Name:_____ Date:_____ Per:_____

AP Environmental Science Summer Assignments

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.

For perspective, there are 99 subunits in the AP curriculum. Last year, we had 148 days of school before the AP test. Add in absences for school events like sports and retreats, as well as a few days for review before midterms and the AP test, and you begin to realize that we almost have to cover a subunit a day in order to finish the curriculum on time. That is a very quick pace!

As you can see, getting a jumpstart on our content over the summer will help alleviate some of the pressure to finish the curriculum throughout the school year.

Your Tasks

1. Course Overview (10 points). Due the first Friday of school
2. Environmental Science in the World Slideshow (40 points). Due the first day of school
3. Unit 1 Lecture Videos and Notes (20 points). Due the first day of school
4. Unit 1 Reinforcement Tasks (30 points). Due the first Friday of school

1. Course Overview–Less than 1 hour

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, and 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 Visual Representations
3 Text Analysis
4 Scientific Experiments
5 Data Analysis
6 Mathematical Routines
7 Environmental Solutions

BIG IDEAS

Big ideas spiral across topics and units.

ENG Energy Transfer
ERT Interactions Between Earth Systems
EIN Interactions Between Different Species and the Environment
STB 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

~14–15 Class Periods | 6–8% AP Exam Weighting

- ERT 1 1.1 Introduction to Ecosystems
- ERT 1 1.2 Terrestrial Biomes
- ERT 1 1.3 Aquatic Biomes
- ERT 2 1.4 The Carbon Cycle
- ERT 2 1.5 The Nitrogen Cycle
- ERT 2 1.6 The Phosphorus Cycle
- ERT 2 1.7 The Hydrologic (Water) Cycle
- ENG 1 1.8 Primary Productivity
- ENG 1 1.9 Trophic Levels
- ENG 6 1.10 Energy Flow and the 10% Rule
- ENG 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

The Living World: Biodiversity

~11–12 Class Periods | 6–8% AP Exam Weighting

- ERT 1 2.1 Introduction to Biodiversity
- ERT 1 2.2 Ecosystem Services
- ERT 1 2.3 Island Biogeography
- ERT 3 2.4 Ecological Tolerance
- ERT 5 2.5 Natural Disruptions to Ecosystems
- ERT 5 2.6 Adaptations
- ERT 5 2.7 Ecological Succession

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

~12–13 Class Periods | 10–15% AP Exam Weighting

- ERT 1 3.1 Generalist and Specialist Species
- ERT 5 3.2 K-Selected r-Selected Species
- ERT 5 3.3 Survivorship Curves
- ERT 5 3.4 Carrying Capacity
- ERT 6 3.5 Population Growth and Resource Availability
- EIN 5 3.6 Age Structure Diagrams
- EIN 5 3.7 Total Fertility Rate
- EIN 7 3.8 Human Population Dynamics
- EIN 1 3.9 Demographic Transition

Personal Progress Check 3
- Multiple-choice: ~20 questions
- Free-response: 1 question (partial)
  - Analyze an environmental problem and propose a solution doing calculations

UNIT 4 Earth Systems and Resources

~11–12 Class Periods | 10–15% AP Exam Weighting

- ERT 2 4.1 Plate Tectonics
- ERT 4 4.2 Soil Formation and Erosion
- ERT 4 4.3 Soil Composition and Properties
- ERT 2 4.4 Earth's Atmosphere
- ERT 2 4.5 Global Wind Patterns
- ERT 1 4.6 Watersheds
- ENG 2 4.7 Solar Radiation and Earth's Seasons
- ENG 2 4.8 Earth's Geography and Climate
- ENG 7 4.9 El Niño and La Niña

Personal Progress Check 4
- Multiple-choice: ~25 questions
- Free-response: 1 question
  - Design an investigation

