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|---------------|---------------|------------------|
| Surname       | Centre Number | Candidate Number |
| First name(s) |               | 0                |



**GCSE**

**3430U30-1**



S25-3430U30-1

**MONDAY, 16 JUNE 2025 – MORNING**

**SCIENCE (Double Award)**

**Unit 3 – PHYSICS 1  
FOUNDATION TIER**

1 hour 15 minutes

| For Examiner's use only |              |              |
|-------------------------|--------------|--------------|
| Question                | Maximum Mark | Mark Awarded |
| 1.                      | 7            |              |
| 2.                      | 6            |              |
| 3.                      | 14           |              |
| 4.                      | 9            |              |
| 5.                      | 9            |              |
| 6.                      | 15           |              |
| <b>Total</b>            | <b>60</b>    |              |

3430U301  
01

### ADDITIONAL MATERIALS

In addition to this paper you will require a calculator and a ruler.

### INSTRUCTIONS TO CANDIDATES

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

You may use a pencil for graphs and diagrams only.

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 additional page 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.

The assessment of the quality of extended response (QER) will take place in question **5(a)**.



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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 $\times$ time                                                                                  | $E = Pt$             |
| power = voltage $\times$ 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) $\times$ time (h)<br>cost = units used $\times$ cost per unit                               |                      |
| wave speed = wavelength $\times$ frequency                                                                                | $v = \lambda f$      |
| speed = $\frac{\text{distance}}{\text{time}}$                                                                             |                      |

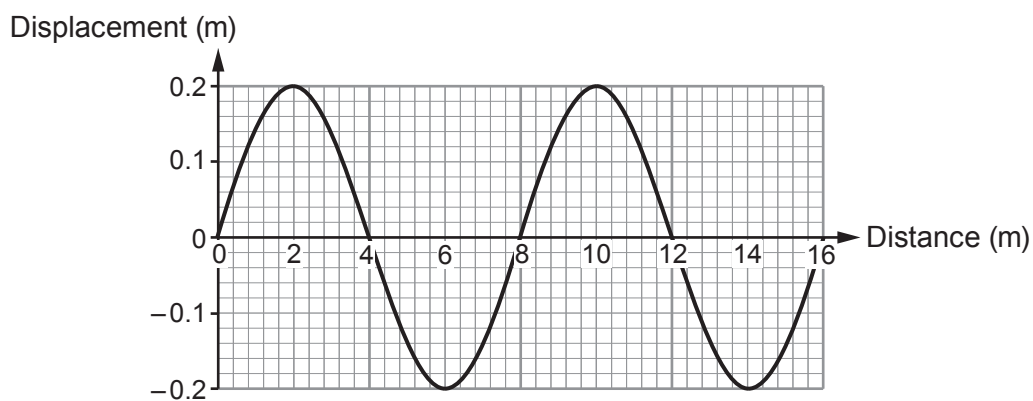
**SI multipliers**

| Prefix | Symbol | Conversion factor     | Multiplier         |
|--------|--------|-----------------------|--------------------|
| milli  | m      | divide by 1000        | $1 \times 10^{-3}$ |
| centi  | c      | divide by 100         | $1 \times 10^{-2}$ |
| kilo   | k      | multiply by 1000      | $1 \times 10^3$    |
| mega   | M      | multiply by 1 000 000 | $1 \times 10^6$    |



Answer **all** questions.

1. The graph represents a water wave on the surface of the ocean.



- (a) (i) Write down the amplitude of the wave. .... m [1]

- (ii) Write down the wavelength of the wave. .... m [1]

- (b) The wave travels with a speed of 2.4 m/s.

- (i) Use the equation:

$$\text{frequency} = \frac{\text{wave speed}}{\text{wavelength}}$$

to calculate the frequency of the wave. [2]

frequency = ..... Hz



(ii) Use the equation:

$$\text{distance} = \text{speed} \times \text{time}$$

to calculate the distance travelled by the wave in 50 s.

