Name: _____ ***AP Biology Summer Assignment***

Welcome to AP Biology!

This course is designed to be the equivalent of a two-semester introductory biology course usually taken in the first year of college. It will be a rewarding experience but will also be very challenging. The two main goals of AP Biology are to help you develop a conceptual framework for modern biology and to gain a deeper appreciation of science as a process (as opposed to an accumulation of facts). Because of the rapid pace of discovery in the life sciences our primary emphasis is on developing an understanding of unifying concepts that connect the major topics of biology.

The AP Biology Curriculum centers around the four **Big Ideas** and you will need to not only know these but also understand how they all relate to each other and to the course as a whole:

- **Big Idea 1:** The process of evolution drives the diversity and unity of life.
- **Big Idea 2:** Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
- **Big Idea 3:** Living systems store, retrieve, transmit and respond to information essential to life processes.
- **Big Idea 4:** Biological systems interact, and these systems and their interactions possess complex properties.

What to do before the first day of school:

- AP Biology was designed to be equivalent to an introductory college biology course. Visit the College Board site to explore what the AP Biology course will be like: https://apstudents.collegeboard.org/courses/ap-biology
- **Assignment 1**: purchase the composition book you need for this class as outlined on the supplies list. Email me if you have questions about this. Review and handwrite Topic 1.1 notes into your composition notebook, take a selfie with the notebook open to a page of your notes, and post it on the assignment page on MSA.
- Complete the **Assignments 2 and 3** of the summer assignment on the following pages! **You must print the pages out and hand write your answers (pgs. 2-10).** This will be due on the first day of school.

AP Biology Summer Assignment Due Dates	
Assignment #1	
Handwrite Topic 1.1 notes into your notebook. Review all slides and handwrite the slides with a highlighted title into your notebook. Take a selfie with a page of the notes and submit on MSA.	08/10/26
Assignment #2	
Stats Review	08/12/26
Assignment #3	
Chemistry of Life (Topic 1.1) Review	08/12/26
Assignment #4	
Quiz over Stats and Chemistry Reviews and Topic 1.1	08/13/26 or 08/14/26

AP Bio: Assignment 1 - Stats & Chem Reviews **Name:**

INTRO TO STATISTICS:

You may be thinking, “Stats??? I thought this was AP Bio!” You're totally right, it is! There will be many opportunities this year to analyze authentic data; having a strong understanding of what graph to use to display information and the skills needed to interpret those results will help you become an even stronger scientist as we're learning content. Watch the following videos. Take notes in your notebook/device and answer the following questions. You must be able to APPLY and/or ANALYZE data on assignments throughout this course based on these principles, concepts and practices.

1. Beginner's Guide to Graphing Data: (Bozeman Science - Beginner's Guide to Graphing Data)
    a. What type of a graph uses a “best fit” line?

    b. Explain the difference between a bar graph and a histogram.

    c. Which type of graph shows a change over time?

    d. Which type of graph displays a correlation of variables?

    e. Distinguish between the independent and dependent variable in an experiment and where their axes are on a graph

    f. Which type of graph is best for comparing 2 or more different groups?

    g. Which type of graph is better for showing distribution of data?

    h. Explain when a pie chart/graph should be used and give (draw, label) any example.

    i. State at least 5 elements that any graph should always display.

2. Bozeman- Statistics for Science (Statistics for Science — bozemanscience)
    a. What is n?

    b. What is x (bar)?

c. What is M?

d. What was the range of the sample he gave?

e. Explain ‘Degrees of Freedom’ (with any example) and why the formula is n-1

3. Bozeman-Standard Deviation (Bozeman Science Standard Deviation)
    a. What is meant by normal distribution?

    b. What does standard deviation (SD) measure?

    c. Can 2 sets of data have the same mean but a different SD? Explain.

    d. 1 SD means _____% of the population falls within this range; while 2 SD means _____% falls in this range and 3 SD means _____% falls in this range.

    e. Pause the video and calculate the SD from the 2nd set of data given BY HAND. Show your work.

    f. Take notes as to how to solve for SD using Excel. You may want to bookmark the video for quick reference for labs we will be doing throughout the course.

4. Bozeman- Standard Error http://www.bozemanscience.com/standard-error and Kevin Piers Standard Deviation & Standard Error of Mean https://www.youtube.com/watch?v=3UPYpOLeRJg
    a. From Bozeman: Explain the significance of standard error among 2 different sets of data with different sample sizes that have the same Mean (in terms of precision).

    b. From Piers:
        i. What do SEM bars that have overlapping Means on a graph indicate?

ii. Explain the significance if SEM bars overlap, but the Means do not overlap

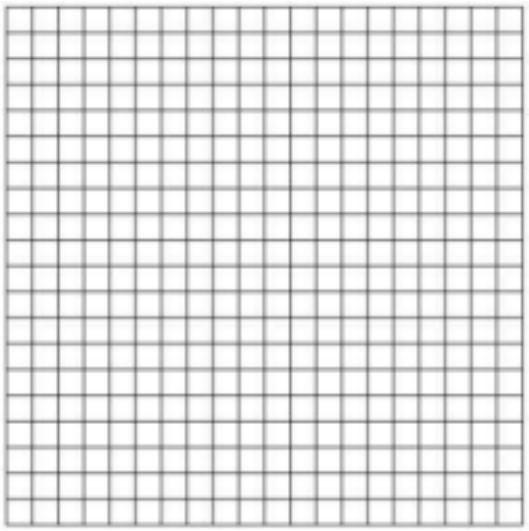
iii. Explain the significance if there is no overlap between SEM bars.

