

Polevchak AP Biology Summer Assignment 2026-27

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Book: We will use the Campbell Biology Book, but I also like OPENSTAX which has a digital AP Biology Book. Find it here: <https://openstax.org/details/books/biology-ap-courses>

The purpose of this summer assignment is to prepare you for the excitement and rigors of AP Biology. Advanced Placement Biology is designed to be the equivalent of a college introductory course usually taken by biology majors during their first year of study. Therefore, there is a large amount of content we will cover, along with required high level laboratory skills and independence. I look forward to experiencing this with you!

The AP Biology curriculum is built around 4 'Big Ideas', with Essential Knowledge and Science Practice that support each Learning Objective:

- Big Idea 1: Evolution (EVO) – The process of evolution drives the diversity and unity of life.
- Big Idea 2: Energetics (ENE) – Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.
- Big Idea 3: Information Storage and Transmission (IST) – Living systems store, retrieve, transmit, and respond to information essential to life processes.
- Big Idea 4: Systems Interactions (SYI) – Biological systems interact, and these systems and their interactions possess complex properties.

What to do before the first day of school:

1. Get a study book! It is not mandatory but I highly recommend the following to be there to help you along with AP Classroom. Practice is the best way to be successful! These are good selections! Make sure you get the current as the AP test has changed over the past few years.
 - a. AP Biology Prep- Princeton Review
 - b. AP Biology - Barrons Premium
2. Biology was designed by a select group of college professors and high school science teachers to be equivalent to an introductory college biology course. Visit the below College Board site to explore what an AP Biology course is like and what we will cover: <https://apstudent.collegeboard.org/apcourse/ap-biology>
3. Complete the 3 parts of the summer assignment on the next pages! While I wouldn't recommend procrastinating until the last day, I would suggest holding off on this until the end of July or the beginning of August, as it won't take a lot of time but I want it to be fresh in your mind. Don't wait until the day before class starts either, because you shouldn't start class stressed!

Part 1: Graphing and Statistics

Stats in AP Biology? Yes!!! On the AP test you will be expected to apply and use basic statistics along with graphing. Complete the following to help prepare you for this!

Review of (or Intro to) Statistics : Go to <https://www.bozemanscience.com/statistics-graphing>

Mr. Andersen (formerly of Bozeman, MT) has created many online lectures to help explain topics in science that are a great resource to use throughout the year. He has a whole series exclusively for AP Biology. Save it!

1. Beginner's Guide to Graphing Data: (from site above)

- 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?
-Distinguish between the independent variable and dependent variable in an experiment, and where their **axes are** on a graph.

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

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

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

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

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2. Watch Graphing Data by Spreadsheet. Take notes for reference. If needed, watch Graphing Data by Hand. Both videos are found at the main website listed in part A. Watch Bozeman: Statistics for Science (<https://www.youtube.com/watch?v=jf9VT4V4aRI&t=43s>) and take notes:

- a. What is n ?
- b. What is x ?
- c. What is M ?
- d. What was the range of the sample in his video?
- e. Explain “**degrees of freedom**” (with any example) and why the formula for it is $n-1$.

3. Watch Bozeman: Standard Deviation

<https://www.youtube.com/watch?v=09kiX3p5Vek&t=17s> and take notes:

- 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.

4. Watch Bozeman: Standard Error (<https://tinyurl.com/y4ltzk3>) and Kevin Piers: Standard Deviation & Standard Error of the Mean ([Standard Deviation and Standard Error of the Mean](#))

- a. From Bozeman: Explain the significance of the standard error among 2 different sets of data with different sample sizes that have the same mean (in terms of precision).

c. Solve the following problems. You must show all work. Make sure graphs have titles and are properly labeled with units.

Problem 1:

1. In relation to AP Biology Investigation #11, you and your lab partner record the following counts of stomata in sunflower leaves.

Table 1: Stomata per Examination Area

Sunflower Plant	1	2	3	4	5	6
Stomata (per examination area)	88	93	90	92	75	78

- (a) Calculate the mean or average number of stomata for these sunflower leaves, \bar{x} .

- (b) Order the number of stomata from lowest to highest and calculate the median number of stomata for the sunflower leaves.

- (c) Calculate the standard deviation of the number of stomata for the sunflower leaves.

- (d) Calculate the standard error in the number of stomata for the sunflower leaves.

(e) Explain in words what the difference in median and mean/average values means.

(f) Make a (very simple) bar graph with the mean of the number of stomata for the sunflower leaves. Draw the error bars on the graph. Interpret the standard error values.

Problem 2:

3. Related to AP Biology Investigation #12, three classes study when fruit fly populations choose Food A over Food B. Each pair of partners in the classes record the number of times that Food A is chosen in preference to Food B in a total of 25 trials. The data from each pair for the three classes is shown below. Use the data to answer the questions below.

