Scientist Activity Badge Outline -- Technology Group

The Scientist Activity Badge is recommended to be presented in a two month format, as outlined in the Webelos Program Helps booklet. This outline presents the Badge in eight weekly meetings. Every requirement is covered in the outline. Each Scout who attends all meetings will satisfy all requirements, even though only six of the nine electives are required.

The Scientist badge lends itself to many different demonstrations, with which the Scouts will have a lot of fun. As the Webelos Den Leader you should read the book ahead of time and be prepared with your demonstration materials. Make sure you try out your demonstrations BEFORE the meeting. Examples are given here, but use your imagination -- you can think up very good demonstrations too! Use the Program Helps and the Webelos Activities book. Lists of materials needed are not given here for demonstrations taken from the Webelos book.

Use the Webelos book in the meeting. Have the Scouts read sections from the book. Then give them hands-on experience doing the demonstrations. Use all your other resources, like the Webelos Resource Book -- there are a lot of demonstrations in the Webelos Resource Book.

Plan one or more outings to show first hand one or more of the principles discussed in the Den meetings. Examples: Visit an airport and observe wing shapes, observe planes taking off, go flying.

Week 1

Requirements to be fulfilled:

Do These:

2. Read Pascal's Law. Show how it works.
3. Show in three different ways how inertia works.

Discussion and Demonstration:

1. Read the introduction and requirements on pages 283-284. Discuss the requirements and how they will be worked on in and outside the Den. Make sure you alert the Scouts and the parents about any field trips that will be planned. Also, make sure you telephone the parents a few days before the field trip -- it helps attendance.
2. Read pages 286-287 on Pascal's Law. "Pressure of a gas or liquid is equal on all sides of a sealed container." Use a balloon as an example.
   Demonstration: You will need a soda bottle, 1/4 cup of vinegar and 1/4 cup of baking soda. Put the vinegar in the balloon, and the baking soda in the soda bottle. Put the balloon tightly over the mouth of the soda bottle and tip up the balloon to make the vinegar go into the bottle. The balloon will begin to expand as the CO_2 is generated from the reaction. The point is that the pressure in the bottle and balloon increases as the gas is produced. The bottle cannot expand so the balloon does in all directions.
   The Cartesian Diver demonstration: You will need a glass jar, a sheet of rubber such as cut from a balloon, a medicine dropper and a rubber band. Fill up the jar nearly to the top with water. Suck a water into the medicine dropper until it just floats at the top of the water in the jar. Place the rubber sheet over the mouth of the jar and fix it to the top with the rubber band. Now press on the rubber to increase the pressure in the bottle. The "diver" will submerge and go toward the bottom of the jar. Release the rubber and the "diver" goes back up to the top. What has happened is that when you push on the rubber, the pressure in the jar increases, forcing more water into the dropper, causing it to be heavier than the lift provided by the air in the dropper -- it submerges.
3. Read pages 288-289 on inertia. "A body in motion stays in motion unless acted on by some outside force. A body at rest stays at rest unless acted upon by an outside force." Demonstrate inertia using a coin on a card over a bottle as shown on page 289. Demonstrate using glass of water and strip of paper. These are "at rest" demonstrations. Demonstrate "in motion" inertia using a rolling ball hit by another rolling ball.

   Extra credit: How is inertia expressed? Inertia is Mass times velocity. Mass can be expressed as pounds. Velocity can be expressed as feet per second. So inertia is expressed as pound-feet

per second. If a 1 pound ball travels due North at 1 foot per second and is hit head on by a 1 pound ball traveling at 2 feet per second due South, what might happen.

Additional Pascal's Law Demonstrations:

1. Place a glass in water, turn it upside down and lift it slowly. What happens when the bottom of the glass rises above the surface of the water. The water stays in the glass and is raised with it. But as the top of the glass breaks the surface of the water, the water in the glass falls out. This happens due to the fact that the air is pushing down on the water outside the glass and when the glass breaks the surface, air can rush in. The air no longer supports the water so the water falls out according to Pascal's Law.

Additional Inertia Demonstrations:

1. Place a doll in the middle of the back of a pickup type truck. The pickup bed needs to be large enough for the doll to slide in. Move the truck rapidly forward and then make it turn a curve sharply. The doll will slide to the side of the truck since it will keep wanting to go in a straight line accordingly to the principle of inertia.
2. Place several books on a smooth table. Push them toward a stick or another book you are holding as an obstacle. When the bottom book is stopped by the obstacle, the books on top continue due to the law of inertia.
3. Place a bucket on the floor, drop a ball into it. Easy, it drops right in. Now while walking past the bucket try to drop the ball in when your hand is positioned exactly above it. You miss. This especially shows up if you try to do this while running past the bucket. Since the ball has acquired your moment of inertia it tends to keep going forward after you have dropped it; thus it misses the bucket.
4. Put a marble, golf ball, or ping pong ball into a glass or jar that is laying on its side. Move the glass forward quickly, then stop it. Due to Newton's First Law (Inertia), the ball continues forward though the glass is stopped.

