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LESSON CLUSTER 2: Other Solids, Liquids and Gases

Lesson 2.1: Other Substances

In Lesson Cluster 1 you studied ice, water, and water vapor. All three states of water are made of the same kind of molecules – H_2O . Each state has molecules arranged differently, but the molecules are the same. Water molecules are the building blocks for ice, water and water vapor.

If you look around, most of the substances you see are solids, liquids, or gases. Most substances can also change from one state to another. For example, lead is usually a solid, but if you heat it hot enough, it becomes a liquid.

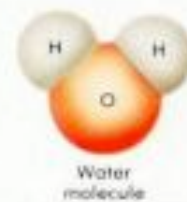
If you heat liquid lead very hot it becomes a gas. You can change the solid form of a substance into a liquid, or a liquid into a gas. It is possible to do this because all the states of a substance are made of the same kind of molecules.

You could never change ice into glass, though, or water into alcohol, or water vapor into oxygen gas. Even though these substances look similar and are in the same state, one cannot be changed into another. Do you know why?

The answer is that their molecules are different. Each substance is different from every other substance because each is made of its own kind of molecules.

In the same way, we can classify all substances as solid, liquid, or gas, but that doesn't mean that all liquids are exactly alike. Each substance is made of its own kind of molecules, with a certain size, shape, and weight.

If we were able to see the molecules in a drop of pure water, (that is, water that is not dirty, or polluted) we would notice that all of the molecules of water would look exactly the same. They would all have the same structure.



If we could see the molecules of another substance, for example, alcohol, would these molecules look the same as the water molecules we just studied?

No, the alcohol molecules are different from the water molecules. That's because each substance has its own kind of molecule, with a certain size, shape, and weight. The molecule of alcohol (CH_3CH_2OH) would look like this:



As you can see, an alcohol molecule looks very different from the molecules of water because it is made of different atoms. If we could see the molecules in a drop of alcohol, we would see that all of the alcohol molecules have exactly the same shape, size, and weight.

The world is made of millions of different substances, and every substance is made of its own kinds of molecules! Some molecules, like water molecules, contain only a few atoms. Other molecules have hundreds or thousands of atoms. Even the largest molecules, though, are far too small to see.

Sugar is another substance you probably know. A sugar molecule (glucose) is made of many atoms. (The formula is $C_6H_{12}O_6$).



Glucose molecule

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All substances are made of molecules, but that doesn't mean that everything is made of molecules. Some things are not substances at all. Light, heat, and sound are not substances; they are forms of energy. Thoughts, love, and space are not substances either. Things that are not substances cannot be solids, liquids, or gases, and they are not made of molecules. There are no light molecules, or heat molecules, or sound molecules. There are no temperature molecules, or space molecules, or love molecules. Only matter exists as solids, liquids, and gases. Only matter is made of molecules.

Now try answering some questions about different substances and their molecules.

Question Set 2.1: Other Substances

1. See if you can classify the following substances by writing "solid", "liquid" or gas. Think of two other solids, liquids, or gases to add to the list below.
 - a. Steel
 - b. Alcohol
 - c. Helium
 - d.
 - e. Sugar
 - f. Milk
 - g. Carbon dioxide
 - h.
2. How are liquid water and water vapor the same? How are they different?
3. How are water vapor and oxygen gas the same? How are they different?
4. Why can you change ice into water but not into glass?
5. My friend says that we see the sunlight because the sun sends light molecules to us on earth. What do you think?
6. Choose one of the following and draw a picture to show how you think the molecules might be arranged and might be moving in: alcohol liquid, ice (solid water), or Oxygen gas.