ENVIRONMENTAL EARTH SCIENCE 11

Description

This laboratory-based course will provide students with a solid foundation in Earth Science and will prepare them for entry into the advanced placement program. Topics that will be covered include energy sources and transformations, polymers and their uses, sources and impacts of pollution, preservation of our Earth. Students in this course are capable of handling primary source material for reference and can work independently.

Course Overview

Course Goals

Students will understand that:

- atoms react with one another to form new molecules.
- the electrical force is a universal force that exists between any two charged objects.
- energy cannot be created or destroyed; however, energy can be converted from one form to another.
- various sources of energy are used by humans and all have advantages and disadvantages
- elements on Earth move among reservoirs in the solid earth, oceans, atmosphere and organisms as part of biogeochemical cycles.
- due to its unique chemical structure, carbon forms many organic and inorganic compounds.
- chemical technologies present both risks and benefits to the health and well being of humans, plants and animals.
- some materials can be recycled, but others accumulate in the environment and may affect the balance of the Earth systems.
- the use of resources by human populations may affect the quality of the environment.

Essential Questions

- How is scientific knowledge obtained and communicated?
- How does the structure of matter affect the properties and uses of materials?
- What is the role of energy in our world?
- How do materials cycle through the Earth's systems?
- How do science and technology affect the quality of our lives?

Assessments

Common Assessments

- Crater Lab Investigation
- Cold Pack Investigation
- Solar Cooker Performance Task
- Energy Use in Connecticut STS
- Acid Rain Performance Task
- Connecticut Brownfield Sites STS
- Synthetic Polymer Performance Task
- Synthetic Polymer STS

Content Outline	**Standards**	**Grade Level Skills**
I. Unit 1 - Measurement / Scientific Problem Solving II. Unit 2 - Understanding the Periodic Table III. Unit 3 - Electricity & Magnetism IV. Unit 4 - Energy Sources and Transformations V. Unit 5 - Rocks, Minerals and Nonrenewable Energy Sources VI. Unit 6 - Polymer Use and Solid Waste Management VII. Unit 7 - Air Quality & Climate Change VIII. Unit 8 - Renewable Resources	State of Connecticut Science Curriculum Frameworks Connecticut State Standards are met in the following areas: • ***Scientific Inquiry*** • ***Scientific Literacy*** • ***Scientific Numeracy*** • ***Energy Transformations – Energy Transfer and Transformations*** • ***Energy Transformations - Science and Technology in Society*** • ***Chemical Structures and Properties – Properties of Matter*** • ***Chemical Structures and Properties - Science and Technology in Society*** • ***Global Interdependence – The Changing Earth*** • ***Global Interdependence – Science and Technology in Society*** State of Connecticut Information and Technology Literacy Frameworks Connecticut State Standards in Information and Technology Literacy are met in the following areas: • ***Definition and Identification of information Needs*** • ***Information Strategies*** • ***Responsible Use*** • ***Application*** • ***Technology Use*** • ***Assessment*** • ***Information Processing***	Students will: • formulate a testable hypothesis. • demonstrate logical connections between scientific concepts guiding a hypothesis and experimental design. • present relationships between variables in appropriate formats (table, graph, chart). • make predictions based on observations. • evaluate the credibility and validity of various sources of scientific information. • assess the validity of experimental results based on the design of an experiment. • use scientific information responsibly.

Pacing Guide				
1st Marking Period			2nd Marking Period	
September	October	November	December	January
Unit 1 **Measurement / Scientific Problem Solving** 15 days	**Unit 2** **Understanding the Periodic Table** 15 days	**Unit 3** **Electricity & Magnetism** 20 days	**Unit 4** **Energy Sources and Transformations** 20 days	

3rd Marking Period			4th Marking Period		
January	February	March	April	May	June
Unit 5 **Rocks, Minerals and Nonrenewable Energy Sources** 25 days	**Unit 6** **Polymer Use and Solid Waste Management** 20 Days	**Unit 7** **Air Quality & Climate Change** 20 days	**Unit 8** **Renewable Resources** 15 days		

Unit 1 – Measurement / Scientific Problem Solving, 15 days (18 class periods) top
****REVIEW OF SKILLS MASTERED BY END OF GRADE 8****

Core Science Standards

Scientific Inquiry

- is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena.
- progresses through a continuous process of questioning, data collection, analysis and interpretation.
- requires the sharing of findings and ideas for critical review by colleagues and other scientists.

