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Unit Title: Air Pollution and Climate Change	Content Area: Science	Grade Level: 9-12
<p>Unit Summary: Students are introduced to the concept of air quality by investigating the composition of the atmospheric layers. Students explore the sources and effects of the criteria air pollutants and how scientists quantify air quality. Students learn the impact of temperature inversions on air pollution concentrations. Students are introduced to the environmental problem of acid deposition, as well as how the type of bedrock influences the effects of acid deposition. Students explore the causes and effects of the Earth's stratospheric ozone depletion and investigate the effect of sunscreen on UV radiation exposure. Using simple models, students study the greenhouse effect, the impact of increased greenhouse gases on the Earth. In this unit, students will demonstrate a proficiency in the following science and engineering practices: asking questions and defining problems; developing and using models; planning and carrying out investigations; analyzing and interpreting data, using mathematics and computational thinking, constructing explanations and designing solutions; engaging in argument from evidence and obtaining, evaluating, and communicating information.</p>		
<p>Unit Essential Questions:</p> <ul style="list-style-type: none"> • How have human activities impacted the atmosphere? • How does the atmosphere interact with/impact Earth's other spheres? • How can air quality be protected for future generations? 	<p>Unit Enduring Understandings:</p>	
<p>Possible Student Misconceptions: The greenhouse effect and global warming are the same phenomenon. Students need to realize that without the greenhouse effect our planet's surface would be about 30 degrees C cooler and with extreme differences in temperature between night and day. Scientists are in agreement that global warming is caused by the anthropogenic increase of greenhouse gases in the atmosphere since the Industrial Revolution, particularly carbon dioxide. Another misconception is that the hole in the ozone layer and atmospheric pollutants, such as aerosols and stratospheric ozone, cause or contribute to global warming. Students often think that the Earth receives heat from the Sun, instead of radiation, and there is confusion between heat and radiation. Students believe the ozone layer shields our planet from the Sun's harmful rays and its heat, and when there is a hole in the ozone layer, the extra heat is allowed in causing the greenhouse effect. Students need to be taught that the energy from the sun mostly reaches us as visible light and ultraviolet radiation and is absorbed by the Earth and radiated as infrared radiation. Students need to be able to distinguish between stratospheric and tropospheric ozone ("Ozone is bad nearby, but good up high"). Ozone and CFC's are greenhouse gases in the troposphere, but ozone depletion in the stratosphere does not cause global warming. Aerosols actually result in a net cooling effect because they contribute to cloud formation which increases the amount of radiation that is reflected.</p>		
<p>NJCCCS: 5.1.12.A.1-A.3, 5.1.12.B.1-B.4, 5.1.12.C.1-C.3, 5.1.12.D.1-D.3, 5.3.12.B.4-B.5, 5.3.12.C.1-C.2, 5.4.12.C.1, 5.4.12.F2-F.3, 5.4.12.G.1-G.7</p>		
<p>NGSS Performance Expectations: <i>Students who demonstrate understanding can...</i></p> <ul style="list-style-type: none"> • HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. • HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.* • HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. [• HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. • HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. 		
<p>Primary CCSS ELA/Literacy Connections:</p> <p>RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6), (HS-LS2-7), (HS-LS2-8)</p> <p>RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-1), (HS-LS2-2), (HS-LS2-6), (HS-LS2-8)</p> <p>RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)</p> <p>RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-6), (HS-LS2-7), (HS-LS2-8)</p> <p>WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS2-1),(HS-LS2-2)</p> <p>WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and</p>	<p>Primary CCSS Mathematics Connections:</p> <p>MP.2 Reason abstractly and quantitatively. (HS-ETS1-1), (HS-ETS1-3), (HS-ETS1-4)</p> <p>MP.4 Model with mathematics. (HS-ETS1-1),(HS-ETS1-2),(HS-ETS1-3),(HS-ETS1-4)</p> <p>HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-6)</p> <p>HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-1), (HS-LS2-2), (HS-LS2-7)</p> <p>HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-1), (HS-LS2-2), (HS-LS2-7)</p> <p>HSS-IC.B.6 Evaluate reports based on data. (HS-LS2-6)</p>	

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<p>audience. (HS-LS4-6) WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7), (HS-LS4-6) RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-1),(HS-ETS1-3)</p>	
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Lesson Pace & Sequence

