GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 1: INTRODUCTION TO ENVIRONMENTAL SCIENCE

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What are the causes of the environmental problems we face? 2. How are these causes connected? 3. What are the historical changes in the environmental history of the United States? 4. What are the basic forms of matter, energy? 5. What happens to matter and energy in an ecosystem?	Options include, but are not limited to: • Unit 1 Exam, Chapters 1-2 • Tragedy of the Commons Activity • PowerPoint Presentations – Environmental History

Curriculum Benchmark	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/Activities
Identify properties of a system that are different from those of its parts but appear because of the interaction of those parts. (9.1.3.1.2)		• Friedland, *Environmental Science for AP** (2012), Chapters 1-2 • Miller, *Living in the Environment*, (2004), Chapter 3 • Tragedy of the Commons Activity • Internet access to ecological footprints
Explain the political, societal, economic and environmental impact of chemical products and technologies. (9C.1.3.3.1)		
Describe how changes in scientific knowledge generally occur in incremental steps that include and build on earlier knowledge. (9.1.1.1.6)		
Describe the relative charges, masses, and locations of the protons, neutrons, and electrons in an atom of an element. (9.2.1.1.1)		
Explain that isotopes of an element have different numbers of neutrons and that some are unstable and emit particles and/or radiation. (9.2.1.1.4)		
Describe a chemical reaction using words and symbolic equations. (9.2.1.2.3)		

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 1: INTRODUCTION TO ENVIRONMENTAL SCIENCE (continued)		
Curriculum Benchmark	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/Activities**
Identify the energy forms and explain the transfers of energy involved in the operation of common devices. (9.2.3.2.1)		• Friedland, *Environmental Science for AP** (2012), Chapters 1-2 • Miller, *Living in the Environment*, (2004), Chapter 3 • Tragedy of the Commons Activity • Internet access to ecological footprints
Compare fission and fusion in terms of the reactants, the products and the conversion from matter into energy. (9.2.3.2.6)		
Describe the properties and uses of forms of electromagnetic radiation from radio frequencies through gamma radiation. (9.2.3.2.7)		
Describe a system, including specifications of boundaries and subsystems, relationships to other systems, and identification of inputs and expected outputs. (9.1.3.1.1)		
Identify properties of a system that are different from those of its parts but appear because of the interaction of those parts. (9.1.3.1.2)		
Describe how positive and/or negative feedback occur in systems. (9.1.3.1.3)		

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 1: INTRODUCTION TO ENVIRONMENTAL SCIENCE (continued)		
Curriculum Benchmark	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/Activities**
READING IN THE CONTENT AREA (Taken from "Standards for Literacy in History/Social Studies/Science/Technical Subjects")		
Cite specific textual evidence to support analysis of technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (11.13.1.1) (Quarter 1)	How Assessed: Summarize conclusions of reading	"Tragedy of the Commons" reading
Determine the central ideas or conclusions of a text, summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (11.13.2.2) (Quarter 1)	How Assessed: Summarize conclusions from online reading.	"Tragedy of the Commons" reading

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 2: POPULATION DYNAMICS

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How do populations change in size, density, and makeup in response to environmental stress? 2. What is the role of predators in controlling population size? 3. What are the major impacts of human activities on populations, communities, and ecosystems? 4. How is natural rate of population change calculated? 5. How is the population size affected by birth, death, fertility, and migration rates? 6. How can population growth be slowed? 7. What success have India and China had in slowing population growth?	Options include, but are not limited to: • Unit 2 Exam (Friedland, Chapters 6-7) • Mark/Recapture Lab (Rachel Carson Nature Area) • Power of Doubling Lab (Molnar Lab Manual) • Species Diversity Index (Molnar Lab Manual) • Easter Island Research

Curriculum Benchmark	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/Activities
Describe the social, economic and ecological risks and benefits of changing a natural ecosystem as a result of human activity (9.4.4.1.2)		• Friedland, *Environmental Science for AP** (2012), Chapters 6-7 • Videotape: *World in the Balance*
Describe factors that affect the carrying capacity of an ecosystem and relate these to population growth. (9.4.2.1.1)		
Explain how ecosystems can change as a result of the introduction of one or more new species. (9.4.2.1.2)		

