Arrow of Light Den Meeting 5

Scientist

Preparation and Materials Needed

- Read the Scientist chapter in the *Webelos Handbook*.
- Note that while this is laid out in one meeting, to complete this activity badge you may want to do more fun experiments and use two or more den meetings. The details of each day depend on the experiments and any guest activity badge counselor.
  - There is a lot to cover, and anything left over can be completed in the following meeting, which is planned as an outdoor hike.
  - If you have several **Scientist activity badge** counselors, you might have separate meetings with each.
- Identify any parents or other pack resources who are scientists (could be in medicine, or research, or just have a scientific hobby or interest) and could be your activity badge counselor for this meeting. Alternatively, you might make and confirm arrangements for a field trip to work with an educator at a science museum, children's museum, or high school to complete the **Scientist activity badge** and **Science belt loop.** If you do not have access to a museum, consider inviting a science teacher.
  - Be sure any guest speaker knows how long the presentation should run, and that you've confirmed what can or should be covered that would be interesting and fun for the Scouts.
  - The guest could be asked to discuss the scientific method and come up with a few science experiments.
  - Show any guest speaker the Scientist chapter in the *Webelos Handbook*.
- If you are doing this as a field trip, inform Scouts and families about when and where to meet.
- Materials checklist (add to your den Cub tub of U.S./den flags, paper/pencils, other supplies):
  - Review the experiments and demonstrations noted below, and any others you select, for the necessary materials. You will want to select which ones are most interesting for you and your Scouts.
  - Scientist activity badges and **Science belt loops** for each of your Scouts (so that they can be awarded if completed today), and compass emblems or points (if those will be completed today).

Before the Meeting

- Review After the Meeting at the end of the previous den meeting plan for necessary preparation and materials.
- Make final preparations with assistance from any assistant den leader or other parent helper, den chief, and/or denner. Organize the space (seating, flags, advancement charts, activity materials, handouts, etc.). If you're snacking, organize space for that and the cleanup.

Gathering

- Have a gathering activity (games, puzzles, other) that will keep Scouts interested and busy and that others may join as they arrive. If the den desires, serve a healthy snack during this time.
- If you have background materials for the activity badge, Scouts may be interested in reviewing those.
- If you're on a field trip, as boys arrive, collect permission slips from parents who are not staying.
- Collect dues, record attendance and any advancement completed at home (a good job for an assistant den leader). Assign parents to meeting roles and hand out a meeting plan to each.

Opening

- Flag ceremony (rotate planning and leadership to complete **Webelos requirement 6**), with Pledge of Allegiance; maybe recite the Cub Scout Promise or sing a patriotic song; perhaps add a roll call, uniform recognition, or den yell.
- If you have a guest, give a formal introduction, including what the guest will do for you.

Business Items

- Remind the boys of appropriate behavior, including safety considerations, at the site of your visit.
- Use this time also to discuss participation in upcoming pack meetings or events as needed.

Activities

▶ **Scientist Activity Badge:** Requirements are to do the first four requirements, and then six of 5 through 14 (This meeting plan does 1 through 4, plus 5, 6, 7, 9, 11, and 12, as set forth below.):

Note: Each boy should conduct the chosen experiment(s) on an individual basis, coming up with his own hypothesis before conducting the experiment. This is not intended to be a group project merely observed by the Webelos Scout.

1. Read Bernoulli's Principle. Show how it works.
   - In 1738, the scientist Daniel Bernoulli discovered an important principle that was later used to design airplane wings. According to Bernoulli's principle, the higher the speed of a moving fluid or gas, the lower its pressure (see the *Webelos Handbook*, page 405, for more). For more, try these:
   - Magnetic Table Tennis Balls:
     — Attach a piece of string to each of two table tennis balls.
     — Hold the strings so the balls are suspended several inches apart from one another.
     — Then blow between the balls.
     — Bernoulli's Principle explains why they move together rather than move apart.
   - The Floating Ball:
     — You can make a table tennis ball float in the air. As Bernoulli proved, when water or air moves, it has less pressure than the air or water around it. The faster it moves, the lower the pressure.
     — To float a table tennis ball, remove the cleaning tool from the end of a vacuum cleaner hose.
     — Remove the hose from the intake hole, and attach it into the outlet hole near the bottom of the vacuum cleaner. (You might also try this experiment using a hair dryer.)
     — Plug the cord into an electrical outlet and turn the vacuum cleaner on.
     — Point the hose straight up, holding it steady.
     — Gently release the ball into the airstream about 10 to 12 inches above the nozzle. Try balls of different sizes and weights to see what happens. Can you float more than one ball at a time?
   - Why a Baseball Curves:
     — When a pitcher throws a curve ball, he is using Bernoulli's principle. When he puts a spin on a ball to make it curve, the ball carries a layer of air around with it.
     — The whirling air is moving in the same direction on one side of the ball as the current passing the ball on its flight toward the plate. On the other side of the ball, the whirling air is moving against the air current. The difference in air pressures causes the ball to curve.

