APES SUMMER ASSIGNMENT

Welcome future APES students! This is an advanced science course that combines the disciplines of biology, chemistry, geology and physics to investigate global environmental issues. We will discover how the 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 in the face of serious environmental issues.

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 you go, but it will be your responsibility to take notes, study and learn your vocabulary. We also work on the assumption that you have a general science background that includes biology, chemistry and algebra. The purpose of the summer assignment is to help you prepare for the APES content by getting organized, reviewing some background information and getting familiar with some basic concepts of environmental science.

Section 1: Environmental Legislation

Create a chart similar to the one below and fill in the missing information pertaining to important legislation. We will study many different environmental policies throughout the semester, so this will get you started. You will want to add to this chart throughout the course, so it may be easiest to type and save your work so you can additional policies as we cover them. This will be great study tool for tests and the AP exam in May. You can change the formatting to fit your personal preferences if you wish to do so, just make sure it is completed by the third day of class (ex: make it a landscape formatted table).

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/facts you find, etc…)
Agenda 21			
Clean Air Act			
Clean Water Acts			
Comprehensive Environmental Response, Compensation Liability Act			
Consumer Product Safety Act			
Convention on International Trade and Endangered Species			
Emergency Planning and 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 Control Act			
Food Quality Protection Act			
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			

Section 2: Roots review

Understanding vocabulary terms is a key skill in science. Instead of memorizing thousands of individual terms, learning the Latin and Greek roots can help you to decipher the meaning of many different terms, even ones that you've never seen before. This is not just useful for understanding science vocabulary, but also many words in the English language as well as other romance languages. For each of the following common roots, look up the definition of the root, find an example word that includes that root, and define that word. Useful websites to try: macroevolution.net and learnthat.org. Your example words do not all have to be specifically science related. For the first day test, be prepared to match roots with definitions (there are some that overlap; I won't give you both of those in the same section) and be able to define a word (real or made up) based on its roots. This chart is due on the first day of school.

Root	**Definition of Root**	**Example Word**	**Definition of Example Word**
a(n)-			
-able			
aero-			
agri-			
amphi-			
anemo-			
ante-			
anthro-			
anti-			
arch(ae/i)-			
-ase			
auto-			

bar- bi- bio-			
carcin-			
cen-			
chem-			
chlor-			
chrom-			
chron-			
-cid-			
circ-			
co-			
com-/con-			
contra-			
de-			
derm-			
di-			

dorm- dys- eco- ecto-/exo- endo- epi- eu-			
extra-			
foli-			
-gen-			
geo-			
herb- hetero-			
homo-			
hydr-			
hyper-			
hypo-			
inter-			

intra- iso- lign- lysis- macr- micr- mono- multi- mut- neo-			
non-			
para-			
photo-			
poly-			
post-			
pre-			

pro- re- semi-			
sol-			
sub-			
super-			
sym/syn-			
terr- therm-			
tox-			
trans-			
troph-			
turb-			

Section 3: Chemistry review

Common chemical elements, ions, and compounds should be recognized quickly. For each of the following, determine its name, identify what type of substance it is, and how it is important to environmental science (e.g. common pollutant, source of energy, etc.) For the first day test, be prepared to give the name for the formula or vice versa. (Due first day as well)

Chemical Formula	Name	Element, Compound, or Ion?	Importance to Environmental Science
C			
$C_6H_{12}O_6$			
CH_4			
Cl			
CO			
CO_2			
H			
H_2			
H_2O			
Hg			
K			
N			
N_2			
NaCl			
NH_3			
NO_3^-			

O			
O_2			
O_3			
P			
Pb			
PO_4^{3-}			
Rn			
S			
SO_2			
U			

Section 4: Math Review

This part of the summer assignment is designed to get you in gear for the math concepts you will be required to use during the semester. By reviewing the math skills needed for APES you will be well on your way to a successful year. The APES math prep assignment will go over these math concepts then give you the opportunity to practice some problems on your own. Beginning this year, calculators **are** allowed on the APES exam so you may use calculators to do the math, but you **must show all work/set up for each question.**

All work for this section must be completed NEATLY on notebook paper and in pencil.

This assignment will be due on the third day of class.

