WORK

- Definition → Force exerted on a system over a distance
- Equation: $W = F d \cos\theta$

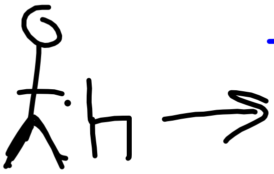
$\cos(0°) = 1$

$\cos(90°) = 0$

$\cos(180°) = -1$

- Units: $N \cdot m = J$

3A.1 Level 2&3

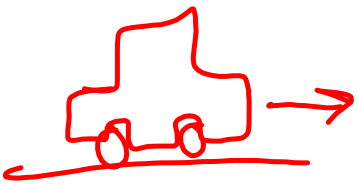
1) 

$$W = F\,d\,\cos(0°)$$
$$= (100\ N)(3\ m)(1)$$
$$= 300\ J$$

2) system: car $\xleftarrow{F_f}$

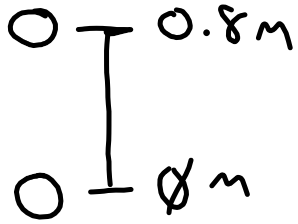
source of force: brakes $\xrightarrow{d}$

negative 180°



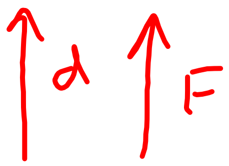
$$W = F\,d \cdot \cos(180°)$$
$$= (300\ N)(6\ m)(-1)$$
$$= -1800\ J$$

3)



system: ball

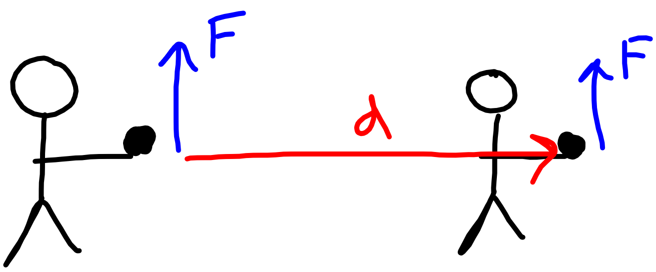
source of force: hand



positive ∅°

$$W = Fd\cos(\emptyset^\circ)$$
$$= (18\ N)(0.8\ m)(1)$$
$$= 14.8\ J$$

4)



