Welcome to Knoke's AP Environmental Science!

The purpose of this summer assignment is to review skills that we will be using throughout the course and to preview content we will be learning this year. ***The assignment itself is optional.*** This is to give you an idea of the type of information that you will be assessed on the first week of class. Completing the assignment in its entirety will result in a major grade equal to a quiz in the gradebook.

There will be a quiz on the material the second day of class.

Please feel free to email me with any questions you may have, I will respond as soon as I can but please know that I am not checking my email every day.

Looking forward to class next year! - Mrs. Knoke
taylor.knoke@richlandone.org

Part 1: Experimental Design

Objective 1: Identify components of strong experimental design

Background Information on Experimental Design

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. Answer the following question on the effective components of this experimental design.

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 that was given to the control group. Control variable and control group are not the same.

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.

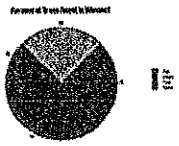
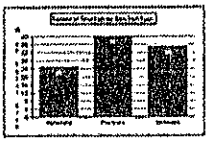
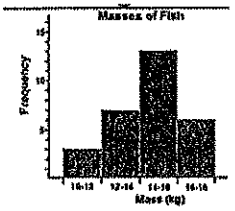
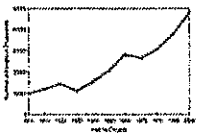
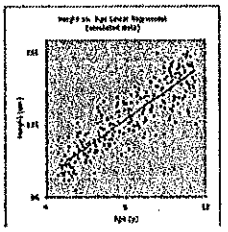
11. **Identify** the control.

12. **Identify** the dependent variable(s).

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

Objective 3a: Create Effective Visuals; Choosing an appropriate graph

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

Pie Graphs	**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 <u>using</u> 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.

Identify the best type of graph to represent each type of data set.

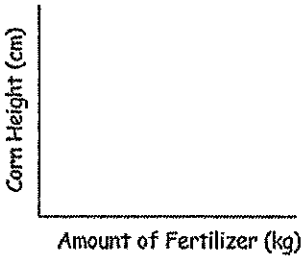
#	Description	Pie	Bar	Histo	Line	Scatter
Ex	A graph showing the number of 5th graders who prefer Coke or Pepsi		X			
14	a newborn baby's weight changes over time					
15	percentage of the class earning As, Bs, and Cs.					
16	distribution of trees of different size groups (e.g. 0-10 cm, 10-20 cm, etc....) in a forest					
17	relationship between height and arm length in a group					
18	percentage of an allowance spent on different categories (e.g. food, movies, etc.)					
19	amount of rainfall, by month over a 12-month period					
20	number of ice cream cones purchased as a function of the day's temperature					

Objective 3b: Create Effective Visuals; Labeling Axes

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).



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

21. 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.

22. A scientist studied the relationship between amount of rain (in cm) and the numbers of zebra babies born each spring.

23. Sea otters were counted over several years to see if their numbers were decreasing over time.

24. Does the amount of nitrogen in the soil (measured in kilograms) affect corn production (measured in kilograms).

Part 2: Watch the Write Like A Scholar Series

An important part of AP Environmental Science is being able to communicate your understanding of the content through writing. The AP exam has three free-response questions (FRQs) that count for 40% of your overall score. The following videos provide an introduction to get you on the path to writing successful FRQs.

Video 1: Write Like A Scholar Series: Annotating AP Environmental Science FRQs

Video 2: Write Like A Scholar Series: Writing AP Environmental Science FRQs

Video 3: Write Like A Scholar Series: Scoring AP Environmental Science FRQs

---

Part 3: Math Skills (30 pts)

Even though APES is a science class, there is A LOT of math!

There are seven Science Practices that we will incorporate throughout the year, these are skills and a way to apply your content knowledge. You can check them all out here.

Practice 6 is Mathematical Routines: Apply quantitative methods to address environmental concepts.

6.A Determine an approach or method aligned with the problem to be solved.

6.B Apply appropriate mathematical relationships to solve a problem, with work shown (e.g., dimensional analysis).

6.C Calculate an accurate numeric answer with appropriate units.

Reminders

1. Write out all your work, even if it's something really simple. This is required on the AP ENVS exam so it will be required on all your assignments, labs, quizzes, and tests as well.
2. **Include units in each step.** Your answers always need units and it's easier to keep track of them if you write them in every step. No naked numbers!
3. Check your work. Go back through each step to make sure you didn't make any mistakes in your calculations. Also check to see if your answer makes sense. For example, a person probably will not eat 13 million pounds of meat in a year. If you get an answer that seems unlikely, it probably is. Go back and check your work.
4. You may use a calculator but will not be provided with a formula sheet.