AP Environmental Science Math Prep

This year in APES you will hear the two words most dreaded by high school students…NO CALCULATORS! That's right, you cannot use a calculator on the AP Environmental Science exam. Since the regular tests you will take are meant to help prepare you for the APES exam, you will not be able to use calculators on regular tests all year either. The good news is that most calculations on the tests and exams are written to be fairly easy calculations and to come out in whole numbers or to only a few decimal places. The challenge is in setting up the problems correctly and knowing enough basic math to solve the problems. With practice, you will be a math expert by the time the exam rolls around. So bid your calculator a fond farewell, tuck it away so you won't be tempted, and start sharpening your math skills! **You will be tested on the math skills in this packet the second week of school.**

Contents

Reminders

1. Write out all 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 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.
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.

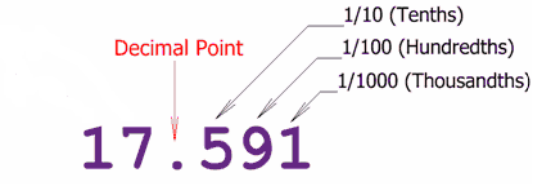
Directions

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 on each step. Check your work.

Decimals

Part I: The basics

Decimals are used to show fractional numbers. The first number behind the decimal is the tenths place, the next is the hundredths place, the next is the thousandths place. Anything beyond that should be changed into scientific notation (which is addressed in another section.)



Part II: Adding or Subtracting Decimals

To add or subtract decimals, make sure you line up the decimals and then fill in any extra spots with zeros. Add or subtract just like usual. Be sure to put a decimal in the answer that is lined up with the ones in the problem.

$$\begin{array}{r} 123.0000 \\ 0.0079 \\ +43.5000 \\ \hline 166.5079 \end{array} \qquad \begin{array}{r} 27.583 \\ -\ 0.200 \\ \hline 27.383 \end{array}$$

Part III: Multiplying Decimals

Line up the numbers just as you would if there were no decimals. DO NOT line up the decimals. Write the decimals in the numbers but then ignore them while you are solving the multiplication problem just as you would if there were no decimals at all. After you have your answer, count up all the numbers behind the decimal point(s). Count the same number of places over in your answer and write in the decimal.

$3.77 \times 2.8 = ?$

$$\begin{array}{rl} & 3.77 \text{ (2 decimal places)} \\ \times & \underline{\ 2.8\ } \text{ (1 decimal place)} \\ & 3016 \\ & +754 \\ \hline & 10.556 \text{ (3 decimal places)} \end{array}$$

Part IV: Dividing Decimals

Scenario One: If the divisor (the number after the / or before the) does not have a decimal, set up the problems just like a regular division problem. Solve the problem just like a regular division problem. When you have your answer, put a decimal in the same place as the decimal in the dividend (the number b the / or under the).

$$\begin{array}{r} 424.9 \\ 38\overline{)\,16146.2} \\ 152 \\ \hline 94 \\ 76 \\ \hline 186 \\ 152 \\ \hline 342 \\ 342 \\ \hline 0 \end{array}$$

Scenario Two: If the divisor does have a decimal, make it a whole number before you start. Move the decimal to the end of the number, then move the decimal in the dividend the same number of places.

$$3.8\overline{)1614.62}$$

Then solve the problem just like a regular division problem. Put the decimal above the decimal in the dividend. (See Scenario One problem).

Practice: Remember to show all your work, include units if given, and NO CALCULATORS! All work and answers go on your answer sheet.

1. 1.678 + 2.456 =
2. 344.598 + 276.9 =
3. 1229.078 + .0567 =
4. 45.937 – 13.43 =
5. 199.007 – 124.553 =
6. 90.3 – 32.679 =
7. 28.4 x 9.78 =
8. 324.45 x 98.4 =
9. 1256.93 x 12.38 =
10. 64.5 / 5 =
11. 114.54 / 34.5 =
12. 3300.584 / 34.67 =

Averages

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

Example: Find the average of 10, 20, 35, 45, and 105.
Step 1: Add all the quantities. 10 + 20 + 35 + 45 + 105 = 215
Step 2: Divide the total by the number of given quantities. 215 / 5 = 43

Practice: Remember to show all your work, include units if given, and NO CALCULATORS! All work and answers go on your answer sheet.

