

Penny Experiments

Pennies & The Properties of Water

I. Penny Splash

Materials:

water

pennies

drinking glass

Fill the drinking glass completely full of water. One at a time, add pennies to the glass, until water overflows.

How many pennies can you put in a full glass of water?

How can you explain this phenomenon?

Do you think that other liquids, such as alcohol, would behave in the same way?

What did the water look like directly before it overflowed?

II. Penny Droppers

Materials:

medicine dropper

penny

dish

water

soap

Place the penny flat on the dish. Using the medicine dropper, drip one drop of water at a time onto the surface of the penny. Observe the surface of the water. Try to predict how many drops the surface of the penny will hold before it falls off.

How many drops of water were you able to drip onto the penny before it fell off?

What did the water look like just before it fell? Now mix a small amount of soap into your water and try the experiment again. What has changed? Why?

(The tendency water has to stick to itself is called "surface tension". You also see this when water bugs walk on water. This is the surface tension of the water holding them up! Adding chemicals such as soap breaks the molecular "hold" of surface tension in water.)

Penny Plated Nails

Materials:

vinegar

salt

small jar with a lid

10 dull pennies

iron nail

steel wool.

Place the pennies in the baby food jar. Cover with some vinegar and 1/2 a teaspoon of salt. Use the steel wool to clean the pennies. Drop nail into the solution with the pennies and wait several hours. What happens?

The vinegar and salt react with the copper in the penny, causing the surface molecules to ionize and float into the vinegar solution. The iron in the nail attracts these loose molecules, which form a thin plating over the surface of the nail.

Floating Penny Boats

Materials:

100 pennies

heavy duty aluminum foil

water and large bowl

Cut out a 10" square of heavy-duty aluminum foil.

Design and fold foil into a boat, using only the foil.

Set boat in water and load your boat with pennies (one at a time) until the boat sinks.

Record results, redesign your boat, and retest.

Try to predict how many pennies each boat model will hold before testing it.

Follow up questions:

What is surface tension?

What is displacement?

Can you come up with a better design for a boat to hold more pennies?

Green Pennies

Materials:

saucer

paper towel

vinegar

3-5 pennies

Procedure: Fold the paper towel in half; fold again to form a square.

Place the folded towel in the saucer.

Pour enough vinegar into the saucer to wet the towel.

Place the pennies on top of the wet paper towel.

Wait 24 hours.

Results: The tops of the pennies are green.

Why?

Vinegar's chemical name is acetic acid. The acetate part of the acid combines with the copper on the pennies to form the green coating composed of copper acetate.

Penny in the Well

Question: How would you get a coin out of a dish of water without touching the water or pouring the water out?

Materials:

dish

matches

jelly jar

water

one candle

penny

Procedure: First you take one of the dishes and fill it up half way with water. Place a penny in the dish so it is in the water near the edge. Place a jelly jar, with a candle in it, in the center of the dish. Now light the candle. Finally place a jar over the candle. Suddenly the water will rise up in the jar, and the coin will be released.

What happened?

The flame from the candle used up the oxygen in the jelly jar, creating a vacuum which sucks up the water into the jar, exposing the penny.

Penny Haloes

Materials:

50mL dilute silver nitrate solution
penny
dish

Place silver nitrate solution in dish.
Place penny in dish and observe.
(you should see a halo of silver wrap around the penny)

Super Clean Pennies

Question: What cleans pennies better -- an acid or a base solution?

Materials

1 c water + baking soda
1 c water + Lava soap shavings
1/2 c lemon juice
1 c vinegar
4 cups
20 dirty pennies

Baking soda and Lava soap are examples of base solutions. Lemon juice and vinegar are acid solutions. Which do you think will clean pennies better? Why?
Place five pennies into each solution. Stir and observe for several minutes. Write whether or not each solution cleaned the dirty penny. Report your findings. Did acids or bases clean the pennies better?

Challenge: Try cleaning other metals in acids and bases. Which metals are the easiest to clean? Which acids or bases make better cleaners?

What's going on: Acids are better penny cleaners. In fact, if you were to leave a penny in vinegar or lemon juice for several days, small pieces of the penny would eventually start to come off. Bases, on the other hand, do not react with metals. Drain cleaners, for example, are bases. Bases do not damage metal pipes like an acid cleaner would.

The Problem of the Counterfeit Penny

You have eight pennies that look the same, but one is counterfeit. The counterfeit penny is known to be heavier than the others. How can you tell which one is counterfeit by using a balance scale only twice?

Solution: Take two pennies and set them aside. Divide the remaining six pennies into two piles of three each and put them on the balance scale. This is the first use of the balance scale.

If the scale is balanced, then the counterfeit penny must be one of the two pennies that were set aside. Put one on each plate for the second use of the balance scale. The heavier one is the counterfeit.

If the balance scale is not balanced, the counterfeit penny is among the three that weigh more. Take the pile of three pennies that weighs more, and set aside one of them. Then put one penny on each plate (second use of balance scale). If the scale is balanced, the counterfeit penny is the one set aside, otherwise it's the heavier of the two pennies on the scale. This solves the problem using the balance scale only twice.

