



Preparation for:

Astronomy Merit Badge
Chemistry Merit Badge
Space Exploration Merit Badge



Adventures in Science

3 Den Meetings to complete

Takeaways

- Methodical Problem Solving
- Evaluating Evidence
- A Scout is Cheerful

Do all of these:

1. An experiment is a “fair test” to compare possible explanations. Draw a picture of a fair test that shows what you need to do to test a fertilizer’s effects on plant growth.
2. Visit a museum, a college, a laboratory, an observatory, a zoo, an aquarium, or other facility that employs scientists. Prepare three questions ahead of time, and talk to a scientist about his or her work.
3. Complete any four of the following:
 - a. Carry out the experiment you designed for requirement 1, above. Report what you learned about the effect of fertilizer on the plants that you grew.
 - b. Carry out the experiment you designed for requirement 1, but change the independent variable. Report what you learned about the effect of changing the variable on the plants that you grew.
 - c. Build a model solar system. Chart the distances between the planets so that the model is to scale. Use what you learn from this requirement to explain the value of making a model in science.
 - d. With adult supervision, build and launch a model rocket. Use the rocket to design a fair test to answer a question about force or motion.
 - e. Create two circuits of three light bulbs and a battery. Construct one as a series circuit and the other as a parallel circuit.
 - f. Study the night sky. Sketch the appearance of the North Star (Polaris) and the Big Dipper (part of the Ursa Major constellation) over at least six hours. Describe what you observed, and explain the meaning of your observations.
 - g. With adult assistance, explore safe chemical reactions with household materials. Using two substances, observe what happens when the amounts of the reactants are increased.
 - h. Explore properties of motion on a playground. How does the weight of a person affect how fast they slide down a slide or how fast a swing moves? Design a fair test to answer one of those questions.
 - i. Read a biography of a scientist. Tell your den leader or the other members of your den what the scientist is famous for and why his or her work is important.

Requirement 1: Draw a picture of a fair test that shows what you need to do to test a fertilizer's effects on plant growth.

Conducting a fair test is one of the most important ingredients of doing good, scientifically valuable experiments. To insure that your experiment is a fair test, you must change only one factor at a time while keeping all other conditions the same.

This is an experiment to see if fertilizer makes a plant grow larger than a plant that doesn't receive fertilizer. Put seeds of the same kind in two pots with rich soil, in the same location, and water each one with the same amount of water every other day. Add fertilizer to one pot and see if the plant with soil and fertilizer grows larger than the one grown without fertilizer.



Requirement 2: Visit a Scientist.



MUSEUM OF NATURAL HISTORY WALK PATCH

Complete eight of the following requirements to earn this patch:

1. Name the difference between a pictograph and a petroglyph.
2. Find the Geiger Counter Exhibit on the second floor and use it to test the different rocks for radioactivity. Which one is the most radioactive?
3. When dinosaur bones are found in the field, they are removed from the rock and transported back to the lab in a material called a plaster jacket. Look in the Palaeontology Lab.

What do these jackets remind you of?

4. Give an example of an animal that is a carnivore, herbivore, and an omnivore.
5. Name one of the differences between an amphibian (i.e. frog) and a reptile (i.e. lizard).
6. Name the five indigenous nations of Utah. Which two cultures preceded them?
7. Identify the ancestor of the horse that existed 50 million years ago.

What modern animal is the same size?

8. Visit the Romney Mine exhibit. Was this a pleasant working place for miners?

Why or why not?

9. Utah was home to many different dinosaurs. Which dinosaur is Utah's state vertebrate fossil? Was it a carnivore or an herbivore?
10. Before leaving the Museum, tell your leader about something new that you learned during your visit.

For more information and to make reservations: Visit: www.nhmu.utah.edu, or call 801-585-9496 Hours: Open daily - 10:00 a.m. to 5:00 p.m. (Last admission - 4:30 p.m.) Wednesday - 10:00 a.m - 9:00 p.m. (Last admission - 8:30 p.m.)

