Unit Test Day

Course Name: Physical Science, Earth Science, Biology	
Unit Title: Radiation in the Human Body	**Day: 15/15**

Relevant NC Standard Course of Study Goal(s):

- PSc.2.1.4 **Interpret the data presented in the Bohr model** diagrams and dot diagrams for **atoms and ions of elements 1 through 18.**
  - Describe the charge, relative mass, and the location of protons, electrons, and neutrons within an atom.
  - Calculate the number of protons, neutrons, electrons, and mass number in neutral atoms and ions.
  - Explain how the different mass numbers of isotopes contributes to the average atomic mass for a given element (conceptual, no calculations).
  - Explain Bohr's model of the atom.
- PSc.2.3.1 Compare nuclear reactions including alpha decay, beta decay, and gamma decay; nuclear fusion and nuclear fission.
  - Compare alpha, beta, and gamma decay processes –alpha decay reduces the mass of an atom by 4 and the atomic number by 2; beta decay increases the atomic number by 1 (a neutron decays into a proton and electron); gamma rays are electromagnetic waves released from the nucleus along with either an alpha or beta particle
  - Compare the processes of fission (splitting of a very large atom) and fusion (joining of atoms) in terms of conditions required for occurrence, energy released, and the nature of products.
- PSc.2.3.2 Exemplify the radioactive decay of unstable nuclei using the concept of half-life.
  - Conceptually explain half-life using models
  - Perform simple half-life calculations based on an isotope's half-life value, time of decay, and/or amount of substance.
- PSc.3.1.1 Explain thermal energy and its transfer.
  - Compare thermal energy, heat, and temperature.
  - Compare conduction, convection, and radiation as methods of energy transfer.

- Bio 1.1.3 Recall that chemical signals may be released by one cell to influence the development and activity of another cell.
- Biol 2.1.1 The input of radiant energy which is converted to chemical energy allows organisms to carry out life processes.
  - Within ecosystems energy flows from the radiant energy of the sun through producers and consumers as chemical energy that is ultimately transformed into heat energy.
- Bio.2.2.1 Infer how human activities (ex. pollution) may impact the environment.
- Bio.2.2.1 Summarize how humans modify ecosystems through population growth, technology, **consumption of resources and production of waste**.
- Bio.3.1.3 Mutations can be random and spontaneous or caused by **radiation and/or chemical exposure**

- EEn.1.1.3 Explain how the sun produces energy which is **transferred to the Earth by radiation.**
  - Compare combustion and nuclear reactions (fusion and fission) on a conceptual

level. Identify fusion as the process that produces radiant energy of stars.
    - Identify the forms of energy (electromagnetic waves) produced by the sun and how some are filtered by the atmosphere (X-rays, cosmic rays, etc.).
    - Summarize how energy flows from the sun to the Earth through space
- EEn.2.2.1 Explain the consequences of human activities on the lithosphere past and present.
    - Explain ways to mitigate detrimental human impacts on the lithosphere and maximize sustainable use of natural resources.
- EEn.2.2.2 Compare the various methods humans use to acquire traditional energy sources (such as peat, coal, oil, natural gas, nuclear fission, and wood).
    - Compare the methods of obtaining energy resources: harvesting (peat and wood), mining (coal and uranium/plutonium), drilling (oil and natural gas) and the effect of these activities on the environment.
- EEn.2.7.3 Explain how human activities impact the biosphere.
    - Summarize ways to mitigate human impact on the biosphere.
- EEn.2.8.1 Evaluate alternative energy technologies for use in North Carolina
    - Critique the benefits, costs and environmental impact of various alternative sources of energy for North Carolina (solar, wind, biofuels, **nuclear fusion**, fuel cells, wave power, geothermal).

Specific Lesson Objectives

Students will understand:

- how energy is transferred from the Sun
- that energy can take different forms
- the scientific use of common words like heat, energy, and temperature
- how electron-electron repulsion and election-proton attraction contributes to the Bohr theory
- how charge is neutralized in an atom
- the relative locations of parts of an atom
- how elements are organized in the periodic table
- the general process of radioactive decay on the atomic level
- how fusion fuels the Sun
- how energy is released in fusion
- the complexity of how each nation uses and harvests energy
- how energy use by nation relates to their daily lives and has differential impacts on the environment
- how different nations' energy use and North Carolina energy use is relative to their daily lives
- the complexity of energy use by region, and the complexity of attempts at mitigation of environmental damage due to harvesting of various types of energy especially at the local level
- the environmental impacts and consequences of different energy uses
- some of the evidence for the multi-faceted arguments against nuclear energy use because of disaster-driven data, and how this data is used by pro and anti-nuclear energy groups
- nuclear power is a highly efficient and "cleaner" energy source in that it does not produce carbon emissions, but there are many controversies over the long-term nuclear waste disposal from these power plants.
- the public perception of radiation on the human body and how the overall levels of radiation in everyday objects contributes to that level

- how radiation might affect the human body

Students will know:

- what radiation means as a scientific process
  - the structure of the atom in accordance with the Bohr theory
  - the components of an element symbol
  - the characteristics of metals and nonmetals
  - what an isotope is and how it differs from an element
  - the difference between fusion and fission
  - the similarities and differences between alpha, beta, and gamma decay
  - Vocabulary Part I (physical science portion)
  - Different energy use data by nation and how these data change by global region/country/etc.
  - the types of energy and how much that energy is used in North Carolina
  - the environmental costs of different types of energy harvesting processes such as drilling, fracking, nuclear power, mining for coal and uranium, etc.
  - the details of the nuclear disaster of the Chernobyl nuclear power plant in Pripyat, Ukraine
  - an overview of how nuclear energy use functions and how uranium is mined to fuel plants
  - the definitions of nuclear waste and the nature of the radioactivity of uranium
  - the standard methods for containing and managing nuclear waste in the United States, which a regional example from North Carolina
  - the various radiation levels of everyday objects
  - sources of radiation

Students will be able to:

- demonstrate their skills and understandings of unit material on the Unit Test

Key Vocabulary/Formulae for this Lesson

- all previous lesson vocabulary: energy, thermal energy, radiant energy, half-life, radiation, convection, conduction, nuclear fusion and fission, mutation, isotope, atom, Geiger counter, cancer, mutagenic, radioactivity, atomic number, proton, electron, nucleus, neutron, electromagnetic wave, chemical energy, radioactive decay, x-ray,

Materials

- printed unit tests (at least two versions to combat cheating)

Technology Needs

- laptop with displayed timer if desired

LESSON ACTIVITIES

Opening (Hook, Warm-Up, Anticipatory Set, Review, etc.)

Describe activity to elicit active involvement of students or refer to previous learning:
Students will complete KWL (Know, Want to Know, Learn) chart on Radiation, filling out only the remaining final column - Learned. (10 min)

Procedure: Include all sections that apply to this lesson; combine as necessary.			
Section	**Time**	**What the Teacher will do:**	**What the Students will do:**
Statement of Objective & Purpose	5 min	Explain the directions for completion of the Unit Test	listen
Input, Modeling, & Check for Understanding	10 min	address last minute clarifying questions from students for a maximum of 10 minutes	independently review notes and ask clarifying questions
	65 min	circulate to address questions and monitor behavior	complete the Unit Test
Assessment of Student Learning			
Comprehensive Unit Test			