Chapter 6 - Work, Energy & Power

§6-1 Work

- Work is not energy, but rather it is the transfer of energy
- in order for there to be work done a force must act in the direction of displacement

$$W = F_{\parallel} \Delta d \quad \text{(scalar)}$$

where W is work $(J = 1 N \cdot m)$

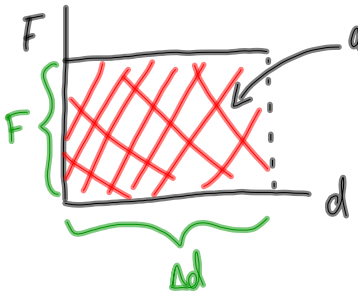
$F_{\parallel}$ is the force acting in the direction of the displacement (N)

Δd is the displacement (m)

No work is done when: (see p222 to 223)

1. there is no displacement $(\Delta d = 0)$
2. there is no force (constant velocity) $(F = 0)$
3. the force is perpendicular to the displacement

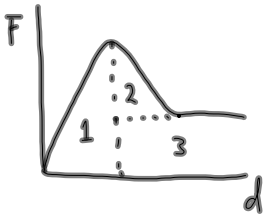
Consider a F·d graph:

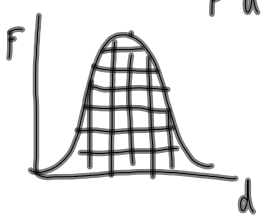


area of a rectangle = l x w

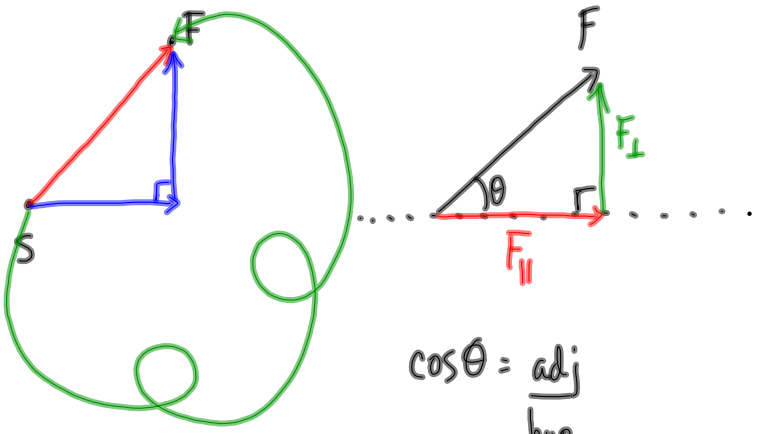
area = $F \Delta d$

$\therefore W$ = area under F·d graph





What if the force is at an angle?... does that mean that there is no work done?



$$\cos\theta = \frac{adj}{hyp}$$

$$\cos\theta = \frac{F_{||}}{F}$$

$$F_{||} = F\cos\theta$$

Recall: $W = F_{||}\Delta d$

$$W = (F\cos\theta)\Delta d$$

$$\boxed{W = F\Delta d\cos\theta}$$

If $\theta = 0°$  (force is in the same direction as Δd)

- maximum work

If $\theta = 90°$  (force is perpendicular to Δd)

- ZERO WORK!

If $\theta = 180°$  (force is opposite Δd)

- NEGATIVE WORK.

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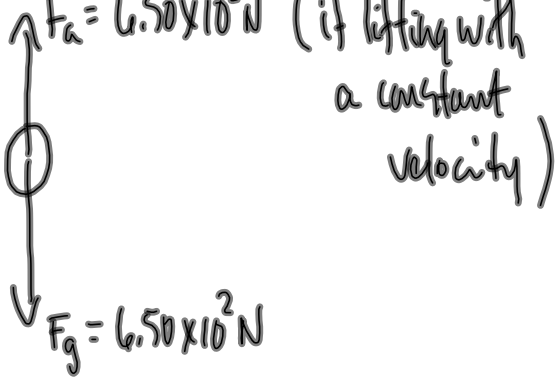
$F_g = 6.50 \times 10^2 N$

$\Delta d = 0.55 m$

a) W = ? (lifting)

b) W = ? (lowering)



a) lifting:

$\theta = 0°$

$W = F_{||} \Delta d$

$W = (6.50 \times 10^2 N)(0.55 m)$

$\boxed{W = 3.6 \times 10^2 J}$ ← POSITIVE WORK.

b) lowering:

$W = F \Delta d \cos\theta$

$W = (6.50 \times 10^2 N)(0.55 m) \cos 180°$

$\boxed{W = -3.6 \times 10^2 J}$

NEGATIVE WORK.

TO DO:

① PP|225

② Look MP|227

③ PP|229|11

④ PP|235