

AP Biology Summer Assignment - 2026-2027

Welcome to AP Biology!

The two main goals of AP Biology are to help you develop a conceptual framework for modern biology and to gain a deeper appreciation of science as a process (as opposed to an accumulation of facts). Because of the rapid pace of discovery in the life sciences our primary emphasis is on developing an understanding of unifying concepts that connect the major topics of biology. The AP Biology Curriculum centers around the four Big Ideas and you will need to not only know these but also understand how they all relate:

- **Big Idea 1:** The process of evolution drives the diversity and unity of life.
- **Big Idea 2:** Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
- **Big Idea 3:** Living systems store, retrieve, transmit and respond to information essential to life processes.
- **Big Idea 4:** Biological systems interact, and these systems and their interactions possess complex properties.

What to do before the first day of school:

• AP Biology was designed by a select group of college professors and high school science teachers to be equivalent to an introductory college biology course. Visit the below College Board site to explore what an AP Biology course is like:

- <https://apstudent.collegeboard.org/exploreap?affiliateId=apcentral&bannerId=exploreap1>

• Email me to introduce yourself. I'd like to know some of your immediate and long term goals as well as why you decided to take AP Biology. Include the following in your email:

- Your full name (& nickname that you go by if you have one)
- Who was your last science teacher? What class? What grade did you earn?
- What other science classes have you taken?
- Why are you taking AP Biology? What do you hope to accomplish/gain?
- What do you like to do (hobbies, sports, music, interests, etc.)?
- Tell me a little about your family (Mom, Dad, Guardian, Siblings, Pets, how long you've lived in the area, etc.)
- What are you most anxious about in AP Biology?
- Anything else you think I should know or would like to share with me.

My email is madeline.zweber@student.bostonprep.org and I will be checking it all summer. If you encounter problems with your summer assignment, please contact me through that email as well.

We have a small problem in AP Biology. Each year new advances in science are discovered but the length of the school year (and when the test occurs) stays the same. What does this mean? We are short on time. In order to cover ALL of the material, you are responsible for reviewing the Chemistry section on your own. Here is what you are to do:

- Watch the following two YouTube videos. These are called Crash Courses with Hank Green. Get to know him as we will tune into him quite a bit during the year. These two videos are great chemistry reviews.

http://www.youtube.com/watch?v=HVT3Y3_gHGg&list=PL6C159EF1A62143A2&index=11

http://www.youtube.com/watch?v=QnQeoxW_JY4&list=PL6C159EF1A62143A2&index=

- **Complete the Chemistry Worksheet.** As an AP Biology student the expectation is that if you don't know it, find it out. Use all of your resources!

- **Complete the Biology Prefixes and Suffixes.** It will make life in AP Biology much easier if you KNOW these roots. Most of these were included in the prefixes you have been quizzed on over the last three years.
- **Complete the scientific method practice.** You should be very comfortable making a hypothesis, establishing controls, and identifying independent and dependent variables.
- **Complete the mini lab report on the dry lab provided.** We will be using the same format for the entire school year on every lab we complete so it is important to get a feel for how to accurately complete a lab report.

The Chemistry Worksheet will be **turned in on the first day of class for a grade.** • Be prepared for a quiz during the first couple of days. This quiz will be on Chemistry and some common biology terms (made from the prefixes and suffixes).

I truly am looking forward to working with you next year. Don't procrastinate on this assignment but don't let it keep you from having a wonderful summer!

