

# Study Materials for Professor Smart and Let's Go Science Show; Grades K-3



## Teachers:

If possible go over with students pre-show vocabulary. Time permitting, pick one or two projects to do before the show and a couple to do afterwards. Included are some great web sites to point your students toward, and a wonderful reading list.

Have fun discovering how and why things work.  
and get ready for a great show!

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## Show Outline

science show last for approximately 60 minutes  
with no intermission  
(The show is subject to change)

- a) Welcome Professor Smart and Ms. Knowitall
- b) States of Matter
- c) Give it up for Gravity
- d) Amazing Air Pressure
- e) Wonderful Wings
- f) Centrifugal Force and Inertia
- g) GO GO Gyroscopes
- h) Lever and Fulcrum
- i) Shocking Static Electricity
- j) Awesome Optical Illusion
- k) Fun with Physics Finale



# Vocabulary

Grades 1-3

Time Frame: 40 Minutes

**Air:** A gas made up mostly of nitrogen and oxygen.

**Example:** We breathe oxygen to stay alive. Did you know that oxygen makes up 65% of all the elements our body?

**Atmosphere:** The mixture of gasses that surrounds the earth and other planets. **Example:** The earth's atmosphere is made up of 78% nitrogen, 20.95% oxygen, 0.93% argon, 0.038% carbon dioxide, trace amounts of other gases.

**Attract:** To pull or draw someone or something toward oneself.

**Example:** A magnet uses electrons to pull objects with iron in them toward it.

**Balance:** The point where two things are equal in weight or force.

**Example:**

**Energy:** The ability to do work, power.

**Example:** We use energy to light our houses and cook our food.

**Experiment:** A test done in order to learn or discover whether something works or is true.

**Force:** A push or pull capable of moving an object.

**Example:** Jet engines use force to propel airplanes through the sky.



**Gas:** The state in which an object or thing does not have a definite shape or volume.

**Example:** Air, helium, natural gas. Did you know that a quart of helium is lighter than a quart of air? That is why a balloon filled with helium floats.

**Gravity:** The force that attracts objects toward one another.

**Example:** An apple falling from a tree to the ground. Without gravity everything on the earth would float.

**Hypothesis:** An idea or explanation for something that is based on facts but has not yet been proved.

**Example:** A guess as to why or how something happens. Issac Newton hypothesized that if an apple dropped from a tree it would fall to the ground because of gravity.

**Invent:** To make or create something that no one else has.

**Example:** Alexander Graham Bell invented the telephone. Before he did, sending a letter in the

mail was the only way to communicate with someone far away.

**Lever:** A simple machine consisting of a rigid bar pivoted on a fixed point and used to move an object or thing.

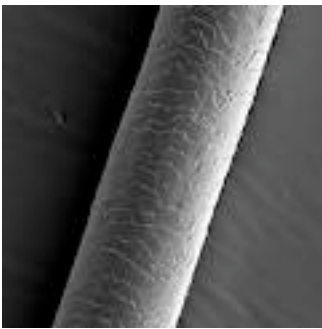
**Example:** A see saw is a lever. Levers were also used in ancient times to move heavy objects from one place to another.

**Liquid:** The state in which an object or thing has a definite volume but does not have a definite shape.

**Example:** Water, milk, and oil are examples of liquids. Did you know that the earth has over 326 million trillion (326,000,000,000,000,000,000) gallons of water on it?

**Microscope:** A machine that is used to make small objects look bigger.

**Example:** This is how a human hair would look under a microscope.



**Physics:** The study of matter and energy and how they interact.

**Pressure:** The force used when something pushes against something else.

**Example:** When you shake an unopened soda can it builds up pressure. When you open the can the pressure is released and the soda sprays out of the can.

**Properties:** A quality or description of an item or thing.

**Example:** Gold is shiny and has a golden, butter yellow, metallic color.

**Quantify:** To guess or measure the size or amount of something.

**Example:** When you add two numbers together ( $1+5=6$ ) you are quantifying them.

**Repel:** To push someone or something away from oneself.

**Example:** Skunks repel animals that are attacking them by spraying a foul odor from scent glands on their bodies. This keeps them from getting eaten by larger animals .

