Winslow Township School District

Environmental Science CP/General

Unit 1: Defining Environmental Science & Earth's Systems

Overview: This unit introduces students to the discipline of environmental science. Grounded in empirical science, environmental science has a wider scope than the traditional sciences because of its interdisciplinary approach to identifying and solving emerging and pressing problems. Students will apply the scientific knowledge and skills they have developed thus far through their study of the biological, chemical, and physical sciences. They will study the impact of human activity in light of current problems such as energy supplies, global climate change, and resource consumption. This course promotes a policy of sustainability in local settings such as the home and school, and at the national and global level. This unit frames science in a political and social light that promotes democratic and active citizenship. Students will learn how environmental policies are developed, with an eye on social justice and activism. Students will be empowered by learning about careers in environmental science in addition to opportunities to take action to solve problems.

Overview	Standards for Science	Unit Focus	Essential Questions
Unit 1 **Defining Environmental Science and Earth's Systems**	• **HS-LS2-4** • **HS-LS2-5** • **HS-ESS1-5** • **HS-ESS1-6** • **HS-ESS2-1 to 7** • **HS-ESS3-5** • **HS-ETS1-1** • **WIDA 1, 4**	• Define environmental science as an interdisciplinary science and relate these disciplines to common environmental issues. • Identify and discuss values and beliefs inherent in environmental decision-making. • Describe the influence of matter and energy cycles on weather, climate, and the environment. • Explain how matter cycles between living systems and the physical environment.	• What is the focus of environmental science? • How do the nonliving parts of Earth's systems provide the basic materials to support life and human societies? • How do the properties and movements of water shape Earth's surface and affect its systems? • How does carbon cycle among the hydrosphere, atmosphere, geosphere, and biosphere?
Unit 1: Enduring Understandings	■ Environmental scientists study how the natural world works, and how humans and the environment affect each other. ■ Both the human population and the consumption of natural resources continue to increase dramatically. ■ Sustainability implies that natural resources are consumed in a way that preserves their supply, as well as environmental health and stable human societies. ■ Scientists monitor environmental health through testing hypotheses, and developing theories ■ Scientists develop ethical solutions to environmental problems that consider benefits and outcomes, as well as the cultures and worldviews of other people. ■ Environmental policies consider scientific evidence, ethics, economics, and politics to solve environmental problems. ■ Earth can be viewed through four interdependent and interacting systems: the hydrosphere, atmosphere, geosphere, and lithosphere. ■ Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. ■ Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust.		

	■ Earth with a hot but solid inner core, a liquid outer core, and a solid mantle and crust. ■ The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. ■ The properties include water's exceptional capacity to absorb, store, and release large amounts of energy; transmit sunlight; expand upon freezing, dissolve and transport materials; and lower the viscosities and melting points of rocks. ■ Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. ■ Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. ■ The total amount of energy and matter in closed systems is conserved. ■ The total amount of carbon cycling among and between the hydrosphere, atmosphere, geosphere, and biosphere is conserved.	

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Curriculum Unit 1	Standards		Pacing	
			Days	Unit Days
Unit 1: **Definining Environmental Science & Earth's Systems**	**HS-LS2-4**	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.	3	46
	HS-LS2-5	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.	3	
	HS-ESS1-5	Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.	4	
	HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.	4	
	HS-ESS2-1	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.	3	
	HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.	3	
	HS-ESS2-3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.	3	
	HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.	3	

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	HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.	4	
	HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.	4	
	HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth systems and life on Earth.	4	
	HS-ESS3-5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.	4	
	HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	2	
	Assessment, Re-teach and Extension		2	

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Disciplinary Core Ideas	**Indicator #**	**Indicator**
LS2.B: Cycles of Matter and Energy Transfer in Ecosystems Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4) Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. (HS-LS2-5) **ESS1.C: The History of Planet Earth** Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old. (HS-ESS1-5) Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history. (HS-ESS1-6) **ESS2.A: Earth Materials and Systems** Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HSESS2-1),(HS-ESS2-2) Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid	**HS-LS2-4**	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
	HS-LS2-5	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
	HS-ESS1-5	Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.
	HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.
	HS-ESS2-1	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
	HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
	HS-ESS2-3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
	HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
	HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
	HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior. (HS-ESS2-3) The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2-4) **ESS2.B: Plate Tectonics and Large-Scale System Interactions** The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection. (HS-ESS2-3) Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust. (HS-ESS2-1) **ESS2.C: The Roles of Water in Earth's Surface Processes** The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (HS-ESS2-5) **ESS2.D: Weather and Climate** The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. (HS-ESS2-2),(HS-ESS2-4)	**HS-ESS2-7**	Construct an argument based on evidence about the simultaneous coevolution of Earth systems and life on Earth.
	HS-ESS3-5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
	HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HS-ESS2-6),(HS-ESS2-7) Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2-6),(HS-ESS2-4) **ESS2.E: Biogeology** The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it. (HS-ESS2-7) **ESS3.D: Global Climate Change** Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. (HS-ESS3-5) **ETS1.A: Defining and Delimiting Engineering Problems** Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1)		