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 3: ECOSYSTEM ECOLOGY

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How do the carbon, nitrogen, and water cycles work to cycle matter? 2. What services do ecosystems provide? 3. What are the major components of ecosystems? 4. What happens to matter and energy in an ecosystem? 5. How is biodiversity measured? 6. How is biodiversity conserved? 7. How do invasive or alien species affect native ecosystems?	Options include, but are not limited to: • Unit 3 Exam (Friedland, Chapters 3, 5, 18) • Biogeochemical cycles illustrations • Decomposition Lab • Productivity Lab • Eating at a Lower Trophic Level Lab • Nitrogen Cycle Game

Curriculum Benchmark	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/Activities
Trace the cyclical movement of carbon, oxygen and nitrogen through the lithosphere, hydrosphere, atmosphere and biosphere. (9.3.2.3.1)		• Friedland, *Environmental Science for AP** (2012), Chapters 3, 5, 18 • Internet access to nitrogen cycle
READING IN THE CONTENT AREA (Taken from "Standards for Literacy in History/Social Studies/Science/Technical Subjects")		
Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. (11.13.5.5)	How Assessed: Unit Exam and Summative Assessment	PowerPoint with discussion involving text content

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 4: CLIMATOLOGY AND GEOLOGICAL RESOURCES

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What major geologic processes occur within the Earth and on its surface? 2. How are rocks recycled? 3. What are the hazards from earthquakes and volcanic eruptions and what are ways to minimize destruction? 4. What are soils? 5. What is soil erosion and how can it be reduced? 6. What are the key factors that determine the earth's weather? 7. How does climate determine location of earth's major seasons? 8. How does the tilt of the Earth's access determine the Earth's seasons? 9. How has El Nino and La Nino had an effect on weather patterns? 10. What are the major types of desert, grassland, and forest biomes? 11. How do the Earth's major biomes differ in regards to precipitation, temperature, flora, and fauna? 12. How do humans impact the Earth's major biomes? 13. What are the basic types of aquatic life zones, and what factors influence the kinds of life they contain? 14. What are the major types of saltwater life zones, and how do human activities affect them? 15. How can aquatic life zones be sustained?	Options include, but are not limited to: • Unit 4 Exam (Friedland, Chapters 4, 8) • Soil Lab • Plate Tectonics online assessment • Drake equation online assessment

Curriculum Benchmark	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/Activities
Explain how the Earth's rotation affects global weather patterns. (9.3.2.2.1)		• Friedland, *Environmental Science for AP** (2012), Chapters 4, 8 • Internet access • LaMotte Soil Lab • Rock and Mineral Collection • Guest Speaker – Soil and Water Conservation District
Explain how human activity and natural processes are altering the hydrosphere, biosphere, lithosphere and atmosphere, including pollution, topography and climate. (9.3.4.1.2)		
Explain how the Earth evolved into its present habitable form through interactions among the solid earth, the oceans, the atmosphere and organisms. (9.3.3.2.2)		
Compare and contrast the environmental conditions that make life possible on Earth with conditions found on the other planets and moons of our solar system. (9.3.3.2.3)		

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 4: CLIMATOLOGY AND GEOLOGICAL RESOURCES (continued)		
Curriculum Benchmark	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/Activities**
Cite evidence from the rock record for changes in the composition of the global atmosphere as life evolved on Earth. (9.3.1.3.2)		• Friedland, *Environmental Science for AP** (2012), Chapters 4, 8 • Internet access • LaMotte Soil Lab • Rock and Mineral Collection • Guest Speaker – Soil and Water Conservation District
Use relative dating techniques to explain how the structures of the Earth and life on Earth have changed over short and long periods of time. (9.3.1.3.1)		
Explain how the rock record provides evidence for plate movement. (9.3.1.1.4)		
Use modern earthquake data to explain how seismic activity is evidence for the process of subduction. (9.3.1.1.2)		
Compare and contrast the interaction of tectonic plates at convergent and divergent boundaries. (9.3.1.1.1)		
Explain how the outward transfer of Earth's internal heat drives the convection circulation in the mantle to move tectonic plates. (9.3.2.1.2)		
READING IN THE CONTENT AREA (Taken from "Standards for Literacy in History/Social Studies/Science/Technical Subjects")		
Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. (11.13.5.5)	How Assessed: Unit Exam and Summative Assessment	PowerPoint with discussion involving text content