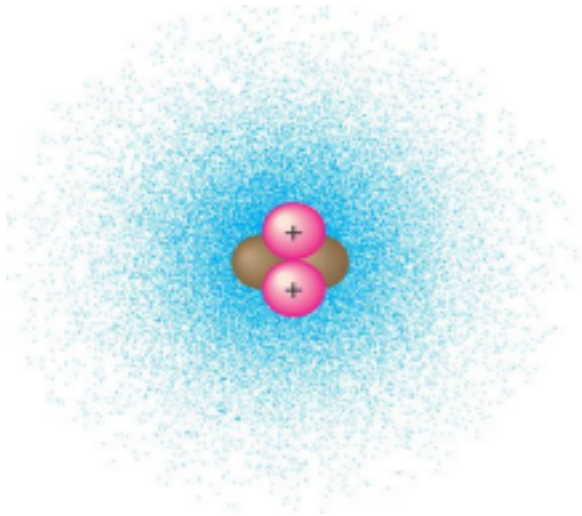
Sincerely,

Ms. Zweber (she/her)
AP Biology and Biology
Boston Preparatory Charter School

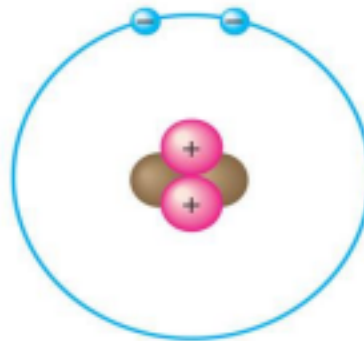
AP Biology Essential Chemistry

This is a review of basic chemistry – we will not spend much class time on these concepts as they should have been learned in chemistry. Please make sure that you know them and if not, be sure to study through them. ***You will need access to a periodic table to complete this which is attached to this packet.*** Do NOT just write down the “AI Overview”. Put extra effort into researching these concepts and use legitimate sources like Khan Academy or the AP Biology textbook.

1. Contrast the term element with compound.
2. Know the symbols of the following elements and their charge:
 - a. Carbon
 - b. Hydrogen
 - c. Oxygen
 - d. Nitrogen
 - e. Phosphorus
 - f. Sulfur
3. Label the diagram below and define the terms that you label.



(a)



(b)

4. Contrast the terms atomic mass and atomic number.
5. What is the difference between the terms atomic mass and atomic weight?

6. What is an isotope and what is “special” about radioactive isotopes?
7. What determines interactions between atoms? Why are valence electrons important?
8. Define the following terms:
- a. Chemical bond
 - b. Covalent bond
 - c. Single bond
 - d. Double bond
 - e. Electronegativity
 - f. Nonpolar covalent bond
 - g. Polar covalent bond
9. What is the difference between a structural and molecular formula?
10. Know both the molecular and structural formula for the following compounds.
- a. Oxygen gas
 - b. Carbon dioxide
 - c. Glucose
 - d. Phosphate
 - e. Ammonia

f. Water (you would be surprised at how many people missed this!!!)

11. How do ionic bonds compare with covalent bonds?

12. Compare and contrast hydrogen bonds and van der Waals interactions.

13. Define a dynamic chemical equilibrium in terms of quantities of reactants and products. This is a critical concept!

14. Why is water considered a polar molecule?

15. 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.

a. Cohesion

b. Adhesion

c. Surface tension

d. High specific heat

e. Heat of vaporization

f. Evaporative cooling

16. What is special about water and density?

17. Explain how these properties of water are related to the phenomena described in the statements below. More than one property may be used to explain a given phenomenon.

- a. During the winter, air temperatures in the northern United States can remain below 0°C for months; however, the fish and other animals living in the lakes survive.
- b. Many substances—for example, salt (NaCl) and sucrose—dissolve quickly in water.
- c. When you pour water into a 25-ml graduated cylinder, a meniscus forms at the top of the water column.
- d. Sweating and the evaporation of sweat from the body surface help reduce a human's body temperature.
- e. Water drops that fall on a surface tend to form rounded drops or beads.
- f. Water drops that fall on your car tend to bead or round up more after you polish (or wax) the car than before you polished it.
- g. If you touch the edge of a paper towel to a drop of colored water, the water will move up into (or be absorbed by) the towel.

