AP Environmental Science Summer Assignment - Panther Creek High 2022-2023

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 assignment 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.

Assignment Guidelines:

- Print out a copy of the Summer Assignment packet.
- Read the directions for each section carefully!
- Each section should be clearly labeled in your work.
- Each section of the assignment must be fully handwritten in a neat and organized format.
- All research/information needs to be appropriately cited using APA format. This should be completed for EACH section. 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. Do not add in grades, only check what has been completed.
- You will be required to take a quiz on the information covered in this assignment within the first two weeks of the course. The assignment, along with the quiz, will count as a test grade.
- Do NOT include this page in your submission. The CHECKLIST must be the first page as part of your submitted assignment.

CHECKLIST:

This checklist should be completed and attached to the front of your work. **Do not add in grades, only check what has been completed.** Please place this completed checklist at the front of your assignment before you turn it in.

Name _____

Section 1: Score _____/10

- ☐ I have identified all 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 (APA format)** all the sources I used to find my information.

Section 2: Score _____/10

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

Section 3: Score _____/10

- ☐ I have researched and recorded information for all the legislation listed.
- ☐ I have **CITED (APA format)** all the sources I used to find my information.
- ☐ I have studied the legislation and am ready for a quiz.

Section 4: Score _____/10

- ☐ I have completed all questions for both objective 1 & 2 on experimental design.
- ☐ I have studied how to identify variables, controls and can generate a valid hypothesis as part of experimental design.

Section 5: Score _____/10

- ☐ I have completed all questions on graphing and understand how to appropriately label, title, and scale a graph.
- ☐ I have learned how to select the appropriate graph based on data collected and am ready for a quiz.

Summer Assignment Quiz _____/50

Total Score for Summer Assignment _____/100

REMINDERS:

- **This assignment is due September 1st when you enter the classroom (first semester students only; separate due date for second semester APES students).**
- **Points will be deducted for assignments turned in after the due date based on the PCHS Late Work Policy.**
- **Assignments that are not turned in will receive a zero.**

Section 1: Chemistry Review

Chemistry is a big part of environmental science. It is highly recommended that you take chemistry before registering for this course. To review some of the basic chemistry concepts you will need complete the following on a clean sheet of paper. **<u>This must be handwritten (pen or pencil is acceptable).</u>** Make sure to **CITE (APA format)** your sources used for all parts.

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

CO_2		SO_2	
CO		SO_3	
$C_6H_{12}O_6$		H_2SO_4	
CH_4		NaCl	
H_2		Pb	
H_2CO_3		SO_4^{2-}	
N_2		U	
NO_2		Rn	
NO_3		Hg	
NH_3		Cl_2	
HNO_3		H_2O	
O_2		NO_3^{1-}	
O_3		NO_2^{1-}	
P		As	
PO_4^{3-}		CH_3Hg^+	
S		Fe	
SO_3^{2-}		Fe_2O_3	
CH_2O		Ag^+	

2. Answer each of the following questions in <u>sentence</u> form:
    a. What is the pH scale? Explain what it measures.

    b. 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!

    c. What are the average pH ratings of the following common substances in the environment? **(memorize these)**
        i. Blood
        ii. Rain
        iii. Freshwater (lake or river)
        iv. Ocean water

Section 2: Math Review

The APES exam has a significant amount of math. 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 with dimensional analysis in a long time, in the beginning it can be daunting. It is encouraged that you attend SMART lunch in the first week of the course to receive additional help, if needed.

****In this class, it will be assumed that you are able to solve math problems using the following skills.****

Percentage

- 17% = 17/100 = 0.17
- Remember that "percent" literally means divided by 100.
- Percentage is a measure of the part of the whole. Or part divided by whole.
- What is 20% of this $15 bill so that I can give a good tip? $15 x .20 = $15 x 20/100 = $3

Rates

- Percent change = (final-initial)/initial
- All of the above are ways to look for rates. The second equation is the easiest way to calculate a rate, especially from looking at a graph. Rates will often be written using the word "per" followed by a unit of time, such as cases per year, grams per minute or miles per hour. The word per means to divide, so miles per gallon is the number of miles divided by one gallon.
- Rates are calculating how much an amount changes in a given amount of time.

