6 **(a)** The graphs on Fig. 6.1 show how the resistance of a metal resistor **R** and a thermistor **T** varies when the temperature changes.

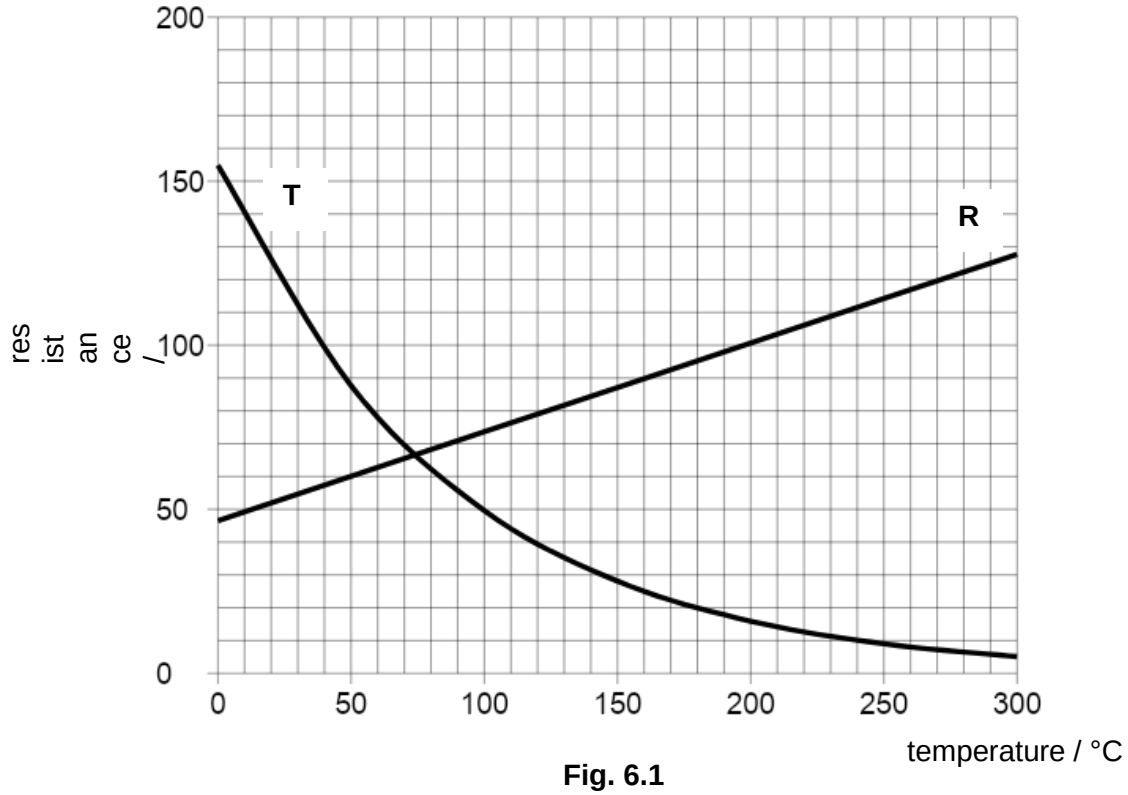

Fig. 6.1

The metal resistor **R** and the thermistor **T** are connected in series as shown in Fig. 6.2 together with a battery of negligible internal resistance. **R** and **T** are kept at the same temperature as each other.

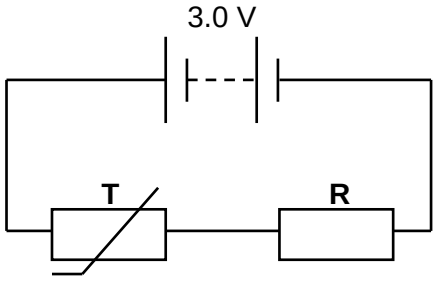

Fig. 6.2

(i) Determine the current in the circuit shown in Fig 6.2 when the resistance of **R** is twice that of **T**.

current = …….. A [2]

(ii) Describe how the effective resistance of the circuit in Fig 6.2 changes as temperature increases from 0 °C to 75 °C.

……...

…….. [1]

(iii) Determine the potential difference across **T** when the temperature is at 30 °C.

potential difference = …….. V [2]

(b) Fig. 6.3 shows a circuit containing five identical lamps A, B, C, D and E. The circuit also contains three switches S_1, S_2 and S_3.

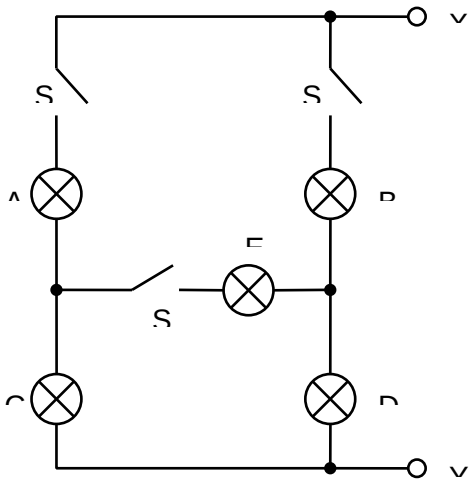

Fig. 6.3

One of the lamps is faulty. In order to detect the fault, an ohm-meter (a meter that measures resistance) is connected between terminals X and Y. When measuring resistance, the ohm-meter causes negligible current in the circuit.

Table 6.1 shows the readings of the ohm-meter for different switch positions. The resistance of the non-faulty lamps can be assumed to be constant.

switch			ohm-meter reading / Ω
S_1	S_2	S_3	
open	open	open	∞
closed	open	open	30.0
closed	closed	open	30.0
closed	closed	closed	15.0

Table 6.1

(i) Identify the faulty lamp, and the nature of the fault.

faulty lamp = ……[1]

nature of fault = ……[1]

(ii) State the resistance of one of the non-faulty lamps, as measured using the ohm-meter.

resistance = ……Ω [1]

(iii) After replacing the faulty lamp in the circuit in Fig. 6.3 with a similar working lamp, the ohm-meter is connected between terminals X and Y.

On Table 6.2, complete the readings of the ohm-meter for different switch positions.

switch			ohm-meter reading / Ω
S_1	S_2	S_3	
open	open	open	∞
closed	open	open	
closed	closed	open	
closed	closed	closed	

Table 6.2

[2]