Everett SD Framework: AP Environmental Science

CIP Code: 030103	**Total Framework Hours:** 180 Hours
Course: Environmental Studies	**Type:** Exploratory
Career Cluster: Agriculture, Food and Natural Resources	**Date Last Modified:** December 21,2012

Unit 1 INTRODUCTION TO AP ENVIRONMENTAL SCIENCE — Hours: 5

Performance Assessment(s)

Formative assessment about environmental issues

Industry Standards and Competencies

Standard 1: Introduction to AP Environmental Science
- Science is a process.
- Energy conversions underlie all ecological processes.
- The Earth itself is one interconnected system.
- Humans alter natural systems.
- Environmental problems have a cultural and social context.
- Human survival depends on developing practices that will achieve sustainable systems.
- Define the term environment
- Describe natural resources and explain their importance to human life
- Characterize the interdisciplinary nature of environmental science

State Standards Alignment

Arts

Communications

Health and Fitness

Common Core State Standards for Mathematics

MP.2 Reason abstractly and quantitatively (HS.b),(HS.c)
MP.4 Model with mathematics (HS.d)
MP.5 Use appropriate tools strategically (SS.e),(SS.f)
S.ID Summarize, represent, and interpret data on a single count or measurement variable; Summarize, represent, and interpret data on two categorical and quantitative variables (HS.c),(HS.e)
S.IC Make inferences and justify conclusions from sample surveys, experiments, and observational studies (HS.c),(HS.d)

Common Core State Standards (CCSS) for English Language Arts

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (MEOE.d)
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. (MEOE.h)
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. (MEOE.b),(MEOE.f)
SL.9-10.2 Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. (MEOE.b)
WHST.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. (MEOE.e)
SL.9-10.5 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. (MEOE.e)
RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. (MEOE.f),(MEOE.h)
SL.9-10.1c Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. (MEOE.g)

Science

9-11 ES2C: Earth is a system that contains a fixed amount of each stable chemical element existing in different chemical forms. Each element on Earth moves among reservoirs in the solid Earth, oceans, atmosphere, and organisms as part of biogeochemical cycles driven by energy from Earth's interior and from the Sun.
Inquiry (Conducting Analysis and Thinking Logically)
9-12 INQA: Scientists generate and evaluate questions to investigate the natural world.
9-12 INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light

Application (Science, Technology, and Society)
9-12 APPA: Science affects society and cultures by influencing the way many people think about themselves, others, and the environment. Society also affects science by its prevailing views about what is important to study and by deciding what research will be funded.
9-12 APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design.
9-12 APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not.
9-12 APPF: It is important for all citizens to apply science and technology to critical issues that influence society.
Life Science – Ecosystems (Maintenance and Stability of Populations)
9-11 LS2D: Scientists represent ecosystems in the natural world using mathematical models.
9-11 LS2F: The concept of sustainable development supports adoption of policies that enable people to obtain the resources they need today without limiting the ability of future generations to meet their own needs. Sustainable processes include substituting renewable for nonrenewable resources, recycling, and using fewer resources.

Social Studies

21st Century SKILLS

Leadership:
Make Judgments and Decisions
2.A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation
2.C.1 Effectively analyze and evaluate evidence, arguments, claims and beliefs
2.C.2 Analyze and evaluate major alternative points of view
2.C.3 Synthesize and make connections between information and arguments
2.C.4 Interpret information and draw conclusions based on the best analysis
2.C.5 Reflect critically on learning experiences and processes
Be Responsible to Others
11.B.1 Act responsibly with the interests of the larger community in mind
Communicate Clearly
3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts
3.A.2 Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions
3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)
3.A.4 Utilize multiple media and technologies, and know how to judge their effectiveness a priori as well as assess their impact
3.A.5 Communicate effectively in diverse environments (including multi-lingual)
Solve Problems
1.A.1 Use a wide range of idea creation techniques (such as brainstorming)
1.A.2 Create new and worthwhile ideas (both incremental and radical concepts)
1.A.3 Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts
2.D.1 Solve different kinds of non-familiar problems in both conventional and innovative ways
2.D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions

Produce Results
10.B.1 Demonstrate additional attributes associated with producing high quality products including the abilities to:
- 10.B.1.a Work positively and ethically
- 10.B.1.b Manage time and projects effectively
- 10.B.1.c Multi-task
- 10.B.1.d Participate actively, as well as be reliable and punctual
- 10.B.1.e Present oneself professionally and with proper etiquette
- 10.B.1.f Collaborate and cooperate effectively with teams
- 10.B.1.g Respect and appreciate team diversity

10.B.1.h Be accountable for results

Collaborate with Others
3.B.1 Demonstrate ability to work effectively and respectfully with diverse teams
3.B.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
3.B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member

Interact Effectively with Others
9.A.1 Know when it is appropriate to listen and when to speak
9.A.2 Conduct themselves in a respectable, professional manner

Adapt to Change
7.A.1 Adapt to varied roles, jobs responsibilities, schedules and contexts
7.A.2 Work effectively in a climate of ambiguity and changing priorities

Implement Innovations
1.C.1 Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur

Work Effectively in Diverse Teams
9.B.1 Respect cultural differences and work effectively with people from a range of social and cultural backgrounds
9.B.2 Respond open-mindedly to different ideas and values
9.B.3 Leverage social and cultural differences to create new ideas and increase both innovation and quality of work

Guide and Lead Others
11.A.1 Use interpersonal and problem-solving skills to influence and guide others toward a goal
11.A.2 Leverage strengths of others to accomplish a common goal
11.A.3 Inspire others to reach their very best via example and selflessness
11.A.4 Demonstrate integrity and ethical behavior in using influence and power

Work Creatively with Others
1.B.1 Develop, implement and communicate new ideas to others effectively
1.B.2 Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work
1.B.3 Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas
1.B.4 View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes

Employability:

Employability:

Manage Projects
10.A.1 Set and meet goals, even in the face of obstacles and competing pressures
10.A.2 Prioritize, plan and manage work to achieve the intended result

Access and Evaluate Information
4.A.1 Access information efficiently (time) and effectively (sources)
4.A.2 Evaluate information critically and competently
4.B.1 Use information accurately and creatively for the issue or problem at hand
4.B.2 Manage the flow of information from a wide variety of sources
4.B.3 Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information

Use Systems Thinking
2.B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems

Apply Technology Effectively
6.A.1 Use technology as a tool to research, organize, evaluate and communicate information
6.A.2 Use digital technologies (computers, PDAs, media players, GPS, etc.), communication/networking tools and social networks appropriately to access, manage, integrate, evaluate and create information to successfully function in a knowledge economy
6.A.3 Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies

Be Flexible
7.B.1 Incorporate feedback effectively
7.B.2 Deal positively with praise, setbacks and criticism
7.B.3 Understand, negotiate and balance diverse views and beliefs to reach workable solutions, particularly in multi-cultural environments.

☒ **Analytical, Logical & Creative Thinking (check those that students will demonstrate in this lesson):**				
☐ Observe	☒ Cause/Effect	☒ Finding Evidence	☒ Reasoning	☐ Originality
☐ Patterns	☒ Fact/Opinion	☐ Evaluation	☐ Problem Solving	☐ Risking
☐ Sequence	☐ Main Idea	☐ Detect Bias	☐ Goal Setting	☐ Inquisitiveness
☐ Classify	☐ Summary	☐ Inference	☐ Fluency	☐ Attending
☒ Compare/Contrast	☐ Point of View	☐ Conclusion	☐ Elaboration	☐ Persistence
☒ Predict	☐ Analysis	☐ Metacognition	☐ Flexibility	☐ Precision

Unit 2 EARTH SYSTEMS AND RESOURCES — Hours: 20

Performance Assessment(s)

Formative and Summative Assessments based on AP standards
Lab assessments on Soil and Water
Begin long range water quality testing of local watershed.

