AP Environmental Science (APES) Summer Work

Welcome to APES! I am very happy that you have decided to take this course and embark upon what I hope you find an exciting and rewarding educational journey. This letter contains an outline and brief description of the summer work for APES that is required to be completed BEFORE the next school year begins. By performing these tasks, you will take a huge step towards preparing for the upcoming year. I want you to understand that I, like you, enjoy summer break! This is not intended to be "busy work." By completing these tasks, you will perform research and source information that we will be using throughout the year. Because the AP exam will be held the beginning of May, class time is very precious. We will use most of April to review for the exam which leaves us about seven months, including breaks and holidays to prepare for the AP exam.

Summer Tasks With Estimated Timeframes

Complete the AP Environmental Science Math Prep Activity (about 5 hours total)
While there is not a lot of math in APES, it is important that you are comfortable solving some problems. You must be comfortable working out problems using pencil and paper. Most of our math will involve dimensional analysis - solving problems involving unit conversions. You should be comfortable working with percentages, operations with decimal numbers and using scientific notation. Most of the math in APES uses very large numbers, so you should be able to work problems using scientific notation. While not included in this assignment, you also need the ability to read, interpret and create graphs from data. The packet starts out with very simple arithmetic, moves on to scientific notation and percentages, and culminates in dimensional analysis. You need to show all your work and answer the questions in the boxes provided in the packet. This packet will be due on Canvas by the end of the first week of school. You will NOT hand it in on paper.

Environmental Laws and Treaties (about 8 hours total)
Research and summarize the relevant **environmental laws and treaties** that are listed on the assignment sheet. Many times throughout the year, you will need to reference these environmental acts. Having a working familiarity with them will make the course go so much smoother. We will also be having a quiz on these acts, laws and treaties. If you complete the work during the summer, the quiz should be a breeze! This research will be due on Canvas by the end of the second week of school. You will NOT hand it in on paper.

Be Aware of and Enjoy Nature (as long as you would like!)
Environmental Science, while an academic discipline, is also an experience. My hope is that through this class, you will become more aware of your environment, the challenges we face as a society to preserve the environment, and maybe some potential solutions for environmental problems. Throughout the course we will take several field trips to experience nature and study an environmental problem. To kick start this process, I would like you to visit a natural area, go for a walk, sit in your backyard, go to a park or the beach or anywhere outside and make some

observations. There are questions on the assignment sheet to guide you. These questions are due the first day of school, on Canvas. You will not turn them in on paper.

I will be available over the summer if you have questions. You can email me at MichelleMason@thefirstacademy.org (I will check my email at least once a week).

I want you to enjoy your summer, so I don't expect you to spend a huge amount of time on any of these assignments. Total, it should take you less than 14 hours (which is about an hour a week). By putting this time in, you will end up with good, quality work and you will be very well prepared to start the year on a positive note.

Have a safe and enjoyable summer and I look forward to a great year with you!
Mrs. Mason

AP Environmental Science Math Prep

You can use a calculator on the AP Environmental Science exam, and therefore, you will be able to use calculators on exams given throughout the school year (since the point of the class is to prepare you for the AP exam). The good news is that most calculations on the tests and exams are written to be fairly easy calculations and answers come out to whole numbers or only a couple of decimal places. The challenge is in setting up the problems correctly and knowing enough basic math to solve the problems. This packet will help you remember and sharpen some basic math skills including: decimals, averages, percentages, metric units, scientific notation and dimensional analysis.

A few key points:

1. **Write out all of your work**, even if it's something really simple. This is required on the APES exam so it will be required on all your assignments, labs, quizzes, and tests.
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.
3. **Check your work**. Go back through each step to make sure you didn't make any mistakes in your calculations.
4. **Check to see if your answer makes sense**. If you get an answer that seems unlikely, it is probably incorrect. Go back and check your work again. It's also helpful to have a likely answer in mind before you start your problem so you can easily see if there is a mistake along the way.

Directions:
Read each section below for review. Look over the examples and use them for help on the practice problems. When you get to the practice problems, write out all your work and be sure to include units in each step. Again, don't forget to check your work! This packet is due September 4, 2020.

Averages

To find an average, add all the quantities given and divide by the total number of quantities.

Example: Find the average of 10, 20, 35, 45, and 105
Add: 10 + 20 + 35 + 45 + 105 and divide by 5 = 43

Practice:
Remember to show all of your work in the answer box below each problem. Please **highlight** your answer.

