

ffAP Biology Summer Assignment 2023-2024

AP Biology is an intensive and interesting course as it provides real world examples and synthesizes the concepts you have been introduced to in your previous Biology and Chemistry classes. Upon successful completion of AP Biology, you will have covered content that is equivalent to the **first year** of college majors Biology; both lecture and lab credits can apply, depending on the college. This means that the course will move at a fast pace. You should expect to spend between 4+ hours outside of class working on AP Biology every week (note that this doesn't necessarily mean AT HOME time, it could be during study hall).

Being on time, present, and prepared for class will also be critical to your success. To be a successful AP Biology student, you must embrace the idea of learning independently and advocating for yourself if you do not understand the content or the applications. Engaging in successful study habits is part of the learning process. This includes daily reflections, completing nightly homework, forming a study group (hint!!), and seeking teacher assistance during office hours. These habits will serve you well in class and in your future when you move on to the university-level, post-secondary education, or the work force.

The following packet is the summer assignment for AP Biology 2023-2024. You will need to recall information from your previous Biology and Chemistry classes as well as learn new information that will be critical to your success in AP Biology. On the first day of class in the Fall, you must bring in a completed packet. The work will be collected and awarded effort/accuracy points based on the evidence provided along with the correct answers (except where noted). Your baseline knowledge and skills will be assessed during the first week of classes. Depending on your results, you may need to engage in additional study as your success in this class is dependent on your prior knowledge. To make the most of this packet and start the semester off right, follow the instructions on the pages. Do not try to finish after school ends for the summer—the topics should be fresh in your mind for the Fall! Do not attempt to do it all the night before the first day of classes—you will find yourself buried in Bio! Start working in early August so that you can truly decide if you need a refresher or need to relearn this content. There are resources linked in the following pages to help you, if needed. Resist the temptation to type every question into Google for the answer, lots of students did that during the 2020 AP Biology exam. I prefer that you get something wrong on your work than you copy someone's correct answer.

I look forward to seeing you in September, Mrs. Speisman

Resources:

The [OpenStax Biology](#) text is an excellent resource for reviewing information from past classes. Check it out now and learn how to navigate it using the search bar and the contents bar on the left side of the page. It has interactive quizzes and interactive media which will help you visualize concepts. The following are links to video sources on chemistry and biology concepts that will show up throughout the year. As you are working through the practice problems, you should use these videos as a reference to help you fill in gaps in content knowledge and/or understanding.

Chemistry Review Resources	Biology Review Resources
Bozeman Science - Chemistry Khan Academy If you find you need some chemistry review, check out this textbook: OpenStax Chemistry	Bozeman Science – Biology Khan Academy Amoeba Sisters
Scientific Method Review	Graphing/Statistics Practice
Bozeman – Scientific Method	Bozeman – Graphing Basics Bozeman – Statistics in Science

Chemistry Review

Atomic Structure:

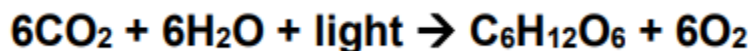
1. **Define** electronegativity and **explain** why Oxygen has a higher electronegativity than Chlorine.
2. **Explain** why Sodium is more reactive than Carbon.
3. **Explain** why Oxygen and Sulfur have similar chemical properties. Which substance is more electronegative and why?
4. **Describe** what an isotope is. **Propose** an explanation as to why isotopes may be useful for tracing molecules through biological processes.

Bonds and Intermolecular Forces:

1. **Identify** the three types of chemical bonds and how they are different.
2. **Explain** why some bonds are polar while others are not. How can you predict whether a bond is polar or non-polar? How can you tell if a molecule is polar or non-polar?
3. If you were to take 2 ice cubes and put one on a block of wood and the other on a same-sized block of copper which ice cube would melt the fastest. **Explain** your answer.
4. **Explain** why CO₂ is a non-polar molecule even though its bonds are polar.
5. **Describe** what a Hydrogen bond is and **explain** why it is so important to biology.
6. The molecules that make up olive oil are all non-polar. **Explain** how the lipid molecules bond to each other.

