

Chemistry Penny Lab Answers

Name: _____ Class Period: _____ Date: _____



Chemistry Penny Lab Investigation of Intermolecular Forces



Chemistry is the study of the properties and interactions of matter. In this activity you will observe and quantitatively record a phenomenon that is a function of various forces acting on molecules in some liquid compounds. Observers will record the maximum number of drops that hold together on the surface of a penny.

Safety

- This lab will use flammable and toxic materials in manageable sizes.
- If you are unclear about any step, seek clarification before proceeding.
- Make sure to wear safety goggles and a lab apron.
- Keep the vials closed between uses.

Materials

1 vial of water	1 penny
1 vial of isopropyl alcohol	20 Q-tips
1 vial of acetone	paper towels
1 vial of heptane	Ziploc bag for waste
4 disposable pipettes	

Procedure

1. **Prepare workspace:** During this lab always work over a clean paper towel. Locate the water vial and two Q-tips.
2. **Clean the penny surface:** ~~Make sure your goggles are on at this point.~~ Open the vial of water and dip one end of a Q-tip in it. Use a second dry Q-tip to hold the penny down while scrubbing it with the wet Q-tip. After scrubbing, wipe the penny dry with the second dry Q-tip, you can use both ends. Open the Ziploc bag and place both Q-tips in it. Repeat the entire process a second time. At all times do not touch any water during the process. This same technique will be used on the more hazardous liquids. Close the Ziploc bag containing the used Q-tips, consider it your mini fume hood.
3. **Measure the drop count:** Place the open vial of water near the penny. Draw water into the pipette until the barrel is mostly full. (The bulb part should remain empty). Keeping the pipette pointed straight downward, position it a few millimeters

Penny Lab IMF Investigation page 1 of 5 Jeanne Capriotti 1/25/09
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CHEMISTRY PENNY LAB ANSWERS ARE ESSENTIAL FOR UNDERSTANDING THE INTERACTIONS BETWEEN DIFFERENT CHEMICAL SUBSTANCES AND THE PRINCIPLES OF CHEMICAL REACTIONS. THIS LAB ACTIVITY TYPICALLY INVOLVES INVESTIGATING THE PROPERTIES OF PENNIES THROUGH VARIOUS CHEMICAL TESTS AND REACTIONS. BY EXAMINING THE REACTIONS THAT OCCUR, STUDENTS CAN GAIN INSIGHTS INTO CONCEPTS SUCH AS OXIDATION, REDUCTION, AND THE PROPERTIES OF METALS. THIS ARTICLE WILL EXPLORE THE KEY ASPECTS OF THE CHEMISTRY PENNY LAB, THE EXPECTED ANSWERS, AND THE UNDERLYING SCIENTIFIC PRINCIPLES INVOLVED.

OVERVIEW OF THE CHEMISTRY PENNY LAB

THE CHEMISTRY PENNY LAB IS A COMMON EXPERIMENT IN INTRODUCTORY CHEMISTRY COURSES. THE PRIMARY OBJECTIVE IS TO OBSERVE THE EFFECTS OF DIFFERENT CHEMICAL SOLUTIONS ON PENNIES, WHICH ARE PRIMARILY COMPOSED OF COPPER. THE LAB PROVIDES A PRACTICAL APPLICATION OF CHEMICAL CONCEPTS AND ALLOWS STUDENTS TO ENGAGE IN HANDS-ON LEARNING.

OBJECTIVES OF THE LAB

THE MAIN OBJECTIVES OF THE CHEMISTRY PENNY LAB INCLUDE:

1. **UNDERSTANDING CHEMICAL REACTIONS:** STUDENTS WILL WITNESS FIRSTHAND HOW DIFFERENT CHEMICALS INTERACT WITH COPPER AND OTHER SUBSTANCES.
2. **OBSERVING PHYSICAL CHANGES:** THE EXPERIMENT ALLOWS STUDENTS TO SEE PHYSICAL CHANGES THAT OCCUR DURING CHEMICAL REACTIONS, SUCH AS COLOR CHANGES AND THE FORMATION OF GASES.
3. **LEARNING ABOUT OXIDATION AND REDUCTION:** THE LAB SERVES AS AN INTRODUCTION TO THE CONCEPTS OF OXIDATION AND REDUCTION, PARTICULARLY HOW METALS CAN UNDERGO OXIDATION WHEN EXPOSED TO CERTAIN CHEMICALS.

