Summer Assignment for Summer 2024 – AP Environmental Science
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This summer assignment will help you get ready for AP Environmental Science in multiple ways. First, you must review some of the basic material you have previously learned so that we can spend class time on information that is new to you. Second it will give you an idea of the amount of time and independent work it takes to be successful in the class. Legislative acts are reviewed. Finally, the concepts of experimental design and graphing are reviewed. You may email me with questions at jtargett@eustace.org. I look forward to meeting you in the fall. You may need your APES textbook for this summer assignment. ***Good luck!***

I. Review your basic chemistry - use any source that you like (old notes, websites, etc.). There will be a short quiz on these topics in early September.
Make sure you know the following: (you do NOT need to hand anything in for this review)
Atomic structure
Atomic number, mass number
Chemical formulas
pH, pH scale,
Compounds, molecules
Isotopes, radioisotope
Acids and bases

II. Learn the names and symbols of important ions, molecules, and elements. Here are lists of ions and compounds/molecules. The next page has a table of elements that needs to be completed. There will be a quiz on ions, compounds, and elements in September.

Ions:

NH_4^+	ammonium ion	CO_3^{-2}	carbonate ion
NO_2^-	nitrite ion	PO_4^{-3}	phosphate ion
NO_3^-	nitrate ion	SO_4^{-2}	sulfate ion
OH^-	hydroxide ion		

Compounds/Molecules:

H_2	hydrogen gas	O_2	oxygen gas
N_2	nitrogen gas	O_3	ozone
CO	carbon monoxide	H_2S	hydrogen sulfide
CO_2	carbon dioxide	NH_3	ammonia
NO_2	nitrogen dioxide	SO_2	sulfur dioxide
N_2O	nitrous oxide	SO_3	sulfur trioxide
HNO_3	nitric acid	CH_4	methane
H_2SO_4	sulfuric acid	$C_6H_{12}O_6$	glucose
Fe_2O_3	iron oxide (rust)	CH_3Hg+	methyl mercury
Cl_2	chlorine gas	NaCl	sodium chloride
CH_2O	formaldehyde	$CaCO_3$	calcium carbonate

<u>Elements</u>. Complete the chart with the names of the elements. Learn the names and symbols of these elements for a quiz in early September.

Symbol	Name of Element	Symbol	Name of Element
Ag		**Mg**	
Al		**N**	
As		**Na**	
Au		**Ni**	
Ba		**Np**	
Be		**O**	
Br		**P**	
C		**Pb**	
Ca		**Po**	
Cd		**Pt**	
Cl		**Pu**	
Co		**<u>Rn</u>**	
Cr		**S**	
Cu		**Se**	
F		**Si**	
Fe		**Sn**	
H		**Ti**	
Hg		**U**	
I		**V**	
K		**Zn**	
Kr			

III. Chemical Formulas. You should be able to total atoms in a chemical formula. Also, you should know how to work with coefficients, subscripts, and parentheses.

Coefficient = large number in front of formula; indicates the number of molecules

Subscript = small number to the lower right of an element; indicates the number of atoms

Parentheses = used to attach a subscript to a polyatomic ion, in a chemical formula

Counting Atoms Practice – Do not hand this in to the teacher.

A. Count the number of atoms of EACH ELEMENT in the substances below.
B. Count the TOTAL NUMBER OF ATOMS in each substance below.

1) $3Mg(OH)_2$

2) $3NaHCO_3$

3) $4Al_2(CO_3)_3$

4) $5H_2SO_4$

5) $4C_6H_7O_2(OH)_3$

6) $3(NH_4)_2SO_4$

7) $5Ca(OH)_2$

8) $2(NH_4)_3PO_3$

Answers for Part B

1) 15 total atoms
2) 18 total atoms
3) 56 total atoms
4) 35 total atoms
5) 84 total atoms
6) 45 total atoms
7) 25 total atoms
8) 38 total atoms

IV. **Map Quizzes**.
Learn the names and locations of:
a) developed countries in Europe – **Western Europe Map**
b) nations in Asia – **Asia map**

Study the maps from the website www.ilike2learn.com
There are interactive map quizzes on this website, as well as copies of maps that can be printed out. **There will be map quizzes in early September.** There will be a word bank with the names of the countries, so don't be concerned with incorrect spellings.

Name _____
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Only pages 4-12 will be handed in to the teacher on day 1 of classes. Handwrite your answers on these pages.

V. **pH and pH scale**. Answer each of the following questions in **sentence** form:

a. What is the pH scale? Explain what it measures. Identify the range of the pH scale.

