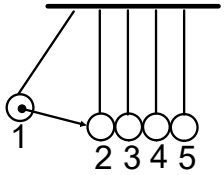
7.3 – Work-Energy Theorem: Kinetic Energy

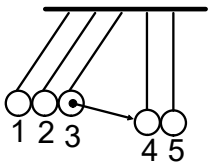
I will release sphere 1 and let it hit the other four. What will happen?

Physics Democracy 1	
Sphere 1 stops - no more motion	
All spheres move, but slower than 1	
Only sphere 5 moves - same speed sphere 1	
Sphere 1 stops, other four move slower than first	



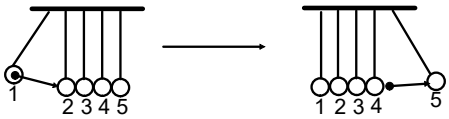
What happens when I release spheres 1, 2, and 3 and let them hit the other four?

Physics Democracy 2: Caucus Style	
Candidates	Votes

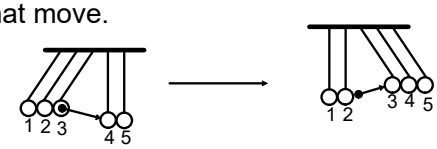


Physics Democracy Answers

Democracy 1 - Ball 5 is the only one that moves.



Democracy 2 - Balls 4 and 5 are the only ones that move.



Kinetic Energy

Energy of motion, units = Joules.

Doing work on something gives it kinetic energy, and something with kinetic energy can do work (demo).

Mathematically:

$K = \frac{1}{2}mv^2$ AP Equation	m = mass (kg) v = velocity (m/s)

Velocity is squared, so K can't be negative.

Unit analysis:

$$K = \frac{1}{2}mv^2 = kg\left(\frac{m}{s}\right)^2 = kg \cdot m^2/s^2 = J$$

Work-Energy Theorem:

Net work done equals kinetic energy change

$$W = \Delta K$$

$$= K_2 - K_1$$

This can be positive **OR** negative, depending on the situation.

1. Example

A 165 g puck is hit by a 72 kg skater going 1.5 m/s and flies at 27 m/s towards the goalie.

Which object has more kinetic energy, the skater or the puck?

Example 1: Answer

Compute the kinetic energy of both objects:

$$K_{Skater} = \frac{1}{2}mv^2 = \frac{1}{2}\cdot 72\text{ kg}\,(1.5\text{ m/s})^2 = 81\text{ J}$$

$$K_{Puck} = \frac{1}{2}mv^2 = \frac{1}{2}\cdot 0.165\text{ kg}\,(27\text{ m/s})^2 = 60.\text{ J}$$

The skater has more kinetic energy.

2. Goalie Example

The goalie stops the puck in his glove.

A. How much work did he do on the puck?

B. How much work did the puck do on him?

Example 2.A

Compute the change in kinetic energy of the puck.

$$W = \Delta K$$

$$= K_2 - K_1$$

$$= 0.0\text{ J} - 60.\text{ J} = -60.\text{ J}$$

He did negative work on the puck because it lost kinetic energy.

Example 2.B

The puck does work on him, however. As he slows it down, it transfers an equal and opposite amount of kinetic energy to him.

$$W = 60.\text{ J}$$

Homework

Read 5.4 in your book
7.3 Problems in your Booklet
Due: next class

Attachments

Mousetrap Movie.MOV

Mousetrap 2.MOV