

AP Biology Summer Assignment Packet 2026

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Welcome to AP Biology! This class is designed to be the equivalent of a two-semester introductory biology course usually taken in the first year of college. Throughout the course, you will become familiar with major topics that this course centers around: Biochemistry, Cellular Energetics, Genetics, Heredity, Evolution, and Ecology.

The AP Biology course shifts from a traditional “content coverage” model of instruction to one that focuses on enduring conceptual understandings and the content that supports them. Please be aware that part of taking this class is a commitment to being on time, on task, and working hard. There are different parts to this assignment: graphing, chemistry, and designing your own experiment. This assignment counts as 100 points total. (point amounts are shown next to each part) **Please print out a hard copy to hand in.** This assignment is due on the first day of class. Points will be deducted if it is late (-5pts per day late). It is imperative that you do your own work! **Answer the bolded questions in complete sentences! Do not type in answers, they must be handwritten.** There will be a test on this within the first 2 weeks of school!



“Looks aren’t everything. It’s what’s inside you that really matters. A biology teacher told me that.”

Name: _____

Part #1: Writing a hypothesis: (6 points) :Research the answer to the following questions :

1. Suppose you are designing an experiment to test the effects of different temperatures on the activity level of pill bugs. What are the disadvantages of having too small a sample size (i.e., testing too few pill bugs)? What are the disadvantages of having too large a sample size (i.e., testing too many pill bugs)? (2pts)
2. What is a null hypothesis? What would be the null hypothesis for the pill bug experiment mentioned in #1 above(2pts)
3. *"If bean plants receive more hours of sunlight each day, then they will produce more leaves than bean plants that receive fewer hours of sunlight."*
Is this a null hypothesis? If not, rewrite it to make it one. 2pts

Part #2: Design your own experiment. One of the most commonly asked free response questions on an AP Bio exam is for you to "design an experiment" based on a set scenario. Please answer the following questions in accordance with the experiment below.(19pts total)

Experiment: A biologist noticed that soybean plants, a type of legume, appeared to grow differently in fields with high numbers of pollinators(ex. bees) compared to fields with fewer pollinators. The biologist wanted to determine whether pollinator abundance affects soybean seed production. Please answer the following as you design your own experiment:

4.State a hypothesis(called an alternative) and null hypothesis based on the experiment given above. This is usually stated as an expectation of results based on the known effects of the independent variable. 2 pt

Hypothesis:

Null hypothesis:

5. Design and identify a control group you will use? (include number and type of organism used and clear descriptions of how they will be different from other group(s)) Why is it necessary to have a control group? 3pts

6. What will your experimental group consist of ? Include the number of organisms and how they will differ from the control group. 3pts

7. Explain how you will hold at least two other experimental variables constant.(what will be the same/not change between your different groups)? 2pts

8. DESCRIBE how the independent variable will be manipulated (varied) -X axis? 2pt

9. Describe how the dependent variable will be measured quantitatively? If you are trying to derive a rate, be sure to indicate the time frame of the measurements. If the dependent variable will be measured indirectly, explain how the method works to measure the dependent variable. 2pt

10. Describe what *results* would you expect to find during the experiment that would support the claim that fertilizer affected the peanuts plant growth? 2pt

11. List 3 possible sources of error that could exist during the experiment. 3pt

Part #3: Statistics, Graphing & Data Skills Assignment (43pts)

You may be asking, “Why am I learning statistics in AP Bio!?!?” The reason is because we will be looking at and analyzing data throughout the year. Having a strong understanding of what graph to use to display information and having the skills to interpret the results will help you become a strong scientist while we are learning content. If you move into a scientific field in college, these concepts are inseparable from scientific research and learning. Below you will find video links and questions to accompany the videos. If the video leaves you feeling confused or you don't feel you understand it well, seek out other sources for explanation. (each question is worth 1 point unless otherwise noted)

12. Watch :Beginner's Guide to Graphing Data:

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

Or <https://youtu.be/9BkbYeTC6Mo>

a. What type of graph uses a “best fit” line?

b. Explain the difference between a bar graph and a histogram? 2pts

c. Which type of graph shows a change over time?

d. Which type of graph displays a correlation of variables?

e. Distinguish between the independent variable and dependent variables in an experiment, and where their axes are on the graph. 2pts

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) an example.

h. State at least 5 elements that any graph should always display: 3pts

Graphing Practice

Graphing is an important procedure used by scientists to display the data that is collected during a controlled experiment. Line graphs must be constructed correctly to accurately portray the data collected. Many times the wrong construction of a graph detracts from the acceptance of an individual's hypothesis. A graph contains five major parts:

a. Title: depicts what the graph is about. By reading the title, the reader should get an idea about the graph. It should be a concise statement placed above the graph.

b. Independent variable: variable that can be controlled by the experimenter. It usually includes time (dates, minutes, hours, etc.), depth (feet, meters), and temperature (Celsius). This variable is placed on the X axis -numbers will be dictated by your data values.

e. Legend: is a short descriptive narrative concerning the graph's data. It should be short and concise and placed (horizontal axis).

c. Dependent variable: variable that is directly affected by the independent variable. It is the result of what happens because of the independent variable. Example: How many oxygen bubbles are produced by a plant located five meters below the surface of the water? The oxygen bubbles are dependent on the depth of the water. This variable is placed on the Y-axis or vertical axis.

d. Scales for variables: In constructing a graph one needs to know where to plot the points representing the data. In order to do this a scale must be employed to include all the data points. This must also take up a conservative amount of space. It is not suggested to have a run on scale making the graph too hard to manage. The scales should start with 0 and climb based on intervals such as: multiples of 2, 5, 10, 20, 25, 50, or 100.

