AP Biology Summer Work

Due Thursday, August 7, 2025

Hebrews 13:8: "Jesus Christ is the same yesterday and today and forever."

Cambridge Christian School

60th 1964-2024 ANNIVERSARY

AP Biology Summer Assignment 2025

Hello! Welcome to AP Biology! I'm so excited to be your teacher next year and show you how amazing God is through the study of life in AP Biology! As some of you already know, I took AP Biology as a senior in high school and it forever changed the trajectory of my life…I hope to do that for you, too! After I took this class, I knew I would major in Biology in college and it would always be a part of my professional life.

So we start off strong, there is a little work for you to do over the summer. I tried to keep it reasonable so you can still enjoy your summer but still come to class in August ready to go! This summer work will go over some of the scientific practices you will be expected to do in AP Biology as well as some basic Chemistry (most of you are already experts at this part!) and latin prefixes/suffixes. The websites will get you started, but don't worry if you don't understand it all right now. We will cover this in class as the first topic for the year. We are forced to go at an accelerated pace, so the more you know on the first day of school, the better off you will be! If you do not do the summer assignment, you will start behind in the course.

The summer assignment is due the first day of class, on Thursday, August 7, 2025. It is worth 50 points.

I can't wait to share this amazing learning experience with you all! Have a great summer and feel free to email me know if you have any questions at wwilson@ccslancers.com.

In Him,

Mrs. Wilson

p.s. If you want access to a free AP Biology textbook over the summer, you can use openstax until you get your textbook in August. Here is the link: https://openstax.org/details/books/biology-ap-courses

Part I: Video learning Bozeman Science

We will be using a lot of videos for Bozeman science this year as homework so this will give you a good introduction to the host, Mr. Anderson. Each video is about 10 minutes but allow yourself extra time to pause the video and answer the questions.

1) Video 1 – Water as a Polar Molecule – 10 pts.
2) Video 2 – Molecules of Life – 10 pts.

AP Biology Video #1 – Bozeman Video Guide: Water As A Polar Molecule – 10 pts

Video link:https://www.bozemanscience.com/water-a-polar-molecule/

1. What is the definition of a polar molecule: _____
2. Oxygen is highly electronegative. What does this mean? _____
   _____
3. As you go across the periods of the periodic table, electronegativity _____
4. As you go up the groups of the periodic table, electronegativity _____
5. In a water molecule, what is the partial charge on Oxygen? _____What is the partial charge on the 2 Hydrogens? _____
6. Why does water behave like a magnet?

7. The bond between oxygen and hydrogen on **different** water molecules is a _____bond
8. The bond between oxygen and hydrogen **within** a water molecule is a _____bond
9. Draw the hydrogen bonds between the five water molecules show at 2:28 (pause the video here!)

10. Using the table below, describe the five properties of water that are due to its polarity.

Property	Description	"Real life" application of this property
High specific heat		
Good Solvent		
Cohesion		
Capillary action		
Ice floats		

11. Why is Seattle warmer in the winter than Yellowstone, even though both locations are at similar latitudes?

12. What does "like dissolves like" mean?

13. Why is it "good" for aquatic organisms that live in cold climates that ice floats?

AP Biology Video #2 – Molecules of Life – 20 pts

Video link: https://youtu.be/QWf2jcznLsY?si=z0tnRgiVZSfG5q-1

1. We eat _____and it's building blocks are weaved together to make _____ things.
2. The_____in the burger are broken down into _____ _____and these make proteins in people like you.
3. The carbohydrates in the bun are broken down into sugars and used in _____ _____to make _____to move materials inside you.
4. The _____inside the burger is used to make the_____membrane of us.
5. Life is built on _____. The reason why is that carbon has _____valence _____. So carbon is really good at _____. Carbon makes fairly large, stable molecules and that's what we are.
6. Life is made up of huge _____ chains. On the outside of those chains are _____groups. They give _____to the chemical group.
7. Describe the carboxyl group:
8. Describe the amino group:
9. Describe the carbonyl group:
    - What is the difference between a ketone and an aldehyde?
10. Describe the methyl group:
11. Describe the phosphate group:
12. Describe the hydroxyl group:
13. What type of molecule contains both a carboxyl group and an amino group?
14. Most molecules are _____, which are made up of Monomers.
15. What process builds polymers? _____ synthesis;
    - removing a molecule of _____forms a bond.
16. What process breaks down polymers?
    - Adding a molecule of _____breaks a bond.

