Power

Average power is the rate at which work is done.

$$P = \frac{w}{t} = \frac{Fd}{t} = Fv$$

$$= \frac{\text{energy transferred}}{\text{time}}$$

Power is measured in Watts (W) or horsepower (hp). 1hp = 746W

Example 6-16 page 170: A 70kg jogger runs up a long flight of stairs in 4.0s. The vertical height of the stairs is 4.5m. Find the power of the jogger and the energy required to run up the stairs.

Part1:

$$P = \frac{w}{t}$$

$$P = \frac{mgh}{t}$$

$$P = \frac{(70kg)(9.8m/s^2)(4.5m)}{4.0s}$$

$$P = 770W$$

Energy = Power x time

Energy = 770W x 4.0s = 3100J

Do # 58,59,62,64,66 page 177-178

6-9, Energy Conservation with Dissipative Forces

- Frictional forces reduce the total mechanical energy.

- Frictional forces are therefore dissipative forces.

- Dissipative forces have historically been difficult to quantify, but since they usually result in heat energy being produced they can be measured in terms of thermal energy.

- Frictional forces are non-conservative forces.

- The work energy principle can now be applied:

$$W_{NC} = \Delta KE + \Delta PE$$

$$W_{NC} = -F_{fr}d$$

The negative sign indicates the friction force and the displacement are in the opposite direction.

- Since the friction force is non-conservative we can update the above relationship to:

$$-F_{fr}d = 1/2mv_2^2 - 1/2mv_1^2 + mgy_2 - mgy_1$$

or

$$1/2mv_1^2 + mgy_1 = 1/2mv_2^2 + mgy_2 + F_{fr}d$$

Example 6-15, Roller-coaster revisited with dissipative forces