LESSON 4:
CHEMICAL REACTIONS

SUPPLIES

TEACHER BRINGS
- Apple Juice (8 oz)
- Grape Juice (8 oz)
- Lemonade (8 oz)
- Vinegar (8 oz)

MAIN BIN
- Paper Towels (1)
- Tablecloth (2)
- Gloves (15 pairs)
- Frosted Cups (45)
- Spoons (45)

FOLDER
- Predication worksheet (15)

PENCIL BOX
- Markers

OBJECTIVES

☑ Explore the effects of different substances on a solution to identify the source of a mysterious pink residue.

HOOK

3-5 min

- Last night, as an intruder slipped past the security guards into the secret Spy Base, he tampered with the lock, leaving behind a puzzling clue: a mysterious liquid. The cleaning crew tried to use vinegar to clean it up before the forensic team had a chance to test it.

- But not all was lost! When the janitor poured the vinegar onto the glass and mysterious liquid, it turned pink! Could this color-changing reaction hold the key to unlocking the secrets of our case? You are going to test out a few solutions to see which one was left at the scene!

INTRODUCTION

3-5 min

Welcome back, agents! Today, you are not only agents, but scientists as well! You'll be testing different liquids to figure out which one the thief spilled at the crime scene (see hook). By using your observation skills, you'll help Agent Phelix get to the bottom of this mystery by exploring the effects of different substances on a solution.

But first, let's dive into chemical reactions! Many substances can be broken down into three categories: acid, base or neutral. Acids are often sour, like lemon juice or vinegar. Bases are often slippery, soapy, or bitter, like soap or baking soda. Neutrals are neither sour nor bitter but somewhere in between. Water is an example of a neutral! Scientists and agents alike use something called the pH scale to measure how acidic or basic something is.

MEET TODAY'S SECRET AGENT

PHELIX

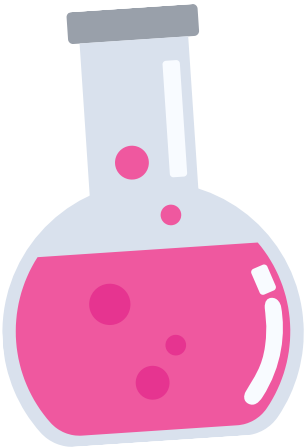
Specialty: Chemical Decoder

Meet Agent Phelix, a top-level secret agent with a unique specialty: chemical clues. With sharp observation skills and a deep knowledge of chemical compounds, Agent Phelix can solve even the trickiest of cases using the secrets of science!

CHEMICAL REACTIONS

DISCUSSION

3-5 min



When you add vinegar to certain liquids, they change colors. This happens because some liquids can help show us how acidic or basic something is. Scientists use something called the pH scale to determine these findings.

The pH scale is like a number line that goes from 0 to 14. If a substance has a low number, like 2 or 3, it means it's an acid — something sour like lemon juice. If the number is 7, it's neutral, which means it's not an acid or a base, like water! If the number is higher, like 8 or 9, then it's a base — something slippery or bitter, like baking soda. For example, lemon juice, orange juice, and soda are sour (acidic), while soap and baking soda are soapy (basic).

ACTIVITY

30 min

1. Introduction to Chemical Detection: (5 minutes)
   - Using your curiosity and keen observation skills, you will conduct a series of experiments to test the effect of vinegar on different substances. This will help determine where the pink residue came from. Your goal is to identify the specific liquid that is affected by the vinegar, causing it to turn pink. Once you've successfully identified the liquid that was left behind, you'll be one step closer to solving the mystery of the museum heist. The forensic team believes that the liquid is a type of juice. You will be testing grape juice, apple juice, and lemonade.

2. Safety Precautions (5 minutes)
   - Discuss safety procedures with students, including the importance of wearing safety goggles and gloves when handling chemicals.
   - Remind students to follow the teacher's instructions and handle chemicals responsibly.

3. Testing (20 minutes): NOTE: make sure to use tablecloths to protect tables.
   - Have students color each cup of juice based on how it looks before adding vinegar.
   - Guide them to write or draw their prediction.
   - Provide each pair of students with 3 cups with the sample liquids (grape juice, apple juice, and lemonade).
   - Instruct students to add a tablespoon of vinegar and observe the color of the residue and note any other visible characteristics.
   - Have them draw and record their observations, noting if their predictions were correct on which juice would change colors.

