

Iodine Rainbow

Student Worksheet

Name _____

Overview: Welcome to the chemistry magic show! Here's what happens – you start with five seemingly empty test tubes. Into each test tube, pour a little of the main gold-colored solution, say a few magic words, and the test tubes turn clear, black, pink, gold, yellow, and white. With a flourish, pour the solutions back into one and the final solution turns from inky black to clear. Voila!

What to Learn: Chemical reactions happen when the atoms of a molecule rearrange to form something completely different. You will see many chemical changes, indicated in today's experiment by a color change.

Materials

- Iodine (non-clear, non-ammonia from the pharmacy) ([MSDS](#))
- 3 % hydrogen peroxide, H_2O_2 ([MSDS](#))
- Acetic acid, $\text{C}_2\text{H}_4\text{O}_2$ (distilled white vinegar) ([MSDS](#))
- Cornstarch (tiny pinch) or one starch packing peanut
- Distilled water
- Sodium thiosulfate, $\text{Na}_2\text{S}_2\text{O}_3$ ([MSDS](#))
- Sodium carbonate, Na_2CO_3 (washing soda) ([MSDS](#))
- 2 drops phenolphthalein (keep this out of reach of kids) – this is optional ([MSDS](#))
- 9 disposable plastic cups OR 3 disposable plastic cups and 6 test tubes
- Popsicle sticks
- Gloves
- Goggles
- Medicine droppers (at least four)

Lab Time

1. Prepare solutions. Fill three disposable cups halfway full with distilled water. LABEL, and add to each:
 - Cup #1: packing peanut (or a dash of cornstarch). Squish the peanut up a bit (it may not dissolve completely)
 - Cup #2: $\frac{1}{4}$ teaspoon of sodium thiosulfate. Stir, but it will not dissolve completely.
 - Cup #3: $\frac{1}{4}$ teaspoon of sodium carbonate. Stir.
2. Prepare test tubes and label each.
 - Test tube #1: Fill most of the way with distilled water. Add 10 drops iodine. Mix by holding thumb on opening and flipping upside down.
 - Test tube #2: Add one full dropper of sodium thiosulfate crystals (from cup #2)
 - Test tube #3: Add one full dropper of starch (from cup #1)
 - Test tube #4: Add one full dropper plus a few drops of vinegar
 - Test tube #5: Add 2 drops only of phenolphthalein (**SAFETY NOTE: Do not let drip or get on skin!**))
 - Test tube #6: Add full dropper of sodium carbonate solution (from cup #3)
3. If doing a chemistry magic show, ask 5 volunteers to come up. Give them test tubes #2-6 and have them stand in order.
4. Evenly distribute iodine mixture from test tube #1 into test tubes #2-6.

5. Add contents of test tube #6 to test tube #5.
6. Add contents of test tube #5 to test tube #4.
7. Add contents of test tube #4 to test tube #3.
8. Add contents of test tube #3 to test tube #2. Put finger on top of test tube and mix. If mixture does not turn clear, add more acetic acid (distilled white vinegar).
9. Now, take the clear mixture in test tube #2 and add it to other test tubes to turn them clear as well. Test tube #6 may have a slight violet color. Add acetic acid to make it clear.

Iodine Rainbow Data Table

Write all of your observations. What colors did you see? Be as precise as possible.

| Mixture | Color | Mixture | Color |
|--|-------|-------------------|-------|
| <u>Test Tube #2</u> Iodine + sodium thiosulfate | | Test Tube #6 + #5 | |
| <u>Test Tube #3</u> Iodine + starch | | Test Tube #5 + #4 | |
| <u>Test Tube #4</u> Iodine + acetic acid (vinegar) | | Test Tube #4 + #3 | |
| <u>Test Tube #5</u> Iodine + phenolphthalein | | Test Tube #3 + #2 | |
| <u>Test Tube #6</u> Iodine + sodium carbonate (washing soda) | | | |

| | | | |
|--|--|--|--|
| | | | |
|--|--|--|--|

Exercises Answer the questions below:

1. In today's chemistry magic show, did you see chemical reactions or physical reactions? How do you know?
2. Phenolphthalein is an indicator that turns clear in acid but pink in a base. What did you notice when sodium carbonate (washing soda) was added to the phenolphthalein? What does this tell you about sodium carbonate?
3. Some students need to add acetic acid to their final solution in order to make it clear. Why?

Exercises

1. In today's chemistry magic show, did you see chemical reactions or physical reactions? How do you know? (Chemical reactions, because there were color changes.)
2. Phenolphthalein is an indicator that turns clear in acid but pink in a base. What did you notice when sodium carbonate (washing soda) was added to the phenolphthalein? What does this tell you about sodium carbonate? (It turned pink, so it is a base.)
3. Some students need to add acetic acid to their final solution in order to make it clear. Why? (The solution is too basic so the phenolphthalein turns it pink. The acid will make it clear again.)

Closure: Before moving on, ask your students if they have any recommendations or unanswered questions that they can work out on their own. Brainstorming extension ideas is a great way to add more science studies to your class time.