AP Biology Summer Enrichment: Data Skills, Math, Essential Vocab and Ecology

Background:

Graphing is an important procedure used by scientists to display the data that is collected during a controlled experiment. **Line graphs** must be constructed correctly to accurately portray the data collected. Many times, the wrong construction of a graph detracts from the acceptance of an individual's hypothesis. A graph contains five major parts:

- a. **Title:** depicts what the graph is about. By reading the title, the reader should get an idea about the graph. It should be a concise statement placed above the graph.
- b. **Independent variable:** variable that can be controlled by the experimenter. It usually includes time (dates, minutes, hours, etc.), depth (feet, meters), and temperature (Celsius). This variable is placed on the X axis (horizontal axis).
- c. **Dependent variable:** variable that is directly affected by the independent variable. It is the result of what happens because of the independent variable. Example: How many oxygen bubbles are produced by a plant located five meters below the surface of the water? The oxygen bubbles are dependent on the depth of the water. This variable is placed on the Y-axis or vertical axis.
- d. **Scales for variables:** In constructing a graph one needs to know where to plot the points representing the data. In order to do this a scale must be employed to include all the data points. This must also take up a conservative amount of space. It is not suggested to have a run-on scale making the graph too hard to manage. The scales should start with 0 and climb based on intervals such as: multiples of 2, 5, 10, 20, 25, 50, or 100. The scale of numbers will be dictated by your data values.
- e. **Legend:** is a short descriptive narrative concerning the graph's data. It should be short and concise and placed under the graph. See attached sheet for TAILS and DRY MIX.

Problem 1:

In an experiment about photosynthesis, an underwater plant produces oxygen during the process.

Depth in meters	Number of O_2 Bubbles / minute Plant A	Number of O_2 Bubbles / minute Plant B
2	29	21
5	36	27
10	45	40
16	32	50
25	20	34
30	10	20

a. Plot a graph representing the data on a separate graph paper. Be sure to give it a title, correct X and Y axis with correct variables and scales, and legend.

b. What is the dependent variable and why?

c. What is the independent variable and why?

d. What title would you give the graph?

e. What is the mean, median, and mode of all 3 columns of data? Use http://www.purplemath.com/modules/meanmode.htm to help you calculate the 3 M's.

• Depth: Mean_____ Median_____ Mode_____

• Bubbles Plant A.: Mean _____ Median_____ Mode_____

• Bubbles Plant B: Mean _____ Median_____ Mode_____

Problem 2:

Diabetes is a disease affecting the insulin producing glands of the pancreas. If there is not enough insulin being produced by these cells, the amount of glucose in the blood will remain high. A blood glucose level above 140 ml/L for an extended time after eating is not considered normal. This disease, if not brought under control, can lead to severe complications and ultimately death.

Time After Eating (hours)	Blood glucose ml/L of person A	Blood glucose ml/L of person B
0.5	170	180
1	155	195
1.5	140	230
2	135	245
2.5	140	235
3	135	225
4	130	200

a. Plot a graph representing the data on a separate graph paper. Be sure to give it a title, correct X and Y axis with correct variables and scales, and legend.

b. What is the dependent variable and why?

c. What is the independent variable and why?

d. What title would you give the graph?

e. Which, if any, of the above individuals (A or B) has diabetes?

f. What data do you have to support your hypothesis?

g. If the time period were extended to 6 hours, what would be the expected blood glucose level for Person B? (This is called **extrapolation**).

