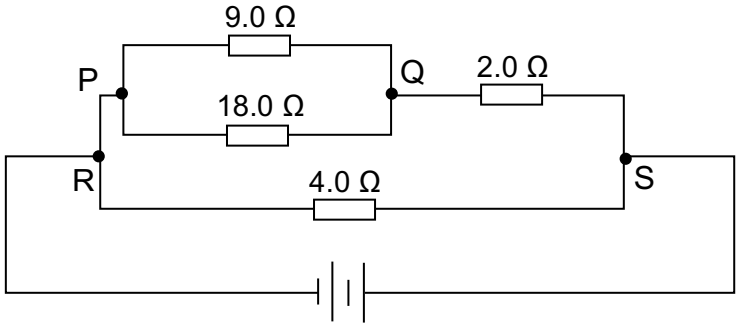
# Practice Questions: Electric Circuits – 2

**1** A circuit is shown below in which the connecting wires have negligible resistance. The current in the 18.0 Ω resistor is 0.50 A.




Calculate:

**(a)** the potential difference between P and Q,

potential difference = ……[1]

**(b)** the current in the 2.0 Ω resistor,

current = ……[1]

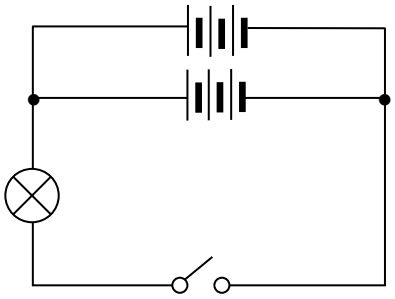
**(c)** the potential difference between R and S,

potential difference = ……[2]

**(d)** the power dissipated by the 4.0 Ω resistor.

power = ……[2]

**2** The diagram shows a circuit diagram of a torch using six 1.5 V cells to light a bulb with resistance 18 Ω.



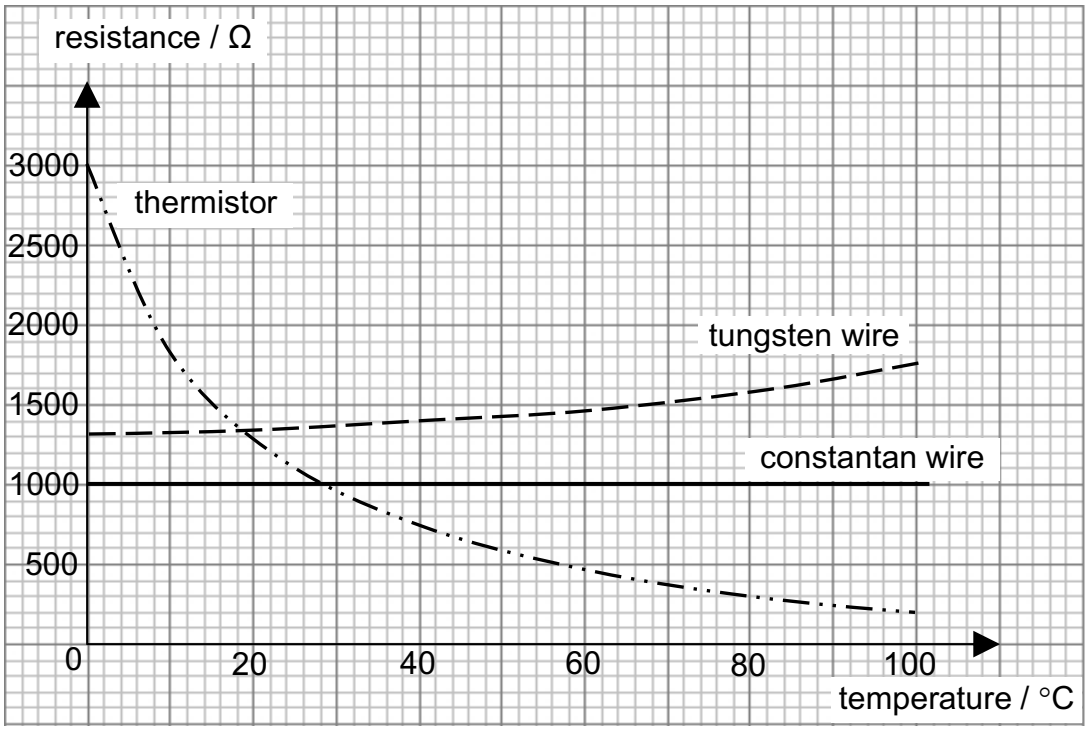
**(a)** Calculate the current through the bulb when the torch is switched on.

current = ……

**(b)** Hence, calculate the amount of electrical charge passing through the bulb each second.

charge = ……

**3** The graph shows how the resistance of three different circuit components changes with temperature. Constantan is an alloy of copper and nickel.



**(a)** Describe how the resistance of constantan changes with temperature.

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**(b)** When a tungsten light bulb is switched on, describe and explain what would happen to the current passing through the light bulb over some time.

