LESSON 9: LAVA LAMPS

Students will experiment with density and chemical reactions by making their own homemade lava lamp.

OBJECTIVES

- ☑ What happens when water and baby oil mix?
- ☑ How do Alka Seltzer tablets react with water?
- ☑ How does density affect a chemical reaction?
- ☑ What is the evidence that a chemical reaction has occurred?

SUPPLIES

- 6 clear plastic soda bottles
- 2 bottles of baby oil or vegetable oil (clearer is better)
- Water
- Food coloring
- 6 Alka Seltzer tablets
- 12 pieces of paper and 12 pencils (optional)

See Extension for additional supplies

HOOK

5-10 min

If you have a lava lamp, turn it on and let children observe what happens. If you do not have a lava lamp, ask children If they know what a lava lamp is. Where have they seen one before?

A lava lamp is a decorative light which has special wax inside it. When the wax heats up, it rises to the top of the lamp and as it cools it falls back down to the bottom. This gives the image of a constantly moving shape through the lamp.

Tell children that today they will be making their own homemade lava lamps by creating a chemical reaction.

HYPOTHESIS

3-5 min

Discuss with students:

- What happens when water and oil combine?
- What happens when water and Alka Seltzer tablets combine?
- How does this reaction look like a lava lamp?

EXPERIMENT

20-25 min

1. Split students into pairs and give each pair a plastic water bottle.
2. Fill bottle about 2/3 of the way up with oil.
3. Then, top up the rest of the cup with water so that there is about an inch of room left in the cup. Have students observe what has happened with the water and oil. They can write this down if they wish.
4. Add drops of food coloring to the cup. Observe what happens to the food coloring.
5. Then, drop in one Alka Seltzer tablet and screw the cap onto the bottle. Observe what happens.

LESSON 9

CHEMICAL REACTION

A chemical reaction is where different substances (reactants) are changed into a new substance (product)

SIGNS

- change of color
- change of temperature
- change of smell
- production of gas
- production of a solid
- emission of light

KEYWORDS

- Carbon dioxide
- Catalyst
- Gas
- Density
- Molecule
- Atom

OBSERVATION

5-10 min

Ask students to discuss:

- What happened when the water and oil were put in the cup together?
- What happened when the food coloring was added to the solution?
- What did you notice in the cup when the Alka Seltzer was added?

Students should note that the oil and water did not mix, the oil sat on top of the water. When the food coloring was added, it sank to the bottom of the cup. When the Alka Seltzer was added, bubbles appeared, and the food coloring began to move throughout the liquid.

CONCLUSION

3-5 min

Ask students to share their ideas.

- Why did the water and oil separate?
- Why did the food coloring sink to the bottom of the cup?
- What evidence was there that a chemical reaction occurred?

Students may note that the water and oil separated because the water was heavier than the oil. They may also note that the food coloring sank to the bottom because it was heavier. Some students may be familiar with density and offer this as an explanation. Students should note that the evidence of a chemical reaction was the formation of bubbles in the liquid.

EXPLANATION

5-10 min

The oil and water do not mix because of their different densities. All liquids are made up of molecules and atoms. How tightly packed together these molecules are affects the density of the liquid. Water has a greater density than oil, which means it is heavier and therefore sank to the bottom of the cup. Meanwhile, the oil floated on top because it is less dense.

When the food coloring was added, it also sank to the bottom of the cup because it has a greater density than oil. The food coloring and the water had similar density levels which is why they were able to mix.

When the Alka Seltzer was added to the liquid, it sank to the bottom as well because of its density. Alka Seltzer is made up of citric acid and sodium bicarbonate. When the tablet enters the water, it begins to dissolve in the water and carbon dioxide is formed.

The carbon dioxide is visible in the liquid as bubbles. The bubbles begin on the bottom of the cup where the Alka Seltzer is. The carbon dioxide bubbles are lighter than water and oil, so begin to rise to the top of the cup. As they do this, the bubbles carry some of the colored water with them. The colored bubbles rise to the top of the oil, where they pop, and the carbon dioxide is released into the air. When the carbon dioxide is released, the colored water that has risen to the surface once again has a greater density than the oil so sinks back down to the bottom.

The bubbles continue to rise and fall until the reaction between the Alka Seltzer, and water is complete, at which point no more carbon dioxide is being produced. As the bubbles rise and fall, they move color throughout the cup, similar to the way the colored wax moves through a lava lamp, therefore creating your own homemade lava lamp!

CLEAN UP & DISMISSAL

3-5 min

Students must then clean their workspace. Liquids can be disposed of safely. Make sure to leave the classroom the way you found it.

EXTENSION

5-10 min

If students have time to expand on this experiment, try one of these alternatives:

- Have students repeat the experiment using one of the following catalysts:
  - Use baking soda and vinegar rather than Alka Seltzer. Mix two spoons of baking soda with your water before adding it to the cup. Add the food coloring as above. Slowly pour vinegar into the cup and watch the reaction.
  - Use salt rather than Alka Seltzer. Add a large amount of salt to your oil/water/food coloring. The salt is denser than the oil and as it falls through the oil, it will carry some of the oil into the water. Once the salt dissolves in the water, the oil that was carried down will immediately float back up to join the top oil layer. This is a slower reaction and will produce fewer bubbles.
- Repeat the experiment but this time try adding more or less oil.
- Repeat the experiment but use warm or hot water rather than room temperature water.

If you try one of these extension activities, ask students:

- How were the results of this reaction similar or different to the original experiment?
- Why do you think this reaction was different?

Children should note that baking soda and vinegar has a similar result to the Alka Selzer. Salt produces the same bubbles but at a much slow rate. Adding more oil means the colored bubbles have further to travel, but also that there is less water for the tablet to react with. Adding less oil means that the colored bubbles haves less space to travel to the surface, so the appearance of moving colored bubbles is reduced. Using hot or warm water speeds up the reaction (acts as a catalyst) because it makes the tablet dissolve faster and thus a quicker production of carbon dioxide.