Kitchen Chemistry Lesson Plan for Homeschool

Overview

Raddish is designed by a dedicated team of teachers and chefs who believe the kitchen classroom is the tastiest place to learn. We love watching learning come alive when kids mix math, stir science, and taste culture!

Paired with the materials found in your Kitchen Chemistry box, this lesson plan divides your box into 3 45-90 minute lessons you can use and adapt to support your homeschool study, pre-k – middle school. Depending on your timeframe and child's age and engagement, these can be taught together or separated for a longer lesson. Please refer to the curriculum provided in your box: recipe guides, activity cards, skill card, and introduction card. Happy cooking! Happy learning!

Lesson 1: High-Rise Biscuits and Fizzy Fun Experiments with Baking Soda

Activity Time: 45-90 minutes

Learning Outcomes

All Students will:

- Learn the chemical name for baking soda and vinegar
- Practice using the terms acid and base
- Explore with baking soda and vinegar to create visual art and propel objects
- Make and share High-Rise Biscuits
- Identify and explor the terms density, volume and mass

Older Students (4th -8th Grade) will:

- Research atoms, molecules and electrons.

Materials

- Recipe guide, ingredients, and tools listed within.

Baking soda art experiment

- Baking soda
- Distilled white vinegar
- Food coloring or liquid tempera paints
- A pie plate or plate with high sides (or paint brushes for older students)
- Water color paper (older students)
- A tray or plastic tablecloth
- A pipette, medicine dropper, or spray bottle or a spoon

Baking soda on the move Younger Students (Pre-K- 3rd Grade)

- Baking Soda
- Distilled white vinegar
- A large glass
- Warm water
- Raisins
- Optional- food coloring
- Optional-dance music

Older Students (4th – 8th Grade)

- 1 Tablespoon of baking Soda
- 1 cup of white vinegar
- Small empty water bottle with lid
- Paper towel
- Scissors
- Straw
- Tape
- Body of water, bath tub or large container
- Water

- Helpful websites about Baking Soda
  - www.wikipedia.org/wiki/Sodium_bicarbonate
  - https://brightnest.com/posts/a-brief-history-of-baking-soda
  - www.madehow.com/Volume-1/Baking-Soda.html

Websites used to create this lesson:

- www.familyhomeandlife.com/2012/07/fun-kids-activity-easy-and-inexpensive.html
- www.Rainydaymum.co.uk/baking-soda-painting
- www.childcentralstation.com/2013/03/preschool-chemistry-fun-with-vinegar-and-baking-soda.html
- For more baking soda experiments for young children www.science-sparks.com/2012/06/22raising-raisins/

1. Introduction

a. Bring out a box of baking soda and a bottle of vinegar.
   i. Ask students if they know what it is? What is it used for?
   ii. Find 50 uses of baking soda here: www.care2.com/greenliving/51-fantastic-uses-for-baking-soda.html and for vinegar here: www.versatilvinegar.org/usesandtips.html
   iii. Curious where baking soda comes from or how vinegar is made? Visit: www.madehow.com/Volume-1/Baking-Soda.html. www.versatilvinegar.org/faqs.html
   iv. Allow students to touch, smell, even taste baking soda.

b. Teach older students about the chemical makeup of baking soda and vinegar:
   i. Baking soda is sodium bicarbonate: each molecule of baking soda contains a sodium atom, a hydrogen atom, an oxygen atom, and a carbon dioxide molecule. $NaHCO_3$
   ii. Baking soda is a base. *"In chemistry, bases are substances that, in aqueous solution, are slippery to the touch, taste bitter, change the color of indicators (e.g., turn red litmus paper blue), react with acids to form salts, and promote certain chemical reactions (base catalysis)"* (From Wikipedia)
   iii. Vinegar is a mixture of acetic acid and water. Dilute acetic acid is the chemical name for vinegar, and its chemical formula is CH_3COOH
   iv. Vinegar is an acid. *"A compound usually having a sour taste and capable of neutralizing alkalis and reddening blue litmus paper, containing hydrogen that can be replaced by a metal."* (From Dictionary.com)

c. Tell students that they will have the opportunity to experiment with how baking soda (a base) will react with vinegar (an acid) in either or both art and propulsion experiments.

