WORK, ENERGY AND POWER MINDMAP

Work :→

* When force is constant–

$\boxed{W = F \cdot d \cos\theta}$

- If, $\theta = 0^\circ$, $W = +ve$
- If, $\theta = 90^\circ$, $W = 0$
- If $\theta = 180^\circ$, $W = -ve$

1 erg	10^{-7} J
1 eV	1.6×10^{-19} J
1 cal	4.186 J
1 KWh	3.6×10^{6} J

* Work done by variable force–

$$W = \int \vec{F} \cdot d\vec{r}$$

$$W = \int_{x_1}^{x_2} F_x \cdot dx + \int_{y_1}^{y_2} F_y \cdot dy + \int_{z_1}^{z_2} F_z \cdot dz$$

* Work Energy Theorem–

$\boxed{\text{Work done by all forces} = \Delta K}$

ΔK = change in K.E.

Kinetic Energy and Potential Energy→

• Kinetic Energy – $\boxed{K = \frac{1}{2} m v^2}$

→ Conservative Forces:
Work done does not depend on path.
eg- Gravitational force, Electrostatic force.

→ Non-Conservative Forces:
Work done depends on path.
eg- Friction

• Potential Energy – Only defined for conservative forces.

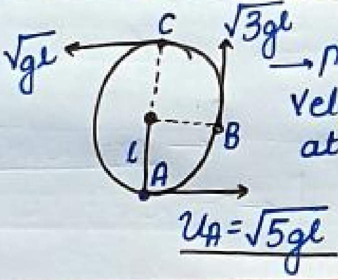
→ Gravitational potential energy = mgh

→ Spring potential energy = $\frac{1}{2} Kx^2$

→ Work Done by spring force–

$\boxed{W_s = -\Delta U = \frac{1}{2} K x_i^2 - \frac{1}{2} K x_f^2}$

Vertical Circular Motion→



→ Minimum velocity required at each point to complete circle

Conservation Of Energy and Power→

* Conservation of Mechanical Energy–

→ In absence of non-conservative forces–

$\boxed{K_i + U_i = K_f + U_f}$

→ Mechanical Energy = $K + U$

* Power → Rate of doing work.

$\boxed{P_{avg} = \frac{W}{t}}$ $\boxed{P_{int} = \vec{F} \cdot \vec{v}}$

* Relation b/w potential energy and force.

$$\boxed{W_c = \int \vec{F_c} \cdot d\vec{r} = -\Delta U}$$

$$\boxed{\vec{F} = -\frac{\delta U}{\delta x}\hat{i} - \frac{\delta U}{\delta y}\hat{j} - \frac{\delta U}{\delta z}\hat{k}}$$

Collisions →

→ Elastic Collisions – $\boxed{e = 1}$

Kinetic energy before Collisions = Kinetic energy after collisions

→ Inelastic Collisions – $\boxed{0 < e < 1}$

Kinetic energy before Collisions ≠ Kinetic energy after collisions

$$\boxed{e = \frac{\text{Velocity of separation}}{\text{Velocity of approach}}}$$

→ For all types Of Collisions–

$\boxed{\text{Initial Momentum} = \text{Final Momentum}}$

→ For perfectly inelastic Collision – $\boxed{e = 0}$
Both Bodies stick to each other