



# Penny Science



## Overview

This series of educational programs was designed to entertain and challenge gifted youth in their time outside of the school setting; however, the activities may be easily shared and enjoyed by older people as well. Programs may be scaled up or down depending on number of attendees, desired level of complexity, etc. Sample materials are included with most plans. The series was developed by Lisa Van Gemert, M.Ed.T., the Mensa Foundation's Gifted Children Specialist. Contact her at [giftedyouth@mensafoundation.org](mailto:giftedyouth@mensafoundation.org).

## Introduction

May 23 is Lucky Penny Day, but pennies are fun any day of the year. Don't believe us? Try out some of these cent-sational ideas!



## 1. Making Pennies Look New

### Materials

- 15-20 dark, dirty pennies
- ¼ cup white vinegar (or lemon juice)
- 1 teaspoon salt
- A shallow bowl (glass or plastic)
- Paper towels (2)

### Directions

1. Mix the salt and vinegar in the bowl, and stir it until the salt dissolves.
2. Dip one of the pennies into the bowl so that half of it is in the salt and vinegar solution and half is not. Hold it there 10-15 seconds. When you pull it out, compare the halves. Did the time in the solution make a difference?
3. Put the rest of your pennies into the solution. Let them sit for five minutes, and then remove half of them. Put the pennies you removed onto a paper towel.
4. Now take out the rest of the pennies and rinse off the solution. Lay them on a separate paper towel that you have marked with a big "R."
5. After an hour, look at your pennies. What do you notice about the pennies that were not rinsed versus the ones that were? What do you notice about your paper towels?

### Why did this happen?

The copper in the pennies combines with oxygen in the air to form copper oxide. This turns the pennies dull and dark. The acid in the salt and vinegar solution you made dissolves the copper oxide. The pennies you didn't rinse off turn that cool blue-green color because the removal of the copper oxide from the pennies created a situation in which the copper atoms joined with oxygen from the air and chlorine from the salt (sodium chloride) to make malachite, which is blue-green.

## 2. Making Pennies Dance

### Materials

- Glass bottle (the neck should be about the same size as a penny)
- Penny

### Directions

1. Wet the penny and place it on the top of the mouth of the bottle.
2. Wrap your hands around the bottle.
3. The penny will start to dance (well, it's more of a hop).

### Why did this happen?

The water sealed the air in the bottle, and the heat of your hand then made the air inside the bottle expand, and the pressure of this makes the penny hop.



### 3. The Amazing Balancing Water Trick

#### Materials

- Eye dropper or pipette
- Penny
- Water

#### Directions

1. Lay the penny flat on a surface.
2. Using the eye dropper or pipette, slowly add drops of water to the top of the penny.
3. Repeat until the water spills. How many drops can you get to stay? Try to get 30!

#### Why did this happen?

Two forces are at work here: hydrogen bonding and surface tension. Hydrogen bonding is a force that makes water form dome-like droplets on surfaces (it also is why water has a relatively high boiling point, why it has lower density when it is solid than when it is liquid, and why it is liquid at a wide range of temperature). Hydrogen bonds are not as strong as many other chemical bonds (like covalent bonds), but they make water molecules 15% closer together than they would be otherwise.

Surface tension is a result of cohesive forces between liquid molecules (that means they stick together!). The molecules on the top of the water drops do not have other molecules just like them all around them, and so they cling more tightly to the ones next to them on the surface. This makes them more resistant to outside forces.

### 4. The Incredible Penny Tower

Pennies can be used to build truly incredible structures. To begin, stack two columns of pennies, 10 pennies high. Then, you must make what is called a triad – three pennies stacked as a pyramid, with two lying flat next to each other and one lying flat on top of them.

After you build a stack, place two triads on top of it. Repeat.

Slide the two stacks together. Slide extra pennies in between the pennies in the triad to strengthen the structure.

Add another triad and more pennies.

See this in action here <http://www.fischer.org/Misc/Pennies>.



## 5. Playing with Pennies

### **Pitch and Toss (also called Pitching Pennies)**

To Play: Toss pennies toward a wall. The player whose penny lands closest to the wall wins (and perhaps keeps the other players' pennies!)

### **Three-Penny Hockey**

This game is played with two players and three pennies. To play, arrange three pennies in an upside down flat triangle in front of you on the edge of a table. The other player uses his/her fingers to create a goal and goalie at the other end of the table.

Flick the back penny to make all three pennies move forward, and then flick the rear penny through the space created by the other two to move the penny down the "ice" toward the goalie. Repeat.

If your penny stops too soon or goes off of the table, it is the other player's turn. When you get close to the goal, try to flick the back penny between the other two and into the goal. It is then the other player's turn, whether you make the goal or not.

### **The Last Penny Standing**

Place all of the pennies on a flat surface and lay them in rows. Make sure there are equal pennies in each row (so if you have 50 pennies, you could have 5 rows of 10, but not 5 rows of 9 and a row of 5). You also need to make sure that the total number of pennies is not a prime number (when the game is over, see if you can figure out why).

Each player takes a turn selecting pennies from any one row. The player can take the entire row or any number of pennies from it. The player must take at least one penny.

The players take turns until there is only one penny left. The player who has to take the last penny loses.

### **Pantyhose Pennies**

You will need a pair of pantyhose (it's fine if they have a run in them). Place a penny in each toe of the pantyhose, and then put your hands into the pantyhose at the top until your wrists are at the top of the legs. Start a timer and see how long it takes you to grab the pennies in your fingers using only your hands and arms and pull them out of the pantyhose.

Your arms and hands cannot touch any other part of your body or any other thing. If the penny touches the floor, you lose.



### **Penny Prize Toss**

#### Supplies

- 10 pennies per player
- Paper divided into squares
- Treats or small prizes (even other coins will work) in each square

How to play: Place the paper on a flat surface with the treats in each square. If the prize is too big for the square, place a small piece of paper on the square with the name of the prize in it.

Each player tosses a penny onto the paper, winning whatever prize is in that square. Play rotates among all players until all prizes have been claimed.

### **Pennies in the Bucket Relay**

#### Supplies

- Pennies
- Buckets (one for each time – can be any container)

To Play: This game needs at least six players to work well and is best played in an open area (inside or outside). Divide the players into two teams. Place the buckets or containers at one end of the playing area and have players stand at the other end.

The first player on each team places a penny on top of his or her foot and walks down to the bucket. After reaching the bucket, the player must get the penny into the bucket without using his/her hands. The player then walks back to where the team is, and the next player goes. After two minutes (or some other time limit), the team with the most pennies in the bucket wins.

### **Penny Trivia**

The original penny design was created in 1793 and featured a lady with flowing hair symbolizing liberty. It was larger and made of pure copper. Now, pennies are made of copper and zinc.

In 1909 on the 100th anniversary of his birth, Abraham Lincoln became the first president (and first real person) on a coin.

Do you have a lot of pennies in your sofa? There are approximately 150 billion pennies in circulation, and 13 billion new ones are made every year.

A 2006 National Coinstar Poll revealed that 84% of females and 74% of males will pick up a penny off the ground. Will you?

It is said that a penny on top of every doorway in your house will bring you good luck.

You can learn more about the penny from the US Mint at <http://www.usmint.gov/>