

**University of Virginia**

**Department of Physics**

Physics 606: How Things Work II

Lecture #5 Slides:

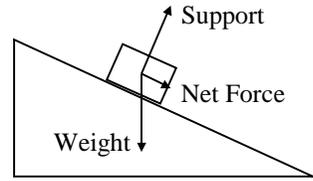
**Seesaws**

## Work Lifting Ball

- Going straight up:
  - Force is large
  - Distance is small

$$\text{work} = \text{force} \cdot \text{distance}$$

## Forces on a Ramp



## Work Lifting Ball

- Going up ramp:
  - Force is small
  - Distance is large

$$\text{work} = \text{force} \cdot \text{distance}$$

## Work Lifting Ball

- Going straight up:

$$\text{work} = \text{force} \cdot \text{distance}$$

- Going up ramp:

$$\text{work} = \text{force} \cdot \text{distance}$$

- The work is the same, either way!

## Physics Concept

- Mechanical Advantage
  - Doing the same amount of work
  - Redistributing force and distance

Seesaws

### Question:

You and a child half your height lean out over the edge of a pool at the same angle. If you both let go simultaneously, who will tip over faster and hit the water first?

### Observations About Seesaws

- A balanced seesaw can remain horizontal
- A balanced seesaw rocks back and forth easily
- Two equal-weight children balance a seesaw
- Two unequal-weight children don't balance
- But moving the heavy child inward helps

### Physics Concept

- Rotational Inertia
  - A body at rest tends to remain at rest.
  - A body that's rotating tends to continue rotating.

### Physical Quantities

- Angular Position – an object's orientation
- Angular Velocity – its change in angular position with time
- Torque – a twist or spin

### Newton's First Law of Rotational Motion

A rigid object that's not wobbling and that is free of outside torques rotates at a constant angular velocity.

### Center of Mass

- The point about which an object's mass balances
- A free object rotates about its center of mass while its center of mass follows the path of a falling object

## Physical Quantities

- Angular Position – an object's orientation
- Angular Velocity – its change in angular position with time
- Torque – a twist or spin
- Angular Acceleration – its change in angular velocity with time
- Moment of Inertia – measure of its rotational inertia