Unit 7: Work, Energy and Power

3 – Kinetic Energy

Kinetic Energy: energy of motion

- Scalar value
- 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?

$E_K = \frac{1}{2}mv^2 = \frac{1}{2}(60.0\text{kg})(5.70\text{m/s})^2$
$= 975\text{ J}$

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

$E_K = \frac{1}{2}mv^2 \quad v = \sqrt{\frac{2E_K}{m}} = \sqrt{\frac{2(1.00\times10^3)}{2.1}}$
$= 31\text{ m/s}$

The Work Energy Theorem

· If a net force acts on an object it must be accelerating

· This must be proportional 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?

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

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?

$\Delta E_K = F_{net}\, d \qquad v_i = 0$
$\frac{1}{2}mv_f^2 = F_{net}\, d$
$v = \sqrt{\frac{2F_{net}\, d}{m}} = \sqrt{\frac{2(85\text{N})(15\text{m})}{25\text{kg}}}$
$= 10.\text{ m/s}$

Worksheet 7.3 - Kinetic Energy

1. A 3.0 kg ewok is traveling at a constant speed of 7.5 m/s. What is its kinetic energy?

2. The kinetic energy of a 20.0 N droid is 5.00×10^2 J. What is the speed of the droid?