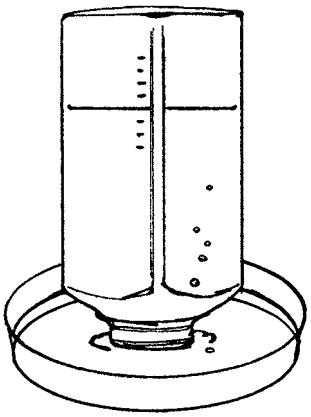
2. Read Pascal's Law. Tell about some inventions that use Pascal's law.
   - Pascal's law describes the effect of applying pressure on a liquid in a closed container. When the pressure of this liquid is increased or decreased at any point, the pressure changes equally throughout the liquid. The principle is used in hydraulic jacks, vacuum pumps, and air compressors. You can show Pascal's law being applied to air by looking at how air pressure functions in a closed container.
   - See the *Webelos Handbook*, page 406–407. Here are some other simple experiments:
   - Balloon Blower.
     — You can show graphically how carbon dioxide is formed and builds pressure inside a closed container with this demonstration.
     — Pour two teaspoons of baking soda into a large, clean soft drink bottle. Add 1/4 cup of vinegar.
     — Now slip a balloon over the mouth of the bottle and tie it tightly with a string.
     — Shake the bottle vigorously. Soon, the balloon will be inflated by carbon dioxide.
     — What happened? The baking soda and vinegar produce carbon dioxide, which increases the pressure inside the bottle and makes the balloon expand.
   - Simple Pressure Lift.
     — Place a stack of books on a balloon and blow into the balloon.
     — The added pressure inside the balloon lifts the books.

3. Read Newton's first law of motion. Show in three different ways how inertia works.
   - According to Newton's laws of motion, an object at rest tends to remain at rest, and an object in motion tends to remain in motion in a straight line at a steady speed unless an outside force acts on it. The property of matter that makes an object resist any change in motion is called inertia.
   - See the *Webelos Handbook*, page 407–409. Here are some other simple experiments:

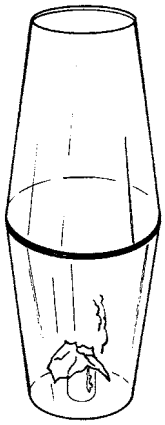
- Lazy Log.
  - — Tie two pieces of string of equal thickness to a block of wood or other heavy object.
  - — Hang the wood up by one piece of string and pull on the other. Which string will break?
  - — If you pull slowly, the strain and additional weight of the object causes the upper string to break. But if you jerk the string quickly, the inertia of the block prevents the transfer of the total force to the upper string, and the lower one breaks.
- Buckle Up.
  - — Another example of inertia can be demonstrated at your pack's annual pinewood derby.
  - — Have boys carve a niche in the top of derby cars where a small plastic figure of a person can sit freely. When the cars hit the bumper at the end of the track, the figures won't stop.
  - — They have the same speed as the car and are free to continue moving forward.
  - — The faster the cars, the farther the figures will fly.
  - — Remind everyone of the importance of wearing a seat belt!

4. While you are a Webelos Scout, earn the Cub Scout Academics belt loop for Science. Science belt loop requirements:
   1. Explain the scientific method to your adult partner.
   2. Use the scientific method in a simple science project. Explain the results to an adult. (If you are unable to plan a simple science project that can be conducted during the den meeting, then assign this as work to be completed at home.)
   3. Visit a museum, a laboratory, an observatory, a zoo, an aquarium, or other facility that employs scientists. Talk to a scientist about his or her work.
      - — Select experiments from the *Webelos Handbook* or these notes.

5. Show the effects of atmospheric pressure.
   - See the *Webelos Handbook*, page 409–411. Here is another simple experiment:
     - — A barometer measures atmospheric pressure. Here's a simple one.
     - — Use a glass or clear plastic quart bottle.
     - — Fill it with water, put a saucer over the top, and flip it over quickly.
     - — Allow a little water to escape into the saucer.
     - — With a felt-tip pen, draw eight or 10 scale marks on the bottle 1/4 inch apart. The middle mark should be even with the water level.
     - — Check the water level each day.
     - — If the water level is higher, the atmospheric pressure is higher and fair weather is coming.
     - — If it's lower, look for unsettled weather.