Find the average of 11, 12, 14, 15, 23, 29	Find the average of 124, 456, 788, 343
Find the average of 4.56, 0.0078, 23.45	Find the average of 4.3, 87.93, 3.4, 2.48

Percentages

Percents show fractions or decimals with a denominator of 100. Always move the decimal TWO places to the right to go from a decimal to a percentage or TWO places to the left to go from a percent to a decimal.

Example: 0.85 = 85% 0.008 = 0.8% 72% = 0.72

Part 1: Finding the Percent of a Given Number
To find the percent of a given number, change the percent to a decimal and MULTIPLY.

Example: 30% of 400
30% = 0.30

$$\begin{array}{r} 400 \\ \times\ .30 \\ \hline 120.00 \end{array}$$

Part 2: Finding the Percent of a Number

To find what percentage one number is of another, DIVIDE the first number by the second, then convert the decimal answer to a percentage.

Example: What percentage is 12 of 25?
12/25 = .48
.48 = 48% (12 is 48% of 25)

Part 3: Finding Percentage Increase or Decrease
To find a percentage increase or decrease, first find the percent change, then add or subtract the change to the original number.

Example: Product X has dropped in price 18% from $139. What is the new price?
$139 X 0.18 = $25
$139 - $25 = $114

Part 4: Finding a Total Value
To find a total value, given a percentage of the value, DIVIDE the given number by the given percentage.

Example: If taxes on a new car are 8% and the taxes add up to $1600, how much is the new car?
8% = 0.08
$1600 / 0.08 = $160000 / 8 = $20000 (remember, when the divisor has a decimal, move it to the end to make it a whole number and move the decimal in the dividend the same number of places → 0.08 becomes 8 and 1600 becomes 160000)

Practice:
Remember to show all of your work in the answer box below each problem. Please **highlight** your answer.

What is 45% of 900?	What percentage is 25 of 162.5?

Thirteen percent of a 12,000 acre forest is being logged. How many acres will be logged?	A water heater tank holds 280 gallons. Two percent of the water is lost as steam. How many gallons will remain to be used?
In a small oak tree, the biomass of insects makes up 3000 kilograms. This is 4% of the total biomass of the tree. What is the total biomass of the tree?	14,000 acres of a 40,000 acre forest burned in a forest fire. What percentage of the forest was damaged?
You have driven the first 150 miles of a 2000 mile trip. What percentage of the trip have you traveled?	Home prices have dropped 5% in the past three years. An average home in your area three years ago was $130,000. What's the average home price now?
35 is what percentage of 2800?	235 acres, or 15% of a forest is being logged. How large is the forest?

The Greenland Ice Sheet contains 2,850,000 cubic kilometers of ice. It is melting at a rate of 0.006% per year. How many cubic kilometers are lost each year?	A teenager consumes 20% of her calories each day in the form of protein. If she is getting 700 calories a day from protein, how many calories is she consuming per day?

Metric Units

Kilo-, centi-, and milli- are the most frequently used prefixes of the metric system. You need to be able to go from one to another without a calculator. You can remember the order of prefixes by using the following sentence: *King Henry Died By Drinking Chocolate Milk*. Since the multiples and divisions of the base units are all factors of ten, you just need to move the decimal to convert from one to another.

Kilo- 1000 units	Hecto- 100 units	Deka- 10 units	**BASIC UNIT**	Deci- 0.1 units	Centi- 0.01 units	Mlli- 0.001 units

Example: 55 centimeters = ? kilometers
First - figure out how many places to move decimal (count the one you are going to, but not the one you are on). You will move the decimal 6 places. So, 55 centimeters = 0.00055 kilometers.

Practice:
Remember to show all of your work in the answer box below each problem. Please **highlight** your answer.

1200 kilograms = ? milligrams	14000 millimeters = ? meters
670 hectometers = ? centimeters	6544 liters = ? millileters
0.078 kilometers = ? meters	17 grams = ? kilograms

Scientific Notation

Scientific notation is a shorthand way to express large or tiny numbers. We will consider anything over 1000 to be a large number. Writing these numbers in scientific notation will help you to do your calculations much quicker and easier and will help prevent mistakes in conversions from one unit to another. Like the metric system, scientific notation is based on factors of 10. A large number written in scientific notation looks like this:

1.23×10^{13}

The number before the "X" is called the coefficient. The coefficient must be greater than 1 and less than 10. The number after the "X" is the base number and is always 10. The number in superscript is the exponent.