UNIT 5 Land and Water Use

~18–19 Class Periods | 10–15% AP Exam Weighting

- EIN 1 5.1 The Tragedy of the Commons
- EIN 1 5.2 Clearcutting
- EIN 3 5.3 The Green Revolution
- EIN 1 5.4 Impacts of Agricultural Practices
- EIN 7 5.5 Irrigation Methods
- EIN 7 5.6 Pest Control Methods
- EIN 5 5.7 Meat Production Methods
- EIN 7 5.8 Impacts of Overfishing
- EIN 7 5.9 Impacts of Mining
- EIN 7 5.10 Impacts of Urbanization
- EIN 5 5.11 Ecological Footprints
- STB 5 5.12 Introduction to Sustainability
- STB 4 5.13 Methods to Reduce Urban Runoff
- STB 7 5.14 Integrated Pest Management
- STB 7 5.15 Sustainable Agriculture
- STB 7 5.16 Aquaculture
- STB 7 5.17 Sustainable Forestry

Personal Progress Check 5
- Multiple-choice: ~35 questions
- Free-response: 1 question
  - Analyze an environmental problem and propose a solution

UNIT 6 Energy Resources and Consumption

~16–17 Class Periods | 10–15% AP Exam Weighting

- ENG 1 6.1 Renewable and Nonrenewable Resources
- ENG 6 6.2 Global Energy Consumption
- ENG 1 6.3 Fuel Types and Uses
- ENG 2 6.4 Distribution of Natural Energy Resources
- ENG 7 6.5 Fossil Fuels
- ENG 2 6.6 Nuclear Power
- ENG 7 6.7 Energy from Biomass
- ENG 5 6.8 Solar Energy
- ENG 7 6.9 Hydroelectric Power
- ENG 1 6.10 Geothermal Energy
- ENG 1 6.11 Hydrogen Fuel Cell
- ENG 7 6.12 Wind Energy
- ENG 6 6.13 Energy Conservation

Personal Progress Check 6
- Multiple-choice: ~35 questions
- Free-response: 1 question
  - Analyze an environmental problem and propose a solution doing calculations

UNIT 7 Atmospheric Pollution

~11–12 Class Periods | 7–10% AP Exam Weighting

- STB 4 7.1 Introduction to Air Pollution
- STB 5 7.2 Photochemical Smog
- STB 2 7.3 Thermal Inversion
- STB 4 7.4 Atmospheric CO_2 and Particulates
- STB 5 7.5 Indoor Air Pollutants
- STB 7 7.6 Reduction of Air Pollutants
- STB 4 7.7 Acid Rain
- STB 3 7.8 Noise Pollution

Personal Progress Check 7
- Multiple-choice: ~20 questions
- Free-response: 1 question
  - Design an investigation

UNIT 8 Aquatic and Terrestrial Pollution

~19–20 Class Periods | 7–10% AP Exam Weighting

- STB 1 8.1 Sources of Pollution
- STB 6 8.2 Human Impacts on Ecosystems
- STB 1 8.3 Endocrine Disruptors
- STB 7 8.4 Human Impacts on Wetlands and Mangroves
- STB 2 8.5 Eutrophication
- STB 1 8.6 Thermal Pollution
- STB 1 8.7 Persistent Organic Pollutants (POPs)
- STB 4 8.8 Bioaccumulation and Biomagnification
- STB 7 8.9 Solid Waste Disposal
- STB 6 8.10 Waste Reduction Methods
- STB 2 8.11 Sewage Treatment
- EIN 6 8.12 Lethal Dose 50% (LD_{50})
- EIN 5 8.13 Dose Response Curve
- EIN 4 8.14 Pollution and Human Health
- EIN 2 8.15 Pathogens and Infectious Diseases

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 7 9.2 Reducing Ozone Depletion
- STB 1 9.3 The Greenhouse Effect
- STB 2 9.4 Increases in the Greenhouse Gases
- STB 5 9.5 Global Climate Change
- STB 7 9.6 Ocean Warming
- STB 1 9.7 Ocean Acidification
- EIN 7 9.8 Invasive Species
- EIN 7 9.9 Endangered Species
- EIN 7 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 FRQs. How are they different from one another?

9. What are the seven task verbs used in the FRQ questions?

2. Environmental Science in the World Slideshow–5 hours?

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. You can also make a video/vlog if you prefer that format. These images must be taken THIS summer, so you must have an identifying object of your choosing in each picture. This object could be a coin, card, St. John's ID, or really anything of your choosing. It must be present in each of your photos for them to count.