	<i>Group 1</i>	<i>Group 2</i>	<i>Group 3</i>	<i>Group 4</i>	<i>Group 5</i>	<i>Group 6</i>	<i>Group 7</i>	<i>Group 8</i>
<i>Class 1</i>	12	16	11	11	13	14	12	15
<i>Class 2</i>	10	9	18	8	16	18	13	12
<i>Class 3</i>	4	19	6	20	12	13	23	7

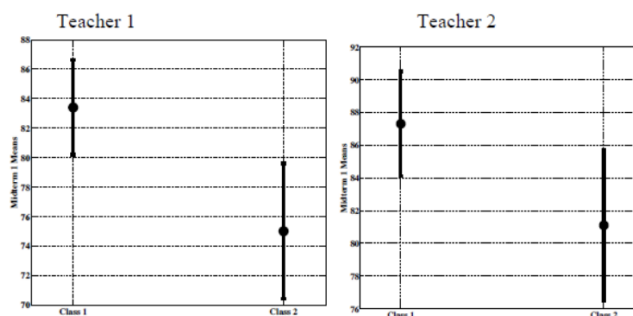
(a) Verify that each class' data set has the same mean and median.

(b) Based on the data that is given, which do you expect to have a bigger standard deviation? Which do you expect to have the smallest standard deviation? *Explain* your answer.

(c) Find the standard deviation for each data set. If your answers do not match your predictions, make sure to go back and explain how you can predict the ranking (i.e. smallest and largest) standard deviations from the data that are given.

Problem 3:

4) Two different AP Biology instructors compute the means and standard errors for the first exam score for their two different AP Biology classes. The means and the SE bars are shown in the graphs. For each of the teacher's sets determine whether the difference between the means of the two classes is: **(A)** definitely significantly different; **(B)** definitely NOT significantly different; or **(C)** unknown based on the graph whether they are significantly different or not. **EXPLAIN** your answer for each teacher's set.



Part 2: AP Biology Essential Chemistry!

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.

Watch the following videos if you need them: [Water: A Polar Molecule](#)

[How polarity makes water behave strangely - Christina Kleinberg](#) [Chemical Bonds: Covalent vs. Ionic](#)

1. Contrast the terms atomic mass and atomic number/periodic table trends.

2. What is an isotope and what is special about radioactive isotopes?

3. Why are valence electrons important?

4. Define the following terms and give an example :
 - a. Covalent bond
 - i. Nonpolar covalent vs. polar covalent

 - b. Ionic bond

 - c. Hydrogen bond

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- d. Electronegativity
 - e. Catalyst
5. Why is water considered a polar molecule?
6. List the major properties of water and how water's structure contributes to the property.
7. What are the symbols for the following functional groups?
- a. Hydroxyl
 - b. Carbonyl
 - c. Carboxyl
 - d. Amino
 - e. Sulfhydryl
 - f. Phosphate
8. What is an acid? Base?
9. Draw the pH scale and label acid/base/neutral in the appropriate sections. How do we calculate pH? As each number changes on the scale, what happens to the concentration of H⁺/OH⁻?
10. What is the purpose of a buffer? How does it work in the human body?
11. How many hydrogen bonds can a single water molecule form?
12. Distinguish between cohesion and adhesion.

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13. What is demonstrated when you see beads of water on a waxed car hood?

14. Which property explains the ability of a water strider to walk on water?

15. Water has a high specific heat. What does this mean? How does water's specific heat compare to alcohol's?

16. Explain how hydrogen bonding contributes to water's high specific heat.

17. Summarize how water's high specific heat contributes to the moderation of temperature. How is this property important to life?

18. Define evaporation. What is the heat of vaporization? Explain at least three effects of this property on living organisms.

19. Ice floats! So what? Consider what would happen if ponds and other bodies of water accumulated ice at the bottom. Describe why this property of water is important. Now, explain why ice floats.

20. Review and define these terms:

solvent

solution

solute

21. Consider coffee to which you have added sugar. Which is the solvent? The solute?

22. Define hydrophobic and hydrophilic.

23. Define molarity.

24. What two ions form when water dissociates?

25. Because the pH scale is logarithmic, each numerical change represents a 10X change in ion Concentration.

- a. So, how many times more acidic is a pH of 3 compared to a pH of 5?
- b. How many times more basic is a pH of 12 compared to a pH of 8?
- c. Explain difference between a pH of 8 and a pH of 12 in terms of H⁺ concentration.

Part 3: Getting to know you!

Find an open slide and claim it by entering your name. Give me a "room" that has all the things you enjoy. Use my slide as a model, though you can do your own variations! I left several up from the current year for you to use as an example. Add a picture of you or a bitmoji!

<https://docs.google.com/presentation/d/1hfXmoNiZt8UCRsmgj4ka4x9Z6Us3jjNBQt3UnZfDKPA/edit?usp=sharing>