

AP Biology 2024 Summer Assignment

Welcome to AP Biology

AP Biology is equivalent to a two semester introductory college biology course. This course requires a lot of independent work/reading. In this class you will be assessed based on your understanding of the material and not just on your ability to memorize the information. Of course that is not to say that memorization is not part of the course, because it is. Along with memorization there needs to be understanding. In this course you will be required to apply the information covered to various situations.

The summer assignment is meant to review concepts that have been covered in previous courses in preparation for AP Biology.

Please make sure you read each section completely.

This assignment will be due the first day of class. **All assignments turned in late will lose points. Points will be deducted for each day the assignment is late.**

Please Do Not staple assignment #2 and #3 together. You will be turning them in separately.

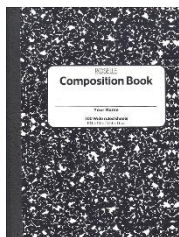
You are to complete this assignment independently.

Enjoy your summer and if you have any questions email me at pfox@eustace.org

Mrs. Fox

Assignment #1:

Laboratory work is an important part of the AP Biology curriculum. You will be keeping a laboratory notebook for this course. So one of your assignments this summer is to purchase a bound composition notebook (example below – it **cannot** be a spiral notebook). You will be required to have this on the first lab day. It will be worth 5 points of your first lab grade.



Assignment #2: Graphing, Data Analysis, and Experimental Design

Being able to generate appropriate data tables and graphs, and being able to correctly analyze data will be an important component of this course. Therefore, it is imperative that you know how to represent experimental data correctly and to interpret experimental results and draw appropriate conclusions. The following activities will help to prepare you for this.

Your assignment can be typed or neatly handwritten (points will be deducted for handwritten work that is not neat and/or difficult to read). For this assignment you **must use graph paper to hand draw** your graph, no computer generated graphs will be accepted for credit – you must prepare your OWN graphs – no copies of other students’.

NOTE: The last page of this assignment is a printable graph paper page you can use if you do not have graph paper.

Assignment #2 will be graded for correctness.

You will be quizzed on this material as well as Chapter 2 and 3 within the first 2 weeks of school. You are also responsible for understanding this material. The information in this section will be used throughout the entire school year on labs, in class assignments, and on quizzes and tests.

Rules and Tips for Graphing:

1. Graphs must be either hand-drawn **on graph paper only** or use Excel. Use a pencil to draw your graph. It’s easier to fix mistakes.
2. Always draw lines with a ruler. Do not freehand.
3. Make sure Independent Variable is on the X-axis and Dependent Variable is on the Y-axis.

4. Include all parts:
 - a. Title - must be descriptive title (not “Graph 1”)

It tells the reader what the graph is representing – the title should include enough information so that, independent of any other information, the reader can understand what is being shown.
 - b. Label the axes (x and y) with what was being measured and the units used.
5. Scale your axes uniformly – pay especially close attention to this if you are using computer-generated graphs. For example, if you have three data points, at 0, 25 and 100 seconds, 25 should not be halfway between 0 and 100, it should be in the correct place.
6. If you are graphing multiple subjects, use different colored or patterned lines and explain what they are in the legend (or key).
7. Choose an appropriate graph to explain your data. Examples:
 - a. **LINE**: Measuring a change in something over time - used when the independent variable is continuous. A continuous variable is capable of having values over a continuous range (i.e. anywhere between those that were used in the experiment). For example, temperature, pH, volume, time are continuous. You can connect the points or draw a smooth curve (not necessarily connecting the points) that represents the data.
 - b. **BEST-FIT LINE**: must be used when a rate (slope) needs to be calculated. Plot your points, then using a ruler, draw a line that best represents those points. The line does not have to pass through the points. When calculating the slope of the line, **use points on the line, NOT your actual data points**. If using Excel, a best-fit line and slope can be automatically given to you.
 - c. **BAR**: Comparing individuals to each other with only one data point - use when the independent variable is discrete (it cannot have intermediate values between those measured). A bar graph compares individuals to each other with only one data point, for example, comparing leaf sizes in three different trees.
 - d. **PIE**: Show percentages that add up to 100%.

