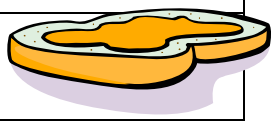
Peanut Crunch

Purpose: To demonstrate the difference between liquids, solids and gases.

Materials

1 stick butter or margarine
1 cup corn syrup
1 cup granulated sugar
4 heaping tablespoons crunchy peanut butter
1 box cornflakes
Hot plate
Big bowl
Pot



Hypothesis

Ask students what they think the difference between a liquid, solid and a gas is. Have them write their answer here.

Procedure

1. Tell students that the only difference between a liquid, solid and a gas is the speed of its molecules
2. Have students pretend their hands are molecules. Have them press the palms of their hands together as hard as they can.
3. Ask them to pull their hands apart as slowly as they can. Ask if they can feel the suction between their hands. Tell them that's what molecules that are close together feel, a bond between each other.
4. Have students clap their hands to represent adding heat energy. Make them clap as fast and as hard as they can.
5. Make them stop and notice the tingle in their hands. Tell them there are no more molecules in their hands now than there were before they started clapping. The difference is that the molecules are bouncing into each other. The tingle they feel is the added energy.
6. Ask them if they noticed that the harder they clapped the farther apart their hands spread. Tell them this happens each time you add energy… the more energy you put into the molecules, the harder they bounce into each other. The harder they bounce into each other the farther apart they get. The farther they bounce apart, the harder it is for the molecules to hold on, so they "loose control" and turn to a liquid. Eventually if you add enough energy, they will bounce so far apart that they have no control over each other and float away as individual molecules in the air, which is what a gas is. (Have students act as molecules to demonstrate)
7. Hold up a stick of butter. Ask students if it is a liquid solid or gas.
8. Tell them it is a solid because even if you take off the rapper, the butter molecules still have enough control to hold on to each other, but what will happen if you add heat energy to the butter molecules? Will the molecules go faster or slower? (Faster)…. Will the molecules get farther apart or closer together? (Farther apart)…. Will the molecules have more control or less control? (Less control) Will they stay solid or turn to a liquid? (Turn to a liquid) Put butter in pot on hotplate.
9. Hold up corn syrup bottle. Turn it upside down. Note how much control the corn syrup has over its molecules. Ask if the syrup is a liquid, solid or gas.
10. Tell students that even though corn syrup has a lot of control over its molecules, it does not have enough control to hold its shape, so we call it a liquid, but what will happen to the syrup if we add heat energy? Will the molecules go faster or slower? (Faster)…. Will the molecules get farther apart or closer together (farther apart)…. Will the molecules have more control or less control? (Less control) Will they stay liquid or turn to a gas? (Turn to a gas) Add the syrup to the pot with the butter. Note that the little bit of heat energy we just added has already made the butter molecules move farther apart and loose control, turning into a liquid.
11. Remind the students we called the corn syrup a liquid because it poured. Hold up a container of sugar. Pour out 1 cup of sugar. Ask students if the sugar is a liquid, solid or a gas. Pass out little bits of sugar and a hand lens to each student and let them see the

individual grains of sugar. Tell them the individual grains of sugar are solid, there just happens to be millions of them in a big cup. Ask what they think will happen if we add heat energy to the sugar…? Will the molecules go faster or slower? (Faster)…. Will the molecules get farther apart or closer together? (Farther apart)…. Will the molecules have more control or less control? (Less control) Will they stay solid or turn to a liquid? (Turn to a liquid)

12. Pour the sugar into the pot with the butter and syrup. Walk around the room moving the hot syrup over the sugar molecules. Note how the heat energy transfers one molecule at a time. Tell them that's because heat energy has to pass through molecules to be felt. That's why space is so cold, because there are no molecules for the energy to transfer through. This is what scientists call ***heat energy transfer.***
13. Hold up a jar of chunky peanut butter. Ask students if the peanut butter is a liquid, solid or a gas. Tell them it is such a strong solid that it holds on to its molecules even if you turn the jar upside down. Ask students to guess what will happen if we add heat energy to the peanut butter? Will the molecules go faster or slower? (Faster)…. Will the molecules get farther apart or closer together? (Farther apart)…. Will the molecules have more control or less control? (Less control) Will they stay solid or turn to a liquid? (Turn to a liquid). Put 4 heaping tablespoons of peanut butter in the pot with the hot syrup and stir until smooth. Talk about the heat energy transfer at this point.
14. Ask student if they smell peanut butter. Ask them if they smelled it before the experiment. (Students will say yes) Ask them how the peanut butter got out of your pot and up their nose, because the only way you can smell something is if the molecules go up your nose and over your olfactory membrane. Tell them that some of the peanut butter molecules must have bounce so far apart that they flew as individual molecules out of the pot, into the air and up your nose.
15. Ask students: If adding heat energy to molecules makes them go faster, what do you think taking heat energy away will do. Explain that in science there is no such thing as cold energy. You can add heat energy, you can take it away, but you can not add cold because there is no such thing; so what do you think will happen if you take heat energy away? Will the molecules go faster or slower? (Slower)…. Will the molecules get farther apart or closer together? (Closer together)…. Will the molecules have more control or less control? (More control) Will they stay liquid or turn back to a solid? (Turn to a solid)
16. Hold up a box of corn flakes. Tell the class that you have some cold, slow moving cornflakes. Pour them into a big bowl. Ask the students what will happen if you pour the hot, fast moving syrup molecules over the cold, slow moving cornflakes? ? Will the molecules go faster or slower? (Slower)…. Will the molecules get farther apart or closer together? (Closer together)…. Will the molecules have more control or less control? (More control) Will they stay liquid or turn back to a solid? (Turn to a solid)
17. Pour the syrup over the cornflakes and stir quickly. The syrup will harden almost immediately. Share finished product with your students.

Conclusion

This recipe works because heat energy transfers through the ingredients. The faster the molecules move, the less control they have over each other. The slower they move the more control they have over each other.

Everything in this world can be a liquid, solid or gas depending on how fast its molecules are moving. Each different kind of matter has its own speed at which this will happen. You can think of a thermometer as a device that measures the relative speed of the molecules in a given substance, kind of like a speedometer measures the relative speed of our cars.

The only difference between a liquid solid and a gas is the speed of its molecules.

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