18. Define the following terms:

- a. Solute

- b. Solvent
- c. Aqueous solution
- d. Hydrophilic
- e. Hydrophobic
- f. Molarity

19. MOLARITY

A. Concentration – *comparison of solute to solvent (solute : solvent)*

- a. Concentrated – *large ratio of solute to solvent*
- b. Dilute – *small ratio of solute to solvent*

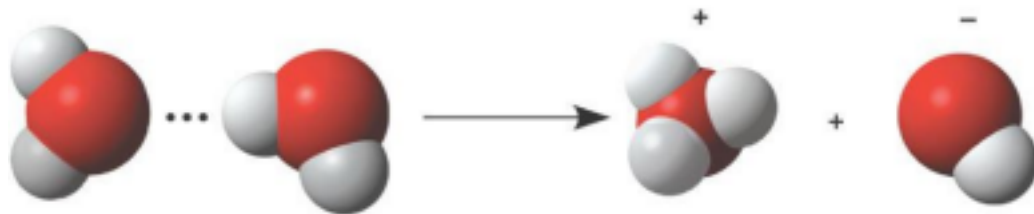
B. Molarity – <http://www.wikihow.com/Calculate-Molarity> and <https://www.youtube.com/watch?v=O7xi3SVbKw4&t=4s>

- a. Symbol – M
- b. Equation – $M = \frac{\text{moles of solute}}{\text{L of solution}}$

C. Example Problems

1. What is the molarity of a solution formed by mixing 10.0 g of H ₂ SO ₄ with enough water to make 0.100 L of solution?	2. To prepare 10.5 L of a 2.50 M solution of KOH, how many grams of potassium hydroxide must be used?
3. How many moles of LiBr must be added to .650 L of water to make a 2.0 M solution?	4. What is the molarity of the solution produced when 145 g of NaCl is dissolved in sufficient water to prepare 2.75 L of solution?
5. How many grams of KCl are needed to prepare 0.750 L of a 1.50 M solution?	6. What is the molarity of the solution produced when .594 mol of HCl is dissolved in 0.385 L of water?
7. To produce 3.00 L of a 1.90 M solution of sodium hydroxide, how many grams of NaOH must be dissolved?	8. If 8.77 g of KI are dissolved in enough water to make 4.75 L of solution, what is the molarity of the solution?

20. Label the diagram below to demonstrate the dissociation of the water molecule and then relate this diagram to the term pH.



21. What defines an acid and a base?

22. Why are small changes in pH so important in biology?

23. What is special about carbon that makes it the central atom in the chemistry of life?

24. Be familiar with each of the following functional groups – know its chemical compound and the functional properties

a. Hydroxyl

b. Carbonyl

c. Carboxyl

d. Amino

e. Sulfhydryl

f. Phosphate

Biology Prefixes and Suffixes-The Language of Science

The main reason students find it difficult to understand science is because of all the hard to write, spell and read words. Actually, scientific vocabulary is a mix of small words that are linked together to have different meanings. If you learn the meanings of the little words, you'll find scientific vocabulary much easier to understand. Find the meaning to the following Greek/Latin root words.

Word	Meaning
a / an	
meso	
leuco	
aero	
anti	
amphi	
aqua / hydro	
arthro	
auto	
bi / di	
bio	
cephal	
chloro	
chromo	
cide	
cyto	
derm	
haplo	
ecto (exo)	
endo	
epi	

gastro	
genesis	
herba	
hetero	
homo	
ov	
kary	
neuro	
soma	
saccharo	
primi / archea	
phyll	

Word	Meaning
hemo	
hyper	
hypo	
intra	
-itis	
lateral	
-logy	
-lysis	
-meter	

mono	
morph	
micro	
macro	
multi / poly	
pod	
-phobia	
-philia	
proto	
photo	
psuedo	
synthesis	
sub	
troph	
therm	
tri	
zoo, zoa	
-tropism	
-taxis	
-stasis	
zyg / zygous	
phago	
path / pathy	
sym / syn	

Identifying Independent and Dependent Variables in Experiments

Goal: To demonstrate student understanding of independent and dependent variables

Procedure - Part I: Identify the dependent and independent variable in each of the eight investigations below. Remember the following definitions:

INDEPENDENT VARIABLE	The factor manipulated (or changed) by the scientist. This might also be described as the change made by the experimenter on purpose.
DEPENDENT VARIABLE	The factor (or result) which changes because of what the scientist does. The dependent variable is the change that occurs because of what the experimenter does; it gets changed by the independent variable. It is sometimes called the responding variable. This is the variable that the scientist measures because it is changed as a result of the IV.

