Super Static Cylinders

Presented by: Hands One In partnership with: BrightRidge[®]

Get a "charge" out of causing foam spheres to dance inside a plastic tube. This seemingly simple device is an amusing way to uncover the hidden wonders of static electricity in the world around us.

Clinging Beads

Shaking and rolling the tube doesn't get the foam beads to stop clinging to the walls of the plastic tube. What to do? **Materials:**

- Static tube
- Low humidity day (not included)
- Pencil and paper (not included)
- Fabric samples (not included)

Instructions

- 1. Gently place your tube on a desk or table. Then, put your finger close to the tube, but DON'T TOUCH IT! Get as close as you can without actually physically touching any part. What happens? Do beads move away? Why?
- 2. Rub the tube in one direction against a shirt, sweater, or if you are brave enough, your hair. Hold your finger close to the tube again without touching. Any bead movement? Do they move towards or away from you?
- 3. As you move your finger closer to the tube, the beads move away from your finger and make space around it. As you move your finger away from the tube, the beads move back to where they were and fill it in.

Take it further...

- Repeat the steps above using small pieces of different types of fabric. You can try wool, nylon, fur, silk, cotton, and more. Each one will produce different results. Natural fibers and synthetic fibers will produce different results. What happens if you use a blend of natural and synthetic fibers? Create a table to record the data for the tests and results. Be sure to include a hypothesis before you get started testing as well!
- 2. You could also try different types of materials that are not fabrics. Thigs such as desks, chairs, walls, and whiteboards may all have interesting results. Create a table to record the data for the tests and results.

Static Balloons

Now it's time to see how a balloon fits in with all this talk about static electricity! **Materials:**

- Static tube
- Low humidity day (not included)
- Clean, dry hair (not included)
- Balloons
- Pencil and paper (not included)

Instructions

- 1. Blow up a balloon and tie the end in a knot.
- 2. Vigorously rub the inflated balloon on your hair in one direction.
- 3. Bring the balloon close to the tube. How do the beads react this time? Which way do they move, away from or towards the balloon? How about your hair? What happens to your hair when it is near the balloon?
- 4. Now rub one side of the balloon on your hair and then hold the rubbed spot near the tube. Which way do the beads move? Rotate the balloon between the rubbed and the un-rubbed side and watch the beads. What happens? Are they moving together or in different ways and directions?

Take it further...

- 1. Test out different types and sizes of balloons
- 2. Try rubbing the balloons on different types of hair and record the results.

What Science is at work?

The word "static" means there is no action, change or movement. Static electricity invisibly builds up on surfaces like hair, balloons, and even carpet. Have you ever been zapped after shuffling your feet across the carpet? That's static electricity! Your movement across the carpet caused you to lose electrons. The electrons start jumping around and you feel a shock when you make contact with something such as a doorknob or a friend. Static electricity is caused by charges on particles, either positive protons (+) or negative electrons (–). Similar charges (+ and +) or (– and –) repel or push away from each other.

When you rub the plastic tube in one direction, the electrons from the plastic are lost and create an imbalance. The plastic of the tube has lost electrons and this imbalance results in a static charge that attracts the beads. Since the beads now mostly share the same charge, they repel each other which causes gaps between the beads inside the tube.

When you rub the balloon in one direction on hair, a static charge is built up on the surface, creating two different charges. Electrons have a negative (-) charge and protons have a positive (+) charge. Electrons build up on the surface of the balloon where it was rubbed. Electrons that are weakly held by the atoms build up and don't move because the balloon material won't let them. This buildup of negative electrons pulls on the positive protons in the beads because they are unlike charges and attract or pull towards each other. Like charges (either positive and positive or negative and negative) repel or push away from each other.

When you rub the balloon on hair, it causes opposite charges to build on the hair and the balloon. When the balloon is pulled away from the hair, you can see the opposite charges attracting. They make the hair stick up and reach for the balloon. You may even hear a crackle caused by the charge jumping from one surface to the other.

Wool fabric releases electrons easily. When a balloon is rubbed on wool, electrons quickly move from the wool to the surface of the balloon. The part of the balloon that was rubbed now has a negative charge. Since the balloon resists electrical charges moving over it, only part of the surface has a negative charge while the rest remains uncharged. Although the beads usually have a neutral charge, they can easily rearrange so a positive charge in them is attracted to the negatively charged balloon.

Did You Know?

Did you know that lightning is caused by an unbalanced static electric charge in the atmosphere? The tops of quickly rising clouds have a positive charge (+) and the bottoms of those same clouds have a negative charge (-). The flash of lightning temporarily balances out the charges within the cloud. Sometimes, positive charges can build up on the ground beneath the clouds and that is what causes lightning to strike the ground.

Key Terms

- **Atoms**-The basic building block for all matter in the universe. Atoms are extremely small and are made up of even smaller particles-electrons, protons, and neutrons.
- **Protons**-Particles that have a positive charge of electricity and travel around the nucleus of an atom.
- **Electrons**-Particles that have a negative charge of electricity and travel around the nucleus of an atom.
- **Positive charge**-Contain or produce electricity that is charged by a proton.
- Negative charge-Contain or produce electricity that is charged by an electron.
- **Neutral charge**-Does not have an electrical charge.
- Like charges-Two of the same charge, such as two positives or two negatives.
- Unlike charges-Charges that are not the same such as negative and positive.
- Static electricity-Electricity that is not moving and builds up on the surface of an object.
- Attracts-Pulls together towards a charge.
- **Repels**-Forces apart and moves away.

Tennessee Science Curriculum Standards addressed:

3.PS1.3, 3.ETS1.1, 3.ETS1.2, 3.ETS2.1; 4.PS3.3, 4.ETS1.1, 4.ETS2.2, 4.ETS2.3; 5.ETS1.1, 5.ETS1.2, 5.ETS2.2, 5.ETS2.3