Industry Standards and Competencies

Standard 2: Earth Systems and Resources
Earth Science Concepts
- Outline the major geologic events that shaped our Earth.
- Outline our knowledge regarding early life and give supporting evidence for each major concept.
- Explain how plate tectonics and the rock cycle shape the landscape around us and the earth beneath our feet

Atmosphere
- Describe the composition, structure and function of Earth's atmosphere
- Describe Earth's climate system and explain the many factors influencing global climate

Global Water Resources and Use
- Explain the importance of water and the hydrologic cycles to ecosystems, human health and economic pursuits
- Define various terms used in water ecology
- Delineate the distribution of fresh water on Earth
- Identify physical, geographical, chemical and biological aspects of the marine environment

Soil and Soil Dynamics
- Explain the importance of soils to agriculture, and describe the impacts of agriculture on soils
- Delineate the fundamentals of soil science, including soil formation and the properties of soil
- State the causes and predict the consequences of soil erosion and soil degradation
- Explain the history and the principles of soil conservation

State Standards Alignment

Arts

Communications

Communication 1.2: Understands, analyzes, synthesizes, or evaluates information from a variety of sources.
1.2.1 Evaluates effectiveness of and creates a personal response to visual and auditory information.
1.2.2 Evaluates the effect of bias and persuasive techniques in mass media.

Health and Fitness

Common Core State Standards for Mathematics

MP.2 Reason abstractly and quantitatively (HS.b),(HS.c)
MP.4 Model with mathematics (HS.d)
MP.5 Use appropriate tools strategically (SS.e),(SS.f)
F.IF Interpret functions that arise in applications in terms of the context (HS.c)
F.BF Build a function that models a relationship between two quantities (HS.c)
F.LE Construct and compare linear, quadratic, and exponential models and solve problems (HS.c)
G.MG Apply geometric concepts in modeling situations (HS.d)
A-CED.1 Create equations that describe numbers or relationships (HS.c)
S.ID Summarize, represent, and interpret data on a single count or measurement variable; Summarize, represent, and interpret data on two categorical and quantitative variables (HS.c),(HS.e)
S.IC Make inferences and justify conclusions from sample surveys, experiments, and observational studies (HS.c),(HS.d)

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SL.9-10.1c Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. (MEOE.g)

Science

Earth and Space Science – Earth Systems, Structures, and Processes
9-11 ES2A: Global climate differences result from the uneven heating of Earth's surface by the Sun. Seasonal climate variations are due to the tilt of Earth's axis with respect to the plane of Earth's nearly circular orbit around the Sun.
9-11 ES2B: Climate is determined by energy transfer from the sun at and near Earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and Earth's rotation, as well as static conditions such as proximity to mountain ranges and the ocean. Human activities, such as burning of fossil fuels, also affect the global climate.
9-11 ES2C: Earth is a system that contains a fixed amount of each stable chemical element existing in different chemical forms. Each element on Earth moves among reservoirs in the solid Earth, oceans, atmosphere, and organisms as part of biogeochemical cycles driven by energy from Earth's interior and from the Sun.
9-11 ES2D: The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources and it depletes those resources that cannot be renewed.
Earth and Space Science – Earth History (Evolution of the Earth)
9-11 ES3A: Interactions among the solid Earth, the oceans, the atmosphere, and organisms have resulted in the ongoing evolution of the Earth system. We can observe changes such as earthquakes and volcanic eruptions on a human time scale, but many processes such as mountain building and plate movements take place over hundreds of millions of years.
9-11 ES3D: Data gathered from a variety of methods have shown that Earth has gone through a number of periods when Earth was much warmer and much colder than today.
Systems (Predictability and Feedback)
9-12 SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible.
9-12 SYSD: Systems can be changing or in equilibrium.

Social Studies

Econ 2.1: Understands that people have to make choices between wants and needs and evaluate the outcomes of those choices.
2.1.1 (9-10) Analyzes how the costs and benefits of economic choices have shaped events in the world in the past or present.
Econ 2.2: Understands how economic systems function.
2.2.1 (11) Understands that nations have competing philosophies about how best to produce, distribute, and consume goods, services, and resources.
Econ 2.4: Understands the economic issues and problems that all societies face.
2.4.1 (9-10) Analyzes and evaluates how people across the world have addressed issues involved with the distribution of resources and sustainability in the past or present.
2.4.1 (11) Analyzes and evaluates how people in the United States have addressed issues involved with the distribution of resources and sustainability in the past or present.
2.4.1 (12) Analyzes and evaluates how individuals affect and are affected by the distribution of resources and sustainability.

21st Century SKILLS

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Make Judgments and Decisions
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10.B.1.f Collaborate and cooperate effectively with teams
10.B.1.g Respect and appreciate team diversity
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Be Flexible
7.B.1 Incorporate feedback effectively
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☒Analytical, Logical & Creative Thinking (check those that students will demonstrate in this lesson):

☐ Observe	☐ Cause/Effect	☒ Finding Evidence	☒☐ Reasoning	☐ Originality
☒Patterns	☐ Fact/Opinion	☒☐ Evaluation	☒☐ Problem Solving	☐ Risking
☒Sequence	☐ Main Idea	☐ Detect Bias	☐ Goal Setting	☐ Inquisitiveness
☐ Classify	☐ Summary	☐ Inference	☐ Fluency	☐ Attending
☐ Compare/Contrast	☐ Point of View	☐ Conclusion	☐ Elaboration	☐ Persistence
☐ Predict	☒ Analysis	☐ Metacognition	☐Flexibility	☐ Precision

Unit 3 THE LIVING WORLD — Hours: 20

Performance Assessment(s)

Case studies on specific organisms affected by climate change.
Worm Composition Lab
Formative / Summative Assessments based on AP standards
Predator / Prey activity

Industry Standards and Competencies

Standard 3: The Living World
Ecosystem Structure
- Distinguish characteristics of a keystone species
- Describe and illustrate the terrestrial and aquatic biomes of the world
- List the levels of ecological organization
- Compare and contrast the major types of species interactions
- Define ecosystems and evaluate how living and nonliving entities interact in ecosystem-level ecology
- Define carrying capacity.
- Discuss why edges (ectones) are traps as it relates to predation.

