APES SUMMER SUGGESTION

Welcome future APES students! AP Environmental Science is a multidisciplinary subject dealing with a wide range of politics, economics, ethics, worldviews, and, yes, sciences. Combining the disciplines of biology, chemistry, geology and physics, environmental science explores the relationship between organisms and their ever-changing environment.

Advanced Placement classes are fast-paced and college level courses. The purpose of this Summer Suggestion is to help you prepare for the upcoming APES content by getting organized, reviewing some prerequisite math, science, and analytical skills, and getting familiar with some basic concepts of environmental science.

THIS SUMMER SUGGESTION IS JUST THAT, A *SUGGESTION*. THERE IS NO PENALTY FOR NOT COMPLETING ANY OR ALL PARTS. LIKEWISE, THERE IS NO EXTRA CREDIT FOR COMPLETING THIS SUMMER SUGGESTION.

In my experience, students who are organized and hit the ground running are more successful throughout the year. If you'd like to better prepare yourself for AP Environmental Science, I ***highly recommend*** completing the 4 Parts I have outlined below.

Part 1 – ELECTRONIC SETUP

1. Visit my website at www.jonesscience.com. Familiarize yourself with the site and **bookmark** it on your phone or computer – you should be accessing this website often throughout the year.

2. Visit Remind.com and sign up for my **text reminders: jonesapes3, jonesapes4, or jonesapes5**. You can choose to get a text message, an e-mail, or download and use the smartphone app.

Part 2 – ENVIRONMENTAL SCIENCE ARTICLE PRACTICE

Every day, in every part of the planet, environmental science is in the headlines, on the nightly news, and dominating conversations. To help highlight this, and to practice for an assignment we will do often, please complete the following:

1. **Find 1 environmental science article.** Find 1 article that you believe relates to the course. The article must be at least 500 words and be no older than June 2020. Aim high when selecting an article – *The New York Times, Los Angeles Times, Wall Street Journal, National Geographic, Science, Scientific American, Discover,* or *Nature* are excellent bets for a great article.

2. **Read the article and write a summary.** Summary must be at least 50 words and explain the important details of the article and the connection to environmental science. Respond to the article – what questions do you have, what is your opinion, how does the issue impact you? It is recommended that you type this summary; you may want to reference it later in the year and having a digital copy may prove helpful.

Part 3 – MATH SKILLS PRACTICE

Math is an extremely important part of science; math is used to support and provide evidence for every conclusion in science. I've created some questions below that reflect the type of math we will be working on throughout the year. **Please attempt all problems**; if you are struggling and having trouble, check out the resources on the next few pages. If you still need help, come see me the first couple weeks of school.

Answer the following questions on a separate sheet of paper**. SHOW ALL WORK**. *Beware: there will be some questions similar to these on our first Unit Test so make sure you know how to do them!*

1. What is ten thousand times one hundred million? Show your work in scientific notation. Give the answer in scientific notation and in words.

2. A population of deer had 300 individuals. If the population grows by 20% in one year, how many deer will there be next year?

3. In the year 1990, the population of the United States was 250 million. In 1998 the population was 275 million. What percent did the population increase by?

4. If a city of 10,000 experiences 100 births, 30 deaths, 10 immigrants, and 20 emigrants in the course of a year, how many people are added to the population? What is its net annual percentage growth rate?

5. Your car gets 20 miles to the gallon and your friend's car gets 30 miles to the gallon. You decide to go on a road trip to visit UC Berkeley, which is 400 miles away. If gas costs $4 per gallon and you decide to split the gas money, how much money will each of you save in gas by driving your friend's car?

6. Long Beach is roughly 10 kilometers wide and 12 kilometers long. If two centimeters of rain falls on Long Beach, how many cubic meters of rain fell on Long Beach? (Hint: convert all units to meters first)

7. Electricity costs 7 cents per kilowatt hour. In one month, one home uses 1.5 megawatt hours of electricity. How much will the electric bill be for the month?

8. LEDs are quickly replacing incandescent and CFL light bulbs. If an LED light bulb lasts for 50,000 hours, a CFL lasts for 10,000 hours, and an incandescent light bulb lasts for 1,250 hours, how many of each would you need to light a room for 50,000 hours?

