

SJC AP Environmental Science

Summer Assignments

Instructor: Seth Brown

sbrown@stjohnschs.org

What is AP Environmental Science? Why Do I Have to Do Work Over the Summer?

AP Environmental Science (APES) is designed to be the equivalent of a one- semester, introductory college course in Environmental Science. The course is interdisciplinary, encompassing topics in chemistry, physics, geology, biology, environmental studies, and geography. It also incorporates a sociological, political, and global perspective. APES is designed to provide 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.

This assignment serves to help you prepare for the year ahead. To be a successful APES student, you must be willing to spend significant time outside of class preparing and completing work. Remember that this course is modeled after a college course, so both the fast pace and sheer depth of information may be new to you. This course requires dedication, commitment, and total immersion into the field of environmental science. Because this is an AP course, we will also be preparing throughout the year to be successful on the AP exam in May.

Your Tasks This Summer

1. Course Overview (14 points). Due the first day of school. Homework category
2. Environmental Science in the World Slideshow (40 points). **Start Immediately!** Due the first day of school. Lab category.
3. Unit 1 Lecture Videos and Notes (20 points). Due the first day of school. Homework category
4. Unit 1 Reinforcement Tasks (30 points). Due the first day of school. Homework category

*Even if you sign up for this class the first day of school you are still responsible for all this work.

Part 1: Course Overview

AP Environmental Science has 9 Units. Each unit is divided into several subunits. There are 99 subunits in total. You can view them all in the screenshots below at this link.

<https://apcentral.collegeboard.org/media/pdf/ap-environmental-science-course-at-a-glance.pdf>

Course at a Glance

Plan

The Course at a Glance provides a useful visual organization of the AP Environmental Science curricular components, including:

- Sequence of units, along with approximate weighting and suggested pacing. Please note, pacing is based on 45-minute class periods, meeting five days each week for a full academic year.
- Progression of topics within each unit.
- Spiraling of the big ideas and science practices across units.

Teach

SCIENCE PRACTICES
Science practices spiral throughout the course.

- 1 Concept Explanation
- 2 Data Analysis
- 3 Visual Representations
- 4 Mathematical Routines
- 5 Test Analysis
- 6 Environmental Solutions
- 7 Scientific Experiments

BIG IDEAS

Big ideas spiral across topics and units.

- 1 Energy Transfer
- 2 Interactions Between Earth Systems
- 3 Interactions Between Different Species and the Environment
- 4 Sustainability

Assess

Assign the Personal Progress Checks—either as homework or in class—for each unit. Each Personal Progress Check contains formative multiple-choice and free-response questions. The feedback from the Personal Progress Checks shows students the areas where they need to focus.

UNIT 1 The Living World: Ecosystems		UNIT 2 The Living World: Biodiversity	
~14–15% Class Periods	6–8% AP Exam Weighting	~11–12% Class Periods	6–8% AP Exam Weighting
ERT 1 1.1 Introduction to Ecosystems		ERT 1 2.1 Introduction to Biodiversity	
ERT 1 1.2 Terrestrial Biomes		ERT 2 2.2 Ecosystem Services	
ERT 1 1.3 Aquatic Biomes		ERT 3 2.3 Island Biogeography	
ERT 2 1.4 The Carbon Cycle		ERT 3 2.4 Ecological Tolerance	
ERT 2 1.5 The Nitrogen Cycle		ERT 3 2.5 Natural Disruptions to Ecosystems	
ERT 2 1.6 The Phosphorus Cycle		ERT 3 2.6 Adaptations	
ERT 2 1.7 The Hydrologic (Water) Cycle		ERT 3 2.7 Ecological Succession	
END 1 1.8 Primary Productivity			
END 1 1.9 Trophic Levels			
END 2 1.10 Energy Flow and the 10% Rule			
END 2 1.11 Food Chains and Food Webs			
Personal Progress Check 1 • Multiple-choice: ~30 questions • Free-response: 1 question (partial) - Analyze an environmental problem and propose a solution		Personal Progress Check 2 • Multiple-choice: ~20 questions • Free-response: 1 question (partial) - Design an investigation	
Note: Partial versions of the free-response questions are provided to prepare students for more complex, full questions that they will encounter on the AP Exam.			

