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Lesson 5.3: Thick Air and Thin Air

You have just learned about how air can be compressed in a syringe when its molecules are pushed closer together. Now we'll look at other examples of air that are more or less compressed; we'll call them thick air and thin air.

One example of thin air is the air that is found in parts of the world where there are very high mountains. The air becomes much thinner high up in the atmosphere. When people climb really high mountains, they need to take extra oxygen with them in tanks. There is not enough oxygen in every breath they take to let them climb the mountain without fainting.

A similar thing happened to runners in the 1968 Olympic Games in Mexico City. Mexico City is very high up in the mountains. Runners had to breathe very hard because they took in less air (less oxygen) with each breath. In order to prepare their bodies for this, many runners did their training in mountain areas all over the world so that they could get used to the "thin" air.

An example of thick air is the air found in a scuba tank. A scuba tank is a tank of air that a person can use to breathe underwater for about an hour.

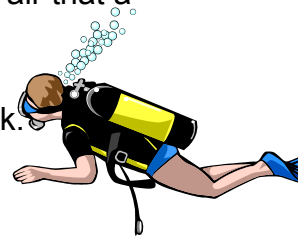
Question Set 5.3: Thick Air and Thin Air

1. Draw what the molecules of air would look in mountain air and in a scuba tank.



Mountain Air

Scuba Tank



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

Why is it harder to breathe up in the mountains than down in the valleys? We have already said that mountain climbers and runners in the mountains take in less air with each breath they take. How can we use what we know about molecules to help us understand that?

Air is made of molecules. These molecules are always moving, and they are very far apart. Up in the mountains, air molecules are farther apart than down in the valleys.

Each breath we take in the mountains has fewer molecules in it because the molecules are farther apart. Our bodies need the same amount of air, so we have to breathe deeper and more often, or else we will not get enough oxygen. That is why mountain climbers need to take the oxygen tanks with them.

What happens when we release air from a scuba tank? The air molecules have been pushed very close together in a full tank. When the tank valve is opened, the air rushes out -- you can hear it making a rushing noise. Because the molecules inside the tank are pressed close together, they escape from the tank very quickly. As they escape, they move farther apart from each other. The air from the tank expands or spreads out, as it escapes into the room.



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Lesson 5.4: Bicycle Tires

Up to this point in this cluster, you have seen that air can be compressed. We explained air compression by saying that air molecules are normally very far apart, with lots of empty space between them, and they can be pushed closer together. Let's use what we know to explain the air inside a common item – a bicycle tire.

Question Set 5.4: Explaining Bicycle Tires

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.

Here is one explanation: As the tire is pumped up, air in the tire is being pushed into the tire and compressed. The molecules of the air are being pushed closer and closer together. Notice that the air is the substance that is making the important changes, not the bicycle tire. The tire is getting a little bit bigger, but not a lot bigger. For a lot of air to fit into a bike tire, the molecules have to move closer together. The air has to be compressed.

The air in a bike tire will be evenly distributed inside the tire. As the molecules of air are pumped into the tire, the molecules spread out evenly, so there will not be more molecules near the valve.

If you let the air out of a tire, the molecules that were pressed very close together will now spread far apart. When this happens, the spaces between the molecules get bigger, and the air expands.



In this lesson cluster, you have learned many things about air molecules. You have learned that air molecules are constantly moving and hitting things. You have learned that air molecules can be pushed closer together; that is, air can be compressed. Air molecules can also spread farther apart. When this happens, we say that the air expands. You have also learned that air molecules are evenly distributed – this means that they spread out evenly and that they don't bunch up together in one place more than another place.