

Basic Definitions:

1. **Speed, Velocity**: the rate of change of distance with respect to time

$$v = \frac{\partial x}{\partial t} \quad , \quad x = \int_0^t v \partial t = v.t \quad , \quad v = \frac{x}{t}$$

$$v = [LT^{-1}] \text{ basic dimensions, } v = [m \text{ sec}^{-1}] \text{ basic S.I units}$$

2. **Acceleration**: the rate of change of velocity during the time

$$a = \frac{\partial v}{\partial t} \quad , \quad v = \int_0^t a \partial t = a.t \quad , \quad a = \frac{v}{t}$$

$$a = [LT^{-2}] \text{ basic dimensions, } a = [m \text{ sec}^{-2}] \text{ basic S.I units}$$

3. Momentum:

$$p = \text{mass} \times \text{velocity} = m \times v$$

$$p = [MLT^{-1}] \text{ basic dimensions, } p = [kgm \text{ sec}^{-1}] \text{ basic S.I units}$$

4. Force: (Newton), the rate of change of momentum during the time

$$F = \frac{\partial p}{\partial t} = \frac{\partial(mv)}{\partial t}, \quad F = [MLT^{-2}] \text{ basic dimensions, } F = [kgm \text{ sec}^{-2}] \text{ basic S.I units}$$

5. Energy: (Joule), the distance integral of force

$$E = \int_0^x F \partial \chi = F \cdot \chi$$

$$E = [ML^2T^{-2}] \text{ basic dimensions, } E = [kgm^2 \text{ sec}^{-2}] = \text{Joule} = J$$

6. **Power:** (Watt) , the rate of work done

$$P = \frac{\partial E}{\partial t}$$

Q

$$P = [ML^2T^{-3}] \text{ basic dimensions, } P = [kgm^2 \text{ sec}^{-3}] \text{ S.I units, } P = J.\text{sec}^{-1}$$

7. Potential of a point (voltage); work done to bring a unit charge from infinity to same point.

$$V = \frac{\text{workdone}}{\text{charge}} = \frac{\text{Joule}}{\text{coulomb}}$$

$$V = [ML^2 I^{-1} T^{-3}] \text{ basic dimensions, } V = [kgm^2 A^{-1} sec^{-3}] \text{ basic S.I units}$$

8. Electrical current; the rate of flow of charge

$$I = \frac{\partial Q}{\partial t}, \quad Q = \int_0^t I \partial t, \quad Q = I.t$$

$$I = [Amp]$$

9. **Resistance (ohm):** the resistance of a load to the current flow when there is voltage difference between its terminals.

$$R = \frac{\partial V}{\partial I}, \quad R = [ML^2 I^{-2} T^{-3}] \text{ dimensions, } R = [kgm^2 A^{-2} sec^{-3}] \text{ basic S.I units}$$

10. Capacitance (farad):

$$C = \epsilon \frac{A}{d}, \quad \text{or } C = \frac{Q}{V}, \quad C = [M^{-1}L^{-2}I^2T^4], \quad C = [kg^{-1}m^{-2}A^2\text{sec}^4]$$

11. Electrical field:

$$E = \frac{\partial V}{\partial x}, \quad E = [MLI^{-1}T^{-3}], \quad E = [kgmA^{-1}\text{sec}^{-3}]$$

12. Permittivity ϵ : how much electrical field lines can pass through some medium

$$\epsilon = \frac{\text{farad}}{m}, \quad \epsilon = [M^{-1}L^{-3}I^2T^4], \quad \epsilon = [kg^{-1}m^{-3}A^2\text{sec}^4]$$

13. Inductance(henry):

Induce emf = inductance x rate of change of current

$$e = -L \frac{\partial i}{\partial t}, \quad \int_0^t e \partial t = L \int_0^i \partial i, \quad L = \frac{e t}{I}$$

$$\text{Henry} = [ML^2I^{-2}T^{-2}], \quad \text{Henry} = [kgm^2A^{-2}\text{sec}^{-2}]$$

14. Reluctance (S): the magnetic resistance to magnetic field lines in same material

$$S = \frac{l}{\mu \cdot A}, \quad S = [M^{-1}L^{-2}I^2T^2], \quad S = [kg^{-1}m^{-2}A^2\text{sec}^2]$$

$$\phi = \frac{mmf}{S} = \frac{N \cdot I}{S}, \quad \phi = [ML^2 I^{-1} T^{-2}], \quad \phi = [kgm^2 A^{-1} sec^{-2}]$$

16. Frequency(hertz): number of cycles in one second

$$f = \frac{\text{cycles}}{\text{second}} = \frac{1}{\text{sec}}, \quad f = [T^{-1}], \quad f = [sec^{-1}]$$