Scientific Literacy

- includes the ability to read, write, discuss and present coherent ideas about science.
- also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media.

Scientific Numeracy

Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.
Students will:

- identify questions that can be answered through scientific investigation.
- read, interpret and examine the credibility and validity of scientific claims in different sources of information.
- formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.
- design and conduct appropriate types of scientific investigations to answer different questions.
- identify independent and dependent variables, including those that are kept constant and those used as controls.
- assess the reliability of the data that was generated in the investigation.

Unit Objectives

Students will be able to:

- identify metric units of measurements used by scientists.
- use metric prefixes with accuracy.
- complete conversions within the metric system including temperature.
- convert standard notation to scientific notation.

Essential Question

- How is scientific knowledge obtained and communicated?

Focus Questions

- How do scientists measure and report data?
- What processes do scientists use to investigate problems and questions?

Assessments

- Density Lab
- Crater Lab – formal lab report

Skill Objectives

Students will:

- measure mass, volume, length using the metric system.
- determine volume of irregularly shaped

• identify a specific relationship between the independent and dependent variable in a hypothesis. • differentiate between independent variable, dependent variable, variables held constant and controls. • create a replicable procedure. • create proper display(s) of data. • evaluate data and draw valid conclusions supported by that data. • create inferences that relate to lab activities and observations. • describe relationships between variables (direct, inverse).		objects. • calculate density of regular and irregular objects. • represent data correctly using charts and graphs.

Unit 2 – Understanding the Periodic Table, 15 days (18 class periods) top

Core Science Standards

Chemical Structures and Properties – Properties of Matter

Atoms react with one another to form new molecules.

Students will:

- describe the general structure of the atom, and explain how the properties of the first 20 elements in the Periodic Table are related to their atomic structures.
- describe how atoms combine to form new substances by transferring electrons (ionic bonding) or sharing electrons (covalent bonding).

Unit Objectives

Students will be able to:

- identify the major regions in the Periodic table (metals, nonmetals, transition elements, noble gases).
- identify the number of protons, neutrons and electrons for a given element.
- use the periodic table to determine valence electrons and number of electron shells for a given element.
- diagram the major sub-atomic particles and their charges and locations in the atom (proton, neutron, electron).
- explain how the Bohr model of the atom differs from "real atoms".
- define excited and ground state.
- explain how bright line emission spectra are used to identify the elements in various situations.
- relate bright-line emission spectra to excited electrons.
- construct Lewis Dot structures.
- differentiate between atoms and ions.
- define ionic and covalent bonds.
- predict which type of bond will form between two elements based on locations in the Periodic table.
- compare isotopes for given elements.

Essential Question

- How does the structure of matter affect the properties and uses of materials?

Focus Questions

- What are atoms made of?
- What holds atoms together in compounds?
- How do we identify elements?

Assessment

- Cold Pack

Skill Objectives

Students will:

- construct Lewis Dot structures of atoms, ions and compounds using the first 20 elements.
- calculate number of protons, neutrons, electrons and atomic mass using data from the Periodic Table.
- diagram ionic and covalent bonding using Lewis Dot notation.

Unit 3 – Electricity & Magnetism, 20 days (24 class periods) top

Core Science Standards

Energy Transformations

The electrical force is a universal force that exists between any two charged objects.

Students will:

- explain the relationship among voltage, current and resistance in a simple series circuit.
- explain how electricity is used to produce heat and light in incandescent bulbs and heating elements.
- describe the relationship between current and magnetism.