THERE ARE FOUR MAJOR MACROMOLECULES:

NUCLEIC ACIDS

17. Two kinds of nucleic acids are _____and _____. DNA stores _____inside the cell.

18. Both are polymers and their building blocks are _____. Each nucleotide has a base, a _____and a phosphate group.

19. We get our DNA by eating _____, breaking it down into monomers, then building polymers.

PROTEINS

20. These are made of amino acids, which contain an _____group and a _____ group, then a H, N, and an side chain. The R group is different for each _____acid. We have 20 amino acids that are needed by humans to _____.

21. Proteins are huge three dimensional structures that sometimes are made up of _____of _____acids attached together. Proteins have a specific shape which will give the protein its function.

LIPIDS

22. These can be used to build _____ _____.

23. Lipids can be _____or _____. Saturated will have _____around the molecule. Unsaturated will have a _____ bond in the middle.

CARBOHYDRATES

24. Carbs come in 3 types; monosaccharides, disaccharides, and _____.

25. Starch in the form of potatoes or _____are a bunch of _____ molecules.

26. Starch is broken down using so that we can use the _____ in cellular respiration.

Part II – Chemistry Review - 20 pts.

OBJECTIVES

I: Elements, Atoms, and Atomic Structure

1. a. Understand that living things are composed of the same materials as the rest of the universe. There is no special living material. The main difference between living and nonliving is the relative degrees of complexity.

   b. Understand that life is consistent with all of the principles of chemistry and physics.

2. a. Name the six most abundant elements found in the human body.

   b. Define trace element and briefly explain why they are important. (Also give a specific example of their importance.)

3. Describe the modern model of atomic structure.
4. Use the periodic table to determine the number of protons, neutrons and electrons in atoms of any given element.
5. Distinguish between the isotopes of a given element.

II: Bonding

1. Name three factors that influence the interactions between atoms, resulting in compounds.
2. Given a chart of electronegativities, determine whether two atoms will form a bond that is nonpolar covalent, polar covalent, or ionic.
3. Describe the formation of ionic bonds.

III: Symbols, Formulas, and Equations

1. Recognize the symbols of the twenty-five elements commonly found in living organisms.
2. Interpret the information provided in the chemical formula of important biological molecules.
3. Interpret the information provided in a chemical equation.
   - Identify the reactants and products.
   - Interpret the meaning of the arrow(s) written between the reactants and products.

INTRODUCTION

The information and questions in this packet are designed to help you review the relevant concepts and skills from chemistry that you will need to be successful in AP Biology. Use the text contained in the packet, as well as any reputable resources available, to answer the question. **Red font** indicates important vocabulary terms that you should know and understand. **BOLD PRINT** indicates the questions that need to be answered.

I. Elements, Atoms, and Atomic Structures

Explain the following statement in your own words: "Living things are made of the same materials as the rest of the universe."

_____

_____

_____

A. The universe is composed of about 92 naturally occurring elements. In nature, most of these elements are found in combination with one or more other elements. These combinations of elements are called compounds. Twenty-five of the known chemical elements are commonly found as part of compounds that make up living things. Eleven of these 25 elements are found in significant amounts, while the remaining 14 are found only in trace amounts.

List the six elements found in greatest abundance in the human body in order from most to least abundant.

_____ _____ _____

_____ _____ _____

Make up a mnemonic device to assist you in remembering these six elements in order from most to least abundant. Write your mnemonic on the lines below.