UNIT 3 Populations		UNIT 4 Earth Systems and Resources		UNIT 5 Land and Water Use	
~12-13% Class Periods	10-15% AP Exam Weighting	~11-12% Class Periods	10-15% AP Exam Weighting	~18-19% Class Periods	10-15% AP Exam Weighting
ERT 1 3.1 Generalist and Specialist Species		ERT 2 4.1 Plate Tectonics		ERT 1 5.1 The Tragedy of the Commons	
ERT 2 3.2 K-Selected r-Selected Species		ERT 3 4.2 Soil Formation and Erosion		ERT 1 5.2 Clearcutting	
ERT 2 3.3 Survivorship Curves		ERT 3 4.3 Soil Composition and Properties		ERT 1 5.3 The Green Revolution	
ERT 2 3.4 Carrying Capacity		ERT 3 4.4 Earth's Atmosphere		ERT 1 5.4 Impacts of Agricultural Practices	
ERT 2 3.5 Population Growth and Resource Availability		ERT 3 4.5 Global Wind Patterns		ERT 2 5.5 Irrigation Methods	
ERT 2 3.6 Age Structure Diagrams		ERT 3 4.6 Watersheds		ERT 2 5.6 Pest Control Methods	
ERT 2 3.7 Total Fertility Rate		END 1 4.7 Solar Radiation and Earth's Seasons		ERT 2 5.7 Meat Production Methods	
ERT 2 3.8 Human Population Dynamics		END 2 4.8 Earth's Geography and Climate		ERT 2 5.8 Impacts of Overfishing	
ERT 2 3.9 Demographic Transition		END 2 4.9 El Niño and La Niña		ERT 2 5.9 Impacts of Mining	
				ERT 2 5.10 Impacts of Urbanization	
				ERT 2 5.11 Ecological Footprints	
				ERT 3 5.12 Introduction to Sustainability	
				ERT 3 5.13 Methods to Reduce Urban Runoff	
				ERT 3 5.14 Integrated Pest Management	
				ERT 3 5.15 Sustainable Agriculture	
				ERT 3 5.16 Aquaculture	
				ERT 3 5.17 Sustainable Forestry	
Personal Progress Check 3 • Multiple-choice: ~20 questions • Free-response: 1 question (partial) - Analyze an environmental problem and propose a solution doing calculations		Personal Progress Check 4 • Multiple-choice: ~25 questions • Free-response: 1 question - Design an investigation		Personal Progress Check 5 • Multiple-choice: ~25 questions • Free-response: 1 question - Analyze an environmental problem and propose a solution	

UNIT 6 Energy Resources and Consumption		UNIT 7 Atmospheric Pollution		UNIT 8 Aquatic and Terrestrial Pollution	
~16-17% Class Periods	10-15% AP Exam Weighting	~11-12% Class Periods	7-10% AP Exam Weighting	~19-20% Class Periods	7-10% AP Exam Weighting
END 1 6.1 Renewable and Nonrenewable Resources		STB 4 7.1 Introduction to Air Pollution		STB 1 8.1 Sources of Pollution	
END 2 6.2 Global Energy Consumption		STB 5 7.2 Photochemical Smog		STB 2 8.2 Human Impacts on Ecosystems	
END 2 6.3 Fuel Types and Uses		STB 5 7.3 Thermal Inversion		STB 2 8.3 Endocrine Disruptors	
END 2 6.4 Distribution of Natural Energy Resources		STB 5 7.4 Atmospheric CO ₂ and Particulates		STB 2 8.4 Human Impacts on Wetlands and Mangroves	
END 2 6.5 Fossil Fuels		STB 5 7.5 Indoor Air Pollutants		STB 2 8.5 Eutrophication	
END 2 6.6 Nuclear Power		STB 5 7.6 Reduction of Air Pollutants		STB 2 8.6 Thermal Pollution	
END 2 6.7 Energy from Biomass		STB 5 7.7 Acid Rain		STB 2 8.7 Persistent Organic Pollutants (POPs)	
END 2 6.8 Solar Energy		STB 5 7.8 Noise Pollution		STB 2 8.8 Bioaccumulation and Biomagnification	
END 2 6.9 Hydroelectric Power				STB 2 8.9 Solid Waste Disposal	
END 2 6.10 Geothermal Energy				STB 2 8.10 Waste Reduction Methods	
END 2 6.11 Hydrogen Fuel Cell				STB 2 8.11 Sewage Treatment	
END 2 6.12 Wind Energy				ERT 1 8.12 Lethal Dose 50% (LD ₅₀)	
END 2 6.13 Energy Conservation				ERT 1 8.13 Dose Response Curve	
				ERT 1 8.14 Pollution and Human Health	
				ERT 1 8.15 Pathogens and Infectious Diseases	
Personal Progress Check 6 • Multiple-choice: ~35 questions • Free-response: 1 question - Analyze an environmental problem and propose a solution doing calculations		Personal Progress Check 7 • Multiple-choice: ~20 questions • Free-response: 1 question - Design an investigation		Personal Progress Check 8 • Multiple-choice: ~35 questions • Free-response: 1 question - Analyze an environmental problem and propose a solution doing calculations	

