4 **(a)** A student uses a circuit for an experiment. The circuit contains a milliammeter, a fixed resistor of resistance R_F and a set of known resistors of different resistance, R. These are connected using switch S, as shown in Fig. 4.1.

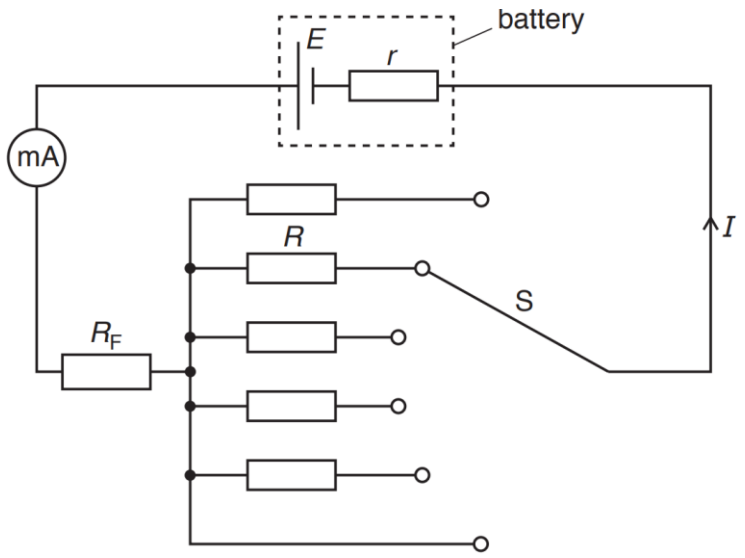

Fig. 4.1

The student records the current I for each value of R. He plots a graph of R against $\frac{1}{I}$. Fig. 4.2 shows the shape of the graph.

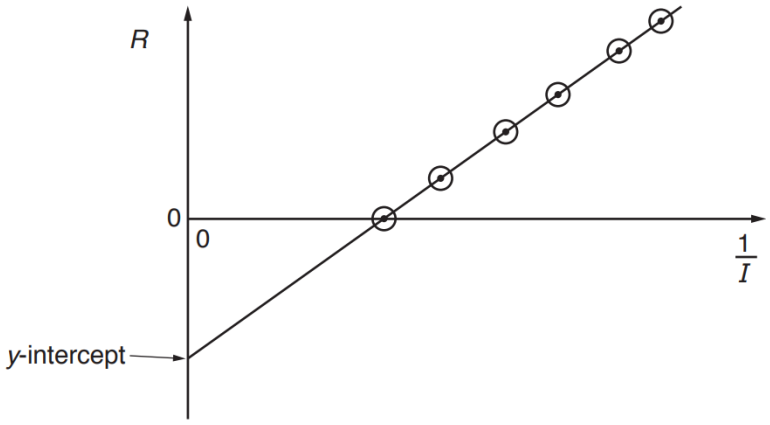

Fig. 4.2

State the physical significance of the gradient and the y-intercept on the graph. You may use the space below to do any necessary working.

gradient ……..……..……..……..……..…...

y-intercept ……..……..……..……..……

[2]

(b) An electric cable is made up of 24 thin strands of copper wire, as shown in Fig. 4.3.

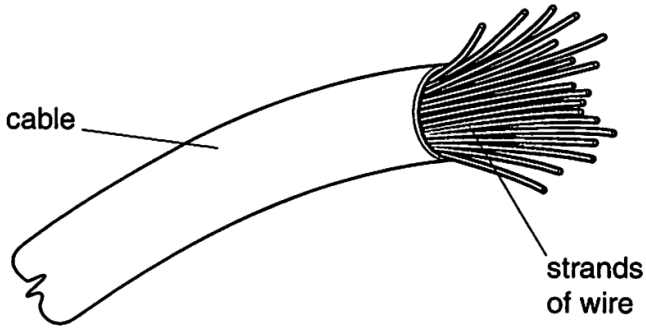

Fig. 4.3

Each strand has diameter 0.26 mm. Copper has resistivity $1.7 \times 10^{-8}\ \Omega$ m.

Calculate the resistance of the cable of length 5.0 m,

resistance = …….. Ω [2]

(c) State and explain why the resistance of metals increases with temperature.

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……

……

..... [3]