

Name _____

AP Biology Summer Assignment – 2026



READ THIS FIRST!

Welcome to AP Biology! This packet includes instructions for assignments that are to be completed over the summer in preparation for beginning the course in the fall. These assignments cover Unit I of the course: Introduction and the Chemistry of Life. This unit encompasses the first 3 chapters of the textbook (*Campbell Biology in Focus*, by Lisa Urry *et al.*) **Any references to textbook page numbers in this assignment are approximate since you will be using a newer edition of the book than I currently have.** Most of these initial assignments involve chemistry and biochemistry, which should be a review for you. We will have a test on unit 1 within the first three weeks of school. It is important to note that we will spend little time in class reviewing this material — so you should study these chapters and do these assignments accordingly. And remember — an AP course is supposed to be college level, so I will expect well-thought-out and well-written answers and explanations.

This summer assignment consists of two parts:

1. Content review – read the textbook and answer questions.
2. Science practices – graphing and data analysis techniques you will be expected to use in the class and on the AP Bio exam in May.

- All work is to be completed neatly and submitted in a well-organized manner.
- Follow directions carefully – points will be deducted if directions are not followed.
- It should be **your own work**, without collaboration with other students, the internet, or AI. The guidelines of Academic Integrity apply to ALL work in this course, including summer work.
- **It is due on the first full day of classes, August 13th.** Points will be deducted for lateness.

Also, please make sure when you order the workbook, you order a NEW book. If you come to class with a used workbook, you will have to re-order a new one.

Have a nice summer and I look forward to working with you this year!

Dr. Morton

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Part I. Unit 1 Review Questions- All questions should be answered in **COMPLETE SENTENCES (unless instructed otherwise) and neatly written on looseleaf**. At the top of the paper, you should have your name, and below it, AP Biology Summer Assignment 2026. Please clearly label/number your answers so I can tell what section they are from.

Chapter 1. Introduction: Evolution and the Foundations of Biology (p. 16-17)

1. Briefly describe how the investigators conducted the experiment Investigating Coat Coloration in Mouse Populations, and what data they collected.
2. What was their conclusion from this experiment?
3. In an experiment, what is a “control” group? Why is a control group necessary?
4. What is the difference between an independent variable and a dependent variable? Give an example of each.

Chapter 2. The Chemical Context of Life

1. Briefly describe how each of the following chemical bonds is formed:
 - a) Covalent bond
 - b) Ionic bond
 - c) Hydrogen bond
2. DRAW 3 water molecules and the hydrogen bonds connecting them. LABEL 1 hydrogen bond and 1 polar covalent bond.
3. Why is water considered a polar molecule? How does water interact with hydrophilic molecules? How does water interact with hydrophobic molecules?
4. LIST four properties of water and explain **how** the molecular structure of the water molecule gives rise to these properties. For each property, **give an example** of its biological importance (how it is helpful to organisms) and **explain** it.

Chapter 3: Carbon and the Molecular Diversity of Life

1. Carbon-based molecules exhibit vast molecular diversity. Using a ruler, COPY this table onto your looseleaf. For each of the 4 classes of organic compounds listed below, fill in the table with the appropriate information.

Class	Monomers (Subunits used to build the polymers)	Function(s)
Carbohydrates		
Lipids		
Proteins		(List all 8)
Nucleic Acids		

2. Contrast the following pairs of terms:
 - a) monomer, polymer
 - b) hydrolysis, dehydration synthesis

Part II: Data Analysis Questions -Answers must be neatly handwritten on looseleaf.

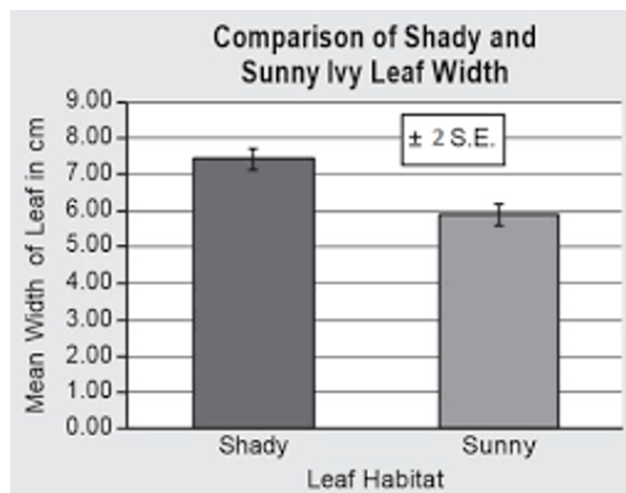
DO THIS FIRST: Watch this video that discusses graphing with standard deviation and standard error of the mean. <https://www.youtube.com/watch?v=RO1O58XnwWY>

