

2018- 2019 APES Summer Assignment

Welcome future APES students! This is an advanced science course that combines the disciplines of biology, chemistry, geology and physics to investigate global environmental issues. We will discover how the Earth's systems function together and how humans have affected our planet. We will also examine our personal consumption habits and learn ways to be responsible global citizens in the face of serious environmental issues.

Because this is a college level course, you will be responsible for learning a large amount of material on your own. I will help you as we go, but it will be your responsibility to take notes, study and learn your vocabulary! We also work on the assumption that you have a general science background that includes biology, chemistry and algebra. The purpose of this project is to help you prepare for the APES content by getting organized, reviewing some background information, and getting familiar with some of the basic concepts of environmental science and your own consumption habits.

General Guidelines:

- Read the directions for each section carefully!
- Each section should be clearly labeled.
- Each section of the project must be fully completed, neat and typed when specified.
- Each piece of the project should be bound together in some way.
- All research/information needs to be appropriately cited using APA format. A quick google search will help you with formatting.
- All work is to be completed on your own. You may not work with other students to complete this assignment.
- The checklist, provided at the end of this packet, should be completed and attached to the front of your work.

Section 1: Electronic Setup

In this course, we will be using technology extensively to help you learn basic content and communicate as scientists in the 21st century. Complete each of the following tasks to ensure that you are ready to begin on the first day of class!

1. Sign up for and Visit google classroom page for APES summer Assignment
 - a. Class code : **664vb9**
2. Fill out the survey so I can get to know you better
 - a. Your name
 - b. Any special hobbies or interests you have
 - c. Why you have chosen to take APES
 - d. Any concerns you have for next year
3. Check out book from library
 - a. Read chapters 1 and 2
 - b. Take focused notes on chapters 1 and 2

Section 2: Chemistry Review

Chemistry is a big part of environmental science. It is highly recommended that you take chemistry before registering for this course. In order to review some of the basic chemistry concepts you will need complete the following on a clean sheet of paper. This may be typed or handwritten.

1. For each of the following, write out the chemical name that goes with the symbol:

CO ₂	CO	C ₆ H ₁₂ O ₆	CH ₄	H ₂
N ₂	NO ₂	NO ₃	NH ₃	NH ₄
O ₂	O ₃	P	PO ₄ ³⁻	S
SO ₂	SO ₃	H ₂ SO ₄	NaCl	Pb
U	Rn	Hg	Cl	H ₂ O

2. Write at least a paragraph that explains the following:
- What is the pH scale? What does it measure?
 - How do the numbers on the pH scale compare? Example – is a pH of 4 twice as strong as a pH of 2? Hint- the pH scale is not linear!
 - What are the average pH ratings of the following common substances in the environment?
 - Blood
 - Rain
 - Freshwater (lake or river)
 - Ocean water

Section 3: Math Review

The APES exam has a significant amount of math and **does not allow the use of calculators!** Most students find that with a little practice, the math is not difficult, but as many of us have not had practice with setting up and solving problems without a calculator in a long time, in the beginning it can be daunting.

Complete each of the following problems including a detailed set up with labeled units and proper scientific notation. **NO CALCULATORS!** You must show all work to get credit.

All problems should be expressed in scientific notation (do not write out large numbers with multiple zeros as place holders). If you need assistance with this, please refer to the sample problems on our website.

1. What is ten million times three thousand?
2. What is thirty-four million plus two hundred fifty-six thousand times four hundred?
3. A population of deer had 200 individuals. If the population dropped 15% in one year, how many deer were lost? What is the total population of deer the next year?
4. One year we had 120 APES students and the next year we had 150 APES students. What percentage did the population of APES students grow by?
5. One year we had 2500 endangered sea turtles hatch. After one year there were only 1500. What percentage of turtles died?
6. Electricity costs 6 cents per kilowatt hour. In one month one home uses one megawatt of electricity. How much will the electric bill be? (be sure to look at the conversion chart for the conversion factor from kilo to mega)
7. Your car gets 12 miles to the gallon and your friend's car gets 20 miles to the gallon. You decide to go on a road trip to Virginia Tech, which is 300 miles away. If gas costs \$4 per gallon and you decide to split the gas money, how much money will you save by driving your friend's car?
8. A turtle was crawling at the rate of 38 cm per minute. How many kilometers would the turtle crawl in 2 hours?
9. A turtle was crawling at the rate of 43 cm per minute. How many kilometers would this turtle crawl in one day (24 hours) if it did not rest and continued to crawl at a continuous pace?
10. There are 125 blades of grass in a square cm of lawn. Assuming the grass stand is even, how many blades of grass would be found in a lawn measuring 8 meters by 6 meters? Use scientific notation in your answer.
11. You purchase a home that is 2500 square feet of living space. How many square meters of living space is this?
12. If a calorie is equivalent to 4.184 joules, how many joules are contained in a 250 kilocalorie slice of pizza?
13. A coal-fired electric power plant produces 12 million kilowatt-hours (kWh) of electricity each day. Assume that an input of 10,000 BTUs of heat is required to produce an output of one kilowatt-hour of electricity. Calculate the number of BTUs of heat needed to generate the electricity produced by the power plant each day.
14. (Using the information in 13) Calculate the pounds of coal consumed by the power plant each day assuming that one pound of coal yields 5,000 BTUs of heat.
15. If a city of 10,000 experiences 200 births, 60 deaths, 10 immigrants and 30 emigrants in the course of a year, what is its net annual percentage growth rate? (By what percentage did the population change?)

