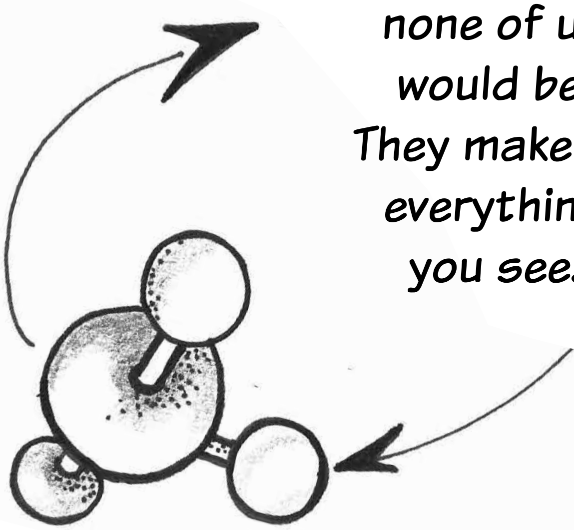
The Atom Song

An atom
is so small
you can't see it,
not at all!



But without atoms
none of us
would be.
They make up
everything
you see.

NAME ____________________________ DATE ___________________

For my notebook

THE ATOM

Have you heard of atoms? Did you know that everything in the world and universe is made of atoms? Atoms are the basic building blocks of everything you see, including yourself. That means even cells are made of atoms. You remember what cells are, don't you? They are the building blocks of living things and atoms are the building blocks of them. Atoms are like the Legos of the universe, only atoms are a lot smaller than Legos. They are so small that a person who weighs 75 pounds would have about 3,500,000,000,000,000,000,000,000,000 (three octillion, five hundred septillion) atoms in his body! Try writing that number down; it's 35 followed by twenty-six zeros.

Thousands of years ago, the ancient Greeks thought a lot about how things are made. About 2,400 years ago, a Greek named Democritus (dih-MOCK-rih-tuss) said that everything was made from particles, called atoms. He thought that all things could be broken down into smaller and smaller pieces until you got to atoms. Democritus also thought atoms moved all the time and that they could join with each other.

The problem with Democritus' theory about atoms was that at that time, there was no scientific way to prove that atoms exist. Atoms are so small that people cannot see them without using a special type of microscope called a scanning-tunneling microscope. There were no scanning-tunneling microscopes 2,400 years ago. Most people living then found it hard to believe in something they could not see. That meant most of the people alive when Democritus was alive did not believe in atoms.

Today we know that Democritus was right. All things are made of atoms. He was right that atoms move all the time. He was also correct that atoms join together. When atoms join, they make molecules.

Move your hands in the air. As you move your hands through the air, you are hitting atoms and molecules. You cannot see them, but they are there. Air is mostly made of two types of atoms whose names are nitrogen and oxygen. Water is made of atoms, too. Water is made of two types of atoms called hydrogen and oxygen. Everything is made of atoms!

The Atom Lab #1: ARE ATOMS Small? - instructions

Materials:
- Lab sheet, pencil
- Five balloons that have not been inflated
- Almond extract
- Water
- Cinnamon
- Lemon, orange, or peppermint extract
- Magnifying glass
- ½ Teaspoon measuring spoon
- Permanent marker

Part 1:

Aloud: Atoms are really small. Think of the smallest thing you have ever seen with your own two eyes. Atoms are a lot smaller than even that. Look at your lab sheet. Do you see the dash under the magnifying glass? How many atoms do you think are in that dash?

Procedure:

Have students trace over the dash on the lab sheet with a pencil, and examine it with a magnifying glass. Wait for students to write a guess about the number of atoms.

Aloud: There are 40,000,000 (40 million) atoms in that dash! Atoms are small, but everything is made of them. The next time you go outside, look at all the different things in the world that are made of atoms. If it is a sunny day, remember even the sun is made of atoms. If it is rainy or cloudy, remember the clouds and the raindrops are all made of atoms. Oh, by the way, a raindrop has about 5,000,000,000,000,000,000,000 (5 sextillion) atoms in it. If you catch one on your tongue, think about that! Do you remember what kind of atoms are in raindrops? There are hydrogen atoms and oxygen atom in raindrops because raindrops are made of water.

Instructor's Notes:
- The dash is 2mm long. There are about 20 million carbon (graphite) atoms in a pencil dash that is 1 mm.

