Advanced Placement Environmental Science

Science Department
Verona Public School District

Curriculum Overview

Verona Public Schools Mission Statement:

The mission of the Verona Public Schools, the center of an engaged and supportive community, is to empower students to achieve their potential as active learners and productive citizens through rigorous curricula and meaningful, enriching experiences.

Course Description:

This course provides students with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, to evaluate the relative risks associated with these problems, and to examine alternative solutions for resolving and/or preventing them. Environmental science is interdisciplinary; it embraces a wide variety of topics from different areas of study. The "Big Ideas" of AP Environmental Science are: 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. The course given at VHS follows the syllabus of AP Environmental Science as prescribed by the College Board. Students must take the AP Exam in order to receive AP course credit.

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Prerequisite(s):

Prerequisite: Honors Biology or teacher recommendation

Standard 8: Technology Standards	
8.1: Educational Technology: *All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.*	**8.2: Technology Education, Engineering, Design, and Computational Thinking - Programming:** *All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.*
A. Technology Operations and Concepts B. Creativity and Innovation **X** C. Communication and Collaboration D. Digital Citizenship **X** E. Research and Information Fluency **X** F. Critical thinking, problem solving, and decision making	A. The Nature of Technology: Creativity and Innovation **X** B. Technology and Society C. Design D. Abilities for a Technological World E. Computational Thinking: Programming

Standard 9: 21st Century Life and Careers			
9.1 Career Ready Practices: *These practices outline the skills that all individuals need to have to truly be adaptable, reflective, and proactive in life and careers. These are researched practices that are essential to career readiness.*	**9.2: Personal Financial Literacy:** *This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.*	**9.3: Career Awareness, Exploration & Preparation:** *This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.*	**9.3: Career and Technical Education:** *This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.*
1. Act as a responsible and contributing citizen and employee. 2. Apply appropriate academic and technical skills. 3. Attend to personal health and financial well-being. **X** 4. Communicate clearly and effectively and with reason. **X** 5. Consider the environmental, social, and economic impact of decisions. 6. Demonstrate creativity and innovation. 7. Employ valid and reliable research strategies. **X** 8. Utilize critical thinking to make sense of problems and persevere in solving them. 9. Model integrity, ethical leadership, and effective management. 10. Plan education and career paths aligned to personal goals. **X** 11. Use technology to enhance productivity. 12. Work productively in teams while using cultural global competence.	A. Income and Careers B. Money Management C. Credit and Debt Management D. Planning, Saving, and Investing **X** E. Becoming a Critical Consumer F. Civic Financial Responsibility G. Insuring and Protecting	A. Career Awareness (K-4) B. Career Exploration (5-8) **X** C. Career Preparation (9-12)	A. Agriculture, Food & Natural Res. B. Architecture & Construction C. Arts, A/V Technology & Comm. D. Business Management & Admin. E. Education & Training F. Finance G. Government & Public Admin. H. Health Science I. Hospital & Tourism J. Human Services K. Information Technology L. Law, Public, Safety, Corrections & Security M. Manufacturing N. Marketing **X** O. Science, Technology, Engineering & Math P. Transportation, Distribution & Log.

Core Instructional Materials:	**Differentiated Resources**:
• ***Living in the Environment (18th edition)***, Miller & Spoolman	• College Board APES Resources • Molnar Lab Book • Green Readings Book • The Habitable Planet: A Systems Approach to Environmental Science • Approved APES Labs

Curriculum Scope & Sequence

Subject/Grade Level: Science HIGH SCHOOL **Course: AP Environmental Science**

Overarching Essential Question: Is our current level of development sustainable on a longer time scale?

Unit	Duration	College Board APES Standards	Transfer Goal(s)	Enduring Understandings	Essential Questions
1 – Systems and Sustainability	**6 cycles**	II. The Living World: B. Energy Flow C. Ecosystems Diversity, E. Natural Biogeochemical Cycles G. Global Economics. III: Population: B. Human Population 3. Impacts of human population growth. IV. Land and Water Use: G. Global Economics. V. Energy Resources and Consumption: A. Energy Concepts D. Nuclear Energy VI. Pollution: A. Polution Types 4. Solid waste C. Economic Impacts	Students will be able to independently use their learning to analyze a case study on a current environmental issue, and write how the issue is contrary to any or all of the three scientific principles of sustainability, and propose a solution to achieve sustainability on that issue. Students will analyze their solution for flaws and conflicts with any of the three scientific principles and three social science principles of sustainability and address them, explaining how to refine their solution so there is no conflict or why their solution is a valid trade-off	U1. Environmental Science is the integration of many disciplines, and Environmental Science is the application of scientific principles from Biology, Chemistry, and Physics. U2. Ecology is the foundation upon which Environmental Science is built U3. Everything is connected to Everything U4. Humans exist in a natural context and are a force of nature U5. Solar Energy, Biodiversity, and Chemical Nutrient cycling are the three scientific principles of sustainability U6. Sustainability is the capacity of the Earth's natural systems and human cultural systems to survive, flourish, and adapt to changing environmental conditions into the very long future U7. There is no free lunch U8. Open Energy system, Closed material System U9. The ultimate destiny of energy is waste heat.	Q1. How are ecology and environmental science different? Q2. What do we really mean when we say sustainability? Q3. Ecology, economy, and politics: Why can't they all just get along?

