Chapter 9: Work done and power (Rev B)

Work done

When a force acts on an object and the object moves we say that work is done. In other words the force is causing the energy of the object to increase. This might increase the objects gravitational potential energy or its kinetic energy. Work done has the units of 'joules' (not Nm).

It is probably best to forget the idea of work = force x distance. Instead learn:

Work done (by a force) (in J) = Average Force (in N) x Distance moved in the direction of the force (in m)

This is useful because sometimes you need to consider a situation when the force is varying. **$W = F\Delta s$**

Power

Power is the rate of doing work i.e how much work is done **per second**.

$$\text{Power} = \frac{\text{work done}}{\text{time}} \quad \text{or} \quad \frac{\text{energy transformed}}{\text{time}}$$

$P = W/t$

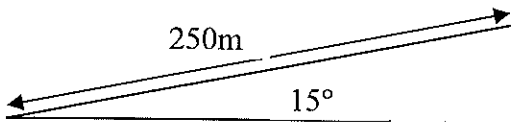
The unit of power is watts (W) and is equivalent to joules per second (J/s)

Questions

1. Calculate the work done in lifting a 10kg weight 1.2 m in the air (take g = 9.81 N/kg). Remember that weight = mg.

2. a) Calculate the work done in pushing a lawnmower with an average force of 30N a distance of 30m.
   b) If this takes 12s what is the power?

3. A 1500kg car moves 250m along a steep road at an angle of 15° to the horizontal in 40s.



   a) Calculate its weight
   b) Calculate the change in height

   c) Calculate the work done
   d) Calculate the output power.

4. a) Using the formula for power and the formula for work done, show that power = F x v
   b) A 450 tonne train has an engine which produces a force of 90 kN. The train travels at 15m/s. Calculate the power of the train (1 tonne = 1000kg)