Types of Reactions:

1. **Explain** what a chemical reaction is.
2. **Identify** the part of an atom responsible for chemical reactions. **Explain** why this part is responsible.
3. **Describe** the characteristics of each of the following reactions:
 - a. Combustion
 - b. Synthesis
 - c. Single Replacement
 - d. Double Replacement
 - e. Decomposition
4. **Contrast** exothermic and endothermic reactions.
5. Using the following chemical reaction, **complete** the table:



What are the products of this reaction?	
What are the reactants?	
How many CO ₂ s are needed to make 1 C ₆ H ₁₂ O ₆ ?	
What sort of energy transformation is occurring?	
Is the reaction spontaneous or does it require an energy input?	

Polymers and Macromolecules

1. **Define** monomer:
2. **Define** polymer:
3. **Complete** the following table:

Type of Macromolecule	Elements Present	Monomer	Polymer	Examples in Animal Cells	Examples in Plant Cells

Biology Review:

Cell Energetics

1. **Define** metabolism:
2. There are two types of reactions in metabolic pathways: anabolic and catabolic.
 - a. Which reactions release energy?
 - b. Which reactions consume energy?
 - c. Which reactions build up larger molecules?
 - d. Which reactions break down molecules?
 - e. Which reactions are considered “uphill”?
 - f. What type of reaction is photosynthesis?
 - g. What type of reaction is aerobic cellular respiration?
 - h. What type of reaction is anaerobic cellular respiration?
 - i. Which reactions require enzymes to catalyze reactions?

Feedback Loops and Homeostasis

For each of the following, state whether it is positive or negative feedback:

1. _____ If blood temperature rises too high, specialized neurons in the hypothalamus of the brain sense the change. These neurons signal other nerve centers, which in turn send signals to the blood vessels of the skin. As these blood vessels dilate, more blood flows close to the body surface and excess heat radiates from the body.
2. _____ If the blood temperature falls too low, specialized neurons in the hypothalamus of the brain sense the change and signals are sent to the cutaneous arteries (those supplying blood to the skin) to constrict them. Warm blood is then retained deeper in the body and less heat is lost from the surface.
3. _____ Part of the complex biochemical pathway of blood clotting is the production of an enzyme that forms the matrix of the blood clot. This has a self-catalytic, or self-accelerating effect, so that once the clotting process begins, it runs faster and faster until, ideally, bleeding stops.
4. _____ The walls of arteries stretch in the presence of high blood pressure. Baroreceptors located in these walls also stretch and as a result, a signal is sent to the brain which in turn slows down the body’s heart rate. This slows the flow of blood through the arteries causing less pressure. As blood pressure drops, the baroreceptors become flaccid, and a signal is sent to speed up the heart rate.
5. _____ As fossil fuels are burned to release energy they produce CO₂ which accumulates in the atmosphere and oceans. As the CO₂ accumulates in the atmosphere it absorbs heat from the Earth, resulting in increased air temperature. This increased air temperature causes permafrost in the Arctic tundra to thaw and release CO₂ that is produced through decomposition processes. When this CO₂ reaches the atmosphere, it absorbs more heat, leading to more permafrost thawing.