Scientific Notation

Thousand = 10^3 = 1,000
Million = 10^6 = 1,000,000 (people in the US)
Billion = 10^9 = 1.000,000,000 (people on Earth)
Trillion = 10^{12} = 1,000,000,000,000 (National debt)

- When using very large numbers, scientific method is often easiest to manipulate. For example, the US population is 300 million people or $300x10^6$ or $3x10^8$
- When adding or subtracting, exponents must be the same. Add the numbers in front of the ten and keep the exponent the same.
- When multiplying or dividing, multiply or divide the number in front of the ten and add the exponents if multiplying or subtract the exponents if dividing.
  - Ex. $9x10^6 / 3x10^2 = (9/3) \times 10^{(6-2)} = 3x10^4$

Dimensional Analysis

- You should be able to convert any unit into any other unit accurately if given the conversion factor.
- Example: 24 miles/gallon = how many kilometers/liter?

$$\frac{24\text{ mi}}{1\text{ gal}} \left|\frac{1.6093\text{ km}}{1\text{ mi}}\right| \frac{3.7854\text{ gal}}{1\text{ L}} = \frac{150\text{ km}}{1\text{L}} = 150\text{ km/L}$$

- Online dimensional analysis tutorials are available:
  - http://www.chemprofessor.com/dimension_text.html
  - http://www.chem.tamu.edu/class/fyp/mathrev/mr-da.html

Prefixes:

m (milli)	= 1/1000	= 10^{-3}
c (centi)	= 1/100	= 10^{-2}
k (kilo)	= 1,000	= 10^3
M (mega)	= 1,000,000	= 10^6
G (giga)	= 1,000,000,000	= 10^9
T (tera)	= 1,000,000,000,000	= 10^{12}

Complete each of the following problems including a detailed set up with labeled units and proper scientific notation. You **must show all work** to get credit. **Must be handwritten (pen or pencil is acceptable).**

- 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 provided reference materials listed above.

1. What is twelve million times four thousand?

2. What is fifty-four million plus two hundred fifty-six thousand times three hundred?

3. A population of deer had 250 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 183 APES students and the next year we had 272 APES students. What percentage did the population of APES students grow by?

5. One year we had 3600 endangered sea turtles hatch. After one year there were only 1500. What percentage of turtles died?

6. Electricity costs 4 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 24 miles to the gallon and your friend's car gets 32 miles to the gallon. You decide to go on a road trip to Virginia Tech, which is 300 miles away. If gas costs $3 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 83 cm per minute. How many kilometers would the turtle crawl in 2 hours?

9. A turtle was crawling at the rate of 34 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 145 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 7 meters by 8 meters? Use scientific notation in your answer.

11. You purchase a home that is 2000 square feet of living space. How many square meters of lving space is this?

12. If a calorie is equivalent to 4.184 joules, how many joules are contained in a 350 kilocalorie slice of pizza?

13. A coal-fired electric power plant produces 14 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 300 births, 60 deaths, 15 immigrants and 40 emigrants in the course of a year, what is its net annual percentage growth rate? (By what percentage did the population change?)

Section 3: Environmental Legislation

Fill in the missing information pertaining to important legislation in **your own handwriting.** You are expected to know the purpose of the legislation for the quiz. Be sure to **CITE (APA format)** your sources.

Legislation Name	Is this a US or World Treaty, Law or Act?	Date Enacted (Year)	Description of the Legislation (Give the general purpose and background of each legislation)
Kyoto Protocol			
Montreal Protocol			
Delaney Clause of Food, Drug, & Cosmetic Act			
Endangered Species Act			
CITES			
SMRCA			
RCRA			
CERCLA			
Clean Water Act			
Safe Drinking Water Act			
Clean Air Act			

Section 4: Experimental Design

For each objective below, read the information provided and answer the questions that follow on a separate sheet of paper in your **own handwriting**.

Objective 1: Identify components of strong experimental design

Read the following articles to gain an understanding of what experimental testing/design should consider and to understand what experimental design is about.

What's a "fair test": http://undsci.berkeley.edu/article/0_0_0/fair_tests_01

Developing a "fair test": http://undsci.berkeley.edu/article/0_0_0/fair_tests_02

http://undsci.berkeley.edu/article/0_0_0/fair_tests_03

http://undsci.berkeley.edu/article/0_0_0/fair_tests_04

Below is an experiment that was designed to investigate the effect of sulfur dioxide on soybean reproduction.