Part 1: Writing Numbers in Scientific Notation
To write a large number in scientific notation, put a decimal after the first digit. Count the number of digits after the decimal you just wrote in. This will be the exponent. Drop any zeros so that the coefficient contains as few digits as possible.

Example: 573,000,000,000 becomes 5.73×10^{11}

Writing tiny numbers in scientific notation is similar. The only difference is the decimal is moved to the left and the exponent is negative. A tiny number written in scientific notation looks like this:

4.26×10^{-9}

To write a tiny number in scientific notation, move the decimal after the first digit that is not a zero. Count the number of digits before the decimal you just wrote in. This will be the exponent as a negative. Drop any zeros before or after the decimal.

Example: 0.00000000376 becomes 3.76×10^{-9}

Part 2: Adding and Subtracting Numbers in Scientific Notation
To add or subtract two numbers with exponents, the exponents must be the same. You can do this by moving the decimal one way or another to get the exponents the same. Once the exponents are the same, add (if it's an addition problem) or subtract (if it's a subtraction problem) the coefficients just as you would any regular math problem. The exponent will stay the same. Make sure your answer has only one digit before the decimal - you may need to change the exponent of the answer once you are finished.

Example: $1.35 \times 10^{6} + 3.72 \times 10^{5} = ?$

Step 1: Make sure both exponents are the same. It's usually easier to go with the larger exponent so you don't have to change the exponent in your answer, so let's make both exponents 6 for this example.

$3.72 \times 10^{5} \rightarrow .372 \times 10^{6}$

Step 2: Add the coefficients just as you would regular decimals. So 1.35 + .372 = 1.722

Step 3: Write your answer including the exponent, which is the same as what you started. So your answer would be 1.722×10^6.

Part 3: Multiplying and Dividing Numbers in Scientific Notation

To multiply exponents, multiply the coefficients just as you would regular decimals. Then add the exponents to each other. The exponents DO NOT have to be the same.

Example: $1.35 \times 10^6 \quad X \quad 3.72 \times 10^5 = ?$

Step 1: Multiply the coefficients. So $1.35 \times 3.72 = 5.022$

Step 2: Add the exponents. So $5 + 6 = 11$

Step 3: Write your final answer → 5.022×10^{11}

To divide exponents, divide the coefficients just as you would regular decimals, then subtract the exponents. In some cases, you may end up with a negative exponent.

Example: $5.635 \times 10^3 \quad / \quad 2.45 \times 10^6 = ?$

Step 1: Divide the coefficients. So $5.635 / 3.45 = 2.3$

Step 2: Subtract the exponents. So $3-6 = -3$

Step 3: Write your final answer → 2.3×10^{-3}

Practice:

Remember to show all of your work in the answer box below each problem. Please **highlight** your answer.

Write 145,000,000,000 in scientific notation	Write 13 million in scientific notation

Write 435 billion in scientific notation	Write 0.000348 in scientific notation
Write 135 trillion in scientific notation	Write 24 thousand in scientific notation
$3 \times 10^{3} + 4 \times 10^{3}$	$4.67 \times 10^{4} + 323 \times 10^{3}$
$7.89 \times 10^{-6} + 2.35 \times 10^{3}$	$9.85 \times 10^{4} - 6.35 \times 10^{4}$
$2.9 \times 10^{11} - 3.7 \times 10^{13}$	$1.278 \times 10^{13} - 1.021 \times 10^{-10}$
Three hundred thousand plus forty-seven thousand	13 million minus 11 thousand
$1.32 \times 10^{8} \times 2.34 \times 10^{4}$	$3.78 \times 10^{3} \times 2.9 \times 10^{2}$
Three million times eighteen thousand	One thousandth of seven thousand

Eight ten-thousandths of thirty-five million	$3.45 \times 10^{9} \ / \ 2.6 \times 10^{3}$
$1.98 \times 10^{-4} \ / \ 1.72 \times 10^{-6}$	Twelve thousand divided by four thousand

Dimensional Analysis

Dimensional analysis is a way to convert a quantity given in one unit to an equal quantity of another unit by lining up all the known values and multiplying. It is sometimes called factor-labeling. The best way to start a factor-labeling problem is by using what you already know. In some cases you may use more steps than a classmate to find the same answer, but it doesn't matter. Use what you know, even if the problem goes all the way across the page!