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 logarithmic rather than 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 _____

VI. **Laws of Thermodynamics. Define these two laws.**

a. First Law of Thermodynamics

b. Second Law of Thermodynamics

VII. **Feedback Loops**. Define these two terms. Give an example for each type.
a. Positive Feedback

b. Negative Feedback

IX. **Metric System Review**. Learn these prefixes. Complete these conversions.

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}

a. 8 millimeters = _____ meters

b. 4 Megawatts = _____ Watts

c. 77 Teraliters = _____ megaliters

d. 55 meters = _____ centimeters

e. 77 Gigagrams = _____ grams

f. 11 kilometers = _____ millimeters

g. 45 Terameters = _____ 45 kilometers

X. **Environmental Legislation**

Fill in the missing information pertaining to important legislation in **your own handwriting.**
These are the major pieces of Environmental Legislation covered on the AP National Exam.

Legislation Name	Is this a US or Global item? Treaty, law or act?	Date (year) enacted	Purpose of law
Kyoto Protocol			
Montreal Protocol			
Delaney Cause of Food, Drug & Cosmetic Act			
Endangered Species Act (ESA)			
CITES			
SMRCA			
RCRA			
CERCLA			
Clean Water Act			
Safe Drinking Act			
Clean Air Act			

XI. **Experimental Design**

For each objective below, read the information provided and answer the questions that follow in **your own handwriting**.

Objective 1: Identify components of strong experimental design.

Read this investigation on 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-fired 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 coal-fired 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 <u>independent variable</u>.

2. A dependent variable is measured or observed; it is the data. The dependent variable depends on the independent variable. Identify the <u>dependent variable(s).</u>

3. Controlled or constant variable are the same in all groups. Identify as five controls.

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 that 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 pesticide 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. Use an if…then statement for the hypothesis. Also, include a prediction of a 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 group.

12. Identify the dependent variable(s).

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

XII. **Graphing**

There are several types of graphs that scientists often use to display data. These include: pie charts, bar graphs, histograms, line graphs, and scatter plots.

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

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:

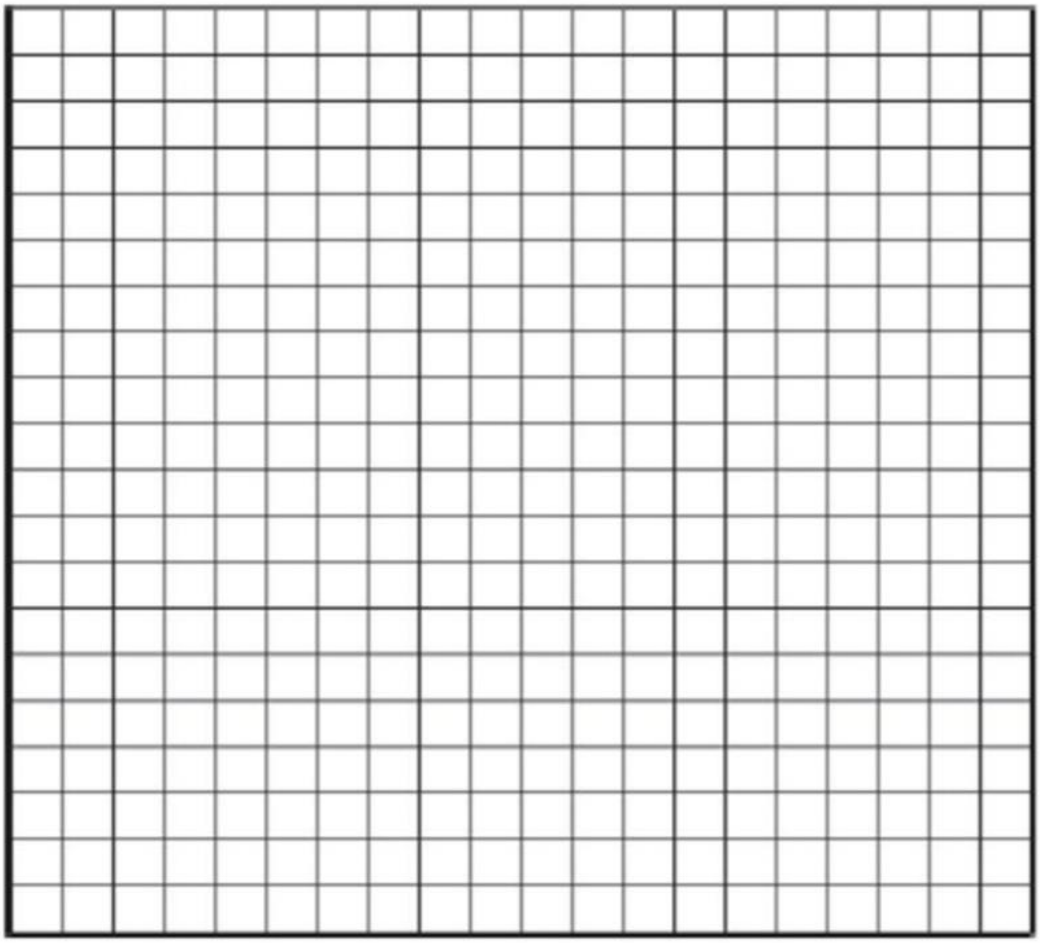
- The title must communicate the dependent and independent variables
- The title cannot be presented in the form "Y versus X"
- Some graphs need more explanation than others. Make sure that your reader would be able to understand what your data represent.