Lesson Title/Number: Atmospheric Composition and Air Pollution/Lesson 1	Learning Objective(s): Describe the composition, structure and function of Earth's atmosphere. Identify the criteria air pollutants and their sources, distinguishing between primary and secondary air pollutants. Explain how air quality is measured utilizing the Air Quality Index. Explain how a temperature inversion affects air quality. Describe the consequences of poor air quality. Discuss ways to prevent or control air pollution.	Lesson Duration: 200-320 minutes
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Learning Cycle <i>What lesson elements will support students' progress towards mastery of the learning objective(s)?</i> <i>*Elements do not have to be in conducted in sequence.</i>	Learning Activities <i>What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?</i>	Resources/Materials <i>What curricular resources/materials are available to facilitate the implementation of the learning activities?</i>	Science and Engineering Practices <i>What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?</i>	Disciplinary Core Ideas <i>What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?</i>	Crosscutting Concepts <i>What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?</i>
Elicit: How will you access students' prior knowledge?	Provide students with a diagram of the layers of the atmosphere. Ask students to explain why the temperature of the layers increases or decreases depending upon the layer. Students can generate questions about the layers. Air is a global commons. Ask students to explain what this means.	<ul style="list-style-type: none"> Layers of the Atmosphere: http://www.geosociety.org/educate/LessonPlans/Layers_of_Atmosphere.pdf 	Asking Questions and Defining Problems, Developing and Using Models	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	Patterns; Scale, Proportion, and Quantity; Systems and System Models
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Ask students to generate a list of which countries are the top 10 most air polluting countries. Have students provide a reason for their choices. Discuss the Air Quality Index which is from 0-500; how AQI is calculated and how air quality is measured.	<ul style="list-style-type: none"> Top 10 Air Polluting Countries (carbon dioxide): http://www.actionforourplanet.com/#/top-10-polluting-countries/4541684868 Air Quality Index: http://www.airnow.gov/index.cfm?action=aqibasics.aqi 	Using Mathematics and Computational Thinking; Obtaining, Evaluating, and Communicating Information	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	Cause and Effect: Mechanism and Explanation; Scale, Proportion, and Quantity
Explore: What hands-	Particulate Air Pollution	<ul style="list-style-type: none"> Particulate Air Pollution 	Planning and Carrying Out	LS2.C: Ecosystem Dynamics,	Patterns; Cause and Effect:

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<p><i>on/minds-on common experience(s) will you provide for students?</i></p>	<p>Laboratory: How Clean is Your Air?</p>	<p>Laboratory: How Clean is Your Air?: http://toxtown.nlm.nih.gov/ext_version/resources/Unit_2_ToxtownBook_final_508_5-10-2012.pdf</p> <ul style="list-style-type: none"> • Video - Particle Pollution: http://www.epa.gov/airnow/pm/pm.html 	<p>Investigations, Analyzing and Interpreting Data</p>	<p>Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Mechanism and Explanation; Scale, Proportion, and Quantity</p>
<p><i>Explain: How will you help students connect their exploration to the concept/topic under investigation?</i></p>	<p>Mini lesson: Status of Air Quality Standards for Criteria Air Pollutants http://www.state.nj.us/dep/cleanair/hearings/powerpoint/Kelly%20Status%20of%20Air%20Quality%20Standards.ppt</p>	<ul style="list-style-type: none"> • Air Pollution Basics Global Ozone Project: http://go3project.com/network2/curriculum/GO3_Curriculum.pdf 	<p>Obtaining, Evaluating, and Communicating Information</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Patterns; Cause and Effect; Mechanism and Explanation; Scale, Proportion, and Quantity</p>
<p><i>Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?</i></p>	<p>Compare and contrast air pollution case studies or have students generate questions about the case studies: Death smog in Donora, Pennsylvania (http://edhelper.com/ReadingComprehension_54_2020.html), The 1952 Killer Smog of London.</p>	<ul style="list-style-type: none"> • Temperature Inversion Demonstration pp. 67-68: http://www.epa.gov/airnow/workshop_teachers/temperature_inversion.pdf 	<p>Obtaining, Evaluating, and Communicating Information</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Patterns; Cause and Effect; Mechanism and Explanation; Scale, Proportion, and Quantity</p>
<p><i>Evaluate: How will students demonstrate their mastery of the learning objective(s)?</i></p>	<p>Post Quiz, Activity Responses</p>		<p>Analyzing and Interpreting Data; Using Mathematics and Computational Thinking; Obtaining, Evaluating, and Communicating Information</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Patterns; Cause and Effect; Mechanism and Explanation; Scale, Proportion, and Quantity</p>
<p><i>Extend: How will students deepen their conceptual understanding through use in new context?</i></p>	<p>Your City's Car of the Future</p>	<ul style="list-style-type: none"> • Your City's Car of the Future: http://www-tc.pbs.org/wgbh/nova/education/activities/pdf/3507_car_06.pdf • Car of the Future: http://www.pbs.org/wgbh/nova/education/activities/3507_car.html 	<p>Analyzing and Interpreting Data; Using Mathematics and Computational Thinking; Obtaining, Evaluating, and Communicating Information</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Cause and Effect; Mechanism and Explanation; Scale, Proportion, and Quantity</p>