5. Solve the following problems in pencil. Make sure graphs have titles and are properly labeled with units.
   a. Graph the following sample data set showing the number of leaf disks that rise in a solution over time as photosynthesis occurs.

Time (min)	Number of Disks Floating
1	0
2	0
3	0
4	0
5	0
6	0
7	1
8	1
9	1
10	2
11	5
12	8
13	10
14	14
15	14
16	15
17	20
18	20
19	20
20	18

Graph





   b. Use the data to sketch the appropriate type of graph.

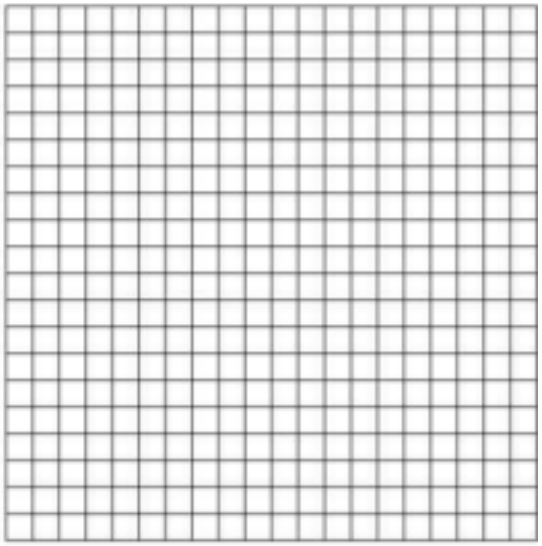
Month	Rainfall (cm)
Jan	2.0
Feb	1.8
Mar	1.2
Apr	5.7
May	6.2
Jun	5.9
Jul	1.0
Aug	1.1
Sep	1.1
Oct	2.3
Nov	2.7
Dec	2.5

Mean =

Standard Deviation =

Graph





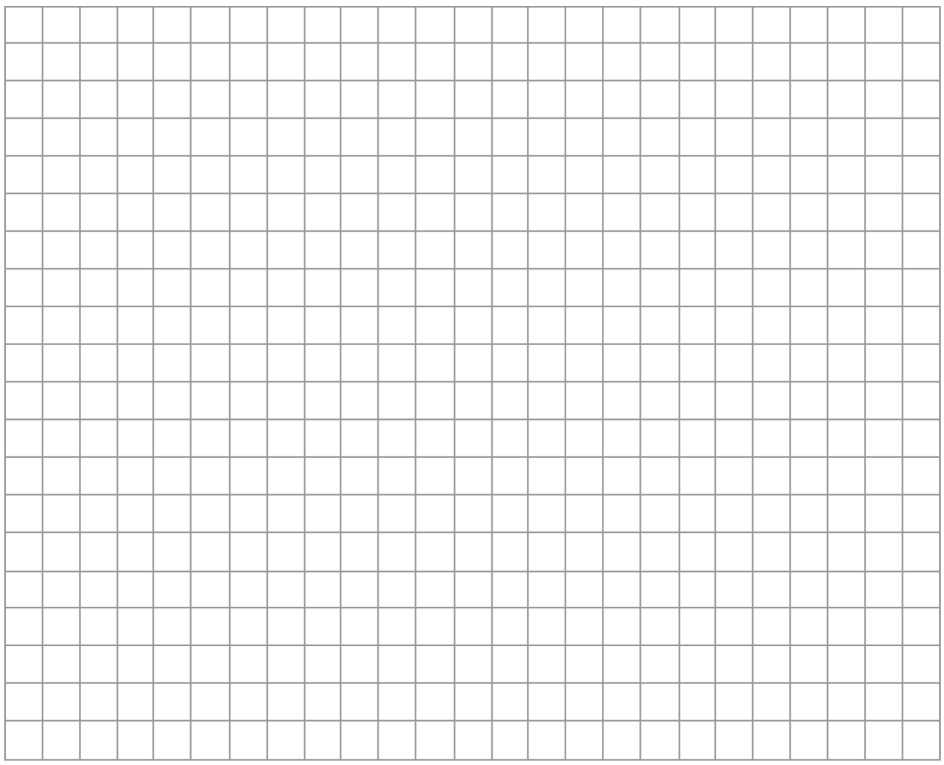
c. Below is part of an AP free response question (FRQ). Do your best to draw the graph (including error bars) and answer the question. The question must be answered in a complete sentence and in your own words. Use what you learned from the videos above to help you with your answers.