Energy Flow
- Differentiate among the types of energy and recite the basics of energy flow
- Distinguish photosynthesis, respiration and chemosynthesis and summarize their importance to living things
- Characterize feeding relationships and energy flow, using them to construct trophic levels and food webs
- Define and give an example of the relationship: primary consumer, secondary consumer, food chain

Ecosystem Diversity
- Explain the process of natural selection and cite evidence for this process
- Describe the ways in which evolution results in biodiversity

Natural Ecosystem Change
- Characterize the process of succession and the debate over the nature of communities
- Perceive and predict the potential impacts of invasive species in communities

Natural Biogeochemical Cycles
- Explain the fundamentals of environmental chemistry and apply them to real world situations
- Describe the molecular building blocks of living organisms
- Compare and contrast how carbon, phosphorus, nitrogen and water cycle through the environment

State Standards Alignment

Arts

Communications

Health and Fitness

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SL.9-10.5 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. (MEOE.e)

Science

Life Science – Ecosystems (Maintenance and Stability of Populations)
9-11 LS2A: Matter cycles and energy flows through living and nonliving components in ecosystems. The transfer of matter and energy is important for maintaining the health and sustainability of an ecosystem.
9-11 LS2B: Living organisms have the capacity to produce very large populations. Population density is the number of individuals of a particular population living in a given amount of space.
9-11 LS2C: Population growth is limited by the availability of matter and energy found in resources, the size of the environment, and the presence of competing and/or predatory organisms.
9-11 LS2D: Scientists represent ecosystems in the natural world using mathematical models.
9-11 LS2E: Interrelationships of organisms may generate ecosystems that are stable for hundreds or thousands of years. Biodiversity refers to the different kinds of organisms in specific ecosystems or on the planet as a whole.
9-11 LS2F: The concept of sustainable development supports adoption of policies that enable people to obtain the resources they need today without limiting the ability of future generations to meet their own needs. Sustainable processes include substituting renewable for nonrenewable resources, recycling, and using fewer resources.
Life Science – Biological Evoluation (Mechanisms of Evolution)
9-11 LS3A: Biological evolution is due to: (1) genetic variability of offspring due to mutations and genetic recombination, (2) the potential for a species to increase its numbers, (3) a finite supply of resources, and (4) natural selection by the environment for those offspring better able to survive and produce offspring.
9-11 LS3B: Random changes in the genetic makeup of cells and organisms (mutations) can cause changes in their physical characteristics or behaviors. If the genetic mutations occur in eggs or sperm cells, the changes will be inherited by offspring. While many of these changes will be harmful, a small minority may allow the offspring to better survive and reproduce.
9-11 LS3C: The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled available ecosystem niches on Earth with life forms.
9-11 LS3D: The fossil record and anatomical and molecular similarities observed among diverse species of living organisms provide evidence of biological evolution.
9-11 LS3E: Biological classifications are based on how organisms are related, reflecting their evolutionary history. Scientists infer relationships from physiological traits, genetic information, and the ability of two organisms to produce fertile offspring.
Application (Science, Technology, and Society)
9-12 APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions.
9-12 APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not.
9-11 ES2B: Climate is determined by energy transfer from the sun at and near Earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and Earth's rotation, as well as static conditions such as proximity to mountain ranges and the ocean. Human activities, such as burning of fossil fuels, also affect the global climate.
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Social Studies

21st Century SKILLS

Leadership:
Make Judgments and Decisions
2.A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation
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2.C.2 Analyze and evaluate major alternative points of view
2.C.3 Synthesize and make connections between information and arguments
2.C.4 Interpret information and draw conclusions based on the best analysis
2.C.5 Reflect critically on learning experiences and processes

Be Responsible to Others

11.B.1 Act responsibly with the interests of the larger community in mind

Communicate Clearly

3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts
3.A.2 Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions
3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)
3.A.4 Utilize multiple media and technologies, and know how to judge their effectiveness a priori as well as assess their impact
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Solve Problems

1.A.1 Use a wide range of idea creation techniques (such as brainstorming)
1.A.2 Create new and worthwhile ideas (both incremental and radical concepts)
1.A.3 Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts
2.D.1 Solve different kinds of non-familiar problems in both conventional and innovative ways
2.D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions

Produce Results

10.B.1 Demonstrate additional attributes associated with producing high quality products including the abilities to:
10.B.1.a Work positively and ethically
10.B.1.b Manage time and projects effectively
10.B.1.c Multi-task
10.B.1.d Participate actively, as well as be reliable and punctual
10.B.1.e Present oneself professionally and with proper etiquette
10.B.1.f Collaborate and cooperate effectively with teams
10.B.1.g Respect and appreciate team diversity
10.B.1.h Be accountable for results

Collaborate with Others

3.B.1 Demonstrate ability to work effectively and respectfully with diverse teams
3.B.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
3.B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member

Interact Effectively with Others

9.A.1 Know when it is appropriate to listen and when to speak
9.A.2 Conduct themselves in a respectable, professional manner

Adapt to Change

7.A.1 Adapt to varied roles, jobs responsibilities, schedules and contexts
7.A.2 Work effectively in a climate of ambiguity and changing priorities

Implement Innovations

1.C.1 Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur

Work Effectively in Diverse Teams

9.B.1 Respect cultural differences and work effectively with people from a range of social and cultural backgrounds
9.B.2 Respond open-mindedly to different ideas and values
9.B.3 Leverage social and cultural differences to create new ideas and increase both innovation and quality of work

Guide and Lead Others

11.A.1 Use interpersonal and problem-solving skills to influence and guide others toward a goal
11.A.2 Leverage strengths of others to accomplish a common goal
11.A.3 Inspire others to reach their very best via example and selflessness
11.A.4 Demonstrate integrity and ethical behavior in using influence and power

Work Creatively with Others

1.B.1 Develop, implement and communicate new ideas to others effectively

1.B.2 Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work
1.B.3 Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas
1.B.4 View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes

Employability:

Employability:

Manage Projects
10.A.1 Set and meet goals, even in the face of obstacles and competing pressures
10.A.2 Prioritize, plan and manage work to achieve the intended result

Access and Evaluate Information
4.A.1 Access information efficiently (time) and effectively (sources)
4.A.2 Evaluate information critically and competently
4.B.1 Use information accurately and creatively for the issue or problem at hand
4.B.2 Manage the flow of information from a wide variety of sources
4.B.3 Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information

Use Systems Thinking
2.B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems

Apply Technology Effectively
6.A.1 Use technology as a tool to research, organize, evaluate and communicate information
6.A.2 Use digital technologies (computers, PDAs, media players, GPS, etc.), communication/networking tools and social networks appropriately to access, manage, integrate, evaluate and create information to successfully function in a knowledge economy
6.A.3 Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies

Be Flexible
7.B.1 Incorporate feedback effectively
7.B.2 Deal positively with praise, setbacks and criticism
7.B.3 Understand, negotiate and balance diverse views and beliefs to reach workable solutions, particularly in multi-cultural environments.