Location: 301 Wakara Way, Salt Lake City, UT Admission: \$6.00 per boy, \$9.00 per adult *Discounted fees for groups of 12 or more. *Free admission offered quarterly.



U of U PHYSICS DEPARTMENT OBSERVATORY TOUR PATCH

Each Cub Scout and leader who takes the observatory tour may earn the patch by answering the following questions:

1. What is a planet? 2. What is a star?
3. What is a nebula?
4. What is a globular star cluster?
5. What is an open star cluster?
6. What is a galaxy?
7. What is a comet?
8. What is an asteroid?
9. What is a reflecting telescope?
10. What is a refracting telescope?
11. Why do the stars appear to be different colors?
12. Draw a picture of our solar system and name the planets in order going outward, starting with Mercury.

The observatory is located on top of the roof of South Physics which is located at 174 South 1400 East. Public parking is available after 6:00 p.m. in the lot just east of the building. A visitor pay lot is available further east. A map and direction can be found at: <http://www.physics.utah.edu/index.php/for-visitors/directions-a-parking>

Star Parties are open to the general public without reservations on Wednesday evenings (weather permitting). Private tours are available on other evenings by appointment only. For reservations send an email to toobservatory@physics.utah.edu. Since the start time depends on the sun, check the observatory web page to verify when it is open. If the weather is bad, the observatory will not be open.
<http://web.utah.edu/astro/>

When arriving at the South Physics building the building will be locked except on Wednesday evening. An observatory staff member will meet you by the doors on the east side of the building at the appointed time of your reservation.

You will be able to look through the telescopes and see planets, nebula, galaxies, and other wonders depending on the time of year you visit. If you visit in the fall, winter or early spring months make sure you dress warmly.



U of U PHYSICS DEPARTMENT LABORATORY TOUR PATCH

Each Cub Scout and leader who takes the lab tour may earn the patch by answering the following questions:

1. What is a laser?
2. How cold is liquid nitrogen?
3. What is a nano technology?
4. What is a nanometer?
5. What is physics?
6. Explain how magnets interact with each other.
7. What is the Scientific Method? Explain how you use the Scientific Method.
8. What do each of the following physicists study:
 - a. astrophysicist
 - b. cosmologist
 - c. atomic physicist
 - d. nuclear physicist
 - e. condensed matter physicist
9. Describe the work of the two types of physicist:
 - a. theoretical physicist
 - b. experimental physicist

Make reservations by calling (801) 581-6901.

The main Physics Office is located in the North Physics Building, 1400 East and 115 South. Public parking is just east of the building. Go east on 100 South and turn right about 1500 East. The free tour is open as arranged through a specific appointment.

When arriving at the North Physics Building, go to the main Physics Office (201 JFB) and ask the receptionist where to meet the tour guide. You will see two or three of the physics research labs and also have a few minutes to see some physics demonstrations.

Requirement 3: Complete any four of the following:

