

LESSON 2:

POWDER ANALYSIS

Students will learn how to use tools to identify substances and sense danger!

SUPPLIES

TEACHER BRINGS

- 1 cup sugar
- 1 cup flour
- 1 cup baking powder
- 1 cup baking soda
- 1 cup cornstarch
- 1 cup vinegar

MAIN BIN

- 15-20 plastic cups
- 5 small plates

FOLDER

- Detective's Worksheets (5)

SUPER SPY SUPPLIES

- 15 toothpicks

NOTE

Keep left over baking powder and baking soda for lessons #5 and #6 respectively

GADGET BOX

- 4 eye droppers
- 4 magnifying glasses

MEET SPECIAL AGENT

CATALYST




Specialty: Forensic Science

Agent Catalyst is a prodigy in the field of laboratory science, specializing in biology and chemistry. With an extraordinary understanding of molecular structures and chemical reactions. His expertise in forensic science allows him to examine samples, identify patterns, and extract crucial information to solve even the most perplexing cases.

OBJECTIVES


- To use senses to figure out what each powder is
- To identify physical and chemical changes

HOOK

 3-5 min

- Every good spy comes across a mystery powder at some point. It is important to know what this powder is to provide clues to help solve a mystery.
- How do you think spies figure out different powders are?
- What clues will they use?
- What tools would they use?
- Let's learn from the best. Agent Catalyst will share his tips and tricks on how to solve a difficult case using lab science

DISCUSSION

 3-5 min

- When coming across a mysterious powder, it is important to first consider safety. Could this powder be dangerous? Spies must always be careful when investigating substances.
- To investigate powders, spies may use tools like a magnifying glass, or other substances to explore if and how the powder reacts. This could give them clues to help solve the mystery.
- Spies must use their senses to determine what the powder is. Can you name the five senses? (Hear, Smell, Taste, Touch, See)
- Using some of these senses is a much more dangerous choice than others. For example, it would not be a good idea to taste a powder without knowing what it was, but it would probably be okay to look at it closely with a magnifying glass.
- Ask students to explain what order they would use each sense to figure out what a mystery powder was. For example, "First, I would use my eyes because it is safe and it would tell me the color and consistency of the powder. I would never taste it unless I knew what it was."

TOOLS



Magnifying glass



Some of your senses



Other substances to observe reaction

DANGER

DO NOT TASTE OR SMELL

Please let students know they cannot taste or smell the substances. For a secret agent to taste an unknown substance might be very dangerous, so they have to follow the rules and not taste any of the substances they are testing.

PREP FOR THE ACTIVITY

Students will be divided into groups of 3-4, each group will receive the following supplies:

- 5 cups labeled 1-5 with a small amount of five mystery powders inside
 - sugar
 - flour
 - baking powder
 - baking soda
 - cornstarch
- 1 extra cup labeled vinegar
- 1 magnifying glass
- 1 eye droppers
- 2 small plates
- 3-5 toothpicks
- 1 Detective's Worksheets Printouts



CLUE SET-UP

During today's Powder Analysis experiment, you will be solving the case of the eraser thief with your students. Before the class, make sure to get the "Criminal's Identity Clues" worksheets and cut the picture into five strips for each group. During the class, as the groups complete the detective's worksheet and correctly identify a "mysterious powder," you can give each group a clue from the "Criminal's Identity Clues" worksheet that you cut into strips. You should distribute the clues in sequential order, starting with clue number one, but remind your students not to share their clues with other groups.



ENGAGING STORY SET-UP

Attention fellow spies! We've got a new case to crack: a sneaky criminal has gone and swiped more erasers from unsuspecting students. But this guy isn't your usual thief - he's leaving behind puzzling powders that we need to decode. But remember, dear spies, we can't risk tasting or sniffing these powders - we'll need to rely on our eagle-eyed senses to crack the case and save the day! As you and your super-sleuth squad analyze a mysterious powder, get ready for a clue that could crack the case and reveal the culprit's identity!



ACTIVITY

🕒 15-20 min

1. Put students in groups of three or four.
2. Show students the plastic cups with the five mysterious powders. Ask students to observe each powder
3. Have students use the Detective's Worksheet and predict what each powder may be
4. Each group will have two paper plates, three toothpicks, one eyedropper and one magnifying glass.
5. To start, ask each group to investigate the powders using the magnifying glass.
6. On their worksheet, note anything they see.
7. Next, using one plate, ask students to put 2-3 drops of water onto each substance and stir them with a toothpick.
8. Note any observations of what happens when the water and powder interact.
9. Finally, using the second plate, have students add 2-3 drops of vinegar to the substances
10. Note anything that happens when the vinegar and powder interact.
11. Based on observations, can you guess or hypothesize what the powders might be?

OBSERVATION & EXPLANATION ⌚ 10-15 min

Ask students to review their notes on the student worksheet. Then, ask them to share their observations for each powder including how it looked and how it reacted with water and vinegar.

- When mixed with water:
 - Flour becomes doughy.
 - Sugar will appear grainy. Baking powder will bubble.
 - Baking soda will dissolve
 - Cornstarch will become a non-Newtonian substance
- When mixed with vinegar:
 - Baking soda and baking powder will bubble, while sugar, flour or cornstarch will not



OBSERVATION & EXPLANATION

Discuss that when the substances are combined with water and vinegar and a new substance is created, this is a chemical reaction.

A chemical reaction occurs when two or more substances combine to form a new substance with different properties. In this case, when the powders are mixed with water and vinegar, they undergo a chemical change, resulting in the formation of a unique substance. This reaction can be used as a valuable tool for spies to gather clues and identify various substances they encounter.

Knowing the properties of different substances and how they react can give spies clues to figure out what each substance is. Understanding the properties of different substances and how they react is crucial for secret agents. Each powder might have distinct characteristics, such as color, texture, or smell, that can provide hints about its identity. However, these properties alone may not always be sufficient for identification. By observing how the substances react when mixed with water and vinegar, spies can gather additional information to solve the mystery.

EXTENSION

Give students the following spy scenarios to solve:

1. A substance was found in the classroom. It was white and grainy, even when mixed with water. It had no reaction when mixed with vinegar. Which substance was this?
2. A substance was found on the floor of the cafeteria. It was white. When mixed with both water and vinegar, it bubbled. What substance was this?
3. A substance was found on the table in the library. It was white and powdery. When mixed with water it became doughy. When mixed with vinegar, nothing happened. What substance was this?

Then, encourage students to make up scenarios for each other to solve.

ANSWERS TO EXTENSION

1. Cornstarch
2. Baking Soda
3. Flour

CONCLUSION AND CLEAN UP 3 min

Instruct students to clean their stations. No powders should be left on any surface. Be very diligent in cleaning off all the tables to make sure no vinegar is left behind. (Because



Exit Ticket

TICKET

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

- What are your five senses?
 - Hear, See, Smell, Touch, Taste
- What is a chemical change?
 - A change that creates a new substance
- Where your initial prediction about the powder correct? Why or Why not?

Substance	Hypothesis: What is the substance in the cup?	Observation: What happens when you add water of vinegar?	Conclusion. Did you guess it correctly? What substance was in the cup?
1			
2			
3			
4			
5			

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Clue # 5



Clue # 4



Clue # 3



Clue # 2



Clue # 1