In a dimensional analysis problem, start with your given value and unit and then work toward your desired unit by writing equal values side by side. Remember you want to cancel each of the intermediate units. To cancel a unit on the top part of the problem, you have to get the unit on the bottom. Likewise, to cancel a unit that appears on the bottom part of the problem, you have to write it on the top.

Once you have the problem written out, multiply across the top and bottom and then divide the top by the bottom.

Example: 3 years = ? seconds

Step 1: Start with the value and unit you are given. There may or may not be a number on the bottom. I find it useful to put a "1" on the bottom if there isn't another number there to use as a placeholder.

$$\frac{3 \text{ years}}{}$$

Step 2: Start writing in all the values you know, make sure you can cancel top and bottom. Since you have years on top right now, you need to put years on the bottom in the next segment. Keep going, canceling units as you go, until you end up with the unit you want (in this case seconds) on the top.

3 years	365 days	24 hours	60 minutes	60 seconds
1	1 year	1 day	1 hour	1 minute

Step 3: Multiply all the values across the top. Write in scientific notation if it's a large number. Write units on your answer.

$3 \times 365 \times 24 \times 60 \times 60 = 9.46 \times 10^7$ seconds

Step 4: Multiply all the values across the bottom. Write in scientific notation if it's a large number. Write units on your answer if there are any. In this case everything was cancelled so there are no units.

$1 \times 1 \times 1 \times 1 = 1$

Step 5: Divide the top number by the bottom number. Remember to include units.

9.46×10^7 seconds $/ 1 = 9.46 \times 10^7$ seconds

Step 6: Review your answer to see if it makes sense. 9.46×10^7 is a really big number. Does it makes sense for there to a lot of seconds in a year? Yes! If you had gotten a tiny number, then you would need to go back and check for mistakes.

In lots of APES problems, you will need to convert both the top and bottom unit. Don't panic! Just convert the top one first and then the bottom.

Example: 50 miles per hour = ? feet per second

Step 1: Start with the value and units you are given. In this case there is a unit on top and on bottom.

$$\frac{50 \text{ miles}}{1 \text{ hour}}$$

Step 2: Convert miles to feet first.

$$\frac{50 \text{ miles}}{} \qquad \frac{5280 \text{ feet}}{}$$

1 hour 1 mile

Step 3: Continue the problem by converting hours to seconds.

$$\frac{50 \text{ miles}}{1 \text{ hour}} \quad \frac{5280 \text{ feet}}{1 \text{ mile}} \quad \frac{1 \text{ hour}}{60 \text{ minutes}} \quad \frac{1 \text{ minute}}{60 \text{ seconds}}$$

Step 4: Multiply across the top and bottom. Divide the top by the bottom. Be sure to include units on each step. Use scientific notation for large numbers.

50 X 5280 feet X 1 X 1 = 264000 feet

1 X 1 X 60 X 60 seconds = 3600 seconds

264000 feet / 3600 seconds = 73.33 feet/second

Practice:
Remember to show all of your work in the answer box below each problem. Include units and use scientific notation when appropriate. Please **highlight** your answer.

Conversions that you may not be familiar with:

1 square mile (mi^2) = 640 acres	1 metric ton = 1000 kg
1 hectare (Ha) = 2.47 acres	1 ton = 2000 lb
1 kilowatt-hour (kWh) = 3,413 BTUs	1 lb = 16 oz
1 barrel of oil = 160 liters	1 Km = 0.62 mi

134 miles = ? inches
8.9×10^5 tons = ? ounces

1.35 kilometers per second = ? miles per hour
A city that uses ten billion BTUs of energy each month is using how many kilowatt-hours of energy?
A 340 million square mile forest is how many hectares?
If one barrel of crude oil provides six million BTUs of energy, how many BTUs of energy will one liter of crude oil provide?

Fifty eight thousand kilograms of solid waste is equivalent to how many metric tons?

AP Environmental Legislation

You need to research and write a brief description of some important **environmental laws and/or treaties**. This part of the summer assignment will be due on Friday, September 11, 2020 (but I would recommend completing it over the summer and getting it out of the way). You will have a quiz on the laws and treaties on the day it is due.

For this assignment, I recommend you search the internet and visit the local library for your research. We also have great databases available through the school. If you are not familiar with how to get into the databases, please see me or visit the media center before the end of the year. If you use a site like Wikipedia, be sure to DOUBLE-CHECK any information you get from there! Wikipedia is susceptible to errors. I would recommend that if you use Wikipedia, use it to get a general understanding, but it can not be used for your final information. Your final sources need to be SCHOLARLY resources. Since these are governmental in nature, .gov sites are best!

