LESSON CLUSTER 4
Compressing and Expanding Air

Demonstration 4.1: Molecules Hitting Things

Answer the questions below after your teacher has done the demonstrations.

1. In your own words, explain how the ping pong ball stays up in the air. Try to use molecules of air in your answer.

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2. Why doesn't the basketball/football get flat when you sit on it? What is holding you up?

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_____

3 a) Are there molecule hitting the chimes when the air is still?

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b) Why don't the wind chimes ring when the air is still?

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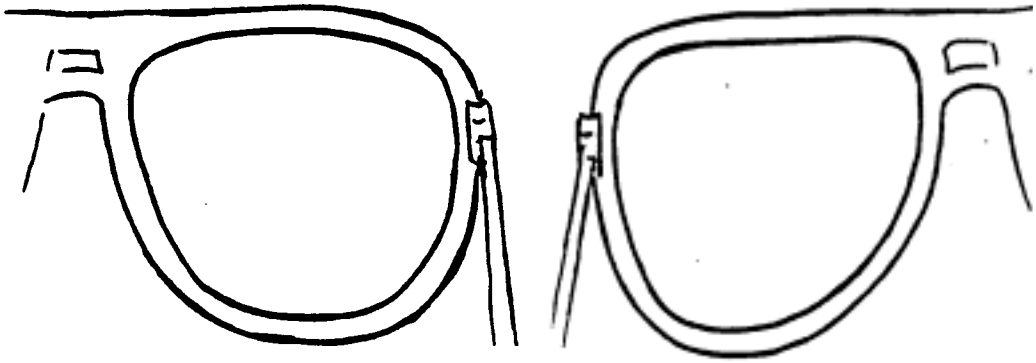
Activity 4.2: Compressing Air and Water

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. Draw in one of the magic eyeglasses below how molecules are arranged in a liquid like water, and in the other magic eyeglasses how molecules are arranged in a gas like air.

WATER (LIQUID) **AIR (GAS)**



1. How far apart are the molecules of a gas compared to a liquid? _____

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2. In which of these two states of matter do you think it would be easier to push to molecules? _____

Why?

_____

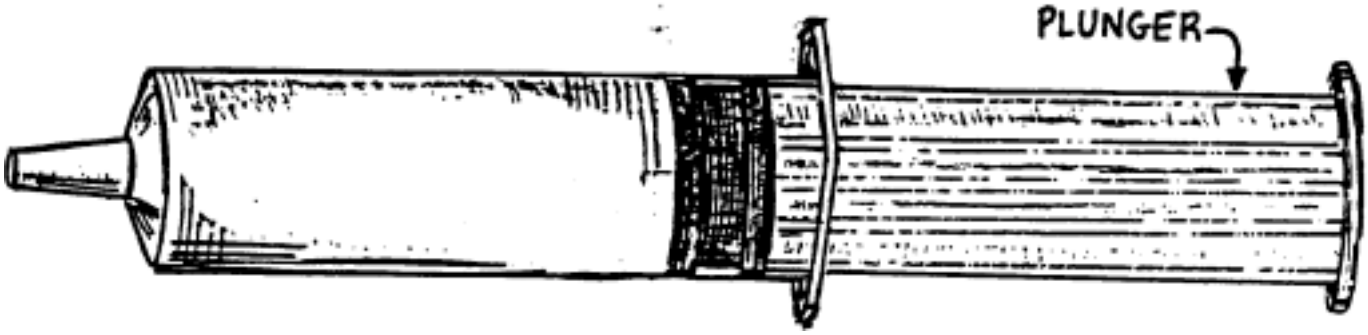
_____

_____

The following activity will help you see 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.

3. Below is a drawing of a syringe. How would molecules of air be arranged in the syringe when the plunger is all the way out? Draw the air molecules in the syringe.



4. Now fill your syringe with water. Hold it over the cup. Now 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?

5. Now try the same experiment with air instead of water and pull the plunger out as far as it will go. 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. What happened?

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

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

Did your explanations for Questions 6 and 7 talk about molecules? Remember that a good explanation talks about molecules. These explanations should talk about the way molecules are arranged in liquids (water) and in gases (air). Go back and write some more for Questions 6 and

7 using these ideas about how molecules are arranged in order to explain what happens in the syringe.

Now, pull the plunger out as far as it will go. Place you thumb firmly over the end of the syringe and push it in as far as it will go. Keep your thumb on the syringe. Let go of the plunger.

Explain why the plunger moves back out.

