

# Penny Lab Chemistry 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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**PENNY LAB CHEMISTRY ANSWERS** ARE AN ESSENTIAL PART OF UNDERSTANDING THE FUNDAMENTAL PRINCIPLES OF CHEMISTRY THROUGH HANDS-ON EXPERIMENTS. THE PENNY LAB IS A CLASSIC EXPERIMENT OFTEN CONDUCTED IN HIGH SCHOOL CHEMISTRY CLASSES TO ILLUSTRATE CONCEPTS SUCH AS CHEMICAL REACTIONS, STOICHIOMETRY, AND THE PROPERTIES OF ELEMENTS. THIS ARTICLE WILL DELVE INTO THE SPECIFICS OF THE PENNY LAB, THE CHEMISTRY INVOLVED, THE RESULTS ONE CAN EXPECT, AND HOW TO ANALYZE AND INTERPRET THESE FINDINGS.

## OVERVIEW OF THE PENNY LAB EXPERIMENT

THE PENNY LAB TYPICALLY INVOLVES THE USE OF PENNIES, WHICH ARE PRIMARILY MADE OF COPPER, AND A CHEMICAL SOLUTION THAT CAN INDUCE A REACTION. THE EXPERIMENT IS DESIGNED TO DEMONSTRATE THE PROCESS OF OXIDATION AND REDUCTION, AS WELL AS HOW CHEMICAL REACTIONS CAN ALTER THE APPEARANCE OF A SUBSTANCE.

## MATERIALS REQUIRED

TO CONDUCT THE PENNY LAB, YOU WILL NEED THE FOLLOWING MATERIALS:

- **PENNIES:** USE PRE-1982 PENNIES, WHICH ARE MADE PRIMARILY OF COPPER.
- **ZINC POWDER:** THIS IS CRUCIAL FOR THE REDUCTION PROCESS.
- **HYDROCHLORIC ACID (HCL):** THIS ACID ACTS AS A SOLVENT THAT CAN DISSOLVE ZINC AND ASSIST IN THE REACTION.
- **WATER:** FOR DILUTING HYDROCHLORIC ACID AND RINSING.
- **SAFETY GOGGLES AND GLOVES:** ESSENTIAL FOR SAFETY DURING THE EXPERIMENT.
- **BEAKERS:** TO HOLD THE CHEMICAL SOLUTIONS.
- **STIRRING ROD:** FOR MIXING SOLUTIONS.

## PROCEDURE

1. PREPARATION: WEAR SAFETY GOGGLES AND GLOVES TO PROTECT YOURSELF FROM THE CHEMICALS.
2. MIXING SOLUTIONS: IN A BEAKER, MIX A SMALL AMOUNT OF ZINC POWDER WITH HYDROCHLORIC ACID. THE REACTION WILL PRODUCE HYDROGEN GAS AND ZINC CHLORIDE.
3. ADDING PENNIES: PLACE THE PENNIES IN THE BEAKER WITH THE ZINC AND HYDROCHLORIC ACID MIXTURE.
4. OBSERVATION: STIR THE MIXTURE GENTLY AND OBSERVE THE CHANGES IN THE PENNIES.
5. RINSING: AFTER A FEW MINUTES, REMOVE THE PENNIES, RINSE THEM WITH WATER, AND DRY THEM WITH A CLOTH.
6. FINAL OBSERVATION: RECORD ANY CHANGES IN COLOR OR TEXTURE OF THE PENNIES.

## CHEMICAL REACTIONS INVOLVED

THE PENNY LAB EXPERIMENT PRIMARILY DEMONSTRATES A REDOX REACTION, WHERE OXIDATION AND REDUCTION OCCUR SIMULTANEOUSLY.

## OXIDATION AND REDUCTION EXPLAINED

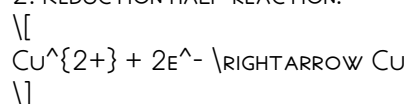
- OXIDATION: IN THIS CONTEXT, OXIDATION REFERS TO THE LOSS OF ELECTRONS FROM THE COPPER IN THE PENNY. WHEN THE PENNY IS EXPOSED TO HYDROCHLORIC ACID, IT CAN OXIDIZE, LEADING TO THE FORMATION OF COPPER IONS ( $\text{Cu}^{2+}$ ).
- REDUCTION: REDUCTION IS THE GAIN OF ELECTRONS. IN THIS CASE, ZINC SERVES AS THE REDUCING AGENT. WHEN ZINC POWDER IS INTRODUCED TO THE HYDROCHLORIC ACID, IT RELEASES ELECTRONS AND REDUCES THE COPPER IONS BACK TO ELEMENTAL COPPER, WHICH CAN DEPOSIT ONTO THE SURFACE OF THE PENNY.

