RADIOACTIVE! THE AMAZING WORLD OF NUCLEAR RADIATION

A Proposed Course for the Summer of 2023

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Number of Classes: 5
Class Frequency: 1x/120 minutes/week
Grade Level: 7-12

COURSE DESCRIPTION

Among the natural forces in creation, radioactivity is the most powerful and least understood. It has been less than a century since the energy of nuclear fission was harnessed. Yet, the existence of a substance with the power to transmutate elements was long anticipated (or at least hoped for) by ancient alchemists. In 1939, The New York Times hailed the discovery of Uranium-235 as a "Philosopher's Stone," capable of releasing almost limitless energy.

Our course will remove some of the mystery surrounding this modern Philosopher's Stone, and others like it. What is radioactivity and is it safe? Students will learn about the physical causes and types of radioactivity, its detection and measurement, its history, its environmental and health effects, its dangers and benefits, and its uses in industry, medicine, consumer products, power generation, and weapons.

This course will impart not only a knowledge of nuclear science and radioactive safety, but also the realization that radioactivity is a natural phenomenon which surrounds us, and its ubiquitous presence (including the isotopes that produce it) stretches back to the beginning of creation. It is noteworthy that alchemists equated Plato's *prima materia* (first matter) of creation with the Philosopher's Stone.

SCOPE AND SEQUENCE

Week 1: Defining Radioactivity, A Brief History, Nuclear vs. Chemical Reactions, Isotopes, Half-Life, Alpha, Beta, Gamma Penetration

Week 2: Properties of Alpha, Beta, Gamma, and Neutron Radiation, How a Geiger Counter and Scintillation Detector Work, Energy and Units of Measurement

Week 3: Nature and Cause of Radioactivity, Decay Chains, Radioactive Minerals, Radioactive Consumer Products

Week 4: Health Physics and Ionizing Radiation, Health Effects of Ionizing Radiation, Time, Distance, Shielding, "The Radioactive Boy Scout," Radium History

Week 5: Fission and Fusion, Criticality, Nuclear Reactors, Nuclear Weapons

CLASS ACTIVITIES

This summer course is intended to be both educational and entertaining. The learning process includes live, laboratory demonstrations of radioactive materials, interactive notes (with plenty of color illustrations), short videos, handouts, and articles.

The homework consists of viewing several videos on the history of nuclear science, reading an article, "The Radioactive Boy Scout," and graphing a Half-Life experiment which uses M&M's or Skittles.

PREREQUISITE KNOWLEDGE

It is recommended that students have a basic familiarity with the Periodic Table of Elements (atomic number, atomic mass, arrangement of elements), basic atomic structure (proton, neutron, electron), and electromagnetic energy. Knowledge of chemistry is a plus, but not required.

REQUIRED RESOURCES

Printed:

- Class Notes
- Worksheets

Equipment:

- Skittles or M&M's
- Parents who are interested in purchasing a radiation detector should contact the instructor.