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Lesson Pace & Sequence					
Lesson Title/Number: Acid deposition/Lesson 2		Learning Objective(s): Explain how acid deposition is formed and discuss its consequences and prevention.			Lesson Duration: 160 minutes
Learning Cycle	Learning Activities	Resources/Materials	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<i>What lesson elements will support students' progress towards mastery of the learning objective(s)?</i> <i>*Elements do not have to be in conducted in sequence.</i>	<i>What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)</i>	<i>What curricular resources/materials are available to facilitate the implementation of the learning activities?</i>	<i>What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?</i>	<i>What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?</i>	<i>What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?</i>
Elicit: How will you access students' prior knowledge?	Pre-laboratory Questions S-5 to S-6	<ul style="list-style-type: none"> Carolina Acid Deposition Kit: The Threat From Above: http://www.eganscienceclasses.org/APES%20Acid%20Rain%202011.pdf 	Obtaining, Evaluating and Communicating Information	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	Patterns, Cause and Effect: Mechanism and Explanation
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Demonstration: The Effects of Acid Rain on Human Made Structures S-9	<ul style="list-style-type: none"> Carolina Acid Deposition Kit: The Threat From Above: http://www.eganscienceclasses.org/APES%20Acid%20Rain%202011.pdf 	Analyzing and Interpreting Data, Developing and Using Models	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	Cause and Effect: Mechanism and Explanation; Scale, Proportion, and Quantity; Systems and System Models
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Activity 1 The pH of Unpolluted Rain S-7 Activity 2 The pH of Acid Rain S-8	<ul style="list-style-type: none"> Carolina Acid Deposition Kit: The Threat From Above: http://www.eganscienceclasses.org/APES%20Acid%20Rain%202011.pdf 	Planning and Carrying Out Investigations, Analyzing and Interpreting Data, Using Mathematics and Computational Thinking	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	Cause and Effect: Mechanism and Explanation; Scale, Proportion, and Quantity
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Mini lesson Acid Deposition - Cornell Notes	<ul style="list-style-type: none"> Cornell Note-taking: http://www.usu.edu/arc/idea_sheets/pdf/note_taking_cornell.pdf 	Using Mathematics and Computational Thinking; Obtaining, Evaluating, and Communicating Information	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate	Cause and Effect: Mechanism and Explanation; Scale, Proportion, and Quantity

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				Change	
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Activity 4 The Effect of Bedrock on Acid Rain S-10 to S-14	<ul style="list-style-type: none"> Carolina Acid Deposition Kit: The Threat From Above: http://www.eganscienceclasses.org/APES%20Acid%20Rain%202011.pdf 	Planning and Carrying Out Investigations, Analyzing and Interpreting Data, Using Mathematics and Computational Thinking, Developing and Using Models	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	Cause and Effect: Mechanism and Explanation; Scale, Proportion, and Quantity; Systems and System Models
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Post Quiz, Activity Responses, Laboratory Report		Analyzing and Interpreting Data, Using Mathematics and Computational Thinking	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	Cause and Effect: Mechanism and Explanation; Scale, Proportion, and Quantity
Extend: How will students deepen their conceptual understanding through use in new context?	Compare and contrast acid deposition to ocean acidification	<ul style="list-style-type: none"> Ocean Acidification: http://ocean.nationalgeographic.com/ocean/critical-issues-ocean-acidification/ 	Obtaining, Evaluating and Communicating Information	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	Cause and Effect: Mechanism and Explanation; Scale, Proportion, and Quantity

