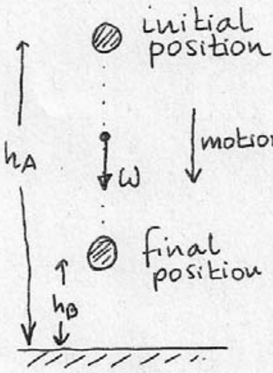
From the Work-Energy Theorem to the Conservation of Mechanical Energy: A demonstration



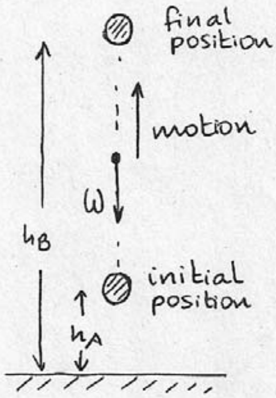
$$PE_{initial} = m \times g \times h_A$$

$$PE_{final} = m \times g \times h_B$$

$$\Delta PE = PE_{final} - PE_{initial} =$$

$$= m \times g \times (h_B - h_A)$$

$$W_w = w \times \Delta y \times \cos 0^\circ = w \times (h_A - h_B) = m \times g \times (h_A - h_B) = -\Delta PE$$



$$PE_{initial} = m \times g \times h_A$$

$$PE_{final} = m \times g \times h_B$$

$$\Delta PE = PE_{final} - PE_{initial} =$$

$$= m \times g \times (h_B - h_A)$$

$$W_w = w \times \Delta y \times \cos 180^\circ =$$

$$= w \times (h_B - h_A) \times (-1) =$$

$$= -m \times g \times (h_B - h_A) = -\Delta PE$$

Equivalence between the Work-Energy Theorem and the Conservation of Mechanical Energy

Work-Energy Theorem

$$\boxed{W_{TOTAL} = \Delta KE = KE_{final} - KE_{initial}}$$

$\updownarrow$ $W_{TOTAL} = W_w + W_{F,F_f}$

↳ work done by the weight

$$W_w + W_{F,F_f} = \Delta KE$$

↳ work done by non-conservative forces

$\updownarrow$

$$\boxed{W_w = -\Delta PE}$$

$\updownarrow$

$$-\Delta PE + W_{F,F_f} = \Delta KE$$

$\updownarrow$

Principle of Conservation of Mechanical Energy

$$\boxed{W_{F,F_f} = \Delta KE + \Delta PE = \Delta E}$$