UNIT 9 Global Change	
~19-20% Class Periods	15-20% AP Exam Weighting
STB 1 9.1 Stratospheric Ozone Depletion	
STB 2 9.2 Reducing Ozone Depletion	
STB 2 9.3 The Greenhouse Effect	
STB 2 9.4 Increases in the Greenhouse Gases	
STB 2 9.5 Global Climate Change	
STB 2 9.6 Ocean Warming	
STB 2 9.7 Ocean Acidification	
ERT 1 9.8 Invasive Species	
ERT 1 9.9 Endangered Species	
ERT 1 9.10 Human Impacts on Biodiversity	
Personal Progress Check 9 • Multiple-choice: ~25 questions • Free-response: 1 question - Analyze an environmental problem and propose a solution	

Unit Guide Questions:

1. Which unit has the most subunits? _____
2. Which subunit covers nuclear power? _____
3. Which subunit covers endocrine disruptors? _____
4. Which unit are you most excited to learn about? Why?
5. Which unit are you least excited to learn about? Why?

This is the 200+ page Course and Exam Description (CED): <https://apcentral.collegeboard.org/media/pdf/ap-environmental-science-course-and-exam-description.pdf>

You do not need to read all of this. Please read pages 221-227 where it gives information about the AP exam.

CED Questions:

1. How many multiple choice questions are on the exam? _____
2. How many minutes do you have to answer the multiple choice questions? _____
3. How many FRQs are on the exam? _____
4. How many minutes do you have to complete the FRQs? _____
5. Which section has more weight toward your exam score, the MCQ or the FRQ? _____
6. How many points is each FRQ? _____
7. Which unit is covered most heavily on the AP test? _____
8. Compare and contrast the FRQ types. How are they different from one another?
9. What are the seven task verbs used in the FRQ questions?

Part 2: Environmental Science in the World Slideshow

Purpose

I want you to develop the skill of noticing the world around you. Notice the trees, the weather, the sounds of the bugs (cicada season!?), and so much more. In this class, we also will develop the skill of noticing how humans interact with the world, often resulting in significant consequences. Think about where water goes when it rains. In the city, it doesn't go into the soil, does it? It hits pavement, then drains into sewage pipes. Where does it go after that? Why do we manage water this way? What are some of the consequences of these actions? For example, if water ends up in storm drains, perhaps a local stream will dry up. Again, the goal of this is to get you to see environmental science that is happening all around you.

To that end, your job is to make a slideshow of images taken throughout summer break that demonstrate you observing environmental science around you. These images must be taken **THIS summer. You must appear in each picture for full credit.**

For every picture that is missing you -.5 points per picture.

Below is a table with all the categories. You may not include more than one selection from each row.

Format: Power Point/Keynote. For each picture you need to place the category and the specific information at the top of the slide.

