PHET SIMULATION LAB AND LESSON PLAN

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LAB EXPERIENCE

The 'Forces and Motion: Basics' PhET simulation allows students to explore concepts of balanced and unbalanced forces through interactive scenarios like tug-of-war and pushing objects.

Series of photographs/screenshots:

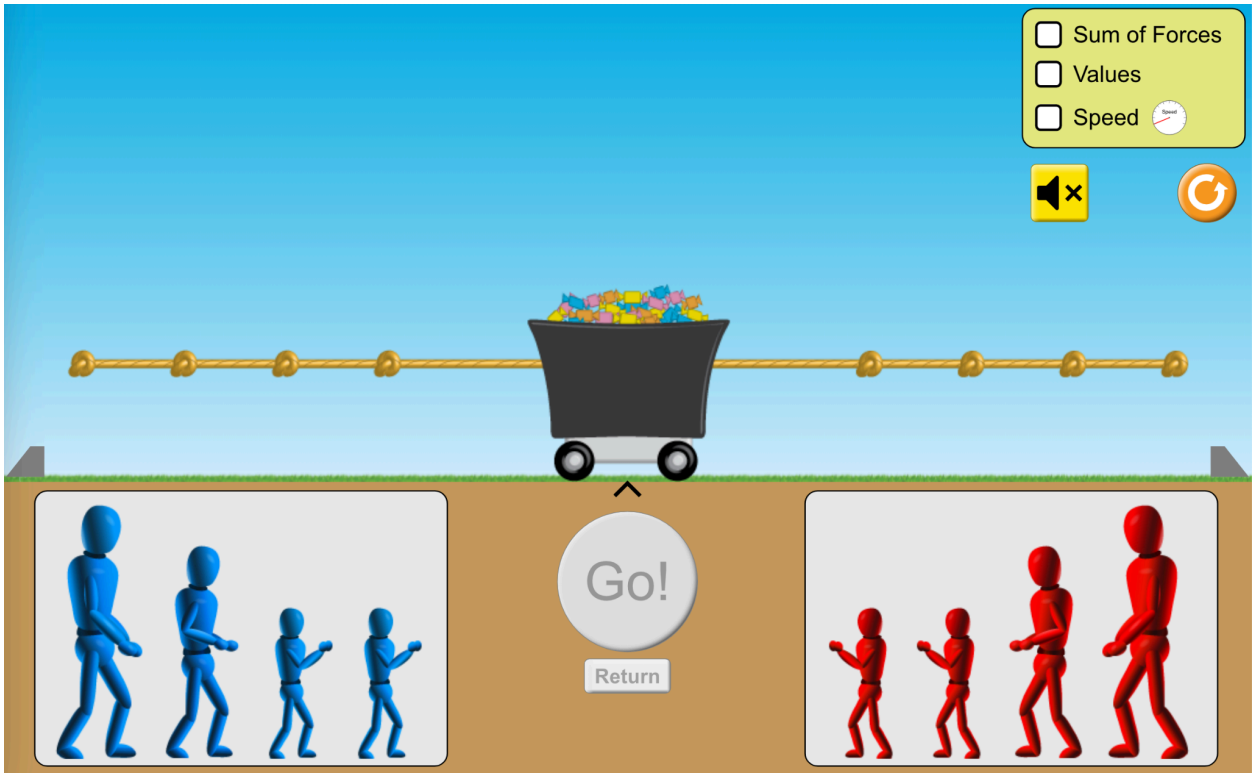
a) The initial setup of the tug-of-war scenario

