

DEPARTMENT: SCIENCE	Course Title: Environmental Science/AP Course Numbers: 255B
GRADE(S): 11-12	PRE-REQUISITES: PRE-REQUISITES (IF ANY): SUCCESSFUL COMPLETION OF BIOLOGY AND CHEMISTRY

UNIT	LENGTH	CONTENT	Skills	Methods of Assessment	Framework Strand(s) & Standard(s) *
Student Independent Research	Ongoing- 2 nd Trimester	• Student directed	Students will: Extract information from written sources. Research independently. Conduct field investigations. Demonstrate experimental design. Record field data in an organized and professional fashion. Understand uncertainty in measurement and data collection. Write a scientific paper	• Final Project	
Unit 1: Science, Systems, and the Cycling of Matter and Energy	2 weeks	Growth: Arithmetic, Geometric, and Logistic; Doubling Time; Principal and Interest; Effects of Globalization Systems: Sustainable Yield; Sources and Sinks; Storing, Depleting, and Steady-State; feedbacks; synergistic effect; IPAT impact model; Ecological Footprint Pollution: Ecological Footprint ; Point vs. Nonpoint Sources; Persistent vs. Nonpersistent; Anthropogenic Energy: Energy, Power, and Efficiency; Quality of Energy; Energy Transformations; 1 st and 2 nd Law of Thermodynamics; Heat transfer (conduction, convection, and radiation)	Students Will: Extract information from written sources. Research independently. Conduct Field Investigations. Record field data in an organized and professional fashion. Demonstrate problem solving abilities. Make environmentally conscious decisions based on scientific data. Understand uncertainty in measurement and data collection. Demonstrate experimental design. Calculate the mean and standard deviation and perform t-tests on sample means. Use Excel to construct data tables, graphs. Write environmental models in Excel. Use environmental models as decision making tools. Create and interpret graphs and diagrams. Work collaboratively. Perform calculations without a calculator. Answer document-based questions.	Chapter 1 and 3 Summer Work Benchmark Labs Systems Lab (Respiration and Photosynthesis) Leaf Thickness Lab Assessments Objective Notes Essay Outlines Graph Interpretations Document-Based Questions Written Assessments Excel Models Calculations Problems Formal Lab Report Independent Research Unit Test	AP Standards IV.G, V.A-C, VI.C

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Unit 2 A: Ecosystems: Components, Energy Flow, and Matter Cycling	1 week	<p>Ecosystem Structure; Ecology; Organisms, Populations, Communities, Ecosystems, and the Biosphere; Trophic levels; Feeding Strategies; Food chains and food webs</p> <p>Ecological Energy: Biomass and energy; NPP, GPP, and Respiration; Reproductive Strategies; Photosynthesizers and Chemosynthesizers; Photosynthesis, Aerobic Respiration, and Anaerobic respiration.</p> <p>Biogeochemical Cycles: Hydrologic, Carbon, Nitrogen, Phosphorous, and Sulfur Cycles; Recent biogeochemical cycle changes.</p> <p>Limiting Factors: Limiting factor principle; Abiotic vs. Biotic Factors; Physical vs. Chemical Factors; Law of tolerance; Terrestrial and aquatic limiting factors.</p> <p>Atmosphere: Atmospheric layers; Atmospheric composition; UV protection; Climate and weather.</p>	<p>Students Will:</p> <p>Extract information from written sources.</p> <p>Conduct Field Investigations</p> <p>Record field data in an organized and professional fashion.</p> <p>Demonstrate problem solving abilities.</p> <p>Make environmentally conscious decisions based on scientific data.</p> <p>Understand uncertainty in measurement and data collection.</p> <p>Demonstrate experimental design.</p> <p>Create and interpret graphs and diagrams.</p> <p>Work collaboratively.</p> <p>Perform calculations without a calculator.</p> <p>Answer document-based questions.</p>	<p>Chapter 4</p> <p>Benchmark Lab: NPP, GPP Aquatic Lab Nutrient and Algal Growth Lab</p> <p>Assessments Objective Notes Essay Outlines Graph Interpretations Document-Based Questions Written Assessments Excel Models Calculations Problems Formal Lab Report Independent Research Unit Test</p>	AP Standards IB, IIA-E
Unit 2B: Evolution and Ecology	2 weeks	<p>Evolution: Evolution by natural selection; Coevolution; Artificial selection; Background extinction vs. mass extinction; Factors affecting Immigration and extinction rates, Equilibrium species</p>	<p>Students Will:</p> <p>Extract information from written sources.</p> <p>Record field data in an organized and professional fashion.</p> <p>Demonstrate problem solving abilities.</p>	<p>Chapter 5 and 7</p> <p>Benchmark Lab: Benthic Macroinvertebrates</p>	AP Standard : IE