THE OVERALL CHEMICAL REACTION CAN BE SUMMARIZED IN TWO HALF-REACTIONS:

1. OXIDATION HALF-REACTION:



2. REDUCTION HALF-REACTION:



THIS PROCESS LEADS TO THE PENNIES APPEARING SHINIER AFTER THE REACTION, DEMONSTRATING THE PRINCIPLES OF REDOX CHEMISTRY.

## EXPECTED RESULTS

AFTER CONDUCTING THE PENNY LAB, YOU SHOULD OBSERVE THE FOLLOWING:

- COLOR CHANGE: THE PENNIES SHOULD APPEAR SHINIER OR MORE METALLIC AFTER THE REACTION, INDICATING THAT THE COPPER HAS BEEN REDUCED AND DEPOSITED BACK ONTO THE SURFACE.
- TEXTURE CHANGES: THE TEXTURE OF THE PENNIES MAY FEEL SMOOTHER AFTER THE REACTION DUE TO THE REMOVAL OF OXIDES AND TARNISH.
- FORMATION OF BUBBLES: DURING THE REACTION, YOU MAY SEE BUBBLING DUE TO THE RELEASE OF HYDROGEN GAS.

# ANALYSIS OF RESULTS

AFTER COMPLETING THE PENNY LAB, IT'S VITAL TO ANALYZE THE RESULTS CRITICALLY.

## DATA COLLECTION

- PHOTOGRAPHIC EVIDENCE: TAKE BEFORE AND AFTER PHOTOGRAPHS OF THE PENNIES TO DOCUMENT THE CHANGES.
- WRITTEN OBSERVATIONS: KEEP A JOURNAL OF YOUR OBSERVATIONS DURING THE EXPERIMENT, NOTING THE COLOR, TEXTURE, AND ANY OTHER NOTABLE CHANGES.

## INTERPRETING THE OBSERVATIONS

1. CHEMICAL CHANGES: DISCUSS THE CHEMICAL CHANGES THAT OCCURRED DURING THE EXPERIMENT. REFLECT ON HOW THE APPEARANCE OF THE PENNIES CHANGED DUE TO THE UNDERLYING CHEMICAL REACTIONS.
2. STOICHIOMETRY: CALCULATE THE AMOUNTS OF REACTANTS USED AND THE THEORETICAL YIELD OF COPPER THAT COULD BE PRODUCED, LINKING IT TO THE PRINCIPLES OF STOICHIOMETRY.
3. REAL-WORLD APPLICATIONS: CONSIDER HOW THESE REACTIONS ARE RELEVANT IN REAL-WORLD CONTEXTS, SUCH AS CORROSION PREVENTION, METALLURGY, AND RECYCLING.

## SAFETY CONSIDERATIONS

SAFETY IS PARAMOUNT WHEN CONDUCTING ANY CHEMISTRY EXPERIMENT, INCLUDING THE PENNY LAB. HERE ARE SOME IMPORTANT SAFETY CONSIDERATIONS:

- PROTECTIVE GEAR: ALWAYS WEAR SAFETY GOGGLES AND GLOVES TO PREVENT CHEMICAL EXPOSURE.
- VENTILATION: ENSURE THAT THE EXPERIMENT IS CONDUCTED IN A WELL-VENTILATED AREA TO AVOID INHALING FUMES FROM HYDROCHLORIC ACID.
- PROPER DISPOSAL: DISPOSE OF ALL CHEMICAL WASTE ACCORDING TO YOUR SCHOOL'S SAFETY GUIDELINES. DO NOT POUR CHEMICALS DOWN THE DRAIN WITHOUT PERMISSION.
- EMERGENCY PROCEDURES: BE AWARE OF THE LOCATION OF SAFETY EQUIPMENT, SUCH AS EYEWASH STATIONS AND FIRE EXTINGUISHERS, IN CASE OF AN EMERGENCY.