Statistical terms you should be familiar with:

MODE = value that occurs most frequently in a data set

The mode for a group of values is the number that occurs most frequently. e.g. 2, 5, 8, 2, 6, 11 The number 2 is the mode because it occurred most often (twice)

MEDIAN = middle value that separates the greater and lesser halves of a data set

To determine median or “middle” for an even number of values, put the values in ascending order and take the average of the two middle values. e.g. 2, 3, 4, 5, 9, 10 Add 4+5 (2 middle values) and divide by 2 to get 4.5

MEAN = sum of all data points divided by the number of data points

To determine the mean for a group of variables, divide the sum of the variables by the total number of variables to get an average.

RANGE = value obtained by subtracting the smallest observation (sample minimum) from the greatest (sample maximum). The range is the simplest measure of variability and is the difference between the largest and smallest values in a set of data.

Part A: Constructing Graphs

The following video reviews the different types of graphs and how to construct a graph.

<http://www.bozemanscience.com/beginners-guide-to-graphing-data>

Answer the following question while watching the above video:

1. Why do we use graphs?

2. What are the 5 important things that must be included on a graph? Please provide an explanation of each item or their significance to the graph.

3. Two plants were placed at different depths in a pond and the number of oxygen bubbles each produced per minute was measured.

Table 1. Effect of Depth on Oxygen Production by Plant A & Plant B

| Depth (meters) | Bubbles per minute, Plant A | Bubbles per minute, Plant B |
|----------------|-----------------------------|-----------------------------|
| 2 | 15 | 10 |
| 5 | 22 | 13 |
| 10 | 31 | 19 |
| 16 | 37 | 26 |
| 25 | 50 | 33 |
| 30 | 56 | 40 |

- a. Plot a graph representing the data on graph paper (graph must be **hand drawn** for this assignment - no computer generated graphs will be accepted for credit). Be sure to give it a title, correct X and Y axis with correct variables and scales, and legend. The following video reviews graphing by hand:

<http://www.bozemanscience.com/graphing-data-by-hand>

- b. What is the dependent variable? _____
- c. What is the independent variable? _____

d. What are the mean and median of all 3 columns of data?

Depth: Mean _____ Median _____

Bubbles Plant A.: Mean _____ Median _____

Bubbles Plant B: Mean _____ Median _____

e. Determine the rate of oxygen bubble production for each plant by calculating the slope of each best-fit line. Show all work.

f. Based on your calculations, which plant had the highest rate of oxygen production?

Part B: Experimental Design Negative and Positive Controls

Some of the components expected for Experimental Design in AP Biology will be new to you. It is important that you have an understanding of these concepts as you begin the course. Watch the following videos and answer the questions.

Video # 1: Experimental Design Negative Controls

<https://www.youtube.com/watch?v=KXOvPvc6zeE>

1. This video talks about negative controls. What does it say the negative control allows for?

2. What is the consequence of not having a negative control?

3. Why must one of the control groups in this experiment drink decaffeinated coffee instead of water?

4. Why does another control group drink water?

5. A proper set of negative controls is critical to determine what?

Video #2: Experimental Design Positive Controls

<https://www.youtube.com/watch?v=ZHTqxczEY6Y>

1. According to the video, what is the purpose of using a positive control?

2. What two positive control groups are added to the experiment?

3. Is an experiment successful based on results matching original predictions? If not, explain what makes an experiment successful.

Assignment #3: Chapters 2 and 3

An understanding of chemistry is one of the requirements for this course. We will start off the year with a review of fundamental concepts that were covered in Chemistry. This part of your summer assignment will be a review of basic chemistry. This section also will review some basic concepts about organic compounds.

The information in this section comes from chapter 2 and 3 of the biology book you will be using. Unfortunately, at this time I cannot give you the textbook but posted along with this assignment are the PowerPoint slides from the textbook for chapter 2 and a YouTube link to the chapter 2 and 3 slides. Along with the slides you can use your old biology or chemistry notes to help you out.