2. Art is Science

Younger Students

a. Collect materials as listed above.
b. You can do this art activity one of two ways, using the pie plate as a canvas.
   i. Provide liquid food coloring or liquid water color. Have students drop colors into baking soda. Then experiment with an eye dropper and a small amount of vinegar to create art.
   ii. Premix food coloring or liquid water color with vinegar and then provide students with a dropper and let them experiment and make art.
c. Provide students with the dish and the baking soda (the more soda the more reactions they get) encourage them to use their hands to smooth it out and break up any lumps.

d. Let students explore and create. Likely, at one point the baking soda will start making its way into the vinegar instead of the other way around!

Older Students

a. Collect materials as listed above.
b. Have students mix paints in a measuring cup. In a general recipe of 1/8 cup of baking soda, add liquid watercolor or food color diluted in water until you have the desired color. (Basically, equal amount of baking soda to liquid.) Then fill the cup with water until the ¼ cup mark. Whisk or stir well. You don't want the paint to be too runny or it won't fizz well.
c. Set up watercolor paper on tray or tablecloth. Encourage students to completely cover the paper with their painting.
d. Provide half a glass of vinegar and dropper and let them experiment by dropping on their art.
e. Set paintings aside to dry overnight and check them out again in the morning. See how they changed as they dried.

3. Baking Soda on the Move

Younger Students

a. Gather materials listed above.
b. **Ask** your students what they think will happen when you put raisins in soda? Record their **hypothesis** or have them draw what they think will happen.
c. Fill the glass halfway with warm water. Add 1 Tablespoon of baking soda and stir to make sure it completely dissolves. Add enough vinegar to make the glass three-quarters full.
d. **Test**- Have students put a couple of raisins into the glass.
e. Put on some music and **Observe**
f. Observation Questions
    i. What happened when you first put the raisins in the glass?
    ii. Once they started floating did the raisins stay at the top?
    iii. How did the raisins look?
    iv. Do you think the same thing would happen if you put the raisins in apple juice, soda water, etc?
g. **Explanation**- At the beginning the raisins sink to the bottom of the glass. This is because of their ***density***, how heavy they are for their ***volume***, or the amount of space they take up. However, because raisins are wrinkly, they are filled with air pockets which attract the carbon dioxide bubbles caused by the reaction of the baking soda and vinegar. The carbon dioxide bubbles make the ***volume*** of the raisin bigger without making it any heavier (***mass-***the quantity of matter usually measured in ounces or grams). When the volume increases but the mass does not, the density of the raisin is lowered allowing it to be pushed up by the surrounding fluid which

now has a higher density than the raisin. At the surface the bubbles pop making the raisins denser again and they sink again pick up more bubbles and do it all again.

Older Students

a. Gather materials listed above.
b. **Ask** Q. What is ***propulsion***? Can you give an example? A. The action of driving or pushing forwards.
c. Using these material, can you make a boat? Do you think you can get your boat to move? Write down your **hypothesis**.
d. Build the boat.
    i. With scissors, make a small hole to fit the straw (without it being squished or flattened) in the middle of the bottom of the bottle.
    ii. Cut the straw in half so that it is shorter. Place it so most of the straw sticks out. Then tape the straw into place so that it is sealed.
    iii. Measure 1 Tablespoon of baking soda and place in the center of half a piece of paper towel. Flatten it out in the middle and then twist your paper towel up like a narrow burrito (so that it fits into the top of the bottle), tucking in the ends to keep all the baking soda in.
    iv. Situate yourself next to the bathtub or your large container of water.
    v. Plug the straw with your thumb and then get a classmate to use a funnel or carefully pour 1 cup of vinegar into the bottle.
    vi. Keeping the straw plugged, push the baking soda burrito into the bottle and quickly put on the lid and place it into the tub.
    vii. Stand back and watch. **Test**
e. **Observation** Questions
    i. How long did it take for your boat to start moving?
    ii. How long did it move around for?
    iii. What do you think you could change to make it go longer?
    iv. What do you see coming out of the straw?
    v. Where do you think the bubbles are coming from?
f. **Explanation**

