

Bearings

Overview: You're going to play with different kinds of bearings: Some only allow movement in one direction, like roller bearings, while others allow movement in two directions, like ball bearings.

What to Learn: Students will learn how scientists and engineers reduce friction in machines.

Materials

- 12-inch square board
- 10 dowels (You can also use or round, not hexagonal, pencils.)
- handful of marbles (at least 20)

Lab Time

1. Place one board on top of the other and push the top one. It moves relatively easily, right?
2. Sit on the top board and have someone try to push you gently across the floor. Is this easy or hard?
3. Now place the dowels parallel between the board and the floor. (Smooth wooden pencils can work in a pinch, as can the hard cardboard tubes from coat-hangers.)
4. Ask someone to push you.
5. Is there a direction you still can't travel easily? Now let's add another direction to your motion...
6. Replace the dowels with marbles. What happens?
7. Draw a diagram of the three different scenarios and indicate the direction of force applied to you, as well as the direction you traveled in. Label everything so it's obvious which experiment each drawing is representing.

Reading

Bearings are found everywhere something moves or rotates. You'll find bearings in your bike, in a car engine and wheel assemblies, at the tip of a ballpoint pen ... anywhere you want to significantly reduce the friction of two surfaces so they slide against each other more easily. There are many different kinds of bearings as well as types of lubricants used to make them operate in different environments.

You can make your own low-friction ball bearings: Get two cans (with a deep groove in the rim, such as paint cans) and stack them. Turn one (still on top of the other) and notice the resistance (friction) you feel. Now sandwich a set of marbles along the rim between the cans. Place a heavy book on top and note how easily it turns around. You can add lubricant by adding a little vegetable oil to the marbles and you'll find it turns more easily yet.

Exercises Answer the questions below:

1. Why do the marbles make you go in all directions?
2. What direction(s) did the dowels roll you in?

Answers to Exercises: Bearings

1. Why do the marbles make you go in all directions? (Due to their shape, they allow movement in two different directions (x-y plane).)
2. What direction(s) did the dowels roll you in? (only in the x-direction, or along a single line, due to their shape)