

## INSTRUCTIONAL GUIDE

### Contents

#### Student Group Sets (6 sets included)

- Shape A
- Shape B
- Shape C
- Shape D
- Brass pins (4 ea.)
- Pendula (4 ea.)
- Dry-erase markers (2 ea.)

#### Teacher Set (1 set included)

- Shape E
- Brass pin
- XL Pendulum

#### Content

- Instructional Guide
- Teacher Activity Guide and Student Worksheet

#### Recommended for Activity:

- [Ring Stand Base with Rod \(66-4220\)](#)
- [Clamp Holder \(66-8290\)](#)



**Note:** If there are more than six student groups, individual student group sets are available for purchase (94-1391). Additional Teacher Sets are also available (94-1392).

### Introduction

The center of gravity of an object can be determined by using gravity. When an object is suspended by any point, the object will swing until it has a minimum of gravitational potential energy. The center of gravity will be directly below this point of suspension.

### Background

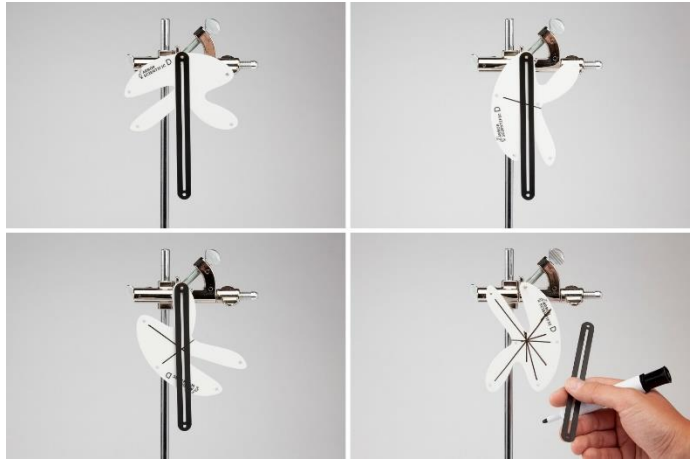
The concept of center of gravity is important in many fields including sports, design, engineering, and science. In general, a person (or object) will be more stable if the center of gravity is lowered and the base of support is widened. Your sports coach might talk about an athletic stance. A car designer will keep heavy components closer to the ground to lower the vehicle's center of gravity. A complex object can be understood by estimating the mass of the various parts, then calculating the center of gravity. A spinning object will naturally rotate about its center of gravity.

### Set-Up

Divide your class into lab teams with 4 students per team. Each lab team will have its own kit. Individual students should select one of the shapes. Students can either hold the brass pin or put the brass pin in a clamp holder on a ring stand in order to have two free hands.

## Activity

- Place the pin through one of the holes and hang the shape from the pin. Gravity will pull down on the shape so that it settles into its lowest energy position.
- Hang the pendulum from the pin and use a dry-erase marker to draw a line in the groove. The center of gravity will be somewhere along this line.
- Repeat the same procedure for a different hole. The center of gravity will be at the intersection of these two lines.



### Check your work

This center of gravity is the also the balance point for this shape. Replace the cap on your dry-erase marker. Try to balance your shape on the end of the marker. Your shape should balance when the center of gravity is above the end of the marker.

### Teacher Challenge Shape

The students should all have a page with a sketch of the large shape (see last page). Hold up the LARGE shape and ask the students to draw an “x” on their sheets to estimate the center of gravity. Ask students to “check your neighbor” to find similarities and differences in their predictions. Select a few students to share their ideas. Now hang the shape and a plumb bob from one point. Repeat the procedure for another hole. Note that the lines would intersect outside of the shape—there is NO mass at this place!

Ask students to think of a few common objects where the center of gravity might not be on the actual object. Ask students to list at least 3 objects on their papers and then to check answers with their neighbors.

## Related Products

**SpillNot (P4-2500)** Solve the Problem of Spilled Drinks with Physics! The SpillNot is a genius gadget that will let you carry an open beverage without spilling it. With a little bit of practice, spin a cup of liquid around in a circle without even losing a drop.

**Balancing Bird 6 inch (P3-5002)** Show students how deceiving an object's center of mass can be. Spin it on the end of your finger to demonstrate rotational motion, or discuss movement in two systems by moving your hand through the air to add translational motion.

**Conceptual Physics Alive: Center of Gravity (99-0090)** In this video, Paul Hewitt teaches Center of Gravity: The concepts of torque, center of gravity, and center of mass are applied to balancing. Demonstrations include finding the center of gravity of irregularly-shaped objects, a weighted disk that rolls uphill, and a seesaw.

