

Potential & Kinetic Energy

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If work is done on an object then the energy of the object changes. ($W = \Delta E$)

- 1) Potential Energy, E_p , stored energy
- 2) Kinetic Energy, E_k , energy of motion
- 3) Heat Energy, E_h , thermal energy

Gravitational Potential Energy (E_p)

- stored energy based on an objects height and mass.

- $E_p = mgh$ h is always measured relative to... a reference point.

E_x

The diagram shows a person standing on a roof. The person is labeled '70 kg'. The roof is 4m above the ground level of a house. The ground level is 20m above a body of water. A vertical red arrow points from the water level up to the person, and a blue arrow points from the ground level up to the person. A green 'x' is next to the 4m label. The text 'Find this person's E_p relative to...' is written next to the diagram.

Find this person's E_p relative to...

- a) the roof $E_p = mgh = 0$
- b) the ground $E_p = (70\text{kg})(9.8)(4\text{m}) = 2744\text{J} \approx 2740\text{J}$
- c) the water $E_p = (70)(9.8)(24) = 16500\text{J}$

To use the E_p , work had to be done on the object

$$W = \Delta E = \Delta E_p$$

Kinetic Energy (E_k)

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$$E_k = \frac{1}{2} m v^2$$

- 1) Determine the E_k of a .050 kg bullet travelling at 200 m/s

$$E_k = \frac{1}{2} m v^2 = \frac{1}{2} (.050 \text{ kg}) (200)^2 = 1000 \text{ J}$$

- 2) A 2.0 kg object has 100 J of E_k . How fast is it moving

$$E_k = \frac{1}{2} m v^2$$
$$100 \text{ J} = \frac{1}{2} (2) v^2, \quad v = 10 \text{ m/s}$$

- 3) Determine the work done to stop a 2000 kg car moving at 20 m/s.

$$W = \begin{cases} \rightarrow F \times d \\ \rightarrow \Delta E \end{cases}$$

$$W = \Delta E_k \text{ final minus initial}$$

$$= E_{k_f} - E_{k_i}$$
$$= 0 - \frac{1}{2} (2000) (20)^2$$

$$= -4.0 \times 10^5 \text{ J}$$

↑
slowing, loss of E_k