2 **(a)** A copper wire of diameter 1.4 mm connects to the tungsten filament wire of a light bulb of diameter 0.020 mm. A current of 0.42 A flows through both of the wires. Copper has 8.0×10^{28} electrons per cubic metre and tungsten can be assumed to have 3.4×10^{28} electrons per cubic metre.

(i) The filament is 2.0 m long when uncoiled and has a resistivity of $5.5 \times 10^{-8}\ \Omega$ m.

Calculate the power dissipated in the filament bulb.

power dissipated = …….W [2]

(ii) The drift speed of electrons in the copper wire is 0.021×10^{-3} m s^{-1}.

1. Determine the drift speed of electrons in the tungsten filament.

drift speed = …….m s^{-1} [2]

2. Explain, in microscopic terms, why the copper wire stays cool although the tungsten filament reaches a high temperature.

…….....

…….....

…….....

……... [2]

(b) A thermistor has resistance 3900 Ω at 0 °C and resistance 1250 Ω at 30 °C. The thermistor is connected into the circuit of Fig. 2.1 in order to monitor temperature changes.

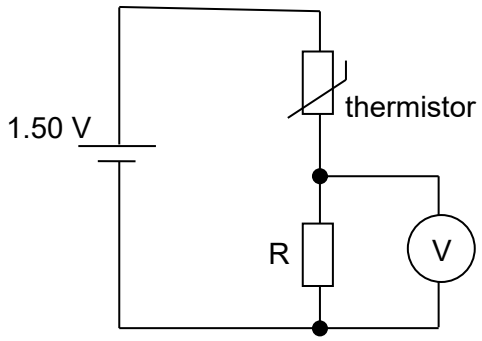

Fig. 2.1

The battery of e.m.f. 1.50 V has negligible resistance and the voltmeter has infinite resistance.

The reading on the voltmeter is 1.00 V at 0 °C.

(i) The temperature of the thermistor is increased to 30 °C. Determine the reading on the voltmeter.

reading = ……V [2]

(ii) The voltmeter in Fig. 2.1 is replaced with one having a resistance of 7800 Ω. Calculate the reading on this voltmeter for the thermistor at a temperature of 0 °C.

reading = ……V [2]

[Total: 10]