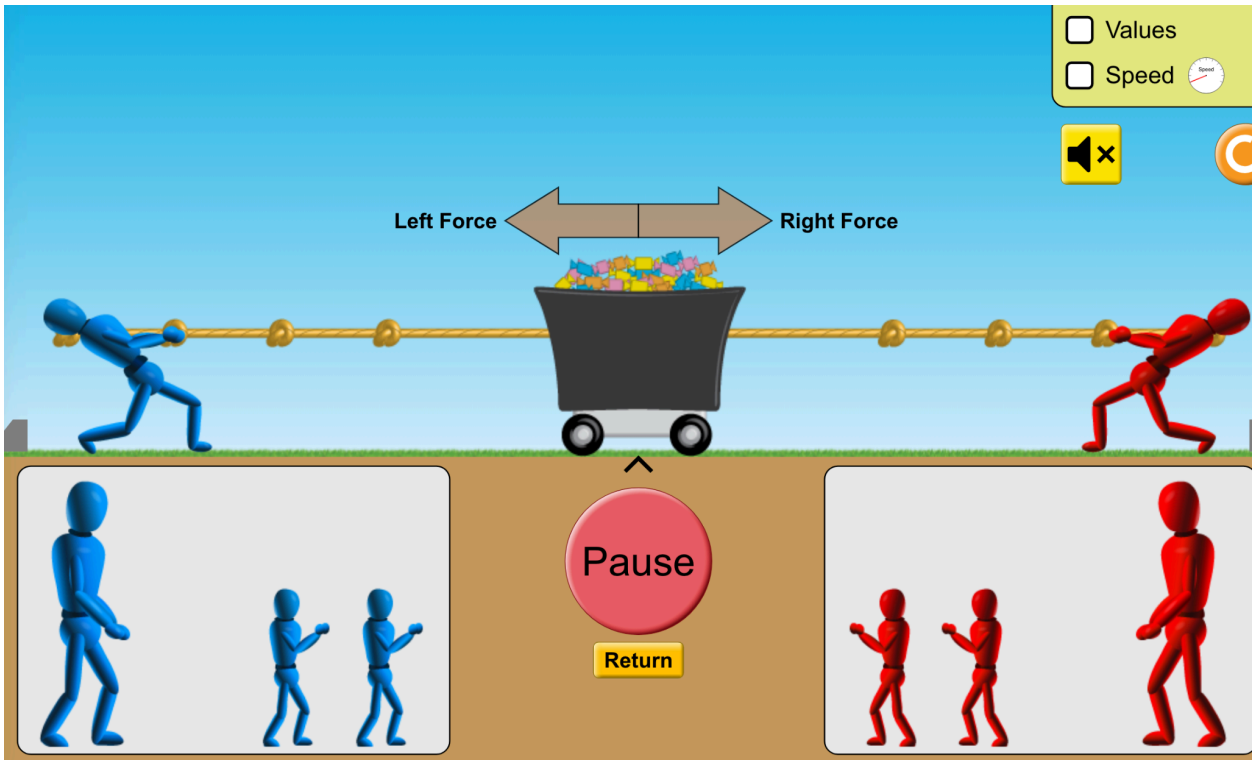
b) A balanced force situation in tug-of-war

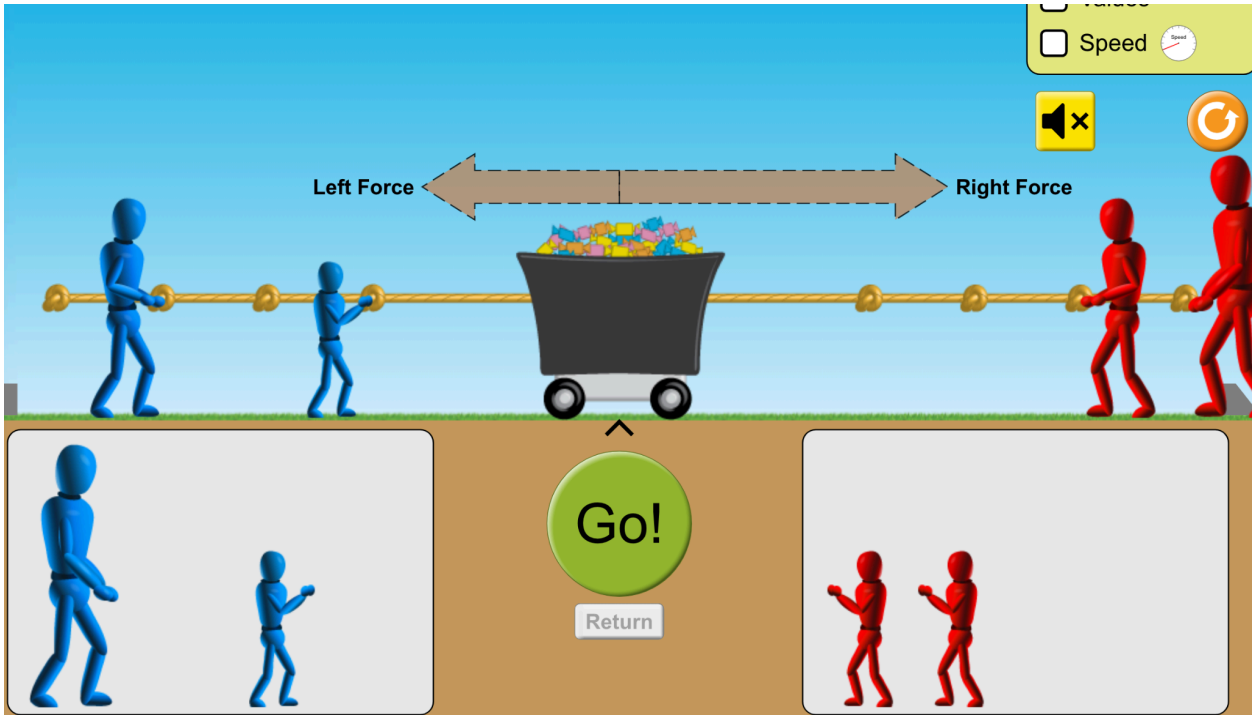
c) An unbalanced force situation in tug-of-war