Zero 90°

system: ball

source of force: hand

$$W = Fd\cos(90^\circ)$$
$$= \emptyset\ J$$

Work-Energy Theorem

$$W = \Delta E$$

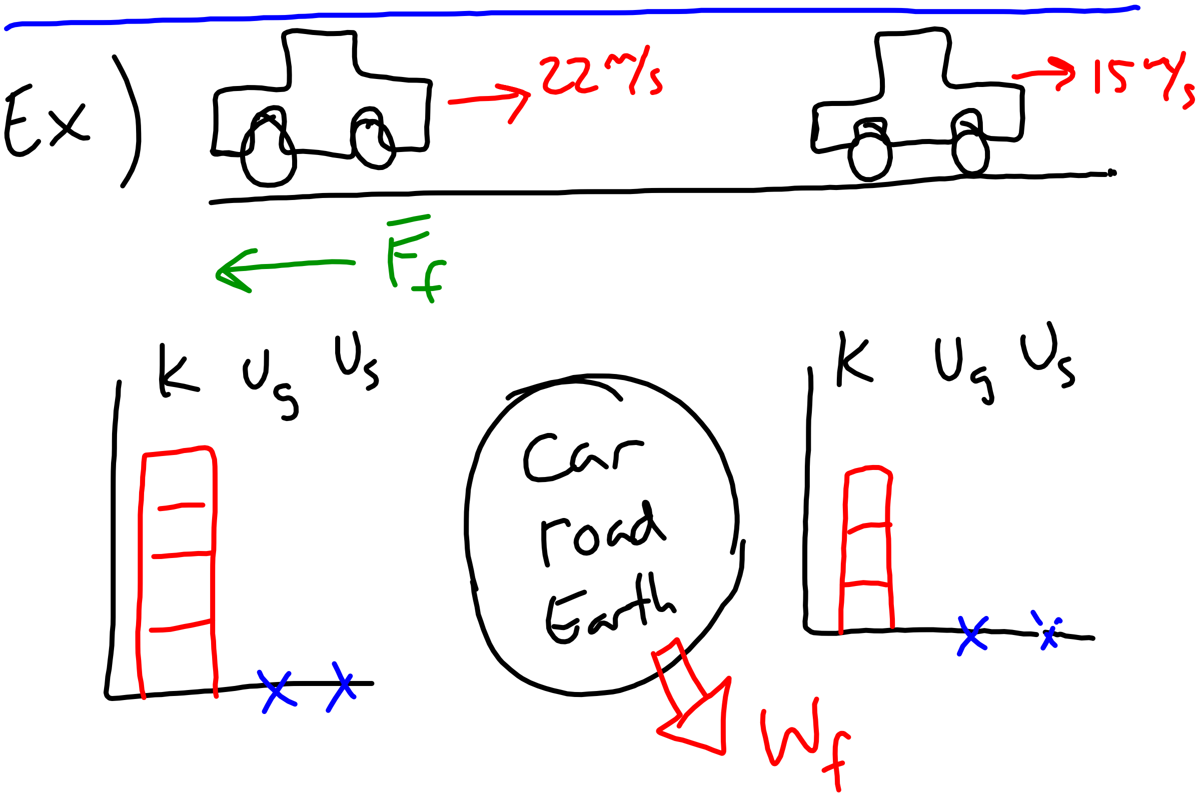
$$W = K_f - K_i$$

(Work-Kinetic Energy)

$$W = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

Work and Kinetic Energy Problem Set

Ex)



$$E_i = W_f + E_f$$

$$\frac{1}{2}mv_i^2 = W_f + \frac{1}{2}mv_f^2$$

$$W_f = \frac{1}{2}mv_i^2 - \frac{1}{2}mv_f^2$$

$$= \frac{1}{2}(450\,kg)(22\,m/s)^2 - \frac{1}{2}(450\,kg)(15\,m/s)^2$$

$$= 108900\,J - 50625\,J$$

$$= 58275\,J \text{ out}$$

$$W = -58275\,J$$

1)

$$K_i + W = K_f$$

$$W = K_f - K_i$$

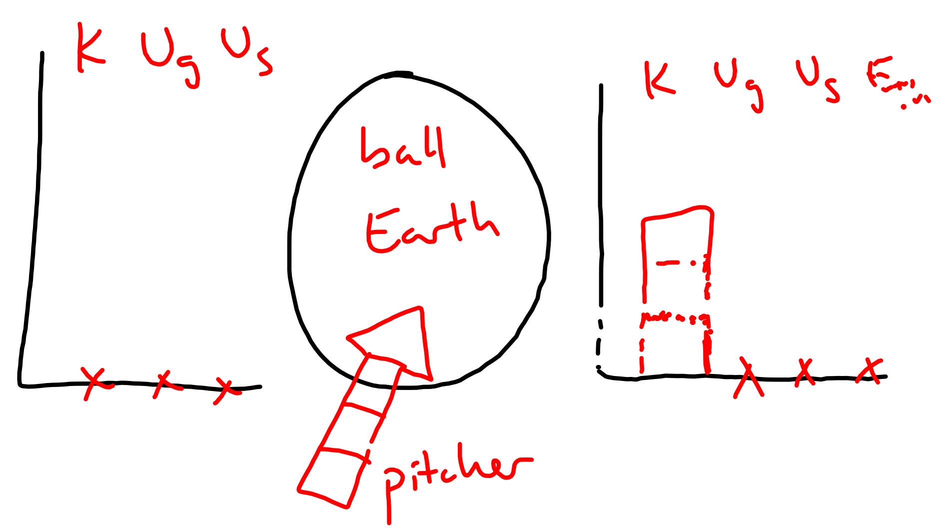
$$= \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

$$= \frac{1}{2} m \left(v_f^2 - v_i^2\right)$$

$$= \frac{1}{2} (120\ \mathrm{kg}) \left[(6\ \mathrm{m/s})^2 - (2\ \mathrm{m/s})^2 \right]$$

$$= 1920\ \mathrm{J}$$

3)



$$W = K_f$$

a) $$Fd = K_f$$

$$K_f = (520\,N)(0.6\,m)$$

$$= 312\,J$$

b) $$K_f = \frac{1}{2}mv_f^2$$

$$v_f = \sqrt{\frac{2K_f}{m}}$$

$$= \sqrt{\frac{2(312\,J)}{0.14\,kg}}$$

$$= 66.8\,m/s$$