Unit Objectives

Students will be able to:

- identify circuit, conductor, insulator.
- explain how electricity flows (moving electrons go from neg. to pos.).
- explain the effect of resistance in a circuit.
- differentiate between series, parallel and combination circuits.
- relate voltage, current and resistance (Ohm's law).
- explain what causes objects to have magnetic properties.
- relate current and magnetism.
- explain how a generator works.
- explain the function of transformers.

Essential Question

- What is the role of energy in our world?

Focus Questions

- How is electricity produced?
- Where does electricity come from?

Assessment

- Ohm's Law Lab

Skill Objectives

Students will:

- formulate a testable hypothesis.
- demonstrate logical connections between scientific concepts guiding a hypothesis and experimental design.
- construct both series and parallel circuits.

Unit 4 – Energy Sources and Transformations, 20 days (24 class periods) top

Core Science Standards

Energy Transformations - Energy Transfer and Transformations

Energy cannot be created or destroyed; however, energy can be converted from one form to another.

Students will:

- explain how energy is transferred by conduction, convection and radiation.
- describe energy transformations among heat, light, electricity and motion.

Energy Transformations - Science and Technology in Society

Various sources of energy are used by humans and all have advantages and disadvantages.

Students will explain how heat is used to generate electricity.

Unit Objectives

Students will be able to:

- apply the 1st and 2nd laws of energy.
- discuss potential, kinetic, chemical, gravitational, stored mechanical, nuclear, radiant, elastic, thermal, motion and electrical energy.
- differentiate between conduction, convection and radiation.
- trace the energy conversions involved in the production of electricity in power plants (hydroelectric, coal, nuclear, wind generated).
- discuss the efficiency of the process used to produce electricity from non-renewable sources.

Essential Question

- How do science and technology affect the quality of our lives?

Focus Questions

- How is electricity produced?
- How does the production of electricity impact the global society?
- Where does electricity come from?

Assessment

- Take a stance: Research project – choose an energy source for the future and defend your choice

Skill Objectives

Students will:

- use scientific information responsibly.
- define their information needs and identify effective courses of action to conduct research and solve problems.

MID –YEAR EXAM

Unit 5 – Rocks, Minerals and Nonrenewable Energy Sources 25 days (30 class periods) top

Core Science Standards

Global Interdependence – The Changing Earth – non renewable energy

Elements on Earth move among reservoirs in the solid earth, oceans, atmosphere and organisms as part of biogeochemical cycles.

Students will:

- explain how internal energy of the Earth causes matter to cycle through the magma and the solid Earth.
- explain how chemical and physical processes cause carbon to cycle through the major earth reservoirs.
- describe the availability, current uses and environmental issues related to the use of fossil and nuclear fuels to produce electricity.

Chemical Structures and Properties – Properties of Matter

Due to its unique chemical structure, carbon forms many organic and inorganic compounds.

Students will describe combustion reactions of hydrocarbons and their resulting by-products.

Information and Technology Literacy Standards

Definition and Identification of Information Needs

Students will define their information needs and identify effective courses of action to conduct research and solve problems.

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Information Strategies

Students will understand and demonstrate information skills and strategies to locate and effectively use print and non-print resources to solve problems and conduct research.

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Responsible Use

Students will demonstrate the responsible, legal and ethical use of information resources, computers and other technologies.

Students will apply established citation standards for a wide range of information sources and formats.

Application

Students will use appropriate information and technology to create written, visual, oral and multimedia products to communicate ideas, information or conclusions to others.

