Authentic Teaching Alliance

Radiation

Noble High School

Fall, 2003

Lesson Information

- **Grade Level**
  10-12
- **Subject areas**
  Chemistry
- **Duration**

  Three to four hour-long class periods.
- **Setting**

  The first two activities will take place in a lab-based classroom with adequate supervision. Students should be reviewed on proper safety protocols for working in the laboratory and in dealing with radioactive samples. The third activity will require the use of a computer lab that has access to the Internet.
- **Vocabulary**

  Radioactivity
  Alpha radiation
  Beta radiation
  Gamma radiation
  Source
  Geiger counter
  Shielding
- **Materials**

  Geiger counter
  Radioactive sources*
  Shielding materials: cardboard, aluminum foil, brick, jar of water, piece of wood, glass pane, and a sheet of steel
  Copies of Understanding Radiation in Our World dose calculation chart (found in Appendix A)
- **Additional Resources**

  Textbook: Exploring Physical Science, 3rd edition (1999). Prentice Hall publication.
  National Safety Council's *Understanding Radiation* resource packet
  This packet can be ordered by following the directions on the following website: http://www.nsc.org/ehc/rad/radbroch.HTM

  Estimate Your Annual Radiation Dose website. http://newnet.lanl.gov/main.htm

Summary

In this unit, students will participate in activities that will allow them to gain understanding of radioactivity found in the real world. They will look at the different types of radioactivity and what types of materials can act as shielding. Finally, students will employ proper research techniques to locate and use appropriate Internet resources in developing and presenting a position statement about an authentic radioactivity-related topic.

Objectives

Students will:

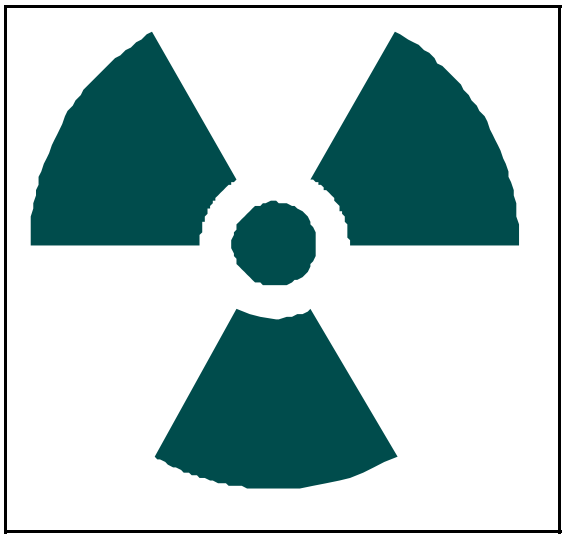
- Demonstrate proper use of a Geiger counter to measure levels of radioactivity from various sources
- Identify types of materials that can be used as effective shields against radiation based on gathered data sets
- Identify natural and manmade sources of radiation
- Calculate their estimated annual radiation dose based on their own lives
- Use the Internet to gather research on a given radiation-related topic
- Write a position statement based on research about a given radiation-related topic
- Present a research-based position to their classmates about a given radiation-related topic

Background Knowledge

Before participating in this activity, students should have a basic understanding of radiation including a working knowledge of each of the terms listed in the *Vocabulary Terms* section of this lesson plan.

Procedures

Activity 1 and Activity 2 will be completed on the first day of the lesson. Students in a class should be divided into two equal groups. While one group completes Activity 1, the other group will finish Activity 2. Then, after approximately 25 minutes, the groups will change assignments.



***Activity 1*:** This lab was borrowed and adapted from the National Council for Safety's Understanding Radiation resource kit. In this activity, students will use a Geiger counter to measure levels of radioactivity and identify the types of materials that are more effective shields against radiation. Students will use a Geiger counter to determine what types of radiation are being emitted from various sources. They will also experiment with what types of materials serve as the best radioactivity shielding materials based on the directions given. See the Lab Guide for Activity 1 for specific instructions.

***Activity 2*:** This lab was borrowed and adapted from the National Council for Safety's Understanding Radiation resource kit. In this activity, using a chart that is provided, students will be able to identify natural and manmade sources of radiation that they are exposed to everyday in their lives. They will also learn about the factors that influence an individual's estimated annual radiation dose. Students will gain insight into the fact that they are exposed to radiation each and every day by calculating their estimated radiation dose based on factors such as if they live in a brick house, how many x-rays they have had in the previous year, etc. See the Lab Guide for Activity 2 for specific instructions.

Activity 3 will require two class periods for completion.

Activity 3: In this activity, students will be given a current issue that involves radiation or radioactive materials in the real world. They will be given one day to research the topic and develop a fact-based opinion. The following day each student will write a position paragraph giving detailed reasons as to why they believe the way that they do about the topic. They will then present their findings to their classmates for discussion. See the Radioactivity Research Rubric found in Appendix A.
On the first day, the students will be given some basic tools for searching the internet effectively and efficiently and obtaining accurate information. Then, the students will spend the remainder of the class period in the computer lab researching a given topic over a current issue that involves radiation. The following day, the students will have the majority of the class period to write a paragraph stating their opinion on the given topic and supporting it with detailed, factual research. Students will then have the opportunity to present their paragraph to the class and discuss their views. See the Radioactivity Research Rubric in Appendix A for specific instructions.

Technology Component

Students will use and gather data from a Geiger counter. Students will also be asked to find appropriate Internet resources and use a word processing program to type a position paper based on a radio-activity-related topic.

Assessment

- Lab guides
- Participation
- Pre-test
  Post-test

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Oklahoma Priority Academic Student Skills Objectives

Observe and Measure
- Use appropriate tools (e.g., metric ruler, graduated cylinder, thermometer, balances, spring scales, stopwatches) when measuring objects and/or events.
- Use appropriate System International (SI) units (i.e., grams, meters, liters, degrees Celsius, and seconds); and SI prefixes (i. e. micro-, milli-, centi-, and kilo-) when measuring objects and/or events.

Classify
- Using observable properties, place an object or event into a classification system.
- Identify the properties by which a classification system is based.

Experiment
- Evaluate the design of a physical science investigation.
- Identify the independent variables, dependent variables, and controls in an
- Use mathematics to show relationships within a given set of observations.

Interpret and Communicate
- Report data in an appropriate manner.
- Evaluate experimental data to draw the most logical conclusion.
- Communicate or defend scientific thinking that resulted in conclusions.

Inquiry
- Design and conduct physical science investigations in which variables are identified
- and controlled.
- Use a variety of technologies, such as hand tools, measuring instruments, and
- computers to collect, analyze, and display data.

Possible Extensions

- Discuss health effects of radiation.
- Discuss professions that involve the use of radiation.
- Discuss some of the uses of radiation in industry and consumer products.
- Conduct research on incidents of accidental releases of radioactive substances.

References

Activity 1 and Activity 2 were created by the National Safety Council's Environmental Health Center and distributed in the Understanding Radiation resource packet. For more information on the resources they have available, feel free to contact them.

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