

<b>DEPARTMENT: SCIENCE</b>	<b>COURSE TITLE: EARTH SCIENCE: UNDERSTANDING ENVIRONMENTAL CHANGE</b>
<b>GRADE(S): 9</b>	<b>COURSE NUMBER: 201</b>
	<b>PRE-REQUISITES (IF ANY): NONE</b>

<b>UNIT</b>	<b>LENGTH</b>	<b>CONTENT</b>	<b>SKILLS</b>	<b>METHODS OF ASSESSMENT</b>	<b>FRAMEWORK STRAND(S) &amp; STANDARD(S)</b>
Introduction	1 week	<ul style="list-style-type: none"> <li>• Introduction to scientific tools for understanding the Earth</li> <li>• Team-building: Orienteering activity</li> <li>• Measurement               <ul style="list-style-type: none"> <li>○ Mass</li> <li>○ Volume                   <ul style="list-style-type: none"> <li>▪ Water displacement</li> </ul> </li> <li>○ Density</li> <li>○ Surface area</li> </ul> </li> <li>• Scientific method – key steps</li> <li>• Map-reading               <ul style="list-style-type: none"> <li>○ Road</li> <li>○ Topographic</li> <li>○ Contour</li> </ul> </li> </ul>	Students will: <ul style="list-style-type: none"> <li>• Follow laboratory safety rules</li> <li>• Select appropriate tools</li> <li>• Use tools to measure correctly</li> <li>• Demonstrate proper use of equipment, including graduated cylinder, balance and compass</li> <li>• Calculate unit conversions: English/metric</li> <li>• Plot and interpret graphs correctly</li> <li>• Recognize and apply symbols</li> <li>• Determine distance, direction and elevation</li> <li>• Find specific locations on a topographic map</li> <li>• Collect data, make predictions, identify sources of error</li> <li>• Take accurate notes</li> <li>• Maintain notebook</li> </ul>	<ul style="list-style-type: none"> <li>• Homework</li> <li>• Notebook</li> <li>• Unit test</li> <li>• Measurement lab</li> <li>• Topographic map exercise</li> <li>• Unit conversion worksheet</li> </ul>	<u>Content:</u> Earth Science 1.8  <u>Inquiry:</u> S1S1, S1S3  <u>Mathematical:</u> Measuring; Converting; Using common prefixes; Use appropriate units

<p>The Geological History of Earth</p>	<p>6 days</p>	<ul style="list-style-type: none"> <li>• Introduction to Earth’s changing landscape</li> <li>• Geologic timetable and Earth history <ul style="list-style-type: none"> <li>○ Virtual field trip: <i>The Case of the Disappearing Ocean</i></li> <li>○ <i>Mystery of the Mega-Flood</i> video</li> </ul> </li> <li>• How Earth has changed over time <ul style="list-style-type: none"> <li>○ Pangaea</li> <li>○ Ice Ages</li> <li>○ Climatic changes, including atmospheric</li> <li>○ Local examples of geologic history of the Pioneer Valley</li> </ul> </li> <li>• Basic geological principles <ul style="list-style-type: none"> <li>○ Superposition</li> <li>○ Original horizontality</li> <li>○ Uniformitarianism</li> </ul> </li> <li>• Evidence supporting the change in Earth over time (<u>Question</u>: How do we <u>know</u> this has happened?) <ul style="list-style-type: none"> <li>○ Plate boundaries</li> <li>○ “Jigsaw” puzzle</li> <li>○ Glacial actions</li> <li>○ Similar rock types &amp; structures within rocks</li> <li>○ Correlation of time periods and geographic findings</li> <li>○ Regions of tectonism (ex. “Ring of Fire”)</li> </ul> </li> <li>• Tools used in examining geologic change <ul style="list-style-type: none"> <li>○ Satellite photos</li> <li>○ Sedimentation rates</li> <li>○ Ground observations</li> <li>○ Radiometric dating</li> </ul> </li> </ul>	<p>Students will:</p> <ul style="list-style-type: none"> <li>• Demonstrate problem-solving ability</li> <li>• Incorporate mathematics to select an appropriate scale</li> <li>• Construct an accurate vertical geological timeline</li> <li>• Understand strategies