_____

_____

B. The periodic table is used to organize a great deal of information about the elements. Among the information presented for each element is the atomic number and the atomic mass. The representation of the element carbon from the periodic table is shown below

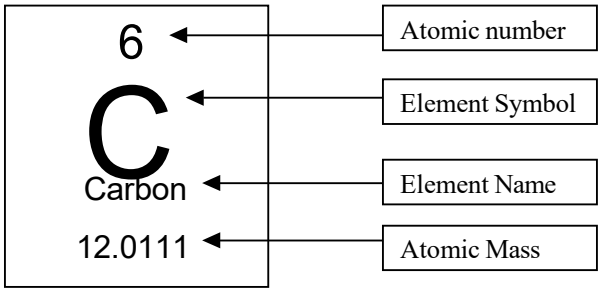


Figure 1.1

The nucleus of an atom is made up of a cluster of two kinds of particles called **protons** and **neutrons**. Protons have a positive charge and neutrons have no charge- they are neutral. A cloud of negatively charged **electrons** surrounds the nucleus. The **atomic number** and the **atomic mass** provide information about the number of protons and neutrons found in atoms of the element. In the case of carbon, the atomic number indicates that there are 6 protons in the nucleus of carbon atoms. Typically, the mass number of an element is not provided on the periodic table. This number is usually provided within a problem and will be equal to the sum of protons and neutrons.

In Figure 1.1, the mass number indicates that there are twelve particles in the nucleus of the carbon atom. If there are 12 particles in the nucleus, and 6 of the 12 particles are protons (equal to the atomic number), then the remaining 6 particles (12 - 6 = 6) are neutrons. The number of electrons in an atom is equal to the number of protons. The negative charge of the electrons balances the positive charge of the protons in the nucleus. Thus the atom, as a whole, is neutral

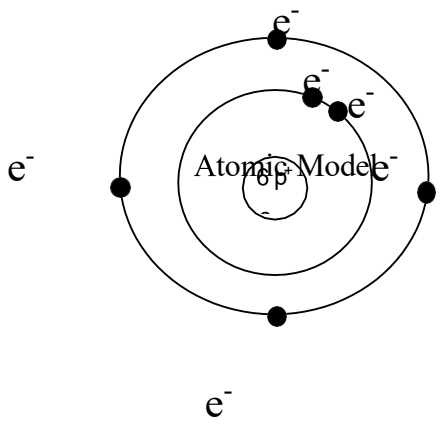


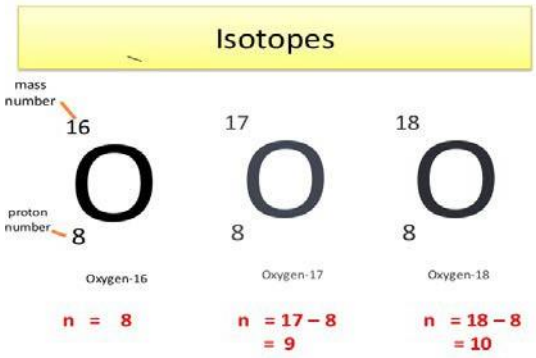
Figure 1.2

Use the periodic table on the last page of this packet to determine the number of protons, neutrons, and electrons in atoms of any given element OR consult
http://www.webelements.com/webelements/scholar/index.html

Find the number of protons, neutrons, and electrons in atoms of each of the following elements (Carbon is done for you).

Element	Protons	Neutrons	Electrons
Oxygen			
Carbon	6	6	6
Hydrogen			
Nitrogen			
Phosphorous			
Sulfur			
Calcium			
Potassium			

C. The number of protons in the nucleus of an atom determines its identity. For example, all carbon atoms have 6 protons (the atomic number, Z = 6). There are no exceptions. However, not all atoms of the same element contain the same number of neutrons. For example, most atoms of carbon contain 6 neutrons, but some contain seven neutrons and some contain 8 neutrons. These atoms, referred to respectively as carbon-12, carbon-13 and carbon-14, are said to be **isotopes** of carbon. Isotopes are atoms of the same element that contain different numbers of neutrons. The atomic number (Z) and the mass number (A) can be included in the symbol of an element to distinguish between the isotopes of an element. For example, the most common isotope of the element oxygen has Z = 8, and A = 16. The symbols for the different isotopes of oxygen can be written



What would be the symbols for the three isotopes of carbon referred to above?

