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Topic: Energy in the Natural Environment

Course Description:

This course focuses in the investigation of the flow of energy through the natural environment, including the atmosphere, hydrosphere and lithosphere, along with the basic chemical and physical principles needed to understand the concepts introduced.

Course Competencies:

Competencies are divided into required and optional objectives and are grouped for organizational rather than instructional purposes.

Competency 1:

The student will understand that basic methodology of science.

The student will be able to:

(Required objectives)

- Describe the scientific method by differentiating between hypothesis, theory, law and experiment, and by giving examples of each.
- Discuss and describe scientific measurement , including SI units, accuracy, and precision.

(Optional objective)

- Differentiate between fields of study considered to be “science” and those considered to be “non-science.”

Competency 2:

The student will understand basic chemical and physical principles.

The student will be able to:

(Required objectives)

- Define and give examples of different types of potential and kinetic energy, including but not limited to chemical, heat, electromagnetic, nuclear, and mechanical forms of energy.
- Relate the first and second laws of thermodynamics to the flow of energy in the natural environment.
- Describe parts of the atom, including protons, neutrons, and electrons, their relative masses, their charges, and their locations in the atom.
- Recognize some common chemical elements with their symbols and discuss their periodic relationships.
- List the properties of ionic and covalent bonding as they relate to the formation of molecules and compounds.
- Describe the process of nuclear fusion and relate it to production of energy by the sun.
- Describe the process of nuclear fission as it relates to energy production.

Competency 3:

The student will demonstrate comprehension of the structure and composition of the earth, including its atmosphere, oceans and rocks.

The student will be able to:

(Required objectives)

- Describe the structure and composition of the earth's atmosphere.
- Differentiate the major zones of the atmosphere, including the troposphere, stratosphere, mesosphere, and thermosphere.
- Explain the causes of air movement within the troposphere and their influences on global pressure systems, climactic zones, and local weather.
- Describe the hydrologic cycle, both globally and locally, by distinguishing among surface, subsurface, and atmospheric movement of water.
- Relate the surface and subsurface oceanic circulation patterns to atmospheric patterns, the earth's rotational forces, and climactic events.
- Explain the theory of plate tectonics and describe the various types of plate boundaries.
- Describe the movement of energy within and upon the Earth.
- Explain how energy flow interacts with the structure of the Earth's interior.
- Use a map or globe to locate and define: North and South Poles, the Circles lines of latitude and longitude, the Prime Meridian, and the International Dateline, and the Tropic, Temperate, and Arctic Zones.
- Describe the structure, composition, and dynamics of the earth's oceans and seas.

(Optional objectives)

- Discuss current theories on the origin and evolution of the universe and solar systems.
- List the major mineral and hydrological resources and describe some of the problems connected with their use.
- Describe various weather systems.

Competency 4:

The student will understand the movement of energy through the biosphere.

The student will be able to:

(Required objectives)

- Explain trophic level organization by describing the flows of energy through terrestrial and aquatic environments.
- Explain photosynthesis and respiration as they pertain to energy flow through the natural environment.
- Outline the major biogeochemical cycles, including the carbon, nitrogen, and phosphorus cycles.

(Optional objectives)

- Outline at least one scientifically acceptable hypothesis of the origin and evolution of life.
- Discuss the strengths and weaknesses of the Gaian Hypothesis.

Competency 5:

The student will demonstrate knowledge of the effect of population on the Earth's energy resources.

The student will be able to:

(Required objectives)

- Differentiate between and give examples of renewable and non-renewable resources (with emphasis on energy related resources).
- Compare and contrast the strengths and weaknesses of energy sources, including but not limited to fossil fuels, nuclear fission and fusion, hydroelectric, wind, solar, waste conversion, hydrogen, ocean technology, tides, and biomass.
- Describe and give examples of conservation and recycling as a strategy to extend available energy and other natural resources.
- Describe the effects of continued population growth on the world's energy resources.
- Discuss the effects of pollution and resource depletion on the atmosphere, hydrosphere, and lithosphere.

(Optional objectives)

- Describe the changes in the use of energy in the U.S. over the past 200 years.
- Develop a plan to minimize personal energy and material resource use.
- Discuss how science can be used to avoid or resolve environmental problems.