9. **SHOW YOUR WORK** for the following multiplication and division problems.

a. 70.0 / 3.5
b. 1900 x 0.7
c. $5.80 \times 10^{-3} \times 2.7$
d. 2362 / 71.9
e. 0.08 / 0.009
f. $4.60 \times 10^{4} / 0.0530$

10. Complete the following metric conversions:

a. 51.37 m to cm
b. 216 cm to m
c. 9.64 m to mm
d. 859,900 mm to m
e. 59.78 Mm to km
f. 8,005 L to kL
g. 34.54 cm to mm
h. 82,570 mm to cm
i. .004538 kg to cg
j. 913,700 kJ to MJ

11. By hand, construct **ONE LINE GRAPH** representing the following data sets from January 26-31, 2015:

Temperature in Long Beach, CA	
Day	Temperature
1	76° F
2	73° F
3	75° F
4	73° F
5	70° F
6	70° F

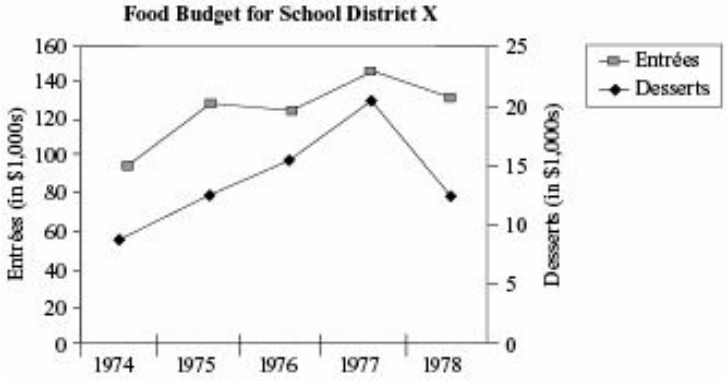
Temperature in Long Beach, NY	
Day	Temperature
1	32° F
2	27° F
3	33° F
4	37° F
5	38° F
6	27° F

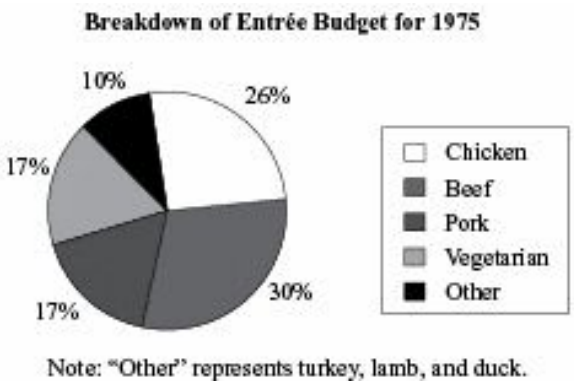
Make sure your graph has a title, axes labeled, correct scale, and a legend or key.

12. Answer the following questions based on your graph.

a. What was the highest temperature recorded for each location?
b. What was the lowest temperature recorded for each location?
c. What was the average temperature for each location?
d. What trend do you notice at each location?

Questions 13-15 refer to the following graphs.





13. In which of the following years was the difference between School District X's budget for entrées and its budget for desserts the lowest?

a. 1974 b. 1975 c. 1976 d. 1977 e. 1978

14. Which of the following is the closest approximation for the amount School District X's budget for chicken in 1975 exceeded its budget for desserts in 1974?

a. $4,000 b. $24,000 c. $32,000 d. $120,000 e. $125,000

15. What was School District X's approximate budget for vegetarian entrées in 1975?

a. $7,500 b. $13,000 c. $21,500 d. $37,500 e. $58,250

Part 4 – EXPERIMENTAL DESIGN PRACTICE

Your friends can't decide which sunscreen brand is the most effective at blocking dangerous ultraviolet energy. Several claim Coppertone, others say Neutrogena, a few say Hawaiian Tropic, and your cousin is partial to Banana Boat. You happen to have all of these brands at home in the same SPF rating.

On a separate sheet of paper, **design an experiment** that could be used to help determine which brand is the most effective at blocking UV.

*** Remember that UV can be harmful so you don't want to use humans or any other mammal as test subjects. Think about alternatives…

Be sure to include and label in your answer:

- A testable hypothesis
- The variable that you will be testing
- The data to be collected
- A description of the experimental procedure
- A description of the results that would validate your hypothesis

Answer the following questions about your experiment:

1. What is the independent variable?
2. What is the dependent variable?
3. What is the control?
4. Why is a control necessary in your experiment?
5. What are some important constants in your experiment?
6. What are some variables that you can't control in your experiment?

