

# Science Expo 2016 Physical Sciences

## Brief Activity Descriptions

### Properties of Matter

#### Physical Properties

1. What's the Matter: Three round trays filled with different amounts of marbles represent how atoms of a substance move when in a solid, liquid, and gaseous state. When the marbles are more tightly packed together, like atoms in a solid state, they have little room to move.
2. Matter on the Move: Basket models are filled with ping pong balls and a fan is placed under them to represent how matter behaves when they are in different states of matter. Matter in a gaseous state move around freely while matter in a solid state can only wiggle.
3. Phase Change Poppers: This activity uses dry ice to demonstrate the process of sublimation. A small amount of dry ice is placed in a container with a lid, and as the solid dry ice converts to gaseous carbon dioxide, the increased pressure causes the lid of the container to pop off.
4. Invisible Mass: This activity uses fizzkeepers and a scale to reveal that air has mass. Use the fizzkeepers to pump more air into a bottle and measure the increase in mass with the sensitive balance.
5. It's a Gas: This activity demonstrates two properties of gases- gases take up space and exert pressure. Two flasks and a beaker are connected with stoppers and tubing, and when baking soda, water, and citric acid are combined in the first flask, carbon dioxide emitted from the reaction exerts enough pressure to move through the tubing into the second flask, which displaces colored water from the second flask into the beaker.
6. Slime Time: Investigate the odd properties of non-Newtonian fluids. A mixture of cornstarch and water behaves like both a liquid and a solid.

### Density

7. Density Table:
  - a) Mystery Box: Beans, ping-pong balls, and metal balls are placed in a box with the metal balls visible at the top and the ping-pong balls at the bottom. When the box is shaken, differences in density cause the ping-pong balls to "mysteriously" float to the top and the metal balls to sink to the bottom.
  - b) Floating Golf Ball: Discover how to manipulate the density of water by adding salt. When enough salt is added to a cup of water with a golf ball in it, the density of water increases to the point that the golf ball floats.
  - c) Density Blocks: There are two sets of blocks – one set with blocks of equal volume and different mass, and the other set with blocks of different volume and equal mass. Using these blocks students learn how to calculate density and determine which substances float in water and which do not.

8. Stacking Colors: Students stack six liquids of various densities in test tubes, guessing the order in which they should be stacked (most dense on bottom to least dense on top).
9. Gassy Lava Lamp: Students learn that water is more dense than oil so they do not mix when placed in the same bottle. They also discover that if a chemical reaction produces a gas, the gas is the least dense and will escape out of the mixture.
10. Hot and Cold Density: Students investigate how the temperature of water affects its density. A model that using colored hot and cold water demonstrates how cold water sinks while hot water floats.
11. Changing the Density of an Object: Students find out that coke and diet coke cans with the same volume do not have the same density. They discover how to change the density of these objects by altering its mass and volume.

### Mixtures

12. Separation Anxiety: Students determine how to separate a mixture of plastic beads, sand, iron fillings and poppy seeds. They are given different tools and determine which tool works the best for the removal of specific substances.

### Chemical Reactions

13. Shake It Up!: Students discover that certain substances can be used to indicate that a chemical reaction has taken place. Glucose reacts with oxygen and methylene blue reveals this change. Cabbage juice can indicate if a substance is acidic by turning red or basic by turning yellowish-green.
14. Exothermic vs. Endothermic: Students explore how chemical reactions can produce changes in temperature. They can feel the results of an exothermic reaction in the form of heat between calcium chloride and water. An endothermic reaction between urea and water, which consumes heat results in a feeling that is much cooler to the touch.

### Energy

1. Give it a Ride: Students navigate their marble in a roller coaster course and realize that roller coasters are about potential and kinetic energy conversions.
2. Keep Your Eye on the Ball: By holding a tennis ball close to their nose and then letting go, students will learn that energy cannot be created nor destroyed, only converted into different forms.

### Heat

3. Some Like It Hot: Conduction of heat? Convection currents? Crooke's radiometer? Students experiment with the three methods of heat transfer: conduction, convection and radiation.

### Electricity

4. Sizzling Static Electricity: Students experience hands-on static electricity with the Van de Graaff generator and will make tinsel "fly."

5. The Human Battery: Can humans generate electricity like a battery? Students find out by placing their hands on different metals and compare which metals generates a stronger current .
6. Currently Working: Students experiment with solutions of fresh and salt water to discover which solution conducts electricity.
7. Electricity: Simply Magnet-ificent: Students explore how electricity and magnetism are connected by creating an electromagnet and witnessing the power of electricity to split water molecules.

