Work, energy, and power

SPH3U – Unit 3 Day 2 Energy

Some useful definitions

- Energy
  - the capacity (ability) to do work
- Kinetic Energy (E_K)
  - energy possessed by moving objects
- Work – Energy Principle
  - the net amount of mechanical work done on an object equals the objects change in kinetic energy

More Useful definitions

- Potential Energy
  - a form of energy an object possesses because of its position in relation to forces in the environment
- Gravitational Potential Energy
  - energy possessed by an object due to its position relative to the surface of the earth
- Reference Level
  - a designated level to which objects may fall
  - Considered to have a gravitational potential energy value of 0 J
- Mechanical Energy
  - the sum of kinetic energy and gravitational potential energy

Kinetic Energy

- scalar quantity
- Equation:

$$E_k = \frac{mv^2}{2}$$

- OR

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

Work Energy Principle

- The net amount of mechanical work done on an object equals the object's change in kinetic energy

$$W_{Net} = \Delta E_k$$

$$W_{Net} = E_{kf} - E_{ki}$$

$$W_{Net} = \frac{mv_f^2}{2} - \frac{mv_i^2}{2}$$

Gravitational Potential Energy

$$E_g = mgh$$

Pg 235 #1

Given: $m = 610\ kg$

$E_k = 40.0\ kJ$ (3 sig digs)

$E_k = 40000\ J$

Required: speed $= v$

Analysis: $E_k = \frac{mv^2}{2}$

$1\ J = 1\ N\,m$

$= 1\ kg\,\frac{m}{s^2}\,m$

$= 1\ kg\,\frac{m^2}{s^2}$

Steps: Isolate v

$$E_k = \frac{mv^2}{2}$$

$$2E_k = mv^2$$

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

$$\sqrt{\frac{2E_k}{m}} = v$$

$$v = \sqrt{\frac{2E_k}{m}}$$

$$= \sqrt{\frac{2(40000 \text{ kg} \frac{m^2}{s^2}}{610 \text{ kg}}}$$

$$= \sqrt{131.147 \frac{m^2}{s^2}}$$

$$v = 11.45 \text{ m/s}$$

$$v = 11 \text{ m/s}$$

Questions

- Pg. 235 #~~1~~-3,5,6

Pg 235 #2, 3, 5, 6

Read pg 230-235