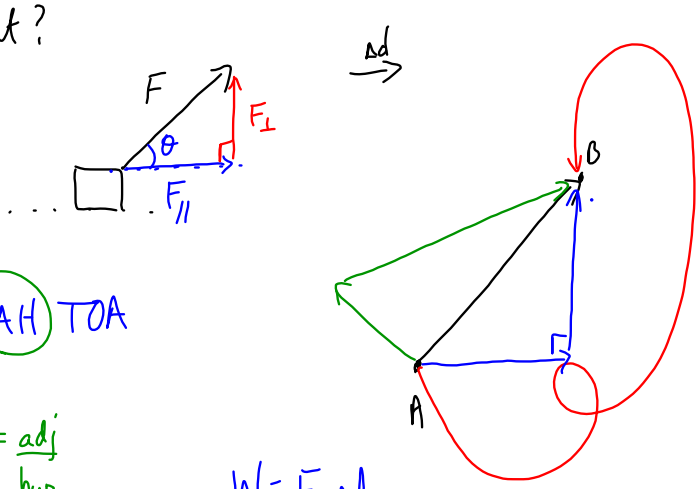
Work

Work → transfer of energy to an object

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

What to do when the force is not parallel to the displacement?



SOH CAH TOA

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

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

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

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

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

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

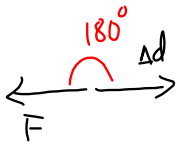
Two Equations for work:

$W = F_{\parallel} \Delta d$ (use if F and Δd are in same direction)

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

If $\theta = 0°$  , maximum work. $(\cos 0° = 1)$ (positive work)

If $\theta = 90°$  , no work $(\cos 90° = 0)$

If $\theta = 180°$  , negative work $(\cos 180° = -1)$

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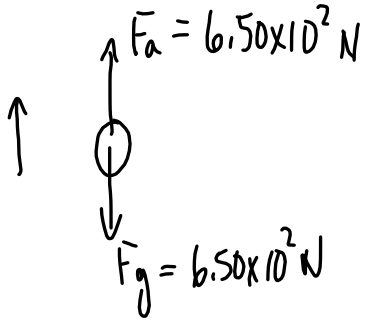
$F_g = 6.50 \times 10^2 N$

$\Delta d = 0.55 m$

a) W = ? (lifting)

b) W = ? (lowering)

a) Lifting:



since F_a is parallel to Δd →

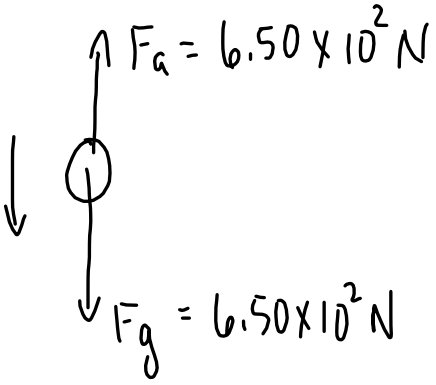
$W = F_{||} \Delta d$

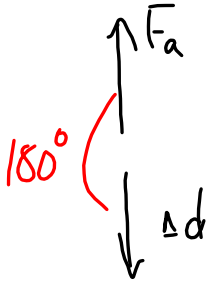
$W = F_a \Delta d$

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

$W = 3.6 \times 10^2 J$

b) lowering:





F is NOT parallel to Δd. →

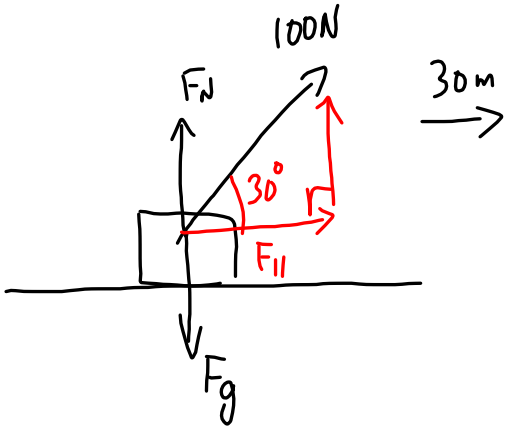
$W = F \Delta d \cos\theta$

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

$W = -3.6 \times 10^2 J$

Example

Calculate the work done by a horse that exerts an applied force of 100N on a sleigh if the harness makes an angle of 30° to the ground and the sleigh moves 30m across a flat level ice surface.



$W = F_{\parallel} d \cos\theta$

$W = (100N)(30m)\cos 30°$

$W = 2.6 \times 10^3 J$

TODO

1. PP|235
2. Assignment.
3. Imp-Mom. Lab