Bang!

Summary

Student will observe a reaction between vinegar and baking soda and then design an experiment to test a variable affecting the reaction.

Time Frame

2 class periods of 90 minutes each

Group Size

Small Groups

Materials

student sheet
(attached)
Needed for Control:

- Paper towel strip 4" wide by 8" long
- 10 mL graduated cylinder
- Baking soda (10 mL per group)
- 20 ounce soda bottle
- Cork (rubber #3)
- Balloon
- 150 mL beaker
- Vinegar (120 mL each)
- Water (120 mL each)
- Purple Cabbage indicator (15 mL)

Other Materials students may request:

- Bromothyol Blue Indicator
- Universal pH Indicator
- pH Strips
- Balloons
- Glass and rubber tubing and 1 hole stopper
- Baking Powder
- Thermometers
- Measuring tape
- Extra Beakers
- Rice paper
- Facial Tissue
- Limewater

Background for Teachers

Safety Precautions:

Chemicals and flying objects will be used in this lab. Students should wear safety goggles at all times. As always, take care to first read through the entire set of procedures, then clarify any questions you have before proceeding with the experiment. Follow the directions exactly, be sure your instructor reads and approves your experiment plan before conducting your experiment.

Instructional Procedures

Days in Advance:
Copy and laminate the "Bang Control" page so there is at least one for every group.
Prepare a tray for each group that contains all of the supplies listed under "Materials"
Reserve computer lab or mobile computers?
Day 1:
Demonstrate the "Bang Control" experiment.
Pass out the Student Page and "Bang Control" page and explain how to fill out the data table on the student page for the control. Discuss the difference between qualitative data and quantitative data and brainstorm ideas for types of quantitative data you might record for this experiment. Then plan what data and where to record the data.
Demonstrate the "Bang Control" experiment again and let the students record their data.
Conduct Research: Options: Use computers and have individual students or groups research answers on internet. Assign groups of students to look up one answer using various sources in your room (text books, web, dictionary, Handbook of Chemistry).
Discuss what variables are, list variables and how they were controlled in the Bang control experiment. Ask what a manipulated variable would be. Discuss reasons to manipulate just one variable when conducting an experiment. Have students brainstorm variables they could manipulate and list them on the board (amount of baking soda, dilution of vinegar, shaking, type of wrapping for b. soda, etc). Explain that they will have to collect quantitative data in this experiment so that they can create a graph. Have students brainstorm ways to quantify data and list them on the board (Examples: How far the cork shoots, the diameter of the balloon if placed over the top of the bottle, the change in pH, temperature). Give an example of a research question and a hypothesis pointing out important components of each.
Explain that they will need to team up with another group, one group will perform the control experiment and the other will test the manipulated variable. They should start these 2 experiments at the same time so they can compare them side by side. Give them time to write their plans. Collect and approve student plans.
Day 2:
Students conduct experiments and complete lab worksheet.
Then students make a "poster" (I usually do this on small whiteboards) to share their results with the class.
This is a good opportunity to discuss sample sizes and for students to discuss choose important information to share with their peers.
Instead of or in addition to doing a poster you may want to have students write just a hypothesis or just a graph--just one part of the lab report on their boards leaving the names off, then discuss as a class criteria that makes a good hypothesis, conclusion, graph etc. (Just choose one at a time or they may get overwhelmed.)
St. IV Ob.1 e: Determine molar proportions of the reactants and products in a balanced chemical equation.
Discuss why sometimes it may be unsafe for students to conduct pure inquiry experiments at home.
Connect this to other areas of chemistry that you have discussed, or are coming up next:
Examples:
Conservation of mass (St.IV Ob. 2)
Factors that influence reaction rates/dynamic equilibrium (St. V)
Solutions, Concentrations and pH. (St. VI)
Chemical Bonding/Chemical & Physical Properties (St. III)
Equations from Googling (formula for baking soda and vinegar balanced)
$NaHCO_3$ (cr) + $HC_2H_3O_2$ (aq) ------> CO_2 (g) + H_2O (l) + $NaC_2H_3O_2$ (aq)
$NaHCO_3 + HOOCCH_3 = NaOOCCH_3 + H_2O + CO_2$

Another demonstration:

Collect gas in a balloon, put it in with bromo blue and shake.
Put clay around top and a straw as diagrammed and bubble Into lime water (Carbon dioxide + calcium hydroxide produces Calcium carbonate and water)
Collect gas with straw and bubble into bromo blue
Measure temperature--endothermic? Can you feel Temperature change?
Use facial tissue not paper towel.

Bibliography

Lesson Design by Jordan School District Teachers and Staff.

Authors

Utah LessonPlans