Section 4: Environmental Legislation

Create a chart similar to the one on the next page and fill in the missing information pertaining to important legislation. **Make sure this is typed so that you can add as many details as needed!** You can change the formatting to fit your preferences (example – make it landscape if that's easier for you). We will study MANY different environmental policies throughout the year. This is just to get you started.

Legislation Name	Is this a US or World Treaty, Law or Act?	Date Enacted (Year)	Description of the Legislation (Give the purpose, important founding organizations or people, any major points that you find)
Kyoto Protocol			
Montreal Protocol			
NEPA			
London Dumping Convention			
Helsinki Convention			
CITES			
SMRCA			
RCRA			
Lacey Act			
Clean Water Act			
Safe Drinking Water Act			

Clean Air Act			
Antiquities Act			
Endangered Species Act			
CERCLA			

Section 5: Practice Free Response Questions (FRQs)

Part of the AP Environmental Science test is answering 4 short answer questions called free response questions or FRQs. These FRQs test your knowledge of Environmental concepts you have learned throughout the year. They are multi question writing prompts that either have data to interpret, a reading to respond to or some form of graphic for you to dissect.

For section 5 you need to *choose 2 out of the 4* FRQ questions below to answer using evidence from research or prior knowledge. Be sure to answer in complete sentences and back up your answers with at least 3 pieces of evidence.

Question 1:

Biogeochemical cycles describe the movement of certain elements (typically bound with other elements in compounds) through Earth's atmosphere, hydrosphere, biosphere, and lithosphere. These elements and their compounds are necessary components of all life, and because they cycle, they can be used repeatedly by new generations of organisms. Each biogeochemical cycle has different pathways with various reservoirs (sources and sinks) where elements may reside for days or millions of years.

- (a) The atmosphere is one important carbon reservoir.
 - (i) **Describe** a biological process by which carbon is removed from the atmosphere and converted to organic molecules.
 - (ii) **Describe** a biological process by which carbon is converted from organic molecules to a gas and returned to the atmosphere.
- (b) Oceans and terrestrial systems are also important carbon reservoirs.
 - (i) **Explain** how atmospheric carbon is incorporated into two oceanic sinks.
 - (ii) **Identify** one terrestrial sink, other than fossil fuels, that stores carbon for thousands to millions of years.
- (c) The burning of fossil fuels has been shown to increase the concentration of carbon in the atmosphere. **Discuss** TWO other human activities that increase the concentration of carbon in the atmosphere.
- (d) **Identify** an environmental problem that results from elevated atmospheric carbon concentrations. **Discuss** one consequence of the problem you identified.
- (e) Phosphorus is another element important to all organisms.
 - (i) **Describe** one major way in which the phosphorus cycle differs from the carbon cycle.
 - (ii) **Identify** one reason that phosphorus is necessary for organisms.