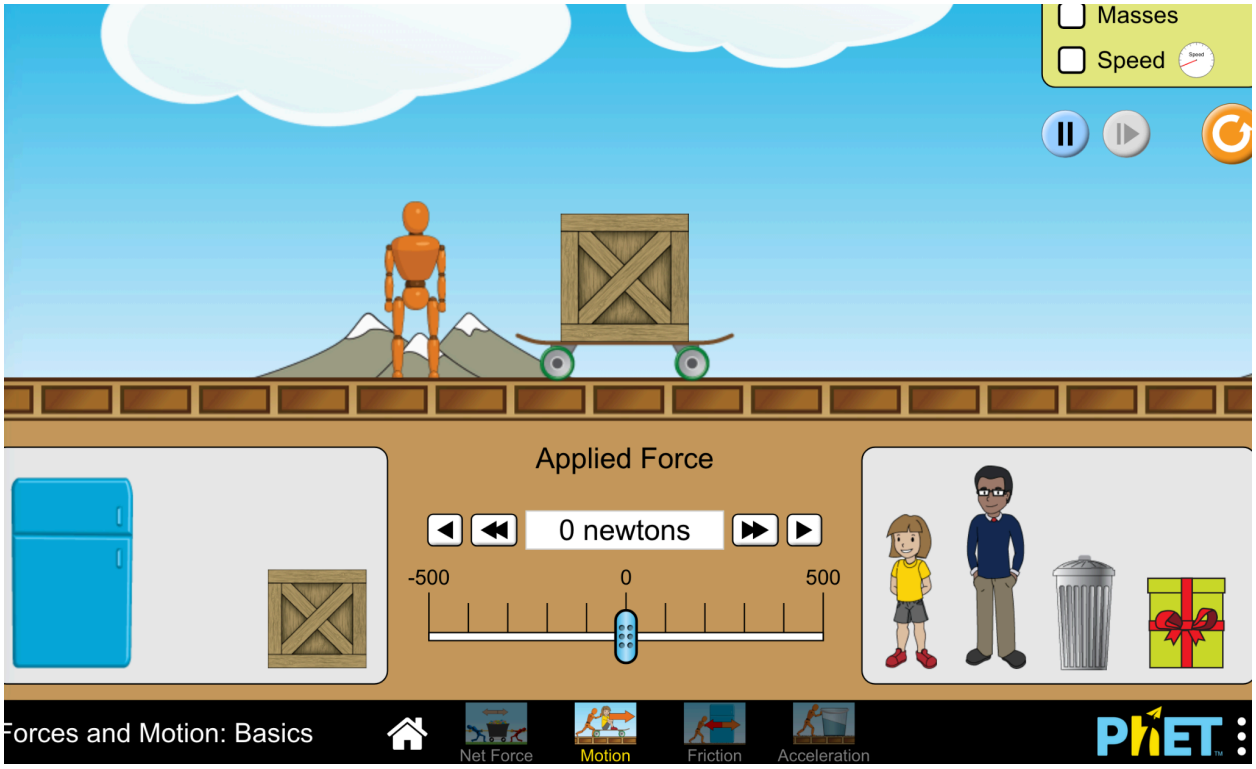
d) The motion tab showing the cart at rest

