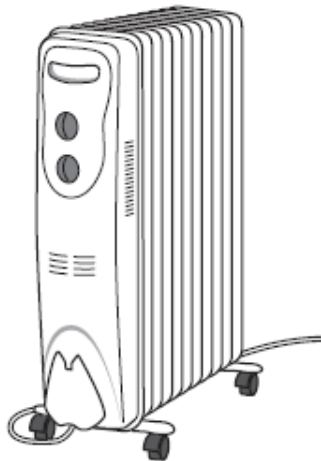


**GCSE Physics B (Twenty First Century Science)**  
**J259/03** Depth in physics (Higher Tier)

**Question Set 3**

1. The diagram shows a common type of electric heater. It contains oil which is heated by an electrical element.



The table shows some information about the heater.

Electrical power	1500 W
Voltage rating	230 V
Specific heat capacity of oil	1600 J/kg °C
Mass of oil	4.5 kg

- (a) Show that more than 700 000 J of energy is needed to heat the oil from 20 °C to 120 °C.

Use the equation:

change in internal energy = mass × specific heat capacity × change in temperature

[2]

- (b) (i) Use your answer to (a) to calculate the minimum time for the oil to reach a temperature of 120 °C, starting at 20 °C.

Minimum time = ..... s [3]

- (ii) In practice, it will take longer than this for the heater to reach 120 °C.

State the reason for this.

[1]

**Total Marks for Question Set 3: 6**

## Resource Materials

### Equations in Physics

change in internal energy = mass  $\times$  specific heat capacity  $\times$  change in temperature

energy to cause a change in state = mass  $\times$  specific latent heat

for gases: pressure  $\times$  volume = constant  
(for a given mass of gas and at a constant temperature)

(final speed)<sup>2</sup> – (initial speed)<sup>2</sup> = 2  $\times$  acceleration  $\times$  distance

energy stored in a stretched spring =  $\frac{1}{2}$   $\times$  spring constant  $\times$  (extension)<sup>2</sup>

potential difference across primary coil  $\times$  current in primary coil =  
potential difference across secondary coil  $\times$  current in secondary coil

**Higher tier only –**

**pressure due to a column of liquid = height of column  $\times$  density of liquid  $\times$  g**

**force = magnetic flux density  $\times$  current  $\times$  length of conductor**

**potential difference across primary coil  $\div$  potential difference across secondary coil =  
number of turns in primary coil  $\div$  number of turns in secondary coil**

**change in momentum = resultant force  $\times$  time for which it acts**

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