**Scientist:** A person who studies science.

**Example:** Albert Einstein, Benjamin Franklin, Aristotle, Galileo, Benjamin Banneker and Marie Currie are all famous scientists. Their studies and discoveries are still considered the basics of modern science.

**Solid:** The state in which an object or thing has a definite shape and definite volume.

**Example:** Metals, wood, and rocks are examples of solids.

**State:** A condition or way of acting or being.

**Example:** A bouncing ball is in a state of motion. A ball on the ground is in a state of being still.

**Static Electricity:** The electrical charge that collects on the surface of an object of thing.

**Example:** When you rub a balloon on your hair the electrons that are on your hair jump to the balloon and stick, making your hair stand on end.

**Theory:** A broad, detailed explanation that interprets the results of an experiment.

**Example:** Issac Newton made up the theory that if you drop an apple from a tree, it would fall to the ground. When he actually dropped the apple out of the tree it fell to the ground proving his theory about gravity was correct.

**Weight:** The measure of the force by which the earth attracts an object or thing.

**Example:** The scale in your bathroom measures the force of the earth's gravity on your body. The force of gravity that pulls you to the earth is proportionate to your weight. That is why some things weigh less then others. The smaller he force of gravity, the less something weighs.



# In Class Science Demos

# 1

## SOLID, LIQUID, OR GAS?

**Description:** Students will learn how to identify physical objects as either a Solid, Liquid and Gas.

**Grade Level:** K-3

**Time Frame:** 20 Minutes

**Materials:**

- balloon full of air
- wooden block
- cup of water (or try putting water in a Ziplok bag!)
- chalkboard, chalk, eraser

**Procedure:**

1. Write on the chalkboard the properties of solids, liquids and gases. Example:

<u>Solid</u>	<u>Liquid</u>	<u>Gas</u>
Feels hard	Feels cold	Can't see it
Shape stays the same	Moves easily	Moves easily
Doesn't float away	Changes shape	Can't feel it

2. Have the students determine which category the block, water, and air in the balloon would fit under.
3. Looking around the room, find other things that can be classified into Solids, Liquids, or Gasses.

**Discussion:**

1. Can an object change from a solid to a liquid to a gas? Name and object that can do this. Why do you think this happens?
2. Is sand a liquid because you can pour it? OR is sand a solid because it is made of solid pieces?

# 2

## PHASE CHANGES

**Description:** Watch water change its state and turn to a gas!

**Grade Level:** 1-3

**Time Frame:** 1 Hour

**Materials:**

clear plastic cup  
plastic wrap  
water  
pen or marker

**Procedure:**

1. Distribute two plastic cups and a piece of plastic wrap to each student.
2. Fill each cup halfway with water and mark the water levels with a pen.
3. Cover cups with plastic wrap.
4. Place one cup in direct sunlight, the other in the shade or dark (e.g. in a closet).
5. Observe changes in water levels in cups.
6. Look for water droplets on plastic wrap.

**Discussion:**

1. Which cup produced droplets of water on the plastic wrap?
2. How did the water get on the plastic wrap?
3. Energy is needed to change a liquid to gas. Where did the energy come from?
4. Remove the plastic cover. Place one cup in the sun and the other in the shade.
5. What happened to the water?
6. Which cup dried out first? Why?

**# 3****CHANGING WATER TO A GAS**

**Description:** Watch water disappear and change to gas over a period of time.

**Grade Level:** K-3

**Time Frame:** 5-7 days

**Materials:**

clear plastic cup                      plastic wrap                      science journal  
rubber bands                              graduated cylinders  
water source (pitcher, bucket, faucet, etc.)

**Procedure:**

1. Divide the class into pairs. Distribute the following to each pair: 2 plastic cups, 1 piece of plastic wrap, 1 rubber band, water source and a graduated cylinder.
2. Measure and pour 10 ml of water into each plastic cup.
3. Cover one cup tightly with plastic wrap and secure with a rubber band.
4. Students place their cups (side by side) in a warm place (e.g. near a heat register or on a windowsill).

