Energy

Recall: $PE = mgh$ $PE = \frac{1}{2}kx^2$

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

$TE = KE + PE$

Changes in Energy (Kinetic & ~~Potential~~)

$KE = \frac{1}{2}mv^2$ ΔKE $\Delta KE = KE_2 - KE_1$

$PE = mgh$ ΔPE $\Delta PE = PE_2 - PE_1$

Ex. What is your change in kinetic energy if you (72.5kg) are riding a unicycle (5kg) up a hill and your speed changes from 5 m/s (v_1) to 3 m/s (v_2)?

$$\Delta KE = KE_2 - KE_1$$

$$= \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

$$\Delta KE = \frac{1}{2}m(v_2^2 - v_1^2)$$

$$= \frac{1}{2}(77.5)(3^2 - 5^2)$$

$$\Delta KE = -620\ J$$

Neg means energy is LOST

Ex. What is the change in potential energy of lifting a 5000kg rhino from a platform 2m high to the top of the Empire State Building (443m)?

$\Delta PE = mgh_2 - mgh_1$

$\Delta PE = mg(h_2 - h_1)$

$= (5000)(9.8)(443 - 2)$

$\Delta PE = 2.16 \times 10^7 \text{ J}$

Pos$^+$ means energy is GAINED!

Power (Ranges)

$$\text{Power} = \frac{\text{Work}}{\text{time}} \qquad P = \frac{W}{t}$$

Units: $\frac{J}{s} \rightarrow$ Watt (W)

Ex How much power would it take for a crane to lift a 5000kg rhino to the top of the Empire State Building (443m) in:

i) 15min? $15 \times 60 = 900s$

ii) 10 sec?

ii) 1 hour? $3600s$

i) $P = \frac{W}{t} = \frac{mgh}{t}$

$P = \frac{(5000)(9.8)(443)}{900}$

$P = 24119\ W$

ii) $P = \frac{(5000)(9.8)(443)}{10}$

$P = 2.17 \times 10^6\ W$

iii) $P = \frac{(5000)(9.8)(443)}{3600}$

$P = 6030\ W$