STEM in the lab

Inspiring Idaho's future STEM workforce

ATOMS MATTER

GRADE LEVELS

This activity is appropriate for students in grades 5-6.

MISSION

Use paper and pompoms to demonstrate the size of atoms and an atom structure.

VOCABULARY

CHAIN REACTION: a series of events in which each event causes the next one. A nuclear chain reaction is when an atom is split, causing other atoms to split, creating energy.

ELECTRON: a very small particle that has a negative charge of electricity and travels around the nucleus of an atom.

NEUTRON: a subatomic particle of about the same mass as a proton but without an electric charge.

PROTON: a stable subatomic particle found in the nucleus of an atom with a positive but opposite electric charge equal in magnitude to that of an electron.

MATERIALS

- Paper
- Scissors
- Glue
- Element cards
- Pompoms (3 colors: yellow for protons, red for electrons and blue for neutrons)

ABOUT THIS ACTIVITY

What's the smallest thing you can think of? Ants? Dust? A blade of grass? Ask your students to consider this analogy as you show them ONE grain of salt. Imagine you were shrunk down to the size of an atom and are standing next to a grain of salt. The grain of salt would be the height of Mount Everest, the tallest mountain on Earth.

Ask: What is an atom? The smallest unit into which matter can be divided.

Ask: What is matter? Everything is made up of matter, which is anything that has mass and takes up space.

In this activity, students will use paper and pompoms to demonstrate the size of atoms and an atom structure.

DIRECTIONS

ACTIVITY 1:

1. Pass a piece of paper to each student. Use a ruler to measure an 11"X1" strip of paper.

2. Challenge students to fold and use scissors to cut the paper in half as many times as they can.

Note: *Students should always fold and cut the paper in the same direction. Have students count the number of cuts they make. It starts to get really difficult after about five cuts. You might see students flip their paper to begin cutting in another direction. Make sure you remind them to keep cutting in the same direction. If they were able to keep cutting, they would need to do this about 31 times to be the size of an atom! Have students imagine what that would look like.*

Explain to Students:

- An atom is considered the basic building block of matter - the smallest thing possible.
- An atom is made up of smaller particles. These particles are often referred to as subatomic particles.
- There are three subatomic particles in an atom: protons, neutrons and electrons.
- The protons and neutrons are found in the center of the atom, which is called the nucleus.
- The electrons orbit the nucleus. The number of electrons and protons are usually equal.
- Show students a picture of the periodic table found on Idaho National Laboratory's website: https://inl.gov/periodic-table/
- Explain to the students that the periodic table is a list of all the known elements. An element is a substance made up of only one type of atom.
- One of the elements on the periodic table is uranium. Have students find and click on the uranium element. Atoms of uranium, a common element that can be mined from the Earth, are used in nuclear reactions. At Idaho National Laboratory, nuclear scientists are working to make nuclear energy more affordable, versatile and sustainable.

ACTIVITY 2:

1. Pass out the uranium element card. Have students point to the number of electrons, protons and neutrons found in uranium.

2. Pass out the hydrogen, helium and lithium task cards. Since these elements have fewer subatomic particles, students will make models of these elements.

3. Pass out six pompoms of each color to students. Students will use yellow pompoms for protons, red pompoms for electrons and blue pompoms for neutrons.

4. Have students glue the pompoms in the correct location.

THE SCIENCE BEHIND IT

Atoms of uranium are used in nuclear reactions. A nuclear reactor converts the heat created by nuclear fission into electricity. Fission occurs when a neutron splits a uranium atom into two smaller atoms, releasing heat and more neutrons that split more atoms, continuing a controlled chain reaction. The heat released by fission is used to create clean steam that spins a turbine to generate electricity.

FURTHER EXPLORATIONS

Learn more about chain reactions and their role in nuclear reactions by doing the following activities.

» Create a chain reaction using dominoes.

1. Stand dominoes upright and arrange them in any pattern on a flat surface.
2. Knock over a single domino. What happens to the other dominoes?
3. Try different patterns. Knock over one domino – what happens to the others?
4. After you've tried multiple patterns, arrange them in a single line. Now what happens to the dominoes?

» What objects work best to stop a chain reaction? In a nuclear reactor, control rods are used to slow down the reaction. A control rod is made of cadmium or boron, which absorb neutrons. If you insert the control rod between the uranium atoms, the number of neutrons available to cause more splits is reduced, breaking the chain reaction. Place a ruler between the dominoes to slow down the reaction.

» Go bowling. How does the setup of the bowling pins cause the most effective chain reaction? What happens to the chain reaction when the center pin is knocked down?

RESOURCES

» https://www.youtube.com/watch?v=jGxqXLFPOsM

» https://education.nationalgeographic.org/resource/nuclear-energyhttps://beakersandink.com/activities-for-teaching-atoms/

» https://public.inl.gov/STEMHelpWanted/Brochure/index.aspx?page=14A

» https://www.nrc.gov/reading-rm/basic-ref/students/science-101/what-is-an-atom.html

» https://inl.gov/periodic-table/

LEARN MORE

Students + Parents + Educators

For information on grants, training and student opportunities, curriculum ideas, and other resources, please visit ***stem.inl.gov.***

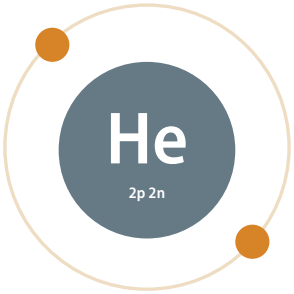
TASK CARDS

Have students glue pompoms in the correct place.

HYDROGEN

LITHIUM

HELIUM



URANIUM