

AP Biology Summer Assignment 2026-2027

AP Biology is an intensive and interesting course; 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; and you should expect to spend **5+ 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. 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 university-level, post-secondary education, or the work force.

The following packet is the summer assignment for AP Biology 2026-2027. 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. 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 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; it did not go well. 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 Chemistry review, check out this textbook: OpenStax Chem	Bozeman Science – Biology Khan Academy
Scientific Method Review	Graphing/Statistics Practice
Bozeman – Scientific Method	Bozeman – Graphing Basics Bozeman – Statistics in Science Bozeman - Standard Deviation Bozeman - Standard Error of Measure

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. Describe what a Hydrogen bond is and explain why it is so important to biology.
4. The molecules that make up olive oil are all non-polar. Explain how the lipid molecules bond to each other.

Types of Reactions:

1. Identify the part of an atom responsible for chemical reactions. Explain why this part is responsible.
2. Describe the characteristics of each of the following reactions:
 - a. Synthesis
 - b. Double Replacement
 - c. Decomposition
3. Contrast exothermic and endothermic reactions.

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.

Graphing

Identify when you'd use each type of graph & what else is important to remember about each.

	When to use
Scatter	
Line	
Bar	
Box and Whisker plot	
Log Y	
Histogram	
Dual Y	

What kind of graph would you use for each of the following data sets?

What scores do students get on the practice test vs the real test?		
Student	Practice test score	Final test score
1	60	70
2	75	90
3	55	55
4	80	95

How many of each type of paramecia are in a drop of water over 12 days?		
Day	Number of <i>P. caudatum</i>	Number of <i>P. aurelia</i>
0	4	4
2	10	10
4	30	46
6	48	66
8	58	70
10	62	68
12	60	71

How does the average height of a plant compare cross three treatments?				
Treatment	Height-Plant 1	Height-Plant 2	Height-Plant 3	Average height
1	6.5	6.1	6.7	6.4
2	4.6	5.7	5.2	5.2
3	4.0	3.9	4.1	4.0

How does the daily number of calories consumed correlate to weight gained? (kg)	
Calories consumed	Weight gained (kg)
1500	0.00
2300	0.20
3400	0.90
2200	0.20
2500	0.30
1600	0.00
1400	0.00

How far does a high-speed bird travel over a period of five hours?	
Elapsed time (hr)	Distance traveled (km)
0	0
1	57
2	102
3	149
4	221
5	248

An environmentalist knows that when exposed to certain wavelengths of light, algae of the species *Nephroselmis minuta* undergo the process of photosynthesis more effectively. In order to quantify the efficiency of the photosynthetic process taking place, this scientist has determined that he will measure the output of oxygen gas (in mL) from a constant amount of algae. This particular species of algae grows best on the equator, but struggles to harvest energy where sunlight is less prevalent.

Wavelength of Light	mL of Oxygen Gas Produced				Statistics		
	Trial 1	Trial 2	Trial 3	Trial 4	Mean	Standard Deviation	Standard Error of Measure
450	15.62	16.73	17.03	16.53			
500	10.45	11.62	11.90	10.41			
550	7.80	8.30	8.25	7.94			
600	5.92	6.71	6.40	4.77			
650	9.54	10.12	9.65	6.11			
700	16.75	15.12	16.73	18.65			

Experimental Question	
Independent Variable	
Dependent Variable	
Positive Control	
Negative Control	
Claim	
Evidence	

Housekeeping genes encode proteins involved in universally important processes such as transcription, translation, and glycolysis. Because these genes appear to be expressed in all cells at constant levels, the expression of housekeeping genes is often used as a control when comparing how the expression of other genes varies under different conditions.

Researchers studying the effect of pesticides on declining bee populations wanted to determine whether the expression of four housekeeping genes (GAPDH, RPL32, RPS-5, and TBP-AF) was in fact constant in bees across different variables. The researchers collected samples of mRNA for each of the four genes and compared how their expression varied across the developmental stage of the bee, the sex of the bee, and the cell type from which the sample was taken. The mRNA from the samples was reverse transcribed to produce DNA copies of each gene. PCR was then used to amplify the DNA, and the Cq value was determined. The Cq value is the number of PCR cycles needed to produce a specified number of DNA copies. A high Cq value for a sample indicates the gene was expressed at a low level.

To analyze whether any of the examined variables affected expression of the housekeeping genes, researchers examined the range of Cq values for each gene in response to each variable. Genes with a wide range of Cq values were determined to be affected by the variable, while genes with a narrow range of Cq values were determined to be unaffected by the variable.

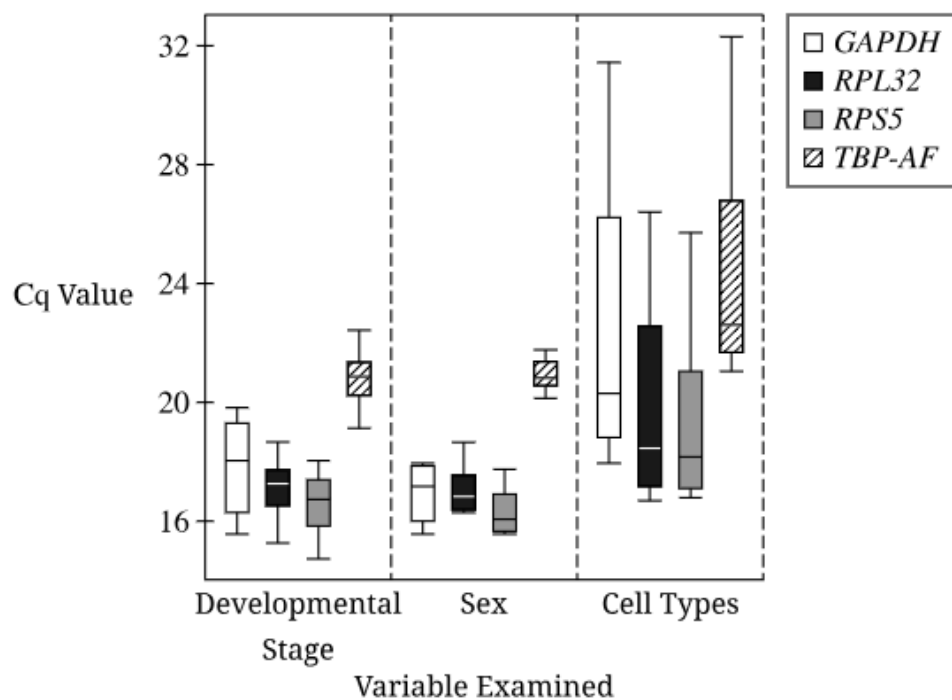


Figure 1. The effect of developmental stage, sex, and cell type on the Cq value of four housekeeping genes

- (a) Based on the data in Figure 1, **identify** the gene that had the lowest median Cq value when bees of different developmental stages were compared.
- (b) The Cq value is inversely proportional to the amount of mRNA from that gene in the starting sample. Based on the data in Figure 1, **identify** the gene that has the lowest level of gene expression regardless of variable.
- (c) The scientists investigated the effect of pesticides on the expression of other genes in one cell type of a group of bees containing males and females of the same developmental stage. They hypothesized that TBP-AF would serve as the best control gene for this experiment. Use the data to **evaluate** their hypothesis.