IMPORTANT FORMULAE

LIGHT:

1. For Mirrors the sign conventions are:
   u (object distance) is –ve (as object is always taken on the left of mirror)
   v (image distance) is –ve if the image is real (front of the mirror)
   v (image distance) is +ve if the image is virtual (behind the mirror)
   h (height of the object) is + ve
   h`(height of the image) is +ve, if the image is erect (virtual)
   h`(height of the image) is -ve, if the image is inverted (real)

   The focal length of a concave mirror is taken as –ve.
   The focal length of a convex mirror is taken as +ve.

   Mirror formula: $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$

   Magnification: $m=\frac{h'}{h}=-\frac{v}{u}$

2. For Lens the sign conventions are:
   u (object distance) is –ve (as object is always taken on the left of lens)
   v (image distance) is –ve if the image is on the same side as that of the object (virtual)
   v (image distance) is +ve if the image is real.
   h (height of the object) is + ve
   h`(height of the image) is +ve, if the image is erect (virtual)
   h`(height of the image) is -ve, if the image is inverted (real)

   The focal length of a concave lens is taken as –ve.
   The focal length of a convex lens is taken as +ve.

   Lens formula: $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$

   Magnification: $m=\frac{h'}{h}=\frac{v}{u}$

3. Refractive index $n \text{ or } \mu=\frac{\text{speed of light in vacuum}}{\text{speed of light in the medium}}=\frac{c}{v}$

4. Power = $\frac{1}{f}$ (unit = diopter, 1D = $1m^{-1}$)

EFFECTS OF CURRENT:

1. Electric current (SI unit: ampere, $1A = 1Cs^{-1}$)

$$\mathbf{I} = \frac{\mathbf{Q}}{\mathbf{t}} = \frac{ne}{t}$$

2. Potential difference (SI unit: volt, $1V = 1JC^{-1}$)

$$\mathbf{V} = \frac{\mathbf{W}}{\mathbf{Q}}$$

3. Ohm's law

$$\mathbf{V} \alpha \mathbf{I}$$
$$\mathbf{or,}\ \frac{\mathbf{V}}{\mathbf{I}} = \mathbf{constant}$$
$$\mathbf{or,}\ \frac{\mathbf{V}}{\mathbf{I}} = \mathbf{R}$$
$$\mathbf{V} = \mathbf{IR}$$

4. Resistance

By Ohm's law (SI unit of ohm, $1\Omega = 1VA^{-1}$)

$$\mathbf{R} = \frac{\mathbf{V}}{\mathbf{I}}$$

Or,

$$\mathbf{R} \alpha \mathbf{l}$$
$$\mathbf{R} \alpha \frac{\mathbf{1}}{\mathbf{A}}\ \mathbf{or,}\ \mathbf{R} \alpha \frac{\mathbf{l}}{\mathbf{A}}$$
$$\mathbf{R} = \rho \frac{\mathbf{l}}{\mathbf{A}} \quad \left(\text{where, } l = \text{length of the wire and } \mathbf{A} = \text{area} = \pi r^2 \text{ or } \frac{\pi d^2}{4} \right)$$

5. Resistivity , $\rho = R\frac{A}{l}$, (SI unit Ω m)

6. Equivalent Resistance in Series

$$V = V_1 + V_2 + V_3$$

$$\text{or, } IR_S = IR_1 + IR_2 + IR_3 \quad (\because \text{Acc. to ohm's law } V = IR)$$

$$IR_S = I(R_1 + R_2 + R_3)$$

$$\Rightarrow R_S = R_1 + R_2 + R_3$$

where, R_S = equivalent resistance in series

7. Equivalent resistance in parallel:

$$I = I_1 + I_2 + I_3$$

$$\text{or, } \frac{V}{R_P} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3} \quad \left(\because \text{Acc. to ohm's law } V = IR \text{ or } I = \frac{V}{R}\right)$$

$$\frac{V}{R_S} = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

$$\Rightarrow \frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

where, R_P = equivalent resistance in parallel

8. Electric energy (SI unit joule(J))

$$W \text{ or } E = I^2Rt = \left(\frac{V^2}{R}\right)t = VIt$$

9. Power (SI unit watt, $1W = 1J^{-1}$)

$$\text{Power} = \frac{\text{Work done}}{\text{time}} = \frac{W}{t}$$

$$P = \frac{VIt}{t} = VI = I^2R = \left(\frac{V^2}{R}\right)$$

10. Commercial unit of Energy (kilowatt hour)

$$1kW = 1000\,W$$

$$1h = 60 \times 60 = 3600\,s$$

$$\therefore 1kWh = 1000 \times 3600\,Ws = 3.6 \times 10^6\,J$$