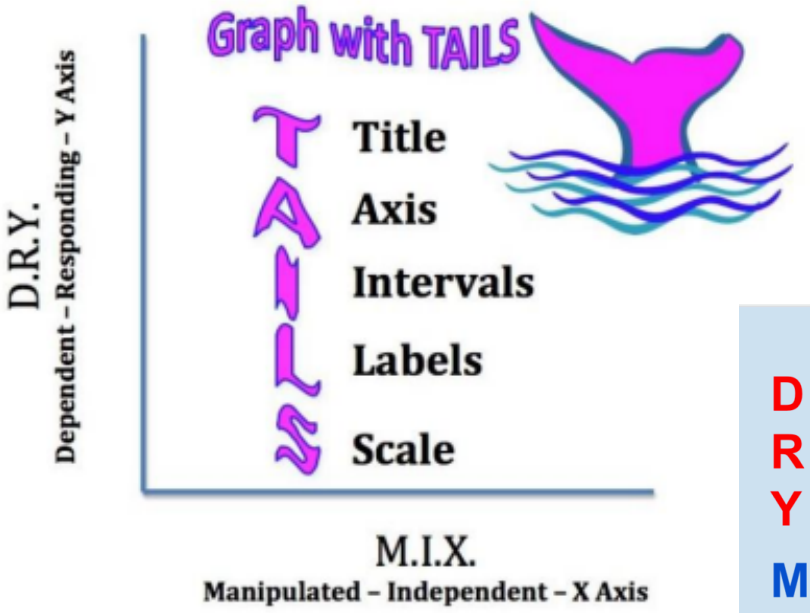
h. What is the mode, range, mean, median, standard deviation, and standard error of the mean for each Person? Show your work. Use this website to calculate SD and SEM:

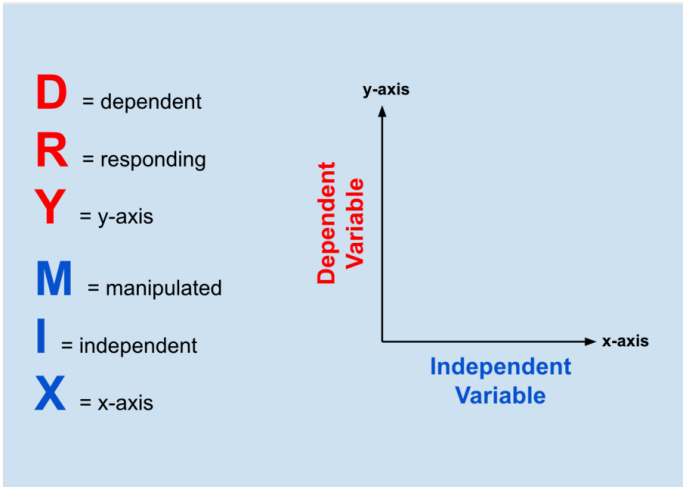
http://www.endmemo.com/math/sd.php

• Person A:
Mode_____ Range _____ Mean _____ Median_____ SD_____ SEM _____

• Person B:
Mode_____ Range _____ Mean _____ Median_____ SD_____ SEM _____

GRAPHING HELPFUL HINTS: DRY MIX





Performing CHI Squared Test

Part One Directions: Go to http://www.youtube.com/watch?v=WXPBoFDqNVk and watch the video tutorial on how to perform a Chi-Squared statistical test. Answer the questions below while you watch the video tutorial. Identify what these symbols represent from the Chi-Square Stats Test:

χ_c^2 = _____

$\sum$ = _____

O_i = _____

E_i = _____

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

1) Why do you perform a Chi-Square test?

2) What is the null hypothesis for the Chi-Square test?

3) How do you calculate your degrees of freedom?

4) What critical value is always used in AP Bio?

5) When do you reject your null hypothesis?

6) When do you accept your null hypothesis?

Part Two: Practice performing the Chi-Squared test with the problems below. Show your set up.

Problem 1: We collected data by flipping a two-sided coin 200 times. The coin landed heads-up 108 times and tails-up 92 times. Perform a Chi-Square test to see if there is any statistical difference between our results and the expected results. Accept or reject the null hypothesis.

Null hypothesis: _There is no statistical difference between the number of heads and the number of tails._

Outcomes	Observed Outcome	Expected Outcome	O-E	$(O-E)^2$	$(O-E)^2/E$
χ^2 Chi Square Value:					

Degrees of Freedom: _____

Accept or Reject Null Hypothesis: _____

Problem 2: We collected data by flipping a two-sided coin 200 times. The coin landed heads-up 120 times and tails-up 80 times. Perform a Chi-Square test to see if there is any statistical difference between our results and the expected results. Accept or reject the null hypothesis.

