Clearview Regional High School District
2019 Summer Assignment

Course:	AP Biology
Teacher:	Ms. Amanda McGeehan
Due Date:	Friday, September 6, 2019
Purpose of Assignment:	An understanding of chemistry is the basis for many topics covered in the AP Biology curriculum. To meet the rigorous demands of AP Biology, students will review fundamental chemistry concepts that they were introduced to in Honors Chemistry and Honors Biology. In addition to chemistry concepts, the students will also practice necessary math skills for AP Biology. Students will also review experimental design concepts from Honors Biology that they will use frequently in AP Biology. The overall goal of these assignments is to measure, maintain, and sharpen skills from previous science courses that will provide a foundation and preparation for AP Biology.
Description of Assignment:	1.) Students will view six brief video lectures on science statistics and graphing. The students will then use the information from these videos to complete a set of practice problems that address data sets, standard deviation, standard error, graphing, types of graphs and Chi-square analysis. 2.) Students will review concepts of designing a controlled experiment. They will review multiple experimental designs and identify variables, while assessing the design and quality of each biological experiment. 3.) Students will access the online textbook to read Chapter 2: *The Chemical Context of Life*. Students will answer questions that pertain to the reading. This chapter will review chemistry concepts. 4.) Students will access the online textbook to read Chapter 3: *Carbon and the Molecular Diversity of Life*. Students will answer questions that pertain to the reading. This chapter will review biochemistry concepts. 5.) Students will access the online textbook to read Chapter 4: *A Tour of the Cell*. Students will answer questions that pertain to the reading. This chapter will review the structure and function of cell organelles.
Grading/Use of Assignment: Category/Weight for Q1:	The 5 assignments will each count as a homework or daily grade for a total of 5 daily grades. Each assignment is due on Friday, September 6, 2019. The information in the summer work assignments will be assessed in the first unit test on or about **Monday, September 16, 2019.** Please note that the information contained within this assignment is an in-depth review of chemistry and biology concepts that you are expected to know coming in to AP Biology.
Specific Expectations:	Students are to write in complete sentences and clearly, providing enough information in explanations. Students are expected to show all work for any math problems. If you are unsure about a question, please answer it to the best of your ability. You may mark the question with a star or question mark, but leaving items blank is not acceptable. If you leave something blank, it will not receive points.

Where to Locate Assignment:	This assignment can be located on the district website: http://clearviewregional.edu/ This assignment can also be located on Ms. McGeehan's school website: http://clearview.oncoursesystems.com/websites/12761614 There are also hard copies of this assignment in classroom 214, Ms. McGeehan's classroom.
Teacher Contact Information:	Ms. McGeehan will check her e-mail weekly: mcgeehanam@clearviewregional.edu
Additional Help/ Resource(s):	**Bozeman Science Videos:** http://www.bozemanscience.com/ap-biology/ This website contains a list of clickable topics in AP Biology. When you find the topic you need help with, click on it and a short video lecture will begin to play that will include helpful information. **MasteringBiology:** Once you have signed up for the online textbook, you can access MasteringBiology at any time for video tutorials, practice quizzes and study resources: http://www.pearsonmylabandmastering.com/northamerica/

Dear AP Biology Students,

Welcome to AP Biology! You have signed up for an awesome class! You are going to work extremely hard, but you are going to learn so much about the world around you!

Our textbook is Campbell Biology In Focus: 1st edition. You will receive a copy of our textbook in September, but for the summer you will have online access to our complete textbook with some awesome additional resources. In order to complete your summer work, you will need to sign up for our online textbook, following the steps below:

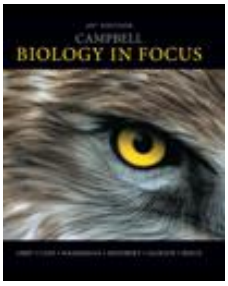
PLEASE try to sign up for the textbook access BEFORE the end of the school year. This way if you are having any trouble, you can stop by room 214 and I can give you some assistance.

1.) Visit this website: www.pearsonschool.com/access

2.) Enter these 6 letters of this access code: SSNAST

3.) Click on "Covered Titles" and then select "Science."

4.) Scroll down to select our textbook: **Campbell Biology in Focus (Urry) 1e AP® Edition Mastering Biology**.



5.) Once you have selected our textbook, click on "Student Registration."

6.) Read through the policies and click on "I Accept" to continue.

7.) You will then be prompted to create your Pearson account. (You will use this account at least once a week in our class, so it would be a good idea to write down your username and password so you do not forget it in September.)
Select "No" for "Do you have a Pearson Education account?" and create your unique username and password (don't forget to write it down).

At the bottom of the screen where it says "Access Code" you will type one of the following codes, based on your last name.

Last Names (alphabetically)	Textbook Access Code
Aiello – Haines	SSNAST-DROSS-MOGEN-ARGUE-POTTO-PORES
James – Yearis	SSNAST-TREAD-MOGEN-ARGUE-HOBBY-RULES

8.) On the next screen, enter your first name, last name and email address.

9.) Under “School Location” you will select “United States” and enter our zip code (08062). Clearview does not appear on the list of schools, so you will select “Other” from the drop down menu. Type “Clearview High School” in the “Other School Name” box and our city (Mullica Hill) and state (NJ).

10.) Select your security question and type your security question answer.

