

# AP Biology Summer Assignment

**Expected time for completion:** 2-3 hours

This summer, students are expected to review and acquire the prerequisite knowledge and skills required to be successful in AP biology.

The summer assignment is designed to support the four big ideas that drive the AP biology curriculum. Answers to all questions should clearly show each student's own understanding. Please do not copy and paste or use words that are not your own words.

The summer assignment is due on the first day of school. On average, most students will take **2-3 hours** to complete the assignment. Each section of the assignment has embedded video instructions to guide and support your understanding.

Looking forward to meeting you in the fall!

## Part I. Foundational Science Skills

- Graphing by hand and digitally
- Design of a scientific experiment

## Part II. Chemistry Review

- Types of chemical bonds (ionic, covalent, hydrogen bonds)
- Electronegativity and polarity
- Solution and molarity
- Acid, base, and pH
- Energy and enthalpy

**\*\*Note:** Clearly show work for all math/graphing-by-hand questions.

## Part I. Foundational Science Skills

Beginner's guide to graphing <https://tinyurl.com/summerapbio1>

1. Complete the following table to compare and contrast the 5 different types of graphs.

Types of graphs	Purpose	Discuss the example graph
	Shows change over time	
Scatterplot		
Bar graph		
Histogram		
Pie chart		

2. What are the qualities of a good graph (temperature vs. ice cream graph)?

3. What are the qualities of a bad graph?

Graphing by hand <https://tinyurl.com/summerapbio2>

4. Which variable do you graph on the x-axis? Y-axis?

5. What information should you include in the graph title?

6. What steps can you take to evenly scale the x- and y-axis?

7. What is a line of best fit? How is it useful?

**Graphing using Google Sheets** <https://tinyurl.com/3apbiosummer>

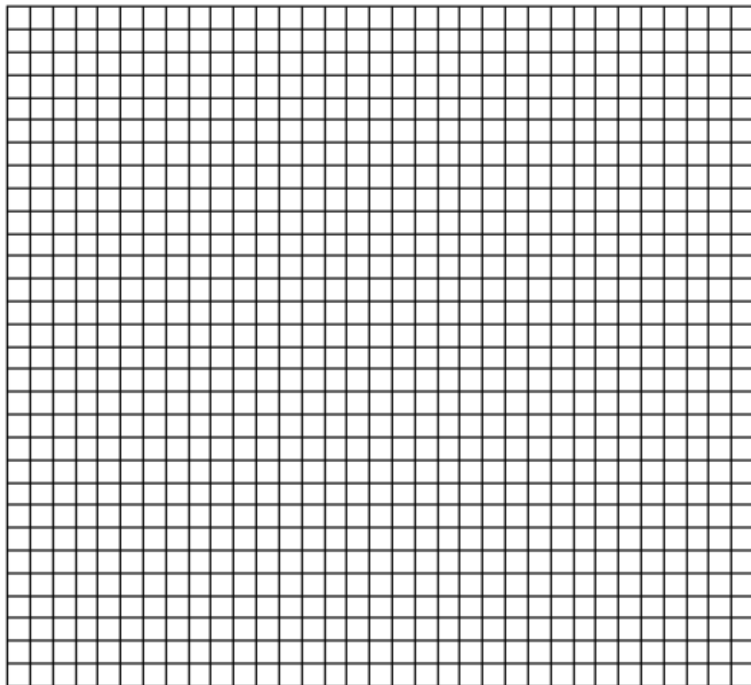
8. Summarize the steps you need to complete to properly create a scatter plot on Google Sheets.

9. Use the skills you learned in the previous two videos to graph the following data 1) by hand and 2) using Google Sheets.

**Table 1.** Effect of light intensity on the rate of photosynthesis in plants

Distance from light (cm)	5	10	15	20	25	50
Rate of O <sub>2</sub> production by plants (ppm/min)	50	43	36	30	21	2

(a) Graph by hand (print and insert a picture)



(b) Using Google sheet (copy and paste the graph)

**Design of a Scientific Experiment** <https://tinyurl.com/apscientificmethods>

10. **Describe** the steps involved in a scientific investigation.

11. Why is it important for scientific papers to be *peer-reviewed* before being published?

12. **Define** the following terms and **identify** the corresponding component in the plant experiment discussed in the video:

Term	Definition	Example in the plant experiment
Independent variable		
Dependent variable		
Hypothesis		
Constants		
Control group		

## Part II. Chemistry Review

Types of Chemical Bond <https://tinyurl.com/summerapbio5>

1. What are organic compounds?
2. How many bonds can a carbon atom make?
3. Draw the following molecules using the correct Lewis dot structures. (Hydrogens make 1 bond, Oxygens 2, Nitrogens 3, Carbons 4 bonds).
  - (a) Water ( $\text{H}_2\text{O}$ )
  - (b) Carbon dioxide ( $\text{CO}_2$ )
  - (c) Ammonia ( $\text{NH}_3$ )
  - (d) Methane ( $\text{CH}_4$ )
  - (e) Amino acid
4. What is the difference between **nonpolar** and **polar** covalent bonds? Cite examples for each.
5. Describe an ionic bond. Cite examples.
6. Describe the hydrogen bond. What is their importance in biological systems?

## **Polarity and Electronegativity** <https://tinyurl.com/summerapbio6>

7. Why can't butter be washed off with water?
8. What is **electronegativity**? Describe the trend in electronegativity in the periodic table.
9. Define the range in electronegativity difference for each of the following.
  - (a) Non-polar covalent -
  - (b) Polar covalent -
  - (c) Ionic -
10. What other factor besides the difference in electronegativity determines the polarity of a molecule?
11. How does the polar property of water help dissolve ions such as NaCl?
12. What is hydrogen bonding? How does it occur and how does it explain why ice is less dense than liquid water?
13. What are hybrid molecules (more commonly known as **amphipathic** molecules)? Examples?

## **Solutions and Molarity** <https://tinyurl.com/summerapbio8>

14. Define the following parts that make up a solution.
  - (a) Solute -
  - (b) Solvent -
15. Describe what happens when an ionic compound (i.e. NaCl) is dissolved in water (discuss both conductivity and what happens at the atomic-molecular level).

16. What is **molarity**? Write down the formula for calculating molarity.

17. Calculate the mass in grams of sodium chloride solution you need to prepare 1.5 L of 0.75M NaCl solution. Clearly show work (Molar mass of NaCl = 58g/mol).

**Acids, Bases and pH** <https://tinyurl.com/summerapbio9>

18. What is a hydronium ion? Hydroxide ion?

19. Answer the following questions about pH.

(a) What is pH? Write the formula for calculating the pH and define each variable.

(b) Define the pH range for acids, neutral, and bases.

(c) Calculate the pH of a solution that has a hydronium concentration of 0.001 M. Would this solution be acidic or basic?

**Energy in chemical reactions** <https://tinyurl.com/summerapbio10>

20. Compare and contrast *exothermic* and *endothermic* reactions (Discuss heat in your answer).

21. **Draw** and **label** an energy diagram for both exothermic and endothermic reactions.

Exothermic Reaction	Endothermic Reaction

22. What is activation energy?