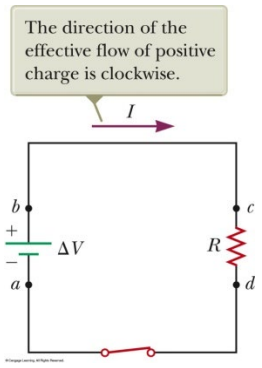
ELECTRIC POWER

Consider a charge 'q' moving CW in a closed path starting at point 'a'. For the closed path, using COE:



$$\Delta U_{closed\ path} = 0$$

$$\Delta U_{bat} + \Delta U_R = 0$$

$$\Delta U_R = -\Delta U_{bat}$$

(1) $$\frac{\Delta U_R}{\Delta t} = -\frac{qV}{\Delta t} = -\left(\frac{q}{\Delta t}\right)V = -IV$$

Eq (1) can be interpreted in the following way:

a) Rate at which 'q' loses energy as it passes through the resistor.
b) Rate at which energy is delivered to the resistor.

The charge 'q' loses this energy as it collides with the atoms in the resistor. This loss of energy to the resistor shows up as an increase in the internal energy (temperature). This energy is then dissipated in the form of heat and radiation.

$\boxed{P = IV}$ Power delivered to resistor (any circuit element)

$$\boxed{\begin{aligned} P &= I^2R \\ P &= \frac{V^2}{R} \end{aligned}}$$

The process by which energy is lost as heat and radiation is called ***joule heating*** or ***I^2R loss***.