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		diversity (Theory of Island Biogeography) Biodiversity: Importance of biodiversity and know; Measures of biodiversity, Native species, nonnative species, indicator species, keystone species; interspecific and intraspecific; Specialists and generalists; Ecological niche vs. habitat; Fundamental and realized niche; resource partitioning. Relationships: symbiotic relationships; predation and defense strategies; Mutualism, Commensalism, and Parasitism Succession: Primary and Secondary Succession; Successional Stages and Effect on Biodiversity	Make environmentally conscious decisions based on scientific data. Understand uncertainty in measurement and data collection. Create and interpret graphs and diagrams. Work collaboratively. Perform calculations without a calculator. Answer document-based questions.	Assessments Objective Notes Essay Outlines Graph Interpretations Document-Based Questions Written Assessments Excel Models Calculations Problems Formal Lab Report Independent Research Unit Test	
Unit 2C: Endangered and Invasive Species.	2 weeks	Endangered Species: Causes of Extinction; Characteristics of Endangered Species; Endangered Species and Wildlife Protection; Current Endangered and Threatened Species Invasive Species: Characteristics of Invasive Species, Introduction of Invasive Species Habitat Fragmentation.	Students Will: Extract information from written sources. Research independently. Conduct Field Investigations. Record field data in an organized and professional fashion. Demonstrate problem solving abilities. Make environmentally conscious decisions based on scientific data. Create and interpret graphs and diagrams. Work collaboratively. Perform calculations without a calculator. Answer document-based questions.	Chapter 17 and 18 Objectives Benchmark Labs: Invasive Species of the AREF Research Activity Endangered Species Research Project Assessments Objective Notes Essay Outlines Graph Interpretations Document-Based Questions Written Assessments Excel Models Calculations Problems Formal Lab Report Independent Research	AP Standards: IE, IIID, VA-B,

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				Unit Test	
Unit 2D: Weather and Biomes	1 week	Weather and Climate: Global Air Circulation; El Nino and ENSO; Ocean Currents Terrestrial Biomes: Distribution of Life, Global NPP, Terrestrial Biomes, Flora and Fauna adaptations Aquatic Biomes: Oceans; Estuaries; Wetlands; Lake Stratification and Life Zones	Students Will: Extract information from written sources. Research independently. Work collaboratively. Perform calculations without a calculator. Answer document-based questions.	Chapter 6 Benchmark Labs: Biomes Research Project Coriolis Effect Demonstration Assessments Objective Notes Essay Outlines Graph Interpretations Document-Based Questions Written Assessments Excel Models Calculations Problems Formal Lab Report Independent Research Unit Test	AP Standards: IE, VA-B
Unit 3A: Environmental Geology and Soil Science	1 week	Geology and Mineral Resources: Major Earth Layers and Processes, Plate Boundaries, Surface and Subsurface Mining, Mineral Resources and Reserves, Environmental impacts of extracting, processing, and using mineral resources, relevant laws and treaties. Implications of the U.S. 1872 Mining Law. Soil Science and Conservation: Requirements for Fertile Soil, Fertile Soils of the World, Soil Horizons, Soil Chemistry, Physical Soil Classifications, Limiting Nutrients, Soil Degradation and Conservation, Agriculture: types of agriculture; Green Revolution; genetic engineering and crop production; deforestation; irrigation;	Students Will: Extract information from written sources. Research independently. Conduct Field Investigations. Record field data in an organized and professional fashion. Demonstrate problem solving abilities. Make environmentally conscious decisions based on scientific data. Understand uncertainty in measurement and data collection. Demonstrate experimental design. Create and interpret graphs and diagrams. Work collaboratively. Perform calculations without a calculator.	Chapter 9 Benchmark Labs: Soil Amendment Lab Physical and Chemical Properties of Soils Geology of the Pioneer Valley Field Trip Assessments Objective Notes Essay Outlines Graph Interpretations Document-Based Questions Written Assessments Excel Models	AP Standards: IC, IIIC, IVA,

