10th Electricity – Remember these terms before solving Numerical problems

1. If a net charge Q, flows across any cross-section of a conductor in time t, then the current I, through the cross-section is

$I = Q/t$

$Q = It$

2. The electric potential difference between two points in an electric circuit carrying some current is the work done to move a unit charge from one point to the other –

Potential difference (V) between two points = Work done/Charge

$V = W/Q$

$W = VQ$

3. Q = n x Charge on 1 electron

When a steady current flows through a conductor, the electrons in it move with a certain average 'drift speed'.

4. If the current I, flowing in a metallic wire and the potential difference across its terminals is V .

Then potential difference, V, across the ends of a given metallic wire in an electric circuit is directly proportional to the current flowing through it, provided its temperature remains the same. This is called Ohm's law.

$V \propto I \Rightarrow V = RI$ or, $I = V/R$

5. Resistance of the conductor depends (i) on its length, (ii) on its area of cross-section, (iii) on the nature of its material and (iv) temperature

$R \propto l/A \Rightarrow R = \rho\, l/A$ Or, $\rho = RA/l$

6. If resistors joined in series: $V = V_1 + V_2 + V_3$ but $I = I_1 = I_2 = I_3$

Then $R = R_1 + R_2 + R_3$

6. If resistors joined in Parallel: $V = V_1 = V_2 = V_3$ but $I = I_1 + I_2 + I_3$

Then $1/R = 1/R_1 + 1/R_2 + 1/R_3$

7. If a current I flowing through a resistor of resistance R. and the potential difference across is V for time t sec

Then, the work done in moving the charge Q through a potential difference V is = $W = VQ$.

But, $Q = It$

$\Rightarrow W = V I t$ ------(i)

Now, Power = work done / Time

$\Rightarrow P = W/t$

{or, $W = Pt$ [The energy supplied to the circuit by the source in time t is $P \times t = V I t$]

$\Rightarrow P = V I t / t$ [Using eq. (i)]

$\Rightarrow P = VI$ ----------- (ii)

The amount of heat produced in time t = H

$\Rightarrow$ H = the energy supplied to the circuit by the source in time t = $V I t$

Applying Ohm's law, $V = IR$

$H = I^2 R t$

Note: heat produced in a resistor is

(i) Directly proportional to the square of current for a given resistance,

(ii) Directly proportional to resistance for a given current, and

(iii) Directly proportional to the time for which the current flows through the resistor.

8. Electric Power: The rate at which electric energy is dissipated or consumed in an electric circuit is called electric power.

The power P is given by $P = VI$ Using, $V = IR$

$\Rightarrow P = I^2R = V^2/R$

Also using, $V/R = I$

$\Rightarrow P = V^2/R$

9. The commercial unit of electric energy is kilowatt hour (kW h) = 1 unit.

10. 1 kW h = 1000 watt $\times$ 3600 second = 3.6×10^6 watt second = 3.6×10^6 joule (J)