☒Analytical, Logical & Creative Thinking (check those that students will demonstrate in this lesson):

☒Observe	☒ Cause/Effect	☐ Finding Evidence	☐ Reasoning	☐ Originality
☒ Patterns	☐ Fact/Opinion	☐ Evaluation	☐ Problem Solving	☐ Risking
☐Sequence	☐ Main Idea	☐ Detect Bias	☐ Goal Setting	☐ Inquisitiveness
☐ Classify	☐ Summary	☐ Inference	☐ Fluency	☐ Attending
☒Compare/Contrast	☐ Point of View	☐ Conclusion	☐ Elaboration	☐ Persistence
☒ Predict	☒ Analysis	☐ Metacognition	☐Flexibility	☐ Precision

Unit 4 POPULATIONS — Hours: 20

Performance Assessment(s)

Analysis of Sustainability case Study
calculate the population density of specific organisms
Analysis of human population growth and it's impact.
Summative Assessment based on AP Standards
population density and biomass lab
Natural Selection Lab
Wildlife camera monitoring

Industry Standards and Competencies

Standard 4: Population
Population Change
- Explain how large populations can be maintained.
- Population density is controlled by limiting factors.
- Outline the characteristics of populations that help predict population growth (use mathematical models of populations)
- Sustainability of a community is dependent on resource use
- Over-consumption—materials use
- K and R selected species
- Discuss reasons for species extinction and mass extinction events
- population growth leads to variety through natural selection

Changes in Human Population
- Assess the scope of human population growth
- Evaluate how human population, affluence and technology affect the environment

Impacts of Human population growth
- Characterize the dimensions of epidemic, such as malaria, HIV/AIDS, current disease migration
- Hunger
- Apply science and technology to issues of population growth

State Standards Alignment

Arts

Communications

Health and Fitness

Common Core State Standards for Mathematics

MP.2 Reason abstractly and quantitatively (HS.b),(HS.c)
MP.4 Model with mathematics (HS.d)
MP.5 Use appropriate tools strategically (SS.e),(SS.f)
F.IF Interpret functions that arise in applications in terms of the context (HS.c)
F.BF Build a function that models a relationship between two quantities (HS.c)
F.LE Construct and compare linear, quadratic, and exponential models and solve problems (HS.c)
G.MG Apply geometric concepts in modeling situations (HS.d)
A-CED.1 Create equations that describe numbers or relationships (HS.c)
S.ID Summarize, represent, and interpret data on a single count or measurement variable; Summarize, represent, and interpret data on two categorical and quantitative variables (HS.c),(HS.e)
S.IC Make inferences and justify conclusions from sample surveys, experiments, and observational studies (HS.c),(HS.d)

Common Core State Standards (CCSS) for English Language Arts

RST.9-10.7 **Translate quantitative or technical information** expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or

mathematically (e.g., in an equation) into words. (MEOE.d)
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. (MEOE.h)
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. (MEOE.b),(MEOE.f)
SL.9-10.2 **Integrate multiple sources of information presented** in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. (MEOE.b)
WHST.9-10.8 **Gather relevant information from multiple authoritative print and digital sources**, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. (MEOE.e)
SL.9-10.5 **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. (MEOE.e)
RST.9-10.9 **Compare and contrast findings presented** in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. (MEOE.f),(MEOE.h)
SL.9-10.1c **Propel conversations by posing and responding to questions** that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. (MEOE.g)

Science

Life Science – Ecosystems (Maintenance and Stability of Populations)
9-11 LS2B: Living organisms have the capacity to produce very large populations. Population density is the number of individuals of a particular population living in a given amount of space.
9-11 LS2C: Population growth is limited by the availability of matter and energy found in resources, the size of the environment, and the presence of competing and/or predatory organisms.
Systems (Predictability and Feedback)
9-12 SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible.
9-12 SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible.
Inquiry (Conducting Analysis and Thinking Logically)
9-12 INQB: Scientific progress requires the use of various methods appropriate for answering different kinds of research questions, a thoughtful plan for gathering data needed to answer the question, and care in collecting, analyzing, and displaying the data.
9-12 INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light
9-12 INQG: Public communication among scientists is an essential aspect of research. Scientists evaluate the validity of one another's investigations, check the reliability of results, and explain inconsistencies in findings
Application (Science, Technology, and Society)
9-12 APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design.
9-12 APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies.
9-12 APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not.
9-12 APPF: It is important for all citizens to apply science and technology to critical issues that influence society.

Social Studies

21st Century SKILLS

Leadership:

Make Judgments and Decisions

2.A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation
2.C.1 Effectively analyze and evaluate evidence, arguments, claims and beliefs
2.C.2 Analyze and evaluate major alternative points of view
2.C.3 Synthesize and make connections between information and arguments

2.C.4 Interpret information and draw conclusions based on the best analysis
2.C.5 Reflect critically on learning experiences and processes
Be Responsible to Others
11.B.1 Act responsibly with the interests of the larger community in mind
Communicate Clearly
3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts
3.A.2 Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions
3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)
3.A.4 Utilize multiple media and technologies, and know how to judge their effectiveness a priori as well as assess their impact
3.A.5 Communicate effectively in diverse environments (including multi-lingual)
Solve Problems
1.A.1 Use a wide range of idea creation techniques (such as brainstorming)
1.A.2 Create new and worthwhile ideas (both incremental and radical concepts)
1.A.3 Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts
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Produce Results
10.B.1 Demonstrate additional attributes associated with producing high quality products including the abilities to:
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10.B.1.c Multi-task
10.B.1.d Participate actively, as well as be reliable and punctual
10.B.1.e Present oneself professionally and with proper etiquette
10.B.1.f Collaborate and cooperate effectively with teams
10.B.1.g Respect and appreciate team diversity
10.B.1.h Be accountable for results
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3.B.1 Demonstrate ability to work effectively and respectfully with diverse teams
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3.B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member
Interact Effectively with Others
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9.A.2 Conduct themselves in a respectable, professional manner
Adapt to Change
7.A.1 Adapt to varied roles, jobs responsibilities, schedules and contexts
7.A.2 Work effectively in a climate of ambiguity and changing priorities

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1.C.1 Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur
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☒ Predict	☒Analysis	☐ Metacognition	☐ Flexibility	☐ Precision

Unit 5 LAND AND WATER USE — Hours: 25

Performance Assessment(s)

Formative and Summative assessments based on AP standards
Evaluation of current public policy
Analysis of the agriculture, timber and fishing industry practices past and present
Presentations making recommendations for future sustainable use.

Industry Standards and Competencies

Standard 5A: Land and Water Use
Land Use for Food Production
- Explain the challenge of feeding a growing human population
- Describe the science behind and evaluate the debate over genetically modified food
- Assess feedlot agriculture for livestock and poultry
- Evaluate sustainable agriculture—corn vs. soybean vs. grass

Land Use for Forestry and Range
- Summarize the ecological roles and economic contributions of forests, and outline the history and scale of forest loss
- Explain the fundamentals of forest management and describe the major methods of harvesting timber
- Analyze the scale and impacts of agricultural land use (rangeland)
- Identify major federal land management agencies and the lands they manage
- List 5 site classes found in forest succession and give one advantage and one disadvantage of each size class for wildlife as it relates to the needs of wildlife (particularly food, shelter and protection)

Non-Agricultural Land and Water Use
- Recognize the types of parks and reserves and evaluate issues involved in their design
- Assess urban and suburban sprawl
- Describe the three characteristics required to identify a wetland.
- Discuss how we use water and alter freshwater systems
- Assess problems of water supply and propose solutions to address depletion of fresh water
- Describe why food, water and cover are important to wildlife.
- Describe and give an example of shelter and protection.

Standard 5B: Land and Water Use (Forestry, Mining, Fishing, Global Economics)
- Compare and contrast the role and purpose of the National Parks Service and the Forest Service
- Explain policy differences between the various land, forest, and natural resource management agencies.
- Describe the Forest Practices Regulations and how they are managed within the government.
- Explain the structure of the government that directs various natural resources related agencies.
- Explain which agency originally controlled the public domain and which group owns over the commercial forest land in the United States.
- Describe the role, philosophy and legacy of various important individuals on American forest.

Mining
- Evaluate a mining proposal for environmental and economic cost vs. benefit analysis.