Missing Categories, specific information, or additional information. -.5 points

Category	3 pts.	2 pts.	1 pt.	Additional Information Needed to Receive Points
Lithosphere	Volcano	An igneous rock	Non-native rock, bigger than you	Location
Hydrosphere	Ocean	Bay	Flowing or standing water in a watershed	Name of water body
Atmosphere	The troposphere from a plane	The night sky with an object beyond Earth's atmosphere	The troposphere from land	Location and description of features in the atmosphere/picture
Biogeochemical Cycles	Nitrogen cycle	Carbon cycle	Water Cycle	Source and destination of the element and compound, and name of process
Energy Flow	Carnivore consuming herbivore or carnivore (not processed food)	Herbivore consuming producer (not processed food)	Photosynthesis happening	Names of participating species
Biodiversity 1	Native endangered animal, in its habitat	Native endangered plant, in its habitat	Non-native endangered species	Name of species
Biodiversity 2	Invasive animal species	Invasive aquatic plant species	Invasive terrestrial plant species	Name of species and where species came from
Population Growth	Twin humans less than 1 year old	A human less than 2 years old	A human less than 5 years old	Name of human(s)
Forest	Native tree you can't reach more than one quarter of the way around	Native tree you can't reach more than halfway around	Non-native tree you can't reach more than halfway around	Name of species
Biodiversity Preserve	National park sign	State park sign	County or city park sign	Location of park
Food Crops	Food crop being grown on a farm	Food crop being transported	County or city park sign	Species name of food crop
Meat	Animals being raised for food in a CAFO	Animals being raised for food on rangeland	Food crop being retailed	Species name of animal
Fishing	Commercial fishing operation	Recreational fishing	Fish being retailed	Species name of fish
Water Resources	Water transport system	Water storage system	Water delivery and use	Where water came from and where water goes
Water Pollution	Point source of water pollution	Non-point source of water pollution	Polluted water or solid water pollutant	Type of water pollution
Air Pollution	Nonmobile point source emitting pollution	Mobile source emitting pollution	Air pollution without identified source	Type of air pollution
Renewable Energy	A nuclear or geothermal power plant,	A windmill or solar panel	A dam	Location and reason for this type of energy generation
Fossil Fuels	Fossil fuel production or processing (mine, well, refinery)	Non-gasoline fossil fuel use or retail	Gasoline pump/use	Name of fossil fuel

Solid Waste	REDUCING waste generation	REUSING potential waste	Recycling potential waste	Explain how waste is averted
Urbanization	LEED Platinum or gold building	LEED silver or certified building	Any “green” feature inside a building	Name of building or occupants; description of “green” features
Transportation 1	Riding public mass transit	A public mass transit vehicle	Private mass transit	Destination and ride quality
Transportation 2	Two cars, in the same image, that differ in mileage by more than 30 mpg	Two cars, in the same image, that differ in mileage by more than 20 mpg	Two cars, in the same image, that differ in mileage by more than 10 mpg	Makes, models and mileages of pictured cars
Politics and Economics 1	University building from which the environment is studied	Community college building from which the environment is studied	Commercial or office building of a company or organization involved with environmentally-related work.	Name of building and description of a specific course or project taught/worked on there
Politics and Economics 2	Worker in environment- related profession	Volunteer in environment-related work	Environmentally aware person	Name and role of person
Politics and Economics 3	A yard sign for or against an environment-related bill	Any local, state, or federal political candidate	A yard sign for a political candidate	Summary of the bill or environmental stance of candidate
Beauty	A non-human thing in the environment that you find extraordinarily beautiful	A non-human thing in the environment that you find moderately beautiful	A non-human thing in the environment that you find ugly	What it is and why it’s beautiful or not
Signage	An educational sign documenting efforts to clean up the environment outside	An educational sign documenting efforts to clean up the environment inside	A street sign that pertains to the environment	A description of what the sign says
Soil	Loam	Clay (from the ground--not an art supply)	Sand	A description of the soil type
Ecosystem Services	A regulatory ecosystem service	A cultural ecosystem service	A provisioning ecosystem service	What the service is and why it is in that category
Irrigation	Furrow irrigation	Drip irrigation	Spray irrigation	What it is and why it’s beautiful or not
Wetlands	Eutrophication	Mangroves	Erosion	Why eutrophication/erosion are problems or why mangroves are beneficial
Survivorship	A species with Type 1 survivorship	A species with Type 2 survivorship	A species with Type 3 survivorship	Name of species and what this type of survivorship means about the organism
Land and Water Use	An example of tragedy of the commons	An example of aquaculture	An example of clearcutting	How does your picture demonstrate this phenomenon
Concluding Slide	You and your family/friends enjoying the environment. This picture must not be used for any other category			