The last page of this packet has rules for scientific graphing- make sure your graph has ALL required components. If you need more help you can watch this video:

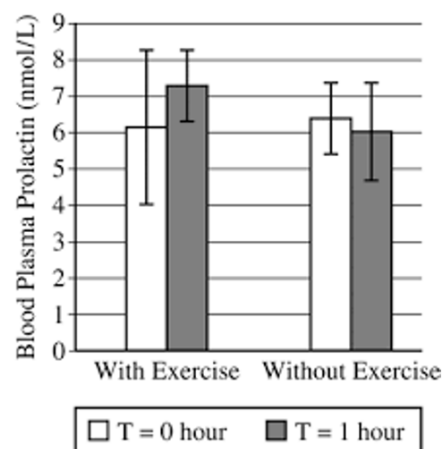
<https://www.bozemanscience.com/beginners-guide-to-graphing-data>

A. Two sample graphs are shown. Study each graph, then, using information from the video you watched, write a detailed explanation about what the graph is telling you; what conclusions can you draw from the data presented?

Graph 1. Comparison of Leaf Width in Two Varieties of Ivy



Graph 2. The Amount of Prolactin in the Blood Plasma after Exercise and Rest



* Researchers conducted a study to investigate the Effect of exercise on the release of prolactin into the blood. Concentrations of prolactin in eight adult males before (T=0) and after one hour (T=1hour) of vigorous exercise. As a control, the same 8 men were tested 1 week later at the same time of the day but did not exercise.

B. Practice AP Exam Questions

1.

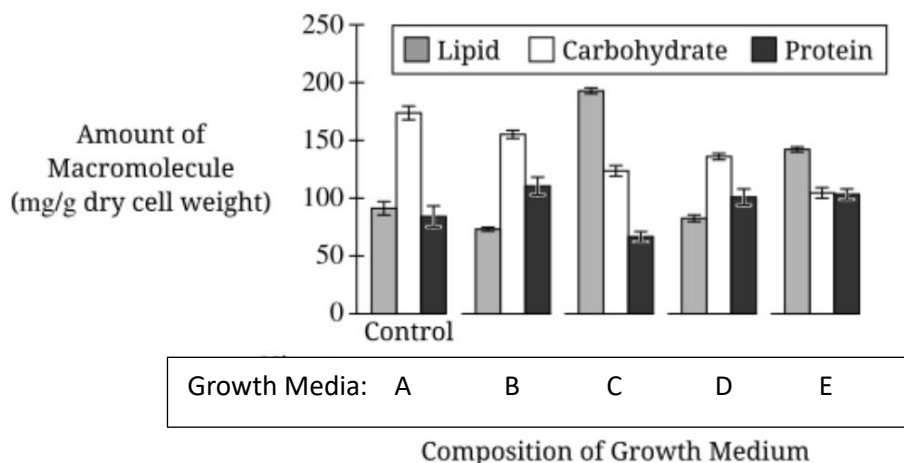
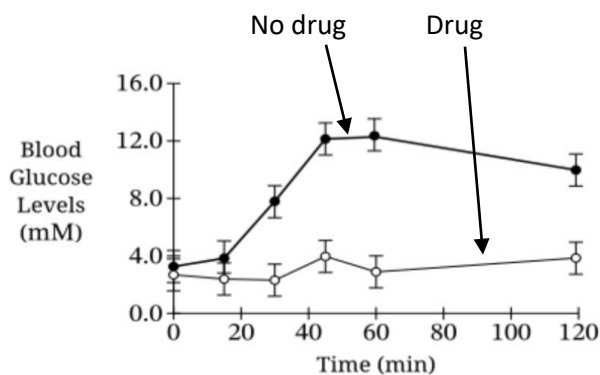


Figure 1. Effect of different abiotic factors on the macromolecule content of bacterial cells. Cells were grown in media with a standard amount (+), twice the standard amount (++), or a reduced amount (–) of each substance. Error bars represent $\pm 2SE_{\bar{x}}$.