Below is a table with all of the categories. You may not include more than one selection from each row, and you must earn 40 points for full credit. If you go above and beyond by taking more photos or choosing more difficult 3 point choices, I will give a maximum of 50 points (10 extra credit points). Please circle or highlight the cells in the table for which you are submitting photos. You must also include a caption with the necessary additional info to receive 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 otther category			

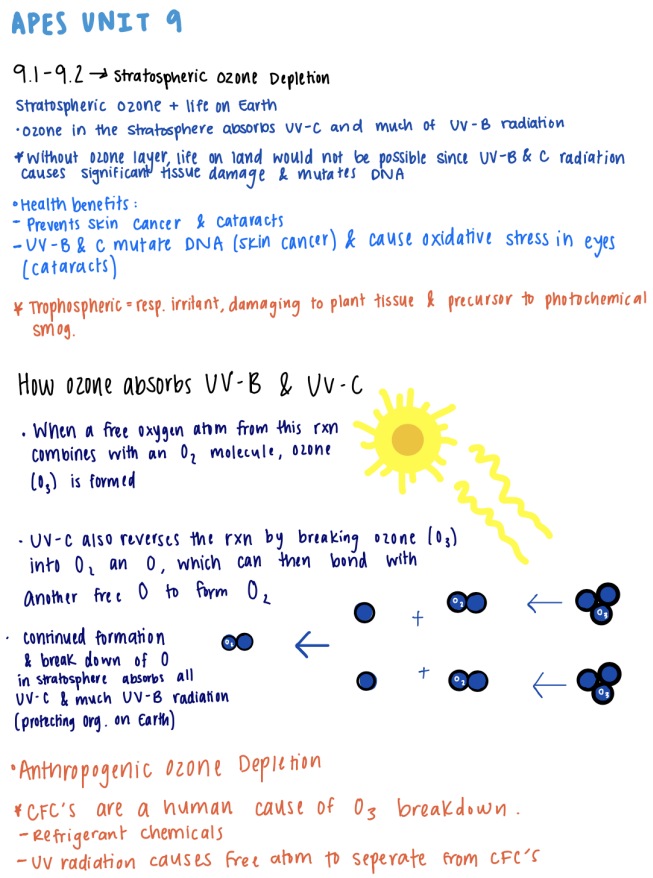
3. Lecture Videos + Notes–~3 hours

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. This should take ~3 hours. 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. Since you should be familiar with these ideas, and they aren't emphasized in the course, it will be very helpful to speed through Unit 1 as quickly as possible at the beginning of the school year.

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.

Example from Unit 9:



4. Reinforcement Tasks–3 hours

Vocabulary:

HIGHLIGHT 10 WORDS YOU DON'T KNOW. DEFINE THEM AND INCLUDE A PICTURE (DRAWN OR FROM THE INTERNET)

1. abiotic
2. aerobic respiration
3. ammonia
4. ammonification
5. aquifer
6. assimilation
7. autotroph
8. bacteria
9. benthos
10. biogeochemical cycle
11. biome
12. biosphere
13. biotic
14. deciduous plants
15. carbon cycle
16. carbon sink
17. carrying capacity
18. climax community
19. coastal wetland
20. commensalism
21. community
22. coniferous trees
23. coral reef
24. deciduous plants
25. decomposer
26. denitrification
27. detritivores
28. detritus
29. detritus feeder
30. diffusion
31. ecology
32. ecosystem
33. energy productivity
34. estuary
35. eutrophication
36. fermentation
37. first law of thermodynamics
38. food chain
39. food web
40. freshwater life zones
41. fundamental niche
42. gross primary productivity (GPP)
43. groundwater
44. habitat
45. herbivore
46. heterotroph
47. host
48. hydrologic cycle
49. infiltration
50. kilocalorie (kcal)
51. law of conservation of energy
52. law of conservation of matter
53. leaching
54. limiting factor
55. mutualism
56. net primary productivity (NPP)
57. niche
58. nitrate
59. nitrogen cycle
60. nitrous oxide
61. nitrogen fixation
62. nitrogen oxides
63. nitrification
64. omnivore
65. parasitism
66. phosphate
67. phosphorus cycle
68. photosynthesis
69. phytoplankton
70. plankton
71. precipitation
72. predation
73. primary consumer
74. primary productivity
75. producer
76. pyramid of energy flow
77. riparian zones
78. runoff
79. scavenger
80. second law of energy
81. second law of thermodynamics
82. secondary consumer
83. species
84. sulfur cycle
85. sulfur dioxide (SO2)
86. sulfuric acid (H2SO4)
87. surface runoff
88. surface water
89. Symbiotic Relationships
90. terrestrial
91. tertiary (higher-level) consumers
92. transpiration
93. trophic level
94. water cycle
95. water table
96. zone of aeration
97. zone of saturation