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Assessment Plan	
• Exploratory activities • Warm-up/Ticket Out activities • Class discussions • Student Participation • Teacher Observations • Virtual/Hands-On Labs • Self-Test Assessments • Scientist Timeline Activity • Clinical Case Study Analysis	• Quizzes and Tests • Authentic assessments and projects • Exploratory activities • Presentations • Lecture Notes • Think-Pair-Share • Graphic Organizers • Study Questions at the end of each chapter • Multiple Choice and Critical Thinking at the end of each chapter
Diversity, Equity & Inclusion Educational Resources	**Activities**
•Chromebooks •Textbook ("Genetics: A Conceptual Approach, 6th ed by Benjamin A. Pierce) •Web Quests •Virtual Field Trips •Video Streaming •BrainPOP •Puzzlemaker: Game Based Learning | Discovery Education	• Use various forms of expository writing-procedural writing, narrative writing, descriptive writing, labeling, as well as to create visuals, graphs, tables, diagrams and charts. • Use scientific argumentation with exercises on writing claims, using evidence to support your claim and explaining the reasoning behind their claim. • Mini-lessons • Independent reading • Films • Website exploration • Discussions, dialogues • Debates • Laboratory experiments • Partner or small group work • Student presentations, reports, journals, reflections • In-class assessments • Written reports, essays, research, and homework

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Instructional Best Practices and Exemplars	
1. Identifying similarities and differences 2. Summarizing and note taking 3. Reinforcing effort and providing recognition 4. Homework and practice 5. Nonlinguistic representations	6. Cooperative learning 7. Setting objectives and providing feedback 8. Generating and testing hypotheses 9. Cues, questions, and advance organizers 10. Manage response rates

9.1 Personal Financial Literacy, 9.2 Career Awareness, Exploration, Preparation and Training & 9.4 Life Literacies and Key Skills
9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth. 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection. 9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data. The implementation of the 21st Century skills and standards for students of the Winslow Township District is infused in an interdisciplinary format in a variety of curriculum areas that include, English language Arts, Mathematics, School Guidance, Social Studies, Technology, Visual and Performing Arts, Science, Physical Education and Health, and World Language. Additional opportunities to address 9.1, 9.2 & 9.4: **Philadelphia Mint** https://www.usmint.gov/learn/kids/resources/educational-standards **Different ways to teach Financial Literacy.** https://www.makeuseof.com/tag/10-interactive-financial-websites-teach-kids-money-management-skills/

Modifications for Special Education/504

Students with special needs: The students' needs will be addressed on an individual and grade level using a variety of modalities. Accommodations will be made for those students who need extra time to complete assignment. Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

- Small group instruction
- Audio books/ Text-to-speech platforms
- Leveled texts/Vocabulary Readers
- Leveled informational texts via online
- Modeling and guided practice
- Read directions aloud
- Repeat, rephrase and clarify directions
- Extended time as needed
- Break down assignments into smaller units
- Provide shortened assignments
- Modify testing format
- Repeat directions as needed
- Graphic organizers
- Study Guides, Study Aids and Re teaching as needed

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Modifications for At-Risk Students
Formative and summative data will be used to monitor student success. At first signs of failure, student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations • Audio books and Text-to-speech platforms • Leveled texts/Vocabulary Readers • Leveled informational texts via online • Extended time as needed • Read directions aloud • Assist with organization • Use of computer • Emphasize/highlight key concepts • Recognize success • Provide timelines for work completion • Break down multi-step tasks into smaller chunks • Provide copy of class notes and graphic organizer

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English Language Learners	Modifications for Gifted Students

