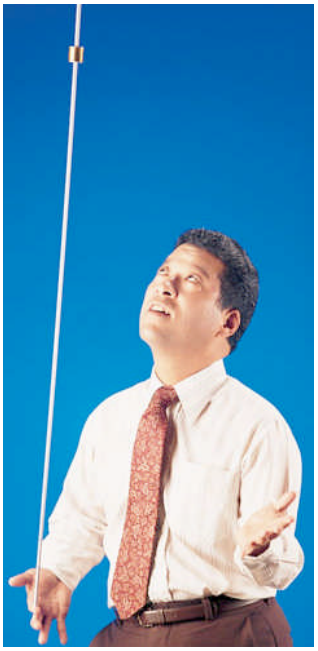
The Concept of Rotational Inertia



What is this about?

Rotational inertia is the resistance an object offers to changes in its rotational motion. It depends upon the mass of the object and the way the mass is distributed.

What do I need?

You will need is a baseball bat and a Sargent-Welch Center of Gravity Paradox (WL0868).

What will I be doing?

You will try to balance the CG Paradox stick vertically in the palm of your hand. You'll try this with the mass in different positions. Then you will try to balance the baseball bat.

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. Will it be easier to keep the CG Paradox stick upright with the mass at the bottom or the mass at the top? Will the bat be easier to balance when the barrel end is up or when the handle end is up?

What really happened?

1. Try to balance the CG Paradox stick vertically with the mass at the bottom. Also try it with the mass at the top.
2. Try to balance the bat on your hand with the handle end up. If this seems rather easy, try it with just one or two fingers.
3. Try to balance the bat on your hand with the barrel end up.

Write a description of your results. Which way was the CG Paradox stick easier to balance? What about the bat?

What did I learn?

Most people will agree that objects are easier to balance when more mass is at the top. Rotational inertia is a measure of how difficult it is to get an object to rotate. Objects are harder to rotate if more of their mass is further away from the axis of rotation. With the barrel on top, more of the mass of the bat is further away from the rotation axis on your hand. Therefore, it is harder to rotate and easier to balance. This effect is even more pronounced if you balance a broom or a golf club. They will balance more easily with the handle in your hand.

What else should I think about?

Notice that a bat is easier to swing if you hold the barrel end and it is harder to swing if you hold the handle end, again demonstrating the idea of rotational inertia. Why then don't batters swing by holding the barrel end? The answer is that batters want the bat to have more rotational inertia! If it is harder to get the bat moving with your arms, it will also be harder to get the bat to slow down when it collides with the ball, exerting more force on the ball.

Batters choose a bat partially based on its rotational inertia. They want a bat that has a high rotational inertia to hit the ball harder, but not so large that they can't get it moving quickly.