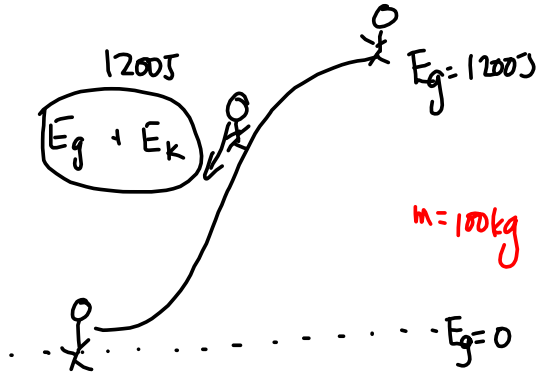
Chapter 15 - Electric Energy + Circuits

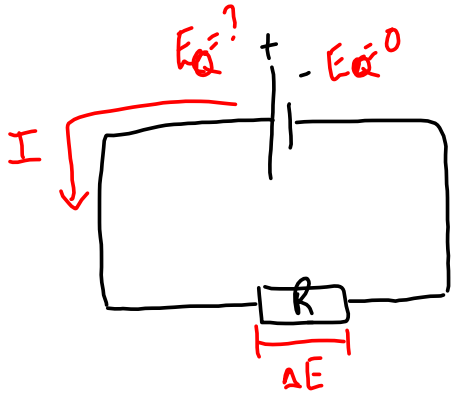
§15-1 Electric Potential Difference



$$V = \frac{\Delta E_g}{m} = \frac{1200\,J}{100\,kg}$$

gravitational potential difference.

$= 12\,\frac{J}{kg}$



$$V = \frac{\Delta E_Q}{q}$$

Electric Potential Difference

where V is the electric potential difference ($\frac{J}{C}$ or Volts)

ΔE_Q is the change in electric potential energy (J)

q is the charge (C)

← also equal to W ($W = \Delta E$)

MP 691

$V = 18.0\,V$

$q = 64.0\,C$

$\Delta E_Q = ?$

anode (+)

cathode (-)

$$V = \frac{\Delta E_Q}{q}$$

$$\Delta E_Q = qV$$

$$\Delta E_Q = (64.0\,C)(18.0\,V) \quad J/C$$

$$\Delta E_Q = 1.15 \times 10^3\,J$$

§15-2 Electric Current

Conventional current travels in the direction that a + test charge would move in a circuit. + → −

Electron flow is opposite to the direction of the convential current − → +

Positive charges do not move unless in an electrochemical cell (flow of + ions and − ions) or molten ionic compounds

Current can be thought of as the amount of charge that passes by a given point in a circuit in 1 second. (this is not the proper SI definition of current)

$$I = \frac{q}{\Delta t}$$

fundamental unit.

where I is the current ($\frac{C}{s}$ or Ampere)
q is the charge (C)
Δt is the time interval (s)

MP/695

$V = 120.0\,V$

$I = 9.60\,A$

$\Delta t = 2.50\,min$

a) $q = ?$

b) $\Delta E_q = ?$

a) $I = \frac{q}{\Delta t}$

$q = I\,\Delta t$ C/s

$q = (9.60\,A)(150.\,s)$

$q = 1.44 \times 10^3\,C$

b) $V = \frac{\Delta E_q}{q}$

$\Delta E_q = qV$

$\Delta E_q = (1.44 \times 10^3\,C)(120.0\,V)$ J/C

$\Delta E_q = 1.73 \times 10^5\,J$

Elementary Charge

$$q = Ne$$

where q is the total charge (C)
N is the # of charges
e is the elementary charge $1.6 \times 10^{-19}\,C$ (the charge on an electron or proton)

MP/699

$I = 0.60\,A$

$\Delta t = 8.0\,min$

$N = ?$

$I = \frac{q}{\Delta t}$

$q = I\,\Delta t$

$q = (0.60\,A)(480\,s)$

$q = 288\,C$

$N = \frac{q}{e}$

$N = \frac{288\,C}{1.6 \times 10^{-19}\,C}$

$N = 1.8 \times 10^{21}$ electrons