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		sustainable agriculture, Types of pesticides; costs and benefits of pesticide use; integrated pest management; relevant laws.	Answer document-based questions.	Calculations Problems Formal Lab Report Independent Research Unit Test	
Unit 3B: Land Use	1 week	Forestry: Forest Classifications, Forest Management and Harvesting Techniques, Lumber Certification, Tree Pathogens, Forest Fires, Air Pollutants, US Forest Management. Rangelands: Overgrazing; deforestation; desertification; rangeland management; federal rangelands Urban land development: Planned development; suburban sprawl; urbanization Transportation infrastructure: federal highway system; canals and channels; roadless areas; ecosystem impacts Public and federal lands: Management; wilderness areas; national parks; wildlife refuges; forests; wetlands Land conservation options: Preservation; remediation; mitigation; restoration Sustainable land-use strategies	Students Will: Extract information from written sources. Research independently. Conduct Field Investigations. Record field data in an organized and professional fashion. Demonstrate problem solving abilities. Make environmentally conscious decisions based on scientific data. Understand uncertainty in measurement and data collection. Demonstrate experimental design. Use Excel to construct data tables, graphs. Interpret graphs and diagrams. Work collaboratively. Perform calculations without a calculator. Answer document-based questions.	Chapter 17 Benchmark Lab: Forestry the AREF Tree Cookie Lab Guest Speaker: Forester Assessments Objective Notes Essay Outlines Graph Interpretations Document-Based Questions Written Assessments Excel Models Calculations Problems Formal Lab Report Independent Research Unit Test	AP Standard : IIIF
Unit 3B Water Resources and Water Quality	2 week	Water Supply: Hydrologic cycle, agricultural, industrial, and domestic water use, freshwater supply and conservation, environmental impacts of dams and groundwater withdraw,	Students Will: Extract information from written sources. Research independently. Conduct Field Investigations. Record field data in an organized and professional fashion.	Chapter 14 Benchmark Labs: Biological Oxygen Demand Lab Modeling Dissolve Oxygen Water Treatment Lab	AP Standards: IIIA, IVA

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		Water Pollution: Water pollution types; sources, causes, and effects; cultural eutrophication; groundwater pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws	Demonstrate problem solving abilities. Make environmentally conscious decisions based on scientific data. Understand uncertainty in measurement and data collection. Demonstrate experimental design. Calculate the mean and standard deviation and perform t-tests on sample means. Use Excel to construct data tables, graphs. Write environmental models in Excel. Use environmental models as decision making tools. Create and interpret graphs and diagrams. Work collaboratively. Perform calculations without a calculator. Answer document-based questions.	Field Trip to Treatment Plant Assessments Objective Notes Essay Outlines Graph Interpretations Document-Based Questions Written Assessments Excel Models Calculations Problems Formal Lab Report Independent Research Unit Test	
Unit 4A: Human Population Growth	1 week	Population Growth: Human population size and distribution, Fertility rates, Growth rates, and Doubling times; Factors affecting Population Birth and Death rates. Demographic Transition: Transition Stages, Age-Structure Diagrams Strategies for Sustainability: National Policies and Other Case Studies Impacts of population growth: hunger, disease, economic effects, resource use, habitat destruction	Students Will: Extract information from written sources. Research independently. Conduct Field Investigations. Record field data in an organized and professional fashion. Demonstrate problem solving abilities. Make environmentally conscious decisions based on scientific data. Understand uncertainty in measurement and data collection. Demonstrate experimental design. Calculate the mean and standard deviation and perform t-tests on sample means. Use Excel to construct data tables, graphs.	Chapter 11 Benchmark Labs: Cemetery Lab Population Research Project Assessments Objective Notes Essay Outlines Graph Interpretations Document-Based Questions Written Assessments Excel Models Calculations Problems Formal Lab Report	AP Standards: IIA-C