Part 3: Lecture Videos + Notes

Watch Mr. Smedes lecture videos for Unit 1 and take notes. There are 10 videos to watch, and each one is about 10 minutes long. Unit 1 should be a review of concepts you learned in biology class. Notice that Unit 1 questions comprise just 6-8% of the AP test. You should be familiar with these ideas. They will be very quickly reviewed and tested within the first and second week.

- 1.1 Video: [APES Video Notes 1.1 - Ecosystems](#)
- 1.2 Video: [APES Video Notes 1.2 - Terrestrial Biomes](#)
- 1.3 Video: [APES Video Notes 1.3 - Aquatic Biomes](#)
- 1.4 Video: [APES Video Notes 1.4 - Carbon Cycle](#)
- 1.5 Video: [APES 1.5 Notes - Nitrogen Cycle](#)
- 1.6 Video: [APES Notes 1.6 - Phosphorus Cycle](#)
- 1.7 Video: [APES Notes 1.7 - Hydrologic \(Water\) Cycle](#)
- 1.8 Video: [APES Notes 1.8 - Primary Productivity](#)
- 1.9 and 1.10 Video: [APES Notes 1.9 & 1.10 - Trophic Levels & The 10% Rule](#)
- 1.11 Video: [APES Notes 1.11 - Food Webs & Chains](#)

For your notes, please take handwritten notes in Notability with clear headings for each subsection. You can also take notes on paper, but know that I will ask you to submit this to Canvas on the first day of school. You may have to do a lot of picture taking or scanning of documents.

APES UNIT 9

Example from Unit 9:

9.1-9.2 → Stratospheric Ozone Depletion

- Stratospheric ozone + life on Earth
- ozone in the stratosphere absorbs UV-C and much of UV-B radiation
- * Without ozone layer, life on land would not be possible since UV-B & C radiation causes significant tissue damage & mutates DNA
- Health benefits:
 - Prevents skin cancer & cataracts
 - UV-B & C mutate DNA (skin cancer) & cause oxidative stress in eyes (cataracts)
- * Tropospheric = resp. irritant, damaging to plant tissue & precursor to photochemical smog.

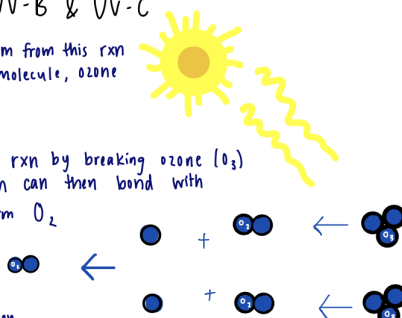
How ozone absorbs UV-B & UV-C

- When a free oxygen atom from this rxn combines with an O_2 molecule, ozone (O_3) is formed

- UV-C also reverses the rxn by breaking ozone (O_3) into O_2 and O , which can then bond with

Another free O to form O_2

- continued formation & break down of O in stratosphere absorbs all UV-C & much UV-B radiation (protecting org. on Earth)



* Anthropogenic Ozone Depletion

- * CFC's are a human cause of O_3 breakdown.
 - Refrigerant chemicals
 - UV radiation causes free atom to separate from CFC's

Part 4: Reinforcement Tasks

1. Complete the following table for these biogeochemical cycles:

Trait	Carbon	Nitrogen	Phosphorus	Water
Importance to life				
Largest reservoir				
Methods of transport				
Cycle duration (long/short)				