Fishing
- Weigh approaches in aquaculture Outline historic and current human uses of marine resources
- Review the current state of ocean fisheries and reasons for their decline

Global Economics
- Discuss how protecting the environment can be compatible with promoting economic welfare

State Standards Alignment

Arts

Communications

Health and Fitness

Common Core State Standards for Mathematics

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MP.4 Model with mathematics (HS.d)
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Science

9-11 ES2D: The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources and it depletes those resources that cannot be renewed.
Application (Science, Technology, and Society)
9-12 APPA: Science affects society and cultures by influencing the way many people think about themselves, others, and the environment. Society also affects science by its prevailing views about what is important to study and by deciding what research will be funded.
9-12 APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions.
9-12 APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design.
9-12 APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies.
Earth and Space Science – Earth Systems, Structures, and Processes
9-11 ES2C: Earth is a system that contains a fixed amount of each stable chemical element existing in different chemical forms. Each element on Earth moves among reservoirs in the solid Earth, oceans, atmosphere, and organisms as part of biogeochemical cycles driven by energy from Earth's interior and from the Sun.
9-11 ES2D: The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources and it depletes those resources that cannot be renewed.
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4.B.3 Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information

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2.B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems

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6.A.1 Use technology as a tool to research, organize, evaluate and communicate information

6.A.2 Use digital technologies (computers, PDAs, media players, GPS, etc.), communication/networking tools and social networks appropriately to access, manage, integrate, evaluate and create information to successfully function in a knowledge economy

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Be Flexible

7.B.1 Incorporate feedback effectively

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☐ Classify	☐ Summary	☒ Inference	☐ Fluency	☐ Attending
☒ Compare/Contrast	☒Point of View	☒ Conclusion	☐ Elaboration	☐ Persistence
☐ Predict	☐ Analysis	☒ Metacognition	☐Flexibility	☐ Precision

Unit 6 ENERGY RESOURCES AND CONSUMPTION — Hours: 20

Performance Assessment(s)

Calculate a personal energy audit.
Interpret a monthly energy bill.
Summative assessment based on AP standards
Analysis of the Alberta Tar Sands
Presentations regarding future energy production.

Industry Standards and Competencies

Standard 6: Energy Resources and Consumption
Energy Concepts
- Identify the energy sources that we use

Non-Renewable Energy: Coal, Propane, Petroleum, Natural Gas, Nuclear
- Evaluate the nature, origin and potential of non-renewable energy including advantages and disadvantages
- Describe the nature and origin of all non-renewable resources and evaluate their extraction, use and future depletion
- Outline the societal debate over non-renewable energy sources
- Evaluate political, social and economic impacts of fossil fuel use
- Describe nuclear energy and how it is harnessed
- Outline the societal debate over nuclear power

Renewable Energy: Biomass, Solar, Hydro, Geothermal, Wind
- Evaluate the nature, origin and potential of renewable energy sources including advantages and disadvantages.
- Discuss the reasons for seeking energy alternatives to fossil fuels
- Summarize the contributions to world energy supplies of conventional alternatives to fossil fuels
- Describe other energy sources and the ways they could be harnessed (ocean energy, hydrogen fuel cells and future options for energy and transportation.

Energy Conservation
- Specify strategies for conserving energy and enhancing efficiency

State Standards Alignment

Arts

Communications

Health and Fitness

Common Core State Standards for Mathematics

MP.2 Reason abstractly and quantitatively (HS.b),(HS.c)
MP.4 Model with mathematics (HS.d)
MP.5 Use appropriate tools strategically (SS.e),(SS.f)
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S.ID Summarize, represent, and interpret data on a single count or measurement variable; Summarize, represent, and interpret data on two categorical and quantitative variables (HS.c),(HS.e)
S.IC Make inferences and justify conclusions from sample surveys, experiments, and observational studies (HS.c),(HS.d)

Common Core State Standards (CCSS) for English Language Arts

W.9-10.7 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.b),(HS.f),(HS.g)
W.9-10.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. (HS.a),(HS.f), (HS. g)
W.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (HS.f),(HS.g)
WHST.9-10.1 Write arguments focused on discipline-specific content. (HS.a),(HS.f),(HS.g)
SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data (HS.b),(HS.d),(HS.e)

Science

Life Science – Ecosystems (Maintenance and Stability of Populations)
9-11 LS2F: The concept of sustainable development supports adoption of policies that enable people to obtain the resources they need today without limiting the ability of future generations to meet their own needs. Sustainable processes include substituting renewable for nonrenewable resources, recycling, and using fewer resources.
Earth and Space Science – Earth Systems, Structures, and Processes
9-11 ES2C: Earth is a system that contains a fixed amount of each stable chemical element existing in different chemical forms. Each element on Earth moves among reservoirs in the solid Earth, oceans, atmosphere, and organisms as part of biogeochemical cycles driven by energy from Earth's interior and from the Sun.
9-11 ES2D: The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources and it depletes those resources that cannot be renewed.
Application (Science, Technology, and Society)
9-12 APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies.
9-12 APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not.
9-12 APPF: It is important for all citizens to apply science and technology to critical issues that influence society.
9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces.
Physical Science – Matter Properties and Change (Chemical Reactions)
9-11 PS2F: All forms of life are composed of large molecules that contain carbon. Carbon atoms bond to one another and other elements by sharing electrons, forming covalent bonds. Stable molecules of carbon have four covalent bonds per carbon atom.
9-11 PS2K: Nuclear reactions convert matter into energy, releasing large amounts of energy compared with chemical reactions. Fission is the splitting of a large nucleus into smaller pieces. Fusion is the joining of nuclei and is the process that generates energy in the Sun and other stars.
Systems (Predictability and Feedback)
9-12 SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system.
9-12 SYSB: Systems thinking can be especially useful in analyzing

Social Studies

21st Century SKILLS

Leadership:
Make Judgments and Decisions
2.A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation
2.C.1 Effectively analyze and evaluate evidence, arguments, claims and beliefs
2.C.2 Analyze and evaluate major alternative points of view
2.C.3 Synthesize and make connections between information and arguments
2.C.4 Interpret information and draw conclusions based on the best analysis
2.C.5 Reflect critically on learning experiences and processes
Be Responsible to Others
11.B.1 Act responsibly with the interests of the larger community in mind
Communicate Clearly
3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts
3.A.2 Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions
3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)
3.A.4 Utilize multiple media and technologies, and know how to judge their effectiveness a priori as well as assess their impact
3.A.5 Communicate effectively in diverse environments (including multi-lingual)
Solve Problems
1.A.1 Use a wide range of idea creation techniques (such as brainstorming)
1.A.2 Create new and worthwhile ideas (both incremental and radical concepts)
1.A.3 Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts
2.D.1 Solve different kinds of non-familiar problems in both conventional and innovative ways

2.D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions

Produce Results

10.B.1 Demonstrate additional attributes associated with producing high quality products including the abilities to:

- 10.B.1.a Work positively and ethically
- 10.B.1.b Manage time and projects effectively
- 10.B.1.c Multi-task
- 10.B.1.d Participate actively, as well as be reliable and punctual
- 10.B.1.e Present oneself professionally and with proper etiquette
- 10.B.1.f Collaborate and cooperate effectively with teams
- 10.B.1.g Respect and appreciate team diversity

10.B.1.h Be accountable for results

Collaborate with Others

3.B.1 Demonstrate ability to work effectively and respectfully with diverse teams

