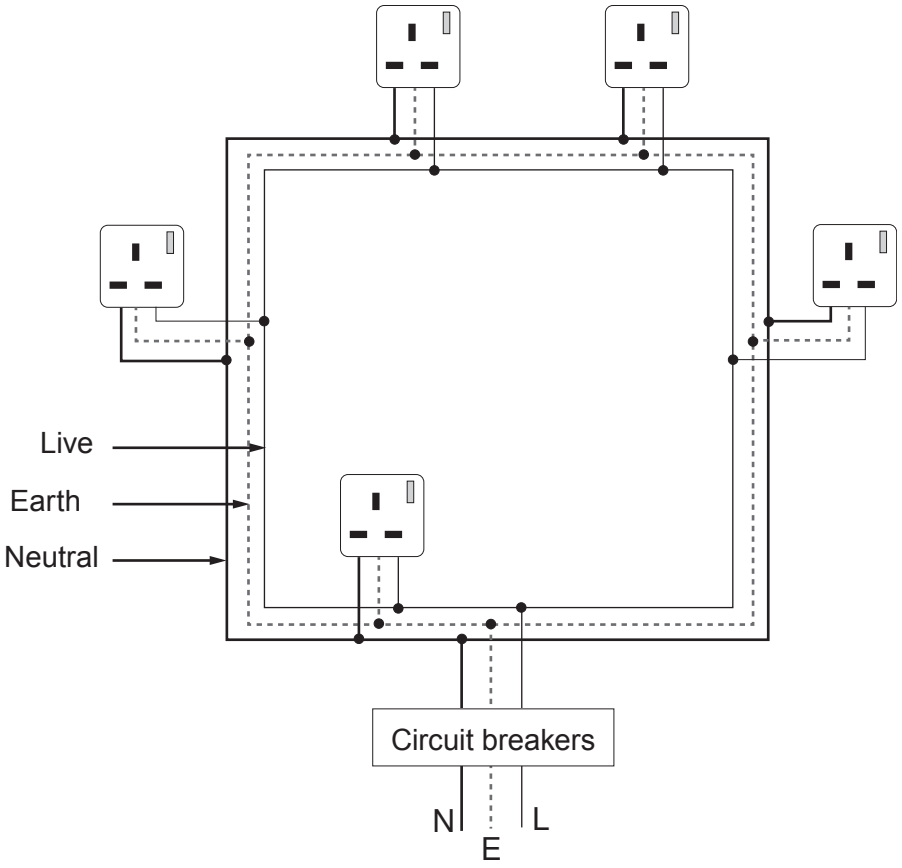
(b) The washing machine is connected to the ring main shown below. The voltage in the ring main is 230 V.



(i) State which wire the fuse must be connected to. [1]

.....

(ii) Describe the function of the earth wire. [2]

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TURN OVER FOR THE LAST PART OF THE QUESTION.

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(c) When the voltage is 230 V, the mean power of the washing machine during a wash is 500 W. However when heating the water it must be able to produce a maximum power of 2400 W. The householder has 3 A, 5 A and 13 A fuses available and chooses to fit a 3 A fuse into the plug. Investigate whether or not this is a suitable choice. [3]

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END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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