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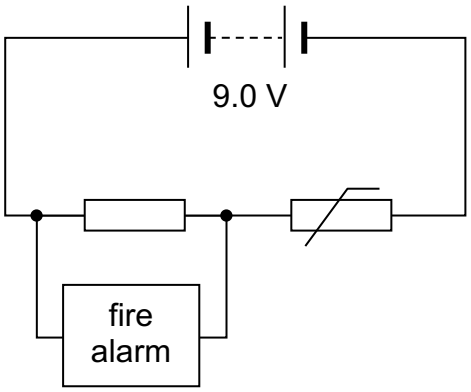
**(c)** State the resistance of the thermistor when the temperature is 28 °C.

resistance = ……

**(d)** The thermistor can be used as a temperature sensor in a fire alarm circuit as shown below. The thermistor is connected in series with a fixed resistor and a 9.0 V battery.




The fire alarm is connected across the fixed resistor and is triggered when the potential difference across the alarm exceeds a minimum value of $V_o$.

Explain clearly this application of the thermistor when there is a fire in the environment.

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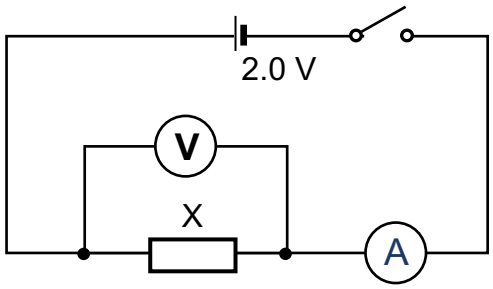
**(e)** The fixed resistor has a resistance of 2.0 kΩ. When the temperature rises to 50 °C, the resistance of the thermistor is 600 Ω and the fire alarm is just triggered.

Calculate the minimum p.d. $V_o$ when the fire alarm is just triggered.

minimum p.d. $V_o$ = ……

**4** The diagram below show a circuit that Jeanette uses to find the resistance of a resistor X. The e.m.f. of the cell E is 2.0 V and the voltmeter has a resistance of $2.5 \times 10^3$ Ω.




**(a)** If the actual resistance of X is $2.0 \times 10^3$ Ω, and the resistance of the ammeter is much smaller than that of X, calculate

**(i)** the reading of the ammeter, and

**(ii)** the value of the resistance of X that Jeanette gets.

ammeter reading = ……

value of resistance of X obtained = ……

**(b)** Explain why the value of X obtained by Jeanette is different from the actual value.

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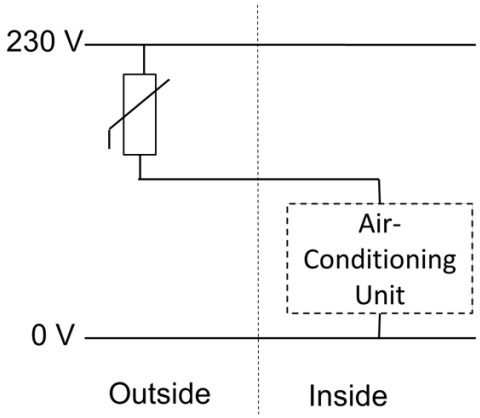
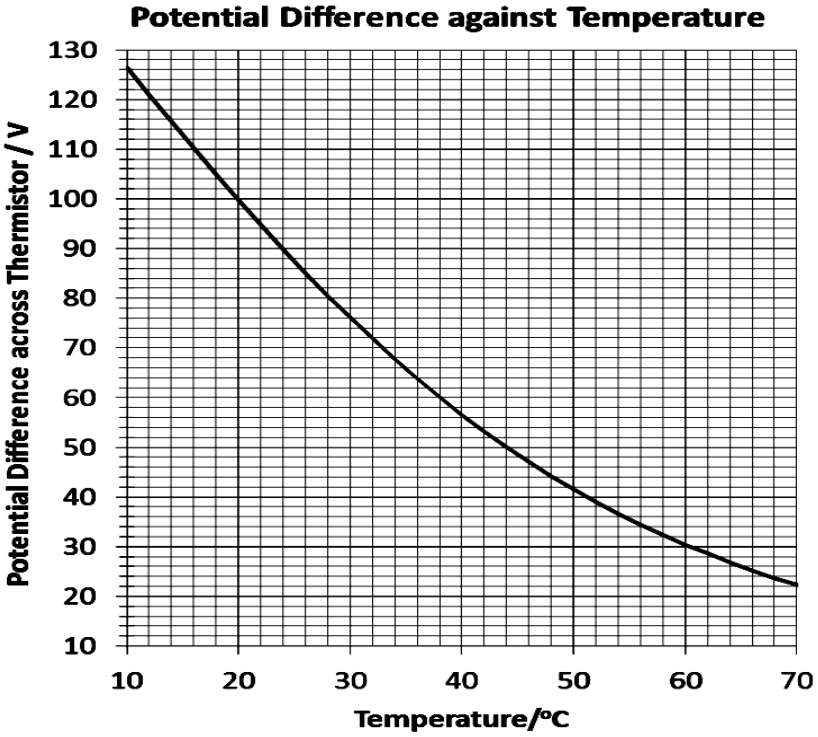
**(c)** In the space below, draw the correct circuit that she should connect to determine the value of X.