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			Write environmental models in Excel. Use environmental models as decision making tools. Create and interpret graphs and diagrams. Work collaboratively. Perform calculations without a calculator. Answer document-based questions.	Independent Research Unit Test	
Unit 4B: Toxicology	1 week	Toxicology: Environmental risk analysis; acute and chronic effects; dose-response relationships; air pollutants; smoking and other risks Hazardous Waste: Types of hazardous waste; treatment/disposal of hazardous waste; cleanup of contaminated sites; biomagnification; relevant laws	Students Will: Extract information from written sources. Research independently. Conduct Field Investigations. Record field data in an organized and professional fashion. Demonstrate problem solving abilities. Make environmentally conscious decisions based on scientific data. Understand uncertainty in measurement and data collection. Demonstrate experimental design. Calculate the mean and standard deviation and perform t-tests on sample means. Use Excel to construct data tables, graphs. Write environmental models in Excel. Use environmental models as decision making tools. Create and interpret graphs and diagrams. Work collaboratively. Perform calculations without a calculator. Answer document-based questions.	Chapter 10 Benchmark Lab: Brine Shrimp LD50 Lab Toxicology Research Project Assessments Objective Notes Essay Outlines Graph Interpretations Document-Based Questions Written Assessments Excel Models Calculations Problems Formal Lab Report Independent Research Unit Test	AP Standard: IVC
Unit 5: Air Pollution & Global Atmospheric	2 weeks	Air Pollution: primary and secondary sources; major air pollutants; measurement units; smog; acid deposition—causes and effects; heat islands and temperature inversions;	Students Will: Extract information from written sources. Research independently. Conduct Field Investigations. Record field data in an organized and	Chapter 12 and 13 Objectives Benchmark Labs: Simulating and Observing the Effects of Acid Rain	AP Standards: ID, IVA, VA-B