Part 2:

Aloud: What does the outside of a balloon smell like? Would you say sort of rubbery or like nothing at all? What if you put something with a strong scent or smell into a balloon? Would you be able to smell what's in the balloon if you inflated it? How could you? Maybe you could put a small hole in it. The problem with that is, if a balloon had a hole, it wouldn't hold air, would it?

Today, you are going to smell five balloons. Each balloon has something different in it. You will see if you can smell the scent atoms through the balloons.

Balloons are made of atoms like everything else in the world. The things you will be putting into the balloons are made of atoms too. Do you think the scent atoms will be small enough to go through the atoms of the balloon?

Procedure (read over the entire procedure before starting the lab):
1. Complete the hypothesis portion of the lab sheet.
2. Before inflating the balloons, have students examine them. They should smell them and check them for holes with a magnifying glass. If they find a hole in a balloon, discard it and get another with no holes. Blow one of the balloons up and have the students examine this balloon with the magnifying glass. They are checking it for holes.

(continued on the back)

3. **Do this next step before inflating the rest of the balloons and out of sight of your students.** Pour water, cinnamon, almond extract, and the other type of extract in four different balloons. After each addition, blow the balloon up and tie off tightly. Do not over-inflate the balloons. If you do, they could pop and you will have a mess. Be careful not to get anything on the outside of the balloons or your hands. If you do get something on the balloon, wash it off with soap and let it dry. Label the balloons "1," "2," "3," and "4," or you can use different-colored balloons for identification. The students will guess what is in them. The rest of the experiment is done in front of the students. Shake each balloon for 30 seconds starting with the balloon that has only air in it. Have students smell the outside of the balloon. Have them record results on the lab sheet.

Instructor's Notes:

- If you use peppermint extract, put it at the end of the experiment. It smells so strong that it can affect how the unscented balloons smell. You might want to leave it in another room until all the other balloons have been tested.
- Cinnamon and vanilla extract can be seen through light-colored balloons. Try using a dark-colored balloon for these scents.

Possible Answers:

Results / Observations

Before being inflated, the balloons should smell like nothing, or rubbery, or like a balloon.
Before and after the balloons are inflated, students should not see any holes in the balloons.

Data Table

Students should fill in the part of the data table where they guess what the balloons have in them. You should help them fill in the part that tells what was really in the balloons.

They should smell both extracts and cinnamon. They should not smell anything from the balloon with air in it and the balloon with water in it. They might correctly guess the balloon with water because they will be able to hear that it has liquid in it.

Discussion/Conclusion

They should have smelled all three things that had a scent.
From this, students should have learned that the scent molecules and atoms are small enough to travel between the atoms that make up the balloon.

NAME ______________________________ DATE ___________________

The Atom Lab #1: ARE ATOMS Small?

Part 1:

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I think there are _________________________________ atoms in that dash.

Part 2: Hypothesis (circle your answer):

I think scent molecules are small enough to travel through the molecules of the balloons and that I will smell the scents put in the balloons.

Yes **No** **I don't know**

I think the balloons with air and water will smell the same as they did before being inflated.

Yes **No** **I don't know**

Results / Observations:

Before being blown up, my balloons smelled like _______________________

When I looked at the balloon with my magnifying glass, I saw:

Before being blown up ____

After being blown up ____

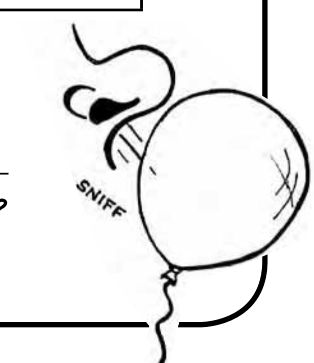
Data Table	The balloon smelled like	What was in the balloon?
balloon filled with air		air
balloon #1		
balloon #2		
balloon #3		
balloon #4		

Discussion and Conclusion:

Did you smell any of the things put into the balloons?__________

Which ones did you smell?____

What did the scents teach you about the size of atoms and molecules?



The Atom Lab #2: DO ATOMS *MOVE*? - instructions

CAUTION: THIS LAB INVOLVES HANDLING VERY HOT WATER. ONLY THE PARENT/INSTRUCTOR SHOULD HANDLE THE HOT WATER.