13. Find the average of the following numbers: 11, 12, 13, 14, 15, 23, and 29
14. Find the average of the following numbers: 124, 456, 788, and 343
15. Find the average of the following numbers: 4.56, .0078, 23.45, and .9872

Percentages

Introduction:

Percents show fractions or decimals with a denominator of 100. Always move the decimal TWO places to the right 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 of a Given Number

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 the Percentage 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?

Step 1: 12/25 = .48

Step 2: .48 = 48% (12 is 48% of 25)

Part III: Finding Percentage Change & Increase or Decrease

To find percent change: (New - old)/ Old x 100

Example: The iphone has decreased from $650 to $515. What is the percent change in the price?

Step 1: 515 - 650 = - 135 We use absolute value in this class. You can ignore the negative.

Step 2: 135 / 650 = .208

Step 3: .208 X 100 =20.1%

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 = $160,000 / 8 = $20,000 *(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. .08 becomes 8, 1600 becomes 160000.)*

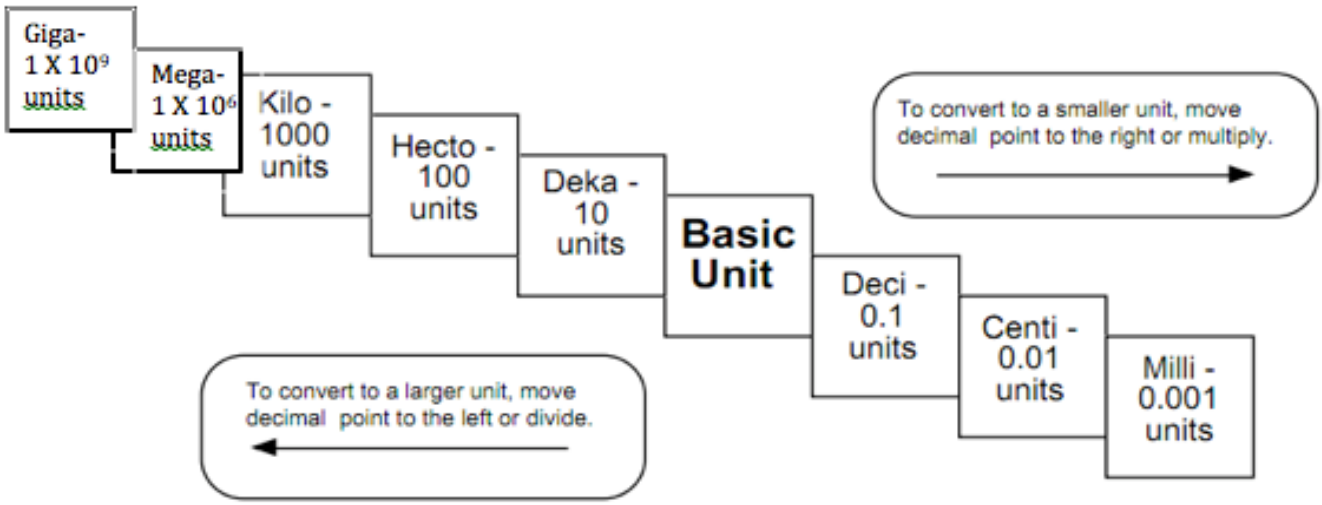
Practice: Remember to show all your work, include units if given, and NO CALCULATORS! All work and answers go on your answer sheet.

16. What is 45% of 900?
17. Thirteen percent of a 12,000 acre forest is being logged. How many acres will be logged?
18. A water heater tank holds 280 gallons. Two percent of the water is lost as steam. How many gallons remain to be used?
19. What percentage is 25 of 162.5?
20. 35 is what percentage of 2800?
21. 14,000 acres of a 40,000 acre forest burned in a forest fire. What percentage of the forest was damaged?
22. You have driven the first 150 miles of a 2000 mile trip. What percentage of the trip have you traveled?
23. Home prices have dropped 5% in the past three years. An average home in Indianapolis three years ago was $130,000. What's the average home price now?

24. Approximately 30 million mobile devices were sold in 1998 in the United States. The number sold increased to 180 million devices in 2007. Calculate the percent increase of mobile device sales from 1998 to 2007.
25. 235 acres, or 15%, of a forest is being logged. How large is the forest?
26. 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?
27. 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?

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 the 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.