Example: You are investigating how soil type influences bean stem growth. In your investigation...

a. Independent variable (the variable that you are changing) is types of soil used.

b. Dependent variable (the results) would be the growth of bean stems.

1. Is plant growth affected by the color of light in which it grows?
 - a. Independent variable:
 - b. Dependent variable:
 - c. Some Controlled variables:
2. Which laundry detergent removes stains more effectively?
 - a. Independent variable:
 - b. Dependent variable:
 - c. Some Controlled variables:
3. Does the type of oil affect the size of popcorn?
 - a. Independent variable:
 - b. Dependent variable:
 - c. Some Controlled variables:
4. Which type of paper towel is more absorbent?
 - a. Independent variable:
 - b. Dependent variable:
 - c. Some Controlled variables:
5. Which battery has the longest life span?
 - a. Independent variable:
 - b. Dependent variable:
 - c. Some Controlled variables:
6. Which paint resists weathering more effectively?
 - a. Independent variable:
 - b. Dependent variable:
 - c. Some Controlled variables:
7. Do different types of music affect student math accuracy?
 - a. Independent variable:
 - b. Dependent variable:
 - c. Some Controlled variables:
8. How do different salts affect the melting point of ice?
 - a. Independent variable:
 - b. Dependent variable:
 - c. Some Controlled variables:

Identifying Independent and Dependent Variables in Experiments

Part II: Evaluation

1. Explain how you know which variable in an experiment is the independent variable.
2. What question can you ask to help you identify the dependent variable?

Identifying Independent and Dependent Variables in Experiments

Identifying Independent & Dependent Variables

Goal: To demonstrate student understanding of independent and dependent variables

Procedure - Part I: Identify the dependent and independent variable in each of the eight investigations below. Remember the following definitions:

INDEPENDENT VARIABLE	The factor controlled (or changed) by the experimenter. This might also be described as the change that I, the experimenter, makes on purpose. It is sometimes called the manipulated variable.
DEPENDENT VARIABLE	The factor (or result) which changes because of what the experimenter does. The dependent variable is the change that occurs because of what the experimenter does; it gets changed by the independent variable. It is sometimes called the responding variable. It usually is measured in some manner.

1. What is the effect of scary movies on pulse rate?
 - a. Independent variable:
 - b. Dependent variable:
2. What is the effect of heat on ice melting?
 - a. Independent variable:
 - b. Dependent variable:
3. What is the effect of different types of oil on the amount of time it takes for the gears to reach a temperature of 30°C?
 - a. Independent variable:
 - b. Dependent variable:
4. What is the effect of higher levels of calcium on dendrite synapse relay time?
 - a. Independent variable:
 - b. Dependent variable:
5. Which restaurant has the least amount of *Escherichia coli* (bacteria) in their rice.
 - a. Independent variable:
 - b. Dependent variable:
6. The most expensive air freshener will kill the least number of bacteria.
 - a. Independent variable:
 - b. Dependent variable:
7. What is the effect of trajectory angle on distance traveled?
 - a. Independent variable:
 - b. Dependent variable:
8. Increased levels of pollution will increase the number of mutations in frogs.
 - a. Independent variable:
 - b. Dependent variable:
9. Sodium Chloride will dissolve the fastest in water at a temperature of 100°C.
 - a. Independent variable:
 - b. Dependent variable:
10. Listening to Jazz music will increase science test grades.
 - a. Independent variable:
 - b. Dependent variable:
11. Longer school days will result in improved student grades.
 - a. Independent variable:
 - b. Dependent variable:

Identifying Independent and Dependent Variables in Experiments

Hair Coloring Experiment

We test a new brand of red hair coloring (Red Hair Paint) on 6th grade students at Beville Middle School to see how well the coloring "takes" and lasts on different colors of hair. We compare "Red Hair Paint" to a popular brand already being used, L'Oreal. We test both brands of coloring on 40 students (10 blonds, 10 brunettes, 10 with black hair and 10 with red hair)...some with straight hair and some with curls. The students use the coloring for two months, under identical washing and combing conditions and in the same kinds of environments (temperature, humidity, etc). Identify the following:

INDEPENDENT VARIABLE	
LEVELS OF THE INDEPENDENT VARIABLE	
DEPENDENT VARIABLE	
CONSTANTS	
CONTROL	
REPEATED TRIALS	
EXPERIMENTAL GROUP (what we are testing it on)	

Does Salt Affect Boiling Point of Water?