5. At the same time each day, students observe the amount of water in both cups. Do not remove the wrap from the covered cup.
6. Record the water level and any observations in a science journal or on a piece of paper.
7. After 5-7 days (depending on how warm the site is), have the students carefully measure and record the amount of water (if any) remaining in the uncovered cup and in the covered cup.

**Discussion:**

Students should conclude that the water in the uncovered cup changed into a gas and escaped, while the water that turned to gas in the cup covered with plastic wrap could not escape and remained in the cup.

**#5**  
**DOES AIR HAVE MASS?**

**Grade Level:** K-3

**Time Frame:** 30 minutes

**Description:** Discover the properties of air using balloons and a yardstick!

**Materials:**

- 1 yardstick
- 2 balloons
- tape
- string

**Procedure:**

1. Inflate the balloons to equal size. Tie and knot securely.
2. Tape the balloons by the knot, to each end of the yardstick.
3. Locate the point on the yardstick where the two balloons balance. Wrap string two or three times around this point and tape.
4. Have a student balance the yard stick by suspending it out in front of them.
5. Have students predict what will happen if the air in one balloon is released.

**Discussion:**

1. Before puncturing the balloon ask the class the following questions:
2. Is there something inside the balloon? *(Yes) What? (Air)*
3. Does air take up space? *(Yes) Procedure (cont.)*
6. Have a student stick a pin into one balloon at its base so the air escapes slowly.
7. Have students describe their observations.

**Discussion:**

1. After puncturing the balloons ask the class the following questions:
2. Why is one end of the yard stick lower? *(One balloon has less air in it.)*



## Reading list

<b>Simple Physics Experiments with Everyday...</b> Breckenridge, Judy	530.078
<b>101 Physics Tricks</b> Cash, Terry	530.078
<b>Fascinating Experiments in Physics</b> Cherrier, Francios	530
<b>Physics Lab in the Home</b> Friedhoffer, Robert	621
<b>Science Lab in a Supermarket</b> Friedhoffer, Robert	540.78
<b>Famous Experiments You Can Do</b> Gardner, Robert	530
<b>Science Projects about the Physics of Toys...</b> Gardner, Robert	507.8
<b>More Engineering Projects for Young Scientists</b> Goodwin, Peter	620.0078
<b>Measuring Weight and Time</b> King, Andrew	530.8
<b>Science School</b> Manning, Mick	530.078
<b>A Physics Lab of Your Own</b> Mark, Steven	530
<b>Adventures with a Cardboard Tube</b> Milgrom, Harry	500
<b>Have a Ball</b> Stone, A Harris	530

<b>The Heat's On</b> Stone, A. Harris	536
<b>Science on a Shoestring</b> Strongin, Herb	372.35
<b>Janice VanCleave's Physics for Every Kid</b> VanCleave, Janice	530.078
<b>Be a Kid Physicist</b> Wellnitz, William	530.078
<b>Mobiles</b> Zubrowski, Bernie	731.55



## Way Cool Web Sites

### **Strange Matter-**

<http://www.strangematterexhibit.com/>

Play and learn online with the Strange Matter of Materials Science.

### **Cool Science for Curious Kids-**

<http://www.hhmi.org/coolscience/>

Fun and interactive site to help kids appreciate science.

### **Brain Pop-**

<http://www.brainpop.com/science/seeall/>

BrainPOP is an educational web site with Flash-based movies about mathematics, technology, health, science, and social studies.

### **Nasa Kids Club Page-**

[http://www.nasa.gov/audience/for\\_students/k-4/index.html](http://www.nasa.gov/audience/for_students/k-4/index.html)

NASA - (National Aeronautics and Space Administration) website just for kids

### **Chem 4 Kids-**

<http://www.chem4kids.com/>

The web site that teaches the basics of chemistry to everyone!

### **Ask Dr. Universe-**

[www.wsu.edu/DrUniverse/](http://www.wsu.edu/DrUniverse/)

Dr. Universe has a whole university full of experts ready to tackle your question on any subject.

### **Science Monster.Com-**

<http://www.sciencemonster.com/>

Free online science games and puzzles.

### **Strange Science-**

<http://www.strangescience.net/>

A collection of misguided attempts to explain natural history, including honest and dishonest mistakes about dinosaurs, mammals, and sea monsters.

