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Lesson 5.2: Compressing Air

Can you push air closer together to get more air in a smaller space? This activity will help us answer that question.

Activity 5.2: Compressing Air and Water

Before we begin this activity, let's review what we've learned about how molecules are arranged and how they move in liquids and gases. Below, draw how molecules are arranged & move in a liquid like water, and also how molecules are arranged in a gas like air.

Molecules
in a Liquid

Molecules
in a Gas

1. How far apart are the molecules of a gas compared to a liquid?
2. Make a prediction: In which of these two states of matter do you think it would be easier to push the molecules? Why?

The following activity will help you decide if your prediction is correct.

Your teacher will give you a plastic syringe and a cup of water. Look carefully at the syringe and move the plunger in and out. Notice that the end of the plunger has a seal so that no air can get past the plunger. Air can move in and out only through the hole in the tapered end. While you are moving the plunger in and out, feel the air coming out of the syringe.

Now fill your syringe with water. Hold it over the cup. Carefully place your thumb over the end of the syringe so that no water can escape and try to push the plunger in when the syringe is filled with water.

3. Write your observations with water in the syringe.

Now try the same experiment with air instead of water. Push all the water out of the syringe. Then, pull the plunger out as far as it will go; you are filling the syringe with air. Place your thumb firmly over the end of the syringe. Keep your thumb on the syringe tightly so no air can escape. Try to push the plunger in.

4. Write your observations with air in the syringe.

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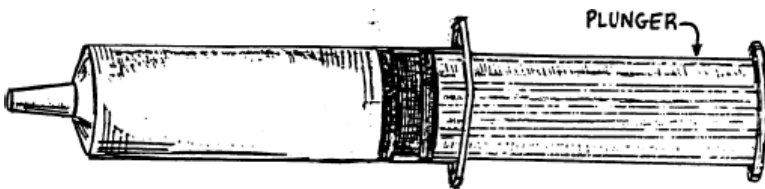
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5. Why can you push the plunger in when there is air in the syringe, but not when there is water in it?

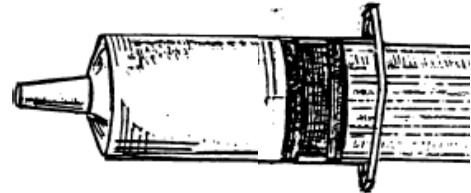
6. Why can't you push the plunger **all the way in** with air in it?

7. Use the drawings of the syringes below to show how molecules of air would be arranged in the syringe when the plunger is all the way out and then in as far as possible. Draw the air molecules in the syringe.

Plunger all the way OUT



Plunger IN as far as possible



A good explanation of why you can push the plunger partway in with air in the syringe, but not all the way, would go like this: Molecules of gases are far apart and have empty spaces between them. The molecules of air in the syringe are scattered all through the syringe. When the plunger is pushed in, the molecules of air are pushed closer together. When air molecules are pushed closer together, we say that the air is compressed.

Air and other gases can be easily compressed because their molecules are far apart. The molecules of solids and liquids, though, are already close together. This makes it almost impossible to compress solids or liquids such as water.

When you pushed the plunger in and then let it go, you should have seen the plunger move back out again. The plunger moves back out because air molecules are hitting it all the time, pushing on it, just like air molecules in the wind were pushing on the ping pong ball to hold it up. When you push in on the plunger, the air molecules are pushed closer together, and more of them hit the plunger. When you let go of the plunger, the air molecules push it back out.

The molecules that make up air and the molecules that make up water are always moving. Molecules of water are sliding past each other, moving all around. Molecules of air move quickly around inside the syringe, hitting each other and hitting off the inside of the syringe and plunger. This constant motion keeps the molecules spread evenly through the inside of the syringe.