Homework:

1. Look for examples of Pascal's Law or inertia around your home and school, to tell the Den next week.

Week 2

Requirements to be fulfilled:

1. Read Bernoulli's Principle. Show how it works.

Do Six of These:

4. Show the effects of atmospheric pressure.

Discussion and Demonstration:

1. Read pages 285-286 on Bernoulli's Principle. "When air moves quickly, pressure is low." Demonstrate Bernoulli's Principle with card and thread spool. Demonstrate by blowing over a strip of paper. Demonstrate by blowing over a straw in a glass of water.

   Extra credit: Aircraft wings are curved on top to reduce the air pressure, but paper or balsa wood gliders have flat wings. Why do they climb? Discuss angle of attack.

2. Read pages 289-292 on Atmospheric Pressure. "We live in a blanket of air. That air exerts 15 pounds per square inch pressure on all surfaces at sea level." Demonstrate with candle in a bottle turned upside down in a bowl of water (page 290). Demonstrate with crush the can (page 291). Demonstrate with a can filled with water and holes in lid and side (page 291). Demonstrate with the cork boat, glass and water.

   Another demonstration: Float a ball in the air flow from a fan. The ball stays in place because the pressure is lower in the flow -- the higher pressure outside the flow forces it to stay put.

Extra credit: What is a vacuum? The absence of air or anything else. It is hard to create a vacuum on earth. Why? Because you have to overcome the 15 pounds per square inch atmospheric pressure. Suppose we want to create a vacuum inside a 12-inch cube. Do you know how to calculate the surface area of a 12 inch cube? The mathematical formula is 6*L*L, where L is the length of a side or 12 inches, and 6 is the number of sides. L*L is 144, so 6*L*L is 864 square inches. So the pressure on the cube is 864 square inches * 15 Pounds per square inch, or 12,960 Pounds of pressure! That's a lot of pressure to overcome in order to make a vacuum!

Additional Bernoulli's Principle Demonstrations:

1. Cut a soda straw about 2/3 thirds through about the midpoint of the straw. Fold the straw back so that it forms a 90 degree angle. Pour colored water into the a glass or cup and have the scouts blow hard into the opposite end of the straw. Air moving rapidly across the top of the straw will cause the air pressure to lower within the straw causing the water to rise in the straw and go down in the glass.
2. Place two ping-pong balls on the table about two inches apart. With a straw blow a steady stream of air between the two balls. As you blow the balls will come together until they hit the stream of rushing air and bounce back apart.
3. Cut a long thin strip of paper and make a fold 1/8 from each end. Try and blow under the beneath the bridge formed to try and blow it over. The more you blow the more it will bend toward the surface it is sitting on. Air pressure is higher above the paper bridge then below, so the paper is bent toward the surface.
4. Make an airfoil section (section of an airplane wing) by gluing a strip of paper around a straw, pencil or small stick. Hold the stick in front of you and blow a stream of air over the leading edge of the airfoil. The airfoil should rise.

Homework:

1. Look for examples of Bernoulli's Principle, and atmospheric pressure at work around your home and school, to tell the Den next week.

Week 3

Requirements to be fulfilled:

5. Show the effects of air pressure.
6. Show the effects of air and water pressure.

Discussion and Demonstration:

1. Read pages 292-293 on Air Pressure. "If we compress air -- increase the air pressure -- we can put it to work for us. Example of compressed air: Blow hard into a bottle. A balloon. Demonstrate air pressure with the newspaper ball and soda bottle (page 292). Demonstrate with the hot water bottle lifting books (page 292). Demonstrate with the balloon lifting a glass.
2. Read pages 294-295 on Air and Water Pressure. "Air pressure keeps water out of a diving bell." Demonstrate with a glass and pan of water -- push down on the glass, the water is displaced. Float a bottle cap and push down on the glass to push the bottle cap to the bottom. **Note: Avoid the balloon demonstration on page 295. This is not a demonstration of air pressure as the book says, it is rather a demonstration of the elasticity of the balloon.**

Other Air & Water Pressure Demonstrations:

1. Hold a glass over a dishpan and fill to the brim with water. Cover the top with a piece of cardboard. Press on the cardboard with one hand, turn the glass upside down and let go of the hand touching the cardboard. The cardboard will stay stuck to the glass.
2. Stick a clear straw in a glass of colored water (for clarity), suck up the water until the straw is full. Putting your tongue or a finger over the straw lift it out of the water. The water will stay in the straw until you let go.