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2 – Earth the Living System	6 cycles	I. Earth Systems Resources A. Earth Science Concepts, D. Soil and Soil Dynamics II. Living World: A. Ecosystem Structure B. Energy Flow C. Ecosystem Diversity D. Natural Ecosystem Change E. Natural Biogeochemical Cycles III. Population: A. Population Biological Concepts B. Human Populations 3. Impacts of population growth VII. Global Change B. Global Warming C. Loss of Biodiversity 1. Habitat loss	Students will be able to independently use their learning to write in the form of a free response question why amphibians are so sensitive to ecosystem changes, and how those ecosystem changes can lead to selection pressures. The students will be able to explain why amphibians fit the characteristics of indicator species, and what steps can be taken to preserve damage to populations within a community.	U1. Niche is more complicated than it seems U2. Life is the confluence of material and energy into a system U3. The only constant is change U4. The ultimate destiny of energy is waste heat U5. Earth's conditions are special and support the only known life in the universe U6. Time perspective is relative and a sense of time is critical to human response to environmental crises U7. Biodiversity is critical for functioning ecosystems U8. Biodiversity is the cornerstone of the planets natural capital U9. Soil is the Interface between the biosphere and the other 3 spheres	Q1. What would happen if Loki turned the sun off? Why? Q2. What would happen if Loki turned off the Earth's Core? Why? Q3. Its Dirt! Why should I care? Q4. How did we get here? Q5. Where do we go from here? Q6. Why can't things grow forever? Q7. If a model did not really happen then why is it used in science? Q8. Why should an endangered creature matter to me? Q9. How does evidence of the deep past inform us about today's conditions? Q10. What transitions has Earth gone through and why?

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3 – Human Population and its impact	6 cycles	III. Population A. Population Biology Concepts B. Human Population 1. Human population dynamics 2. Population size 3. Impacts of population growth	Students will be able to independently use their learning to compare and contrast the national and cultural population policies of the United States and China. The student will clearly identify how the policies have affected the standard of living in both countries, and use population pyramids and survivorship curves, coupled with current data to predict the future of age structure of each country for the year 2025, and 2050	U1. With no limits population will grow exponentially U2. In natural systems there are nearly always limits on population growth U3. Environmental resistance limits population growth and sets carrying capacity. U4. Birth, Death, fertility, and migration determine population size. U5. Population size and population growth rate is profoundly affected by age structure U6. Educating women in the developing world is the key to reducing human population growth	Q1. Why should I care if a woman gets pregnant all the time in poorer countries? Q2. Babies are cute, isn't that why people have so many? Q3. Isn't it mean to slow human population growth? Q4. Would you rather be a baby boomer or a baby buster?

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4 - Sustaining Natural Resources	6 cycles	II. The Living World E. Natural Biogeochemical Cycles IV. Land and Water Use D. Other Land Use 4. Land Conservation Option V. Energy Resources and consumption A. Energy Concepts B. Energy Consumption 1. History 2. Present global use 3. Future energy needs C. Fossil Fuel Resources and Use D. Nuclear Energy E. Hydroelectric Power F. Energy Conservation G. Renewable Energy VI. Pollution A. Pollution Types 1. Air Pollution 2. Water Pollution VII. Global Changes B. Global Warming C. Loss of Biodiversity 1. Habitat loss; pollution	Students will be able to independently use their learning to analyze the feasibility of producing ethanol through corn by analyzing the current uses for corn products and extrapolating the economic effects that an additional use for corn would pose. Students will describe in writing the economic effects on the farmer, and the consumer, and how this change will affect the economy at large. Students will also be required to write how a switching to ethanol, can both positively and negatively effect the environment. The student will balance the tradeoffs to determine if this is a viable environmental solution.	U1. Non renewables have finite lifetimes and some have longer lifetimes than others. U2. There is no free lunch U3. Increasing Energy efficiency benefits people and the environment U4. Fossil fuels grant us a high energy yield with a high environmental cost U5. The hidden cost in any product or fuel can be very high U6. Making decisions involves trade-offs U7. Renewable energy offers a low environmental cost with a low energy yield U8. Not all oil is the same U9. Decisions about energy futures require consideration of long periods of time U10. Infrastructure is important to delivering energy U11. Improving Energy efficiency is like finding energy	Q1. Will we always have enough _____? Who Cares if we run out of _____? Q2. Won't our technology save us? Q3. If I have Plenty of _____, do I need to worry about conserving it? Q4. If it smells like oil and looks like oil, why is it more expensive than this oil? Q5. Fossil Fuels are bad, so why aren't we using our renewables?

