AP Environmental Summer Assignment, 2018-2019

Welcome to Environmental Science

This packet contains 3 items

1. Outdoor reflection and experience. Instructions for doing this are on the following page.
2. Answer sheet grid for a summer math assignment.
3. Summer math assignment.

You are expected to have completed both assignments and be ready to hand in your answer sheet grid and news article summaries on the first day of class after convocation.

Contact amikalauskas@bcps.org, rcausarano@bcps.org, rdrylie@bcps.org if you have questions over the summer. Please contact the instructor of your class.

Outdoor experience and reflection

Having an appreciation for the outdoors will help you understand the importance of this course. You will need to spend **at least 10 hours** on some type of outdoor excursion. There are many different opportunities for you, such as canoeing, hiking, camping, visiting a state or National Parks, volunteering for an environmental group or learning center. Do not consider things such as trips to NYC or vacations to all inclusive resorts but an authentic outdoor experience. **You will need to provide documentation of your experience** (i.e. photo/video library of you taken during the activity, or a signed letter from an on-site supervisor with his or her contact information).

Write a minimum **one page reflection** (12 point font, 1.5 spaced, Times New Roman) of your experience. Include an introduction identifying your activity in detail, any observations of wildlife (be specific), environmental issues you encountered (pollution, traffic issues etc), how you enjoyed the activity and a conclusion reflecting on how the experience may prepare you for this course. The grading rubric will be as follows:

- One page reflection- 40 points (10 points for introduction, 20 points for the information in the body of the paper and 10 points for the conclusion).
- Documentation- 10 points

Please contact me at amikalauskas@bcps.org, rcausarano@bcps.org, rdrylie@bcps.org if you have questions.

APES Math Prep Answer Sheet

Name________________________________

Remember to show all your work, **include units** on each step and *circle your final answer.* ***NO CALCULATORS!!!!***

↓with Units

DECIMALS

1. **Answer:** __________________	**2.** **Answer:** __________________
3. **Answer:** __________________	**4.** **Answer:** __________________
5. **Answer:** __________________	**6.** **Answer:** __________________
7. **Answer:** __________________	**8.** **Answer:** __________________

AVERAGES

9. **Answer:** __________________	**10.** **Answer:** __________________	**11.** **Answer:** __________________

PERCENTAGES

12. Answer: ____________	13. Answer: ____________
14. Answer: ____________	15. Answer: ____________
16. Answer: ____________	17. Answer: ____________
18. Answer: ____________	19. Answer: ____________
20. Answer: ____________	21. Answer: ____________
22. Answer: ____________	

METRIC SYSTEM

23. Answer: ________	24. Answer: ________	25. Answer: ________
26. Answer: ________	27. Answer: ________	28. Answer: ________

SCIENTIFIC NOTATION

29. Answer: ________	30. Answer: ________
31. Answer: ________	32. Answer: ________
33. Answer: ________	34. Answer: ________
35. Answer: ________	36. Answer: ________
37. Answer: ________	38. Answer: ________
39. Answer: ________	40. Answer: ________

41.	42.
Answer: ________	Answer: ________
43.	44.
Answer: ________	Answer: ________

DIMENSIONAL ANALYSIS

45.

Answer: ________

46.

Answer: ________

47.

Answer: ________

48.

Answer: ________

49.

Answer: ____________________

50.

Answer: ____________________

51.

Answer: ____________________

Put graphing practice questions on the graph page

AP Environmental Science Summer 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!

<u>Contents</u>

<u>Reminders</u>

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.

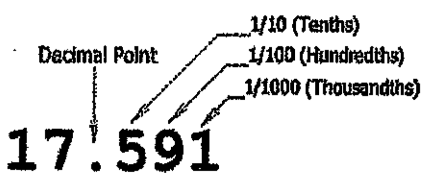
<u>Directions</u>

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.

<u>Decimals</u>

<u>Part I: The basics</u>

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.)