MATERIALS NEEDED

BEFORE CONDUCTING THE CHEMISTRY PENNY LAB, IT IS IMPORTANT TO GATHER THE NECESSARY MATERIALS:

- PENNIES (PREFERABLY PRE-1982 PENNIES WHICH ARE PRIMARILY MADE OF COPPER)
- DISTILLED WATER
- WHITE VINEGAR
- SALT
- BAKING SODA
- HYDROGEN PEROXIDE
- SMALL CONTAINERS OR TEST TUBES
- STIRRING RODS OR SPOONS
- PAPER TOWELS FOR CLEANUP
- SAFETY GOGGLES AND GLOVES

PROCEDURE

THE CHEMISTRY PENNY LAB TYPICALLY FOLLOWS A PROCEDURE THAT CAN BE BROKEN DOWN INTO SEVERAL KEY STEPS:

STEP 1: PREPARE THE SOLUTIONS

1. VINEGAR SOLUTION: MIX ONE PART VINEGAR WITH ONE PART DISTILLED WATER.
2. SALT SOLUTION: DISSOLVE A TABLESPOON OF SALT IN A CUP OF WATER.
3. BAKING SODA SOLUTION: MIX A TABLESPOON OF BAKING SODA IN A CUP OF WATER.
4. HYDROGEN PEROXIDE SOLUTION: USE HYDROGEN PEROXIDE AT A CONCENTRATION OF 3%.

STEP 2: CONDUCT THE EXPERIMENTS

THE FOLLOWING EXPERIMENTS CAN BE CONDUCTED USING THE PREPARED SOLUTIONS:

1. VINEGAR AND SALT TEST:
 - SOAK A PENNY IN THE VINEGAR SOLUTION FOR 5-10 MINUTES.
 - REMOVE THE PENNY AND RINSE IT WITH DISTILLED WATER.
 - OBSERVE THE COLOR CHANGE AND NOTE THE RESULTS.
2. BAKING SODA TEST:
 - CREATE A PASTE OF BAKING SODA AND WATER, THEN APPLY IT TO ANOTHER PENNY.
 - LET IT SIT FOR A FEW MINUTES BEFORE RINSING.
 - RECORD ANY CHANGES IN APPEARANCE.
3. HYDROGEN PEROXIDE TEST:
 - SOAK A PENNY IN HYDROGEN PEROXIDE FOR A FEW MINUTES.
 - RINSE AND OBSERVE FOR ANY COLOR CHANGES OR OTHER REACTIONS.

EXPECTED RESULTS AND CHEMISTRY PENNY LAB ANSWERS

THE EXPECTED RESULTS OF THE EXPERIMENTS WILL DEMONSTRATE VARIOUS CHEMICAL REACTIONS. EACH SOLUTION INTERACTS WITH THE COPPER IN THE PENNIES DIFFERENTLY.

VINEGAR AND SALT REACTION

WHEN PENNIES ARE SOAKED IN A VINEGAR AND SALT SOLUTION:

- OBSERVATION: THE PENNY TYPICALLY BECOMES SHINIER AND MAY EXHIBIT A BRIGHT REDDISH OR PINKISH HUE.
- EXPLANATION: THE ACETIC ACID IN VINEGAR REACTS WITH THE COPPER OXIDE ON THE SURFACE OF THE PENNY, REMOVING TARNISH AND REVEALING THE COPPER UNDERNEATH. THIS IS AN OXIDATION-REDUCTION REACTION, WHERE THE COPPER OXIDE IS REDUCED TO ELEMENTAL COPPER.

BAKING SODA REACTION

APPLYING A BAKING SODA PASTE TO A PENNY WILL YIELD:

- OBSERVATION: THE APPEARANCE OF THE PENNY MAY CHANGE, AND IT MAY FEEL GRITTY OR ROUGH.
- EXPLANATION: THE BAKING SODA (SODIUM BICARBONATE) CAN REACT WITH ANY ACIDIC RESIDUES ON THE PENNY. THIS NEUTRALIZATION REACTION CAN HELP CLEAN THE SURFACE, BUT IT DOES NOT REMOVE THE OXIDATION AS EFFECTIVELY AS VINEGAR.

HYDROGEN PEROXIDE REACTION

SOAKING A PENNY IN HYDROGEN PEROXIDE TYPICALLY RESULTS IN:

- OBSERVATION: THE PENNY MAY DEVELOP A LIGHTER COLOR OR BE FREE OF OXIDATION.
- EXPLANATION: HYDROGEN PEROXIDE ACTS AS AN OXIDIZING AGENT, AND THE REACTION CAN FURTHER CLEAN THE SURFACE OF THE PENNY. IN SOME CASES, IT MAY EVEN LEAD TO THE FORMATION OF BUBBLES AS OXYGEN GAS IS RELEASED.

ANALYZING THE RESULTS

AFTER COMPLETING THE EXPERIMENTS, STUDENTS SHOULD ANALYZE THEIR OBSERVATIONS AND CONSIDER THE CHEMICAL PRINCIPLES AT PLAY.

DISCUSSION QUESTIONS

TO DEEPEN UNDERSTANDING, CONSIDER THE FOLLOWING DISCUSSION QUESTIONS:

1. WHAT IS THE ROLE OF ACIDS AND BASES IN THE REACTIONS YOU OBSERVED?
2. HOW DO THE DIFFERENT SOLUTIONS COMPARE IN TERMS OF CLEANING EFFECTIVENESS?
3. WHAT SAFETY PRECAUTIONS SHOULD BE TAKEN WHEN HANDLING THESE CHEMICALS?

