

## Activity 1.1 Balanced and Unbalanced Forces

### Introduction

Have you ever climbed in a boat and wondered if it would float? When you ride in a car, do you consider all of the forces in action? Exploring forces and recognizing whether they are balanced or unbalanced will help you gain an understanding of the science of flight.

In this activity you will have the opportunity to add forces to a teeter-totter system and explore the causes of motion and stability.

### Equipment

- 12 inch (30 cm) ruler
- 3 small binder clips (3/4" wide – but really any size should do)
- Large paper clips (about 12)
- Small paper clips (about 10)
- iPad® tablet

### Procedure

#### Part 1 Building a model teeter totter

1. In Part 1 of our story, you discovered that Angelina, Mylo, and Suzi are learning about the science of flight.
  - Discuss Part 1 with your class including the following questions from the story:
    - What is a force?
    - How do airplanes and other aircraft fly?
2. Forces must be applied to an airplane for it to fly. In this activity you will learn about balanced and unbalanced forces as you explore stability and motion.
3. Form groups of two.
  - a. If you are using your tablet, open the presentation titled Teeter Totter and follow assembly directions, then skip to Part 2 Experimenting with Forces.
  - b. If you are following the construction details included with this activity, continue below.
4. Clamp one medium binder clip near the middle of your ruler on the inch side of the scale.
5. Clamp two medium binder clips on the metric side of your ruler.
  - Place one clip between the 1-3 cm mark and the other clip between the 28-30 cm mark.

6. Open a large paper clip halfway to create the shape illustrated at right.
  - Insert this paper clip through the handles of the binder clip located in the middle of your ruler.
  - Hold the ruler by this paper clip to allow for movement up and down on each side.
7. Open two more large paper clips to create hangers of the same shape.
  - Add one to each binder clip on the ends of the ruler.
  - Adjust your middle binder clip position so that the ruler swings freely and achieves stability in a horizontal position.



## Part 2 Experimenting with Forces

1. Continue working in your group of two.
2. Draw a diagram in your Launch Log of the initial position and set up of your teeter totter. Add arrows to show how you may have had to move the middle binder clip to achieve a horizontal stable position.
  - a. Since this is level and not moving, label your drawing “Balanced Forces”.
3. Have one person in your group support your teeter totter by holding the middle hanger paper clip.
4. Add one or more paper clips or other objects to one side of your teeter totter.
  - a. Did your teeter totter move? If so, which side moved in which direction?
  - b. Draw a second diagram in your Launch Log of the teeter totter.
    - Add arrows and labels to show the forces being applied.
    - Indicate any direction of movement with arrows.
  - c. If movement occurred, is this a case of balanced or unbalanced forces?
    - Label your diagram as either balanced or unbalanced.
5. Now add one or more paper clips or other objects to the other side to return your teeter totter to a position of horizontal stability.
  - a. Draw a third diagram of your teeter totter in your Launch Log.
    - Add arrows and labels to show all of the forces being applied.
  - b. Are the forces balanced or unbalanced? Label your diagram.
6. Experiment with further trials of your own design. Make sure you are able to identify and explain the forces as balanced or unbalanced.

## Conclusion Questions

1. What was the cause of motion to the teeter totter?

2. Describe what must be true of the forces for your teeter totter to achieve stability in a horizontal position.