3.B.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal

3.B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member

Interact Effectively with Others

9.A.1 Know when it is appropriate to listen and when to speak

9.A.2 Conduct themselves in a respectable, professional manner

Adapt to Change

7.A.1 Adapt to varied roles, jobs responsibilities, schedules and contexts

7.A.2 Work effectively in a climate of ambiguity and changing priorities

Implement Innovations

1.C.1 Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur

Work Effectively in Diverse Teams

9.B.1 Respect cultural differences and work effectively with people from a range of social and cultural backgrounds

9.B.2 Respond open-mindedly to different ideas and values

9.B.3 Leverage social and cultural differences to create new ideas and increase both innovation and quality of work

Guide and Lead Others

11.A.1 Use interpersonal and problem-solving skills to influence and guide others toward a goal

11.A.2 Leverage strengths of others to accomplish a common goal

11.A.3 Inspire others to reach their very best via example and selflessness

11.A.4 Demonstrate integrity and ethical behavior in using influence and power

Work Creatively with Others

1.B.1 Develop, implement and communicate new ideas to others effectively

1.B.2 Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work

1.B.3 Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas

1.B.4 View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes

Employability:

Manage Projects
10.A.1 Set and meet goals, even in the face of obstacles and competing pressures
10.A.2 Prioritize, plan and manage work to achieve the intended result

Access and Evaluate Information

4.A.1 Access information efficiently (time) and effectively (sources)
4.A.2 Evaluate information critically and competently
4.B.1 Use information accurately and creatively for the issue or problem at hand
4.B.2 Manage the flow of information from a wide variety of sources
4.B.3 Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information

Use Systems Thinking
2.B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems

Apply Technology Effectively
6.A.1 Use technology as a tool to research, organize, evaluate and communicate information
6.A.2 Use digital technologies (computers, PDAs, media players, GPS, etc.), communication/networking tools and social networks appropriately to access, manage, integrate, evaluate and create information to successfully function in a knowledge economy
6.A.3 Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies

Be Flexible
7.B.1 Incorporate feedback effectively
7.B.2 Deal positively with praise, setbacks and criticism
7.B.3 Understand, negotiate and balance diverse views and beliefs to reach workable solutions, particularly in multi-cultural environments.

☒**Analytical, Logical & Creative Thinking (check those that students will demonstrate in this lesson):**				
☐ Observe	☐ Cause/Effect	☒Finding Evidence	☒Reasoning	☒ Originality
☐ Patterns	☒Fact/Opinion	☒Evaluation	☐ Problem Solving	☒ Risking
☐Sequence	☐ Main Idea	☒Detect Bias	☐ Goal Setting	☒ Inquisitiveness
☒Classify	☒ Summary	☐ Inference	☐ Fluency	☐ Attending
☒Compare/Contrast	☒ Point of View	☐ Conclusion	☒Elaboration	☐ Persistence
☐ Predict	☐ Analysis	☐ Metacognition	☐Flexibility	☐ Precision

Unit 7 POLLUTION — Hours: 25

Performance Assessment(s)

Testing for air pollution lab
Stream and water quality testing lab
Communicate results and make recommendations based on data
Summative assessment based on AP standards

Industry Standards and Competencies

Standard 7: Pollution
Pollution Types
- Describe the types, abundance, distribution and movement of toxicants in the environment
- Summarize and compare the types of waste we generate
- List the major approaches to managing waste
- Describe conventional waste disposal methods: landfills and incineration
- Evaluate approaches for reducing waste: source reduction, reuse, composting and recycling
- Discuss industrial solid waste management and principles of industrial ecology
- Assess problems of water quality and propose solutions to address water pollution
- Explain how wastewater is treated
- Outline the scope of outdoor air pollution and assess potential solutions
- Characterized the scope of indoor air pollution and assess potential solutions

Impacts on the Environment and Human Health
- Identify the major types of environmental health hazards and explain the goals of environmental health
- Discuss the study of hazards and their effects, including case histories, epidemiology, animal testing and dose-response analysis
- Assess risk assessment and risk management and compare philosophical approaches to risk
- Assess issues in managing hazardous waste

Economic Impact
- Describe policy and regulation in the United States and internationally
- Compare the concepts of economic growth, economic health and sustainability
- Explain the fundaments of environmental economics and ecological economics
- Describe environmental policy and assess its societal context
- Identify the institutions important to US environmental policy and recognize major US environmental laws
- List the institutions involved with international environmental policy and describe how nations handle transboundary issues
- Pollution Reduction Measures (carbon sinks, green roof, porous concrete)

State Standards Alignment

Arts

Communications

Communication 1.2: Understands, analyzes, synthesizes, or evaluates information from a variety of sources.
Communication 3.1: Uses knowledge of topic/theme, audience, and purpose to plan presentations.
Communication 3.2: Uses media and other resources to support presentations.
Communication 3.3: Uses effective delivery.

Health and Fitness

Common Core State Standards for Mathematics

MP.2 Reason abstractly and quantitatively (HS.b),(HS.c)
MP.4 Model with mathematics (HS.d)
MP.5 Use appropriate tools strategically (SS.e),(SS.f)
F.IF Interpret functions that arise in applications in terms of the context (HS.c)
S.ID Summarize, represent, and interpret data on a single count or measurement variable; Summarize, represent, and interpret data on two categorical and quantitative variables (HS.c),(HS.e)

S.IC Make inferences and justify conclusions from sample surveys, experiments, and observational studies (HS.c),(HS.d)

Common Core State Standards (CCSS) for English Language Arts

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (MEOE.d)
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. (MEOE.h)
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. (MEOE.b),(MEOE.f)
SL.9-10.2 Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. (MEOE.b)
WHST.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. (MEOE.e)
SL.9-10.5 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. (MEOE.e)
RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. (MEOE.f),(MEOE.h)
SL.9-10.1c Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. (MEOE.g)

Science

Systems (Predictability and Feedback)
9-12 SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible.
9-12 SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible.
9-12 SYSD: Systems can be changing or in equilibrium.
Application (Science, Technology, and Society)
9-12 APPA: Science affects society and cultures by influencing the way many people think about themselves, others, and the environment. Society also affects science by its prevailing views about what is important to study and by deciding what research will be funded.
9-12 APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design.
9-12 APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies.
9-12 APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not.
9-12 APPF: It is important for all citizens to apply science and technology to critical issues that influence society.

Social Studies

Econ 2.1: Understands that people have to make choices between wants and needs and evaluate the outcomes of those choices.
2.1.1 (9-10) Analyzes how the costs and benefits of economic choices have shaped events in the world in the past or present.
Econ 2.4: Understands the economic issues and problems that all societies face.
2.4.1 (9-10) Analyzes and evaluates how people across the world have addressed issues involved with the distribution of resources and sustainability in the past or present.
2.4.1 (11) Analyzes and evaluates how people in the United States have addressed issues involved with the distribution of resources and sustainability in the past or present.
2.4.1 (12) Analyzes and evaluates how individuals affect and are affected by the distribution of resources and sustainability.