Penny Powered Cars

Materials:

two "Matchbox" or "Hot Wheels" cars
ramp (see instructions)
pennies
tape

Set up a ramp for your toy cars (oversized book, cardboard, etc.). Mark a starting line. Let cars run down ramp and across uncarpeted floor. Mark the distance they travel with a piece of tape. Tape a penny to each car and let run down the ramp again. (If you can use little dump trucks to put the pennies that would be best, but taping them to the car is fine.) Mark the distance they travel. Repeat with two pennies each; four pennies each; eight pennies each. How does the added weight of the pennies affect the distance the cars travel? Why?

The Disappearing Penny!

Materials:

recent (1982 or later) Penny

Cup

Coca Cola

In this experiment, you can either clean another dirty penny... or make it disappear entirely! And we mean REALLY disappear! Here's how:

Drop a dirty penny into a cup and pour some Coca Cola or other carbonated soda into the cup. Look at it again a day later: the penny has been cleaned! Want to make the penny disappear completely? Put the penny in a cup of Coke and leave it there for approximately 10 days. Then pour off the coke (DON'T drink it), and look: the penny has completely dissolved away! Now think about your teeth and your stomach when you drink a soda pop. HMMMM.... How did it do that?

The zinc which makes up the body of the penny beneath the copper jacket is ionized into a zinc 'salt' by the chemicals in the carbonated soda.

Old Pennies vs. New Pennies

In 1982, as a money-saving measure, the U.S. government stopped making pennies out of copper. Since that time, pennies have been made out of zinc, with a thin coat of copper.

What differences are there between the two types of pennies?

On a scale, weigh a stack of ten "old" (pre-1982) pennies and a stack of ten "new" (post 1982) pennies. Which one weighs more?

How many new pennies does it take to equal the weight (mass) of ten old pennies?

Drop a handful of old pennies on a countertop. Drop a handful of new pennies on a countertop. Is there a difference in the sounds? Which sound do you like better?

Mix up your old and new pennies. Drop them one by one onto the countertop. Try to separate them into "old" and "new" piles by the sound they make only. Then check the dates and see if you got them right.

The Penny Flopover Experiment

1. Set 10 pennies on edge on a table that is not too thick. You will need to be able to lightly tap the underside of the table and cause the pennies to just topple over. The table should be perfectly flat. Pennies should face different directions.
2. Predict how many of the pennies you think will fall "heads" up and how many you think will fall "tails" up. Write down your prediction.
3. Next tap the underside of the table gently so that the pennies just topple over. Record the number of heads and tails.
4. Repeat at least 2 more times. Record your results.
5. Do your results agree with your hypothesis? Offer a theory that will explain these results.

Penny Spinout Experiment

1. Now take each of the 10 pennies and hold them on edge with your index finger. With your other hand, hit the edge of the penny causing it to spin like a top on the table. When the penny flops over, record whether it is a head or a tail. Do this for all 10 pennies--then repeat at least 2 more times. Again, make a prediction of what you expect the results to be beforehand. Propose a possible explanation for these results.

What happened and why:

The results are that when the pennies fall over (in Experiment 1), they all land heads up! In experiment 2, about 2 out of 3 pennies fall tails up! The reason is that the pennies are actually sections of a cone, not a cylinder, as we assume. The pennies that are placed on their edge actually lean slightly toward the tails side. When disturbed just enough to topple over, they all fall heads up! Very impressive if you use 50 pennies instead of 10! Of course, a few pennies do fall tails--possibly due to dirt or imperfections in the pennies--or to striking the table too hard or using an unlevel table. Spinning the pennies causes the center of gravity to be located toward the tails side. (Think of the penny as spinning on its edge.) This produces the 2/3 tails result when they're spun.

Shining Pennies

Materials:

dull penny

1 oz. lemon juice (or vinegar)

small glass

This easy experiment is very similar to the last one. Just put the penny in the glass and add the lemon juice. Wait for about 5-10 minutes and come back. When you get back, the penny should be shiny.

Why Does This Work?

When pennies get dull, they are covered with copper oxide. The acid in lemon juice or vinegar reacts with the copper oxide, and removes it, leaving a shiny copper penny.

Rocket powered pennies

Materials:

penny

empty glass soda pop bottle

your kitchen freezer

Place the empty soda bottle in the freezer for an hour. Remove it from the freezer, wet the top and place a penny over the mouth of the bottle so it covers it completely (no air leaks). Now return the bottle to the freezer.

After the bottle has been in the freezer another hour, remove it and hold it with both hands wrapped around it. Hold tightly and wait a few minutes and --- POP! What happened??????

Solution:

Heat causes objects to expand (get bigger), while cold causes objects to contract (get smaller). This includes air, and it includes the air INSIDE the frozen pop bottle. When you place your warm hands around the outside of the bottle, it warms the air inside the bottle which then expands. Since the bottle is sealed by the penny, the heated air can only escape by breaking the ice around the rim and forcing the penny out of the way. When the build up of heated air inside the bottle grows great enough, the ice gives and -- POW! the penny pops off the bottle!

Penny Mushroom Pile

Challenge your patience and dexterity! Try piling pennies on a spool of thread. The catch however, is to pile outward, not up, forming a large mushroom. See how wide a "mushroom head" you can form and challenge your parents to do better!