used by scientists in examining change over time</li> <li>• Understand relative age/dating</li> <li>• Interpret visual diagrams</li> <li>• Collect and analyze data</li> <li>• Model concepts</li> <li>• Take accurate notes</li> <li>• Maintain notebook</li> </ul>	<ul style="list-style-type: none"> <li>• Homework</li> <li>• Notebook</li> <li>• Unit test</li> <li>• Geological timeline</li> <li>• Sedimentation rate lab</li> <li>• Stratigraphic column activity</li> </ul>	<p><u>Content</u>: Earth Science 1.8, 3.7</p> <p><u>Inquiry</u>: S1S1, S1S2, S1S3</p> <p><u>Mathematical</u>: Measure with accuracy and precision; Use tables to interpret data sets</p>
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<p>Mechanics: Agents of Physical Change</p>	<p>2 weeks</p>	<ul style="list-style-type: none"> <li>• Review matter vs. energy; define abiotic</li> <li>• Introduction to agents of physical change <ul style="list-style-type: none"> <li>○ Climate, including temperature</li> <li>○ Weathering and erosion</li> <li>○ Cycles <ul style="list-style-type: none"> <li>▪ Hydrologic cycle</li> <li>▪ Carbon cycles</li> <li>▪ Rock cycle</li> </ul> </li> <li>○ Glaciation</li> <li>○ Volcanos</li> <li>○ Earthquakes</li> <li>○ Tilt of the Earth</li> </ul> </li> </ul>	<p>Students will:</p> <ul style="list-style-type: none"> <li>• Identify several agents of physical change on Earth</li> <li>• Distinguish between renewable and non-renewable resources</li> <li>• Understand the cycling of nutrients in nature</li> <li>• Recognize that interruption of key cycles will have consequences, which can be negative</li> <li>• Record observations</li> <li>• Take accurate notes</li> <li>• Maintain notebook</li> </ul>	<ul style="list-style-type: none"> <li>• Homework</li> <li>• Notebook</li> <li>• Unit test</li> <li>• Rock cycle activity and creating a timeline for a specific rock</li> <li>• Carbon cycle game</li> <li>• Seasons lab</li> </ul>	<p><u>Content:</u>  <u>Earth Science</u>  <u>1.5, 2.1, 2.2, 3.1, 3.5, 3.10</u></p> <p><u>Biology 6.4</u></p> <p><u>Inquiry: S1S1, S1S2</u></p>
<p>The Sun and Solar Energy</p>	<p>4 days</p>	<ul style="list-style-type: none"> <li>• Interactions between atmosphere, hydrosphere, and life on Earth</li> <li>• Solar energy <ul style="list-style-type: none"> <li>○ The electromagnetic spectrum</li> <li>○ UV vs. IR radiation</li> <li>○ The ozone layer</li> </ul> </li> <li>• The Sun as an agent of change <ul style="list-style-type: none"> <li>○ Water movement</li> <li>○ Wind movement</li> <li>○ Transfer of heat <ul style="list-style-type: none"> <li>▪ Conduction</li> <li>▪ Convection</li> <li>▪ Radiation</li> </ul> </li> <li>○ Transfer of energy <ul style="list-style-type: none"> <li>▪ Introduction to trophic/energy cycles</li> </ul> </li> </ul> </li> </ul>	<p>Students will:</p> <ul style="list-style-type: none"> <li>• Perform measurement and calculations</li> <li>• Take accurate notes</li> <li>• Maintain notebook</li> </ul>	<ul style="list-style-type: none"> <li>• Homework</li> <li>• Notebook</li> <li>• Unit test</li> <li>• Convection lab</li> <li>• Solar energy budget activity</li> </ul>	<p><u>Content:</u>  <u>Earth Science</u>  <u>1.1, 1.2, 1.3, 1.4</u></p> <p><u>Inquiry: S1S2</u></p>

