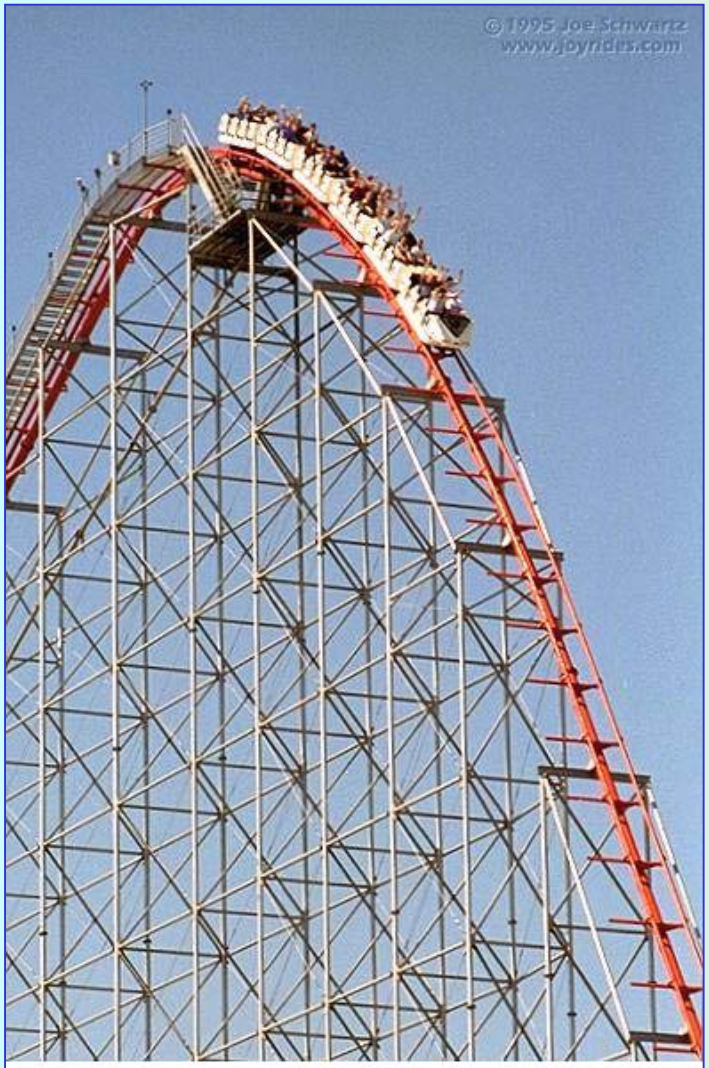
Work – Energy Theorem

Rafa Muñoa
Lizardi Institutua
Zarautz



http://ffden-2.phys.uaf.edu/211_fall2002.web.dir/Shawna_Sastamoinen/Velocity&Kinetic_files/image003.jpg

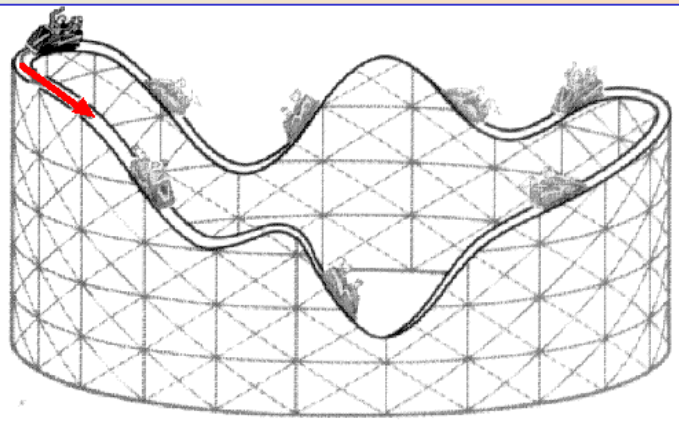
Kinetic Energy (KE)

A body in motion possesses energy associated with its motion (velocity) because it can transform itself or its surroundings.

The (translational) kinetic energy is given by:

$$KE = \frac{1}{2} * m * v^2$$

The SI units are $kg*m^2/s^2$ or joules.



http://teacherknowledge.wikispaces.com/space/showimage/RollerCoasterExample.gif

Work – Energy Theorem

Rafa Muñoa
Lizardi Institutua
Zarautz

Work-Energy Theorem

The work done on a body by the net force acting on it is equal to the change in kinetic energy of the body:

