

LESSON 6:

INVISIBLE INK

Students will work with chemical and physical properties of materials to create invisible ink.

SUPPLIES

TEACHER BRINGS

- 1-gallon grape juice
- 1 cup of baking soda

GADGET BOX

- Paintbrushes (5)
- White crayons (6)
- Water Color Sets (3)

FOLDER

- Printer Paper (30), cut in half sheets

MAIN BIN

- Bowls (15)
- Spoons (15)
- Plastic cups (15)

SUPER SPY SUPPLIES

- Cotton swabs (5)

REMEMBER

Some supplies (like tape) may need to be replenished if it's late in the semester or you share your bin with another teacher!



MEET SPECIAL AGENT

INKJET

Specialty: Chemical Substances




Agent Inkjet possesses an extraordinary power to create invisible messages. With their unique ability, Inkjet can encrypt vital information into invisible ink, concealing it within documents or surfaces. Their expertise in cryptography allows them to develop hidden messages, ensuring that only those with the right knowledge can decipher their hidden messages.

OBJECTIVES

- To identify chemical reactions in invisible ink
- To explore how the properties of wax and water can be used to create invisible ink.

HOOK

 3-5 min

- Ask students why spies would want to send or read secret messages.
- Discuss the benefits of sending a message to trick criminals or to intercept messages from criminals.
- What are different ways that spies would send secret messages?
- Ask if anyone has ever used invisible ink. If so, what did they do?

DISCUSSION

🕒 3-5 min

Share with students that unlike our other secret message activities, the invisible ink we are making today will be a result of a chemical reaction. Ask students what they know about chemical reactions. Discuss their answers.

Review the key ways to tell if a chemical reaction has occurred.

- A gas is formed
- There is a color change
- There is a change in temperature
- A solid is formed
- Light or odor are given off



HYPOTHESIS

🕒 3-5 min

Show students the materials for today. Tell them that they will be making their own secret message using invisible ink and a chemical reaction.

Ask students to predict how their chemical reaction will occur, based on the five ways reviewed in the discussion. Students will record their prediction on the student worksheet.


ACTIVITY PART 1

🕒 10 min

1. Give each student a white sheet of paper and a few cotton swabs.
2. Have students split into groups of 3-4.
3. Give each group a bowl of:
 - 1/4th cup water
 - 1/4th cup baking soda
4. Mix the two substance thoroughly
5. Students will use their cotton swab, dip it into the baking soda mixture and write their message
6. Instruct the students to let the paper dry, then give each pair a cup of grape juice
7. Instruct students to dip the cotton swabs in grape juice and then 'paint' over the page with grape juice, observing what happens.



OBSERVATION & EXPLANATION

 10 min

Ask students to explain what happened when they painted the grape juice over the paper. Explain that a chemical reaction has taken place. Ask students how they knew a chemical reaction took place. Discuss the change of color as an indicator that there was a chemical reaction.

Explain to students that baking soda is a base and grape juice is an acid. When acids and bases mix, they react to try and create a neutral substance.

When the baking soda mixture dries on the paper, the water evaporates and baking soda crystals (base) are left on the paper (Which is also a base). Grape juice is an acid that contains a natural dye called anthocyanin. Grape juice is also a natural indicator. This means it will reveal is something is acidic or basic.

When in contact with a basic substance (like the baking soda message), the grape juice reacts with the baking soda to neutralize the Ph (to make it neutral rather than acidic or basic). The reaction causes a change of color, revealing a darker color where the baking soda and grape juice mixed. This reveals the secret message!

ACTIVITY PART 2

 10-15 min

Attempt another invisible ink activity. Have students write a message in white crayon. Then, using watercolors, paint over the page to reveal the message.

Ask students to explain how this invisible ink works. Did a chemical reaction occur? Hint: There was no change of color, heat, change of temperature or new substance created. In this activity, so no chemical reactions occurred.


If time permits, students send secret messages to one another and their teammates in the group will have to decode the message. They can use either of the two methods that we tried today

FUN FACT

Invisible ink was used during the Revolutionary War to carry secret messages! Their notes could be brushed over with another chemical or heated over a candle to reveal the words.

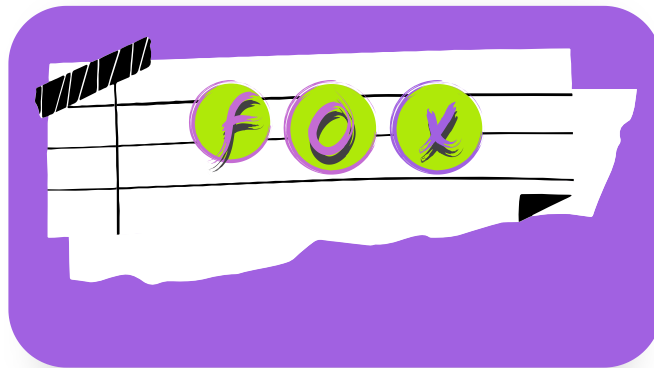
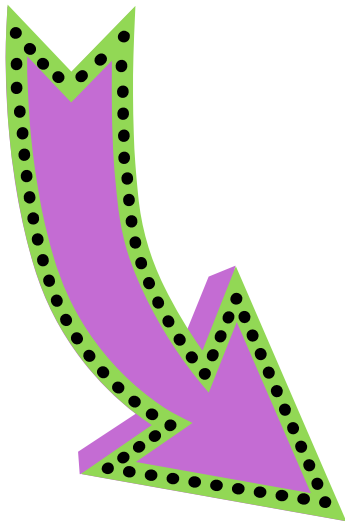


CONCLUSION

 5-7 min

Ask students to explain, based on the activity, what chemical reaction occurred. Complete Exit Ticket Activity.

Instruct students to clean their stations. Make sure to leave the classroom the way you found it.



Exit Ticket



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

- Which activity today resulted in a chemical reaction?
 - The main activity - the extension was not a chemical reaction
- Can you name one of the five ways that we can tell if a chemical reaction occurred? (See 'Discussion' for answers).
- Explain how the invisible ink worked in this activity.
 - Baking soda (base) reacted with grape juice (acid). As it neutralized, the color changed, making the message appear.