### **The Science Explorer-**

[http://www.exploratorium.edu/science\\_explorer/](http://www.exploratorium.edu/science_explorer/)

Offers many easy-to-do experiments, from creating volcanos to tiny sparks.

**Questacon-**

<http://www.questacon.edu.au/>

The National Science and Technology Centre in Australia presents free games, quizzes and activities to explain science to children and teenagers.

**Jest In Time-**

<http://www.jestintime.com>

Professor Smart's and Ms. Knowitall's home page! Jest In Time provides entertainment and education for families at schools, theaters, fairs and festivals.

## Written Science Show Quiz for 1st, 2nd and 3rd Grade:

- 1) Name the elements that make up air:
- 2) In a vacuum all objects fall a) faster if they are heavier? b) slower if they have more surface area in relationship to their weight? c) at the same rate?
- 3) If we were on the moon dropping objects of varying size and weight; would all objects fall: , a) faster if they are heavier b) slower if they have more surface area in relationship to their weight c) at the same rate?
- 4) What if we were dropping objects under water? How would the objects fall in relationship to each other?
- 5) Are all things in text books true? why or why not? 6a) Can you think of one example?
- 6) Where would you find denser air, at sea level or at 20,000 ft. above sea level?
- 7) Centrifugal forces are often used in laboratories, how? describe.
- 8) True or false- An optical illusion makes something appear different than it actually is.
- 9) Wings can give objects lift but what conditions need to be present?
- 10) You are going 20 miles per hour on a skate board, you hit a bump, what do you hope hits the concrete before your head?
- 11) When you rub a balloon on your hair, what causes your hair to stand on end?
- 12) Name 2 common uses of levers?
- 13) Ok you're smart, you study, you've got great grades, what else will you need to do to be happy in your life?
- 14) Who do you think is the smartest person that you know? What have you seen them say or do that has brought you to that conclusion?
- 15) How are you smart?
- 16) What skills are you developing this year that you may use in the future?

## Answers for Written Science Show Quiz for 1st, 2nd and 3rd Grade:

- 1) Nitrogen, Oxygen, Carbon Dioxide
- 2) At the same rate.
- 3) At the same rate.
- 4) Objects with a greater weight in relation to their surface area would pass faster through the water.
- 5) No, knowledge changes as scientists discover and challenge theories of scientist from the past. Often with newer technologies people can rewrite what has been held true for hundreds or thousands of years. 5a) Scientific journals said that the earth was flat not to long ago.
- 6) Centrifuges separate liquids like blood in different substances by putting the liquids an in environment with an artificial gravity many times earth's pull. The more dense of liquids go to the bottom of a centrifuge when in motion.
- 7) True. The objects themselves do not change, only their appearance changes.
- 8) Movement of air or other type of fluid around an object.
- 9) Your helmet! Always wear it when you ride a bike, scooter, or skateboard.
- 10) Static electricity.
- 11) Teeter board, scissors, crow bar, can opener, bottle opener, car jack handle, hammer handle, the top of a soda can are all good examples of levers.
- 12) San Francisco you would be heavier because you be closer to center of the earth then in Denver where you would be farther away from that point.
- 13) **Good health**, eat smart and exercise and don't become a smart lump that sits around and knows everything. Turn off the tube, turn off the computer, get out the door, walk, run, dance, play ball, climb, bike you don't have to be the fastest or the best to do anything. You can choose to participate or you can vegetate.  
**Good friends**, treat everybody with respect because someday they might be the people that you need to help you.  
**Good job**, most of your learning will NOT come from school, go out seek people that you aspire to be like and ask them how they developed their businesses, or skills.  
**Good attitude**, nurture yourself as you would the most important person in the world. You are the most important person in the world to you.  
**Good adventures**, go where no one else is going, think what no one else is thinking, try something that you know you can't do well. It is OK to mess up! Try again, and again and again. Making a mistake is so much better than giving up or not trying at all!  
**Good time**, have fun, do stuff explore, take a chance! Do something that no one else is doing,
- 14, 15 and 16) You are going to have these answers for yourself. There is no wrong answer!

