Work

Scientists are very particular about what they consider 'work'. There are 3 conditions that must be true.

Conditions for Mechanical Work

1. A force must be exerted on the object
2. The object must be displaced by the force (it must move)
3. At least part of the force must be in the same direction as the displacement (collinear)

The textbook gives 3 good examples of **'non-work'** in Figure 4.6 on page 145. Sketch the examples and explain very simply why there is NO work being done.

Example #1 non-work Example #2 non-work Example #3 non-work

Formula **$W = F\Delta d$** where W = work measured in Joules (J)

F = Force measured in Newtons (N)

Δd = displacement measured in metres. (m)

The unit of Work is the Joule named after **James Joule** who studied **energy**.

A 'joule' is a derived unit. What is the base unit? (Nm)

Hint: A 'newton' is a derived unit ; its base unit is $kg \bullet m/s^2$

Ironically, work is a scalar quantity even though it is the product of 2 vector quantities.

$W = F \cos\theta \Delta d$ ** This is used when the forced applied and the displacement are non-collinear.

Sketch Look at picture of person pushed at an angle. Sketch & label accordingly. Do you see why it's the cosine trig function? (and not sine?)

+ Work and -Work

In a nutshell : +work = force and Δd are in same direction (lifting an object up)
- work = force is directly opposite to Δd (bringing object to ground.

Mechanical Work – Work done when there is an applied force AND object is displaced ($\Delta d \neq 0$)

Frictional Work – Work done by friction – always opposes motion

Net Work or Total Work - Sum of Mechanical Work and Frictional Work.