Metric Units: YOU MUST MEMORIZE THE METRIC CONVERSION CHART

We usually see these units in class

Prefix	Symbol	Multiply by Base Unit by	Example
tera	T	1,000,000,000,000	teragram = Tg = 10^{12} g
giga	G	1,000,000,000	gigaliter = GL = 10^{9} L
mega	M	1,000,000	megagram = Mg = 10^{6} g
kilo	k	1,000	kilogram = kg = 10^{3} g
hecto	h	100	hectogram = hm = 10^{2} m
deka	da	10	decagram = dag = 10 g
deci	d	1/10	deciliter = dL = 10^{-1} L
centi	c	1/100	centimeter = cm = 10^{-2} g
milli	m	1/1000	millimeter = mm = 10^{-3} m
micro	μ	1/1,000,000	microgram = μg = 10^{-6} g

Base Unit (g, m, W, L, etc.)

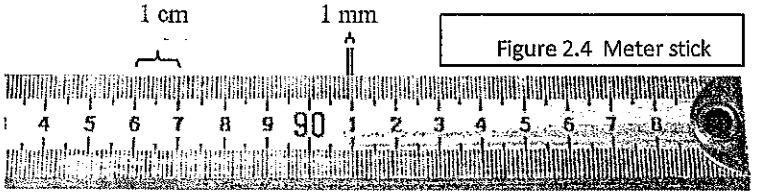


Figure 2.4 Meter stick

1. How many mm are in a centimeter?
2. How many centimeters are in a meter?
   (The prefix *centi-* means 100. How many cents (pennies) are in a dollar?) ____
3. The prefix milli- means a thousand. How many millimeters are in a meter?

$$\text{Percent Change} = \frac{(\text{New} - \text{Original})}{\text{Original}} \times 100$$

4. If you scored a 1090 on your first PSAT and 1210 on your second PSAT. What was your percent improvement?

5. If one termite can destroy 1.2mg of wood per day, how many kilograms of wood can 10 termites destroy in 1 week?

6. What is 70% of 640?

Must use and show dimensional analysis for conversions.

7. 400 kilograms = _____milligrams

8. 600 mm = _____cm

9. 25 MW = _____W

Units of Measure

- Example 1 – Convert 22 000 g to kg
- $\frac{22000\ g}{1} \times \frac{1\ kg}{1000\ g} = \frac{22000\ kg}{1000} =$ **22 kg**

- Example 2 – Convert 0.0290 m to millimeters
- $\frac{0.0290\ m}{1} \times \frac{1000\ mm}{1\ m} = \frac{29\ mm}{1} =$ **29 mm**

- Example 3 – How many seconds in 3.11 hours?
- $\frac{3.11\ hours}{1} \times \frac{60\ min}{1\ hr} \times \frac{60\ sec}{1\ min} = \frac{11196\ sec}{1} =$ **11196 sec**

Write the following in scientific notation

10. 394 billion

11. 0.000070202

Solve the following, using dimensional analysis. Must show all steps and all units from beginning to end.

12. If I can run 6km in 24 minutes, how many cm can I run in 5 hours?

13. Fourteen percent of a 55,000 acre forest is destroyed by the invasive pine weevil. How many acres of the forest were not destroyed?

14. A pesticide was sprayed on a portion of a forest. The pesticide killed 25,000 termites. This is 71% of the local termite population. What is the total termite population?

Part 4: Environmental Legislation

Understand the basics about some important pieces of Environmental Legislation.

Use the internet to fill in the missing information pertaining to important legislation.

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			
CITES			
SMRCA			
RCRA			
Lacey Act			

Clean Water Act			
Safe Drinking Water Act			
Clean Air Act			
Endangered Species Act			
CERCLA			

Part 5: Are you ready to go APES?

There are nine units we will cover throughout the year, each unit is broken down into *Topics*. Every topic has *Learning Objectives*, which are further detailed by the *Essential Knowledge*. Review the units, topics, and learning objectives in the Course Exam Description (CED).
https://apstudents.collegeboard.org/sites/default/files/2019-05/ap-environmental-science-course-and-exam-description.pdf

Summer Assignment 2025 Rubric:		
	Points Earned:	Points Possible:
Part 1: Experimental Design (10 pts)		
#1-13: 2 points for each correct answer		26
#14-24: 1 point for each correct answer		12
Part 2: Watch the Write Like a Scholar Series		
Part 3: Math Skills (30 pts)		
#1-3: 1 point for each correct answer		3
#4: 1 point for correct answer, 1 point for correct set up		2
#5: 1 point for correct answer, 1 point for correct set up, 1 point for units throughout		3
#6: 1 point for correct answer, 1 point for correct set up		2
#7: 1 point for correct answer, 1 point for correct set up (dimensional analysis), 1 point for units throughout		3
#8: 1 point for correct answer, 1 point for correct set up (dimensional analysis), 1 point for units throughout		3
#9: 1 point for correct answer, 1 point for correct set up (dimensional analysis), 1 point for units throughout		3
#10-11: 1 point for correct answer		2
#12: 1 point for correct answer, 1 point for correct set up (dimensional analysis), 1 point for units throughout		3
#13: 1 point for correct answer, 1 point for correct set up (dimensional analysis), 1 point for units throughout		3
#14: 1 point for correct answer, 1 point for correct set up (dimensional analysis), 1 point for units throughout		3
Part 4: Environmental Legislation (22 pts)		
2 points for each law that is filled out correctly		22
Total:		100
		_____%