C **C** **C**

Complete the following table:

Isotope	Atomic Number	Mass Number	# of Protons	# of Neutrons	# of Electrons
^{14}N	7			7	
^{15}N					
^{31}P		31			15
^{32}P					
^{32}S	16		16		
^{35}S					

II. Bonding

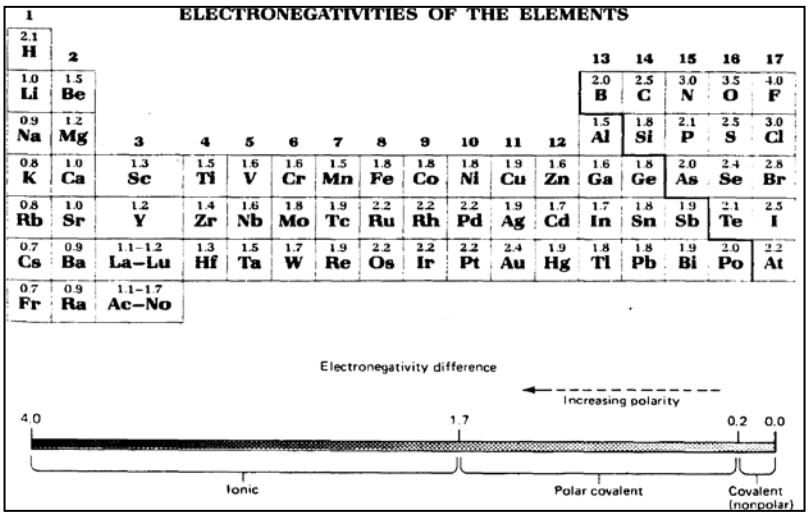
D. There are three factors that influence whether atoms of an element will interact with other atoms to form a compound:
   - The tendency for electrons to occur in pairs.
   - The tendency of atoms to balance positive and negative charges. Atoms and molecules are neutral.
   - The tendency of the outer shell, or energy level, of electrons to be full. This is the octet rule.

E. The attraction an atom has for the shared pair of electrons in a covalent bond is called the atom's **electronegativity**. The difference between the electronegativities of two atoms in a bond can be used as a guide to determine the degree of electron sharing in the bond. As the difference increases, the degree of sharing decreases. If the difference in electronegativities between the two atoms is zero, then the pair of bonding electrons is shared equally. The bond formed between these atoms is called a **nonpolar covalent bond**. On the other hand, if the difference between electronegativities is 1.7 or greater, then electrons are transferred from one atom to the other. In such a case, the element of greater electronegativity is said to exist as a negative ion, while the element of lesser electronegativity exists as a positive ion. The electrostatic attraction between the two oppositely charged ions is called an **ionic bond**.

Molecules that contain bonds with electronegativity differences between 0 and 1.7 are considered to be covalent but with unequal sharing of electrons. They are **polar covalent bonds**. In the HCl molecule, for example, chlorine has the greater electronegativity- 3.0 in comparison to 2.1 for hydrogen). The difference between the two electronegativities is 0.9. The electrons are shared unequally. In such a case, the atom with the greater electronegativity takes on a partial negative charge (between 0 and -1) as the shared pair of electrons spend more time nearby. The other atom takes on a partial positive charge (less than +1). The chart below will enable you to predict the character of bonds between any two atoms that we may need to deal with in biology.

δ+ δ–

H—CL



III. Symbols, Formulas, and Equations

F. Chemists use chemical symbols, formulas, and equations when speaking and writing about matter and the changes it undergoes. When possible, the **symbol** consists of a single letter, usually the first letter of the name of the element. In cases where several elements have names that begin with the same letter, two letters are used. For example, calcium (Ca), cobalt (Co), chromium (Cr), and chlorine (Cl). No symbol contains more than two letters and the first letter is always capitalized. Some symbols are abbreviations of the Latin names of the elements. Among the twenty-five elements commonly found in the human body, only 5 of them have Latin names. These are: potassium (K), sodium (Na), copper (Cu), iron (Fe), and tin (Sn).

