

POINT 2

Mechanical Energy and the Work-Energy Theorem

A. Energy

- Energy is the ability to do work, and its unit is joule (J).
- Energy is a scalar quantity.
- The total energy is neither increased nor decreased in any process. Energy can be transformed from one form to another, and transferred from one body to another, but the total energy remains constant.

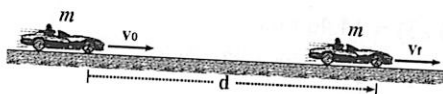
B. Kinetic energy and the work-energy theorem

- Kinetic energy is the energy that an object in moving has at any moment.

$$KE = \frac{1}{2} mv^2$$

m : mass of an object v : speed of an object

- The work-energy theorem states that the net work done on an object by the net force is equal to the change in kinetic energy of the object.



$$W = \Delta KE = KE_f - KE_0 = \frac{1}{2} mv_f^2 - \frac{1}{2} mv_0^2$$

v_0 : initial speed of an object v_f : final speed of an object

C. Gravitational potential energy

- Gravitational potential energy is the energy that an object has by virtue of its position relative to the surface of the earth. The position is measured by the height of the object relative to an arbitrary zero level.

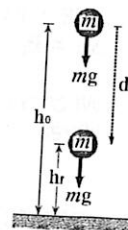
$$PE = mgh$$

m : mass of an object h : height of an object

- The work done by the force of gravity on an object is equal to the change in gravitational potential energy of the object.

$$W_G = \Delta PE = PE_0 - PE_f = mgh_0 - mgh_f$$

h_0 : initial height of an object h_f : final height of an object



- The total mechanical energy of an object is the sum of the kinetic energy and the potential energy of the object.

$$E = KE + PE = \frac{1}{2} mv^2 + mgh$$

- The net work done on an object by the net force is equal to the change in total mechanical energy of the object.

$$W_{NET} = E_f - E_0 = (KE_f + PE_f) - (KE_0 + PE_0) = \Delta E$$