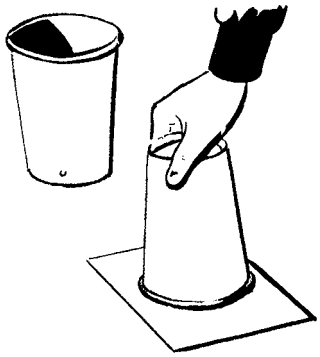


6. Show the effects of air pressure.
   - See the *Webelos Handbook*, page 412–413. Here are some other simple experiments:
   - Welding Glasses.
     - — Show boys how two glasses can be "welded" together—without using any complicated welding equipment.
     - — Use two glass tumblers that fit very closely together at the rims.
     - — Place wet, thick paper over a lighted candle in the bottom of one glass, as shown.
     - — The candle will go out, and the glasses will be stuck together.
     - — See if boys can explain why.
   - Vinegar Rocket (this may be a good one to complete next meeting while on a hike!).
     - — You should do this experiment outside where you have lots of clear air space.
     - — Materials: 1-quart soda bottle, cork that fits tightly, paper towel, ½ cup water, ½ cup vinegar, one teaspoon of baking soda
     - — Pour vinegar and water into the bottle.
     - — Put one teaspoon of baking soda in the center of a 4-by-4-inch piece of paper towel.
     - — Roll up the paper towel and twist the ends so the baking soda will stay inside.
     - — Drop the paper towel with the baking soda into the bottle.
     - — Put the cork on as tightly as you can and stand back and watch. (Make sure that the rocket isn't pointing at anyone!)



— The baking soda reacts with the vinegar to produce carbon dioxide gas. As the gas forms, pressure builds up and pushes out the cork with the thrust similar to a rocket being launched into outer space.
— Add streamers to the cork for effect and to see where the cork goes!

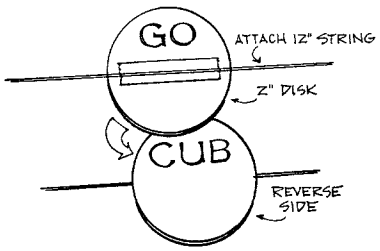
7. Show the effects of water pressure. This may be combined with atmospheric pressure or with air pressure.
   - See the *Webelos Handbook*, page 414–416. Here is another simple experiment:
   - Hanging Water.
     — Atmospheric pressure pushes on us from all directions. One way to demonstrate this is with a cup or glass of water and a piece of stiff cardboard to cover its mouth.
     — Fill the container to the brim with water, and carefully lay the card over the top.
     — Hold the card firmly in place and invert the container. (Do this experiment over a bowl or sink in case it doesn't work for you.)
     — Now remove the hand that is holding the card in place. The card stays in place, and the water remains in the container. Air pressure bearing upward on the bottom of the card is greater than the water pressure pushing downward.



9. Explain what causes fog. Show how this works.
   - See the *Webelos Handbook*, page 419–420. Here is another simple experiment:
   - Fog-Making Machine.
     — Use a plain glass gallon jug, a stopper to fit it, and a bicycle pump with a needle (as used to pump up a basketball).
     — Put a small amount of water or alcohol (alcohol works best) in the jug.
     — Put the stopper on the jug, and the needle of the pump through the stopper.
     — After a few strokes of the pump, remove the stopper quickly.
     — You will hear a loud pop and see a cloud begin to form in the jug.
     — To get fair weather, all you have to do is replace the parts as they were, and pump air back into the jug.
     — What happened? When you pumped air into the jug, the air temperature was raised, making it possible for the air to hold more moisture. When you removed the top, the air expanded and cooled. This cool air couldn't hold as much moisture, thereby forming a cloud.