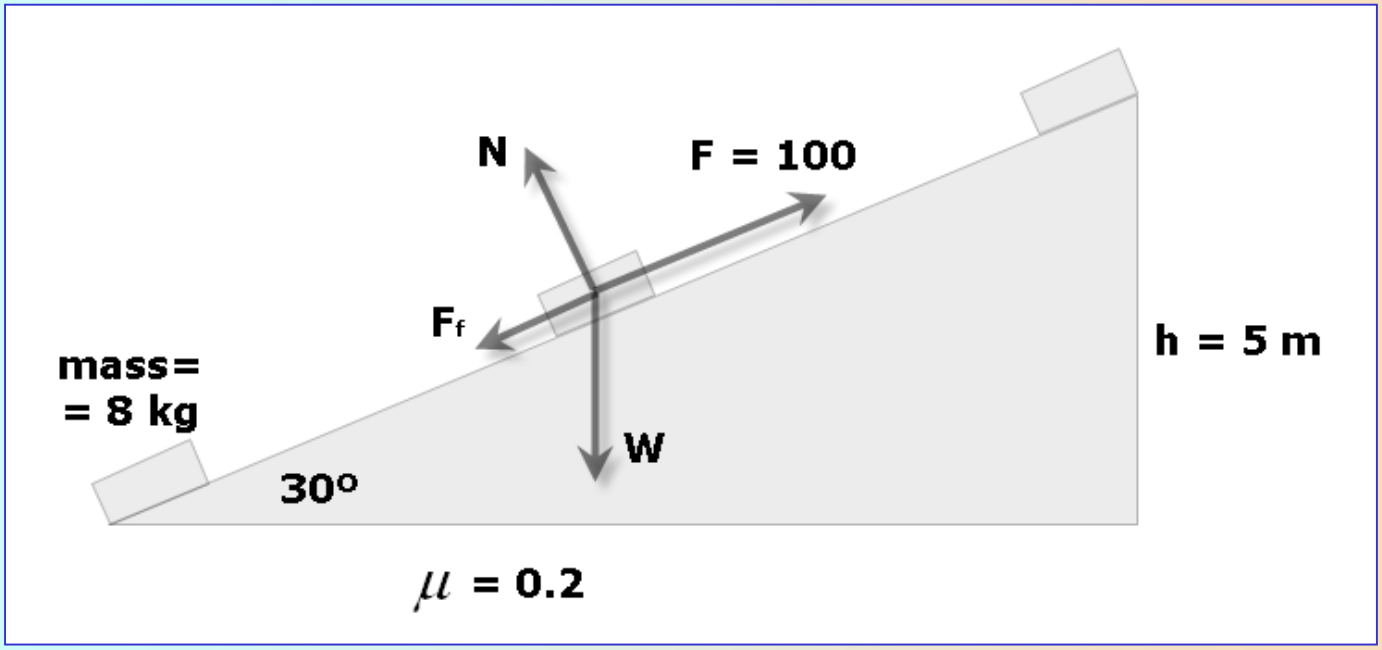
$$W = \Delta KE = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$$

Exercise

The body goes from the bottom of the slope to the top. Initially, the body is at rest.

Determine the velocity on top by using the work-energy theorem.

Sol: v=10.7 m/s



Work – Energy Theorem

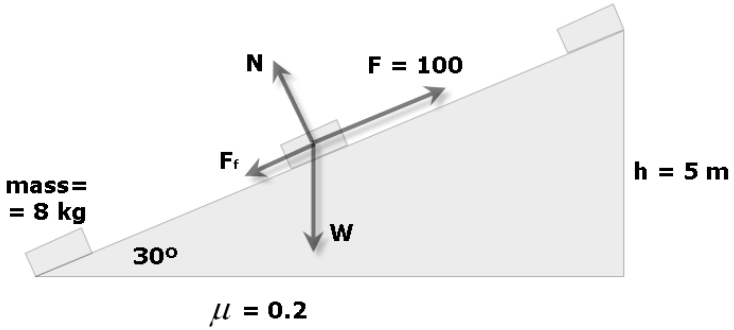
Rafa Muñoa
Lizardi Institutua
Zarautz

Exercise

The body goes from the bottom of the slope to the top. Initially, the body is at rest.

Determine the velocity on top by using the work-energy theorem.

Sol: v=10.7 m/s



The work-energy theorem tells us that

$$W = \Delta KE$$

To calculate the work done by all forces we can use the expression

$$W = W_F + W_W + W_N + W_{Ff}$$

The distance travelled by the body is

$$\sin 30^\circ = \frac{1}{2} = \frac{5m}{\Delta x} \rightarrow \boxed{\Delta x = 10\ m}$$

The work done by each force is:

$$W_F = 100N \times 10m \times \cos 0^\circ = 1000\ J$$

$$W_W = 80N \times 10m \times \cos(-120^\circ) = -400\ J$$

$$W_N = N \times 10m \times \cos 90^\circ = 0$$

$$N = W_y = W \times \cos 30^\circ = 80N \times \cos 30^\circ = 69.3N$$

$$F_f = \mu \times N = 0.2 \times 69.3N = 14N$$

$$W_{Ff} = 14N \times 10m \times \cos 180^\circ = -140\ J$$

The total work is

$$W = W_F + W_W + W_N + W_{Ff} = 460\ J$$

Rafa Muñoa
Lizardi Institutua
Zarautz

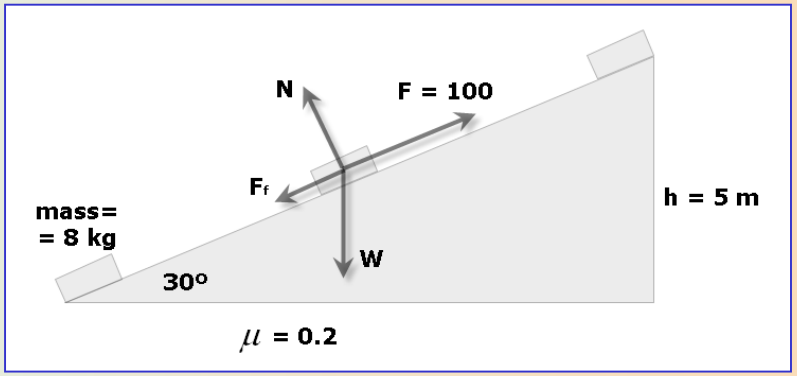
Work – Energy Theorem

Exercise

The body goes from the bottom of the slope to the top. Initially, the body is at rest.

Determine the velocity on top by using the work-energy theorem.

Sol: v=10.7 m/s



Applying the theorem:

$$W = \Delta KE \rightarrow 460\,J = \frac{1}{2} \times 8\,Kg \times v^2 - \frac{1}{2} \times 8\,Kg \times 0$$

$$460\,J = 4\,Kg \times v^2 \longrightarrow v = \sqrt{\frac{460\,J}{4\,kg}} \rightarrow \boxed{v = 10.7\,\frac{m}{s}}$$