[2]

distance = ..... m

(c) Underline the correct phrase from the bracket to complete the following sentence. [1]

The frequency of a wave is the

**(number of cycles / distance travelled / speed of a wave)** each second.

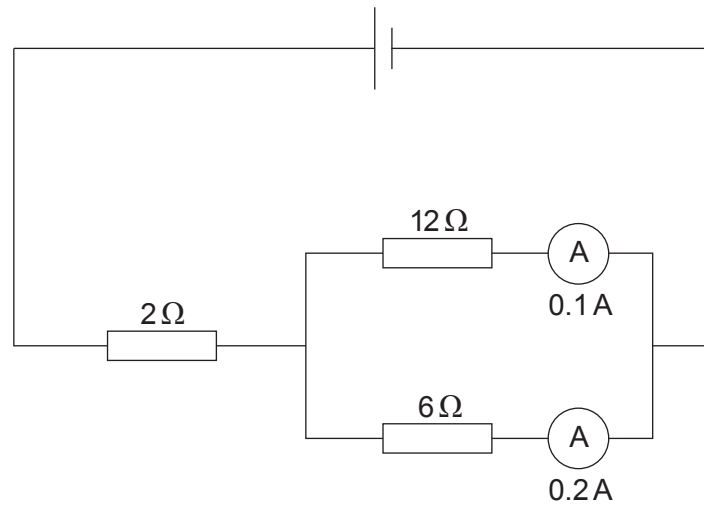


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2. A group of students set up the following circuit.



The current through the  $6\ \Omega$  resistor is  $0.2\ \text{A}$ .

(i) Use the equation:

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

to calculate the voltage across the  $6\ \Omega$  resistor.

[2]

voltage = ..... V

(ii) The current through the  $12\ \Omega$  resistor is  $0.1\ \text{A}$ .

I. **Circle** the current through the  $2\ \Omega$  resistor.

[1]

0.1 A      0.2 A      0.3 A

II. Use the equation:

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

to calculate the voltage across the  $2\ \Omega$  resistor.

[1]

voltage = ..... V



(iii) Use your answers to parts (i) and (ii) to calculate the battery voltage.

[2]

Examiner  
only

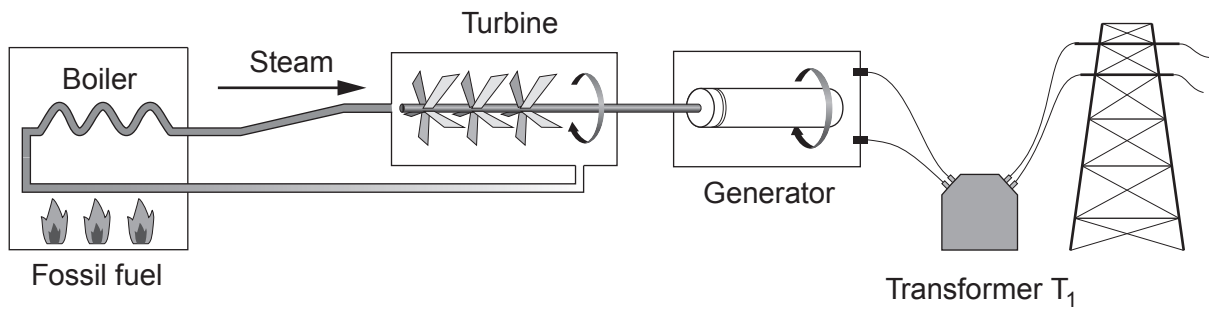
battery voltage = ..... V

6

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3. (a) The diagram shows how electrical power is produced in a power station.



The following statements describe how electricity is produced in this power station; however, they are in the wrong order.

- A. The steam moves.
- B. Fossil fuel is burned.
- C. Water boils to make steam.
- D. Steam drives the turbine.
- E. The turbine drives the generator.