To test the effect of different abiotic (non-living) factors on the macromolecule content of bacterial cells, researchers grew identical samples of bacterial cells on growth media (nutrients) in which the amount of nitrates and phosphates differed. The amounts of carbohydrates, lipids, and proteins in each sample of cells were then determined (Figure 1).

Based on Figure 1, which growth media (A, B, C, D, or E) resulted in an increase in both the amount of proteins and lipids as compared to the control? Use **evidence** (data) from the graph to **justify** your answer.

2. Scientists studying factors that affect glucose absorption into the blood administered a glucose solution to mice that had not eaten overnight. Half of the mice received no additional treatment, while the other half were also given a drug that blocks a sodium-glucose transport protein. Blood glucose levels of both groups of mice were monitored for two hours after glucose administration, as shown in the figure.



a) Which group is the control group? **Explain** why.

b) **Estimate** the time when the average blood glucose level of mice that received the drug first reached 4 mM.

c) For the “no drug” line, calculate the rate (slope) of blood glucose production in the 20 to 40 minute time period. **Show your work** and make sure your answer has **appropriate units**.

3.

High levels of certain plant nutrients in runoff can lead to rapid growth of algae (an algal bloom) in aquatic ecosystems. These algal blooms are generally followed by algal death and decomposition, which consumes large amounts of dissolved oxygen in the water and results in oxygen levels insufficient to support aerobic respiration. This process is known as eutrophication. The amount of algae present in a body of water can be estimated from the amount of chlorophyll *a* in a sample of the water. A researcher studying eutrophication collected samples at different times of the year in a freshwater ecosystem. The samples were analyzed for total nitrogen and chlorophyll *a* concentration (Figure 1) as well as total phosphorus and chlorophyll *a* concentration (Figure 2).

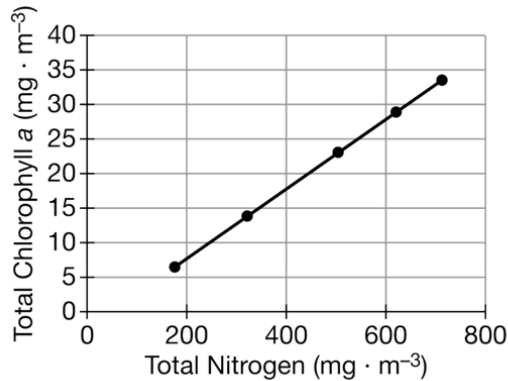


Figure 1. Amount of chlorophyll *a* in relation to the amount of total nitrogen

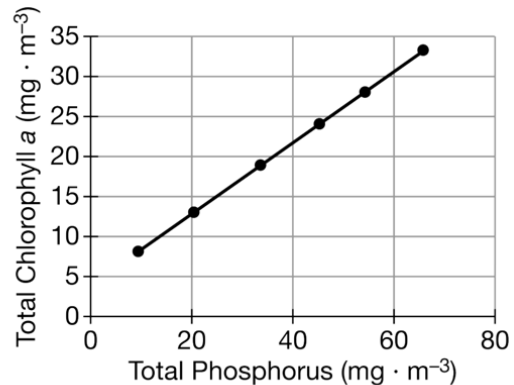


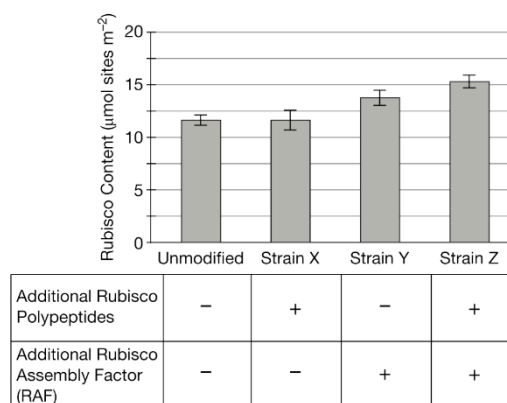
Figure 2. Amount of chlorophyll *a* in relation to the amount of total phosphorous

- What were the independent and dependent variables in this experiment?
- Why did the scientist choose line graphs to represent their data? (See the graphing rules at the end of this packet for help.)
- Describe** the relationship between the amount of chlorophyll *a* in a water sample and the concentration of nitrogen in that sample.

