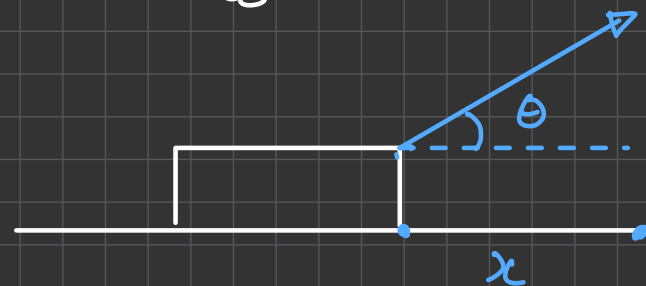


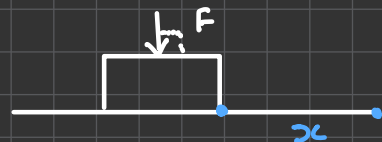
When energy is transferred work is done



$$W = Fx \cos \theta$$

Work done is **maximum** when $\theta = 0^\circ$ $\cos(0) = 1$
 $W = Fx \cos \theta = Fx$

Work done is **minimum** when $\theta = 90^\circ$ $\cos(90) = 0$



$$W = Fx \cos(90) = 0$$

Joule base unit

$$W = Fx \cos \theta$$

$F = ma$ so $W = max \cos \theta$ - no units

$$J = \text{kg} \cdot \text{m} \cdot \text{s}^{-2}$$

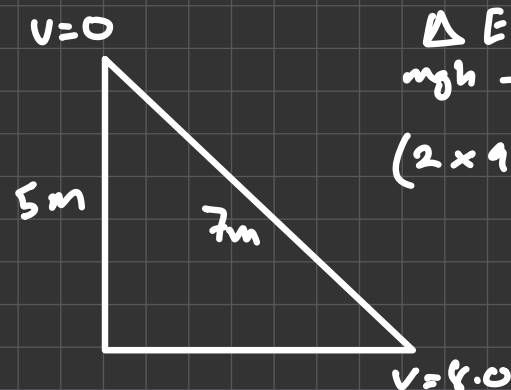
$$J = \text{kg} \cdot \text{m}^2 \cdot \text{s}^{-2}$$

Principle of conservation of energy states that energy can not be created or destroyed. It can only be transferred from one form to another

$$\Delta E = W \rightarrow E_{\text{final}} - E_{\text{initial}} = W$$

Finding the resistive force

Ball of mass 2kg reaches a speed of 8 m/s when it reaches the ground. Calculate the magnitude of the resultant force acting on it as it rolls down. The ramp has a length of 7meters.



$$\Delta E = W$$

$$mgh - \frac{1}{2}mv^2 = Fx$$

$$(2 \times 9.81 \times 5) - \left(\frac{1}{2} \times 2 \times 8^2\right) = F \times 7$$

$$34.1 = F \times 7$$

$$F = 4.9$$

Potential Energy, $E_p = mgh$

$$\Delta E = W$$

$$\Delta E = Fx \cos \theta$$

$$= mgh$$

Kinetic Energy $E_k = \frac{1}{2}mv^2$

$$\Delta E = W$$

$$\Delta E = Fx \cos \theta$$

$$\Delta E = Fs$$

$$\Delta E = mas$$

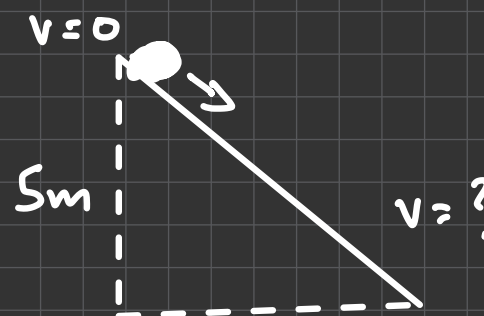
$$\Delta E = m \left(\frac{v^2}{2} \right)$$

$$v^2 = u^2 + 2as$$

$$v^2 = 2as$$

$$as = \frac{v^2}{2}$$

Exchange between GPE and KE



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

$$v^2 = 2gh$$

$$v = \sqrt{2gh}$$

$$\sqrt{2 \times 9.81 \times 5} = 9.9 \text{ m/s}$$

Power: rate of energy transferred

$$P = \frac{W}{t} \rightarrow P = \frac{Fxc}{t} \rightarrow P = Fv$$

$$\text{Efficiency} = \frac{\text{useful output energy}}{\text{total input energy}} \times 100$$

Chapter 5
Work energy and power