**Put the statements in the correct order** using the letters, two have been completed for you. [2]

|   |  |  |  |   |
|---|--|--|--|---|
| B |  |  |  | E |
|---|--|--|--|---|

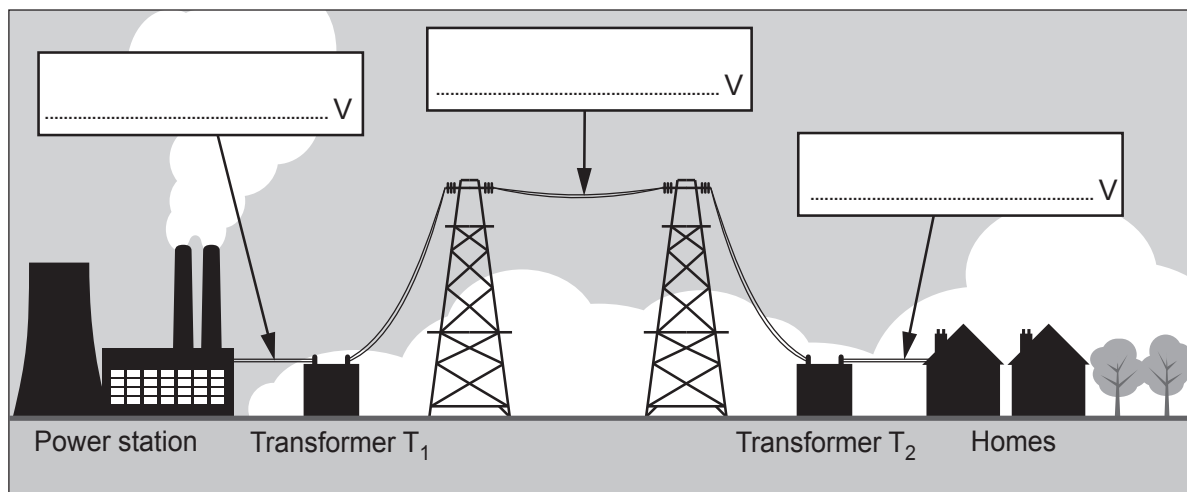


(b) The diagram below shows part of the National Grid which supplies electrical power to consumers around the country.

- (i) Some voltages that are used in the National Grid are 230 V, 50 000 V and 400 000 V.

**Write these values** in the correct boxes on the diagram.  
You should use each number only once.

[2]



- (ii) Complete the following sentences by underlining the correct word or phrase. [3]

- I. T<sub>1</sub> is a (**step-up** / **step-down** / **step-over**) transformer.
- II. T<sub>2</sub> is a (**step-up** / **step-down** / **step-over**) transformer.
- III. The National Grid is designed to deliver electricity  
(**at a higher power** / **efficiently** / **faster**) to consumers.

- (iii) State **one** advantage and **one** disadvantage of a nuclear power station **compared to a coal power station**.

Do not include cost.

[2]

Advantage of a nuclear power station: .....

.....

Disadvantage of a nuclear power station: .....

.....



- (c) The table below shows the sources of electrical power used in the UK on one day in October 2018.

| Source of electrical power | Power (MW)    | CO <sub>2</sub> emissions (kg) |
|----------------------------|---------------|--------------------------------|
| gas                        | 15 000        | 2000                           |
| coal                       | 5000          | 1000                           |
| oil                        | 0             | 0                              |
| nuclear                    | 6000          | 0                              |
| wind                       | 4629          | 0                              |
| hydroelectric              | 681           | 0                              |
| solar                      | 120           | 0                              |
| <b>Totals</b>              | <b>31 430</b> | <b>3000</b>                    |

Use the data above to answer the following questions.

- (i) Calculate the total electrical power generated from **renewable** sources. [2]

power = ..... MW

- (ii) Mari states that to generate 15 000 MW of electrical power using coal would release more CO<sub>2</sub> than by using gas.  
Explain whether you agree.  
**Include data in your answer.**  
Space for calculation. [3]

.....

.....

.....

.....



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4. A house in Aberystwyth is heated by a gas central heating system.

(a) The walls of the house lose heat by conduction, convection and radiation.