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Technology Use

Students will operate and use computers and other technologies as tools for productivity, problem solving and learning across the

content areas.
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Assessment
Students will assess the effectiveness of their information and technology choices for problem-solving and communication.
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Information Processing
Students will apply information from a variety of sources and formats using evaluative criteria to interpret, analyze, organize and synthesize both print and non-print material.
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Unit Objectives
Students will be able to:

- differentiate between minerals and rocks.
- differentiate between the three rock groups (igneous, sedimentary, metamorphic).
- explain the processes that form each rock group (including igneous: intrusive/extrusive, metamorphic: foliated/non-foliated and sedimentary: clastic/organic/chemical).
- classify rocks into the three major rock groups.
- explain the carbon and phosphorous cycles.
- define three types of plate boundaries (convergent, divergent, transform).
- discuss history of energy use.
- differentiate between non-renewable resources (coal, natural gas, crude oil, nuclear fuels).
- identify three major fossil fuels (coal, natural gas and crude oil).
- explain the process of mineral extraction

Essential Question

- How do science and technology affect the quality of our lives?

Focus Questions

- What is the difference between a rock and a mineral?
- How are rocks formed?
- Where do coal and oil come from?
- What are the advantages and disadvantages of different types of non-renewable energy sources?

Assessments

- Mineral / Rock Practical
- Nonrenewable Presentations
- MLA image and video citation format
- MLA citation format –print source (see Library Media Specialist (LMS)for help)
- MLA citation format- internet source
- MLA citation format- database source

Skill Objectives
Students will:

- illustrate the rock cycle and its three major driving forces.
- identify locations of each type of plate boundary on a world map.
- create a PowerPoint presentation.
- apply presentation skills to share knowledge about energy sources.
- apply correct MLA format to document resources used for research.

(gold, phosphate and uranium). • explain the process of fossil fuel formation and extraction (types of coal, natural gas, crude oil). • explain the processing of minerals and fossil fuels listed above. • define hydrocarbons. • explain the process of mining and using uranium. • differentiate between fission and fusion reactions. • evaluate advantages and disadvantages of using each of the four types of non-renewable resources.		

Unit 6 – Polymer Use and Solid Waste Management, 20 days (24 class periods) top

Core Science Standards

Chemical Structures and Properties – Properties of Matter

Due to its unique chemical structure, carbon forms many organic and inorganic compounds.

Students will:

- explain how the structure of the carbon atom affects the type of bonds it forms in organic and inorganic molecules.
- explain the general formation and structure of carbon-based polymers, including synthetic polymers, such as polyethylene, and biopolymers, such as carbohydrate.

Chemical Structures and Properties - Science and Technology in Society

Chemical technologies present both risks and benefits to the health and well being of humans, plants and animals.

Students will:

- explain how simple chemical monomers can be combined to create linear, branched and/or cross-linked polymers.
- explain how the chemical structure of polymers affects their physical properties.
- explain the short- and long-term impacts of landfills and incineration of waste materials on the quality of the environment.

Core Science Standards

Global Interdependence – Science and Technology in Society

Some materials can be recycled, but others accumulate in the environment and may affect the balance of the Earth systems.

Students will:

- explain how land development, transportation options and consumption of resources may affect the environment.
- explain how the accumulation of mercury, phosphates and nitrates affects the quality of water and the organisms that live in rivers, lakes and oceans.

Unit Objectives Students will be able to: • differentiate monomers and polymers. • describe how different monomers combine in long chains to form polymers with different physical properties. • describe how polymers are formed into everyday products. • differentiate between linear and cross-linked chains (properties and recyclability). • categorize polymers according to their properties. • evaluate the advantages and disadvantages of using polymers. • define municipal solid waste • explain methods used to decrease solid waste production. • analyze the use of landfills and incineration as disposal methods. • evaluate environmental impact of solid waste disposal on air, land and water.	**Essential Question** • How do science and technology affect the quality of our lives? **Focus Questions** • What are the consequences of making and using plastics? • Where do different types of plastic come from? • Why should we recycle plastic? • What happens to waste materials in landfills?	**Assessment** • Synthetic Polymers (CAPT embedded STS) http://www.state.ct.us/sde/dtl/curriculum/science/s2stspolymerstudent.doc CT Brownfields **Skill Objectives** Students will: • present relationships between variables in appropriate formats (table, graph, chart). • make predictions based on observations.

