Creator: Dr. Federico Dattila
Date: 10/12/2025

Educational games for Chemistry

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1. Disappearing tracks

Credits: ICIQ Outreach Division.

Age target: 7-12 years old.

Objective: to make what we have written on a piece of paper disappear.

Lab Materials:
Cotton swabs.
Plastic cups.
Paper towel.

Reagents:
Betadine (iodine dissolution)
Vitamin C tablets
Water

Procedure:

- We impregnate the stick with iodized dissolution and write a message on a blank sheet of the secret diary.
- We will dissolve a few vitamin C tablets in water.
- We dip the other clean stick in vitamin C and rewrite the message above. See what happens.

Problems:

1. Describe what you see when we rewrite the message.
2. What reaction has taken place? Write.

Theoretical explanation of the experiment

Vitamin C is a water-soluble heat-sensitive compound and includes ascorbic acid and its salts (ascorbate). Ascorbic acid contains several structural elements that contribute to its chemical behavior. In this case, it acts as an oxidizing agent that in the presence of certain substances, such as iodine, reacts with it by oxidizing. In this way, the complex that formed iodine with the cellulose of the paper is destroyed and therefore the color disappears.

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2. Sparkling water

Credits: ICIQ Outreach Division.

Age target: 7-12 years old.

Objective: The goal of this practice is to understand the behavior of different foods in carbonated water.

Lab Materials:
Glasses.
Raisin.
Lentils.

Reagents:
Sparkling water.

Procedure:
- Fill the glass with sparkling water and add the food little by little.
- See what happens.

Problems:
1. Do all three foods behave the same?

Theoretical explanation of the experiment:
In this experiment what happens is that the raisins are denser than water and will sink to the bottom of the glass. Then the carbon dioxide (CO_2) bubbles will stick to the surface of the raisins (the rougher they stick to it the better they stick to it) and when there are enough bubbles surrounding it, the raisins rise to the surface. When it reaches the surface and comes into contact with air, the bubbles explode and CO_2 is released. Now, raisins are heavy again and sink again.

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3. Food starch

Credits: ICIQ Outreach Division.

Age target: 7-12 years old.

Objective: To detect the presence of starch in different foods.

Lab Materials:
Plastic plates.

Reagents:
Betadine.
Potatoes.
Flour.
Sugar.
Salt
Rice.
Bread.

Procedure:

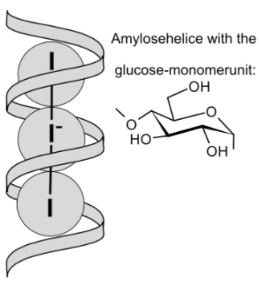
- We put the food we want to analyze in a plastic plate.
- Add a few drops of Betadine and see what happens.

Problems:

1. Explain what's going on.

Theoretical explanation of the experiment

If a very dark blue color appears in the test tube where we have our food when we add the iodine reagent, this indicates that the product contains starch. The iodine dissolves and the I^- ions enter the starch molecule (in particular amylose) producing a blue optical effect.



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4. Iron in breakfast cereals

Credits: ICIQ Outreach Division.

Age target: 7-12 years old.

Objective: Many of the foods currently on the market are enriched in nutrients, many of them iron. Breakfast cereals are one of the foods that have undergone the massive incorporation of iron in their composition. In this experience we will try to extract iron from cereals.

Lab Materials:
Plastic cups.
Plastic spoons.
Magnet.

Reagents:
Kellogs Special K Cereals and Sannia Cereals.
Water.

Procedure:
Experiment 1

- Remove 3 or 4 grains and bring the magnet closer. Does it attract grains?
- Let's try to put them in water on a petri dish.

Experiment 2

- Grind a portion of cereal with water, to facilitate the extraction of iron.
- Place the mixture in a plastic cup.
- Stir with the spoon and at the same time place the magnet on the wall of the glass.
- See how much iron we can find in this serving of cereals.

Problems:

1. Explain what happened in the first experience.
2. What kind of iron can we find in breakfast cereals?
3. How is iron found in grains? Form a homogeneous or heterogeneous mixture? Because?
4. Explain what you think of the 2 experiences. Were you surprised? Because?

5. Inflate a balloon chemically!

Objective: When we inflate a balloon we insert carbon dioxide into it coming out of our lungs. This can also be done chemically, by generating CO_2 from bicarbonate (HCO_3)!

Age target: 7-14 years old.

Lab Materials:
Glass bottles.
Balloons.

Reagents:
Sodium bicarbonate ($NaHCO_3$).
Hydrochloric acid (HCl) (or vinegard).

Procedure:

- Pour hydrochloric acid into a glass bottle;
- Insert baking soda inside the balloon;
- Turn the balloon upside down.

Theoretical explanation of the experiment
On contact with hydrochloric acid, sodium bicarbonate evolves into salt (NaCl), carbon dioxide (CO_2) and water (H_2O)

$$HCl + NaHCO_3 \rightarrow CO_2 + NaCl + H_2O$$

6. Non-Newtonian fluids

Credits: BigVanCiencia.

Age target: 7-14 years old.