A **formula** is a single symbol or a group of symbols which represents the composition of a substance. The symbols in the formula identify the elements present in the substance.

Subscripts are used in the formulas to indicate the number of atoms in the compound, but only when more than one atom of a given element is present. For example, the formula for water, H_2O indicates that each molecule contains two atoms of hydrogen and one atom of oxygen. Recall that the algebraic sum of the positive oxidation numbers and the negative oxidation numbers of the atoms and ions present in a compound must always be zero. Since the sum of the oxidation numbers is zero, a compound is neutral, that is it has no net charge.

G. Atoms are the fundamental particles of the elements that enter into chemical changes. Substances that take part in chemical changes are made up of atoms in the form of molecules or ions (ions are atoms or groups of atoms that are electrically charged). Chemical changes involve the regrouping of atoms or ions to form other substances. The **chemical equation** is the chemist's shorthand expression for describing a chemical change, and the symbols and formulas are used to indicate the composition of the substances involved in the change. Refer to the equation below.

$$2H_{2(g)} + O_{2(g)} \rightarrow 2\ H_2O_{(l)}$$

This formula states that 2 moles (or molecules) of hydrogen gas react with 1 mole (or molecule) of oxygen gas to yield 2 moles (or molecules) of water which condenses as liquid. The numbers written in front of the formulas are called **coefficients**, and they indicate the number of moles (or molecules) of the substance required as a reactant or formed as a product. The arrow indicates the direction of the reaction and can be read as "produces," "yields," or "forms." The subscripted letters in parentheses indicate the state of matter. The following conventions are used:

(s) – indicates a solid

(l) – indicates a liquid

(g) or ↑ – indicates a gas

(aq) – indicates the substance is in aqueous solution

↓ – indicates that a solid precipitate forms in an aqueous solution

PERIODIC CHART OF THE ELEMENTS

IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA or O
1 H 2.1 hydrogen 1.01															2 – He helium 4.00
3 1.0 Li lithium 6.94	4 1.5 Be beryllium 9.01											5 2.0 B boron 10.81	6 2.5 C carbon 12.01	7 3.0 N nitrogen 14.01	8 3.5 O oxygen 16.00	9 4.0 F fluorine 19.00	10 – Ne neon 20.17
11 0.9 Na sodium 22.99	12 1.2 Mg magnesium 24.31									13 1.5 Al aluminum 26.98	14 1.8 Si silicon 28.09	15 2.1 P phosphorus 30.97	16 2.5 S sulphur 32.06	17 3.0 Cl chlorine 35.45	18 – Ar argon 39.95
19 0.8 K potassium 39.10	20 1.0 Ca calcium 40.08	21 1.3 Sc scandium 44.96	22 1.5 Ti titanium 47.90	23 1.6 V vanadium 50.94	24 1.6 Cr chromium 52.00	25 1.5 Mn manganese 54.94	26 1.8 Fe iron 55.85	27 1.8 Co cobalt 58.93	28 1.8 Ni nickel 58.71	29 1.9 Cu copper 63.55	30 1.6 Zn zinc 65.38	31 1.6 Ga gallium 69.74	32 1.6 Ge germanium 72.59	33 2.0 As arsenic 74.92	34 2.4 Se selenium 78.96	35 2.8 Br bromine 79.90	36 – Kr krypton 83.80
37 0.8 Rb rubidium 85.47	38 1.0 Sr strontium 87.62	39 1.3 Y yttrium 88.91	40 1.4 Zr zirconium 91.22	41 1.6 Nb niobium 92.91	42 1.8 Mo molybdenum 95.94	43 1.9 Tc technetium 98.91	44 2.2 Ru ruthenium 101.07	45 2.2 Rh rhodium 102.91	46 2.2 Pd palladium 106.40	47 1.9 Ag silver 107.87	48 1.7 Cd cadmium 112.41	49 1.7 In indium 114.82	50 1.8 Sn tin 118.69	51 1.9 Sb antimony 121.75	52 2.1 Te tellurium 127.60	53 2.5 I iodine 126.90	54 – Xe xenon 131.30
55 0.7 Cs cesium 132.91	56 0.9 Ba barium 137.33	57-71	72 1.3 Hf hafnium 178.49	73 1.5 Ta tantalum 180.95	74 1.7 W tungsten 183.85	75 1.9 Re rhenium 186.21	76 2.2 Os osmium 190.20	77 2.2 Ir iridium 192.22	78 2.2 Pt platinum 195.09	79 2.4 Au gold 196.97	80 1.9 Hg mercury 200.59	81 1.8 Tl thallium 204.37	82 1.8 Pb lead 207.19	83 1.9 Bi bismuth 208.98	84 2.0 Po polonium (209)	85 2.2 At astatine (210)	86 – Rn radon (222)
87 0.7 Fr francium (223)	88 0.9 Ra radium 226.03	89-103	104 – Rf rutherfordium (260)	105 – Ha hahnium (260)	106 – (263)	107 –											