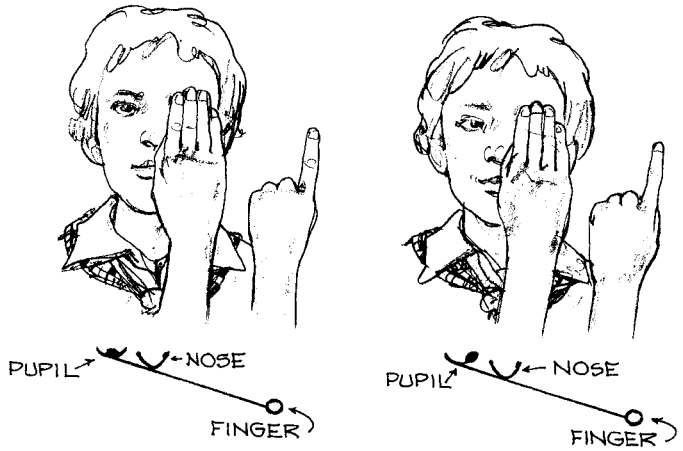
11. Explain how you use your center of gravity to keep your balance. Show three different balancing tricks.
    - See the *Webelos Handbook*, page 422–423 for some balancing exercises.

12. Show in three different ways how your eyes work together, and show what is meant by an optical illusion.
    - Boys may be surprised to learn that they're either right-eyed or left-eyed, just as they are right-handed or left-handed.
      — They can check by extending a finger toward a distant object while keeping both eyes open.
      — Close the right eye. If the finger appears to jump, this means they are right-eyed.
      — If it doesn't, they are left-eyed, since the left eye is dominant.
    - See the *Webelos Handbook*, page 424–427. Here are some other simple experiments:
    - Optical Illusion: Illusion Spinner.
      — Cut a 2-inch disk out of cardboard.
      — On one side write "Go" on the top half; on the other side write "Cub" on the bottom half.
      — With glue or clear tape, attach a 12-inch string across either side of the disk as shown.
      — Twirl the disk and an optical illusion will make it read "Go Cub."



    - Optical Illusion: Disappearing Finger.
      — Cover your left eye with your right hand and look straight ahead with your right eye.
      — Raise your left forefinger to your left ear and move it until the tip of the finger is just visible (A).

— If you now move your eye to look directly at the finger (B), it has disappeared!
— This apparent shift of objects due to the angle from which you are viewing them is called parallax and is the principle that scientists use to determine the distance of stars from the earth.



► Other activity badge requirements that could be done in lieu of, or in addition to, 5, 6, 7, 9, 11, and 12:

8. With adult supervision, build and launch a model rocket. (***Note:*** You must be at least 10 years old to work with a model rocket kit sold in stores.) Describe how Newton's third law of motion explains how the rocket is propelled into the sky.

10. Explain how crystals are formed. Make some.
    - Have jam jars available at a meeting with craft sticks and string.
    - Add water and sugar to the jar.
    - The Webelos Scout should take home the jar with plastic wrap over it secured with a rubber band, and bring the jar back at the next den meeting to show how big the crystals grew.

13. While you are a Webelos Scout, earn the Cub Scout Academics belt loop for Weather. Weather belt loop requirements:
    1. Make a poster that shows and explains the water cycle.
    2. Set up a simple weather station to record rainfall, temperature, air pressure, or evaporation for one week.
    3. Watch the weather forecast on a local television station.

14. While you are a Webelos Scout, earn the Cub Scout Academics belt loop for Astronomy. Astronomy belt loop requirements:
    1. Set up and demonstrate how to focus a simple telescope or binoculars. (A local astronomy club may be a resource for this activity.)
    2. Draw a diagram of our solar system—identify the planets and other objects.
    3. Explain the following terms: planet, star, solar system, galaxy, the Milky Way, black hole, red giant, white dwarf, comet, meteor, moon, asteroid, star map, and universe.

► In the boys' *Webelos Handbooks*, sign the requirements met (and update your records).

Closing

► Award (or recognize) any advancement completed today (ideally, award the activity badge, belt loop or compass item completed today, and recognize later at the pack meeting); thank hosts, guests, helpers.
► Closing ceremony (rotate planning and leadership to complete **Webelos requirement 6**): Retire the colors; maybe with the Boy Scout Oath and/or Law, or the Law of the Pack and/or den yell. Den leader may add a den leader's minute comment.
► Remind the Webelos Scout who will plan and lead the next meeting's flag ceremony.
► Hand out or send family information letter.

► **Home Assignment:** Remind boys to review the Scientist chapter in their *Webelos Handbook* before the next meeting.

After the Meeting

- If you've changed the sequence of den meetings, double-check to make sure you will still advance your boys appropriately and check with the Cubmaster to make sure you stay coordinated with the pack.
- Refreshments: If appropriate
- Cleanup: Recruit enough help to do a good job. Scouts always leave an area as clean, or cleaner, than they found it.