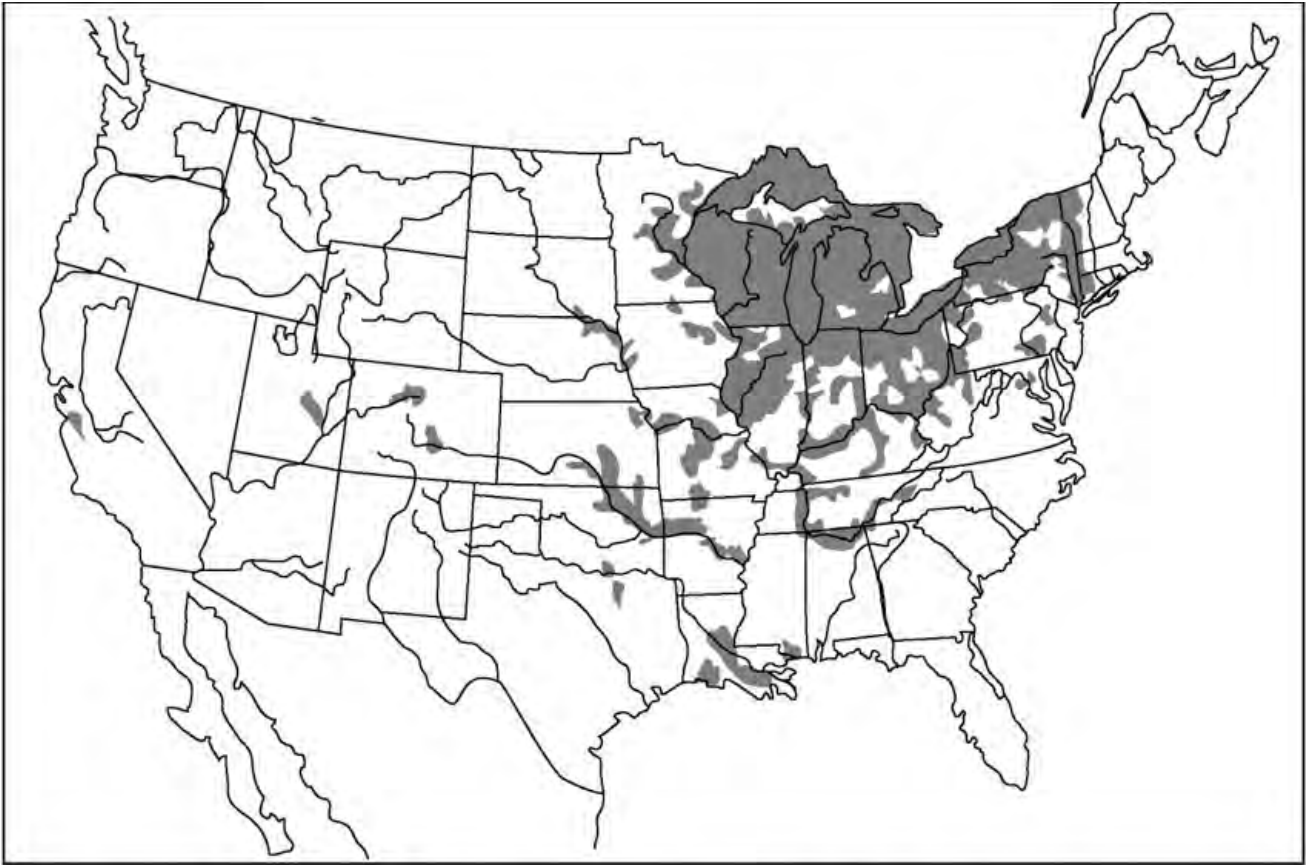
Question 2:

Termites are social insects that are essential decomposers in tropical rain forest ecosystems. Termites may account for up to 95 percent of insect biomass in tropical rain forests. Termites consume vast amounts of dead and decomposing plant material, thanks to the work of mutualistic cellulose-digesting microorganisms that inhabit their guts. In addition to their roles as important decomposers, termites digest plant materials and directly contribute to carbon dioxide and methane emissions into the atmosphere. It is likely that, like many insect species, termites and their symbionts may be sensitive to changes in their microclimate caused by global climate change, especially with regard to temperature and humidity.

		Relative Humidity		
		50%	70%	90%
Temperature	20°C	0.04	0.05	0.05
	25°C	0.05	0.07	0.10
	30°C	0.12	0.13	0.27
	35°C	0.09	0.13	0.15
	40°C	0.00	0.00	0.00