Lesson Pace & Sequence

Lesson Title/Number: The Hole in the Ozone/Lesson 3		Learning Objective(s): Students can compare and contrast stratospheric and tropospheric ozone. Students can explain the causes and consequences of ozone depletion. Students can describe how the Montreal Protocol successfully prevented ozone depletion.			Lesson Duration: 240-280 minutes
Learning Cycle <i>What lesson elements will support students' progress towards mastery of the learning objective(s)?</i> *Elements do not have to be in conducted in sequence.	Learning Activities <i>What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?</i>	Resources/Materials <i>What curricular resources/materials are available to facilitate the implementation of the learning activities?</i>	Science and Engineering Practices <i>What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?</i>	Disciplinary Core Ideas <i>What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?</i>	Crosscutting Concepts <i>What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?</i>

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<p>Elicit: How will you access students' prior knowledge?</p>	<p>Compare and contrast graphic organizer: Tropospheric and Stratospheric Ozone</p>	<ul style="list-style-type: none"> Compare and Contrast Chart Graphic Organizer: http://www.readwritethink.org/files/resources/lesson_images/lesson275/compcn_chart.pdf 	<p>Developing and Using Models</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Systems and System Models</p>
<p>Engage: How will you capture students' interest and get students' minds focused on the concept/topic?</p>	<p>Chemical Ozone Model Animation; Students generate questions from viewing the animation</p>	<ul style="list-style-type: none"> The Ozone Hole video (5 min): http://ca.pbslearningmedia.org/resource/ess05.sci.ess.watcyc.ozonehole/ozone-hole/ 	<p>Asking Questions and Defining Problems</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Systems and System Models, Stability and Change</p>
<p>Explore: What hands-on/minds-on common experience(s) will you provide for students?</p>	<p>Special Frisbees Detect Ultraviolet Radiation</p>	<ul style="list-style-type: none"> Special Frisbees Detect Ultraviolet Radiation: http://www.ucar.edu/learn/1_6_2_27t.htm Why Worry About Too Much Sun? (UV Frisbee Fun) p. 20: http://www.epa.gov/sunwise/doc/met_kit.pdf 	<p>Planning and Carrying Out Investigations, Analyzing and Interpreting Data, Using Mathematics and Computational Thinking, Developing and Using Models</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Cause and Effect: Mechanism and Prediction; Scale, Proportion and Quantity</p>
<p>Explain: How will you help students connect their exploration to the concept/topic under investigation?</p>	<p>Mini lesson: Inside the Ozone Hole - Cornell Notes</p>	<ul style="list-style-type: none"> Mini lesson: Inside the Ozone Hole - Cornell Notes: Mini lesson: Inside the Ozone Hole - Cornell Notes The Ozone Hole Tour: http://www.atm.ch.cam.ac.uk/tour/index.html 	<p>Obtaining, Evaluating and Communicating Information</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Patterns; Cause and Effect: Mechanism and Prediction; Scale, Proportion and Quantity</p>
<p>Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?</p>	<p>What would have happened to the ozone layer if chlorofluorocarbons (CFCs) had not been regulated?</p>	<ul style="list-style-type: none"> Simulations of Global Ozone: http://www.nasa.gov/topics/earth/features/world_avoided.html 	<p>Obtaining, Evaluating and Communicating Information</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Patterns; Cause and Effect: Mechanism and Prediction; Scale, Proportion and Quantity</p>

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Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Activity Responses, Laboratory Report		Analyzing and Interpreting Data, Using Mathematics and Computational Thinking, Developing and Using Models	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	Cause and Effect: Mechanism and Prediction; Scale, Proportion and Quantity
Extend: How will students deepen their conceptual understanding through use in new context?	Indoor Air Pollution or Sick Building Syndrome: Select one indoor air pollutant; research its sources and its effects	<ul style="list-style-type: none"> I've Gotta Get Some Air: http://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_air/cub_air_lesson09.xml 	Obtaining, Evaluating and Communicating Information	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	Patterns; Cause and Effect: Mechanism and Prediction; Scale, Proportion and Quantity

Lesson Pace & Sequence

Lesson Title/Number: The Greenhouse Effect/Lesson 4		Learning Objective(s): Describe the Greenhouse Effect and explain why it is necessary for life on Earth. Describe greenhouse gases and their sources. Analyze greenhouse gas emissions in the community.			Lesson Duration: 160 minutes
Learning Cycle <i>What lesson elements will support students' progress towards mastery of the learning objective(s)?</i> <i>*Elements do not have to be in conducted in sequence.</i>	Learning Activities <i>What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?</i>	Resources/Materials <i>What curricular resources/materials are available to facilitate the implementation of the learning activities?</i>	Science and Engineering Practices <i>What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?</i>	Disciplinary Core Ideas <i>What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?</i>	Crosscutting Concepts <i>What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?</i>
Elicit: How will you access students' prior knowledge?	KWL Chart	<ul style="list-style-type: none"> KWL Chart: http://www.eduplace.com/graphicorganizer/pdf/kwl.pdf 		LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	