Agricultural scientists were concerned about the effect of air pollution, sulfur dioxide in particular, on soybean production in fields adjacent to coal-power plants. Based on initial investigations, they proposed that sulfur dioxide in high concentrations would reduce reproduction in soybeans. They designed an experiment to test this hypothesis. In this experiment, 48 soybean plants, just beginning to produce flowers, were divided into two groups, treatment and no treatment. The 24 treated plants were divided into four groups of 6. One group of 6 treated plants was placed in a fumigation chamber and exposed to 0.6ppm (parts per million) of sulfur dioxide for 4 hours to simulate sulfur dioxide emissions from a power plant. The experiment was repeated on the remaining three treated groups. The no-treatment plants were divided similarly into four groups of 6. Each group in turn was placed in a second fumigation chamber and exposed to filtered air for 4 hours. Following the experiment, all plants were returned to the greenhouse. When the beans matured, the number of bean pods, the number of seeds per pod, and the weight of the pods were determined for each plant.

1. An independent variable is changed or manipulated by the scientist. Identify the independent variable?

2. A dependent variable is measured or observed. Identify the dependent variable(s)?

3. Controlled or constant variable are the same in all groups. Identify as many controls as you can.

4. Explain why replication and sample size are important considerations when designing an experiment. Describe how these scientists incorporate replication and sample size in their investigation.

5. Identify the treatment was given to the control group?

6. Identify the level of treatment given to the experimental group? (This is a concentration and/or time.)

7. Describe result(s) that would support the scientists' hypothesis.

8. Describe result(s) that would force the scientists to reject the hypothesis?

Objective 2: Create an experiment to investigate a scientific question

The active ingredients in many pesticides are chemical compounds that kills organisms such as insects, molds, and weeds. Opponents of pesticides use claim that pesticides degrade water and soil quality. Design a laboratory experiment to determine whether or not a new pesticide (product X) is toxic to minnows, a type of small fish.

9. Create a hypothesis for this scenario. (Do not use if…then statements. Include a prediction of result and propose a scientific explanation for these results. Multiple sentences are often needed.)

10. Describe the method you would use to test your hypothesis.

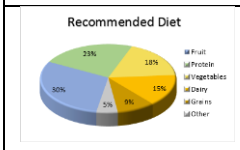
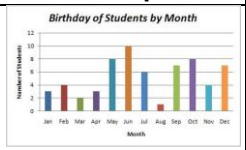
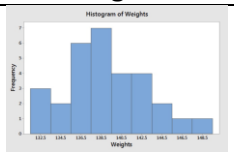
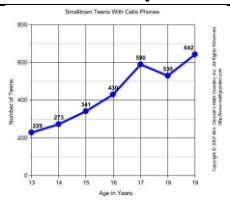
11. Identify the control.

12. Identify the dependent variable(s).

13. Describe experimental results that would lead you to reject your hypothesis. (Be specific)

Section 5: Graphing

There are several types of graphs that scientists often use to display data. They include:

Pie Charts	Bar Graphs	Histograms	Line Graphs	Scatter Plots
				
- Dependent variable is NOT continuous. - Usually presents data as a "part of a whole" or as percentages.	- Dependent variable is NOT continuous. - There is no order to the categories on the X-axis. - Bars typically don't touch. - Y-axis is usually a percentage or frequency (count)	- A specific type of bar graph. - Dependent variable must have a natural order that can be grouped into defined "chunks".	- Dependent variable IS continuous. - Points are plotted using x and y components. - The points are connected because the observations are NOT independent.	- Dependent variable IS continuous. - Points are plotted using x and y components. - The points are NOT connected because the observations are independent. - Uses a best-fit line or curve to show relationship.

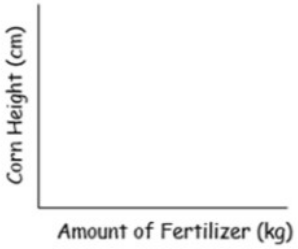
For each example given below, identify the best type of graph to represent each type of data set.