CHEMICAL REACTIONS

OBSERVE & EXPLAIN

5-7 mins

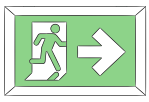
When you add vinegar to grape juice, something amazing happens. During this chemical reaction, the grape juice can turn from purple to pink! This happens because the grape juice is already a little sour, or acidic, and vinegar is even more acidic. When you mix the two, the grape juice becomes extra acidic, and this causes a color change.

Grape juice gets its purple hue from something called anthocyanins (an-tho-SIGH-a-nins). Anthocyanins are natural color pigments found in grapes and grape juice. Anthocyanins can change color depending on how acidic an added liquid is. When you added vinegar to the grape juice, you helped increase the liquids acidity, creating a vibrant color shift from purple to pink!

Now that we have a way to tell which substance the culprit left behind at the crime scene, we have more intel that will help us crack the case! Agent Phelix is thankful for the assistance today, agents!

Extension:
State of Matter Movement Break

In this movement activity, the teacher calls out “solid,” “liquid,” or “gas,” and students act out each state with their bodies. For “solid,” they freeze in place like a rock. For “liquid,” they move slowly and smoothly around the room. For “gas,” they move quickly and freely like bouncing molecules. To add extra fun, when the teacher yells “plasma,” students can jump and wiggle. This game is a great way to get students moving while reinforcing science concepts about states of matter.



Exit Ticket

Ask each student one of the following questions as they walk out the door.

- Q: What is an example of an acid?
  - A: Soda, lemon juice, orange juice.
- Q: What is an example of a base?
  - A: Baking soda, baking powder, hand soap.
- Q: What is an example of a neutral substance?
  - A: Water

CHEMICAL REACTIONS

PREDICTION WORKSHEET

Instructions: Color in each cup with the type of juice and the color that you see before adding the vinegar. Write your prediction. Then, draw the color of the liquid after. Write your observations on the lines below.

YOUR PREDICTION

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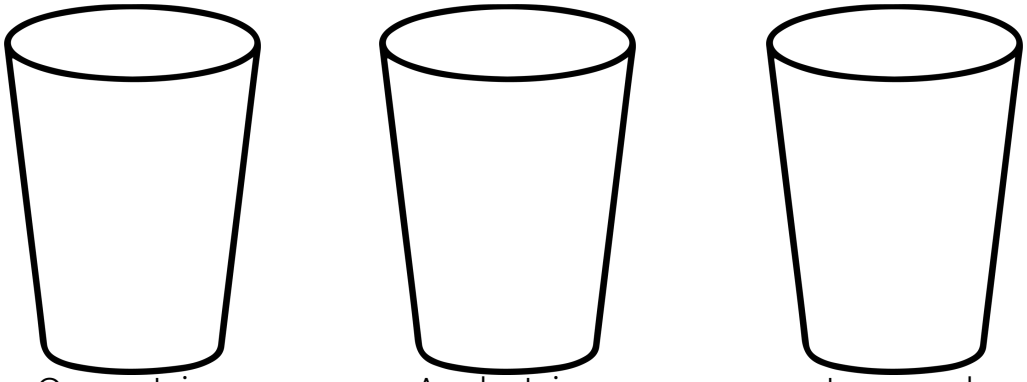
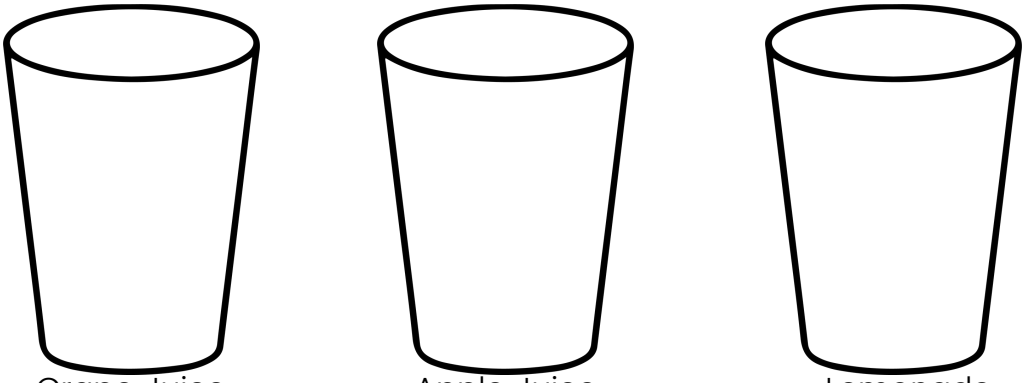
_____

BEFORE VINEGAR



Grape Juice | Apple Juice | Lemonade

AFTER VINEGAR



Grape Juice | Apple Juice | Lemonade

Write your observations.

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