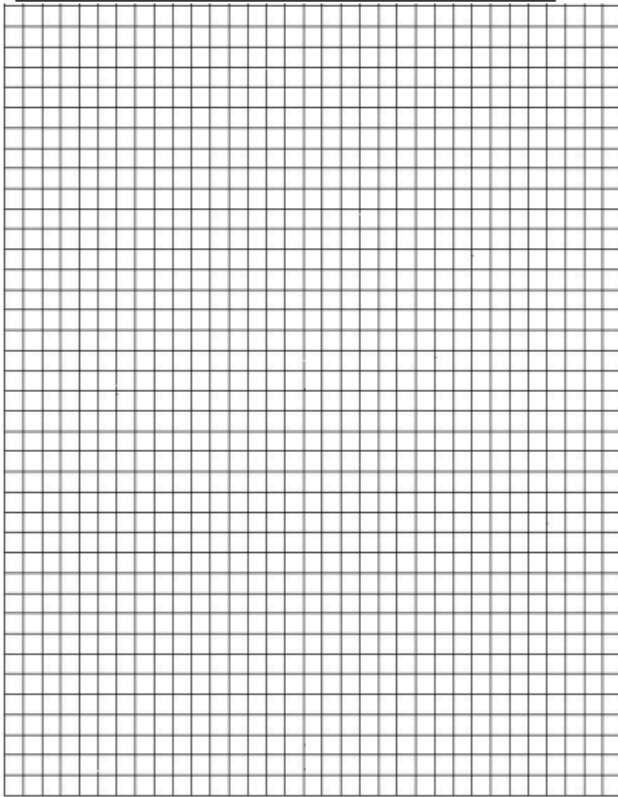
Graph 1:

Diabetes is a disease affecting the insulin producing glands of the pancreas. If there is not enough insulin being produced by these cells, the amount of glucose in the blood will remain high. A blood glucose level above 140 for an extended period of time is not considered normal. This disease, if not brought under control, can lead to severe complications and even death.

Answer the following questions on the next page concerning the data below and graph it. (6pts graph). Label both the x and y -axes and include a title.

Time After Eating hours	Glucose ml / Liter of Blood Person A	Glucose ml / Liter of Blood Person B
0.5	170	180
1	155	195
1.5	140	230
2	135	245
2.5	140	235
3	135	225
4	130	200

Title: _____



13. What is the dependent variable ? 1pt

14. What is the independent variable ? 1pt

15. Which, if any, of the above individuals (A or B) has diabetes? 1pt

16. What is your hypothesis? What data do you have to support your hypothesis? 1pt

17. If the time period were extended to 6 hours, what would the expected blood glucose level for Person B? 1pt

Statistics

18. Statistics for Science: Go to the following website <http://www.bozemanscience.com/statistics-for-science> and watch this video: <https://youtu.be/jf9VT4V4aRI>

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 what the formula for it is $n-1$.

19. **Standard Deviation:** Watch this video and answer the following questions: <https://youtu.be/09kiX3p5Vek>

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.

d. 1 SD means _____% of the population falls within this range, while 2 SD mean _____% falls within this range.

e. Pause the video and calculate the SD from the 2nd set of data given by hand at the 6:30 mark. Show your work. (5 pts)

20. **Standard Error.** Watch : <http://www.bozemanscience.com/standard-error>

a. 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). 2pts

21. **Standard Deviation and Standard Error of the Mean.** Watch: <https://youtu.be/3UPYpOLeRJg>

▶ Standard Deviation and Standard Error of the Mean

a. What do SEM bars that have overlapping means on a graph indicate?

b. Explain the significance if SEM bars overlap, but the means do not overlap.

c. Explain the significance if there is no overlap between SEM sbar.

Part #4: Chemistry Review: (note: you may need to use a periodic table which can be found online) 32pts total. We will begin the year with biochemistry, therefore it is important that you have a strong chemistry foundation coming into this class. Please make sure you understand the following material.

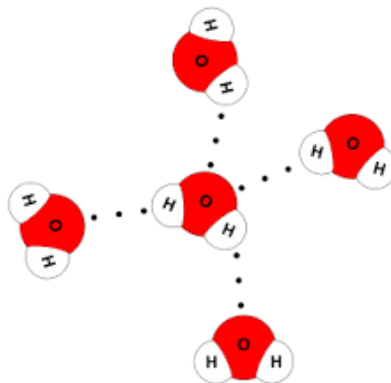
22. Contrast the term element with compound. Give an example of each. 3pts

23. Write the symbols of the following elements and their charge: (carbon is done for you). If there is more than one charge, include both. (5pts)

27. What type of bonding exists between the atoms in the following molecules?(water is done for you) 3pts

- a. Water ? *covalent bond*
- b. Ammonia?
- c. Oxygen?
- d. Carbon dioxide?

28. What is a hydrogen bond? What does hydrogen bonding have to do with water molecules? Label one hydrogen bond in the picture below. (2pts)



29. Why is water considered a polar molecule? Draw an electron dot diagram of water. Label the more negative and more positive regions of the molecule. (hint=look up electronegativity of each atom) (2pts)

30. For each of the below listed properties of water – briefly *define* the property and then explain how water's polar nature and polar covalent bonds contribute to the water special property. 3pts

a. Cohesion

b. Adhesion

c. Surface tension