



Y-CITYSCI: A Youth-Led Citizen Science Network for Community Environmental Assessment
Introduction to Nature of Science and Citizen Science: Lesson 1
Grade Level: Middle school
Duration: 1 hour

Introduction to the Nature of Science

Next Generation Science Standards

Science and Engineering Practices 3: Planning and Carrying Out Investigations

Crosscutting Concepts 2: Cause and Effect

Objectives

- 1) Students will recognize how to make observations.
- 2) Students will use those observations to form a hypothesis.

Materials

- Computers or tablets with internet access (1 per student if possible)
- Search for a Scientist worksheet (1 per student)
- Science-a-thon instructions
- Science-a-thon materials (listed below as “Science-a-thon Stations”)
- Time

Activities

Bellringer: Have students search online for 5 images of what they think a scientist looks like. Have students fill out the “Search for a Scientist” worksheet electronically (or handwritten) as they search for images. As a class, discuss and share what photos were chosen and why. (15 minutes)

Lecture: Discuss what observations are and how you can use those to form a hypothesis. During discussion, set up for Science-a-thon. (5 minutes)





Activity: Give students directions for the Science-a-thon. Students will break into small groups and visit the following stations, filling out the answers to the writing prompts at each station. Give students about 3 minutes per station. (30 minutes)

Science-a-thon Stations:

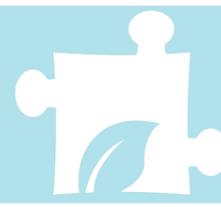
- Choositz Decision Balls
- Euler's Disk
- Poly Density Bottle
- Nature of Science (NOS) Tube
- Steel Density Spheres (and small tub of water)
- Firework glasses
- Hand Boilers
- Viscosity Tubes

Discussion: Have students return to their original seats and discuss their answers to the Science-a-thon worksheets. Can any of them guess the science that explains how the individual materials work? Collect sheets to reference in a later class if needed. (10 minutes)

Extension: Have students choose their favorite station and research the scientific reasoning that explains why each item works the way that it does. Students must write a half page explanation and share their work at the beginning of the next class. (optional)

Resources

- 1) Key terms:
 - Observations - the process of using the senses to acquire information from something or someone.
 - Hypothesis - a proposed explanation for a phenomenon that is testable and based on previous observations.
- 2) APPENDIX H – Understanding the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards (<https://www.nextgenscience.org/resources/ngss-appendices>)



Search for a Scientist

Instructions: You will search for five images that look like a scientist to you. For each image you choose, you will download that image and add it to this worksheet. Then add the search terms you used to find this image below the picture. Finally, describe what about the image and the person or people in that image made you think they look like a scientist?

Image One:

What search terms did you use to find this image?

What about this image makes you think that this person is a scientist?



Image Two:

What search terms did you use to find this image?

What about this image makes you think that this person is a scientist?

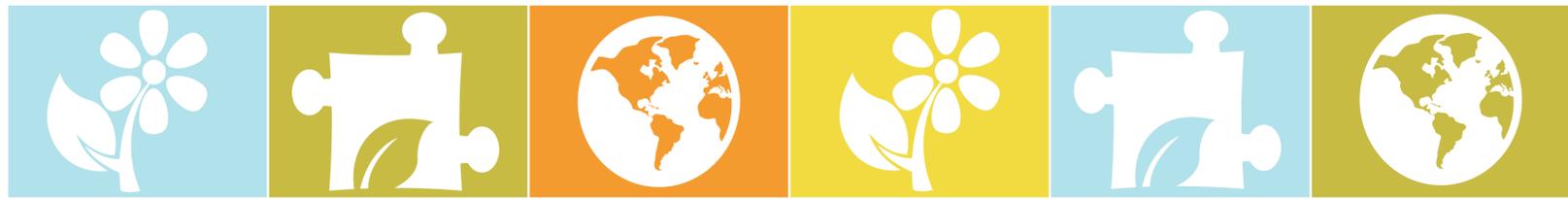


Image Three:

What search terms did you use to find this image?

What about this image makes you think that this person is a scientist?



Image Four:

What search terms did you use to find this image?

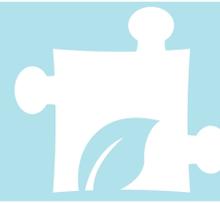
What about this image makes you think that this person is a scientist?



Image Five:

What search terms did you use to find this image?

What about this image makes you think that this person is a scientist?



Science-a-thon Instruction Sheet

The following are instructions for individual Science-a-thon stations. Each station should include one of the following items and its set of instructions or prompts. Cut out each set of instructions and tape it on the station table along with the item. Set a timer and have students visit the individual stations in a rotation while writing the answers to the station prompts on a separate sheet of paper.

Station 1: Choositz Decision Balls

- Make observations about the two objects before taking them out of the container.
- Hold the objects in your hands and form a hypothesis for what will happen when you drop the balls on the table (please do not drop them on the floor).
- After dropping the balls on the table, record what happens.

Station 2: Euler's Disk

- Hold the disk upright, slightly angled onto its rolling edge and give it an easy twist.
- What did you notice? See? Hear?
- Form a hypothesis as to why the disk behaves the way it does.

Station 3: Balloon and a Soda Can

- Hypothesize what will happen when you put the balloon next to the can.
- Challenge: Can you get the can to roll off the table using only the balloon?



Station 4: Poly Density Bottle

- Make observations about the bottle.
- Shake the bottle and set it back on the table.
- Describe, in detail, what happened.
- Write down one question you have about the bottle.

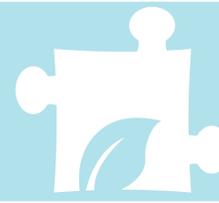
Station 6: Astro-Blaster Multiple Collision Accelerator

- Put on your **safety glasses first!**
- Place the red ball on top of the orange/yellow ball.
- Hold the top of the purple stick and keep the Astro-Blaster at an arm's length away from people.
- Form a hypothesis about what will happen when you let go of the Astro-Blaster.
- Let go of the Astro-Blaster.
- Record your observations.

Station 7: NOS Tube

- Make three observations about the tube.
- Pull **one** of the strings sticking out of the tube.
- Form a hypothesis about what will happen when you pull on a different string.
- Pull the string and see what happens.
- Continue to pull on all the strings.
- Sketch how you think the inside of the tube looks.

*No peeking into the NOS tube!



Station 8: Steel Spheres

- Both of the spheres have the same mass.
- Hypothesize what will happen when you put both spheres in the water.
- Put both spheres in the water.
- Record your observations.
- **Put the spheres back on the table** for the next group.

Station 9: Firework Glasses

- Put the firework glasses on and look towards a light source.
- Record your observations.
- Form a hypothesis about what causes the glasses to work the way that they do.

Station 10: Hand Boilers

- Hypothesize what will happen when you hold the base of the boiler in your hand.
- Hold the base in your hand and record your observations.



Station 11: Viscosity Tubes

- Hypothesize what will happen to the individual tubes when you turn them upside down.
- Pick up at least two tubes at once.
- Hold them vertically and then turn them upside down at the same time.
- Repeat this with a different combination of tubes.
- Record your observations.