4. Increasing the efficiency of photosynthesis is one way to increase crop yield and help feed human populations. One enzyme vital to photosynthesis is Rubisco. Rubisco catalyzes the reaction in which CO₂ from the air is used to make organic compounds like glucose. Rubisco is composed of two different types of polypeptide subunits: large subunits and small subunits. It is hypothesized that another protein called RAF is needed to help the large and small subunits fold together to make functional Rubisco.

Researchers engineered three genetically modified strains of maize (corn). Strain X produces additional large and small subunits; strain Y produces additional RAF protein; Strain Z produces both additional large and small subunits and additional RAF protein. The Rubisco content of each of the maize strains studied is shown in Figure 1.

Figure 1 Rubisco content in genetically modified and unmodified strains of maize. (-) indicates unmodified levels of polypeptides or RAF; (+) indicates additional polypeptides or RAF



a) **Identify** the dependent variable in the experiment shown in Figure 1. **Identify** the strain of maize that served as the control group.

b) Based on the data, **describe** the effect of additional RAF compared to the effect of additional polypeptides on the Rubisco content.

TABLE 1. AVERAGE PLANT HEIGHT, FRESH MASS, AND DRY MASS OF FOUR STRAINS OF MAIZE

Strain	Rubisco Production	RAF Production	Average Plant Height (cm) $\pm 2SE_{\bar{x}}$	Average Fresh Mass (g) $\pm 2SE_{\bar{x}}$	Average Dry Mass (g) $\pm 2SE_{\bar{x}}$
Unmodified	-	-	73.0 $\pm$ 4.0	230.0 $\pm$ 25.0	29.0 $\pm$ 2.0
Strain X	+	-	83.0 $\pm$ 1.0	292.0 $\pm$ 13.0	32.0 $\pm$ 2.0
Strain Y	-	+	81.0 $\pm$ 3.0	281.0 $\pm$ 37.0	34.0 $\pm$ 2.0
Strain Z	+	+	86.0 $\pm$ 6.0	294.0 $\pm$ 32.0	37.0 $\pm$ 1.0

c) Using **graph paper, construct** an appropriately labeled graph that represents the data for average plant height ONLY (average plant height $\pm 2SE_{\bar{x}}$) shown in Table 1. Based on the data, determine whether there is a statistical difference in the plant height between Strain X and the unmodified strain; then determine whether there is a statistical difference in the plant height between Strain X and Strain Y. **Justify** your answers by using your graph and the data.

Scientific Graphing

Graphing is an important procedure used by scientists to display the data that is collected during a controlled experiment. When a graph is put together incorrectly, it detracts the reader from understanding what you are trying to present. Most graphs have 5 major parts:

1. Title and heading
2. Independent variable (x-axis)
3. Dependent variable (y-axis)
4. Scale for each variable
5. Legend (or key)

REMEMBER – “DRY MIX”

- **D**ependent variable, **r**esult, **Y** axis
- **I**ndependent variable, **m**anipulated condition, **X** axis

- A. Title and heading:** Tells the reader what the graph is about. Be as descriptive as possible and place it above the graph. For example, “Graph 1: Effect of Different Amounts of Water on Plant Growth”.
- B. Independent variable:** Variable controlled by the experimenter, for example, time, temperature, etc.
- C. Dependent variable:** Variable that the experimenter measures. An easy way to check which is the dependent variable is to use the sentence “_____ depends on _____”. For example, “plant growth depends on amount of water”. So, plant growth is the dependent variable.
- D. Scale:** Before you can plot your data points, you must figure out how much each box on the graph paper is worth. Scale must be consistent within one axis. Make sure your axes are labeled with what it is and what the units are, for example, “Heart Rate (beats per minute)”.
- E. Legend:** Used when there are multiple sets of data on one graph, use different colors, or different symbols for the points.

Rules and Tips for Graphing:

1. Always use GRAPH PAPER when hand-drawing graphs. A graph should NEVER be done on notebook or plain paper. You may also use a computer program like Excel.
2. Choose an appropriate graph to explain your data:
 - a. **LINE:** 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 (regression) line and slope can be automatically given to you.
 - c. **BAR:** 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.
3. Do NOT automatically plot a point at the origin (0,0) unless it is a **true** data point.
4. Make sure all parts are included (see above) and everything is labeled correctly – title, axis labels with units, legend if needed.