MATHEMATIC AND SCIENTIFIC SKILL 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 you have not had practice with setting up and solving problems without a calculator in a long time, in the beginning it can be daunting. The following is meant to help you review basic math and science numeracy skills.

Percentage

$$17\% = \frac{17}{100} = 0.17$$

- Remember that "percent" literally means divided by 100
- Percentage is a measure of the part of the whole, or part divided by whole

Example: 15 million is what percentage of the US population?

$$\frac{15 \text{ million}}{300 \text{ million}} = 0.05 = 5\%$$

Example: What is 20% of this $15 bill so that I can give a good tip?

$$\$15 \times 0.20 = \$15 \times \frac{20}{100} = \$3$$

Rates

$$\frac{\text{Rise}}{\text{Run}} = \frac{Y_2 - Y_1}{X_2 - X_1} \qquad \text{Slope} = \frac{\text{change}}{\text{time}} \qquad y = mx + b$$

- All of the above are ways to look at 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 actually the number of miles driven by one gallon.
- Rates are calculating how much an amount changes in a given amount of time.

Scientific Notation

- When using very large numbers, scientific notation is often easiest to manipulate. For example, the US population is 300 million people or 3×10^8.
- When adding or subtracting, exponents must be the same. Add the numbers in front of the ten and keep that 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.

Online resource: http://www.chem.tamu.edu/class/fyp/mathrev/mr-scnot.html

Dimensional Analysis / Unit Conversion

Dimensional analysis is the analysis of the relationships between different physical quantities by identifying their fundamental dimensions and units of measure and tracking these dimensions as calculations or comparisons are performed. Converting from one dimensional unit to another is often somewhat complex. Dimensional analysis is a widely used technique for performing such conversions using the rules of algebra.

You should be able to convert any unit into any other unit accurately if given the conversion factor.

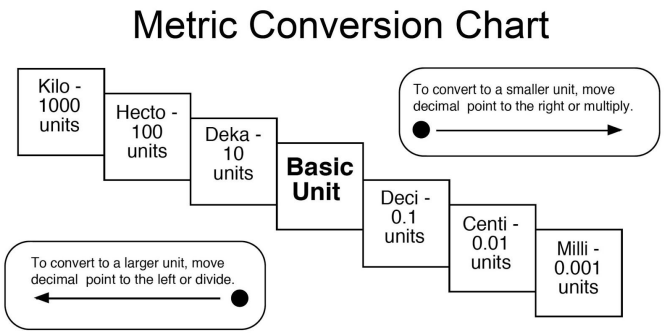
Online resources:

http://www.chemprofessor.com/dimension_text.htm http://www.chem.tamu.edu/class/fyp/mathrev/mr-da.html

Prefixes and Metric Conversion

A metric prefix or SI prefix is a unit prefix that precedes a basic unit of measure to indicate a multiple or fraction of the unit. Each prefix has a unique symbol that is added to the unit symbol. The prefix kilo-, for example, may be added to gram to indicate multiplication by one thousand; one kilogram is equal to one thousand grams. The prefix centi-, likewise, may be added to meter to indicate division by one hundred; one centimeter is equal to one hundredth of a meter.

Common Prefixes used with SI Units			
Prefix	Symbol	Meaning	Order of Magnitude
giga-	G	1 000 000 000	10^9
mega-	M	1 000 000	10^6
kilo-	k	1 000	10^3
hecto-	h	100	10^2
deka-	da	10	10^1
	base unit	1	10^0
deci-	d	0.1	10^{-1}
centi-	c	0.01	10^{-2}
milli-	m	0.001	10^{-3}
micro-	μ	0.000 001	10^{-6}
nano-	n	0.000 000 001	10^{-9}



Easy way to remember the order:

King	**Henry**	**Died**	**By**	**Drinking**	**Chocolate**	**Milk**
Kilo	Hecto	Deka	Base Unit	Deci	Centi	Milli
1,000	100	10	1	0.1	0.01	0.001

Online resource:
http://www.montereyinstitute.org/courses/DevelopmentalMath/COURSE_TEXT_RESOURCE/U06_L2_T1_text_final.html

Long Division and Multiplication

You should be able to do basic calculations by hand, including values with decimals and scientific notation. Many students struggle in this area because CALCULATORS ARE NOT ALLOWED ON THE AP EXAM. Make sure you are comfortable with these calculations.

Online resources:

http://www.mathsisfun.com/dividing-decimals.html
http://www.tutors4you.com/tutorialondecimals.htm

Graphing and Interpreting Data

Graphs, tables, and charts can communicate a mass of information in a clear and concise fashion. Successful APES students are able to analyze data sets and interpret or construct the appropriate graphic for the data.