**Diagram 1** shows a cavity wall between the inside and outside of the house.

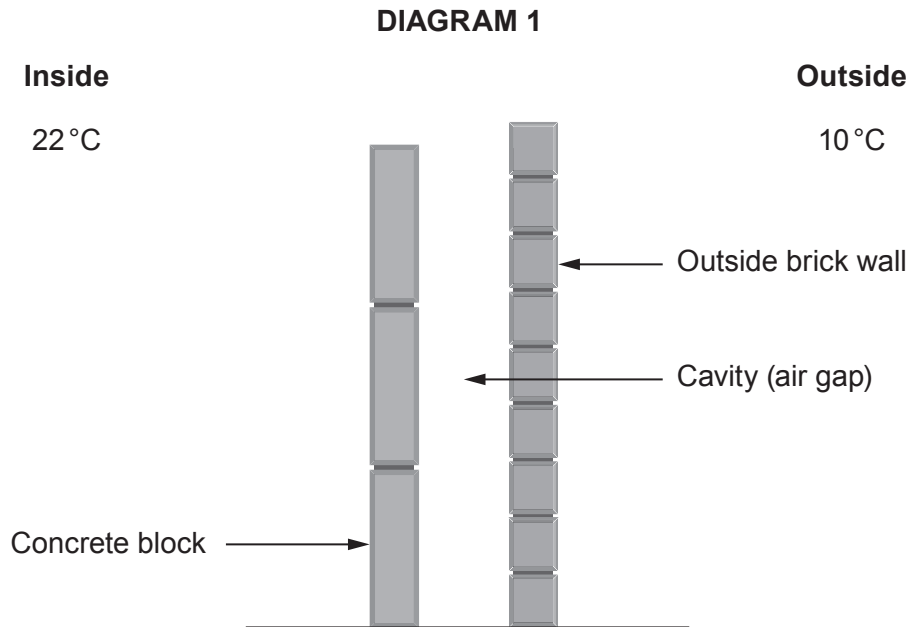
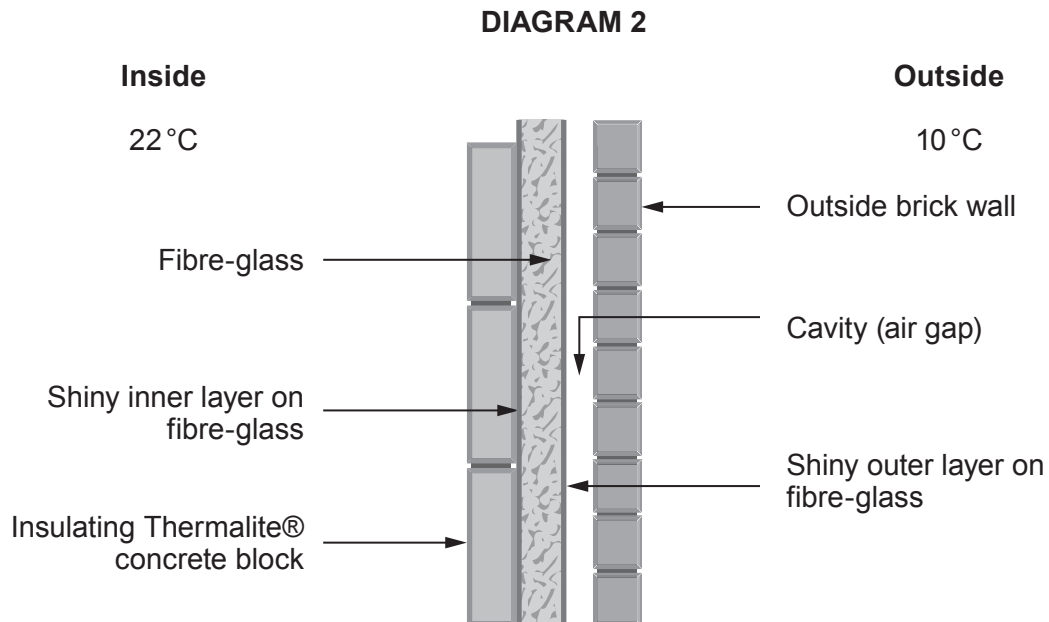


**Diagram 2** shows some features of a more recent cavity wall built to reduce heat loss.



- (i) The wall loses some heat by convection.  
Complete the following sentence about convection in air by underlining the correct words. [2]

As air is heated, its (**density** / **pressure** / **force**) becomes less so hot air (**falls** / **doesn't move** / **rises**).