21st Century SKILLS

Leadership:
Make Judgments and Decisions
2.A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation
2.C.1 Effectively analyze and evaluate evidence, arguments, claims and beliefs
2.C.2 Analyze and evaluate major alternative points of view
2.C.3 Synthesize and make connections between information and arguments
2.C.4 Interpret information and draw conclusions based on the best analysis
2.C.5 Reflect critically on learning experiences and processes

Be Responsible to Others
11.B.1 Act responsibly with the interests of the larger community in mind
Communicate Clearly
3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts
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3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)
3.A.4 Utilize multiple media and technologies, and know how to judge their effectiveness a priori as well as assess their impact
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Solve Problems
1.A.1 Use a wide range of idea creation techniques (such as brainstorming)
1.A.2 Create new and worthwhile ideas (both incremental and radical concepts)
1.A.3 Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts
2.D.1 Solve different kinds of non-familiar problems in both conventional and innovative ways
2.D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions
Produce Results
10.B.1 Demonstrate additional attributes associated with producing high quality products including the abilities to:
- 10.B.1.a Work positively and ethically
- 10.B.1.b Manage time and projects effectively
- 10.B.1.c Multi-task
- 10.B.1.d Participate actively, as well as be reliable and punctual
- 10.B.1.e Present oneself professionally and with proper etiquette
- 10.B.1.f Collaborate and cooperate effectively with teams
- 10.B.1.g Respect and appreciate team diversity

10.B.1.h Be accountable for results
Collaborate with Others
3.B.1 Demonstrate ability to work effectively and respectfully with diverse teams
3.B.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
3.B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member
Interact Effectively with Others
9.A.1 Know when it is appropriate to listen and when to speak
9.A.2 Conduct themselves in a respectable, professional manner
Adapt to Change
7.A.1 Adapt to varied roles, jobs responsibilities, schedules and contexts
7.A.2 Work effectively in a climate of ambiguity and changing priorities

Implement Innovations
1.C.1 Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur
Work Effectively in Diverse Teams
9.B.1 Respect cultural differences and work effectively with people from a range of social and cultural backgrounds
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Guide and Lead Others
11.A.1 Use interpersonal and problem-solving skills to influence and guide others toward a goal
11.A.2 Leverage strengths of others to accomplish a common goal
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11.A.4 Demonstrate integrity and ethical behavior in using influence and power
Work Creatively with Others
1.B.1 Develop, implement and communicate new ideas to others effectively
1.B.2 Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work
1.B.3 Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas
1.B.4 View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes

Employability:

Employability:

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Use Systems Thinking
2.B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems

Apply Technology Effectively
6.A.1 Use technology as a tool to research, organize, evaluate and communicate information
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7.B.1 Incorporate feedback effectively
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☒**Analytical, Logical & Creative Thinking (check those that students will demonstrate in this lesson):**				
☐ Observe	☒ Cause/Effect	☐ Finding Evidence	☒ Reasoning	☐ Originality
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☒ Classify	☒ Summary	☐ Inference	☐ Fluency	☐ Attending
☒ Compare/Contrast	☐ Point of View	☐ Conclusion	☐ Elaboration	☐ Persistence
☐ Predict	☐ Analysis	☐ Metacognition	☐ Flexibility	☐ Precision

Unit 8 GLOBAL CHANGE — Hours: 20

Performance Assessment(s)

Calculate personal carbon footprints
Formative and Summative assessments based on AP standards
Design a program that lessens human impact, yet maintains quality of life.

Industry Standards and Competencies

Standard 8: Global Change
Stratospheric Ozone
- Explain stratospheric ozone depletion and identity steps taken to address it
- Characterize human influences on the atmosphere and global climate

Global Warming
- Diagnose and illustrate some of the pressures on the global environment

Loss of Biodiversity
- Characterize the scope and benefits of biodiversity on Earth
- Contrast background extinction rates with periods of mass extinction
- Evaluate the primary causes of biodiversity loss and impact of invasive species
- Assess conservation biology practices and analyze traditional
- and innovative biodiversity conservation efforts
- Explain loss of Biodiversity in Water Systems including
- Acidification, Nitrification, and supply demands
- Describe the importance of the Endangered Species Act.

Sustainability
- Explain the concept of sustainable development
- Describe and assess key approaches to designing sustainable solutions
- Evaluate the concepts of sustainability and sustainable development
- Define and give examples of a Habitat Conservation Plan.

State Standards Alignment

Arts

Communications

Communication 1.1: Uses listening and observation skills and strategies to focus attention and interpret information.
Communication 1.2: Understands, analyzes, synthesizes, or evaluates information from a variety of sources.
Communication 2.1: Uses language to interact effectively and responsibly in a multicultural context.
Communication 2.2: Uses interpersonal skills and strategies in a multicultural context to work collaboratively, solve problems, and perform tasks.

Health and Fitness

Common Core State Standards for Mathematics

MP.2 **Reason** abstractly and quantitatively (HS.b),(HS.c)
MP.4 **Model** with mathematics (HS.d)
MP.5 Use **appropriate tools** strategically (SS.e),(SS.f)
S.ID **Summarize, represent, and interpret data** on a single count or measurement variable; Summarize, represent, and interpret data on two categorical and quantitative variables (HS.c),(HS.e)
S.IC **Make inferences and justify conclusions** from sample surveys, experiments, and observational studies (HS.c),(HS.d)

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Science

Earth and Space Science – Earth Systems, Structures, and Processes
9-11 ES2A: Global climate differences result from the uneven heating of Earth's surface by the Sun. Seasonal climate variations are due to the tilt of Earth's axis with respect to the plane of Earth's nearly circular orbit around the Sun.
9-11 ES2B: Climate is determined by energy transfer from the sun at and near Earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and Earth's rotation, as well as static conditions such as proximity to mountain ranges and the ocean. Human activities, such as burning of fossil fuels, also affect the global climate.
9-11 ES2C: Earth is a system that contains a fixed amount of each stable chemical element existing in different chemical forms. Each element on Earth moves among reservoirs in the solid Earth, oceans, atmosphere, and organisms as part of biogeochemical cycles driven by energy from Earth's interior and from the Sun.
9-11 ES2D: The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources and it depletes those resources that cannot be renewed.
9-11 ES3D: Data gathered from a variety of methods have shown that Earth has gone through a number of periods when Earth was much warmer and much colder than today.
9-12 SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system.
9-12 SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible.
9-12 SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible.
9-12 SYSD: Systems can be changing or in equilibrium.
Application (Science, Technology, and Society)
9-12 APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not.
9-12 APPF: It is important for all citizens to apply science and technology to critical issues that influence society.

Social Studies

21st Century SKILLS

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2.C.3 Synthesize and make connections between information and arguments
2.C.4 Interpret information and draw conclusions based on the best analysis
2.C.5 Reflect critically on learning experiences and processes
Be Responsible to Others
11.B.1 Act responsibly with the interests of the larger community in mind
Communicate Clearly
3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts
3.A.2 Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions

3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)
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3.A.5 Communicate effectively in diverse environments (including multi-lingual)
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1.A.2 Create new and worthwhile ideas (both incremental and radical concepts)
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2.D.1 Solve different kinds of non-familiar problems in both conventional and innovative ways
2.D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions
Produce Results
10.B.1 Demonstrate additional attributes associated with producing high quality products including the abilities to:
10.B.1.a Work positively and ethically
10.B.1.b Manage time and projects effectively
10.B.1.c Multi-task
10.B.1.d Participate actively, as well as be reliable and punctual
10.B.1.e Present oneself professionally and with proper etiquette
10.B.1.f Collaborate and cooperate effectively with teams
10.B.1.g Respect and appreciate team diversity
10.B.1.h Be accountable for results
Collaborate with Others
3.B.1 Demonstrate ability to work effectively and respectfully with diverse teams
3.B.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
3.B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member
Interact Effectively with Others
9.A.1 Know when it is appropriate to listen and when to speak
9.A.2 Conduct themselves in a respectable, professional manner
Adapt to Change
7.A.1 Adapt to varied roles, jobs responsibilities, schedules and contexts
7.A.2 Work effectively in a climate of ambiguity and changing priorities