Example: 55 centimeters = ? kilometers

Step 1: Figure out how many places to move the decimal. King Henry Died By Drinking… – that's six places. (Count the one you are going to, but not the one you are on.)

Step 2: Move the decimal five places to the left since you are going from smaller to larger.

55 centimeters = .00055 kilometers

Example: 19.5 kilograms = ? milligrams

Step 1: Figure out how many places to move the decimal. … Henry Died By Drinking Chocolate Milk – that's six places. (Remember to count the one you are going to, but not the one you are on.)

Step 2: Move the decimal six places to the right since you are going from larger to smaller. In this case you need to add zeros.

19.5 kilograms = 19,500,000 milligrams

Practice: Remember to show all your work, include units if given, and NO CALCULATORS! All work and answers go on your answer sheet.

28. 1200 kilograms = ? milligrams
29. 14000 millimeters = ? meters
30. 670 hectometers = ? centimeters
31. 6544 liters = ? milliliters
32. .078 kilometers = ? meters
33. 17 grams = ? kilograms

Scientific Notation

Introduction:

Scientific notation is a shorthand way to express large or tiny numbers. Since you will need to do calculations throughout the year WITHOUT A CALCULATOR, we will consider anything over 1000 to be a large number. Writing these numbers in scientific notation will help you 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:

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

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.

Part I: 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: 123,000,000,000

Step 1: Place a decimal after the first digit. 1.23000000000

Step 2: Count the digits after the decimal…there are 11.

Step 3: Drop the zeros and write in the exponent. 1.23×10^{11}

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

$$4.26 \times 10^{-8}$$

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: .0000000426

Step 1: 00000004.26

Step 2: Count the digits before the decimal…there are 8.

Step 3: Drop the zeros and write in the exponent as a negative. 4.26×10^{-8}

Part II: 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 addition problem (review the previous section about decimals if you need to). 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.

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 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.

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

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

1.722×10^6

Part III: 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.

$$\begin{array}{r} 1.35 \\ \times\ 3.72 \\ \hline 270 \\ 9450 \\ 40500 \\ \hline 50220 \rightarrow 5.022 \end{array}$$

Step 2: Add the exponents.

$5 + 6 = 11$

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

Step 1: Divide the coefficients.

$5.635 / 3.45 = 2.3$

Step 2: Subtract the exponents.

$3 - 6 = -3$

Step 3: Write your final answer.

2.3×10^{-3}

Practice: Remember to show all your work, include units if given, and NO CALCULATORS! All work and answers go on your answer sheet.

Write the following numbers in scientific notation:

34. 145,000,000,000
35. 13 million
36. .000348
37. 135 trillion
38. 24 thousand

Complete the following calculations:

39. $3 \times 10^3 + 4 \times 10^3$
40. $4.67 \times 10^4 + 323 \times 10^3$
41. $7.89 \times 10^{-6} + 2.35 \times 10^{-8}$
42. $9.85 \times 10^4 - 6.35 \times 10^4$
43. $2.9 \times 10^{11} - 3.7 \times 10^{13}$
44. $1.278 \times 10^{-13} - 1.021 \times 10^{-10}$
45. three hundred thousand plus forty-seven thousand
46. 13 million minus 11 thousand
47. 1.32×10^8 X 2.34×10^4
48. 3.78×10^3 X 2.9×10^2
49. three million times eighteen thousand
50. one thousandth of seven thousand
51. eight ten-thousandths of thirty-five million
52. $3.45 \times 10^9 / 2.6 \times 10^3$
53. $1.98 \times 10^{-4} / 1.72 \times 10^{-6}$
54. twelve thousand divided by four thousand

Dimensional Analysis

Introduction

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 in 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.

$$\underline{3 \text{ years}} \quad \left[\quad\right]$$

Step 2: Start writing in all the values you know, making 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.

$$\left[\frac{3 \text{ years}}{}\right]\left[\frac{365 \text{ days}}{1 \text{ year}}\right]\left[\frac{24 \text{ hours}}{1 \text{ day}}\right]\left[\frac{60 \text{ minutes}}{1 \text{ hour}}\right]\left[\frac{60 \text{ seconds}}{1 \text{ minute}}\right]\left[\frac{}{}\right]$$

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

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

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.

$$9.46 \times 10^7 \text{ seconds} / \ 1 = 9.46 \times 10^7 \text{ seconds}$$

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 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.