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5 – Sustaining our resources	6 cycles	I. Earth Systems and Resources A. Earth Science Concepts C. Global Water Resources and Use D. Soil and Soil Dynamics II. The Living World E. Natural Biogeochemical Cycles III. Population B. Human Population 3. Impacts of population growth IV. Land and Water Use A. Agriculture 1. Feeding a growing population 2. Controlling pests D. Other Land Use 3. Public and Federal Land 4. Land conservation options 5. Sustainable Land use Strategies E. Mining F. Fishing VI. Pollution A. Pollution Types 1. Air pollution 2. Noise pollution 3. Water Pollution 4. Solid Waste B. Impacts on Environmental and Human Health 2. Hazardous Chemicals in the Environment	Students will be able to independently use their learning to analyze a news article about a depleting aquifer. The student will write in an essay proposing reasons for the resource depletion, and solutions to the water shortage based on the geography of the location. The student will address conservation, efficiency, and alternate sources or methods of attaining water.	U1. Food system relies on three parts: Croplands, Rangelands, Fisheries U2. Soil degradation is our biggest threat to food production. U3. The Green Revolution helped feed the world but came with an environmental cost. U4. Water keeps us alive, moderates climate, sculpts the land, removes and dilutes wastes, and moves continually through the hydrologic cycle. U5. Only a small fraction of water is fresh water U6. Most aquifers are renewable resources unless water is removed faster than it is replenished U7. Efficient use of resources is like finding resources U8. Scientists are developing new material as a substitute for many metals U9. Future supply of resources depends upon affordability and how quickly the supply is used U10. Life cycle of a metal is very energy intensive	Q1. Why is food security so difficult to maintain? Q2. The Green Revolution has green in its name so it must be good… right? Q3. How can we use freshwater more sustainably? Q4. Can I run out of water? Q5. Why should I care if I waste water, it will just rain down again? Q6. Won't recycling solve the problem of low supply? Q7. Is Frankenfood a fair description of GMOs, and GM crops.

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6 – Environmental Quality	6 cycles	I. Earth Systems and Resources A. Earth Science Concepts B. The Atmosphere C. Global Water Resources and Use 1. Freshwater/Saltwater, conservation II. The Living World E. Natural Biogeochemical Cydes III. Population B. Human Population 1. Human population dynamics 3. Impacts of population growth IV. Land and Water Use D. Other Land Use 1. Urban Land Development 2. Transportation Infrastructure 4. Land Conservation options VI. Pollution A. Pollution Types 1. Air pollution 2. Noise pollution 3. Water Pollution 4. Solid Waste B. Impacts on Environmental and Human Health 1. Hazards to Human Health 2. Hazardous Chemicals in the Environment C. Economic Impacts VII. Global Change A. Stratospheric Ozone B. Global Warming C. Loss of Biodiversity 1. Pollution, Habitat Loss 2. Maintenance through Conservation 3. Relevant Laws and Treaties	Students will be able to independently use their learning to write in the form of an essay how acid deposition occurs and discuss several ways it can be prevented. The student will write how acid deposition poses harm to humans directly, and how it impacts the environment, then conclude with solutions for both problems and any tradeoffs that must be made to reduce acid deposition.	U1. Human Hazards include cultural hazards as well as physical hazards U2. Risks to humans can be estimated, managed, and reduced U3. Indoor air pollution has proven more dangerous than outdoor air pollution U4. Physical structures may make air pollution worse but wind, rain and ocean can help clean it U5. Chemical and Biological hazards are the main water pollutants U6. Different types of water present different challenges for cleanup U7. Oceans can disperse and breakdown large quantities of degradable pollutants if they are not overloaded U8. Climate change is a long term, global problem and the impacts will not be spread evenly around the world U9. Waste management, waste reduction, reduced usage and pollution prevention can all be used to reduce, reuse, or recycle solid waste	Q1. he world is scary, how can I stay safe and happy? Q2. Why should I care if some other country does not control pollution? Q3. Since the ocean is so big, is the solution to pollution, dilution? Q4. Why should the climate concern me, it is comfortable here in NJ? Q5. Why are refusing, reusing and recycling material so important? Q6. Solid Waste: What good is it?