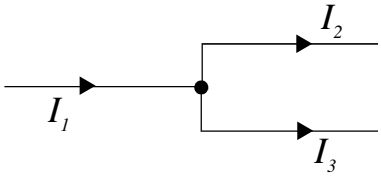
5.1 Circuit Rules

Rules for currents

- At a junction in a circuit, the total current entering is equal to the total current leaving. (This is known as Kirchoff's First Law)

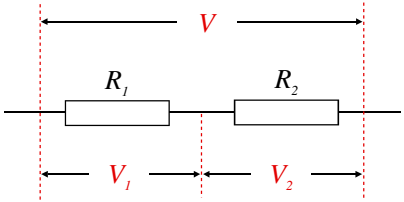


$$I_1 = I_2 + I_3$$

- The current is the same all the way around a series circuit. This means that the current entering any component is the same as the current leaving.

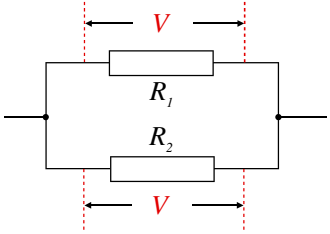
Rules for potential differences

- For components in series, the total p.d. across them all is the sum of the p.d.s across each component.



$$V = V_1 + V_2$$

- For components in parallel, the p.d. across each component is the same.

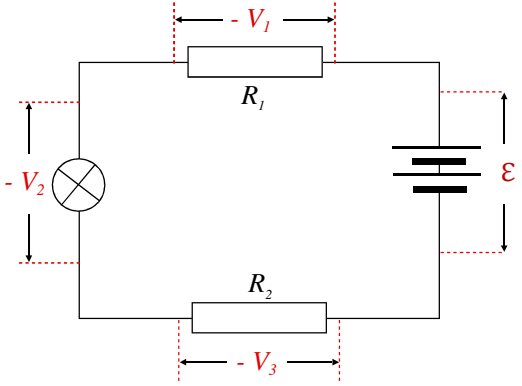


$$V_1 = V_2 = V$$

Potential differences and emfs around closed loops

When electrons flow around a circuit, they gain energy when they pass through a source of emf, (such as a battery) and lose energy when they flow through circuit components such as resistors.

- **Around any closed loop in a circuit, the sum of the emfs must equal the sum of the potential drops.** (This is known as Kirchoff's Second law).



$$\mathcal{E} - V_1 - V_2 - V_3 = 0$$

where $\mathcal{E}$ is the emf of the battery, and V_1, V_2 and V_3 are the potential drops across each of the other components.