$$\left[\frac{50 \text{ miles}}{1 \text{ hour}}\right]$$

Step 2: Convert miles to feet first.

$$\left[\frac{50 \text{ miles}}{1 \text{ hour}}\right]\left[\frac{5280 \text{ feet}}{1 \text{ mile}}\right]\left[\frac{}{}\right]$$

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

$$\frac{50 \text{ miles}}{1 \text{ hour}}\left[\frac{5280 \text{ feet}}{1 \text{ mile}}\right]\left[\frac{1 \text{ hour}}{60 \text{ minutes}}\right]\left[\frac{1 \text{ minute}}{60 \text{ seconds}}\right]\left[\frac{}{}\right]$$

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 your work, include units if given, and NO CALCULATORS! All work and answers go on your answer sheet. Use scientific notation when appropriate.

Non-metric Conversions:
1 hectare (Ha) = 10000 square meters
1 barrel of oil = 159 liters

55. 1200 cm per hour = ? km per week
56. Approximately 30 million mobile devices were sold in 1998 in the United States. Each mobile device sold in 2007 contained an average of 0.03 gram of gold. Calculate the number of kilograms of gold that were used in the production of the mobile devices sold in 1998.
57. The U.S. consumes approximately 20 million barrels of oil per day. How many liters of oil does the U.S. consume in one year?
58. The Roe family of four showers once a day with an average of 10 minutes per shower. The shower has a flow rate of 5 gallons per minute. How many gallons of water does the family use in one year?
59. A 340 million square meters of forest is how many hectares?
60. Termites live in the tropical rainforest breaking down dead and decaying plant material. As they break down the plant material they release methane, a greenhouse gas. Annually, 1,000 termites release approximately 500 grams of methane. Given a density of 3.5×10^6 termites per hectare, what is the annual amount of methane released, in kilograms, by the termites inhabiting a 3,000 hectare of tropical rain forest?

Practice Making Graphs:

Use the following steps to create graphs and answer questions for each of the problems below. All your work will go on the separate answer sheet.

1. *Identify the variables. The independent variable is controlled by the experimenter. The dependent variable changes as the independent variable changes. The independent variable will go on the X axis and the dependent on the Y axis.*
2. *Determine the variable range. Subtract the lowest data value from the highest data value.*
3. *Determine the scale of the graph. The graph should use as much of the available space as possible. Each line of the scale must go up in equal increments. For example, you can go 0, 5, 10, 15, 20, etc. but you cannot go 1, 3, 9, 34, 50, etc. Increments of 1, 2, 5, 10, or 100 are commonly used but you should use what works best for the given data.*
4. *Number and label each axis.*
5. *Plot the data. If there are multiple sets of data on one graph, use a different color for each.*
6. *Draw a smooth, best-fit line for each data set.*

7. *Title the graph. Titles should explain exactly what the graph is showing and are sometimes long. Don't be afraid of a long title!*
8. *Create a key to the graph if there is more than one set of data.*

Problem 1

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	4.5	4.0
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.

A. Make a line graph of the data.
B. What is the dependent variable?
C. What is the independent variable?
D. What was the average thickness of the annual rings of 40 year old trees in Forest A?
E. Based on this data, what can you conclude about Forest A and Forest B?

Problem 2

pH of water	Number of tadpoles
8.0	45
7.5	69
7.0	78
6.5	88
6.0	43
5.5	23

A. Make a line graph of the data.
B. What is the dependent variable?
C. What is the independent variable?
D. What is the average pH in this experiment?
E. What is the average number of tadpoles per sample?
F. What is the optimum water pH for tadpole development?
G. Between what two pH readings is there the greatest change in tadpole number?
H. How many tadpoles would you expect to find in water with a pH reading of 5.0?

Problem 3

Amount of ethylene in ml/m^2	Wine sap Apples: Days to Maturity	Golden Apples: Days to Maturity	Gala Apples: Days to Maturity
10	14	14	15
15	12	12	13
20	11	9	10
25	10	7	9
30	8	7	8
35	8	7	7

Ethylene is a plant hormone that causes fruit to mature. The data above concerns the amount of time it takes for fruit to mature from the time of the first application of ethylene by spraying a field of trees.

A. Make a line graph of the data.
B. What is the dependent variable?
C. What is the independent variable?