APES Summer Assignment 2024-2025
Due Date: Friday August 16th.

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Welcome future APES students! This is an advanced course that combines the disciplines of biology, chemistry, geology, physics, and a little bit of political science and economics, to investigate global environmental issues. We will discover how Earth's systems function together and how humans have affected our planet. We will also examine our personal consumption and learn ways to be responsible global citizens.

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 you should be prepared to take notes, study, and learn your vocabulary. Pre-requisites for this course are biology, chemistry, and algebra. The summer assignment should help you prepare for the content by getting organized, reviewing some background info, and familiarizing yourself with some of the basics of environmental science. There is also a bit of fun thrown into section 2 below! I can't wait to see where you go!

Section 1: Complete the form
1. Complete Survey found here: https://forms.gle/Vhqmh5G8St58oqt87

Section 2: Take a Hike!
Sustainability of our environment is the key concept that governs all topics of this course. Go outside this summer! Camp, ride your bike, go to the beach, swim in a lake, hike in the mountains, explore a forest. Have some unplugged experience out in nature and then tell us about it!
Requirements:
- Spend a minimum of 2 hours, hiking somewhere in nature without any man-made noise or screens! No music, phone calls, snapchatting, instagramming, etc.
  - Be safe (go with someone, bring your cell phone, water, snacks, and a flashlight with you).
- Take a picture of you with a sign showing where you are. Be creative and have fun, we will share these in class!
- Write a 2-page reflection on your observations as you hiked. Include things you saw and heard, what you thought about the area, how you felt about hearing no man-made noise, etc. Minimum 700 words, double-spaced, 12 point font.
  - Please submit this report and your pictures through Schoology by August 19th.

Section 3: Chemistry Review
Chemistry is a big part of environmental science and a prerequisite before registering for APES. Complete the following on a clean sheet of paper. It may be written or typed.

1. For each of the following, write out the chemical name that goes with the symbol *(you will do this on your answer sheet)*.

CO_2	CO	$C_6H_{12}O_6$	CH_4	H_2
N_2	NO_2	NO_3	NH_3	NH_4
O_2	O_3	P	PO_4^{3-}	S
SO_2	SO_3	H_2SO_4	$NaCl$	Pb
U	Rn	Hg	Cl	H_2O

2. Write at least a paragraph that explains the following: (you will do this on your answer sheet).
   a. What is the pH scale? What does it measure?
   b. How do the numbers on the scale compare? Example – is a pH of 4 twice as strong as a pH of 2? Hint – the scale is not linear!
   c. What are the average pH ratings of the following common substances in the environment?
      i. Blood
      ii. Rain
      iii. Freshwater (lake or river)
      iv. Ocean water

Section 4: Math Review

Great news! After many years of students struggling through the APES class and exam without a calculator, calculators are now allowed on the APES exam! While that probably has you breathing a sigh of relief, you still need to understand and be able to do the math required in this course, which means reviewing those concepts ahead of time are necessary! The math prep assignment will go over concepts and then give you an opportunity to practice some problems on your own.

- You'll need 2 documents to complete this assignment (both are included at the end of this document).
    - **AP Environmental Science Math Prep Primer** – this will come in handy throughout the year!
    - **APES Summer Assignment Answer Sheet.**
- Use the primer to review and go over concepts and then use the Answer sheet to work out practice problems at the end of each section.
- Even though calculators are allowed, you are required to show your work **(setup the problem)** on the AP exam.
- All work for this assignment should be done neatly in PENCIL in your own handwriting.

Section 5: Environmental Legislation

Create a chart similar to the one on the next page and fill in the missing information pertaining to important legislation. We will study many different environmental policies throughout the year, so this will get you started. Make sure you type it and save the document so that you can add to it as we cover additional policies. This will be a great study tool for tests and the final AP exam. You can change the formatting to fit your preferences (ex – make it landscape if that's easier for you).