    Baking soda and vinegar react with one another because they both have a lot of energy that they don't want and can help each other get rid of it.
    In other words they are exchanging atoms. In this reaction the baking soda (base) takes a proton (a subatomic particle that makes atoms) from vinegar (acid). The reaction releases gas because when the baking soda receives the proton, it transforms into water and carbon dioxide.The carbon dioxide, a gas, is the bubbles that you see. The force of the movement of the carbon dioxide backwards, out the straw, causes a reaction force which pushes the boat forwards.
g. For more detailed chemistry explanations visit:
    www.chemisty.about.com/od/chemicalreactions/What -IS-The-Equation-For-The-

Reaction-Between-Baking-Soda-And-Vinegar.htm and
www.scienceline.ucsb.edu/getkey.php?key=4147

4. Kitchen Prep

a. Read the High-Rise Biscuits recipe card together.
b. Identify and gather ingredients.
c. Gather tools.
d. Discuss kitchen safety. Specifically, oven safety (Visit Raddishkids.com/pages/safety)

5. Prepare High-Rise Biscuits!

a. Ask children to read or describe each step.
b. Together, follow the steps in the recipe.
c. While the biscuits are cooking gather your friends and family and peek through the window on the oven. Explain to them what is happening with the baking powder (a mixture of baking soda and a dry acid called cream of tartar) and the moisture in the biscuits. What does that reaction do to your biscuits?
d. When the High-Rise biscuits are ready, eat, taste and share!

Lesson 2: Onion Jam
and Evaporation Investigation
Activity Time: 60 minutes

Learning Outcomes

All students will:

- Understand that water on earth moves in a continuous cycle.
- Identify the terms precipitation, evaporation, and condensation.
- Investigate the stages of the water cycle.
- Learn that evaporation is used in cooking to change the chemistry and taste of ingredients.
- Make Onion Jam to share with their family.

Younger students (Pre-k – 3rd) will:

- Observe and draw pictures that portray some features of the water cycle being described
- Record observations and data with pictures, numbers or written statements

Older Students will:

- Measure liquid volume with appropriate tools and express those measurements in standard metric system units

Materials

- Recipe guide, ingredients, and tools listed within.

  Make a Mini Water Cycle
  - A large metal or plastic bowl
  - A pitcher or bucket
  - Sheet of clear plastic wrap
  - A dry ceramic coffee mug
  - Long piece of string or large rubber band
  - Younger students also need
    - Paper and drawing tools
  - Older students also need
    - Paper and writing tools
    - Liquid measuring cup

Lesson adapted from www.thewaterproject.org

1. Introduction

a. Provide each student with a glass of water.
   i. Do you think water is important? Why or why not?
   ii. Where does water come from?
   iii. What are clouds? What are they made of?
   iv. How does rain form?
b. Watch the Water Cycle Boogie www.youtube.com/watch?v=nWgpwldu8QU
c. After watching invite students to:
   i. Take turns explaining what evaporation, condensation, and precipitation is.
   ii. Draw their version of the water cycle.

