POLAR TREC
Learning Resources

Details

Arctic / Antarctic
About one period
Download, share, and mix
Middle School and up

How We Can Use Isotopes to Study Glaciers?

Overview

This lesson is based on studies completed by undergraduate geoscience students working around the glaciers of Kongsfjord, Svalbard during the summer of 2014. It is intended as part of a larger unit on matter that covers atomic theory, atomic structure and the periodic table. Students connect authentic research to their classroom understanding of atoms while learning how this knowledge applies to real-world scientific investigations.

Objectives

- Students know each element has a specific number of protons in the nucleus (the atomic number) and each isotope of the element has a different but specific number of neutrons in the nucleus.
- Students will cite examples of how isotopes are used in science research.

Lesson Preparation

Preparation includes making copies of student worksheets and periodic tables, if needed. Additionally, preview of the video and power point is recommended along with setup of required audiovisual equipment.

This lesson presents a definition and examples of isotopes and should be presented in the context of a larger unit that includes atomic theory, atomic structure and the periodic table. It is assumed that students have completed prior units in a physical science curriculum and have the requisite background knowledge necessary for mastery of the objectives.

Materials

- Each student needs the worksheet, a periodic table and possibly a calculator.
- The teacher needs audiovisual equipment and access to the power point presentation and video.
- The video can be found at: http://youtu.be/WB13XBEut0Y

Learning Resources

Procedure

The components of the lesson are:

- A six-minute video to generate interest, add authenticity and inform students about how the study of isotopes applies to real-world scientific investigations.
- A teacher guided power point that reviews atomic structure, defines isotopes and gives several examples.
- A worksheet for students to complete with video notes and practice determining the number of subatomic particles of various isotopes of different elements.

The above order is suggested, however it can be modified to accommodate different age groups, time allotments, etc.

Extension

As an extension activity, students can investigate how isotopes found in gas bubbles in ice cores help us understand past climate and model possible future climate scenarios. The Climate Change Institute at the University of Maine provides an interactive website, "Ice Core 101" at: http://climatechange.umaine.edu/icecores/IceCore/Ice_Core_101.html.

Resources

N/A.

Assessment

Evidence of mastery of the objectives should be evident on the worksheet and can be further assessed on a test or quiz. Specifically, did the student adequately:

- Determine the correct number of protons and neutrons for the various isotopes and accurately identify the atomic numbers and element names.
- Provide examples of how isotopes can be used in scientific research.
-

Author / Credits

PolarTREC teacher, Peggy McNeal created this lesson based on her experience with High Arctic Change 2014. Peggy may be reached at peggy.mcneal@me.com.

Files Included

- Worksheet: What is an Isotope?
- Power point presentation: What is an Isotope?

Learning Resources

Standards

Science Content Standards for California Public Schools, Grade 8:
Periodic Table
The organization of the periodic table is based on the properties of the elements and reflects the structure of atoms. As a basis for understanding this concept:

- Students know each element has a specific number of protons in the nucleus (the atomic number) and each isotope of the element has a different but specific number of neutrons in the nucleus.

Name_____

Date_____Period_____

WHAT IS AN ISOTOPE?

Video notes: Complete as you watch *What is an Isotope? With REU student, Jessica Miles*

1. Inside atoms are: protons, _____ and electrons.

2. An element is defined by its atomic number or the number of positively charged (circle one) protons/neutrons/electrons in its nucleus.

3. Can atoms have a different number of neutrons in their nucleus and still be the same element? Yes/No (circle one)

4. What is different about atoms with a different number of neutrons? (circle one)
their charge
their color
their mass
their spin

5. Varieties of different atoms of the same element are called _____.

6. Jessica is looking for isotopes of two elements, strontium, number _____ and neodymium, number _____.

7. Evidence of strontium can give information about the chemical composition of a glacier and neodymium can determine the _____ of the bedrock that the glacier erodes.

8. Strontium levels vary in a glacier depending on the type of _____ that the glacier sits on.

Extra notes:

- Column chemistry is a way to purify samples and extract just the compounds that are desired from an entire mixture (in this case the mud).
- A mass spectrometer is an instrument that can measure the mass and relative concentrations of atoms in a sample.
- By analyzing isotopes in glaciers we can see how climate is affecting glaciers in different locations of the world.

9. When you have completed the lesson, give two examples of science research that use isotopes as part of the investigation. (If you are not sure, you can look online.)
1.

2.

Use your periodic table to fill in the number of protons and neutrons for each atom. The number after the element name is the mass number and is equal to the number of particles (protons and neutrons) in the atom's nucleus.

	Chromium-58	Chromium-63
# of protons		
# of neutrons		

	Carbon-12	Carbon-13	Carbon-14
# of protons			
# of neutrons			

	Nitrogen-15	Nitrogen-20
# of protons		
# of neutrons		

	Sulfur-23	Sulfur-25
# of protons		
# of neutrons		

	Sodium-12	Sodium-20
# of protons		
# of neutrons		

	Selenium-50	Selenium-55
# of protons		
# of neutrons		

Use your periodic table to fill in the missing information

# of protons	25	
# of neutrons	17	15

# of protons	32	
# of neutrons	30	32

	Germanium-	Germanium-
# of protons		
# of neutrons	33	36

	-54	-56
# of protons	24	
# of neutrons		

	Iron-	Iron-
# of protons		
# of neutrons	27	30

	Iodine-	Iodine-
# of protons		
# of neutrons	32	35