Forms of Energy (PE & KE)

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Kinetic Energy

- Electromagnetic
- Thermal (Friction)
- Light
- Wind
- Pressure
- Sound

Potential Energy

- Nuclear
- Chemical
- Gravity
- Elastic

Kinetic Energy: Energy of motion

Potential Energy: the stored ability to move.

Potential Gravitational Energy

$PE = mg \cdot h$

or

E_P

Derive the formula for KE

① $\Delta E = \text{Work}$

If we bring an object from zero to "v"

② $KE_i = 0$ (↑ Rest)

$KE_F = ?$

$KE_F - KE_i = W$

$KE_F - 0 = F \cdot d$

$KE_F = F \cdot d$

We need to connect

③ Kinematics

$v_f^2 = v_i^2 + 2ad$

$v_i = 0$

$v_f^2 = 2ad$

$F = m \cdot a$

$a = \frac{F}{m}$

$v_f^2 = 2\frac{F}{m}d$ Isolate Fd

$\frac{1}{2} m v_f^2 = Fd$

$KE_f = F \cdot d$

$KE_F = \frac{1}{2} m v_f^2$

$$KE = \frac{1}{2} m v^2 \qquad PE = mgh$$

Ex. What is the Kinetic Energy of a 0.50 kg soccer ball that was kicked to fly 3.4 m/s?

$$KE = \frac{1}{2} m v^2 = \frac{1}{2}(0.50)(3.4)^2 = 2.9\ J$$

Ex. How much potential energy does Mason (72kg) have when he is strung up 13m above the ground?

$$PE = mgh = 72(9.8)(13) = 9200\ J$$

Work-Energy Theorem

- IF a non-zero net Force is acting on an object, the object will accelerate
- Acceleration is the rate of change of velocity

∴ (Therefore) The Force must be proportional the change in Kinetic Energy

in Kinetic Energy

$$\Delta KE = F \cdot d$$

Ex. Yasin (65kg) accelerates from 1 m/s using a 378 N force over 12m. What is his final velocity?

$$\Delta KE = F \cdot d$$

$$KE_f - KE_i = F \cdot d$$

$$\frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 = F \cdot d$$

$$\frac{1}{2}(65)v_f^2 - \frac{1}{2}(65)(1)^2 = 378(12)$$

$$32.5 v_f^2 - 32.5 = 4536$$

$$+32.5 \quad +32.5$$

$$32.5 v_f^2 = 4568.5$$

$$\frac{32.5}{32.5} \quad \frac{4568.5}{32.5}$$

$$\sqrt{v_f^2} = \sqrt{139.5569}$$

$$v_f = 12 \text{ m/s}$$

Proportionality

$KE \propto m$ Directly proportional

→ Double the mass → Double KE

→ $\frac{1}{9}$ of the mass = $\frac{1}{9}$ of the KE

$KE \propto v^2$ Squared proportionality

→ Doubled the v = 4 times the KE

→ $\frac{1}{3}$ of the v $= \frac{1}{9}$ of the KE