XIII. Line Graphs. Problem 1. Line Graph for one set of data. Create a **line graph** based on the data table. Include appropriate **scale, title, and axis labels**.

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.

Data Table 1. Temperature Values and Transpiration Rates for a Plant

Temperature (°C)	20	23	27	28
Transpiration Rate (mmol/m².sec)	1.5	3	5	4.5



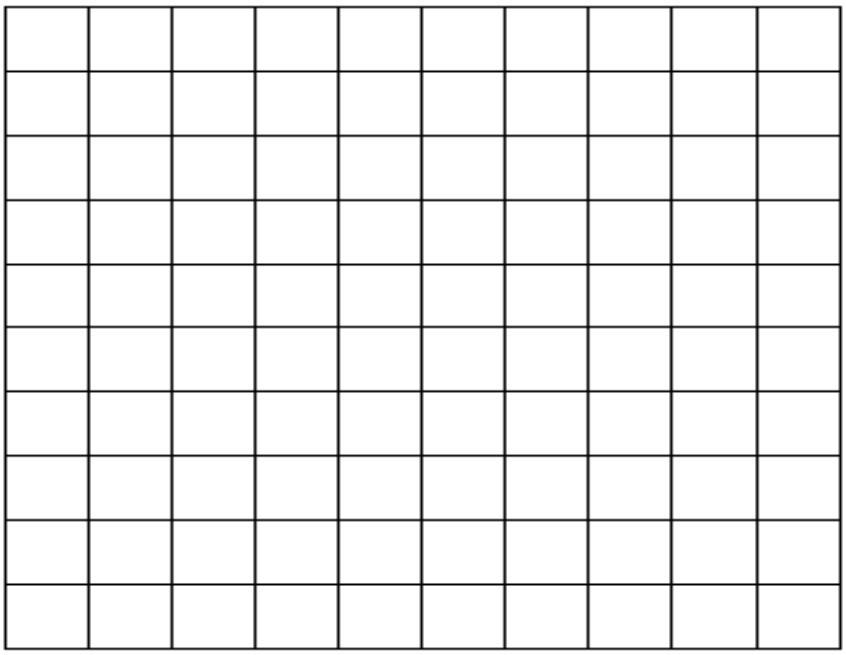
Problem 2. Line Graph for two sets of data.

Table 2. Age of Trees vs. Thickness of Annual Tree Rings in Two Forests

Age of the tree in years	Average thickness of the annual rings in cm. Forest A	Average thickness of the annual rings in cm. Forest B
10	2.0	2.2
20	2.2	2.5
30	3.5	3.6
35	3.0	3.8
50	4.0	4.2
60	4.3	4.5

The thickness of the annual rings indicate what type of environmental situation was occurring at the time of its development. A thin ring, usually indicates a rough period of development. Lack of water, forest fires, or a major insect infestation. On the other hand, a thick ring indicates just the opposite.

1. Using the data, make a line graph. Plot the data points and connect the data points with a line (not a best-fit line). Include a descriptive title. Label the x- and y-axes; include units. Make a key for the two sets of data.



Analysis Questions for Graph 2.

2. What is the **dependent** variable?_____

3. What is the **independent** variable?_____

4. Which forest had larger tree rings for the 50-year old trees?

5. Based on your graph, what was the average thickness of the annual rings of 45-year old trees in Forest A?

6. Based on your graph, what was the average thickness of the annual rings of 25-year old trees in Forest B?

7. Based on these data, what can you conclude about Forest A and Forest B in regards to the size of the annual tree rings?