2. Investigating the Water Cycle

a. Gather materials listed above for the creating A Mini Water Cycle.
b. The bowl represents the earth holding the world's water.
c. Place the mug (a lake) in the center of the bowl.
d. Using the pitcher pour water into the bowl until it reaches at least halfway up the mug. Be careful not to splash any water into the mug. The water inside the bowl represents the ocean.
e. Cover the bowl with plastic wrap and secure tightly using a rubber band or string. This is the atmosphere.
f. Place the bowl in the sun or under a warm light source.
g. **Observe** the bowl to see what happens.
h. Have students draw the set up of their Mini Water Cycle.
i. Have students **hypothesize** what they think will happen. Encourage them to use the terms evaporation, condensation, and precipitation.
j. The mist that forms on the plastic wrap will change into larger drops of water that will begin to drip. Keep watching for a few minutes (or leave it for a set period of time), then carefully peel back the plastic. Is the coffee mug/lake still empty? Water from the ocean of water in the bowl **evaporated**. It **condensed** to form clouds on the plastic wrap. When the clouds became saturated it **precipitated**/ rained into the mug/lake. (After a lot of water has condensed on the plastic wrap you can carefully move the bowl into the shade in order to speed up the precipitation part.)
k. Older students can use the measuring cup to measure and record the amount of water recovered into the lake/mug.
l. Extensions:
   i. Younger students can act out the water cycle with their bodies.
   ii. Students can time the process to see whether differing lengths of time effects the amount of water gathered.
   iii. Students can take air temperature readings to determine if that has an effect on the amount of water gathered.

iv. Students can try this experiment in different locations to represent different climates.
v. You can lead a discussion about parts of the world where people do not have access to enough water.
vi. You can lead a discussion about water conservation and water pollution.

3. Kitchen Prep

a. Read the title page together.
b. Identify and gather ingredients and tools.
c. Discuss kitchen safety, in particular stove top safety, keep elbows high when stirring. (Visit Raddishkids.com/pages/safety)

4. Prepare Onion Jam

a. Ask children to read or describe each step.
b. Give each child a turn measuring, slicing, etc.
c. What part of the water cycle is happening to the onions as they caramelize? How does that change the flavor of the onions?
d. Once the Onion Jam is ready eat, taste and share!

Lesson 3: Reactive Ricotta Cheese and Louis Pasteur, the Pasteurization of Milk and the Raw Milk Debate
Activity time: 45 minutes

Learning Outcomes

All Students will:

- Learn about Louis Pasteur and his contribution to our health today.
- Create a poster explaining why they think it is important to believe in themselves.
- Learn what the pasteurization process is and what it does to milk.
- Use milk to make Reactive Ricotta Cheese.
- Discuss the term bias as it applies to media products.

Older students will (4th- 8th Grade):

- Research about raw milk vs. pasteurized milk and create a list of pros and cons.
- Take a stand on whether they support legalizing raw milk in the United States.

Materials

- Recipe guide and ingredients and tools listed within.
- Recommended optional reading: The Value of Believing in Yourself: The Story of Louis Pasteur by Spencer Johnson. (The quality of the recording is not great but there is a video on YouTube of someone reading the story https://www.youtube.com/watch?v=HfPwqrToz8Y)
- Optional: Library books on Louis Pasteur and pasteurization
- Bristol board or large paper
- Paints, crayons, markers

Older Students

  - Raw Milk Pros and Cons Worksheet and Pasteurized Milk Pros and Cons Worksheet (included)
  - Milk Debate Resource Sheet (included)

Sites consulted for this lesson plan

- www.realmilk,com/health/raw-milk-vs-pasteurized-milk/
- www.ducksters.com/biography/scientists/louis_pasteur.php
- www.mediasmarts.ca
- science.howstuffworks.com/life/cellular-microscopic/pasteurization3.htm

