

## Notes

### Potential energy:

The concept of potential energy is oftenly used to express the work done by a conservative force. Unlike kinetic energy which is dependent of objects motion(speed), potential energy is described by the position and configuration of object.

For defining potential we must define a reference whose potential we assume to be zero.

### Potential energy due to gravitation:

We know that two bodies having mass exerts a conservative force called gravitational force.

The work done of this force is stored in the form of gravitational potential energy.

Gravitation potential energy of 2 bodies of mass  $m$  and  $M$  seperated by distance  $r$ , when the reference is taken at  $\infty$  is given by

$$U = -\frac{GmM}{r}$$

The negative sign indicates that the gravitational force has done a positive work on the bodies in order to decrease their seperation from  $\infty$  to  $r$

Gravitational potential energy follows the law of superposition i. e. potential energy of an object due to a system of objects can be computed as sum of individual potential energy due to each object.

### Escape velocity:

It is the minimum speed required by a body to escape the gravitational field of an object.

For example if we want to calculate the escape velocity of an object on the surface of earth.

Then by conservation of total mechanical energy on the surface of earth and at  $\infty$  we can write

$$\frac{1}{2}mv^2 + \frac{-GmM}{R} = 0 + 0 \rightarrow v = \sqrt{\frac{2GM}{R}} = \sqrt{2gR}$$