Objective: To understand the difference between a fluid, a solid and a non-Newtonian fluid.

Lab Materials:
Bowl.

Reagents:
Corn starch (250 g).
Water (180 g).

Method:
- Mix cornstarch and water;
- Have the children check how, depending on the contact rate, the non-Newtonian fluid behaves as a fluid or as a solid.

Theoretical explanation of the experiment
A non-Newtonian fluid has a viscosity that depends on the applied shear stress. The greater the stress, the higher the viscosity and vice versa.

7. Distinguishing a hard-boiled egg from a fresh one

Credits: BigVanCiencia.

Age target: 7-14 years old.

Objective: Differentiate a hard-boiled egg from a fresh egg just by rotating them.

Lab Materials:
Plastic Plate.
1 hard-boiled egg.
1 fresh egg.

Method:

- Ask the audience to guess whether an egg is hard-boiled or fresh (without breaking it);
- Rotate the eggs.

Theoretical explanation of the experiment
The hard-boiled egg will rotate much faster as it is solid. The fresh egg, on the other hand, constantly changes its center of mass so it has a slower rotary movement.

8. The fiery water!

Credits: BigVanCiencia.

Age target: 7-14 years old.

Objective: To demonstrate why flames are extinguished with water

Lab Materials:
Flat candles.
Basin.
Glass glass.

Procedure:
Experience 1
- Insert a lighted candle inside the basin;
- Place an upside-down glass over the candle;
- Push the glass down.

Experience 2
- Place a lighted candle on the table;
- Place an upside-down glass over the candle.

Theoretical explanation of the experiment
The glass allows the formation of an air bubble underwater. This bubble nourishes the flame with its oxygen, allowing the flame to be maintained even underwater. After all the oxygen has been consumed, the flame goes out.

9. Vegetable dyes and pH with cabbage!

Credits: Dott. Francesco Dattila.

Age target: 10-16 years old.

Introduction

Indicators are substances that change color as the pH changes: that is, they indicate the acidity and alkalinity (basicity) of a solution. More than 50 substances with this property are known, the best known is litmus obtained from a lichen that takes on a blue color in basic solution and red in acid solution.
Purple cabbage is a plant indicator that can be used to check the pH of a solution.

Objective:

Checking the indicator properties of plant extracts.

Equipment, glassware, instrumentation

- Spray.
- Pasteur pipette.
- Mortar with pestle.
- Flask 100 mL.
- 12 tubes with tube holders.
- 10 mL cylinder.
- Universal pH indicator map.

Reagents

- Ethyl alcohol 95%,
- HCl 1M, HCL 0.01 M, HCl 0.001 M, NH_4Cl 0.2 M, H_2O dist., CH_3COONa 0.2 M, NaOH 0.01 M, NaOH 1M; these solutions have pH respectively: 0, 2, 3, 5, 7, 9, 12, 14.

Preparation of alcoholic extract of red cabbage

Cut the cabbage leaves into pieces and put in a mortar with 5-10 cc of ethyl alcohol, pound with the addition of a little water. A violet-colored liquid is obtained, filtered and stored in a 100 mL flask; repeat the operation until a final volume of extract of about 100 mL is obtained. Alternatively, extraction can be done with hot water.

Procedure

Put about 5 mL of each of the solutions at different pH in 8 tubes, add 6-8 mL of extract to each tube and observe the colors thus obtained (from red to purple to blue to green). Also check the pH value of the various solutions with the universal indicator paper.
By wetting a strip of filter paper with the alcohol extract and letting it dry in the air, you will obtain an indicator paper similar to those normally used in laboratories.

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10. Carbon dioxide hunters!

Age target: 14-18 years old.

Objective

- Understand the composition of molecules through the use of molecular models.
- Introduce the concept of chemical bond and molecular structure.
- Reflect on the impact of molecules in reducing CO_2 emissions and their economic/environmental value.
- To stimulate cooperation and competition in an educational context.

Material

- Molecular model kit (with carbon, hydrogen, oxygen atoms and bond rods).
- Table of scores assigned to molecules based on "market cost" (e.g. methane, water, carbon dioxide, ethanol, etc.).
- Papers and pens to write down the molecules created and the score.
- Timer or stopwatch.
- Whiteboard or projector (optional, for final ranking or explanations).

Procedure

- Divide the participants into teams (2-4 members each).
- Distribute a molecular model kit to each team.
- Explain the rules: Teams must build real molecules using available atoms, connecting them with rods (bonds).
- Each molecule formed is validated and evaluated according to the score table.
- Teams write down the molecules created and the corresponding score.
- After a set time (e.g. 30 minutes), the game is stopped.
- The scores of each team are added up: the one with the highest score wins!
- Final discussion on what was learned and the environmental implications.

Explanation

This activity combines scientific learning with teamwork. Using molecular models, students actively learn how molecules are formed and what the bonds between atoms are. The dynamics of the competition stimulate strategic thinking: each molecule has a value, and teams must decide which ones to build to get more points. In addition, the activity promotes awareness of the importance of chemistry in the fight against climate change and in the reduction of CO_2, making visible how certain molecules are more "precious" in this context.