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Bruce Museum at Home
STEAM Activities for Children

Lesson # 9: ***Mixtures, Solutions, and Compounds, Oh My!***

Week of May 18, 2020

This week, the Bruce Museum's STEAM At Home lesson is moving away from physics and toward chemistry. Over the coming weeks, learners will experiment with the physical and chemical properties and interactions of different substances. None of the experiments use materials that are difficult to source, but these are messy projects that do require some specific materials. Please plan accordingly before beginning any of these projects with your learners.

Learners will be using their science journals to predict, record, and explore their experiments. If your learner hasn't yet made a science journal, instructions can be found here, or if they have a notebook or other paper they prefer to use, that's fine.

In order of appearance, this lesson contains: a materials list for *Mixtures* and a simple art activity, general instructions for *Mixtures*, ways to add on to the activity, open-ended question ideas, a brief art activity, and NGSS Performance Expectations. Additionally, a list of chemistry vocabulary words is available as a separate document.

A tip for adults: *This is about to get messy! Your learner will need a flat surface with raised edges, like a baking sheet or dinner tray, to put underneath their experiment. Protect your furniture, and yourselves; you and your learner may want to wear aprons or other protection for your clothing.*

Materials for experiment: 6-12 empty nonreactive containers (paper or plastic cups, empty yogurt containers, Tupperware), salt or sugar, measuring spoons, vinegar, baking soda (make sure you use baking soda, not baking powder), room temperature water, science journals, pens or pencils.

Materials for art project: watercolor paints, food coloring, or watercolor pencils, paint brushes, water, rinsing cups, baking soda, vinegar, pencils.

Let's Get Mixing!

Before you get started with this lesson, set up a station in your kitchen or outdoors for your learner's experiments.

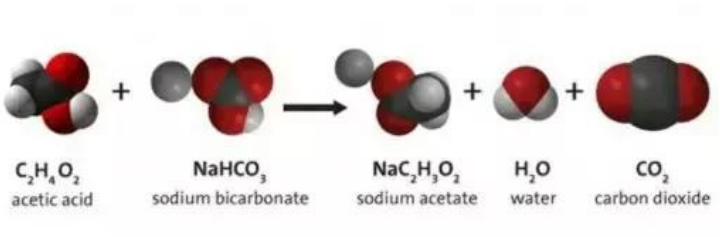
- Learners can use their science journals and make a list of all the mixtures they can find in your home.
    - Examples of household mixtures: toys in the toy box, the different ingredients in granola, or the contents of a junk drawer.
        - Learners can make a list of all the different substances they see in the mixture.
        - If they needed to separate the mixture into its different substances, how would they do it?
        - How would they classify the different substances?
- Give your learner a clear container of room temperature water, a measuring spoon, and sugar or salt, or some other substance that will dissolve into water.
    - Ask your learner, what would happen if you added 1 spoonful of sugar to the water?
        - What would happen if you added two spoonfuls?
        - What would happen if you added 200 spoonfuls?
    - Your learner should mix in the salt or sugar, spoonful by spoonful, stirring until each spoonful dissolves completely.
        - As learners add in the salt or sugar, they should note in their science journal how many spoonfuls they use.
        - There will be a point where the salt or sugar will no longer dissolve into the water: your learner has created a saturated solution.
    - Ask your learner:
        - What could they do to return the materials in their solution to their original state?
        - How has the water changed?
        - How has the salt/sugar changed?
        - These crystal growing experiments are a fun way to explore creating and separating solutions.

Before you move on to another part of the experiment, your learner should clean up their work area. Spills and messes can contaminate a chemical experiment.

- Set up two cups, one with white vinegar and one with water. (You may want to do this when your learner isn't looking.)
    - Each cup should contain the same amount of liquid; use a measuring cup to make sure of this.
    - Label the cups A and B.
    - Ask your learners to examine the cups. What do they notice?
        - Are the liquids the same or different?
        - How can they tell which liquid is which?

        - In the chemistry lab there is no tasting, touching, or smelling materials, but you can do these things in this home lab experiment safely.
    - What do they think is the biggest difference between the liquids?
- In their science journals, learners should draw and label each of the cups, with enough space around the drawing to add more details.
- Learners should now add ½ tablespoon of baking soda to cup A.
    - Using their science journals, learners will note what happened as they added the baking soda.
- After they are done with noting the reaction from cup A, your learner repeats the experiment with cup B, using their science journal to record their reactions.

Why it works: Baking soda reacts strongly to acids like vinegar (acetic acid). One of the products of the reaction is carbon dioxide gas. The products of the reaction with vinegar are carbon dioxide gas, sodium acetate, and water.



Questions for Learners

- What happened when you added the baking soda to liquid (a,b,c, etc.)?
    - Think about a cause and a reaction. What was the cause and what was the reaction?
    - Why do you think it worked sometimes and sometimes it didn't?
- How could you change the reaction without changing the cause?
    - If you want to supply your learner with dish soap, a little drop of dish soap will prolong the lifespan of the bubbles made by the reaction.
    - Try doing the experiment again but with different amounts of liquid or different amounts of baking soda.
    - Experiment with using different liquids. Vinegar will get a huge reaction, but liquids like ice tea, lemonade, fruit juice, etc. may also react.
    - Add other substances, like glitter, food coloring, or small toys. What happens?
- Besides the visible reaction, is anything else happening that we can't see?
    - What do they think might be happening that we can't see?
    - How could we measure things we can't see?
        - Temperature
        - Smell
        - Texture
- Has there been a change in state of matter?
- How could we use this type of chemical reaction to help us?
- How do we normally use the materials from this experiment?
    - Do the chemical properties of these materials influence how we use them?

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Art Project: Paint by Reaction

This art project combines water-based paint with baking soda for dramatic results.

- Your learner should make a relatively simple picture using watercolor paints.
- When the painting is completed, have your learner paint over their images with plain water. Try not to get water on the unpainted parts of the paper.
- When the painting is completely wet, cover the paper with baking soda and shake off the excess. The powder will stick wherever the paper is wet.
- Pour white vinegar into a cup, and using an eye dropper, large paint brush, or paper towel, drip vinegar all over the paper.
    - The baking soda will foam up and cover the painting.

- Wipe away the vinegar and baking soda to reveal your new masterpiece with mixed colors.
    - The example on the right was made with non-washable watercolor paints as that was what was available; your results will depend on what materials you use.
- There are other approaches to mixing paint and baking soda. Check out the links below to explore these other options.
    - Baking Soda Liquid Watercolors
    - Baking Soda Egg Dye
    - Baking Soda Poster Paint

NGSS Standards:

2-PS1-2 Matter and Its Interactions: Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*

2-PS1-4 Matter and Its Interactions: Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

5-PS1-4 Matter and Its Interactions: Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

5-PS1-3 Matter and Its Interactions: Make observations and measurements to identify materials based on their properties.