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 5: GEOLOGIC RESOURCES – NONRENEWABLE AND RENEWABLE ENERGY

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What are nonrenewable mineral resources and how are they formed? 2. How are resources mined? 3. What are the environmental effects of mining Earth's nonrenewable energy resources? 4. What are the advantages and disadvantages of coal, oil, natural gas, and nuclear energy? 5. How can we increase the supply of key nonfuel and fuel resources? 6. Where are the world's supplies of mineral resources and fuel resources? 7. What are the advantages and disadvantages of solar, hydroelectric, biomass, hydrogen, geothermal, and wind energy? 8. What can we do to increase energy efficiency?	Options include, but are not limited to: • Unit 5 Exam (Friedland, Chapters 12, 13) • Cooking Mining Lab (Dotti) • Fermentation Lab • Copper Extraction Lab (Molnar) • Energy Conversions (Internet activity) • Nuclear Storage Lab

Curriculum Benchmark	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/Activities
Relate the reliability of data to consistency of results, identify sources of error, and suggest ways to improve data collection and analysis. (9.1.3.4.4)		• Friedland, *Environmental Science for AP** (2012), Chapters 12, 13 • Video: "Frontline Heat" • Video: "Who Killed the Electric Car?" • Miller, *Living in the Enviornment*, Companion Site Objectives and Tutorial Quiz • Fuel Economy.gov (website) • Internet: MN DNR History of Mining & "Coal Paradox" • Guest Speaker: Prairie island Nuclear Power Plant • Guest Speaker: Environmental Air Quality Monitoring • "Tar Sands" RDG website
Compare local and global environmental and economic advantages and disadvantages of generating electricity using various sources of energy. (9.2.4.1.1)		

READING IN THE CONTENT AREA (Taken from "Standards for Literacy in History/Social Studies/Science/Technical Subjects")		
Analyze the author's purpose in describing phenomena, pro9viding an explanation, describing a procedure, or discussing/reporting an experiment in a text, identifying important issues and questions that remain unresolved. (11.13.6.6) (Quarter 2)	How Assessed: Energy Debate	Identifying pros and cons of energy resources

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 6: WASTE MANAGEMENT

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What are solid waste and hazardous waste? 2. How much solid and hazardous waste is produced? 3. What can we do to reduce, reuse, and recycle solid and hazardous waste? 4. How is hazardous waste regulated in the United States? 5. What can we do to reduce our exposure to lead, mercury, hazardous chlorine compounds, and dioxins? What are the sources of these pollutants? 6. How can we achieve a more sustainable low – waste society?	Options include, but are not limited to: • Unit 6 Exam (Friedland, Chapter 16) • Tire Disposal lab (Molnar) • Composting Activity (Molnar)

Curriculum Benchmark	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/Activities
Changes in scientific knowledge build on earlier findings. (9.1.1.1.6)		• Friedland, *Environmental Science for AP** (2012), Chapter 16 • Video: "Trash Inc." • Mercury in the Environment MN DNR Lake Finder (DNR website) • Superfund assignment (Dotti)

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 7: CLIMATE CHANGE AND AIR POLLUTION

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How do the layers of the atmosphere differ in regards to temperature, height, composition of gasses, etc.? 2. What are the major indoor air pollutants and what are their sources? 3. What is acid deposition and how can it be reduced? 4. What are the major outdoor air pollutants and what are their sources? How can we reduce outdoor air pollution? 5. How has the Earth's climate changed in the past? 6. How will the Earth's climate change in the future? 7. What factors affect changes in the Earth's temperature? 8. What can be done to slow or adapt to world climate change? 9. What effect is ozone depletion having on our world today? How can ozone depletion be reduced?	Options include, but are not limited to: • Unit 7 Exam (Friedland, Chapters 15, 19) • Indoor/Outdoor Air Pollution Lab