All WIDA Can Do Descriptors can be found at this link:
https://wida.wisc.edu/teach/can-do/descriptors
Grades 9-12 WIDA Can Do Descriptors...
Listening…
• Process recounts by…
  ○ Categorizing perspectives of multiple speakers
  ○ Identifying important information on specific event & concept from lecture/presentation
• Process explanations by…
  ○ Recognizing specific language used to enhance clarity and precision
  ○ Recognizing and following language related to the same event or phenomenon throughout presentations
• Process arguments by…
  ○ Identifying strengths, limitations, and potential biases from oral presentations
  ○ Organizing claims and counter claims presented in debates
Speaking…
• Recount by…
  ○ Adjusting presentation style, degree of formality, word choice, tone, and information to the context and audience
  ○ Presenting information that follows discipline specific organization (e.g., orientation to topic, sequence of events, conclusion)
• Explain by…
  ○ Providing precision and accuracy in classifications, procedures, processes, and accounts using abstraction, technical language, and a variety of active/passive verb forms
  ○ Following discipline-specific organization (e.g., orienting the reader, details, conclusion) and supporting presentations with graphs, formulas, quotes or other media
• Argue by…
  ○ Organizing claims and counter claims in debates with evidence from multiple sources
  ○ Negotiating differing cultural perspectives in pairs or small groups
Reading…
• Process recounts by…
  ○ Analyzing and comparing how authors use language for specific purposes and audiences
  ○ Identifying how authors develop and maintain cohesion by connecting ideas or events in extended texts
• Process explanations by…
  ○ Recognizing discipline-specific patterns (e.g., orienting the reader, part-whole classification, neutral/ authoritative tone)
  ○
	Students excelling in mastery of standards will be challenged with complex, high level challenges related to the topic.
	• Raise levels of intellectual demands
	• Require higher order thinking, communication, and leadership skills
	• Differentiate content, process, or product according to student's readiness, interests, and/or learning styles
	• Provide higher level texts
	• Expand use of open-ended, abstract questions
	• Critical and creative thinking activities that provide an emphasis on research and in-depth study
	• Enrichment Activities/Project-Based Learning/ Independent Study
	
	Additional Strategies may be located at the links:
	❖ Gifted Programming Standards
	❖ Webb's Depth of Knowledge Levels and/or Revised Bloom's Taxonomy
	❖ REVISED Bloom's Taxonomy Action Verbs

- Identifying authors' precision and accuracy in classifications, comparisons, accounts, or procedures as a result of clear language choices

- Process arguments by…
  - Evaluating word choice and nuance as tools for distinguishing facts, claims, reasoned judgment, and opinions
  - Identifying the logical connections among claims, counterclaims, reasons, and evidence

Writing…

- Recount by…
  - Summarizing content-related notes from lectures or readings
  - Producing research reports using multiple sources of information
- Explain by…
  - Developing ideas about phenomena with relevant and sufficient facts, extended descriptions, concrete details, or quotations
  - Maintaining discipline-specific patterns that bridge across key uses (e.g., explanation to argument in history, explanation to recount for information reports)
- Argue by…
  - Evaluating positive and negative implications associated with various positions (e.g., historical events, scientific discoveries, individuals)
  - Organizing information logically and coherently to represent contrasting views

Oral Language…

- Discuss by…
  - Identifying and reacting to subtle differences in speech and register (e.g., hyperbole, satire, comedy)
  - Producing coherent oral discourse appropriate to task, purpose, and audience
  - Synthesizing and sharing information from a variety of sources and perspectives

Students will be provided with accommodations and modifications that may include:

- Relate to and identify commonalities in Social Studies and science in student's home country
- Assist with organization
- Use of computer
- Emphasize/highlight key concepts
- Teacher Modeling
- Peer Modeling
- Label Classroom Materials - Word Walls

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Interdisciplinary Connections
English Language Arts/Literacy

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. **RST.11-12.1** (HS-LS2-1),(HS-LS2-2),(HS-LS2-6)
2. 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. **RST.11-12.7** (HS-LS2-6)
3. 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. **RST.11-12.8** (HS-LS2-6)
4. 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. **RST.11-12.9** (HS-ETS1-1),(HS-ETS1-3)
5. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. **WHST.9-12.2** (HS-LS2-1),(HS-LS2-2)
6. 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. **WHST.9-12.7** (HS-LS1-3)
7. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. **WHST.11-12.8** (HS-LS1-3)
8. Draw evidence from informational texts to support analysis, reflection, and research. **WHST.9-12.9** (HS-LS1-1)
9. **WIDA Standards 1** English language learners communicate for social and instructional purposes within the school setting
10. **WIDA Standards 4** English language learners communicate information, ideas, and concepts necessary for academic success in the content area of science
11. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. **SL.11-12.5** (HS-LS1-2)

Mathematics

1. Reason abstractly and quantitatively. **MP.2** (HS-LS2-1),(HS-LS2-2),(HS-LS2-6)
2. Model with mathematics. **MP.4 (**HS-LS2-1),(HS-LS2-2)
3. 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**. HSN.Q.A.1** (HS-LS2-1),(HS-LS2-2)
4. Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.2** (HS-LS2-1),(HS-LS2-2)
5. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **HSN.Q.A.3** (HS-LS2-1),(HS-LS2-2)
6. Represent data with plots on the real number line. HSS-ID.A.1 (HS-LS2-6)
7. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **HSS- IC.A.1** (HS-LS2-6)

Integration of Computer Science and Design Thinking NJSLS 8

8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.