- (ii) The wall also loses heat by conduction and radiation.  
Place **two** ticks (✓) in **each row** of the table below to show which features reduce heat loss by each of these methods. [4]

| Method of heat loss | Feature that reduces heat loss        |             |                   |                   |
|---------------------|---------------------------------------|-------------|-------------------|-------------------|
|                     | Insulating Thermalite® concrete block | Fibre-glass | Shiny outer layer | Shiny inner layer |
| Conduction          |                                       |             |                   |                   |
| Radiation           |                                       |             |                   |                   |

- (b) Many houses in Wales are heated by gas central heating.  
Explain how insulating these houses benefits the environment. [3]

.....

.....

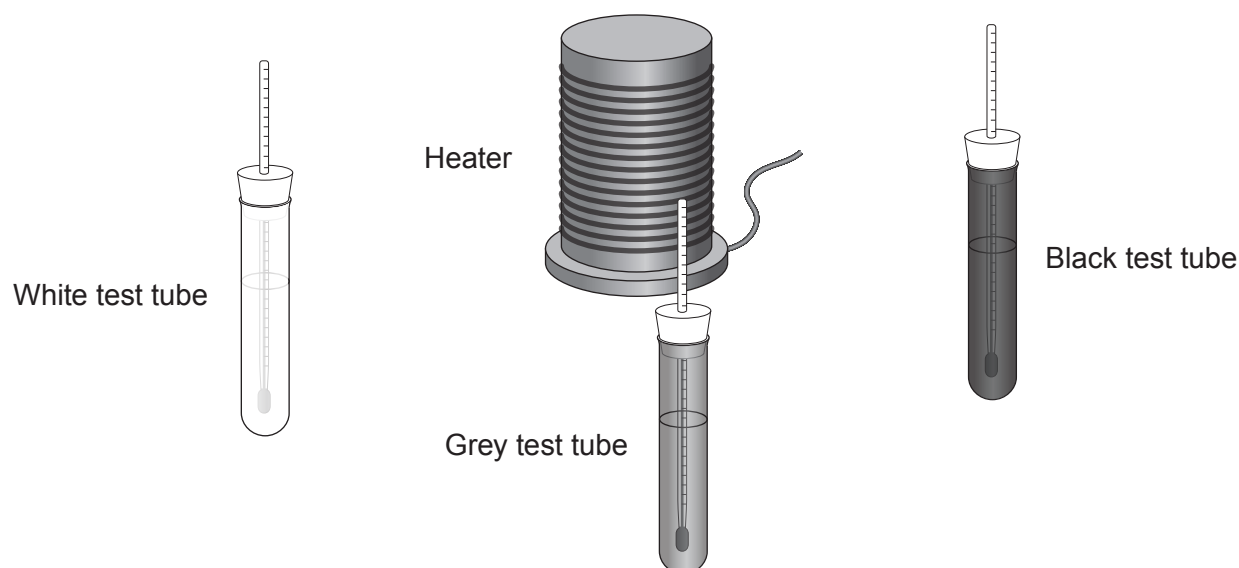
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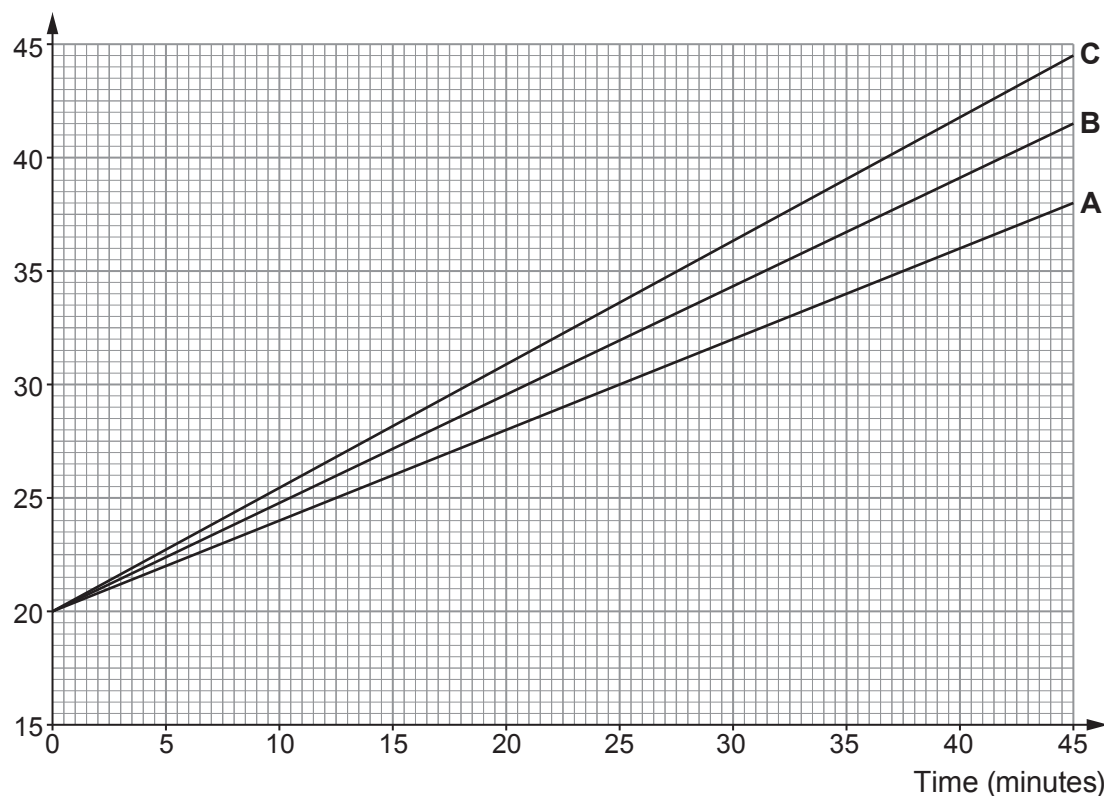


