4 **(a)** Using energy considerations, distinguish between electromotive force (e.m.f.) and potential difference (p.d.).

……

……

……

……

…… [2]

(b) A cell is connected to identical resistors arranged in series as shown in Fig. 4.1.

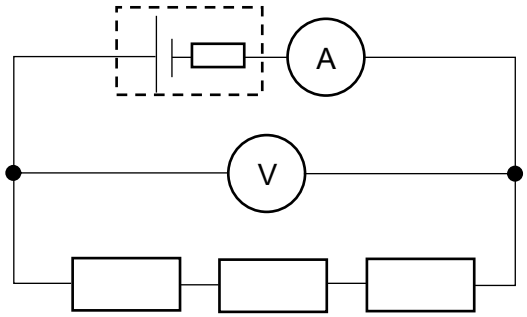
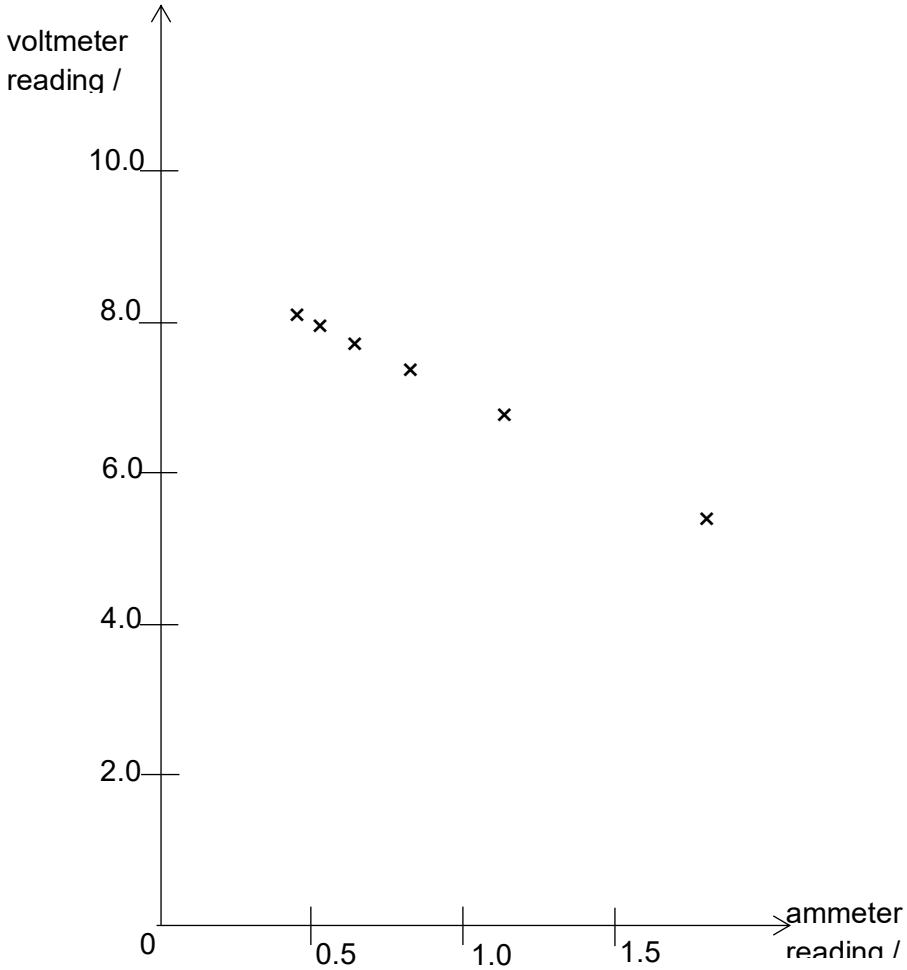


Fig. 4.1

A student recorded both the voltmeter and the ammeter readings as he varied the number of resistors arranged in series. He plotted both the voltmeter and ammeter readings in the grid in Fig. 4.2.



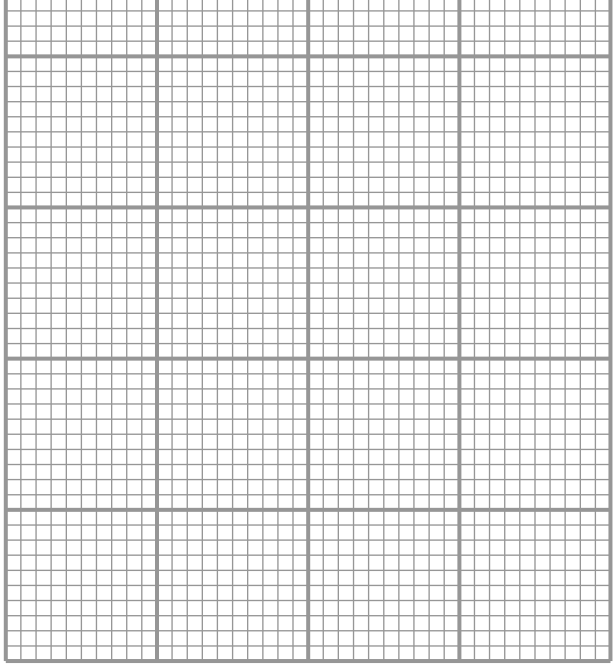


Fig. 4.2

(i) On Fig 4.2, draw the line of best fit for all the points and state the e.m.f. of the cell.

…..…… [1]

(ii) Using Fig. 4.2, determine the internal resistance of the cell.

internal resistance = …… Ω [2]

(iii) On Fig. 4.1, draw a component that can be added to the circuit so that the emf of the cell can be obtained directly from the voltmeter reading.

Explain your answer.

…..……..……

…….……..……

…….……..……

……..……..…….... [2]

(c) A circuit is set up as shown in Fig. 4.3.

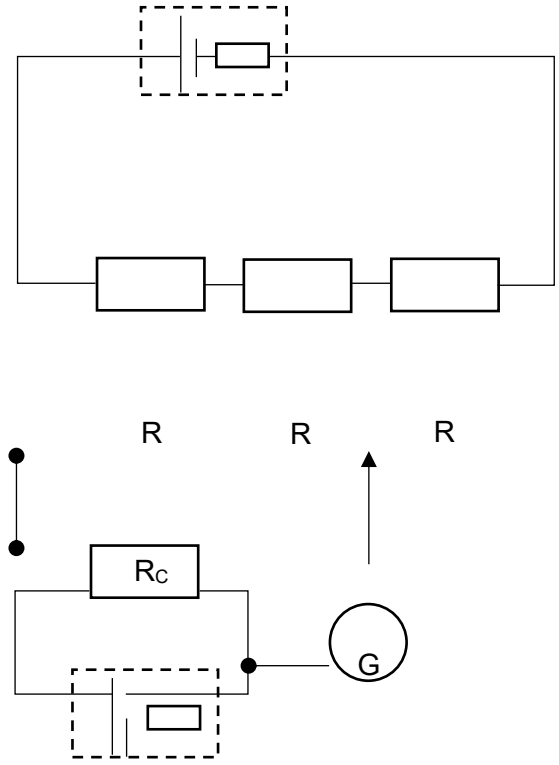


Fig. 4.3

The table below shows the specifications for the components in the circuit.

Internal resistance of cell	15 Ω
External resistor R	25 Ω

The two cells are identical and the galvanometer shows null deflection.

Calculate the resistance R_C.

Rc = …… Ω [3]

[Total: 10]