For each law or treaty, you need to find the following information:

1. Year enacted and year amended (if applicable).
2. Is the law International or American?
3. Describe the function of the law or treaty.
4. State what environmental issues are affected.
5. Name the agency or group responsible for regulation and enforcement (i.e. - U.N., Department of the Interior, EPA, etc.).

You need to create a table like my example below that organizes the important information regarding environmental legislation for the laws/treaties listed below. You may find it easier to do this in landscape orientation to give you more room to work.

Name	Draft & Amendment Year(s)	International or US?	Description	Issue(s) Affected	Agency
Clean Air Act	1963, 1977, 1990	US	To monitor and control air pollutants such as sulfur dioxide, nitrogen oxides, carbon monoxide, particulate matter, ozone, lead, carbon dioxide, volatile organic compounds, mercury. Meant to protect public welfare and health and to regulate emissions of dangerous air pollutants.	Air pollution, human health	EPA

Below is the list of laws/treaties that you need to research:

1. Clean Air Act (CAA)
2. Clean Water Act (CWA)
3. Comprehensive Environmental Response, Compensation Liability Act (CERCLA)
4. Convention on the International Trade in Endangered Species (CITES)
5. Corporate Average Fuel Economy (CAFE standards)
6. Endangered Species Act (ESA)
7. Energy Independence & Security Act
8. Energy Policy Act
9. Environmental Education Act
10. Federal Food, Drug, and Cosmetic Act (FFDCA, FDCA, or FIFRA)
11. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
12. Federal Water Pollution Control Act
13. Food Quality Protection Act
14. Food Security Act
15. Fish and Wildlife Act
16. General Mining Act of 1872
17. Hardrock Mining & Reclamation Act
18. Hazardous Materials Transportation Act
19. Healthy Forests Initiative (HFI)
20. International Environmental Protection Act
21. Kyoto Protocol (Convention of Climate Change)
22. Law of the Sea Convention (UNCLOS or LOSC)
23. Madrid Protocol (Antarctic Treaty)
24. Magnuson Fishery Conservation and Management Act
25. Marine Mammal Protection Act (MMPA)
26. Marine Protection, Research, and Sanctuaries Act (MPRSA)
27. Mineral Leasing Act
28. Mining Act
29. Montreal Protocol (Convention of Ozone Depletion)
30. National Energy Act
31. National Environmental Policy Act (NEPA)
32. National Park Act
33. National Wildlife Refuge System Act
34. Noise Control Act
35. Nuclear Waste Policy Act (NWPA)
36. Occupational Safety & Health Act (OSHA)
37. Ocean Dumping Ban Act (ODA)
38. Oil Pollution Act (OPA)
39. Oil Spill Prevention & Liability Act
40. Paris Agreement
41. Pollution Prevention Act (PPA)
42. Refuse Act

43. Resource Conservation & Recovery Act (RCRA)
44. Safe Drinking Water Act
45. Soil & Water Conservation Act
46. Solid Waste Disposal Act
47. Superfund Amendments and Reauthorization Act (SARA)
48. Surface Mining Control & Reclamation Act (SMCRA)
49. Toxic Substances Control Act (TSCA)
50. Wilderness Act

Be Aware of and Enjoy Nature

Go visit a natural area! Some places you may consider visiting include any of the local state parks (we have a lot in our area) or a neighborhood park, forest, open grassy area, anywhere you want to go! While you are there, I would like you to make the following observations:

1. Record the date, time, duration of visit, and location of your outing
2. Record observations on the following things:
    a. Flora (plants)

b. Fauna (animals, fungi, etc.)
c. Geology (rocks, soil, etc.)
d. Weather (today) and Climate (throughout the seasons)

*You don't need to know specific species names for all of the plants and animals and types of rocks and soil you see, but DESCRIBE them. What color are they? How big are they? What are they doing? How are they interacting with each other? This part of the assignment can just be a list, they don't need to be in complete sentences. You can even draw what you see if you would like or take pictures of your surroundings to add to your observations.

Once you have made your observations, write a paragraph (in complete sentences) reflecting on the following questions:

1. What did you encounter?
2. What questions did you wonder as you observed everything?
3. How much and what kinds of human impacts did you notice in that area?
4. How did you enjoy the activity?

Your observations and paragraph are due to me on the first day of school.