Room for Vocabulary

Sample:

71 Precipitation: The quantity of water deposited on the Earth as hail, mist, rain, sleet, or snow.

Questions:

1. What are five biotic and five abiotic factors we might study in an ecosystem? How might these impact the carrying capacity of an ecosystem?

2. Draw a picture and add captions of the water cycle. Which steps are humans most likely to disrupt (intentionally or otherwise)?

3. Draw a picture and add captions of the carbon cycle. Which steps are humans most likely to disrupt (intentionally or otherwise)? What would be the likely consequence(s) of such interferences?

4. Draw a picture and add captions of the nitrogen cycle. Which steps are humans most likely to disrupt (intentionally or otherwise)? What would be the likely consequence(s) of such interferences?

5. Draw a picture and add captions of the phosphorus cycle. Which steps are humans most likely to disrupt (intentionally or otherwise)? What would be the likely consequence(s) of such interferences? How is the phosphorus cycle different from the other biogeochemical cycles?

6. 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)				

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

Nitrogen fixation_____

Nitrification_____

Assimilation_____

Ammonification_____

Denitrification_____

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

Symbiotic Relationship	Definition	Two Examples
Mutualism		
Commensalism		
Parasitism		
Competition		
Predation		

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

10. 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 –

11. List two environmental benefits of wetlands.

B. Energy Flow

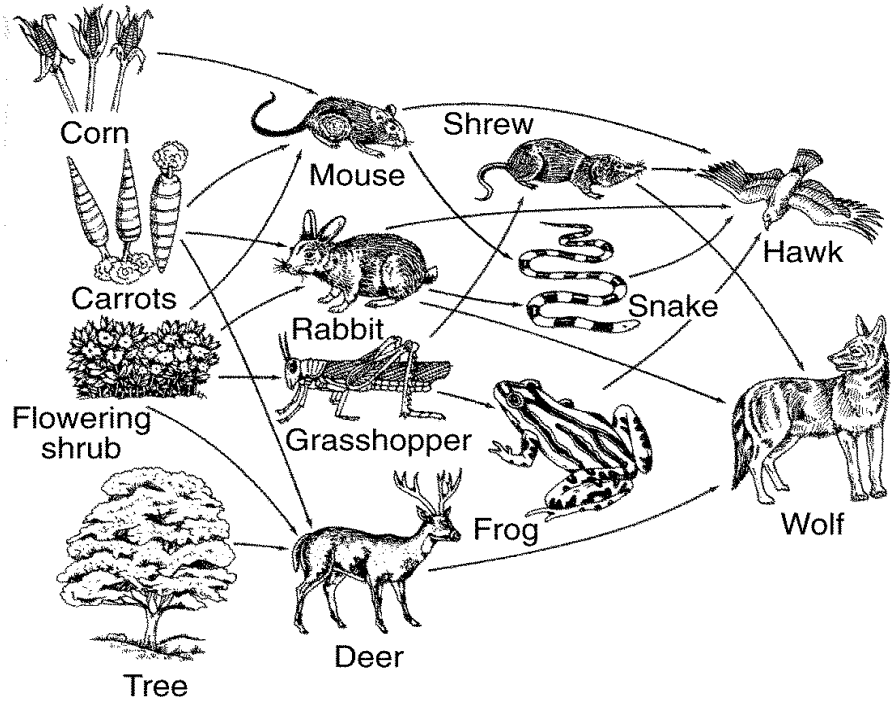
12. Write the balanced chemical equation for photosynthesis in the box on the right. Label the reactants and products.

Photosynthesis:

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

14. 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?

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



16. 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.

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

18. 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 kcal/m^2 . The trees have increased the gross primary productivity by 20%. What is the new GPP of the wetland?