5. The diagram shows apparatus that can be used to investigate the transfer of heat by radiation. Three test tubes are placed equal distances away from a heater. The test tubes all contain equal volumes of water and are identical except for their outside colour. One is white, one is grey and one is black.



The heater was switched on and the water temperatures were measured every 5 minutes. The students produced the following graphs of their results but forgot to label them.

Water temperature ( $^{\circ}\text{C}$ )



- [6 QER]

- (i) State **two** variables that must be controlled. [2]

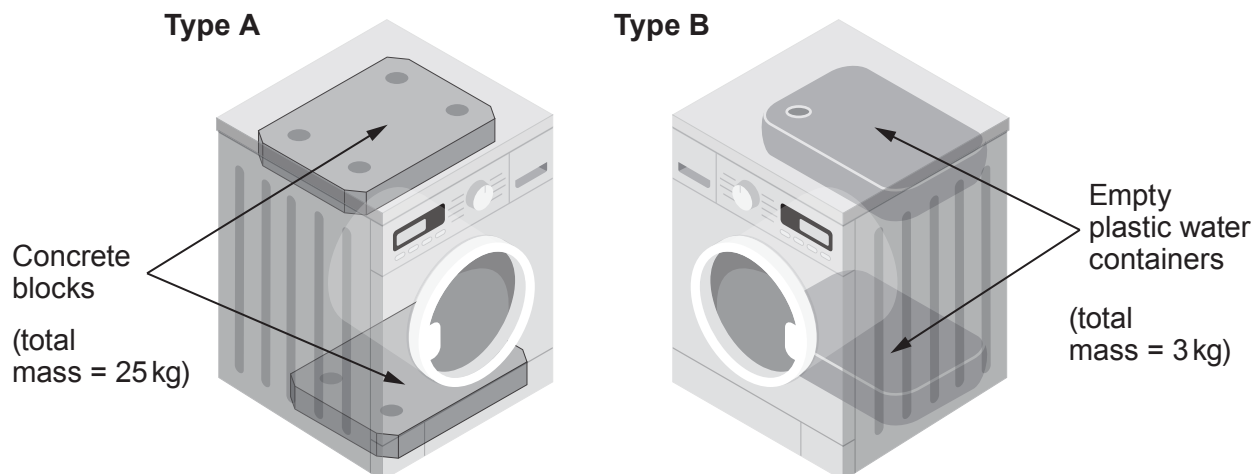
- (ii) State the independent variable. [1]