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Change		<p>indoor air pollution; remediation and reduction strategies; Clean Air Act and other relevant laws.</p> <p>Stratospheric Ozone: formation of stratospheric ozone; ultraviolet radiation; causes of ozone depletion; effects of ozone depletion; strategies for reducing ozone depletion; relevant laws and treaties.</p> <p>Global Warming: Greenhouse gases and the greenhouse effect; impacts and consequences of global warming; reducing climate change; relevant laws and treaties</p>	<p>professional fashion.</p> <p>Demonstrate problem solving abilities.</p> <p>Make environmentally conscious decisions based on scientific data.</p> <p>Understand uncertainty in measurement and data collection.</p> <p>Demonstrate experimental design.</p> <p>Calculate the mean and standard deviation and perform t-tests on sample means.</p> <p>Use Excel to construct data tables, graphs.</p> <p>Write environmental models in Excel.</p> <p>Use environmental models as decision making tools.</p> <p>Create and interpret graphs and diagrams.</p> <p>Work collaboratively.</p> <p>Perform calculations without a calculator.</p> <p>Answer document-based questions.</p>	<p>Ozone Lab</p> <p>Temporal CO2 and Temperature Graphing Activity</p> <p>Assessments</p> <p>Objective Notes</p> <p>Essay Outlines</p> <p>Graph Interpretations</p> <p>Document-Based Questions</p> <p>Written Assessments</p> <p>Excel Models</p> <p>Calculations Problems</p> <p>Formal Lab Report</p> <p>Independent Research</p> <p>Unit Test</p>	
Unit 6 : Energy Use and Conservation	2 weeks	<p>Nonrenewable: Fossil Fuel Resources and Use; Formation of coal, oil, and natural gas; extraction/purification methods; world reserves and global demand; synfuels; environmental advantages/disadvantages of sources) Nuclear Energy: Nuclear fission process; nuclear fuel; electricity production; nuclear reactor types; environmental advantages/disadvantages; safety issues; radiation and human health; radioactive wastes; nuclear fusion</p> <p>Renewable Energy: Hydroelectric Power (Dams; flood control; salmon; silting; other impacts); solar energy; solar electricity; hydrogen fuel cells; biomass; wind energy;</p>	<p>Students Will:</p> <p>Extract information from written sources.</p> <p>Research independently.</p> <p>Conduct Field Investigations.</p> <p>Record field data in an organized and professional fashion.</p> <p>Demonstrate problem solving abilities.</p> <p>Make environmentally conscious decisions based on scientific data.</p> <p>Understand uncertainty in measurement and data collection.</p> <p>Demonstrate experimental design.</p> <p>Calculate the mean and standard deviation and perform t-tests on sample means.</p> <p>Use environmental models as decision making tools.</p> <p>Create and interpret graphs and diagrams.</p>	<p>Chapter 19 and 20</p> <p>Benchmark Labs:</p> <p>Nonrenewable vs. Renewable Energy Research Project</p> <p>Personal Power Lab</p> <p>Biodiesel Lab</p> <p>Assessments</p> <p>Objective Notes</p> <p>Essay Outlines</p> <p>Graph Interpretations</p> <p>Document-Based Questions</p> <p>Written Assessments</p> <p>Excel Models</p> <p>Calculations Problems</p> <p>Formal Lab Report</p>	AP Standards: IA, VA

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		<p>small-scale hydroelectric; ocean waves and tidal energy; geothermal; environmental advantages/disadvantages</p> <p>Energy Conservation: Energy efficiency; CAFE standards; hybrid electric vehicles; mass transit</p>	<p>Work collaboratively.</p> <p>Perform calculations without a calculator.</p> <p>Answer document-based questions.</p>	<p>Independent Research</p> <p>Unit Test</p>	
Unit 7: Environment and Society	1 week	<p>Environmental effects of globalization; Tragedy of the Commons; relevant laws and treaties; Cost-benefit analysis; externalities; marginal costs; sustainability, cap-and-trade and other pollution control strategies.</p>	<p>Students Will:</p> <p>Extract information from written sources.</p> <p>Research independently.</p> <p>Use environmental models as decision making tools.</p> <p>Work collaboratively.</p> <p>Perform calculations without a calculator.</p> <p>Perform professionally during a debate.</p> <p>Answer document-based questions.</p>	<p>Chapter 2</p> <p>Benchmark Labs:</p> <p>Tragedy of the Commons Simulation</p> <p>HG Cap and Trade Role Playing Game</p> <p>Assessments</p> <p>Objective Notes</p> <p>Essay Outlines</p> <p>Graph Interpretations</p> <p>Document-Based Questions</p> <p>Written Assessments</p> <p>Excel Models</p> <p>Calculations Problems</p> <p>Formal Lab Report</p> <p>Independent Research</p> <p>Unit Test</p>	<p>AP Standards: VIA-E</p>
Student Independent Research	Ongoing- 2 nd Trimester	<ul style="list-style-type: none"> • Student directed 	<p>Students will:</p> <p>Extract information from written sources.</p> <p>Research independently.</p> <p>Conduct field investigations.</p> <p>Demonstrate experimental design.</p>	<ul style="list-style-type: none"> • Final Project 	

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			Record field data in an organized and professional fashion. Understand uncertainty in measurement and data collection. Write a scientific paper		