Environmental Legislation Information

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).
Agenda 21			
Clean Air Act			
Clean Water Acts			
Comprehensive Environmental Response, Compensation Liability Act			
Consumer Product Safety Act			
Convention on International Trade in Endangered Species			
Emergency Planning & Community Right-To-Know Act			
Endangered Species Act			
Energy Policy Act			
Federal Food, Drug, and Cosmetic Act			
Federal Insecticide, Fungicide, and Rodenticide Act			
Federal Water Pollution Control Act			
Fish and Wildlife Conservation Act			
Food Quality Protection Act			
Kyoto Protocol			
Law of the Sea Convention			
Marine Mammal Protection Act			
London Dumping Convention			
Helsinki Convention			
Marine Plastic Pollution Research and Control Act			
Montreal Protocol			
National Energy Act			
National Environmental Policy Act			
National Park Act			
National Wildlife Refuge System Act			
Nuclear Waste Policy Act			
Occupational Safety and Health Act			
Ocean Dumping Ban Act			
Resource Conservation and Recovery Act			

Scientific Notation:

Scientific notation is a shorthand way to express large or tiny numbers. Since many of the calculations will deal with such numbers, converting to and using scientific notation to solve problems will help you do your calculations much quicker and easier, and will help prevent mistakes when converting 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:

$$1.23 \times 10^{11}$$

The number before the x (1.23) 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 (11) is the exponent.

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 and this will be the exponent. Drop any zeros so that the coefficient contains as few digits as possible.

- *Example: 123,000,000,000*
    - *Step 1: Place a decimal after the first digit – 1.23,000,000,000*
    - *Step 2: Count the digits after the decimal – there are 11.*
    - *Step 3 Drop the zeros and write in the exponent – 1.23 x 10^{11}*

Writing tiny numbers is similar. The only difference is the decimal is moved to the left and the exponent is a negative.

- *Example: .0000000426 would be written as: 4.26 x 10^{-8}*

Practice: Remember to show your work/setup for each problem. Always include units if they are given. All work and answers go on your answer sheet.

Convert the following numbers into scientific notation or from scientific notation to regular notation.

1. 16,502
2. 0.0067
3. 0.015
4. 600
5. 3950
6. 0.22
7. 6.96 x 10^{3}
8. 3.46 x 10^{-5}
9. 2.54 x 10^{4}
10. 9.1 x 10^{-2}
11. 5.0 x 10^{-3}
12. 9.4444 x 10^{2}

Working In Scientific Notation: Adding and Subtracting

To add or subtract using exponents, the exponents must be the same. You can do this by moving the decimal one way or another to get the same exponents. Once the exponents match up, add or subtract the coefficients as you normally would. Once you have an answer, make sure your answer has only one digit before the decimal – you may now need to change the exponent of the answer.

- Example: 1.35 x 10^{6} + 3.72 x 10^{5}
    - Step 1: Make sure both exponents are the same. It's usually easier to go with the large exponent so you don't have to change the exponent in your answer, so let's make both exponents 6 for this problem.

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

    - Step 2: Add the coefficients just as you would regular decimals. Remember to line up the decimals.

$$\begin{array}{r} 1.35 \\ + .372 \\ \hline 1.722 \end{array}$$

   o Step 3: Write your answer including the exponent, which is the same as what you started with.

$$1.722 \times 10^6$$

Working In Scientific Notation: Multiplying or Dividing

To multiply exponents, multiply the coefficients as normal, then add the exponents to each other. The exponents do NOT have to be the same in this case!

