Week 7: Overheads Not in Reader

Inventing Reality

The Physics of Motion

Before Isaac Newton: Kinematics

Galilean Relativity: All motion is relative.

**Speed:** Rate at which distance is being covered.
**Rate:** Change of a quantity with respect to time.

→ I travel at a speed of 10 miles per hour for 2 hours. How far do I go?

**Velocity:** Speed and direction.

→ I travel at a velocity of 10 mph North for 2 hours. How far do I travel?

→ I then travel 20 mph South for 2 hours. Where do I end up with respect to where I started?

**Acceleration:** The rate at which velocity is changing.

→ I am at rest. I then smoothly accelerate to a speed of 20 mph in one hour. What was my acceleration during the hour?
I am traveling at 50 mph. I then smoothly increase my speed to 70 mph over 1 hour. What was my acceleration during the hour?

Typical units in physics are metric ($kg \cdot m/s^2$)

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\[ \frac{1 \text{ ft}}{2 \text{ mile}} \]
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**Free Fall**

On Earth, objects dropped increase their speed at a rate of 10 meters per second every second. That is, $a_g = 10 \frac{m}{s^2}$, or $g = 10 \frac{m}{s^2}$ — the acceleration due to gravity on Earth's surface.

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<th>Elapsed Time (s)</th>
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I drop a stone from atop a building. How fast is it going after 2.5 seconds?

I throw a stone down from atop a building. How fast is it going 2.5 seconds later?

**Newtonian Mechanics**

How forces produce changes in motion.

I exert a force of 10N on a 2 kg object. What is its acceleration?

If mass is 1 kg, what is the acceleration?