Null hypothesis: _____

Outcomes	Observed Outcome	Expected Outcome	O-E	$(O-E)^2$	$(O-E)^2/E$
χ^2 Chi Square Value:					

Degrees of Freedom: _____

Accept or Reject Null Hypothesis: _____

Degrees of Freedom (*df*)	Probability (ρ)										
	0.95	0.90	0.80	0.70	0.50	0.30	0.20	0.10	0.05	0.01	0.001
1	0.004	0.02	0.06	0.15	0.46	1.07	1.64	2.71	3.84	6.64	10.83
2	0.10	0.21	0.45	0.71	1.39	2.41	3.22	4.60	5.99	9.21	13.82
3	0.35	0.58	1.01	1.42	2.37	3.66	4.64	6.25	7.82	11.34	16.27
4	0.71	1.06	1.65	2.20	3.36	4.88	5.99	7.78	9.49	13.28	18.47
5	1.14	1.61	2.34	3.00	4.35	6.06	7.29	9.24	11.07	15.09	20.52

Essential Vocab and Review of Cells and Cell Function

NOTE: You will be able to PRINT THIS and it will be in the front of your Binder all year f0r reference

Use the following digital textbook and find the definition/ function of the following terms

Term	Definition or Function
Nucleus	
Vacuole	
Cell Membrane	
Cell Wall	
Cytoplasm	
Mitochondrion	
Chloroplast	
Golgi apparatus/Body	
Endoplasmic Reticulum	
Lysosome	
Ribosome	
Prokaryotic Cell	
Eukaryotic Cell	
Lytic Cycle	
Lysogenic Cycle	
Photosynthesis	

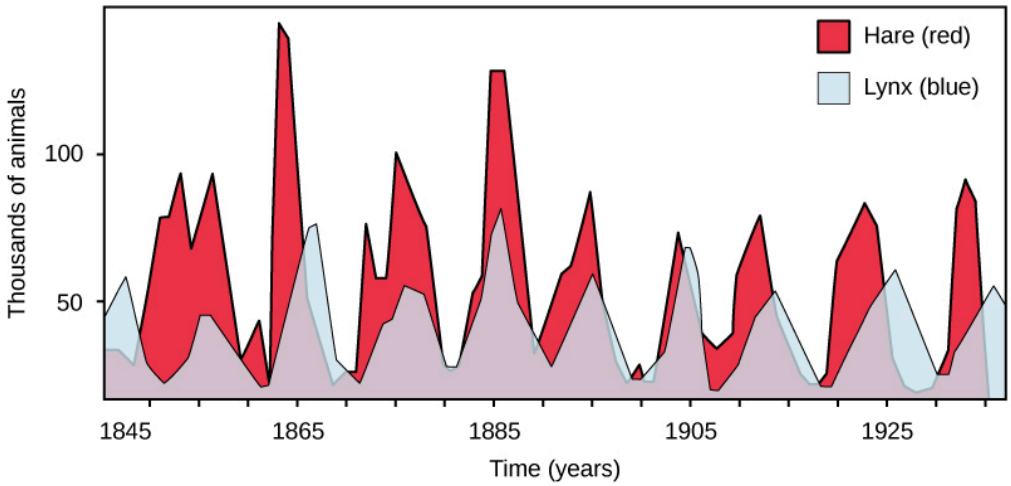
Cellular Respiration	
Organic Molecule	
Carbohydrate	
Lipid	
Protein	
Nucleic Acid	
Monomer	
pH	
Acid	
Base	
Water Potential	
Cohesion	
Adhesion	
Polar	
Enzyme	
Passive Transport	

Active Transport	
Biotic	
Abiotic	
Organism	
Population	
Community	
Ecosystem	
Carrying Capacity	
Producer	
Consumer	
Mutualism	
Commensalism	
Parasitism	
Autotroph	
Primary Consumer	
Secondary Consumer	

Tertiary Consumer	

More Ecology!

1) Look at the graph and infer the relationship dynamic between the Hare and the Lynx.



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2) Look out your window, go on a walk, or observe nature SOMEWHERE around you this sumer. Identity at least one example of the following organisms:

Autotroph	
Primary Consumer	
Secondary Consumer	
Tertiary Consumer	

Once you have identified at least one organism in each category construct a food chain OR food web in the space below.