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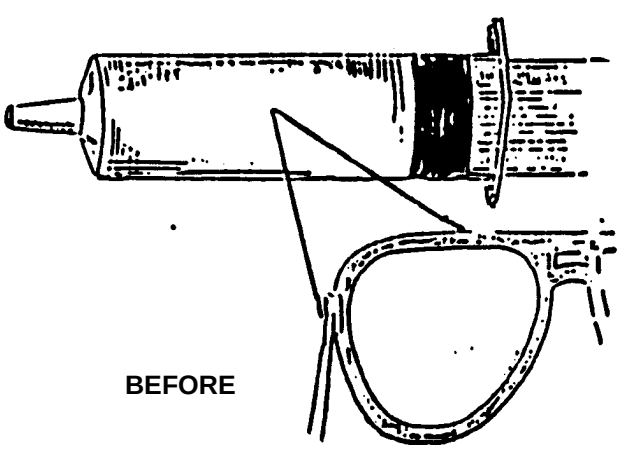
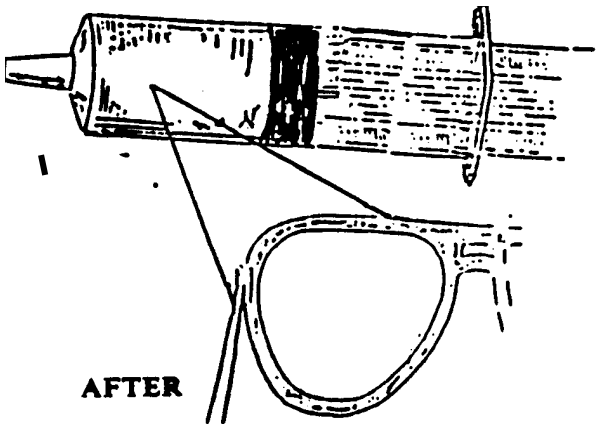
Question Set 4.3: Thick Air and Thin Air

1. In the drawings of the syringes below, draw what you think the molecules draw what you think the molecules of air would look like in the syringe BEFORE you compressed it and AFTER you compressed it.



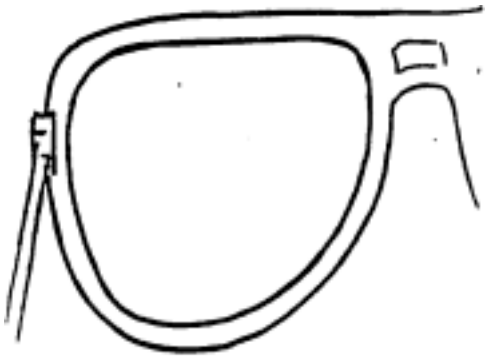
BEFORE



AFTER

2. In the magic eyeglasses below, draw what the molecules of air would look in mountain air and in a scuba tank.

MOUNTAIN AIR



SCUBA TANK

3. Which would have more molecules in a gallon: a gallon of air from the top of a mountain or a gallon of air from a valley? Explain your answer.

_____

_____

4. If the valve of a scuba tank full of air is opened, what do you think will happen? Use what you know about molecules to explain your answer.
Answer:

_____

_____

Question Set 4.4: Explaining Bicycle Tire

1. What is happening to the air as it is being pumped into a bike tire? Is it expanding or being compressed? _____ Explain in terms of molecules.

_____

_____

_____

2. My friend says there is more air near the valve of the bike tire where the air was pumped in. Do you agree with him? Explain why or why not.

_____

_____

_____

3. What is happening to the air as it is released from a bike tire? Is the air expanding or being compressed? _____ Explain in terms of molecules.

_____

_____

_____

4. Briefly state the two parts of a good explanation.

a) _____

b) _____

Question Set 4.4: Cluster Review

1. What are the two questions that a good explanation must answer?

a. A question about _____ : _____

_____

_____

b. A question about _____ : _____

_____

_____

2. Explain what is happening to the air as it is being pumped into a bicycle tire. Make sure your explanation answers both questions.

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_____

3. Explain what happens if you run over a nail on your bicycle and the tire starts to leak. Make sure you answer both questions.

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4. Look back at the explanation you gave for Question 8 in Activity 4.2. Why does the plunger of the syringe move back out after you let go of it? Did your explanation answer both questions? Try to write a better explanation now, one that does a good job of answering both questions.

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5. Helium balloons are filled with gas from a helium tank. A whole balloonful of helium gas can be compressed into one tank.

HELIUM BALLOON

HELIUM TANK

Explain how all that helium can fit in the tank. Make sure your explanation answers both questions.