Implement Innovations
1.C.1 Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur
Work Effectively in Diverse Teams
9.B.1 Respect cultural differences and work effectively with people from a range of social and cultural backgrounds
9.B.2 Respond open-mindedly to different ideas and values
9.B.3 Leverage social and cultural differences to create new ideas and increase both innovation and quality of work
Guide and Lead Others
11.A.1 Use interpersonal and problem-solving skills to influence and guide others toward a goal
11.A.2 Leverage strengths of others to accomplish a common goal
11.A.3 Inspire others to reach their very best via example and selflessness
11.A.4 Demonstrate integrity and ethical behavior in using influence and power
Work Creatively with Others
1.B.1 Develop, implement and communicate new ideas to others effectively
1.B.2 Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work
1.B.3 Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas
1.B.4 View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes

Employability:

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Manage Projects
10.A.1 Set and meet goals, even in the face of obstacles and competing pressures
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4.A.1 Access information efficiently (time) and effectively (sources)
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Use Systems Thinking
2.B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems

Apply Technology Effectively
6.A.1 Use technology as a tool to research, organize, evaluate and communicate information
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Be Flexible
7.B.1 Incorporate feedback effectively
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7.B.3 Understand, negotiate and balance diverse views and beliefs to reach workable solutions, particularly in multi-cultural environments.

☒**Analytical, Logical & Creative Thinking (check those that students will demonstrate in this lesson):**				
☐ Observe	☐ Cause/Effect	☒ Finding Evidence	☐ Reasoning	☒ Originality
☒ Patterns	☒ Fact/Opinion	☐ Evaluation	☒ Problem Solving	☒ Risking
☐ Sequence	☐ Main Idea	☐ Detect Bias	☐ Goal Setting	☒ Inquisitiveness
☐ Classify	☒ Summary	☐ Inference	☐ Fluency	☐ Attending
☐ Compare/Contrast	☒ Point of View	☒ Conclusion	☒ Elaboration	☒ Persistence
☐ Predict	☒ Analysis	☒ Metacognition	☐ Flexibility	☐ Precision

CAREERS AND FIELD INVESTIGATIONS I Unit 9 N ENVIRONMENTAL SCIENCE Hours: 25

Performance Assessment(s)

Unit 9 is done after the completion of the AP exam.
Students will be required to design and implement their own research project.
Through internships and field experience, students will prepare for the various career options in Environmental Science and will prepare for post-high school opportunities.
Service Learning opportunities
Class presentations on Environmental careers
Job Shadow

Industry Standards and Competencies

Standard 9: Careers and Field Investigations in Environmental Science
- Through internships and field experience, students will prepare for the various career options in Environmental Science and will prepare for post-high school opportunities.

State Standards Alignment

Arts

Communications

Communication 1.1: Uses listening and observation skills and strategies to focus attention and interpret information.
Communication 1.2: Understands, analyzes, synthesizes, or evaluates information from a variety of sources.
Communication 2.1: Uses language to interact effectively and responsibly in a multicultural context.
Communication 2.2: Uses interpersonal skills and strategies in a multicultural context to work collaboratively, solve problems, and perform tasks.
Communication 2.3: Uses skills and strategies to communicate interculturally.
Communication 3.1: Uses knowledge of topic/theme, audience, and purpose to plan presentations.
Communication 3.2: Uses media and other resources to support presentations.
Communication 3.3: Uses effective delivery.
Communication 4.1: Assesses effectiveness of one's own and others' communication.
Communication 4.2: Sets goals for improvement.

Health and Fitness

Common Core State Standards for Mathematics

MP.2 **Reason** abstractly and quantitatively (HS.b),(HS.c)
S.IC **Make inferences and justify conclusions** from sample surveys, experiments, and observational studies (HS.c),(HS.d)

Common Core State Standards (CCSS) for English Language Arts

SL.9-10.2 Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. (MEOE.b)
WHST.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. (MEOE.e)
SL.9-10.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning,
SL.9-10.1c Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. (MEOE.g)

Science

Application (Science, Technology, and Society)
9-12 APPA: Science affects society and cultures by influencing the way many people think about themselves, others, and the environment. Society also affects science by its prevailing views about what is important to study and by deciding what research will be funded.
9-12 APPF: It is important for all citizens to apply science and technology to critical issues that influence society.

Social Studies

21st Century SKILLS

Leadership:
Make Judgments and Decisions
2.A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation
2.C.1 Effectively analyze and evaluate evidence, arguments, claims and beliefs
2.C.2 Analyze and evaluate major alternative points of view
2.C.3 Synthesize and make connections between information and arguments
2.C.4 Interpret information and draw conclusions based on the best analysis
2.C.5 Reflect critically on learning experiences and processes
Be Responsible to Others
11.B.1 Act responsibly with the interests of the larger community in mind
Communicate Clearly
3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts
3.A.2 Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions
3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)
3.A.4 Utilize multiple media and technologies, and know how to judge their effectiveness a priori as well as assess their impact
3.A.5 Communicate effectively in diverse environments (including multi-lingual)
Solve Problems
1.A.1 Use a wide range of idea creation techniques (such as brainstorming)
1.A.2 Create new and worthwhile ideas (both incremental and radical concepts)
1.A.3 Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts
2.D.1 Solve different kinds of non-familiar problems in both conventional and innovative ways
2.D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions
Produce Results
10.B.1 Demonstrate additional attributes associated with producing high quality products including the abilities to:
- 10.B.1.a Work positively and ethically
- 10.B.1.b Manage time and projects effectively
- 10.B.1.c Multi-task
- 10.B.1.d Participate actively, as well as be reliable and punctual
- 10.B.1.e Present oneself professionally and with proper etiquette
- 10.B.1.f Collaborate and cooperate effectively with teams
- 10.B.1.g Respect and appreciate team diversity

10.B.1.h Be accountable for results
Collaborate with Others
3.B.1 Demonstrate ability to work effectively and respectfully with diverse teams
3.B.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
3.B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member
Interact Effectively with Others
9.A.1 Know when it is appropriate to listen and when to speak
9.A.2 Conduct themselves in a respectable, professional manner
Adapt to Change
7.A.1 Adapt to varied roles, jobs responsibilities, schedules and contexts
7.A.2 Work effectively in a climate of ambiguity and changing priorities

Implement Innovations
1.C.1 Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur
Work Effectively in Diverse Teams
9.B.1 Respect cultural differences and work effectively with people from a range of social and cultural backgrounds
9.B.2 Respond open-mindedly to different ideas and values
9.B.3 Leverage social and cultural differences to create new ideas and increase both innovation and quality of work
Guide and Lead Others
11.A.1 Use interpersonal and problem-solving skills to influence and guide others toward a goal

11.A.2 Leverage strengths of others to accomplish a common goal
11.A.3 Inspire others to reach their very best via example and selflessness
11.A.4 Demonstrate integrity and ethical behavior in using influence and power
Work Creatively with Others
1.B.1 Develop, implement and communicate new ideas to others effectively
1.B.2 Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work
1.B.3 Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas
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