A student wonders if adding salt to fresh water will change the temperature at which the water boils. In her kitchen, she puts 1L of fresh water into 2 pans (one pan is large, the other is small), then adds 50 grams of salt to the water in the small pan. She places both pans on the stove, uses a thermometer to obtain their starting temperatures and then turns both heating elements to the same high temperature. She continues to monitor the water temperatures in both pans of water until they both boil. Identify the following parts of the experimental design process.

INDEPENDENT VARIABLE	
LEVELS OF THE INDEPENDENT VARIABLE	
DEPENDENT VARIABLE	
CONSTANTS	
CONTROL	
REPEATED TRIALS	
EXPERIMENTAL GROUP (what we are testing it on)	

Identifying Independent and Dependent Variables in Experiments

Experimental Procedure

You are conducting an experiment designed to investigate the effect of chemicals upon plants.

Two groups of plants (Group 1 and Group 2) were planted in identical pots, with identical soils, in identical lighting and temperature environments, receiving identical amounts of water and fertilizer. Every day Group 2 plants also received small, measured amounts of acid mixed with the water that they received.

Identify the following items:

1. Constants:
2. Control Group (if there is one):
3. Independent Variable
4. Dependent Variable

SpongeBob Clean Pants

SpongeBob noticed that his favorite pants were not as clean as they used to be. His friend, Sandy, told him that he should try using Clean-O detergent, a new brand of laundry soap she found at Sail Mart. SpongeBob made sure to wash one pair of pants in plain water and another pair in water with the Clean-O detergent. After washing both pairs of pants three times each, the pants washed in the Clean-O detergent did not appear to be any cleaner than the pants washed in plain water.

Answer the following questions:

1. What was the problem SpongeBob wanted to investigate?
2. What is the independent variable?
3. What is the dependent variable?
4. What should be SpongeBob's conclusion?

Identifying Independent and Dependent Variables in Experiments

Squidward's Symphony

Squidward loves playing his clarinet and believes it attracts more jellyfish than any other instrument he has played. In order to test his hypothesis, Squidward played a song on his clarinet for a total of 5 minutes and counted the number of jellyfish he saw in his front yard. He played the song a total of 3 times on his clarinet, and then repeated the experiment using a flute and a guitar. He also recorded the number of jellyfish he observed when he was not playing an instrument. The results are shown in the chart.

1. What is the independent variable?

Number of Jellyfish Attracted By Each Instrument				
Trial	Without Music	Clarinet	Flute	Guitar
1	5	15	5	12
2	3	10	8	18
3	2	12	9	7

2. What is the dependent variable?

3. What should be Squidward's conclusion?

4. Are the results reliable? Why or why not?

Super Bubbles

Patrick and SpongeBob love to blow bubbles! Patrick found some Super Bubble Soap at Sail-Mart. The ads claim that Super Bubble Soap will produce bubbles that are twice as big as bubbles made with regular bubble soap. Patrick and SpongeBob made up two samples of bubble solution. One sample was made with 5 oz. of Super Bubble Soap and 5 oz. of water, while the other sample was made with the same amount of water and 5 oz. of regular bubble soap. Patrick and SpongeBob used their favorite bubble wands to blow 10 different bubbles and did their best to measure the diameter of each one. The results are shown in the chart.

1. What did the Super Bubble ads claim?

2. What is the independent variable?

3. What is the dependent variable?

4. Look at the results in the chart. 5.
Calculate the average diameter for each
bubble solution.

- a. Super Bubble = _____ cm
Regular Soap = _____ cm

b. What should be their conclusion?

Bubbles (Diameter in centimeters)		
Bubble	Super Bubble Soap	Regular Bubble Soap
1	15	10
2	10	5
3	12	16
4	18	14
5	22	11
6	13	12
7	16	11
8	18	15
9	15	13
10	12	6

6. Are the results reliable? Why or why not?