<u>Part II: Adding or Subtracting Decimals</u>

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.

```
 123.0000          27.583
   0.0079        - 0.200
+ 43.5000        -------
---------          27.383
 166.5079
```

<u>Part III: Multiplying Decimals</u>

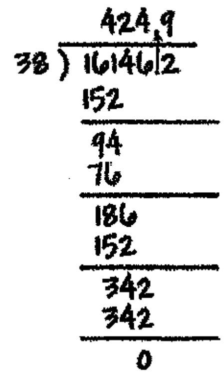
Line up the numbers just as you would if there were no decimals. DO NOT line up the decimals. Write the decimals in the numbers but then ignore them while you are solving the multiplication problem just as you would if there were no decimals at all. After you have your answer, count up all the numbers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

$3.77 \times 2.8 = ?$

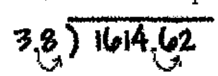
```
     3.77  (2 decimal places)
x     2.8  (1 decimal place)
     3016
    +754
   10.556  (3 decimal places)
```

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 before the / or under the ⟌).



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.



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! **<u>All work and answers go on your answer sheets</u>**.

1. 1.678 + 2.456 =
2. 344.598 + 276.9 =
3. 45.937 – 13.43 =
4. 90.3 – 32.679 =
5. 20 x .0005 =
6. 64.5 x 5 =
7. 114.54 / 30 =
8. 3300.584 / .02 =

<u>Averages</u>

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! **<u>All work and answers go on your answer sheet.</u>**

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

<u>Percentages</u>

<u>Introduction:</u>

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:

$$\begin{array}{r} 400 \\ \underline{\times .30} \\ 12000 \end{array}$$

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 a Percent Change

Subtract the initial value from the final value. Divide the difference by the initial value. Finally, multiply by 100.

Example: in 1700 we estimate the amount of CO_2 in the atmosphere to have been 280 ppm. Today, it is around 400 ppm. What was the % change?

Step 1: 400 ppm – 280 ppm = 120 ppm

Step 2 120 ppm/280 ppm = .429

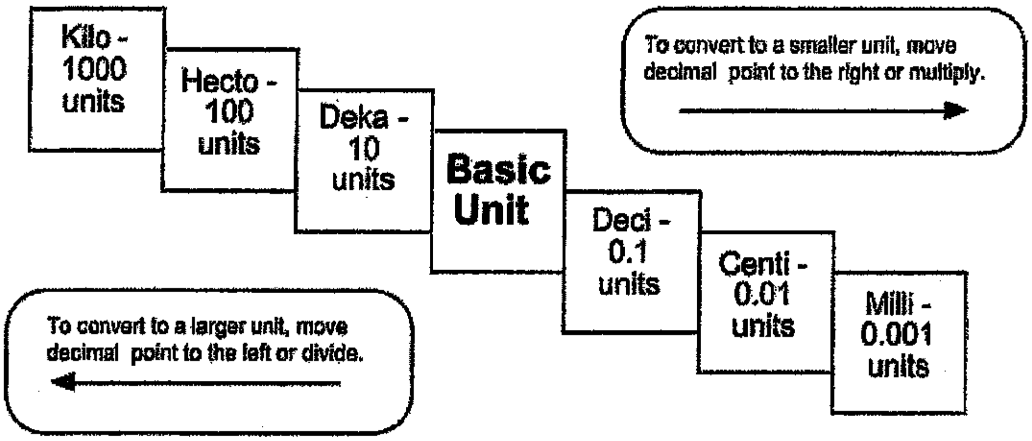
Step 3 .429 x 100 = 42.9 %

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

12. What is 45% of 900?
13. Twenty percent of a 12,000 acre forest is being logged. How many acres will be logged?
14. A water heater tank holds 280 gallons. Two percent of the water is lost as steam. How many gallons remain to be used?
15. What percentage is 25 of 175?
16. 35 is what percentage of 7000?
17. 14,000 acres of a 42,000 acre forest burned in a forest fire. What percentage of the forest was damaged?
18. You have driven the first 150 miles of a 2000 mile trip. What percentage of the trip have you traveled?
19. 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?
20. The Greenland Ice Sheet contains 2,850,000 cubic kilometers of ice. It is melting at a rate of .010% per year. How many cubic kilometers are lost each year?
21. When you were 5 years old, you were 3 feet tall. Now that you are 17, you are 6 feet tall. What was your % change in height?
22. The number of blue crabs caught in Maryland has dropped from 200,000,000 in 1990 to 75,000,000 today. What is the % change in the crab population?

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. Deca and deci are not terms you will see in APES



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

Example: A plot of land measures 100 m on a side. Find its area in m^2 and in km^2

Step 1: area in m^2= 100 m x 100 m or 10,000 m^2

Step 2: length of a side is .l km (100/1000), so area is .1 km x .1 km = .01 km^2

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

23. 1200 kilograms = ? milligrams
24. 14000 millimeters = ? meters
25. 6544 liters = ? milliliters
26. .078 kilometers = ? meters
27. 17 grams = ? kilograms
28. 150 mm^2 = ? cm^2

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, <u>we will consider anything over 1000 to be a large number.</u> Anything less than .01 will be considered a small number, and you should also use scientific notation for it. 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 <u>coefficient</u>. 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 <u>exponent</u>.