#	Description	Best type of graph
Example	*A graph showing the number of 5th graders who prefer Coke or Pepsi*	*Bar graph*
1.	a newborn baby's weight changes over time	
2.	percentage of the class earning As, Bs, and Cs	
3.	distribution of trees of different size groups (e.g. 0-10 cm, 10-20 cm, etc.…) in a forest	
4.	relationship between height and arm length in a group	
5.	percentage of an allowance spent on different categories (e.g. food, movies, etc.)	
6.	amount of rainfall, by month over a 12-month period	
7.	number of ice cream cones purchased as a function of the day's temperature	

When **labeling** your axes, keep 3 things in mind:

- The independent (manipulated) variable is written along the horizontal axis (X axis)
- Dependent (responding) variable is written along the vertical axis (Y axis)
- Units on any variables should be included in parentheses ( ) following the axis title

SAMPLE: A farmer wants to know if there is a relationship between the amount of fertilizer (in kilograms) she uses and how tall her corn grows (in centimeters).



There are a few important steps involved in correctly **scaling** an axis:

STEP 1: Find the range for the variable Range = Largest Value - Smallest Value

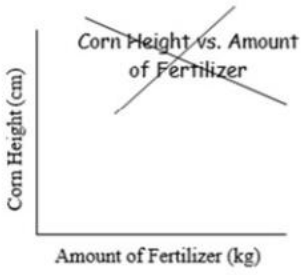
STEP 2: Divide the range by the number of intervals you want (not too many or too few). We don't want all of the data smooshed in only part of the graph; spread it out. After dividing, we may need to round up to get a number that is easy to count by. (It is easier to count by 2s instead of 1.9s)

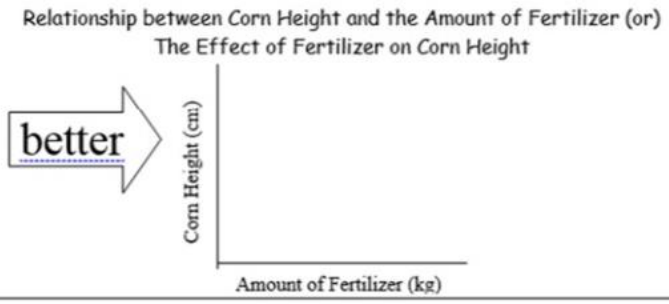
STEP 3: Use the rounded number to mark off intervals along the axis. The interval must be the same amount each time (count up by the same number).

When writing a **title** for you graph, please remember:

- The title must communicate the dependent and independent variables
- The title cannot be presented in the form "Y versus X"
- Some graphs need more explanation than others. Make sure your reader would be able to understand what your data represent.

SAMPLE: A farmer wants to know if there is a relationship between the amount of fertilizer (in kilograms) she uses and how tall her corn grows (in centimeters).





Complete each of the following questions below to practice this skill set:

For each experiment described below, write the independent and dependent variable on the appropriate axis. Be sure to include units when appropriate. Label with an appropriate title.

8. Geologists wanted to know if there was a relationship between the density (in g/cm^3) of a rock and how many meters down it was collected from.	9. Does the amount of nitrogen in the soil (measured in kilograms) affect corn production (measured in kilograms).
	

10. For each set of data below, determine the appropriate range:

EX.

Mass (g)
5
11
14
19
26
30
40

Largest #: 40

Smallest #: 5

Range: 40-5 = 35

A)

Students
100
99
88
70
72
64
55

Largest #: _____

Smallest #: _____

Range: _____

B)

Distance (cm)
3
5
6
7
9
10
12

Largest #: _____

Smallest #: _____

Range: _____

C)

Time (s)
0.22
0.51
0.78
1.01
1.23
1.60
1.74

Largest #: _____

Smallest #: _____

Range: _____

11. Graph the following data set and include appropriate scale, title, and axis labels. Make sure to choose the appropriate graph based on the type of data collected.

Plants lose water from their aboveground surfaces in the process of transpiration. Most of this water is lost from stomata, microscopic openings in the leaves. Excess water loss can have a negative effect on the growth, development, and reproduction of a plant. Severe water loss can be fatal. Environmental factors have a major impact on the rate of plant transpiration.

Temperature (°C)	20	23	27	28
Transpiration Rate ($mmol/m^2.sec$)	1.5	3	5	4.5