# Power

**Average Power: Work per Time**

$$\overline{P} = \frac{W}{\Delta t} = \frac{Fd}{\Delta t} = F\overline{v}$$

**Instantaneous Power:**

$$P = \frac{dW}{dt} = \frac{Fdx}{dt} = F \cdot v$$

Formulas on AP Sheet:

$$P = \frac{dW}{dt}$$

$$P = \mathbf{F} \cdot \mathbf{v}$$

$$W = \int_{t_1}^{t_2} P\,dt$$

SI unit of power = J/s = **Watt [W]**

British system uses horsepower. 1 hp = 746 W

Kilowatt hour = unit of energy.

1 KWh = 1000 W (3600 s) = 3.6 x $10^6$ J

**Ex1:** An elevator has a mass of 1800 kg. It experiences a constant frictional force of 4000 N.

a) What power delivered by the motor is needed to lift the elevator at a constant speed of 3.0 m/s?

b) The elevator now comes to rest in 6 s. What is the average power during this time period?

**Ex2:** A 5 kg object's position varies with time according to $x = 4t^2 - 20$

Find: KE(t)

F(t)

P(t)

And the net work done from t = 1.0 to t = 3.0 s

Formulas on AP Sheet:

$$P = \frac{dW}{dt}$$

$$P = \mathbf{F} \cdot \mathbf{v}$$