**5** A thermistor is placed outside a room and is connected to an air-conditioning unit inside the room as shown in below.




The graph below shows how the potential difference across this thermistor changes with temperature.



**(a)** State and explain what happens to the resistance of the thermistor as temperature increases.

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**(b)** Using the diagrams above, state whether the potential difference across the air conditioning unit increases, decreases, or remains the same, when the temperature outside the room increases.

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**(c)** The air conditioning unit automatically switches on when the potential difference across it exceeds 154 V.

State the temperature at which the air-conditioning unit switches on.

temperature = ……

**(d)** The resistance of the thermistor is 1630 Ω when the temperature is 40°C. Assume that the resistance of the air-conditioning unit is fixed.

**(i)** From the graph above, determine the potential difference across the thermistor when the temperature is 40°C.

potential difference = ……

**(ii)** Calculate the current flowing through the thermistor when the temperature is 40°C.

current = ……

**(iii)** Determine the potential difference across the air-conditioning unit when the temperature is 40°C.

potential difference = ……

**(iv)** Calculate the resistance of the air-conditioning unit.

resistance = ……

**(e)** Based on your answer in part **(d) (iv)**, determine the resistance of the thermistor at 58°C.

resistance = ……

**6** **Fig. 1** below shows how the resistance of a thermistor varies with temperature.

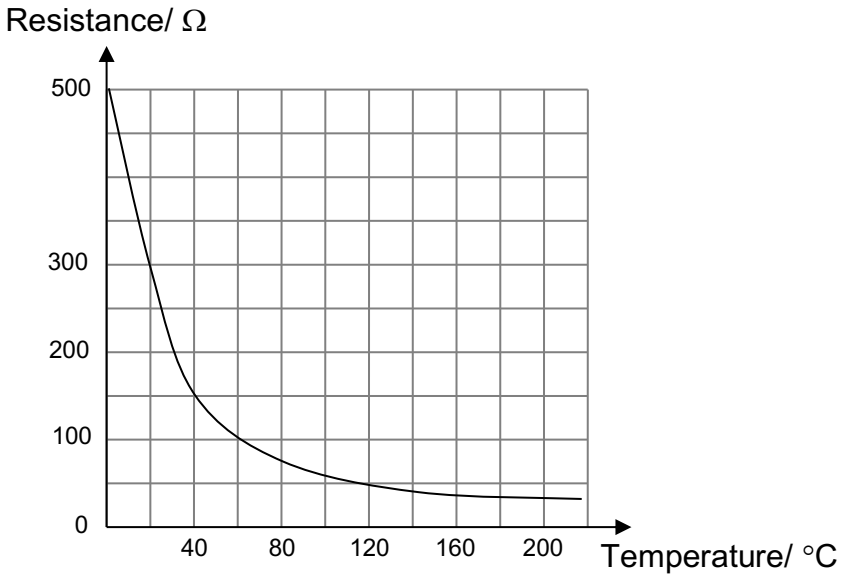


**Fig. 1**

**(a)** From the graph, what is the resistance of the thermistor at 80 °C?

resistance = ……

**(b)** A student connects the above thermistor in series with a 2.0 V dry cell and a 15.0 Ω resistor. The thermistor is then placed in a beaker of water kept at
80 °C. What is the current flowing through the circuit?

current = ……[2]

**(c)** The same thermistor is removed from the beaker of water and then connected in series with a bulb of resistance 15.0 Ω. They are then connected in parallel with a heating element of resistance 10.0 Ω as shown in **Fig. 11.2**. The heating element is placed close to the thermistor.

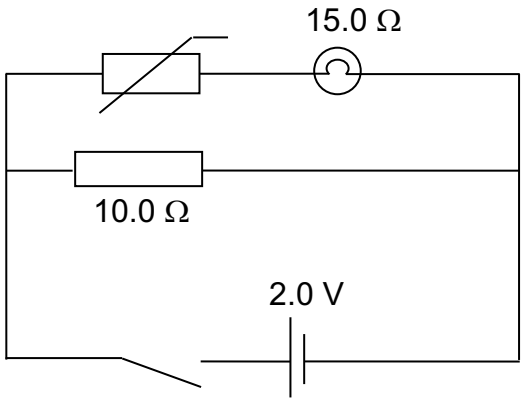


**Fig. 11.2**

**(i)** When the switch is closed, it is observed that the bulb did not light up immediately. However, the bulb gradually lit after a short while later.
Explain these observations clearly.

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**(ii)** If the bulb barely lights up when a current of 12.1 mA flows through it, what is the lowest temperature of the thermistor that would cause the bulb to light up?

lowest temperature = ……[3]