2. Describe what happens at each step of the nitrogen cycle:

Nitrogen fixation_____

Nitrification_____

Assimilation_____

Ammonification_____

Denitrification_____

3. For each of the following species interactions, define it and give two common examples.

Symbiotic Relationship	Definition	Two Examples
Mutualism		
Commensalism		
Parasitism		
Competition		
Predation		

4. What variables determine the type of biome an area will have?

5. Fill out the chart below on the various biomes.

Type of Biome	Typical Location	Typical Climate	Characteristic adaptations for survival
Tropical Rainforest			Plants – Animals –
Temperate Deciduous Forest			Plants – Animals –
Taiga (Boreal) Forest			Plants – Animals –
Tropical Grasslands (Savanna)			Plants – Animals –
Temperate Grassland (Prairie)			Plants – Animals –
Tundra (Cold Grassland)			Plants – Animals –

Desert			Plants – Animals –
--------	--	--	---------------------------

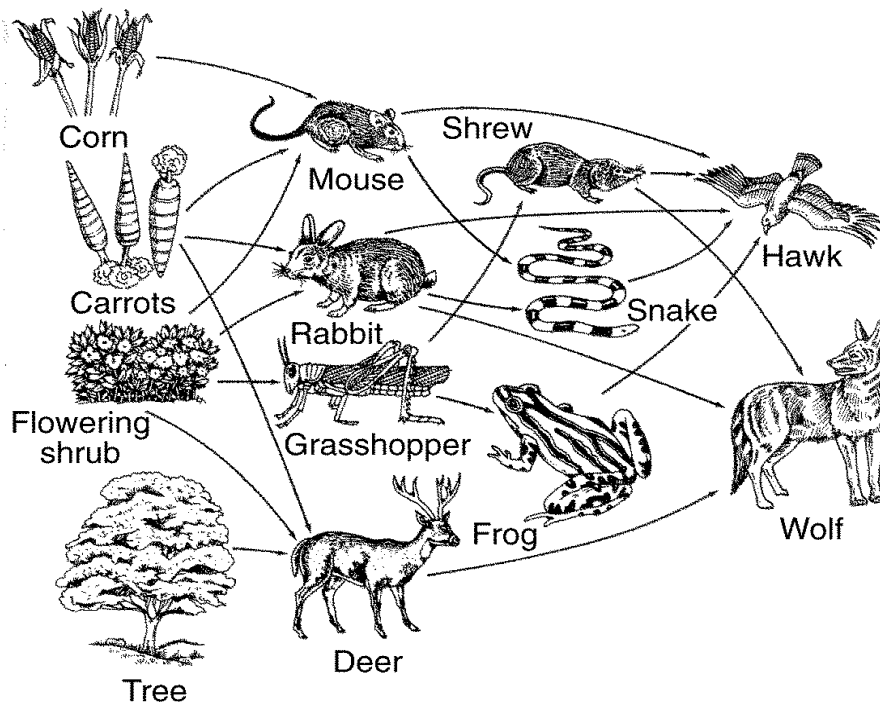
6. List two environmental benefits of wetlands.

7. Write the balanced chemical equation for photosynthesis in the box on the right. Label the reactants and products.

8. Write the balanced chemical equation for cellular respiration in the box on the right. Label the reactants and products.

9. Perform the following calculation. The net annual primary productivity of a particular wetland ecosystem is found to be 8,000 kcal/m². If respiration by the aquatic producers is 12,000 kcal/m² per year, what is the gross annual primary productivity for this ecosystem, in kcal/m² per year?

10. On the following food web, classify each species into its trophic level.



11. Next to the food web, draw an ecological pyramid using the food web above and determine the biomass of the deer if the wolf consumes 8943 kg. Label each trophic level in the pyramid.

12. Explain how the law of conservation of matter relates to the cycling of carbon through a food web.

13. Before a group of volunteers planted 400 mangrove trees, the gross annual primary productivity of a particular wetland ecosystem is found to be $22,000 \text{ kcal/m}^2$. The trees have increased the gross primary productivity by 20%. What is the new GPP of the wetland?