I will collect this section and check it for completion. The answers will be posted/given within the first week of school. I will review the material on the first few days of class. **You are responsible for understanding this material for the Unit 1 quiz and Test.**

Your assignment can be typed or neatly handwritten (points will be deducted for handwritten work that is not neat and/or difficult to read). You can print out assignment #3 and write your answers directly on this document. **Do Not** just copy definitions or sentences from the slide or other resources that you use. Putting answers into your own words will help you understand the material.

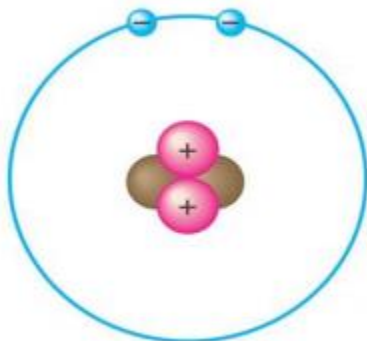
Chapter 2 The Chemical Context of Life

Chapter 2 video link:

<https://www.youtube.com/watch?v=2ZtGPe8atmIhapter>

Concept 2.1

1. Below is a sketch of an atom of helium, label the electrons, protons, neutrons, and atomic nucleus.



2. Consider the entry in the periodic table for carbon.

What is the atomic mass? _____ What is the atomic number? _____

How many electrons does carbon have? _____ How many neutrons? _____

3. Explain which has more potential energy in each pair:

a. the child at the top of a slide/the child at the bottom

b. electron in the first energy shell/electron in the third energy shell

Concept 2.3

4. Define the following:

a. Molecule

b. Covalent bond

c. Electronegativity

d. Ionic bond

e. Anion

f. Cation

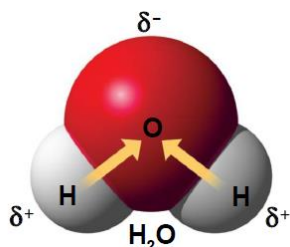
g. Hydrogen bond

5. Now, refer back to your definition of a *compound* and fill in the following chart:

| | Molecule? (Y/N) | Compound? (Y/N) | Molecular Formula | Structural Formula |
|-------------------|--------------------|--------------------|----------------------|--------------------|
| Water | | | | |
| Carbon Dioxide | | | | |
| Oxygen | | | | |

6. Explain the difference between a *nonpolar covalent bond* and a *polar covalent bond*.

7. Below is an electron distribution diagram of water.



a. Which element is most electronegative?

b. Why is water considered a *polar* molecule?

8. Explain *van der Waals interactions*. Though they represent very weak attractions, when these interactions are numerous they can stick a gecko to the ceiling!

Concept 2.4

9. Define the following:

a. Chemical reactions

b. Reactants

c. Products

Concept 2.5

10. Define the following terms:

a. Polar molecule

b. Hydrogen bond

- c. Adhesion
- d. Cohesion
- e. Surface tension
- f. Specific heat
- g. solution
- h. solute
- i. solvent
- j. aqueous solution
- k. hydrophobic
- l. hydrophilic
- m. Hydrogen ion
- n. Hydroxide ion
- o. Hydronium ion
- p. Acids
- q. Bases
- r. Buffers

11. How many hydrogen bonds can a single water molecule form?

12. Which is demonstrated when you see beads of water on a waxed car hood?
Circle the correct answer: adhesion or cohesion

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

14. Explain *why* ice floats. Why is 4°C the critical temperature?

15. Consider what would happen if ponds and other bodies of water accumulated ice at the bottom. Describe why this property of water is important.

Chapter 3 – Carbon and The Molecular Diversity of Life

Video link for chapter3:

<https://www.youtube.com/watch?v=fqR75qRHCgc>

Section 1

1. Make an electron distribution diagram of carbon.

- a. How many valence electrons does carbon have? _____
- b. How many bonds can carbon form? _____
- c. What type of bonds does carbon form with other elements?