Energy Flow and Biotic Factors in the Environment	1 week	<ul style="list-style-type: none"> <li>• Photosynthesis <ul style="list-style-type: none"> <li>○ Equation: raw materials and end-products of photosynthesis</li> <li>○ The Sun as the source of energy for living thing</li> </ul> </li> <li>• Key terms: niche, organism, heterotroph, autotroph, producer, consumer, decomposer <ul style="list-style-type: none"> <li>○ Levels of organization of the Biosphere (organism → Biosphere)</li> </ul> </li> <li>• How producers changed the atmosphere by releasing oxygen</li> <li>• Food chains, pyramids, and webs</li> <li>• 10% rule for energy transfer</li> </ul>	<p>Students will:</p> <ul style="list-style-type: none"> <li>• Understand each component of the chemical equation for photosynthesis</li> <li>• Select an appropriate scale</li> <li>• Plot and interpret graphs accurately</li> <li>• Add to their timelines the appearance of consumers and producers</li> <li>• Analyze trophic levels and construct food webs</li> <li>• Predict the effects on a pyramid of losing the organisms at one trophic level</li> <li>• Understand energy flow through ecosystems</li> <li>• Take accurate notes</li> <li>• Maintain notebook</li> </ul>	<ul style="list-style-type: none"> <li>• Homework</li> <li>• Notebook</li> <li>• Unit test</li> <li>• Construction of food web</li> <li>• Graph food pyramids in one area for three time periods in one year</li> </ul>	<p><u>Content:</u> <u>Biology 2.4, 6.3, 6.4</u></p> <p><u>Mathematical:</u> <u>Construct and interpret graphs;</u> <u>Interpret data sets</u></p>
The Fossil Record and Evidence for Evolution	1 week	<ul style="list-style-type: none"> <li>• Introduction of fossils as evidence of change over time <ul style="list-style-type: none"> <li>○ What is a fossil?</li> <li>○ How, where, and why are they preserved? Why are some organisms not preserved?</li> <li>○ What can be inferred about the environment in which a fossil organism lived?</li> <li>○ What can be learned about change over time by examining fossils?</li> </ul> </li> <li>• Definition of evolution <ul style="list-style-type: none"> <li>○ Key components of Darwin's theory</li> <li>○ Fossils as evidence for evolution</li> <li>○ Paleoclimatology and evolution – ex. forams</li> <li>○ Transitions in the record</li> </ul> </li> <li>• Correlation and dating <ul style="list-style-type: none"> <li>○ Relative dating</li> <li>○ Absolute dating</li> </ul> </li> </ul>	<p>Students will:</p> <ul style="list-style-type: none"> <li>• Interpret graphs and timelines</li> <li>• Interpret diagrams</li> <li>• Examine evidence and interpret it</li> <li>• Distinguish between relative and absolute dating</li> <li>• Explain some knowledge of the past that can be gained from fossils</li> <li>• Take accurate notes</li> <li>• Maintain notebook</li> </ul>	<ul style="list-style-type: none"> <li>• Homework</li> <li>• Notebook</li> <li>• Unit test</li> <li>• Fossil box examination</li> <li>• Gases in atmosphere graph and timelines</li> </ul>	<p><u>Content:</u> <u>Earth Science 3.7</u></p> <p><u>Biology 5.1, 5.3</u></p> <p><u>Inquiry: SIS1</u></p> <p><u>Mathematical:</u> <u>Interpret graphs</u></p>

<p>Mechanics: Agents of Biotic Change</p>	<p>1 week</p>	<ul style="list-style-type: none"> <li>• Relationships and survival <ul style="list-style-type: none"> <li>○ Adaptations with survival value</li> <li>○ Predator/prey relationships</li> <li>○ Competitive relationships</li> <li>○ Symbiotic relationships <ul style="list-style-type: none"> <li>▪ Mutualism <ul style="list-style-type: none"> <li>• The nitrogen cycle</li> </ul> </li> <li>▪ Commensalism</li> <li>▪ Parasitism</li> </ul> </li> </ul> </li> <li>• Endangerment and extinction <ul style="list-style-type: none"> <li>○ Index fossils <ul style="list-style-type: none"> <li>▪ Relate back to Darwin</li> </ul> </li> <li>○ Faunal succession</li> <li>○ Causes of extinction, including climate change</li> <li>○ The Day Earth Almost Died film</li> </ul> </li> </ul>	<p>Students will:</p> <ul style="list-style-type: none"> <li>• Understand that living things are connected with other living things</li> <li>• Recognize that relationships between organisms may be positive, neutral, or negative</li> <li>• Understand that certain adaptations have survival value; and that when these adaptations are not adequate to meet the challenges of the environment, endangerment or extinction may result</li> <li>• Take accurate notes</li> <li>• Maintain notebook</li> </ul>	<ul style="list-style-type: none"> <li>• Homework</li> <li>• Notebook</li> <li>• Unit test</li> <li>• Dating and correlation of assemblages of fossils</li> <li>• Video worksheet on “Wild Survivors”</li> </ul>	<p><u>Content:</u>  <u>Earth Science</u>  <u>3.3, 3.7</u></p> <p><u>Biology 5.1, 6.2, 6.3, 6.4</u></p> <p><u>Inquiry: S1S1</u></p>
<p>Biomes</p>	<p>1 week</p>	<ul style="list-style-type: none"> <li>• Key terms: habitat, climax vegetation</li> <li>• Introduction of biomes as a major regional community, characterized by specific climate and vegetation <ul style="list-style-type: none"> <li>○ Biomes and altitude</li> <li>○ Ocean as the largest biome</li> <li>○ Terrestrial biomes include: desert, rainforest, tundra, taiga, grasslands, deciduous forest</li> </ul> </li> <li>• Identification of where specific biomes exist on Earth</li> </ul>	<p>Students will:</p> <ul style="list-style-type: none"> <li>• Interpret maps</li> <li>• Analyze data</li> <li>• Write an essay on a current topic of environmental change</li> <li>• Take accurate notes</li> <li>• Maintain notebook</li> </ul>	<ul style="list-style-type: none"> <li>• Homework</li> <li>• Notebook</li> <li>• Unit test</li> <li>• Biome map activity</li> </ul>	<p><u>Content:</u>  <u>Biology 6.3</u></p> <p><u>Mathematical:</u>  <u>Interpret data</u></p>

Human Impact	2 weeks	<ul style="list-style-type: none"> <li>• What makes certain areas suitable for life? Ex. oxygen, water, resources, suitable climate</li> <li>• Humans as an agent of change <ul style="list-style-type: none"> <li>○ On the physical environment</li> <li>○ On other living things</li> <li>○ Human impact may be positive, neutral, or negative</li> </ul> </li> <li>• In-depth information on global warming <ul style="list-style-type: none"> <li>○ Causes</li> <li>○ Effects</li> <li>○ Possible solutions</li> </ul> </li> <li>• In-depth information on tropical rainforest <ul style="list-style-type: none"> <li>○ Diversity of the biome</li> <li>○ Characteristic flora and fauna <ul style="list-style-type: none"> <li>▪ Adaptations required for survival in this biome</li> </ul> </li> <li>○ Endangerment of tropical rainforest <ul style="list-style-type: none"> <li>▪ Ecological impact</li> <li>▪ Socioeconomic impact (BAMSS component)</li> </ul> </li> <li>○ Impact on indigenous peoples (BAMSS component)</li> </ul> </li> </ul>	<p>Students will:</p> <ul style="list-style-type: none"> <li>• Perform research</li> <li>• Reference sources correctly</li> <li>• Prepare a visual, oral, and written presentation</li> <li>• Work equitably within a group</li> <li>• Meet required deadlines</li> <li>• Take accurate notes</li> <li>• Maintain notebook</li> </ul>	<ul style="list-style-type: none"> <li>• Homework</li> <li>• Notebook</li> <li>• Rainforest destruction essay</li> <li>• Presentation of final project</li> </ul>	<p><u>Content:</u>  <u>Earth Science</u>  <u>2.1, 2.2</u></p> <p><u>Biology 5.3, 6.2,</u>  <u>6.4</u></p> <p><u>Inquiry: S1S1</u></p>
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