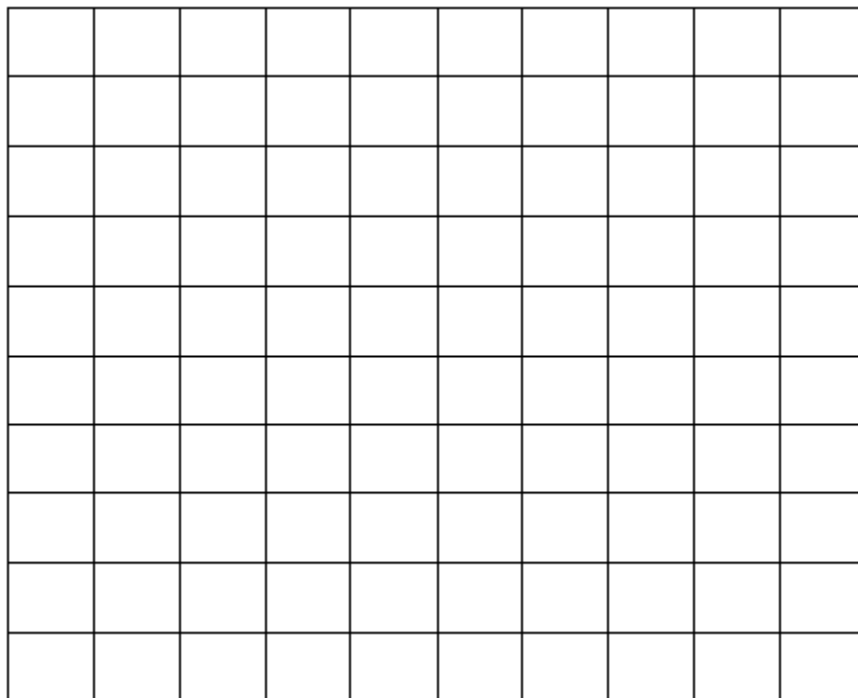
Scientific Practices Review

Read the problem below and then graph the data. Remember that a good graph includes a title, axis labels and units, as well as appropriate scale, and a caption. Make sure to take up the whole graphing area!

Charlie is being tested for lactose intolerance. His blood is drawn and circulating glucose is measured over time. The normal range for blood glucose is 70-110 mg/dL. The normal range for blood pH is 7.35-7.45. If he can digest lactose, his blood glucose should rise and decrease. In a normal response the islet cells in his pancreas will detect the elevated concentration of glucose and release insulin to travel through his body and direct cells such as those in his liver to produce more glucose transporters and remove the excess glucose from the blood. If this happens, blood glucose concentrations should decrease with time.

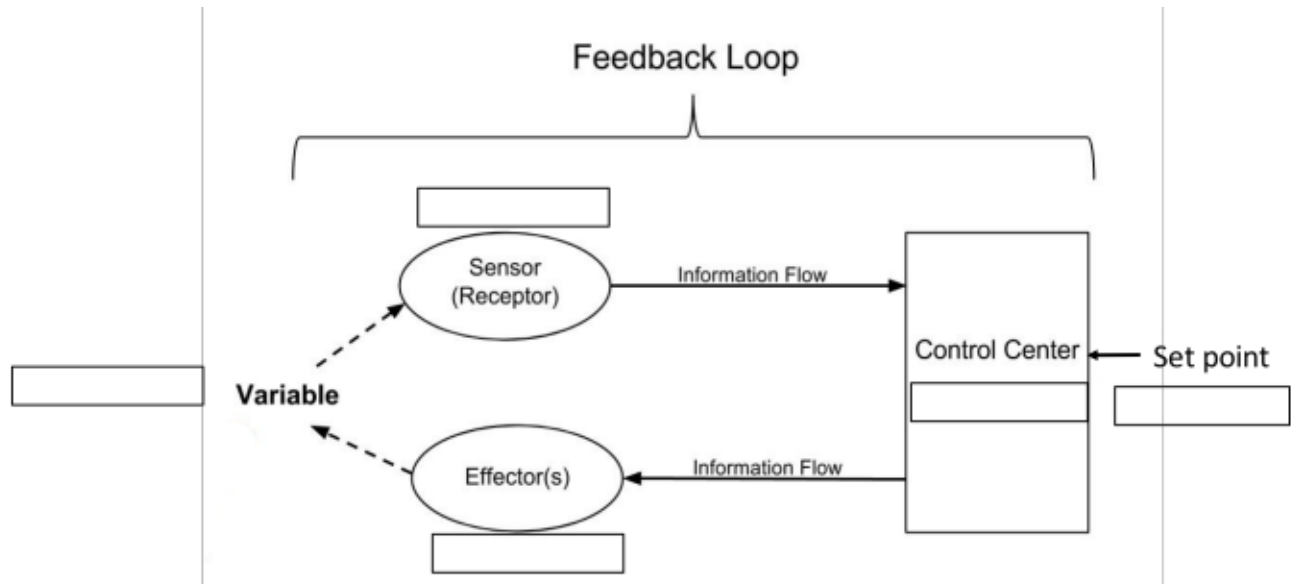
Time (minutes)	Blood Glucose (mg/dL)
0	96
15	105
30	146
45	143
60	98