- Example: 1.35×10^6 X 3.72×10^5 = 5.022×10^{11}

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

- Example: 5.635×10^3 / 2.45×10^6 = 2.3×10^{-3}

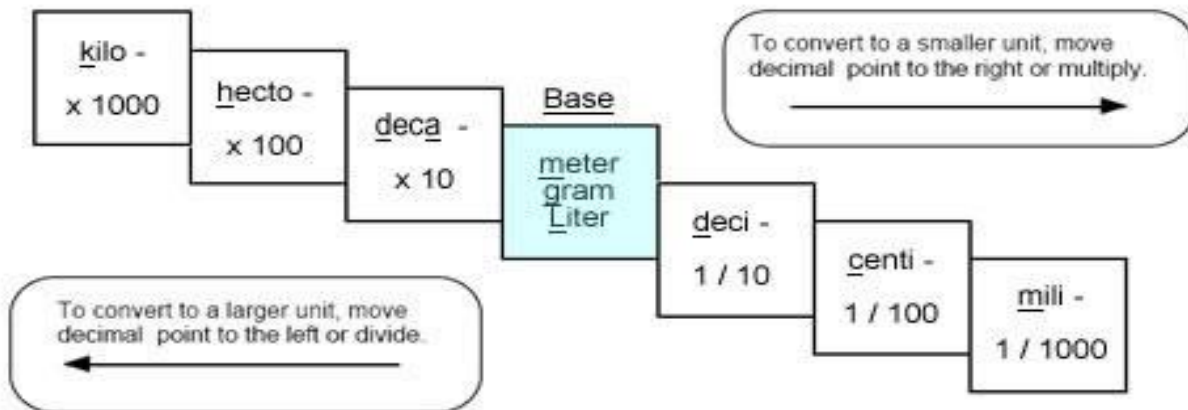
Practice: Remember to show your work/setup for each problem. Always include units if they are given. All work and answers go on your answer sheet.

Calculate the following using only scientific notation.

13. $3.0 \times 10^9 + 1.4 \times 10^6$
14. $1.5 \times 10^4 + 2.5 \times 10^3$
15. $8.5 \times 10^7 - 4.5 \times 10^7$
16. $9.2 \times 10^9 - 1.5 \times 10^6$
17. $3.0 \times 10^5 \times 3.3 \times 10^4$
18. $5.2 \times 10^{18} \times 8.7 \times 10^{22}$
19. $9.0 \times 10^8 / 4.5 \times 10^3$
20. $5.2 \times 10^{18} / 8.7 \times 10^{22}$

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 easily. You can remember the order of the prefixes by using the following sentence: *King Henry Died By Drinking Chocolate Milk*. Since the multiples and division of the base units are all factors of 10, you just need to move the decimal to convert from one to another.

- Example: 55 Centimeters = ? kilometers
  - o Step 1: Figure out how many places to move the decimal. King Henry Died By Drinking… - that's five places (count the one you are going to, but not the one you are on).
  - o Step 2: Move the decimal five places to the left since you are going from smaller to larger.

$$55 \text{ cm} = .00055 \text{ km}$$

Practice: Remember to show your work/setup for each problem. Always include units if they are given. All work and answers go on your answer sheet.

Convert the following:

21. 1200 kg to milligrams
22. 14000 mm to meters
23. 670 hm to centimeters
24. 3544 liters to milliliters
25. 0.078 km to meters
26. 17 grams to kilograms

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.

- Examples: .85 = 85%   .008 = .8%

Part I: finding the percent

To find the percent of a given number, change the percent to a decimal and MULTIPLY.

- Example: 30% of 400
   - Step 1: 30% = .30
   - Step 2: 400 x .30 = 12000
   - Step 3: Count the digits behind the decimal in the problem and add decimal to the answer.

12000 → 120.00 →120

Part II: finding percent of a number

To find what percent 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?
   - Step 1: 12/25 = .48
   - Step 2: .48 = 48%

Part III: finding percent 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: Kindles have dropped in price 18% from $139. What is the new price of a Kindle?
   - Step 1: $139 x .18 = $25
   - Step 2: $139 - $25 = $114

Part IV: 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?
   - Step 1: 8% = .08
   - Step 2: $1600/.08 = $20,000

27. What is 45% of 900?
28. 13% of a 12,000 acre forest is being logged. How many acres will be logged?
29. A water heater holds 280 gallons. Two percent of the water is lost as steam. How many gallons remain to be used?
30. What percentage is 25 of 162.5?
31. 35 is what percentage of 2800?
32. 14,000 acres of a 40,000 acre forest burned in a forest fire. What percentage of the forest was damaged?
33. You have driven the first 150 miles of a 2000 mile trip. What percentage of the trip have you traveled?
34. Home prices have increased around 5% in the last four years. An average home in Spring Hill four years ago was $214,000. What is the average home price now?
35. The Greenland Ice Sheet contains 2,850,000 cubic kilometers of ice. It is melting at a rate of .006% per year. How many cubic kilometers are lost yearly?
36. 235 acres, or 15% of a forest is being logged. How large is the forest?
37. A teenager consumes 20% of her calories each day in the form of protein. If she is getting g700 calories a day from protein, how many calories is she consuming per day?
38. In a small oak tree, the biomass of insects makes up 13 kilograms. This is 4% of the total biomass of the tree. What is the total biomass of the tree?

