



### I. Introduction

The material contained within this lesson plan is meant to be used as preparation for the Newton's Second Law e-Lab. As part of this pre-lab lesson, students will:

- A. Be able to state Newton's Second Law and explain how force, mass, and acceleration are related.
- B. Use the equation 'Force = mass x acceleration' to solve words problems.

### II. Objective:

Students will gain an understanding of Newton's Second Law of motion: "The acceleration produced by the force on an object is directly proportional to the magnitude of the net force, is in the same direction as the net force and is inversely proportional to the mass of the object."

### III. Key Vocabulary:

- Acceleration- a change in velocity. You can accelerate by speeding up, slowing down, or changing direction.
- Air resistance- the force of air exerted on a falling object. The air pushes up as gravity pulls down. It is dependent upon the shape and surface area of the object.
- Force- a push or pull exerted on an object; they can be balanced or unbalanced.
- Gravity – an attraction force between all masses proportional to the mass of the objects and the distance between them.
- Mass- the measure of the amount of matter in an object
- Newton – the force needed to give a mass of one kilogram an acceleration of one meter per second per second.

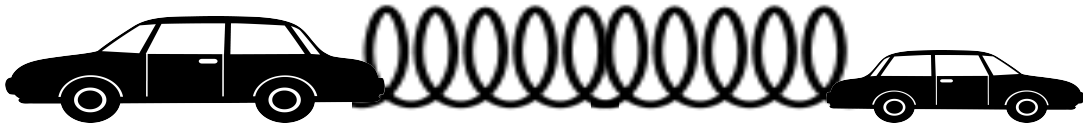
### IV. Materials:

- Slinky
- Two toy cars of noticeably different masses
- Tape or string to attach slinky to cars
- Newton's Second Law PowerPoint
- Newton's Second Law Notes Worksheet
- Newton's Second Law Prelab Calculations Worksheet

### V. Lesson Sequence:

#### A. Engage and Explore

1. Inform the students that today they will be learning about Newton's Second Law.
2. To capture students attention, conduct the following demonstration:
  - Attach the back end of each car to each end of the slinky, (see illustration) either with tape or string. Place the two cars back to back, and pull them as far away from each other as the slinky allows.



- Have students predict what will happen if you let go of the cars at the same time. Ask them to think about the force being applied to them by the slinky, and how the different masses of the cars will affect the distance they are pulled.
  - Let go of the cars and allow the slinky to pull both cars toward each other. Have students make observations of this demonstration a couple of times.
3. Students should be able to see that the car with less mass traveled the farthest, and the car with the most mass didn't travel quite as far. Explain to them that this is because of Newton's Second Law, and that the acceleration of an object is determined by the object's mass and the force applied to it.

**B. Explain and Elaborate**

4. Give each student a Newton's Second Law Note Worksheet. If each student is able to use a computer, have him or her read through the Newton's Second Law PowerPoint while filling out the note worksheet. If computers are limited, you can have them work in small groups, or you can project the PowerPoint to the class and have them fill out the notes together.
5. As a class, discuss and answer the comprehension check questions on the last slides.

**C. Evaluate**

6. Have students complete the Newton's Second Law Prelab Calculations Worksheet either in small groups or together as a class.