2. Define *functional group*.

3. There are seven chemical groups important in biological processes that you should know. Using Figure 3.5 in the chapter 3 video link (in the textbook), complete the following chart.

| | Hydroxyl | Carbonyl | Carboxyl | Amino | Sulfhydryl | Phosphate | Methyl |
|-----------------------|----------|----------|----------|-------|------------|-----------|--------|
| Structure | | | | | | | |
| Example | | | | | | | |
| Functional Properties | | | | | | | |

Section 2

4. The large molecules of all living things fall into just four main classes. Name them.

5. What is a *polymer*? What is a *monomer*?

6. Monomers are connected in what type of reaction? What occurs in this reaction?

7. Large molecules (polymers) are converted to monomers in what type of reaction?

8. The root word hydrolysis will be used many times to form other words you will learn this year. What does each root word mean?

hydro –

lysis -

Section 3

9. Let's look at carbohydrates, which include sugars and starches. First, what are the monomers of all carbohydrates?

10. Notice that all sugars have the same two functional groups. Name them:

C=O

-OH

11. So, as a quick review, all hexose sugars have the same chemical formula: $C_6H_{12}O_6$. What is the term for compounds that have the same molecular formulas but different structural formulas?

12. What is a *glycosidic linkage*?

13. Why can you not digest cellulose? What organisms can?

14. Let's review some key points about the carbohydrates. Each prompt below describes a unique carbohydrate. Name the correct carbohydrate for each.

a. Has 1-4 β glucose linkages _____

b. Is a storage polysaccharide produced by vertebrates; stored in your liver _____

c. Structural polysaccharide that comprises plant cell walls _____

Section 4

15. Lipids include fats, waxes, oils, phospholipids, and steroids. What characteristic do all lipids share?

16. What are the building blocks of fats?

17. If a fat is composed of three fatty acids and one glycerol molecule, how many water molecules will be removed to form it? Again, what is this process called?

18. What are ester linkages?

19. Name two saturated fats.

20. Draw a fatty acid chain that is eight carbons long and is unsaturated. Circle the element in your chain that makes it unsaturated, and explain what this means.

21. Name two unsaturated fats.

22. Why are many unsaturated fats liquid at room temperature?

23. Why are the “tails” hydrophobic?

24. A phospholipid has a glycerol attached to a phosphate group and two fatty acid chains. The head is hydrophilic, and the tail is hydrophobic. Now, sketch the phospholipid bilayer structure of a plasma membrane. Label the hydrophilic heads, hydrophobic tails, and location of water.

25. Study your sketch. Why are the tails all located in the interior?

26. Figure 3.16 in the chapter 3 video link (in the textbook) is an important one! It shows many different functions of proteins. Select any five types of proteins and summarize each type here.

| Type of Protein | Function | Example |
|-----------------|----------|---------|
| | | |
| | | |
| | | |
| | | |
| | | |

27. The monomers of proteins are *amino acids*. Sketch an amino acid here. Label the *alpha* or *central carbon*, *amino group*, *carboxyl group*, and *R group*.

28. What is represented by *R*? How many are there?

29. Define these terms:

| Term | Definition |
|--------------|------------|
| peptide bond | |
| dipeptide | |
| polypeptide | |

Section 6

30. The components of a nucleic acid are a *sugar*, a *nitrogenous base*, and a *phosphate group*. Make a quick sketch of a nucleotide.

31. Notice that there are five nitrogen bases. Which four are found in DNA?

32. Which four are found in RNA?

33. What is the shape of the DNA called?

34. Why are the strands said to be *antiparallel*?

35. What two molecules make up the “sides” of the DNA?

36. What molecules make up “the rungs” of the DNA?

37. In a DNA double helix, a region along one DNA strand has this sequence of nitrogenous bases:
5'-T A G G C C T-3'

Write the complementary strand. Indicate the 5' and 3' ends of the new strand.

