

ALL ABOUT URANIUM LESSON PLAN

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GRADE LEVEL	BACKGROUND
6-8, 9-12	<p>Iran's controversial nuclear deal is becoming a defining issue in the Middle East and the world. Iran insists it is not developing nuclear weapons and is simply enriching Uranium for peaceful purposes. Enriching Uranium is in the forefront of the nuclear program. What does it mean to enrich Uranium? Do we or don't we need it? How is it used as a source for energy?</p>
KEY QUESTIONS What is Uranium? How is Uranium processed? What is the difference between nuclear energy and nuclear weapons? What are the advantages and disadvantages of enriching Uranium?	<p>In this lesson plan, students will be able to explore the topic of Uranium, how it is processed and the advantages and disadvantages of enriching Uranium. Students will identify the uses of Uranium and why we need to mine it. Students will understand the differences between nuclear energy and nuclear weapons and examine the advantages and disadvantages of the uses of Uranium for nuclear energy and nuclear weapons.</p> <p>Often, the discussion around this issue presents an interesting and thought-provoking debate. The United States and other nations are concerned that Iran will utilize its nuclear program to enhance its power in the Middle East and pose a threat to its neighbors, including Israel, a American ally in the region. The IAEA (International Atomic Energy Agency) has worked to develop a compromise with all of the nations involved. Its responsibility is to monitor the proposed agreement and the activities of Iran as it relates to any nuclear facilities. Aside from the political issues in this case, what is the science behind nuclear material and its capacity to be utilized for energy or weapons? This interdisciplinary lesson gives students an opportunity to find out.</p>
CURRICULUM CONNECTIONS	KEY TERMS
Engineering U.S. Foreign Policy	<p>Uranium – A silvery-white metal and chemical element with the symbol U and atomic number 92.</p> <p>Periodic table – A table of chemical elements arranged in order of atomic number, usually in rows so that elements with similar atomic structure appear in vertical columns.</p> <p>Centrifuge – A machine that creates a force thousands of times more powerful than the force of gravity</p> <p>Atom – Tiny units that make up all matter in the universe.</p> <p>Nuclear energy – The energy in the nucleus of an atom.</p> <p>Nuclear power – The use of nuclear reactions that release nuclear energy to generate heat, which most frequently is then used in steam turbines to produce electricity in a nuclear power station.</p> <p>Fission – The splitting of an atom's large nucleus into smaller pieces.</p> <p>Fusion – Two or more atoms fuse together, creating a larger, heavier atom.</p>
COMMON CORE CONNECTIONS	
<p>CCSS.ELA-LITERACY.RH.6-8.2, RH.9-10.2, 11-12.2 - determine the central ideas or information of a primary or secondary source</p> <p>CCSS.ELA-LITERACY.RH.6-8.4, RH9-10.4, RH 11-12.4 – determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history and social studies</p> <p>CCS.ELA_LITERARY.RH. 9-10.7, 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem.</p>	

TIME NEEDED
Four to six 45-minute class periods

GLOBAL COMPETENCIES
Critical thinking
Communicate ideas
Collaboration
Recognize ideas
Inquiry & Application

DOCUMENTS
All about a nuclear fuel cycle http://www.whatisnuclear.com/articles/fuelcycle.html

PRE-LEARNING ACTIVITY
<p>Materials</p> <p>Computer and internet</p> <p>Iran’s nuclear power fuel cycle: http://www.whatisnuclear.com/articles/fuelcycle.html</p> <p>Live Science – Facts about Uranium http://www.livescience.com/39773-facts-about-uranium.html</p> <p>USNRC Backgrounder – Uranium Enrichment http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/enrichment.pdf</p> <p>Periodic Table: http://ieer.org/resource/classroom/periodic-table-of-the-elements/</p> <p>Procedure</p> <ol style="list-style-type: none"> 1. General discussion: Teacher writes on the board “What is Uranium?” Write answers that students say. Discuss if students have come across it and what they think it is used for. Where is Uranium on the periodic table? What are the countries that have Uranium? Have a general discussion on the uses of Uranium. 2. Introduction & motivation for students: Ask students to review the fact sheets on Uranium, review the periodic table and key terms, point to where Uranium is on the periodic table and then do some preliminary research using the internet. 3. Research activity: Ask students to investigate where Uranium comes from, how it is processed and how it is used as a source for nuclear energy. What countries have Uranium? Ask students to identify uses of Uranium.

ACTIVITY

Materials

Nuclear Fuel Cycles

<http://www.whatisnuclear.com/articles/fuelcycle.html>

Nuclear Energy

<http://www.whatisnuclear.com/articles/nucenergy.html>

Hands-on Activity: Pump It!

https://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_pumpit/cub_pumpit_activity1.xml

What is Enriched Uranium?

<http://www.smithsonianmag.com/science-nature/what-is-enriched-uranium-17091828/?no-ist>

Procedure

1. In small groups, research the methods for enriching Uranium. What does it mean to enrich Uranium? Ask students to be thinking about the pros and cons of enriching Uranium for Iran and for the rest of the world. In addition, have students:
 - Distinguish between nuclear fusion and nuclear fission by comparing and contrasting and describing how each process transforms elements.
 - Research nuclear energy. How is it made? What are the two processes for energy production? Research nuclear weapons. What are the differences between nuclear energy and nuclear weapons?
 - How is Uranium Ore made into nuclear fuel? What are the mechanics involved? How does the centrifuge work in the enrichment of Uranium?
2. Break students into groups – those who are for mining for Uranium and those who are not for mining. Students will discuss pros and cons of mining and enriching Uranium and write a list to of the pros and cons. Optional: Class presentation on pros and cons of mining for Uranium.
3. Establish a teacher's blog and have students post their findings on the pros and cons of mining for Uranium. Students may post questions on this topic on the blog.

EXTENSION ACTIVITY

Option 1

Research and identify the uses of nuclear energy and write a one page essay on your findings.

Option 2

How is Uranium Ore turned into nuclear fuel using centrifuge technology? Investigate how Uranium is processed. Research your findings and write a one page essay on this process.

Option 3

What is Iran's role in mining for Uranium? Draw a map of Iran with areas where mining is occurring. Write a one page essay how you think the nuclear deal between the US and Iran will affect Iran's use of Uranium.

Option 4

Materials needed: PVC pipes

Using PVC pipes, design a prototype of a centrifuge. Explain how a centrifuge works and why it is needed in enriching uranium.