Materials:

- *Lab sheet, pencil*
- *Color pencil or crayon (same color as the food coloring)*
- *3 cups of Water at three different temperatures:*
  1) *Chilled (Put ice and water into a container and drain off the water for use.)*
  2) *Room temperature*
  3) *Very hot (just been boiled)*
- *Food coloring (Use the same color and amount for each test. A darker color is better.)*
- *Three clear glasses, the same size*
- *Thermometer, science or kitchen-type*
- *Stopwatch or a timer that counts in seconds*

Aloud: When you look at a drop of water, can you tell that the hydrogen and oxygen atoms in it are moving? Well, they are moving, and very fast too. In this lab, you are going to drop food coloring into water. You will not see a single food color atom move through the water; atoms are too small to see by themselves. But you can see a group of food color atoms move through the water. When you put the drops in the water, the food coloring will mix with the water without you stirring it. When things mix without being stirred, it is called diffusion. Temperature can affect how fast atoms and molecules mix with each other. The water in each glass will be a different temperature. Do you think the molecules will diffuse faster in the hot water or the cold water?

Procedure:

1. *Complete the hypothesis portion of the lab sheet.*
2. *Measure one cup of each temperature of water into three clear glasses.*
3. *Right away, measure the temperature of each glass of water. Do this very carefully so you don't stir the water. (To prevent the thermometer from shattering, allow it to cool for a few seconds between the hot and cold water.) When the thermometer stops moving up or down, record the temperatures on the lab sheet.*
4. *Carefully drop 5 drops of food coloring into each glass of water.*
5. *Immediately observe what happens in each glass and record observations on the lab sheet. Observations should be recorded in words and pictures.*
6. *Wait 2 minutes. Measure the three temperatures again. Record observations on the lab sheet.*
7. *Wait 30 minutes. Measure the three temperatures again. Have there been any changes?*
8. *Complete the lab report.*

Aloud: When you can see things diffuse, you are watching molecules and atoms in motion. Heat can make atoms and molecules move faster. You used colored molecules in this experiment so it would be easy to see them move through the colorless water. But atoms are moving all the time, even when you can't see them.

Instructor's Notes:

- *Make sure each glass has the same amount of water. If you use more or less than a cup of water the rate of diffusion will be affected.*
- *Make the sure the water is not stirred, or otherwise moving, when you carefully drop in the food coloring. You want the atoms to mix through diffusion, not from stirring.*
- *When food coloring is put in the hot water, it diffuses very quickly. Make sure students are watching the experiment right from the start.*
- *Thirty minutes might not be enough time for the food color to diffuse completely through the water in the room temperature and cold water. Try leaving the glasses sitting out until the color diffuses completely.*

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Possible Answers:

Hypothesis:

The correct answers are yes, yes, hot.

Results:

Data Table

The temperatures will vary.

Observations:

Each square represents a glass of water with food coloring in it. The coloring in each square should look similar to the diffusion pattern in each glass of water + food coloring at the specified time.

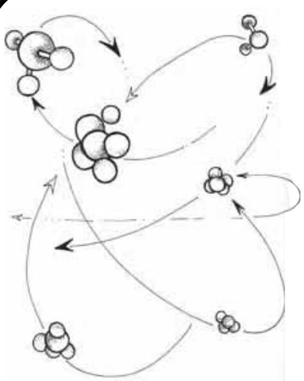
Conclusion:

The atoms diffused fastest in hot water.

The atoms diffused slowest in cold water.

NAME ______________________________ DATE ____________________

The Atom Lab #2: DO ATOMS *MOVE*?



Hypothesis:

Do you think you will see the food color atoms diffuse (move) through the water?

Yes No I don't know

Do you think the temperature of the water affects the rate of diffusion (how fast things move) in the water?

Yes No I don't know

I think atoms move faster when they are _____________.

cold room temperature hot

Results:

Temperature:	Chilled water	Room temperature water	Hot water
Start			
2 minutes			
30 minutes			

Observations: *Color the squares to show what is happening to the food coloring in each glass of water.*

Chilled water			Room temperature water			Hot water		
Start	2 min	30 min	Start	2 min	30 min	Start	2 min	30 min

Conclusion: *Circle the correct word(s) to complete each sentence.*

The atoms diffused fastest in cold room temperature hot water.

The atoms diffused slowest in cold room temperature hot water.