<u>Part I: Writing Numbers in Scientific Notation</u>

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}

<u>Part II: Adding and Subtracting Numbers in Scientific Notation</u>

To <u>add</u> or <u>subtract</u> 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.

$$1.722 \times 10^6$$

<u>Part III: Multiplying and Dividing Numbers in Scientific Notation</u>

To <u>multiply</u> 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: 1.35×10^6 X $3.72 \times 10^5 = ?$

Step 1: Multiply the coefficients.

```
   1.35
 x 3.72
    270
   9450
  40500
  50220 → 5.022
```

Step 2: Add the exponents.

$$5 + 6 = 11$$

Step 3: Write your final answer.

$$5.022 \times 10^{11}$$

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: 5.635×10^3 / $2.45 \times 10^6 = ?$

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.

$$2.3 \times 10^{-3}$$

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:

29. 145,000,000,000
30. 13 million
31. 435 billion
32. .000348
33. 135 trillion
34. 24 thousand

Complete the following calculations:

35. $3 \times 10^3 + 4 \times 10^3$
36. $4.67 \times 10^4 + 323 \times 10^3$
37. $9.85 \times 10^4 - 6.35 \times 10^4$
38. $2.9 \times 10^{11} - 3.7 \times 10^{13}$
39. three hundred thousand plus forty-seven thousand
40. 13 million minus 11 thousand
41. three million times eighteen thousand
42. $3.50 \times 10^9 / 2.0 \times 10^3$
43. $3.00 \times 10^{-4} / 1.50 \times 10^{-6}$
44. 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.

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

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.

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

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.

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

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

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

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! **<u>All work and answers go on your answer sheet.</u>** Use scientific notation when appropriate

Conversions:
1 square mile = 640 acres
1 hectare (Ha) = 2.47 acres
1 kw-hr = 3,413 BTUs
1 barrel of oil = 160 liters
1 metric ton = 1000 kg

45. 134 km = ? cm
46. 8.9 x 10^5 metric tons = ? kg
47. 1.5 kilometers per second = ? m per minute
48. A city that uses ten billion BTUs of energy each month is using how many kilowatt-hours of energy?
49. A 340 million square mile forest is how many acres?
50. If one barrel of crude oil provides six million BTUs of energy, how many BTUs of energy will one liter of crude oil provide?
51. Fifty eight thousand kilograms of solid waste is equivalent to how many metric tons?

Data for plotting graphs

Answer any associated questions on the back of your graph(s). Graph paper can be printed from the internet. All questions. Remember that the independent variable goes on the X axis, the dependent variable on the Y axis. You should be familiar with these terms from previous science classes. You will need to provide your own graph paper. Graph paper can easily be printed off the internet if you do not have some already.

Rate of change: The rate of change is also called the <u>slope</u>. Slope is defined s rise over run, or $(x_2-x_1)/(y_2-y_1)$

Graphing Practice Problem #1: A clam farmer has been keeping records concerning the water temperature and the number of clams developing from fertilized eggs. The data is recorded below.

Water Temperature in °C	Number of developing clams
15	75
20	90
25	120
30	140
35	75
40	40
45	15
50	0

A. **Make a line graph of the data, and give your graph a title**, label axes
B. **What is the dependent variable?**
C. **What is the independent variable?**
D. **What is the optimum (best) temperature for clam development?**

E. Give your graph a Title
F. What is the rate of change between a water temperature of 15 and 30?
G. What is the % change in number of developing clams between these two temperatures?

Graphing Practice Problem #2: 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. Put lines for both data sets on the same graph.

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

A. Make a line graph of the data, and give your graph a title, label axes
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. What was the rate of change between 30 and 50 year old trees in Forest A? In Forest B?
F. Based on this data, what can you conclude about Forest A and Forest B?

Graphing Practice Problem #3:

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, and give your graph a title, label axes
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. What is the % change between these two readings?
I. What is the rate of change between a pH of 6.5 and a pH of 6.0?
J. How many tadpoles would we expect to find in water with a pH reading of 5.0? (extrapolation)