WORK, POWER & ENERGY

WORKDONE BY CONSTANT FORCE :

$$W = \vec{F} \cdot \vec{S}$$

WORK DONE BY MULTIPLE FORCES

$$\Sigma\vec{F} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \ldots..$$

$$W = [\Sigma\vec{F}] \cdot \vec{S} \qquad \ldots(i)$$

$$W = \vec{F}_1 \cdot \vec{S} + \vec{F}_2 \cdot \vec{S} + \vec{F}_3 \cdot \vec{S} + \ldots..$$

or $\quad W = W_1 + W_2 + W_3 + \ldots\ldots\ldots.$

WORK DONE BY A VARIABLE FORCE

$$dW = \vec{F} \cdot d\vec{s}$$

RELATION BETWEEN MOMENTUM AND KINETIC ENERGY

$$K = \frac{p^2}{2m} \quad \text{and} \quad P = \sqrt{2\,m\,K} \quad ; \quad P = \text{linear momentum}$$

POTENTIAL ENERGY

$$\int_{U_1}^{U_2} dU = -\int_{r_1}^{r_2} \vec{F} \cdot d\vec{r} \qquad \text{i.e.,} \qquad U_2 - U_1 = -\int_{r_1}^{r_2} \vec{F} \cdot d\vec{r} = -W$$

$$U = -\int_{\infty}^{r} \vec{F} \cdot d\vec{r} = -W$$

CONSERVATIVE FORCES

$$F = -\frac{\partial U}{\partial r}$$

WORK-ENERGY THEOREM

$$W_C + W_{NC} + W_{PS} = \Delta K$$

Modified Form of Work-Energy Theorem

$$W_C = -\Delta U$$

$$W_{NC} + W_{PS} = \Delta K + \Delta U$$

$$W_{NC} + W_{PS} = \Delta E$$

POWER

The average power ($\overline{P}$ or p_{av}) delivered by an agent is given by $\overline{P}$ or

$$p_{av} = \frac{W}{t}$$

$$P = \frac{\vec{F} \cdot d\vec{S}}{dt} = \vec{F} \cdot \frac{d\vec{S}}{dt} = \vec{F} \cdot \vec{v}$$