## Light

8. Great Wall of Color: Students uncover why bubbles are so colorful and how to poke a bubble without it popping!
9. Color Combinations: What happens when you combine different colors of light? Students create colors using flashlights of the primary colors of light.
10. Three Little Pigments: Students recreate an image using just the secondary colors of light.
11. Colored Shadows: Using the primary colors of light, students discover what makes a shadow and explore the different colors of shadows.
12. Laser Light Show: Students see laser beams reflect and refract off different colors of Jell-O and observe total internal reflection in a stream of water.
13. Why is the Sky Purple?: Don't you mean, why is the sky blue? Students learn how scattering causes us to see the sky as blue and sunsets as red, and why our sky isn't purple.
14. It's a Mirror-cle: Students stand over a mirror to give off the illusion of flying. Using mirrors students can also combine faces with a partner!
15. Super Spectroscopes: Students observe different sources of light through a spectroscope and build their own simple spectroscope to take home.
16. Refraction Action: Students witness an arrow reverse direction and a magnifying glass de-magnify in this activity.

## Sound

17. Musical Coat Hangers: Does sound move the same in different forms of media? Students find out using air, water and ice, and strings tied to coat hangers to magnify sound waves.
18. Good Vibrations: Sound carries energy, as students find out by touching tuning forks to water and ping pong balls. Students also create patterns using salt, oobleck, and a laser!

19. The Resonator: Students discover objects like rubber balls and paper rings like to vibrate at certain frequencies.

## Forces and Motion

### Momentum

1. Show Me the Momentum: Two balls on their own don't bounce very high, but when bounced together conservation of momentum causes one to bounce really high and the other not at all. Students manipulate linear momentum by changing mass or velocity.
2. Momentum machine: Students discover the principle of angular momentum by spinning in an office chair with hand weights. They will feel acceleration and deceleration as they bring the weights near and far away from their body.

### Air Pressure

3. Automatic Balloon Inflator: A balloon on top of a bottle is placed into warm and cold water, and left at room temperature. The balloon inflates or deflates at different temperatures as the air in the bottle expands or contracts. Students learn air expands when it is heated and contracts when cooled.
4. Mystery Candle: A candle placed in water is lit and covered with an Erlenmeyer flask. The flame heats the air in the flask, pushing it out of the flask. The air pressure outside of the flask pushes water into the flask.
5. Balloon in a Bottle: Try to blow up a balloon inside two plastic bottles, one with a hole in it and one without. Students will learn that air takes up space and exerts pressure.
6. Magic Card: A mason jar of water with a mesh lid is turned upside down with a notecard covering the mouth. The card and the water stay put! The notecard is removed and the water still does not fall! Students will learn that the atmosphere exerts pressure on objects and cohesion and adhesion form strong bonds between water molecules and other surfaces.
7. The Power of Words: Students try to prevent a ruler from being flipped off a table with just one sheet of newspaper. Students understand that surface area directly relates to atmospheric pressure exertion.

### Gravity

8. Gravity Keeps you Down: Students try to make a feather and a book fall at the same rate. Students learn that air resistance causes objects to fall at different rates depending on their size and shape.

9. Strike a Balance: Students investigate center of gravity with a magic balancing toys and a fulcrum challenge. Students learn that center of gravity keeps objects balanced.

### Friction

10. Friction Frenzy: Students investigate friction with sandpaper covered wooden blocks and blocks coated in petroleum jelly. In a race in which two students are pulled by rope, one sitting on the ground, one sitting on a skateboard students learn what friction is and how it effects movement.

### Magnetism

11. Magnet Magic: A hanging donut magnet is pulled or pushed away by block magnets. Magnetic fields are seen through attraction and repulsion of different magnets.
12. Magnet Mania: Students investigate magnetism comparing magnetic and nonmagnetic materials. Students will test the strength of magnets and their magnetic field in 3 challenges. Students will understand that not all materials are magnetic and that magnets have magnetic fields and investigate the strength of magnetic force.
13. Eddy Currents: Students view eddy currents by dropping magnets through a plastic or copper tube and with the use of aluminum plates. Students will learn that eddy currents have magnetic fields that oppose those of magnets.

### Properties of Water

14. H<sub>2</sub>Olympics: Student-Olympians participate in 3 events including adding drops of water onto a penny, floating paperclips on water, and comparing paper towel absorption. Through these activities students will learn basic properties of water including cohesion, adhesion, surface tension and capillary action.