Curriculum Benchmark	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/Activities
Understand that scientists conduct investigations for a variety of reasons, including: to discover new aspects of the natural world, to explain observed phenomena, to test the conclusions of prior investigations, or to test the predictions of current theories. (9.1.1.1.2)		• Friedland, *Environmental Science for AP** (2012), Chapters 15, 19 • NY Times website (timeline activity) • Bill Gates' Speech • Air Pollution Chemistry
Human activity and natural process are altering the world's climate. (9.3.4.1.2)		
READING IN THE CONTENT AREA (Taken from "Standards for Literacy in History/Social Studies/Science/Technical Subjects")		
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. (11.13.7.7) (Quarter 3)	How Assessed: Class Discussion and Summative Assessment	• Climate Δ assignments (readings) Analyze data on CO_2 • Expert speakers on climate Δ
Evaluate the hypotheses, data, analysis, and conclusions in a technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (11.13.8.8) (Quarter 3)	How Assessed: Formal Discussion and Summative Assessment	Analyze data to support CO_2 or disprove CO_2 as a climate Δ indicator
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. (11.13.9.9) (Quarter 3)	How Assessed: Formal Discussion and Summative Assessment	Analyze data to support CO_2 or disprove CO_2 as a climate Δ indicator

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 8: LAND MANAGEMENT/FOOD RESOURCES

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How is the world's food produced? 2. How has food production increased, and what are environmental effects of producing food? 3. What are the approaches and policies that promote sustainable land use? 4. What are the causes and consequences of urban sprawl? 5. What are the four major public land management agencies and how do they function? 6. What is smart growth?	Options include, but are not limited to: • Unit 8 Exam (Friedland, Chapters 10, 11) • PowerPoint presentations • City Planning

Curriculum Benchmark	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/Activities
Describe how technological problems and advances often create a demand for new scientific technologies. (9.1.3.4.1)		• Friedland, *Environmental Science for AP** (2012), Chapters 10, 11 • Guest Speaker: Organic Foods • Video: *"Foot Inc."* • Maps and materials for city planning
Explain how human activity and natural processes are altering the hydrosphere, lithosphere and atmosphere, including pollution, topography, and climate. (9.3.4.1.2)		

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 9: WATER RESOURCES/WATER POLLUTION

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What are Earth's natural sources of water? 2. What are the ways in which humans manage water distribution? 3. What are the major uses of water by humans? 4. What factors will affect the future availability of water? 5. What technologies have humans developed for treating wastewater? 6. What heavy metals pose serious health concerns for people and animals?	Options include, but are not limited to: • Unit 9 Exam (Friedland, Chapters 9, 14) • Water Quality Index (Molnar)

Curriculum Benchmark	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/Activities
Describe the social, economic and ecological risks and benefits of changing a natural ecosystem as a result of human activity (9.4.4.1.2)		• Friedland, *Environmental Science for AP** (2012), Chapters 9, 14 • "Poisoned Waters" (Frontline) • Dam Proposal Readings
READING IN THE CONTENT AREA (Taken from "Standards for Literacy in History/Social Studies/Science/Technical Subjects")		
Follow precisely a complex multistep procedure when carrying out experiments, designing solutions, taking measurements, or performing technical tasks, analyze the specific results based on explanations in the text. (11.13.3.3) (Quarter 4)	How Assessed: Presentation and Unit Exam	Water testing for limiting nutrients and pollutants
Determine the meaning of symbols, equations, graphical representations, tabular representations, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics. (11.13.4.4) (Quarter 4)	How Assessed: Presentation and Lab Write-up	Water Testing Lab

GRADES 11-12: AP ENVIRONMENTAL SCIENCE CURRICULUM FRAMEWORKS

UNIT 10: TOXICOLOGY

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What are the three major categories of human health risk? 2. What are the major historical and emerging infectious diseases? 3. What factors go into risk analysis?	Options include, but are not limited to: • Unit 10 Exam (Friedland, Chapter 17) • Daphnia Magna Lab • Environmental Laws

Curriculum Benchmark	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/Activities
Explain the political, societal, economic and environmental impact of chemical products and technologies. (9C.1.3.3.1)		• Friedland, *Environmental Science for AP** (2012), Chapter 17 • Daphnia Magna Lab • YADDA Boards
Describe how changes in scientific knowledge generally occur in incremental steps that include and build on earlier knowledge. (9.1.1.1.6)		

READING IN THE CONTENT AREA (Taken from "Standards for Literacy in History/Social Studies/Science/Technical Subjects")		
By the end of grade 12, read and comprehend technical texts in the grades 11-12 text complexity band independently and proficiently. (11.13.10.10)		