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<p>Engage: How will you capture students' interest and get students' minds focused on the concept/topic?</p>	<p>Diagram of the Greenhouse Effect</p>	<ul style="list-style-type: none"> • Diagram of the Greenhouse Effect: http://www.rsac.co.uk/BN/SC_CDs/cd/edu/images/greenhe.gif • The Greenhouse Effect Video (3.5 minutes): https://www.youtube.com/watch?v=ZzCA60WnoMk 	<p>Developing and Using Models</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Patterns, Cause and Effect: Mechanism and Explanation, Systems and System Models</p>
<p>Explore: What hands-on/minds-on common experience(s) will you provide for students?</p>	<p>The Greenhouse Effect Interactive Simulation</p>	<ul style="list-style-type: none"> • The Greenhouse Effect Interactive Simulation: http://phet.colorado.edu/en/simulation/greenhouse • The Greenhouse Effect Teacher's Guide: http://phet.colorado.edu/files/teachers-guide/greenhouse-guide.pdf 	<p>Developing and Using Models, Using Mathematics and Computational Thinking</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Patterns, Cause and Effect: Mechanism and Explanation, Systems and System Models; Scale, Proportion, and Quantity</p>
<p>Explain: How will you help students connect their exploration to the concept/topic under investigation?</p>	<p>Mini lesson - Climate Change and Carbon Dioxide Global Ozone Project Slide 13+ Cornell Notes</p>	<ul style="list-style-type: none"> • Mini lesson - Climate Change and Carbon Dioxide Global Ozone Project Slide 13+ Cornell Notes: http://go3project.com/network2/curriculum/climate_change_v1.pdf 	<p>Obtaining, Evaluating and Communicating information</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Patterns, Cause and Effect: Mechanism and Explanation</p>
<p>Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?</p>	<p>Mapping Greenhouse Gas Emissions Where You Live</p>	<ul style="list-style-type: none"> • Mapping Greenhouse Gas Emissions Where You Live: http://www.epa.gov/climatestudents/documents/mapping-emissions.pdf 	<p>Using Mathematics and Computational Thinking; Obtaining, Evaluating and Communicating information</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	<p>Patterns; Cause and Effect: Mechanism and Explanation; Scale, Proportion, and Quantity</p>

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Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Post Quiz; Activity Responses		Developing and Using Models; Using Mathematics and Computational Thinking; Obtaining, Evaluating and Communicating information	LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	Patterns; Cause and Effect: Mechanism and Explanation; Systems and System Models, Scale, Proportion, and Quantity
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Lesson Pace & Sequence

Lesson Title/Number: Climate Change/Lesson 5		Learning Objective(s):			Lesson Duration:
Learning Cycle <i>What lesson elements will support students' progress towards mastery of the learning objective(s)?</i> <i>*Elements do not have to be in conducted in sequence.</i>	Learning Activities <i>What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?</i>	Resources/Materials <i>What curricular resources/materials are available to facilitate the implementation of the learning activities?</i>	Science and Engineering Practices <i>What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?</i>	Disciplinary Core Ideas <i>What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?</i>	Crosscutting Concepts <i>What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?</i>
Elicit: How will you access students' prior knowledge?	Pre-Quiz: Climate Change			LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	The Climate Challenge – Our Choices	<ul style="list-style-type: none"> The Climate Challenge – Our Choices: http://www.planetseed.com/relatedarticle/climate-challenge-our-choices Climate Change Challenge: Our Choices: http://www.planetseed.com/files/flash/science/features/earth/climate/en/challenge/index.htm?width=835&height=680&popup=true 		LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change	

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<p>Explain: How will you help students connect their exploration to the concept/topic under investigation?</p>		<ul style="list-style-type: none"> Surging Seas: Sea Level Rise Analysis Interactive: http://sealevel.climatecentral.org/surgingseas/ 		<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	
<p>Extend: How will students deepen their conceptual understanding through use in new context?</p>	<p>National Geographic Video Six Degrees Could Change The World - Have students generate questions as they watch the video. Some individuals feel this documentary utilizes scare tactics. Do you agree or disagree? Support your claim.</p>	<ul style="list-style-type: none"> National Geographic Video Six Degrees Could Change The World: https://www.youtube.com/watch?v=R_pb1G2wloA 		<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS2.D: Weather and Climate, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change</p>	