3. Fill a glass with colored water, place the short end of a bendable straw in the glass and bending the straw so that the long end will be below the surface of the water in the glass. Place a second shorter glass next to the first. Suck on the long end until water starts to move up the straw. Point the long end in the second glass and let the water flow out. The water will continue to flow until the water reaches the same level in both containers.
4. Fill a dishpan with water. Poke several holes in the bottom of a detergent bottle using a small pick or cork screw. Place the bottle in the water and fill with water. Bring the bottle out and the water will run out the bottom. Put a finger over the hole in the lid of the bottle and the water will stop running. The bottle can be used for a shower when outside.

Homework:

1. Look for examples of air pressure, and air and water pressure at work around your home and school, to tell the Den next week.
   [Bicycle tires, car tires, tire pumps, aerosol cans, etc.]

Week 4

Requirements to be fulfilled:

7. Explain what causes fog.

Discussion and Demonstration:

1. Read pages 295-297 on Fog. "Did you know that air has water in it?" Demonstrate making fog with the hot water in a bottle and place an ice cube at the top of the bottle (page 296). Demonstrate with cold water in the bottle and light a wooden match, drop into bottle (pages 296-297).

Homework:

1. Have you walked in a cloud? Have you played games at school out in the field when it was so foggy you could not see your friends? What does fog smell and taste like?

Week 5

Requirements to be fulfilled:

8. Show how crystals are formed. Make some.

Discussion and Demonstration:

1. Read pages 297-298 on Crystals. "When many liquids cool, they make geometric shapes called crystals. All crystals of one material are identical." Bring examples to show. If a microscope is available bring salt, sugar, and any other crystalline materials you have available to view under the microscope.

   Demonstrate crystal making by with sugar crystals (page 298). Demonstrate with the Coal Crystal Garden (page 298).

Homework:

1. With your parents, try making sugar crystals at home. Bring your experiment to the next Den meeting. You need to protect you experiment from mold, so cover it up. What did you learn? How easy is it to dissolve the sugar in the water? Why do you have to heat the water?

Week 6

Requirements to be fulfilled:

9. Define balance. Show three different balancing tricks.
10. Show in three different ways how your two eyes work together.

Discussion and Demonstration:

1. Read pages 299-300 on Balance. "Balance is when the center of gravity (or center of mass) is exactly over a pivot point (of fulcrum)." Show examples of balance, using a ruler or yard stick balanced on your finger, a mobile, a teeter-totter. Bring a weeble and show how the center of mass is so low that it returns to equilibrium on its own. (What's a weeble? A weeble is one of those very annoying standup toys that you can hit at the top, it falls over and then comes back up to right itself automatically.]

   Balancing Tricks from the book -- have all Scouts try all of these: Back up to a wall and try to pick up a paper at your feet (page 299). Chair lift leaning against the wall (page 299). Stand sideways to a wall; try to bring the outside foot up to the one next to the wall (page 299).

2. Read pages 300-302 on How Your Two Eyes Work Together. "Binocular vision means two eyes. Your two eyes work together to give you depth perception -- because your brain can put the two images together, the brain can figure out how far away things are."

   Demonstrate with the paper tube trick, making it appear as though you have a hole in your hand (page 300). Have all Scouts do this. This shows how the brain puts the two images together.
   Demonstrate by holding two pencils at arms length, and changing focus to beyond the pencils (page 301). This shows how the brain makes the eyes refocus to perform depth perception.
   Demonstrate the "finger sausage" (page 301). This shows how your brain can play tricks.

   Question: Your eyes are wonderful sensing instruments, but where is all the work being done?

Homework:

1. Look for examples of balance at work around your home and school, to tell the Den next week. Do you have a weeble? Bring it to the Den meeting. Why is it so hard to knock over a weeble?
2. Can you find other ways your eyes work together and share that with the Den next meeting?