KEY

ATOMIC NUMBER →
ELECTRONEGATIVITY →
NAME OF THE ELEMENT →
ATOMIC MASS →

1 2.1 H hydrogen 1.01 ← SYMBOL OF THE ELEMENT

BASED ON $^{12}_{6}C$

( ) INDICATES MASS OF THE MOST STABLE ISOTOPE

NOTE: The legend at right denotes the physical state of the elements at 101 kPa and 298.15 K (25°C)

LEGEND

SOLID

LIQUID

GAS

57 1.1 La lanthanum 138.91	58 1.1 Ce cerium 140.12	59 1.1 Pr praseodymium 140.91	60 1.2 Nd neodymium 144.24	61 – Pm promethium (145)	62 1.2 Sm samarium 150.35	63 – Eu europium 151.96	64 1.1 Gd gadolinium 157.25	65 1.2 Tb terbium 158.93	66 – Dy dysprosium 162.50	67 1.2 Ho holmium 164.93	68 1.2 Er erbium 167.26	69 1.2 Tm thulium 168.93	70 1.1 Yb ytterbium 173.04	71 1.2 Lu lutetium 174.97
89 1.1 Ac actinium (227)	90 1.3 Th thorium 232.04	91 1.5 Pa protactinium 231.04	92 1.7 U uranium 238.03	93 1.3 Np neptunium 237.05	94 1.3 Pu plutonium (244)	95 1.3 Am americium (243)	96 – Cm curium (247)	97 – Bk berkelium (247)	98 – Cf californium (251)	99 – Es einsteinium (254)	100 – Fm fermium (257)	101 – Md mendelevium (258)	102 – No nobelium (259)	103 – Lr lawrencium (260)

Part III– Root Word Investigation – Research each root word write definition - **10 pts**

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-	
chemo-	
-cide	
cyto-	
derm-	
haplo-	
ecto- / exo-	
endo-	
epi-	
gastro-	
-genesis	
herba-	
hetero-	
homo-	

Word	Meaning
hemo-	
hyper-	
hypo-	
intra-	
inter-	
lateral	
-logy	
-lysis	
-meter	
mono-	
morph-	
micro-	
macro-	
multi- / poly-	
-path / -pathy	
-ped /-pod	
phago-	
-phobic	
-philic	
proto-	
photo-	
pseudo-	
-stasis	
sub-	
sym- / -syn	
-synthesis	

Using Root words to define unknown words

Once you have completed the above root word table, use it to develop a SIMPLE definition, **in your own words,** for each of the following terms:

Example: "the study of water mechanics"

1. Hydrology _____
2. Cytolysis _____
3. Hydrolysis _____
4. Protein synthesis _____
5. Dehydration synthesis _____
6. photolysis _____
7. Hydrophobic _____
8. Hydrophilic _____
9. Phototrophism _____
10. Chemotaxis _____
11. Endocytosis _____
12. Exocytosis _____
13. Anaerobic _____
14. Aerobic _____
15. Autotroph _____
16. Monosaccharide _____
17. Disaccharide _____
18. Polysaccharide _____
19. Hypothermia _____
20. Biogenesis _____