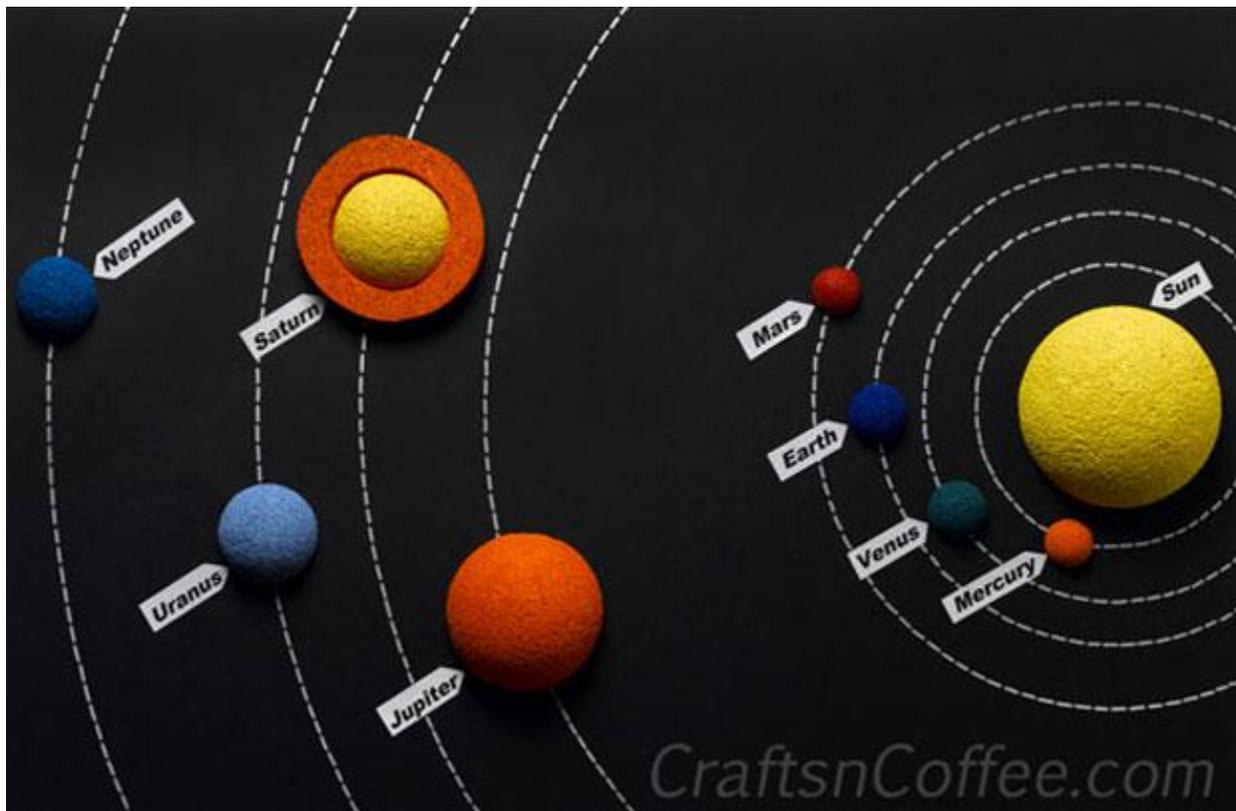
Report what you learned about the effect of fertilizer on the plants that you grew.

This completes the fair test experiment in Requirement #1.

Report what you learned about the effect of changing the variable on the plants that you grew.

The variable in this case is the type of fertilizer. What different type of fertilizer did they try, and what were the results?

Build a model solar system.



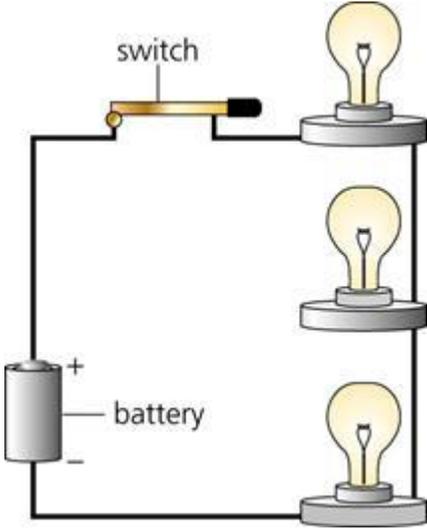
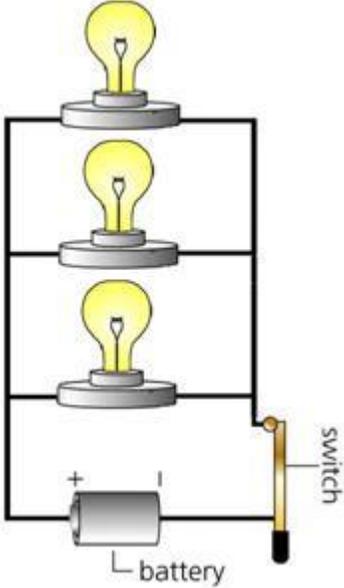
With adult supervision, build and launch a model rocket.