- (a) Respond to the following using the data in the table above, which gives the rate of wood consumption by termites, in mg per day per termite, under various temperature and relative humidity conditions. Under optimal conditions, the emission rate of methane by termites is approximately 70 kilograms of CH₄ per year per 1,000 termites.
- According to the data, what are the optimal temperature and relative humidity for termite activity?
 - Given a density of 4.5×10^7 termites per hectare and optimal conditions, calculate the annual amount of methane emitted, in kilograms, by the termites inhabiting a 2,000-hectare tropical rain forest.
 - Suppose the temperature increases to 35°C and the relative humidity decreases to 50 percent. Using the data provided, determine the amount of methane, in kilograms, that would be emitted by the termites in the 2,000-hectare tropical rain forest.
 - Explain why the population size of termites is also affected by temperature and humidity.
- (b) It has been observed that soon after a tropical rain forest is cleared, termite density increases to an estimated 6.8×10^7 termites per hectare. Thereafter, the termite population size decreases dramatically.
- What is the most likely reason that the density of the termites increases when a tropical rain forest is cleared?
 - Why do the termite populations eventually decrease dramatically?
- (c) Describe one way, other than changes in termite activity, that tropical rain forest destruction contributes to anthropogenic climate change.

Question 3:



The zebra mussel, a mollusk native to Eurasia, was first discovered in the Great Lakes of North America in 1988. Zebra mussels attach to solid substrates and are filter feeders. Adult zebra mussels can survive for several days or even weeks out of water if the temperature and humidity are favorable. An adult female zebra mussel can produce as many as one million eggs per year. The recent range of occurrence of zebra mussels in the United States is indicated by shading in the map above.

- (a) Why are zebra mussels located primarily in areas in the eastern United States rather than in the western United States?
- (b) How are zebra mussels introduced into isolated lakes? Describe one viable method for preventing the spread of zebra mussels into isolated lakes.
- (c) Identify and explain one impact that zebra mussels can have on aquatic ecosystems.
- (d) Identify another invasive species, either terrestrial or aquatic, and describe one negative impact it has had.
- (e) One strategy for controlling an invasive species has been to introduce another nonnative species to control it; this strategy can often have unintended results. Give a specific example of the use of this strategy and discuss a negative impact of introducing a nonnative species to control an invasive species.
- (f) Discuss TWO specific characteristics of invasive species that enable them to thrive in new environments.

Question 4:

Read the editorial below and answer the questions that follow.

14 FREMONT INQUIRER

Is the Seafood We Eat Safe?

Poisonous mercury is on our dinner plates everywhere - in sea bass served in fancy restaurants, in tuna casserole ladled out at home. Most of the time it is harmless, but eat enough and it can make you sick. Too much mercury can damage the nervous system, especially the brain, and too much in pregnant and breast-feeding women can hurt their babies - adversely affecting children's intelligence, coordination, and memory. But how much is too much? Are adults at risk as well? Public concern about these questions is prompting public-health officials to look more seriously at mercury in the environment

and its effects. Because there are no conclusive long-term studies on humans, government officials disagree on what constitutes safe exposure levels. There are those who say mercury in seafood is a very real menace and a major threat to child development. Burning fossil fuel releases mercury into the environment and this will only get worse as our dependence on coal increases. Others say the threat is overblown and that the benefits of eating fish far outweigh the worries. The fact is, no one knows.

- (a) On the basis of the article above, indicate one human activity that releases mercury into the environment. Describe how mercury is transported from that source and enters aquatic systems, often hundreds of miles away.
- (b) Describe TWO ways that the amount of mercury released into the environment from the source in part (a) could be reduced.
- (c) Explain why there are greater health risks associated with eating large predatory fish, such as tuna and sea bass, than from eating small nonpredatory fish.
- (d) Identify a toxic metal other than mercury that has a negative impact on human health and describe how it is introduced into the environment. Describe an acute sublethal effect on humans that results from exposure to this metal.

Checklist:

Please place this completed checklist at the front of your assignment before you turn it in.

Name:

Section 1: Score _____ /20

- I have been to the course website.
- I have read the course syllabus.
- I have checked out the APES book from library
- I have read and taken focused notes on chapters 1 and 2

Section 2: Score _____ /20

- I have identified all of the chemical compounds and I am ready for a quiz.
- I have written at least one paragraph about pH and I am ready to explain it to someone else.
- I have cited all of the sources I used to find my information.

Section 3: Score _____ /20

- I have read through the math review material and understand how to solve these types of problems.
- I have completed all of the review problems and am ready to take a math quiz.

Section 4: Score _____ /20

- I have researched and recorded information for all of the legislation listed.
- I have cited all of the sources I used to find my information.
- I have studied the legislation and am ready for a quiz.

Section 5: Score _____ /20

- I have answered 2 out of the 4 FRQs using evidence
- I have attached the answers to this packet