6 **(a)** State Kirchhoff's first law.

.....

..... [1]

(b) A cell with internal resistance r is connected to two resistors of resistances R_1 and R_2 as shown in Fig. 6.1.

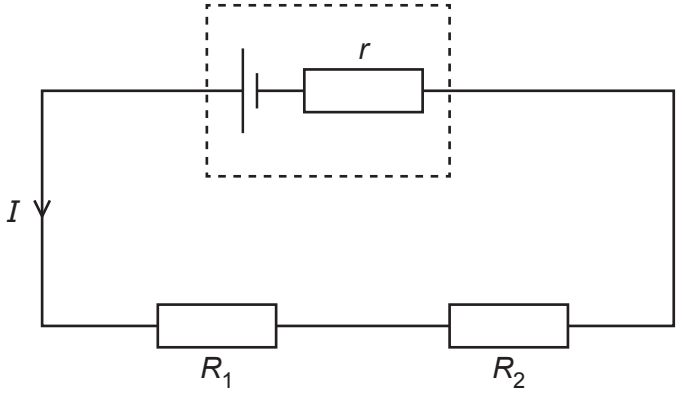

Fig. 6.1

The potential differences (p.d.s) across R_1 and R_2 are V_1 and V_2 respectively.
The terminal p.d. across the cell is V.
The current in the circuit is I.

Use Kirchhoff's laws to show that the total resistance R_T of the external circuit is given by

$$R_T = R_1 + R_2 .$$

[2]

(c) The electromotive force (e.m.f.) of the cell in Fig. 6.1 is 1.50 V.

The values of R_1 and R_2 are 10 Ω and 15 Ω respectively. The terminal p.d. of the cell is 1.35 V.

Calculate the internal resistance r of the cell.

r = ... Ω [3]

(d) A resistor of resistance R_3 is added to the circuit in Fig. 6.1, so that the circuit is as shown in Fig. 6.2.

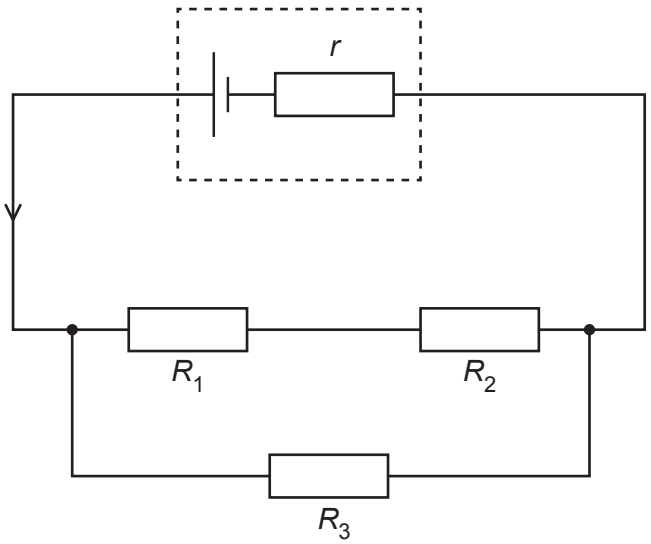

Fig. 6.2

State and explain the effect, if any, of this change on:

(i) the current in the cell

.....

.....

..... [2]

(ii) the terminal p.d. of the cell.

.....

.....

..... [2]

[Total: 10]