These can be the standard model rockets available at the Scout Shop and hobby stores, water bottle rockets, vinegar rockets, and air rockets. Instructions for all types of rockets are readily available on the internet.

http://www.scouting.org/Home/Membership/Youth_Recruitment/Events/Rocket.aspx

Create two circuits of three light bulbs and a battery. Construct one as a series circuit and the other as a parallel circuit.

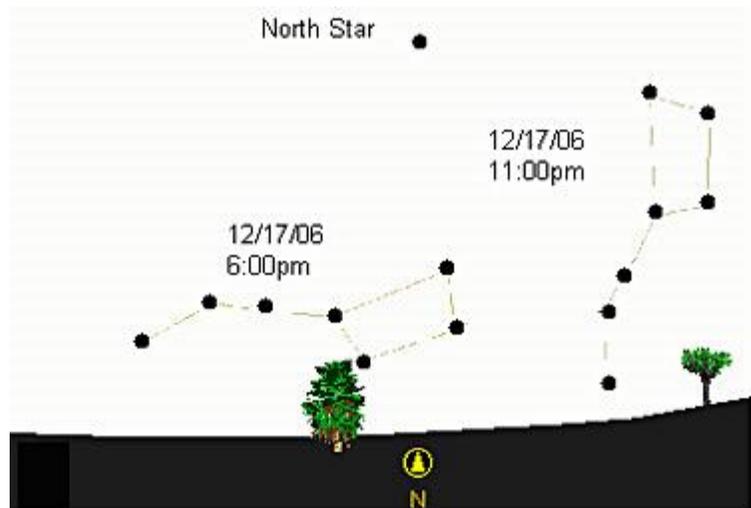
<p>The circuit below has three light-bulbs wired in series. This means that the current has no choice but to flow through one bulb, than the next, and the next, and so on until it goes to the other side of the battery.</p>	<p>The circuit below has three light-bulbs wired in parallel. This means that the current flows equally through all three bulbs simultaneously, then goes to the other side of the battery.</p>
	

Sketch the appearance of the North Star and the Big Dipper over at least six hours.

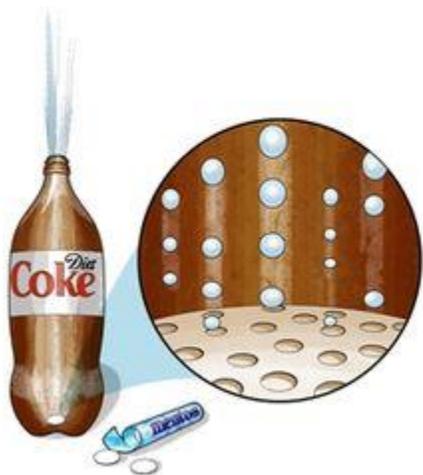
This is a great overnight campout activity, or a fun summer activity to do with their families.

On a blank sheet of paper draw the horizon and North Star. Also include any features along the horizon that can be used as reference like houses, trees, telephone poles, and street lights.

Use the outer lip of the Big Dipper to find the North Star.



With adult assistance, explore safe chemical reactions with household materials. Using two substances, observe what happens when the amounts of the reactants are increased.



Explore properties of motion on a playground. How does the weight of a person affect how fast they slide down a slide or how fast a swing moves? Design a fair test to answer one of those questions.



Read a biography of a scientist. Tell your den leader or the other members of your den what the scientist is famous for and why his or her work is important.

http://www.ducksters.com/biography/scientists/scientists_and_inventors.php

http://cybersleuth-kids.com/sleuth/Society_and_Culture/Biographies/Scientists/

<http://easyscienceforkids.com/biographies/>