STEM in the lab

Inspiring Idaho's future STEM workforce

X-RAY YOUR HAND

GRADE LEVELS

This activity is appropriate for students in grades 1-4.

MISSION

Combine science with art to understand how X-rays work.

VOCABULARY

X-RAY: an electromagnetic wave of high energy and very short wavelength which is able to pass through many materials opaque to light.

RADIOGRAPHY: the process or occupation of taking radiographs to assist in medical examinations.

MATERIALS

- 1 Dark crayon (dark purple, dark blue, or black work best)
- Table covering
- Vegetable oil
- Colored construction paper (yellow, pink, orange and red work best)
- Plastic cup
- Q tip

ABOUT THIS ACTIVITY

Have you ever had an X-ray done on your body? Try making an "X-ray" drawing of your hand with a few materials from home. X-rays are powerful waves of energy and similar to light and are a form of radiation. X-rays are beneficial because they can go through substances that light cannot, so they can show images or pictures of the insides of an object, such as the human body.

At Idaho National Laboratory, some nuclear engineers are working on developing advanced neutron radiography capabilities for evaluating nuclear fuels. This project is like X-ray radiography at a doctor's office but uses neutrons instead of X-rays.

INSTRUCTIONS

1. Move your hand, observe, and think about the bones inside of it.
2. Try moving your hands in a fist and curl your fingers. Take about a minute to do this.

   What do you notice?

3. Cover your prep area with a trash bag or table covering to keep it clean.
4. Get your construction paper and crayon ready.
5. Put your hand and the top of your arm on top of your paper.
6. Spread your fingers wide and trace your hand and wrist in crayon.
7. Be sure to trace your hand with the hand you write with.
8. When you were bending your fingers earlier, you may have noticed that all the places your fingers bend are where there are wrinkles on the skin. That is where the finger joints are.
9. On your paper, make marks where the finger joints are. Do not forget about your thumb.
10. Draw a line across each finger to mark the joint.
11. Make a fist. Find your knuckles. You may notice that each knuckle is the end of a finger bone. That is a joint.
12. Line up your fist. Mark each knuckle with a dotted line. Do not forget about your thumb.
13. Draw each finger bone with ovals. Leave space between each joint.

    How many ovals (finger bones) do you have in each finger?

14. Your hand also bends at the wrist. That is another joint. Bend your wrist on your paper. Mark the bend with a line.
15. Your palm bones are hard to feel in your hand. Try looking at a real-life X-ray of the hand online. Your palm bones go from each finger to the wrist. Draw your 5 palm bones in ovals.
16. Look at the X-ray of a hand again to see the bones in your wrist. There are 8 small bones in your wrist.
17. Draw a circle for each one.
18. Look at the X-ray to see the bones of your arm. Draw those 2 bones.
19. Use the dark crayon to color in the areas around your bones.
20. Now you will make light shine through the bones. You will need your vegetable oil, Q tip and a paper towel.
21. Dip the Q tip in oil. Wipe away some of the oil. Then color in a few bones. You want to do this to all the bones. You do not want too much oil. Try wiping the oil off the Q tip a little bit each time.

    What will the oil help accomplish?

22. Put your hand aside and give it time to dry.
23. Place your hand in a window for all to see.

    What do you notice?

THE SCIENCE BEHIND IT

X-rays are a form of electromagnetic radiation which is similar to visible light. However, unlike light, X-rays have higher energy and can pass through most objects, including the body. At INL, nuclear engineers are working on developing advanced neutron radiography capabilities for evaluating nuclear fuels. This project is similar to X-ray radiography at a doctor's office but uses neutrons instead of X-rays.

FURTHER EXPLORATIONS

» **Watch this video about the lesson:**
https://mysteryscience.com/trending/mystery-1/bones-animal-structures/161?r=288982814&s=md%3Abones-activity#slide-id-0

RESOURCES

» **Invention of the X-ray Machine**
https://www.youtube.com/watch?v=k9EBoQQMODA

» **Accelerator Generation and Thermal Separation (AGATS) of Technetium-99m**
https://www.youtube.com/watch?v=2B40eDz_sW0

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