## CONCLUSION

IN CONCLUSION, PENNY LAB CHEMISTRY ANSWERS PROVIDE VALUABLE INSIGHTS INTO THE PRINCIPLES OF CHEMISTRY THROUGH A HANDS-ON APPROACH. BY ENGAGING IN THIS EXPERIMENT, STUDENTS NOT ONLY LEARN ABOUT CHEMICAL REACTIONS, OXIDATION, AND REDUCTION BUT ALSO DEVELOP CRITICAL THINKING AND ANALYTICAL SKILLS. THE PENNY LAB SERVES AS A MICROCOSM OF THE FASCINATING WORLD OF CHEMISTRY, PROVIDING A FOUNDATIONAL UNDERSTANDING THAT CAN BE BUILT UPON IN MORE ADVANCED STUDIES. WHETHER FOR EDUCATIONAL PURPOSES OR PERSONAL EXPERIMENTATION, THE PENNY LAB REMAINS A TIMELESS AND EFFECTIVE TOOL FOR TEACHING THE CONCEPTS OF CHEMISTRY.

## FREQUENTLY ASKED QUESTIONS

### WHAT IS A PENNY LAB IN CHEMISTRY?

A PENNY LAB IS AN EDUCATIONAL ACTIVITY THAT INVOLVES USING PENNIES TO EXPLORE CONCEPTS IN CHEMISTRY, SUCH AS

OXIDATION-REDUCTION REACTIONS, METAL PROPERTIES, AND THE EFFECTS OF DIFFERENT SOLUTIONS ON COPPER.

## How can I demonstrate oxidation in a penny lab?

YOU CAN DEMONSTRATE OXIDATION BY PLACING COPPER PENNIES IN A SOLUTION OF VINEGAR AND SALT, WHICH WILL REMOVE THE OXIDATION LAYER AND REVEAL THE SHINY COPPER BENEATH.

## What are some common experiments performed in a penny lab?

COMMON EXPERIMENTS INCLUDE TESTING THE EFFECT OF DIFFERENT ACIDS ON PENNIES, OBSERVING THE REACTION OF PENNIES WITH VARIOUS SOLUTIONS, AND ANALYZING THE RATE OF CORROSION ON DIFFERENT COINS.

## What safety precautions should be taken during a penny lab?

ALWAYS WEAR SAFETY GOGGLES AND GLOVES, HANDLE ACIDS AND CHEMICALS WITH CARE, AND WORK IN A WELL-VENTILATED AREA TO AVOID INHALING FUMES.

## What is the significance of using pennies in chemistry experiments?

PENNIES ARE MADE PRIMARILY OF COPPER, MAKING THEM AN EXCELLENT MATERIAL FOR STUDYING METAL REACTIONS AND CORROSION, AND THEY ARE EASILY ACCESSIBLE AND INEXPENSIVE.

## Can the results of a penny lab be quantified?

YES, RESULTS CAN BE QUANTIFIED BY MEASURING THE MASS OF PENNIES BEFORE AND AFTER EXPERIMENTS, CALCULATING THE RATE OF CORROSION, OR USING COLORIMETRIC ANALYSIS TO DETERMINE THE CONCENTRATION OF IONS IN SOLUTIONS.

## What role does vinegar play in penny lab experiments?

VINEGAR, WHICH CONTAINS ACETIC ACID, ACTS AS A MILD ACID THAT CAN REACT WITH THE COPPER OXIDE ON THE SURFACE OF PENNIES, EFFECTIVELY CLEANING THEM AND DEMONSTRATING THE CONCEPT OF ACID-BASE REACTIONS.

## How can I analyze the effects of different solutions on pennies?

YOU CAN PLACE PENNIES IN VARIOUS SOLUTIONS SUCH AS LEMON JUICE, SODA, AND SALTWATER, THEN OBSERVE AND DOCUMENT THE CHANGES IN COLOR, SURFACE TEXTURE, AND MASS OVER TIME.

## What are some variables to control in a penny lab experiment?

VARIABLES TO CONTROL INCLUDE THE CONCENTRATION OF SOLUTIONS, THE DURATION OF EXPOSURE, THE TEMPERATURE OF THE ENVIRONMENT, AND THE INITIAL CONDITION OF THE PENNIES USED IN THE EXPERIMENTS.

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