

## The Center of Mass

### What is this about?

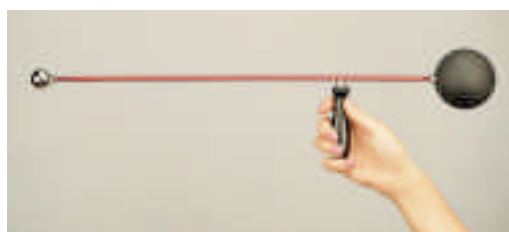
Why do some bats feel right and others not so much? There are several design features of a baseball bat in addition to its mass and length. They are the location of the center of mass (CM), the moment of inertia (MOI), and the vibrational nodes (VN). All of these determine the feel and effectiveness of a bat. After this activity, you will understand the center of mass (CM) and how to find it for several objects including a bat.

### What do I need?

You need a meter stick, the Sargent-Welch Center of Mass Apparatus (WL0861), a baseball bat that you can sacrifice in the name of science, a saw to do the deed, and a scale such as the Ohaus Demonstration Spring Scale from Sargent-Welch (WLS3775-30D). You can use a miniature souvenir bat if you have a smaller scale.

### What will I be doing?

First, you will learn how to find the center of mass (CM) of a meter stick by balancing it on your fingers. Next, you'll find the CM of the Sargent-Welch Center of Mass Apparatus the same way. Finally, you will find the CM of the baseball bat, cut it at the CM with the saw and weight each side.



### What do I think will happen?

Take a minute and write down a description of what you think will happen and why you think it. Where will you find the CM of the meter stick? Where will you find the CM of the Sargent-Welch Center of Mass Apparatus? Will the CM of the bat be right in the middle? If not, which side will be longer, the handle or the barrel? When the bat is cut at the CM, which side weighs more?



### What really happened?

1. Rest the meter stick on one finger from each hand, as shown at the right. Slowly bring your fingers together. They will meet at the CM. You should be able to balance the meter stick on one finger under the CM.
2. Repeat this process to find the CM for the Sargent-Welch Center of Mass Apparatus
3. Now find the CM for the bat. Is it longer from the CM to the handle end or the barrel end?
4. Use the saw to cut the bat into two pieces at the CM. Hang each half of the bat on the scale and weight it. Which side weighs more?



Write a description of your results.


### What did I learn?


While the CM is in the middle of a uniform object, like the meter stick, it is not in the middle of more complex objects. Also, the mass on opposite sides of the CM is not generally equal. You can understand this in terms of a seesaw. If a heavy person is on one side and a lighter person is on the other, the heavier person needs to move closer to the pivot to get the seesaw to balance. This is why the Center of Mass Apparatus has its CM nearer the big mass. This is also true for the baseball bat. The CM is closer to the barrel end and the barrel end weighs more.

### What else should I think about?

Some ball players like to shave the handle of their bats. What does this do to the CM for their bat?

### Catch it in the Web!

 The Center of Mass of a Baseball Bat by Paul Doherty at  
(<http://www.exo.net/~pauld/activities/baseball/batcofm.htm>)  
Some really fantastic photos of a thrown baseball bat.

 Sargent-Welch at  
(<http://www.sargentwelch.com/>)