Line graphs and tables are the most commonly used in AP Environmental Science. Line graphs provide an excellent way to map independent and dependent variables that are both quantitative. When both variables are quantitative, the line segment that connects two points on the graph expresses a slope, which can be interpreted visually relative to the slope of other lines or expressed as a precise mathematical formula.

Online resources:
http://www.mathgoodies.com/lessons/graphs/construct_line.html
http://mathbench.umd.edu/modules/visualization_graph/page01.htm
www.uh.edu/~tech132/sln12.doc

6 Commandments of Scientific Graphing

1. Thou shalt draw your graph in pencil with a ruler.
2. Thou shalt use all thy graph paper.
3. Thou shalt label your axes.
4. Thou shalt always give units.
5. Thou shalt not draw bar graphs.
6. Thou shalt not play dot-to-dot with thy data points!

If you have ticked off each of the Commandments, you are halfway to achieving a good overall score for this particular graph. But now it is time to pick up question specific marks...

1. Give your graph a descriptive title. E.g.: A Graph to show the effect of x on y
2. Ensure you have put your graph the right way around. Your x-axis should always show the independent variable - this is the variable **you are changing**. Your y-axis should always plot the dependent variable - this is the variable **you are measuring**. For example, when looking at the effect of temperature on rate of reaction (a classic chemistry investigation), you change the temperature and measure the rate. As such, temperature goes on your **x-axis** (it is independent) and rate goes on your **y-axis** (it is dependent)
3. Ensure you plot your data carefully, along the corridor and up the stairs. Mark your data point with a **small x.** If you are plotting multiple data sets on one graph then use a small o or l or similar to distiguish between data sets.
4. If plotting multiple data sets, **WRITE OUT A KEY/LEGEND**!
5. Do not play dot-to-dot. Only very rarely are data points connected in this way. More often, we are seeking the **trend** or pattern that our results show, for that we need...
6. **DRAW A LINE OF BEST FIT.** These lines pass through or near as many data points as possible. They can either be straight lined, or a smooth curve. Look for the pattern to decide which is most appropriate.
7. **TIP FOR THE TOP:** circle your anomalous results (any outliers that do not fit your trend) and label them in your key/legend.

Experimental Design Reference

Scenario: For a class project, a group of students decide to determine the effect of sunlight on radish plants. They grow 12 radish plants in 4" clay pots with 25 mL of water daily and 100 g of potting soil in 24 hours darkness, 12 hours sunlight/12 hours darkness, and 24 hours sunlight. (They use Grow-Lights to simulate sunlight.) After 5 days, they measure the height of all the plants in each pot.

1. TITLE: Communicates what your experiment is about.

The Effect of (the independent variable) on (the dependent variable.)

Example: The Effect of Sunlight on the Height of Plants.

2. HYPOTHESIS: Communicates what you think is going to happen in the experiment.

If (the independent variable) is (increased, decreased, changed), then (the dependent variable) will (increase, decrease, change.)

Example: If the sunlight is increased, then the height of the plants will increase.

3. INDEPENDENT VARIABLE: Also called the Manipulated Variable. The variable you purposely change or manipulate. Will be the CAUSE of the changes you measure.

Example: The Sunlight

LEVELS: The values you choose for your Independent Variable.

Example: 24 hours of darkness, 12 hours of sunlight/12 hours of darkness, and 24 hours of sunlight.

TRIALS: The number of times each level is repeated. Could be the number of seeds in a pot, or the number of fish in a fish bowl.

Example: 12 radish seeds in each pot = 12 trials for each level of sunlight

4. DEPENDENT VARIABLE: The variable that responds. Also called the Responding Variable. The variable you will measure after the experiment is set up. Will be the EFFECT of the action you took.

Example: The Height of the Plants.

5. CONSTANTS: All the other variables that remain the same for all the trials. Must be quantified. (Include numbers.)

Example: 4" pots, 100g potting soil, 25 mL water daily

6. CONTROL: A level that does NOT contain the independent variable. The NO TREATMENT GROUP or NORMAL TREATMENT GROUP. Gives you a way to detect hidden variables.

Example: the level in the above scenario that most acts like NORMAL for plants would be the 12 hours sun/12 hours dark. You are comparing the 24 hours darkness and 24 hours sunlight to the normal situation for plants.