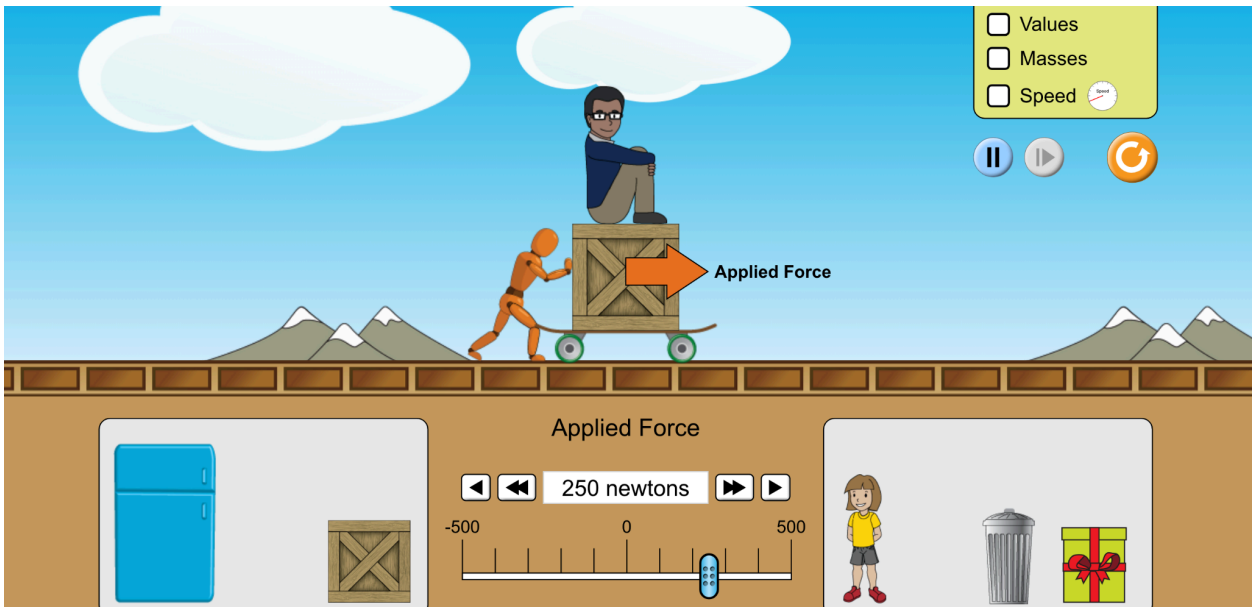
e) The motion tab showing the cart in motion




Values
Speed
Left Force
Right Force
Pause
Return


Speed
Left Force
Right Force
Go!
Return


Masses
Speed
Applied Force
0 newtons
-500
0
500
Forces and Motion: Basics
Net Force
Motion
Friction
Acceleration
PhET


Values
Masses
Speed
Applied Force
Applied Force
250 newtons
-500
0
500

Lesson Plan: Exploring Forces and Motion

Grade Level: 4-5
Duration: 45-60 minutes

Learning Objectives

By the end of this lesson, students will be able to:

1. Identify balanced and unbalanced forces
2. Predict how forces affect the motion of objects
3. Explain the relationship between force and motion

Materials

- iPads
- PhET "Forces and Motion: Basics" simulation
- car
- Worksheet (optional)

Introduction (5-10 minutes)

1. Begin by asking students to roll a toy car across their tables gently. Then ask them to push harder.
2. Discuss: What happened? Why did the car move differently?
3. Introduce the concept of force as a push or pull that can change an object's motion.

Guided Exploration (20-30 minutes)

Part 1: Tug of War

1. Have students open the "Forces and Motion: Basics" simulation and navigate to the "Net Force" tab.
2. Demonstrate how to add characters to each side of the rope.
3. Ask students to predict what will happen with:
    - Equal numbers on each side
    - More characters on one side
4. Let students experiment and observe the results.
5. Discuss: What is a balanced force? An unbalanced force?

Part 2: Motion

1. Direct students to the "Motion" tab.
2. Show them how to apply force to the cart and observe its motion.
3. Ask students to predict and then test:
    - What happens when you push and let go?

- What happens if you keep pushing?
- How does changing the force affect the motion?

Class Discussion (10-15 minutes)

1. What did you notice about balanced and unbalanced forces?
2. How does force affect an object's motion?
3. Can you think of real-life examples of balanced and unbalanced forces?

Assessment (5-10 minutes)

Have students complete a quick exit ticket:

1. Draw a diagram showing balanced forces.
2. Draw a diagram showing unbalanced forces.
3. Explain in your own words how force affects motion.

Extension Activities

- For advanced students, explore the "Friction" and "Acceleration" tabs of the simulation.
- Have students design their own tug-of-war game and predict outcomes based on what they learned.

This lesson plan utilizes the PhET simulation to provide a hands-on, interactive experience for students to explore forces and motion. It allows them to make predictions, test their ideas, and draw conclusions based on their observations. The simulation's visual nature helps make abstract concepts more concrete for younger students (and myself included!), enhancing their understanding of these physics principles.

Resources:

PhET Interactive Simulations. (n.d.). *Forces and motion: Basics*. University of Colorado Boulder. https://phet.colorado.edu/en/simulation/forces-and-motion-basics

PhET Interactive Simulations. (n.d.). *For teachers*. University of Colorado Boulder. https://phet.colorado.edu/en/for-teachers