4.6 Kinetic Energy

Kinetic Energy: Energy of motion. Still scalar... still measured in Joules

$E_k = \frac{1}{2}mv^2$ where: m = mass

v = speed (not velocity)

ex. A 60.0 kg student is running at a uniform speed of 5.70 m/s. What is the kinetic energy of the student?

$$E_k = \frac{1}{2}mv^2 = \frac{1}{2}(60.0)(5.70)^2 = 975\ J$$

$$kg \cdot m^2/s^2$$

ex. The kinetic energy of a 2.1 kg rotten tomato is 1.00 x 10^3 J. How fast is it moving?

$$E_k = \frac{1}{2}mv^2 \Rightarrow \sqrt{v^2} = \sqrt{\frac{2E_k}{m}} \Rightarrow v = \sqrt{\frac{2(1000)}{2.1}}$$

$$= 31\ m/s$$

The Work-Energy Theorem: If a net force acts on an object, it must be accelerating. This net force must be proportional to its change in E_k. Therefore,

$$\Delta E_k = F_{net}d$$

ex. A sprinter exerts a net force of 260 N over a distance of 35 m. What is his change in kinetic energy?

$$\Delta E_k = F_{net}d$$
$$= (260\ N)(35\ m)$$
$$= 9100\ J$$

ex. A student pushes a 25 kg crate which is initially at rest with a force of 160 N over a distance of 15 m. If there is 75 N of friction, what is the final speed of the crate?

$$\vec{F}_{net} = 160N - 75N = 85\ N$$

$$\Delta E_k = F_{net}\Delta d$$
$$= (85\ N)(15\ m)$$
$$= 1275\ J$$

but $\vec{F}_{net}d = \frac{1}{2}mv^2$

$$\frac{1275}{25} = \frac{1}{2}(25)v^2$$

$$\sqrt{102} = \sqrt{v^2}$$

$$v = 10.099\ m/s$$

$$v = 1.0 \times 10^1\ m/s$$

practice: handout - Kinetic Energy #1-8