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 (aka factor-labeling). The best way to start 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!

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, you have to also get the unit on the bottom, and likewise.

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 unit on the bottom.

    3 years

  - Step 2: Start writing in all the values you know, making sure you can cancel the top and bottom units. 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 on the top.

    3 years x 365 ~~days~~ x 24 ~~hours~~ x 60 ~~minutes~~ x 60 seconds
                 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. Make sure to include units on your answer!

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

  - Step 4: Multiply all values across the bottom. Write in scientific notation if needed. 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 make sense for there to be a lot of seconds in three years? YES! If you had gotten a tiny number then you would need to go back and check for mistakes.

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

- Example: 50 miles per hour = ? feet per second

$$\frac{50 \text{ miles}}{1 \text{ hour}} \times \frac{5280 \text{ feet}}{1 \text{ mile}} \times \frac{1 \text{ hour}}{60 \text{ min}} \times \frac{1 \text{ minute}}{60 \text{ seconds}} = \frac{50 \times 5280 \times 1 \times 1 = 264000 \text{ feet}}{1 \times 1 \times 60 \times 60 = 3600 \text{ seconds}} = \textbf{264000/3600 = 73.33 feet/second}$$

Helpful Conversions:
1 sq mile = 640 acres
1 hectare (Ha) = 2.47 acres
1kw-hr = 3.413 BTUs
1 barrel of oil = 159 liters
1 metric ton = 1000 kg
1 ton = 2000 pounds

Practice: Remember to show your work/setup for each problem. Always include units if they are given. All work and answers go on your answer sheet.

Convert the following:

39. 134 miles = inches
40. 8.9×10^5 tons = ounces
41. 1.35 kilometers per second = miles per hour
42. 10 billion BTUs = kilowatt-hours
43. 340 million square miles to hectares
44. If one barrel of crude oil provides six million BTUs of energy, how many BTUs of energy will one liter of crude oil provide?
45. Fifty eight thousand kilograms of solid waste is equivalent to how many metric tons?

Interpreting Data:

APES students must be able to read and interpret the information in a variety of ways, including graphs and tables. Use the information presented in the graphs to answer the questions that follow them.
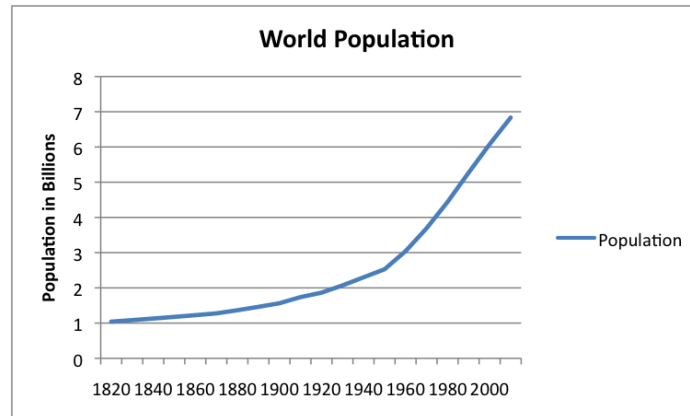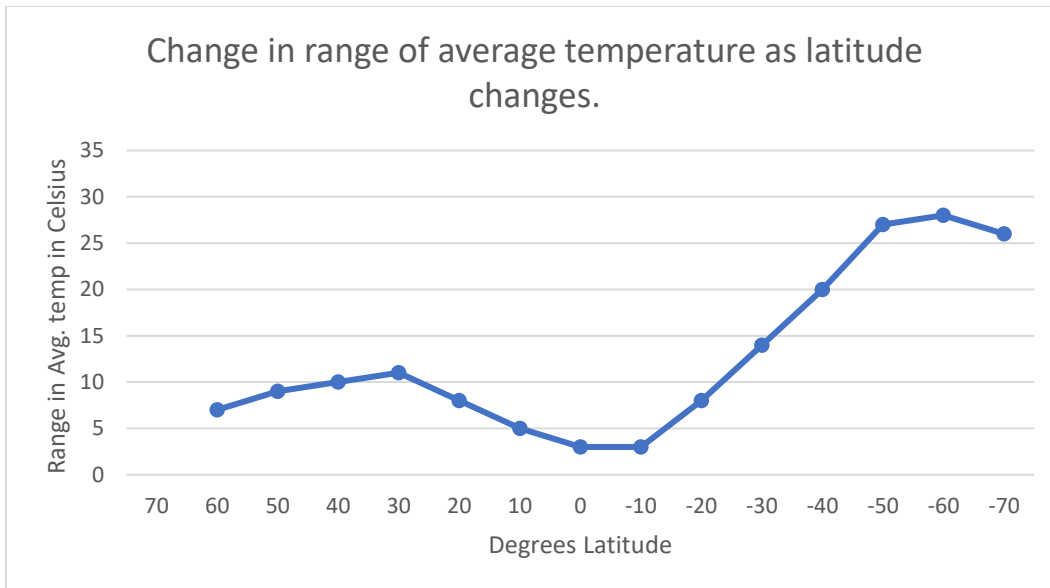