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6. Washing machines (type A) contain concrete blocks, of total mass 25 kg, to stop them vibrating too much.  
A new type of washing machine (type B) replaces the concrete blocks with empty plastic water containers of total mass 3 kg.



- (a) (i) Calculate the difference in mass of the two types of washing machine. [1]

difference in mass = ..... kg

- (ii) A lorry transports **35 type A washing machines** from a warehouse to a shop. For this journey it releases 0.085 g of carbon dioxide ( $\text{CO}_2$ ) **for every kilogram** of mass it carries.

- I. Use your answer from part (i) to calculate the reduction in  $\text{CO}_2$  emissions if the lorry transports 35 type B washing machines instead of type A. [2]

reduction in  $\text{CO}_2$  emissions = ..... g

- II. Each year in the UK, **3 500 000** type A washing machines are transported by lorry over similar journeys.  
Use your answer from part (ii) I to calculate the reduction in the mass of  $\text{CO}_2$  produced if 3 500 000 type B washing machines are transported instead of type A. [2]

reduction in the mass of  $\text{CO}_2$  = ..... g



- (b) The 3 kg empty plastic containers in a type B washing machine have a total volume of  $0.022 \text{ m}^3$ .  
Before the machine is used for the first time the containers are filled with water.  
Evelyn suggests that the containers will not have enough mass, when filled with water, to replace the 25 kg concrete blocks.

Use the equation:

$$\text{mass} = \text{density} \times \text{volume}$$

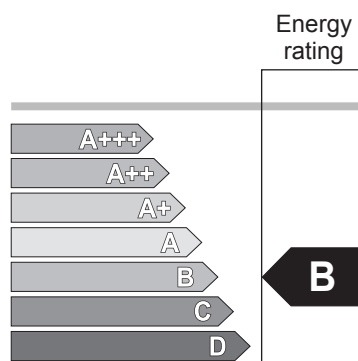
to decide if Evelyn is correct.  
Water has a density of  $1000 \text{ kg/m}^3$ .  
Space for calculation.

[3]

- (c) The table below shows the number of units of electricity (kWh) used per wash for washing machines manufactured from the year 1990 onwards.

| Year | kWh per wash |
|------|--------------|
| 1990 | 1.34         |
| 1995 | 1.29         |
| 2000 | 1.19         |
| 2005 | 1.15         |
| 2010 | 1.11         |
| 2015 | 1.06         |
| 2020 | 1.04         |

- (i) A washing machine manufactured in 2010 had this energy rating label attached.



Explain how the label for a washing machine manufactured in 1995 would have been different. [2]

- (ii) A family uses a washing machine that was manufactured in 1990. They are considering changing it. Use an equation from page 2 to calculate the **money saved per wash** if they used a 2020 washing machine instead. One unit of electricity (kWh) costs 30p. [2]

money saved per wash = ..... p

- (iii) The family uses the 1990 washing machine **5 times each week**. A 2020 washing machine costs £350 and has an expected lifetime of 12 years. A salesperson suggests that they should buy this washing machine as a replacement because its payback time is less than its expected lifetime. Explain whether you agree with the salesperson. (52 weeks = 1 year) Space for calculation. [3]

END OF PAPER



[illegible]