Homework 16

Power.

Power ***P*** is the work done per unit time, or, in other words, power is the time rate of doing work. As long as time period of ***Δ***T is required to do work ***ΔW*** the power can be found from the following expression:

$$P = \frac{\Delta W}{\Delta T} \quad \text{.....(1)}$$

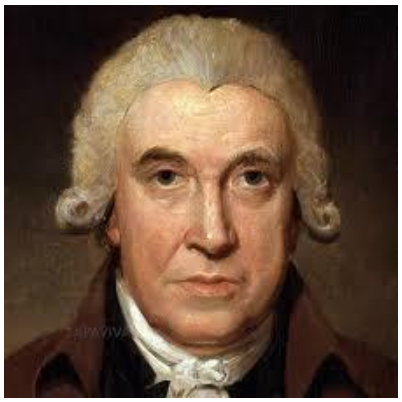
Let us assume that the force ***F***, which is doing the work, is directed along the displacement ***Δd***, so

$$\Delta W = F \cdot \Delta d \qquad (2)$$

Then for the power we have

$$P = \frac{\Delta W}{\Delta T} = \frac{F \cdot \Delta d}{\Delta T} = F \cdot \frac{\Delta d}{\Delta T} = F \cdot V \qquad (3)$$

Here ***V*** is the velocity. So, power can be calculated as force multiplied to the velocity along the force. As the work, power can be negative and positive. The unit of power is Watt. It is equal Joule/second and named after James Watt, Scottish inventor



James Watt (1736-1819).

James Watt made an important contribution to the Industrial revolution suggesting an improved steam engine in 1776.

Another power unit which was also developed by J.Watt and widely used in engineering is *horsepower*. *Mechanical horsepower* is about 745.7 W; metric horsepower is approximately 735.5W.

Problems:

1. An advertisement claims that a certain 1,200kg car accelerate from rest to a speed of 25m/s in a time of 8.0 seconds. What average power must the motor produce in order to cause this acceleration?
2. At 8 cents per kilowatt hour, what is the cost of operating 5 horse power motor (mechanical horse power)for 2 hours?.
3. A 30,000 kg airplane takes off at a speed of 50m/s, and 5 min later it is at an elevation of 3km and has a speed of 100m/s. What average power is required during this 5 min if 40 percent of the power is used to overcome air friction force?