Practice: Remember to show your work/setup for each problem. Always include units if they are given. All work and answers go on your answer sheet.

46. Describe what the graph shows. (Describing means to look at the overall picture presented or trend in the data. What's happening? Interpret the graph; don't just repeat the title.
47. What was the world's population in 1900? 2010?
48. Assuming that the population trend continues, predict the world population in 2025. Do you think this is likely to occur? Defend your answer.

Change in range of average temperature as latitude changes.

Practice: *Remember to show your work/setup for each problem. Always include units if they are given. All work and answers go on your answer sheet.*

49. Describe what the graph shows.
50. At what latitude does the lease variation occur?
51. Miami is at approximately 26ᴼN latitude. From the information on the graph, what is the range in mean monthly temperature there?
52. Moorestown is at approximately 36ᴼN latitude. Based on the graph, what is the range in mean monthly temperature here?
53. Sydney, Australia is at approximately 33ᴼS (-33 on the graph). From the graph, what is the range in mean monthly temperature there?
54. Which hemisphere, the northern or the southern, has the greatest range in monthly temperatures? Why do you think this occurs?

Record all answers on your answer sheet.

Section 1: Nothing to write here! Make sure you've joined the google classroom and completed the survey!
Section 2: Take a Hike! Submitted separately through google classroom!
Section 3: Chemistry Review

1.

CO_2	CO	$C_6H_{12}O_6$	CH_4	H_2
N_2	NO_2	NO_3	NH_3	NH_4
O_2	O_3	P	PO_4^{3-}	S
SO_2	SO_3	H_2SO_4	NaCl	Pb
U	Rn	Hg	Cl	H_2O

2. Ph Scale Write-up goes here:

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Section 4: Math Review

<u>Scientific Notation</u>

1.	2.
3.	4.
5.	6.
7.	8.
9.	10.
11.	12.

Scientific Notation and Basic Math Computations

13.	14.
15.	16.
17.	18.
19.	20.

Metric Unit Conversions
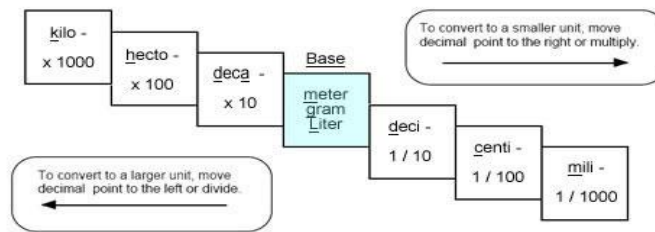
21.	22.
23.	24.
25.	26.

Percentages

27.	28.
29.	30.
31.	32.
33.	34.
35.	36.
37.	38.

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Section 5: Turn in separately on schoology or through Email.