CONCLUSION

THE CHEMISTRY PENNY LAB PROVIDES A HANDS-ON OPPORTUNITY FOR STUDENTS TO ENGAGE WITH CHEMICAL CONCEPTS IN A PRACTICAL SETTING. BY OBSERVING REACTIONS BETWEEN PENNIES AND VARIOUS SOLUTIONS, STUDENTS CAN BETTER UNDERSTAND OXIDATION, REDUCTION, AND THE PROPERTIES OF METALS.

THE EXPECTED OUTCOMES OF THE CHEMISTRY PENNY LAB ILLUSTRATE SIGNIFICANT CHANGES THAT OCCUR DUE TO CHEMICAL INTERACTIONS, ALLOWING FOR A DEEPER APPRECIATION OF THE PRINCIPLES OF CHEMISTRY. WITH CAREFUL OBSERVATION AND

ANALYSIS, STUDENTS CAN DERIVE MEANINGFUL INSIGHTS THAT WILL ENHANCE THEIR UNDERSTANDING OF CHEMICAL PROCESSES AND REACTIONS.

IN SUMMARY, CHEMISTRY PENNY LAB ANSWERS REFLECT THE FASCINATING WORLD OF CHEMICAL REACTIONS, DEMONSTRATING HOW EVERYDAY MATERIALS CAN BE TRANSFORMED THROUGH INTERACTION WITH DIFFERENT SUBSTANCES. THIS LAB IS NOT ONLY EDUCATIONAL BUT ALSO A FUN AND ENGAGING WAY TO EXPLORE THE FOUNDATIONAL CONCEPTS OF CHEMISTRY.

FREQUENTLY ASKED QUESTIONS

WHAT IS THE PURPOSE OF THE PENNY LAB IN CHEMISTRY?

THE PURPOSE OF THE PENNY LAB IS TO DEMONSTRATE CONCEPTS OF CHEMICAL REACTIONS, CONSERVATION OF MASS, AND THE PRINCIPLES OF QUANTITATIVE ANALYSIS THROUGH THE OBSERVATION OF CHANGES IN PENNIES BEFORE AND AFTER CHEMICAL TREATMENTS.

WHAT MATERIALS ARE TYPICALLY REQUIRED FOR THE PENNY LAB EXPERIMENT?

COMMON MATERIALS INCLUDE PENNIES (PREFERABLY PRE-1982 FOR THEIR COPPER CONTENT), VINEGAR, SALT, A CONTAINER FOR SOAKING, PAPER TOWELS FOR DRYING, AND A RULER FOR MEASURING ANY CHANGES.

HOW DOES VINEGAR AFFECT THE PENNIES IN THE LAB EXPERIMENT?

VINEGAR, WHICH IS ACETIC ACID, REACTS WITH THE COPPER OXIDE ON THE SURFACE OF THE PENNIES, HELPING TO CLEAN THEM AND RESTORE THEIR ORIGINAL COLOR BY REMOVING TARNISH.

WHAT CHEMICAL REACTION OCCURS WHEN SALT IS ADDED TO VINEGAR IN THE PENNY LAB?

WHEN SALT IS ADDED TO VINEGAR, IT ENHANCES THE CLEANING PROCESS BY INCREASING THE CONDUCTIVITY OF THE SOLUTION, WHICH FACILITATES THE REACTION BETWEEN THE ACETIC ACID AND THE COPPER OXIDE.

WHAT OBSERVATIONS SHOULD BE MADE DURING THE PENNY LAB EXPERIMENT?

STUDENTS SHOULD OBSERVE THE CHANGE IN COLOR OF THE PENNIES, THE FORMATION OF BUBBLES (INDICATING A CHEMICAL REACTION), AND ANY CHANGES IN TEXTURE OR APPEARANCE BEFORE AND AFTER THE TREATMENT.

HOW CAN THE RESULTS OF THE PENNY LAB BE RECORDED SCIENTIFICALLY?

RESULTS CAN BE RECORDED BY TAKING PHOTOGRAPHS OF THE PENNIES BEFORE AND AFTER THE EXPERIMENT, MEASURING THE MASS OF THE COINS, AND DOCUMENTING THE TIME TAKEN FOR VISIBLE CHANGES TO OCCUR.

WHAT SAFETY PRECAUTIONS SHOULD BE TAKEN DURING THE PENNY LAB?

SAFETY PRECAUTIONS INCLUDE WEARING GLOVES TO AVOID SKIN IRRITATION FROM VINEGAR, USING GOGGLES TO PROTECT EYES FROM SPLASHES, AND ENSURING PROPER VENTILATION WHEN HANDLING CHEMICALS.

WHAT IS THE SIGNIFICANCE OF USING PRE-1982 PENNIES IN THE PENNY LAB?

PRE-1982 PENNIES ARE SIGNIFICANT BECAUSE THEY ARE MADE OF 95% COPPER, WHICH REACTS DIFFERENTLY THAN THE ZINC-COATED PENNIES PRODUCED AFTER 1982, ALLOWING FOR CLEARER OBSERVATIONS OF CHEMICAL REACTIONS.

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