Work, Energy, Power

Work is said to be done if the point of the application of the force undergoes a displacement in the direction of force.

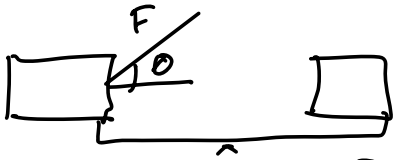
Work is defined as the product of the force applied and the distance moved in the direction of force.

Work = force × displacement in the direction of force.

i)

Work = Fx

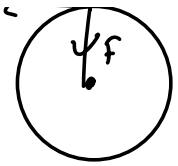
ii)



Work = $F\cos\theta x$

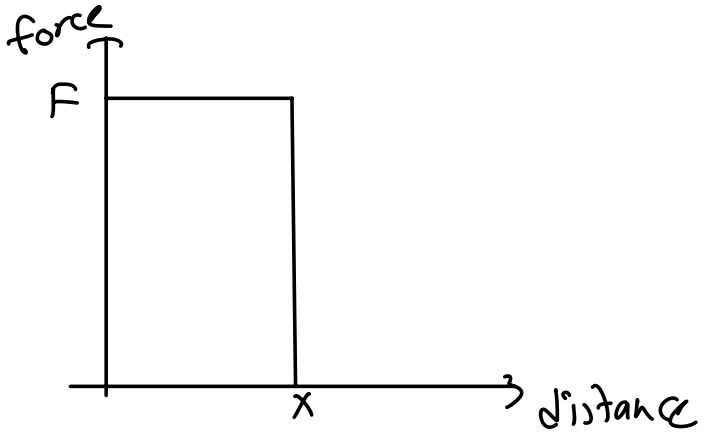
iii)

No work, force and distance perpendicular

iv)  Work done = 0

Force - displacement graph

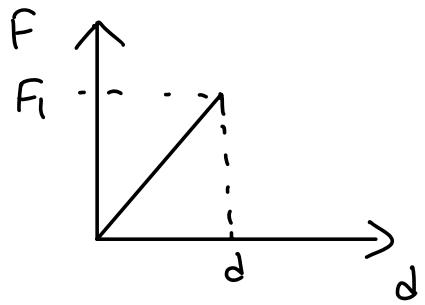
i) constant force



Work = F x d

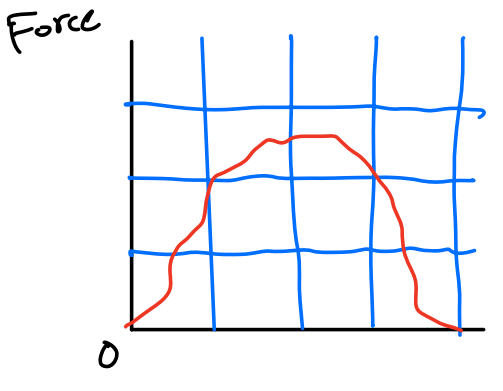
W = fx

ii) Force changing uniformly



$W = \frac{1}{2} F_1 d$

iii) Force changing non uniformly

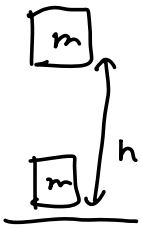


* Find area of one box, count boxes

Energy → It is the ability to do work

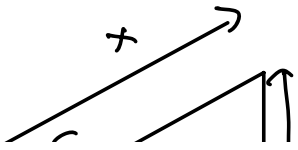
Potential energy → Whenever work is done against a non contact force, the energy gained by the object is potential energy.

GPE

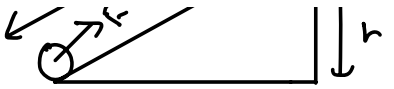


An object of mass 'm' is taken upwards without acceleration (constant velocity)
Force applied is equal to weight and distance moved.

Work = Force x distance
= weight x h
Work = mgh = energy transferred = GPE



lets consider an object



of mass m is moved through an inclined plane of length 'x' and height 'h'.

Work done by driving force = Fx

Change in G PE = mgh

If no frictional force acts

$Fx = mgh$

If friction acts $Fx > mgh$

loss of energy due to friction 'f'

$fx = Fx - mgh$

The energy is dissipated as heat.

Kinetic Energy (KE)

energy possessed by an object due to its speed.

$$KE = \frac{1}{2}mv^2$$

Work done by gas

When a gas sample expands work is done by the gas sample / work done on atmosphere pushing the atmosphere back.

If the gas is expanding against a constant external force,

Work done by gas $W = P\Delta V$

$P \rightarrow$ constant pressure

$\Delta V \rightarrow$ change in volume.

$$W = P\Delta V$$

$$\Rightarrow \frac{kg\ m\ s^{-2}}{m^2} \times m^3$$

$$\Rightarrow kg\ m^2 s^{-2}$$

Law of conservation of energy

Energy cannot be created or destroyed. It can only be converted from one form to another.

The total energy of an isolated system is always conserved (constan).