- www.historylearningsite.co.uk/a-history-of-medicine/louis-pasteur/

1. **Introduction**
   a. Ask your students if they know who Louis Pasteur is.
   b. Using books and YouTube resources mentioned above, educate students about Louis Pasteur:
      i. Additional biography -- www.ducksters.com/biography/scientists/louis_pasteur.php
      ii. Important Facts About Louis Pasteur
         - Famous for his work on disease causes and prevention.
         - Well known for inventing a process to stop food and liquid from making people sick. This is called pasteurization.
         - Pasteur studied the immune system and helped produce the first vaccine for rabies.
         - Pasteur's experiments supported the germ theory of disease and helped show that microorganisms are the actual causes of many diseases. This led to discovering things as simple as hand washing can keep us healthy!
         - Famous quote "Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world."
   c. Discussion Questions about Louis Pasteur
      i. What discoveries did Louis Pasteur make that we benefit from today?
      ii. Who was the boy that Pasteur tested the rabies vaccine on?
      iii. Did people believe in Louis Pasteur's work? Why or why not?
      iv. Why is it important to believe in yourself?
      v. What do you think his famous quote means?
   d. Have students create a poster/picture about why it's important to believe in yourself.

2. **Understanding Pasteurization Discussion**
   a. **What is Pasteurization?** The heating of a food or liquid in order to kill pathogens (a bacteria, virus, or other microorganism that can cause disease).
   b. **How does it work?**
      i. A bacterium is like balloon that has everything it needs to live inside itself: food, air, water. In scientific terms a bacterium is made up of a cell envelope called cytoplasm
      ii. When the temperature gets hot enough during pasteurization the enzymes in the bacterium are *denatured,* which means they change shape. This makes them no longer able to do their work.
      iii. If the bacterium can't do its job, it can't make you sick.
   c. **What does pasteurization do to milk?**

i. Pasteurization is heating milk to a certain temperature for a specific period of time to kill off the most heat-sensitive pathogens. It still keeps the qualities of milk like a creamy texture, milk flavor color.

d. **Would you drink milk that isn't pasteurized? - Older Students**
   i. Have students brainstorm reasons.
   ii. Next students will do some online research about the positions for and against pasteurization. But first let's talk about bias in media.

3. Media Bias

a. **How Media is Constructed- "***Media products (magazine or newspaper articles, blogs, tv reports, etc) are created by individuals who make conscious and unconscious choices about what to include, what to leave out and how to present what is included. These decisions are based on the creators' own point of view, which will have been shaped by their opinions, assumptions and biases – as well as media they have been exposed to. As a result of this, media products are never entirely accurate reflections of the real world."* (From Media Smarts- Canada's Centre of Digital and Media Literacy)

b. In other words, one should always ask themselves:
   i. Who created this media product?
   ii. What is its purpose?
   iii. What assumptions or beliefs do its creators have that are reflected in the content?

c. Students should use the internet or the library to research both sides of the raw vs. pasteurized milk debate.
   i. Keep in mind the Media Bias questions above.
   ii. Use the Milk Debate Resource Sheet (included) and other websites and sources
   iii. Complete the Raw Milk Pros and Cons Worksheet and Pasteurized Milk Pros and Cons Worksheet (included)
   iv. After weighing all the information, what do you believe is in the best interests of consumers of milk? Should everyone in the United States have the ability to buy raw milk regardless of where they live?
   v. Write up your position giving at least three reasons for your decision.
   vi. Optional: If a friend or sibling has an opinion that differs with yours, conduct an amicable debate!
   vii. Share your position with classmates and family. Be prepared to share what you learned and/or debate/refute their opinions.

4. Kitchen Prep

a. Read the title page together.
b. Identify and gather ingredients and tools.
c. Discuss kitchen safety, in particular stove top safety. (Visit Raddishkids.com/pages/safety)

5. **Prepare Reactive Ricotta Cheese**
    a. Ask children to read or describe each step.
    b. Give each child a turn measuring, squeezing, etc.
    c. While you are waiting for your cheese to form. Put up your Believe in Yourself Posters for a Gallery Viewing.
    d. Gather together with your friends and family to enjoy Reactive Ricotta Cheese. Serve it on your biscuits! Eat, taste and share!
    e. Share with your family and friends what you learned about Louis Pasteur and his contribution to the milk industry as well as how hard he worked to believe in himself when others did not.