

**AS Level Physics A**  
**H156/02** Depth in physics

**Question Set 4**

1

Some houses are heated by “night storage heaters” which use cheap electricity between the hours of midnight and 7.00 am.

Fig. 4.1 shows a circuit diagram of three identical 230 V, 3.5 kW storage heaters connected to a 230 V mains power supply of negligible internal resistance.

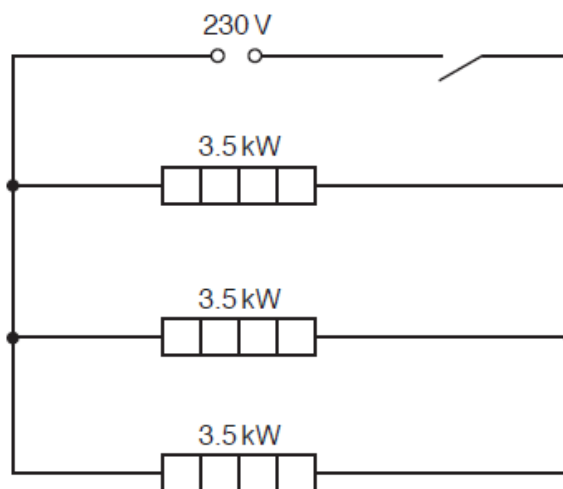


Fig. 4.1

(a) (i) Show that the resistance of each heating element is about  $15\ \Omega$  when the heater is operating at 230 V.

[1]

(ii) The heating element is constructed from a metallic wire of resistivity  $1.6 \times 10^{-6}\ \Omega\text{m}$ .  
The radius of the wire is 0.55 mm.  
Determine the length  $L$  of the metallic wire in one heating element.

$L = \dots\dots\dots\ \text{m}$  [3]

(iii) State and explain whether the heater obeys Ohm's law.

[2]

(b) The cost of 1 kWh of energy is 7.6 pence.

Calculate the cost of using the three storage heaters between midnight and 7.00am every night for one week.

Cost = £  $\dots\dots\dots$  [2]

- (c) A student monitors the temperature in a room by using a potential divider circuit containing a negative temperature coefficient (NTC) thermistor. The student sets up the circuit shown in Fig. 4.2.

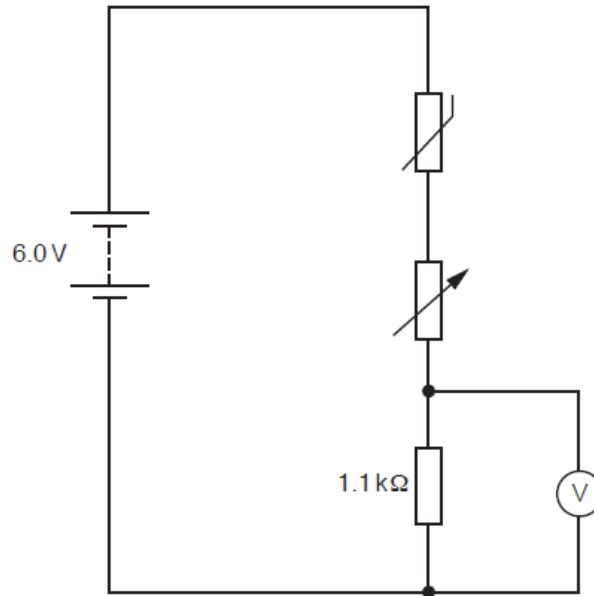


Fig. 4.2

The battery has an e.m.f. of 6.0 V and negligible internal resistance.

- (i) When the temperature of the thermistor is 12°C the thermistor has a resistance of 6.8 kΩ. The resistance of the variable resistor is set to a value of 1.4 kΩ. Calculate the reading  $V$  on the voltmeter.

$V = \dots\dots\dots$  V

[2]

- (ii) Explain how the reading on the voltmeter will change when the temperature of the thermistor increases.

[4]

**Total Marks for Question Set 4: 14**

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