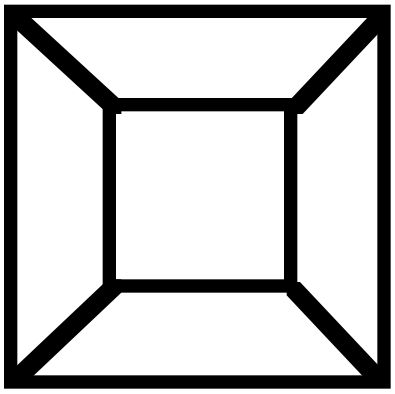
Week 7

Requirements to be fulfilled:

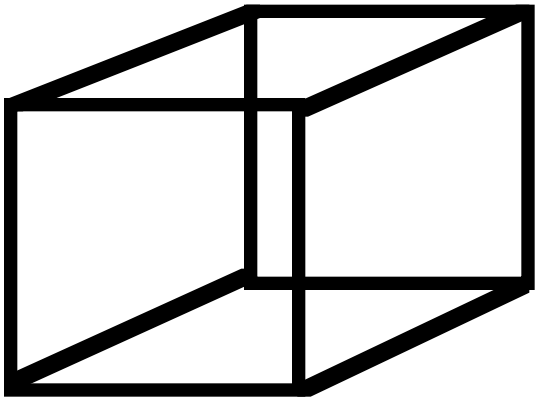
11. Show what is meant by an optical illusion.
12. Get a book on how to care for the eyes. Read it.

Discussion and Demonstration:

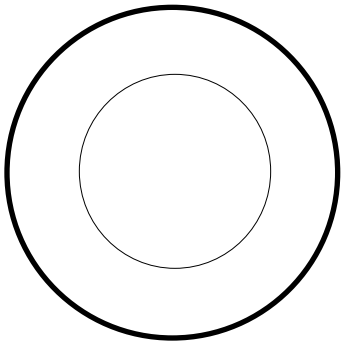
1. Read pages 303-303. "An optical illusion is when our eyes tell us something that isn't really true." Demonstrate with the optical illusions in the book on page 303.

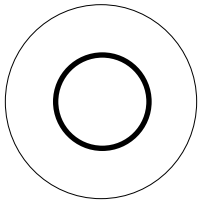


Is the Inner square closer or farther away?



Are you looking down on this box or looking up at this box?





Which dotted circle is smaller?

2. Obtain copies of a pamphlet on eye care from the local optometrist. Give a copy to each Scout. Skim over the pamphlet in the meeting.

Additional Optical Illusion Demonstrations:

1. Make a frame out of construction paper or cardboard and attach a piece of cellophane. Draw a picture (i.e. a house) on a piece of white paper using a marker the same color as the cellophane. Look at the picture through the cellophane and the picture disappears.
2. Fill a drinking transparent glass with water. Set a nickel in the palm of your hand and hold the glass over the coin. If you look down into the glass you will see the coin without any trouble. Cover the top of the glass with your other hand and look at the coin through the side of the glass and you will notice that it seems to disappear. The reason for this illusion is that first you looked straight down at the coin. The second time you looked through the side of the glass. When looking through the side of the glass the light rays are bent as they pass through the water and you couldn't see the coin. This is known as refraction.

Homework:

1. Do you know who M.C. Escher was? He was a famous artist that specialized in optical illusions. Do you any optical illusions around your home? If so, bring something in to show the Den next week.
2. Read the eye care pamphlet at home. How can be take better care of our eyes?

Week 8

Requirements to be fulfilled:

Makeup week. Review all requirements, dwell on anything missed, sign off books.

Discussion and Demonstration:

1. Who can tell us what Bernoulli's Principle is? Do you remember a demonstration of it?
2. Who can tell us what Pascal's Law is? Do you remember a demonstration of it?
3. Who can tell us what inertia is? Do you remember a demonstration of it?
4. Who can tell us what atmospheric pressure is? Do you remember a demonstration of it?
5. Who can tell us what air pressure is? Do you remember a demonstration of it?
6. Who can tell us what the effects of air and water pressure are? Do you remember a demonstration of it?
7. Who can tell us what causes fog? Do you remember a demonstration of it?
8. Who can tell us how crystals are formed? Do you remember a demonstration of it?
9. Who can define balance? Do you remember a demonstration of it?
10. Who can tell us different ways how your two eyes work together? Do you remember a demonstration of it?
11. Who can tell us what is meant by an optical illusion.
12. What did we learn from the book on eye care?

Scientist Activity Badge Den Leaders Record

Date: _____
Month/Year

List Boy's Names

Requirements												
Do These:												
1. Read Bernoulli's Principle.												
Show how it works.												
2. Read Pascal's Law.												
Show how it works.												
3. Show in three different ways how inertia works.												
And Do Six of These:												
4. Show the effects of atmospheric pressure.												
5. Show the effects of air pressure.												
6. Show the effects of air and water pressure.												
7. Explain what causes fog.												
Show how this works.												
8. Show how crystals are formed.												
Make some.												
9. Define balance.												
Show three different balancing tricks.												
10. Show in three different ways how your two eyes work together.												
11. Show what is meant by an optical illusion.												
12. Get a book on how to care for the eyes. Read it.												
Date Completed												
Awarded												