Create your graph using the grid below. Do not just insert an Excel or other computer-generated graph. You may be expected to properly draw a graph on the AP Biology exam.



Using the information given in the scenario, the table and your graph above answer the following questions. Be sure to focus on the bold type words as these are the response prompts.

1. **Identify** the type of feedback being shown in this data set.
2. Using the figure below, **identify** the indicated parts of the feedback loop involved in this test.



3. **Identify** the independent and dependent variables for this test.
4. **Describe** the trend of blood glucose concentration seen during the duration of the test.
5. **Calculate** the rate of increase in Charlie's blood glucose concentration.
6. If Charlie has Type I diabetes (he is unable to produce insulin), **predict** what the blood glucose response would look like. **Justify** your answer using information given in the scenario.

These next two questions are from past AP Biology exams (don't go looking them up yet). Answer the prompts as best you can. In this section, I am interested in seeing how you currently answer these types of questions. These will not be graded as correct or not, it's more of a skills survey. All the information you need to answer the questions is either in the information given or from previous Biology courses.

- A. In an experiment, rats averaging 300g of body mass were tested several times over a three-month period. For each individual rat, urine was collected over a three-hour period after ingestion of 10 mL of liquid (water, 1% ethyl alcohol solution, or 5% ethyl alcohol solution). The volume of urine was then measured, and the results were averaged for all individuals within each experimental group. The data are shown in the table below.

THREE-HOUR URINE OUTPUT FOLLOWING FLUID INGESTION

Fluid ingested (10 mL)	Water	1% Ethyl Alcohol	5% Ethyl Alcohol
Mean urine output (mL)	3.5	3.8	4.7

1. **Pose** ONE scientific question that the researchers were most likely investigating with the experiment.
2. **State** a hypothesis that could be tested to address the question you posed in part 1.
3. Using the data in the table, **describe** the effect of ethyl alcohol on urine production.

B. Use the figure and information below to answer the questions –

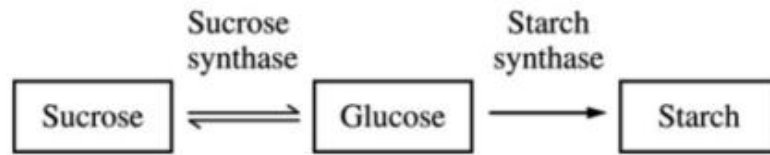


Figure 1. Simplified starch biosynthesis pathway in plants

A rice grain is a fruit that encloses a seed. Most of the dry mass of a rice grain is starch. In rice plants, starch is produced by hydrolyzing sucrose and then linking the released glucose molecules together into starch (Figure 1). The optimal temperature range for starch synthase activity in a strain of rice is 27° C – 30° C. The optimal temperature for sucrose synthase in the strain is 30° C – 35° C.

1. **Describe** how temperatures above 35° C most likely affect the structure and function of the starch synthase in the rice strain.
2. Using the information provided, **predict** the most likely consequences to starch content in mature rice grains if the rice is grown in an area where the average temperature during the growing season is 33° C.