Unit 7 – Air Quality & Climate Change, 20 days (24 class periods) top

Core Science Standards

Global Interdependence – Science and Technology in Society

The use of resources by human populations may affect the quality of the environment.

Students will:

- explain how the release of sulfur dioxide (SO_2) into the atmosphere can form acid rain, and how acid rain affects water sources, organisms and human made structures.
- explain how the accumulation of carbon dioxide (CO_2) in the atmosphere increases Earth's greenhouse effect and may cause climate change.

Some materials can be recycled, but others accumulate in the environment and may affect the balance of the Earth systems.

Students will describe human efforts to reduce the consumption of raw materials and improve air and water quality.

Chemical Structures and Properties – Properties of Matter

Atoms react with one another to form new molecules.

Students will explain the chemical composition of acids and bases, and explain the change of pH in neutralization reactions.

Unit Objectives

Students will be able to:

- define air quality.
- identify factors that affect air quality.
- explain various techniques for reducing air pollutants, including catalytic converters, scrubbers, filters.
- identify primary and secondary pollutants and sources.
- explain impacts of pollutants on human health.
- explain the role of the carbon cycle in pollution, including possible mitigation measures such as carbon sequestration.
- relate pollutants (CO2, CH4, N2O), global warming and climate change.

Essential Question

- How do science and technology affect the quality of our lives?

Focus Questions

- What causes air pollution?
- What are the impacts of different forms of air pollution on humans and the environment?
- What role does air pollution play in global climate change?

Assessment

- Acid Rain (CAPT embedded performance task) http://www.state.ct.us/sde/dtl/curriculum/science/s3studentlab.doc

Skill Objectives

Students will:

- illustrate and explain the carbon cycle.
- present relationships between variables in appropriate formats (table, graph, chart).
- make predictions based on observations.
- evaluate the credibility and validity of various sources of scientific information.
- assess the validity of experimental results

• identify common acids and bases. • explain causes and effects of acid deposition.		based on the design of an experiment.

Unit 8 – Renewable Resources, 15 days (18 class periods) top

Core Science Standards

Global Interdependence – The Changing Earth

Elements on Earth move among reservoirs in the solid earth, oceans, atmosphere and organisms as part of biogeochemical cycles.

Students will:

- explain how solar energy causes water to cycle through the major earth reservoirs.
- describe the availability, current uses and environmental issues related to the use of hydrogen fuel cells, wind and solar energy to produce electricity.

Energy Transformations - Energy Transfer and Transformations

Energy cannot be created or destroyed; however, energy can be converted from one form to another.

Students will describe the effects of adding energy to matter in terms of the motion of atoms and molecules, and the resulting phase changes.

Information and Technology Literacy Standards

Definition and Identification of Information Needs

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Information Processing
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Unit Objectives
Students will be able to:

- distinguish among types of renewable energy (hydro, solar, wind, biomass, ocean thermal, geothermal, fuel cells, ocean waves, tidal energy).
- explain how each type of renewable energy is used to produce electricity.
- evaluate advantages and disadvantages of using each type of renewable energy.

Essential Question

- How do science and technology affect the quality of our lives?

Focus Questions

- What other types of energy can we use?
- What are the advantages and disadvantages of different types of renewable energy sources?

Assessment

- PowerPoint Presentations
  Solar Cooker (CAPT embedded performance task with STS)
  http://www.state.ct.us/sde/dtl/curriculum/science/s1energylabstudent.doc
  http://www.state.ct.us/sde/dtl/curriculum/science/s1energyoriginalstudent.doc

Skill Objectives
Students will:

- use appropriate information and technology to create visual, oral and multimedia products to communicate ideas, information or conclusions to others.
- evaluate the credibility and validity of various sources of scientific information.
- assess the validity of experimental results based on the design of an experiment.