

Unit 3: Causes of Motion

Essential Questions

What is a force?

How do we represent a force?

What do we mean by an unbalanced force?

What is the effect of unbalanced forces on a system?

How is unbalanced force related to uniform motion?

How is unbalanced force related to being at rest?

How is unbalanced force related to speeding up?

How is unbalanced force related to slowing down?

Instructional Goals

By the end of this unit, you should be able to do the following:

1. Newton's 1st law (Galileo's thought experiment)
Develop notion that a force is required to *change velocity*, not to *maintain motion*
Constant velocity does not require a force.
2. Force concept
View force as an interaction between and agent and an object
Choose system to include objects, not agents
Express Newton's 3rd law in terms of paired forces (agent-object notation)
3. Force diagrams
Correctly represent forces as vectors originating on object (point particle)
Use the superposition principle to show that the net force is the vector sum of the forces
4. Statics
 $\Sigma F = 0$ produces same effect as no force acting on object
Decomposition of vectors into components

Sequence

1. Activity 1 Broom Ball
2. Activity 2 Class Demo and Discussion: Force Identification and Notation
3. Exercise 1 (a, b, & c) - Representing Forces
4. Quiz 1 Force Diagrams.
5. Lab 1 Gravitational Force vs. Mass Experiment
6. Exercise 2 Problems using the relationship between gravitational force and mass
7. Activity 3 Forces between objects – Newton's Third Law
8. Exercise 3 Application of Newton's Third Law
9. Activity 4 Newton's 2nd Law – UC PHet simulation – Forces in 1 dimension
10. Test