The unicellular green alga Chlorella is often used as a model organism to study the effects of various substances on the growth of photosynthetic organisms. Researchers studying the detoxification of certain metals by Chlorella first collected data on the growth dynamics of the alga. A small number of Chlorella were added to 1,500 mL of culture medium that contained all of the inorganic nutrients needed for growth. Every five days for 30 days, the researchers performed multiple counts to determine the concentration of Chlorella in the culture (Table 1).

Table 1. The growth dynamics of a culture of *Chlorella* over a period of 30 days

Days Since Inoculation	Concentration of *Chlorella* ($\times 10^6 \text{per mL}$)
0	0.01 (0.005)
5	0.08 (0.01)
10	0.55 (0.1)
15	1.9 (0.2)
20	2.8 (0.4)
25	3.2 (0.25)
30	3.2 (0.3)
$\pm 2\text{SE}_{\bar{x}}$ values are shown in parentheses.	

Using the template, **construct** an appropriately labeled graph to represent the data in Table 1. Based on the data, **determine** whether the concentration of Chlorella on day 20 is statistically different from the concentration on day 15 and from the concentration on day 25.



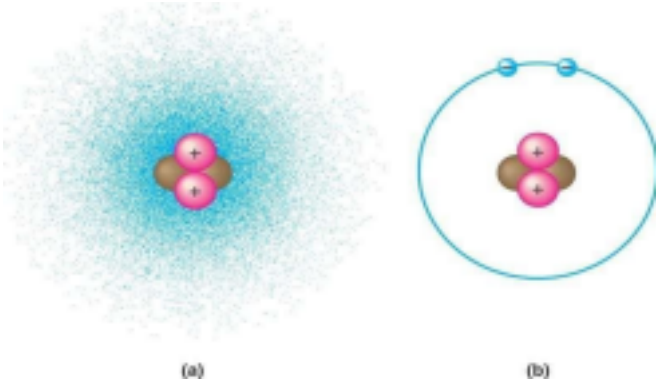
AP Bio: Assignment 2 - **Essential Chemistry Review**

This is a review of basic chemistry — we will not spend a lot of class time on these concepts as they should have been learned in chemistry. Please use the posted PDF notes of topic 1.1 and the following videos (there are several videos that help - these are just two examples):
https://www.youtube.com/watch?v=HVT3Y3_gHGg and Properties of Water

1. Contrast the term element with compound.

2. Know the symbols of the following elements and their charge:
    a. Carbon:
    b. Hydrogen:
    c. Oxygen:
    d. Nitrogen:
    e. Phosphorus:
    f. Sulfur:

3. Label the diagram below and define the terms that you label.



4. Contrast the terms atomic mass and atomic number.

5. What is an isotope and what is “special” about radioactive isotopes?

6. What determines interactions between atoms? Why are valence electrons important?

7. Define the following terms:
    a. Chemical bond

    b. Covalent bond

c. Single bond

d. Double bond

e. Electronegativity

f. Nonpolar covalent bond

g. Polar covalent bond

8. Write the molecular formulas for the following compounds.
    a. Oxygen gas:
    b. Carbon dioxide:
    c. Glucose:
    d. Phosphate:
    e. Ammonia:
    f. Water:

9. How do ionic bonds compare with covalent bonds?

10. Compare and contrast hydrogen bonds and van der Waals interactions.

11. Why is water considered a polar molecule?

12. For each of the below listed properties of water briefly define the property and then explain how water's polar nature and polar covalent bonds contribute to the water special property. (The Amoeba Sisters video should help with this)
    a. Cohesion

b. Adhesion

c. Surface tension

d. High specific heat

e. Heat of vaporization

f. Evaporative cooling

13. What is special about water and density?

14. Explain how these properties of water are related to the phenomena described in the statements below. More than one property may be used to explain a given phenomenon.
    a. During the winter, air temperatures in the northern United States can remain below 0°C for months; however, the fish and other animals living in the lakes survive.

    b. Many substances—for example, salt (NaCl) and sucrose—dissolve quickly in water.

    c. When you pour water into a 25-ml graduated cylinder, a meniscus forms at the top of the water column.

d. Sweating and the evaporation of sweat from the body surface help reduce a human's body temperature.

e. Water drops that fall on a surface tend to form rounded drops or beads.

f. Water drops that fall on your car tend to bead or round up more after you polish (or **wax**) the car than before you polished it.

g. If you touch the edge of a paper towel to a drop of colored water, the water will move up into (or be absorbed by) the towel.

15. Define the following terms:
    a. Solute

    b. Solvent

    c. Aqueous solution

    d. Hydrophilic

    e. Hydrophobic

f. Molarity

16. What defines an acid and a base?

17. Why are small changes in pH so important in biology?

18. What is special about carbon that makes it the central atom in the chemistry of life?

19. Describe the following chemical compounds and their functional properties (what biomolecule(s) can you find them in and where):
    a. Hydroxyl

    b. Carbonyl

    c. Carboxyl

    d. Amino

    e. Sulfhydryl

    f. Phosphate