11.) On the next screen, you will click the orange button to login to Mastering Biology. You will be asked to enter a Course ID, select “Skip this step” for now. Once school begins, I will provide you with a unique Course ID for your class period.

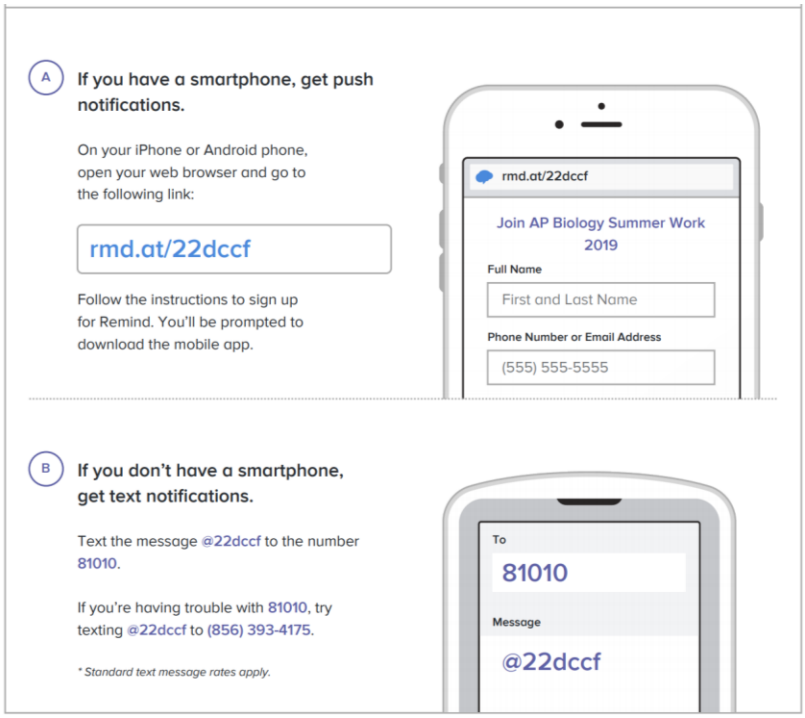
On the drop down menu below you will select our textbook, **Urry/Cain/Wasserman/Minorsky/ Jackson/Reece, Campbell Biology in Focus – AP Edition (High School), 1e.**

12.) On the next screen you will be given three options. The second, “Launch Your eText” is what you will need to complete your summer assignments.

Please take some time this summer to navigate the Mastering Biology website. After you have registered, the next time you sign in to the website, you will use this link:
http://www.pearsonmylabandmastering.com/northamerica/
Please be aware that Pearson, the textbook publisher, will sometimes shut down the website in the summer time for maintenance. Therefore, do not wait until the last minute to complete your summer work.

Have a great summer,
Ms. McGeehan

If there are any website issues this summer, I can let you know through Remind 101. Please sign up:



AP Biology Assignment #1: Necessary Math Skills

Directions: Believe it or not, you will need to have some necessary math skills for AP Biology. Most of these skills pertain to statistics and graphing. In this first assignment, you will view 5 Bozeman Science videos. Go to this website: https://www.youtube.com/watch?v=jf9VT4V4aRI&list=PLllVwaZQkS2omBpLjQm_BAQKsQ7lq86ku

Please view videos #1-5. 1.) Statistics for Science 2.) Standard Deviation 3.) Standard Error 4.) A Beginner's Guide to Graphing Data 5.) Graphing Data by Hand

Once you have watched each of these videos carefully, please complete Parts A and B below:

Part A: Statistics and Standard Deviation

1. Define and provide the symbol for each of the following:

Range:

Mode:

Median:

Mean:

Standard Error:

Standard Deviation:

2.) Practice Problem:

Consider the following three data sets A, B and C.

A = {9, 10, 11, 7, 13}

B = {10, 10, 10, 10, 10}

C = {1, 1, 10, 19, 19}

a.) Calculate the mean of each data set. Show your work.

b.) Calculate the standard deviation each data set. Show your work.

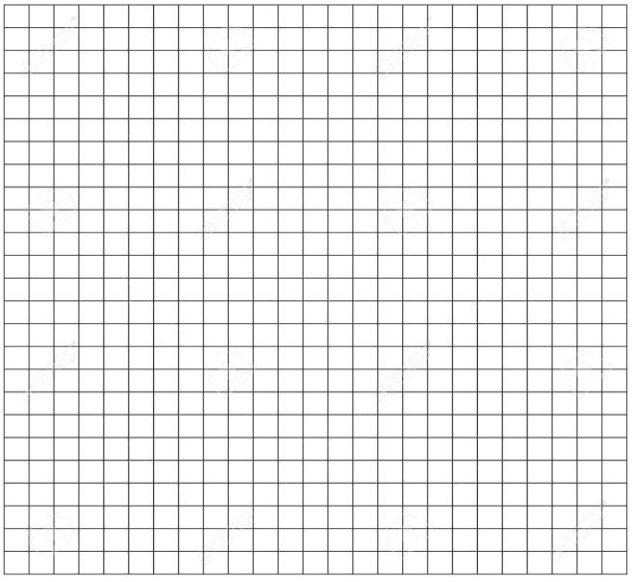
c.) Which set has the largest standard deviation?

d.) What is the standard error for each data set? Show your work.

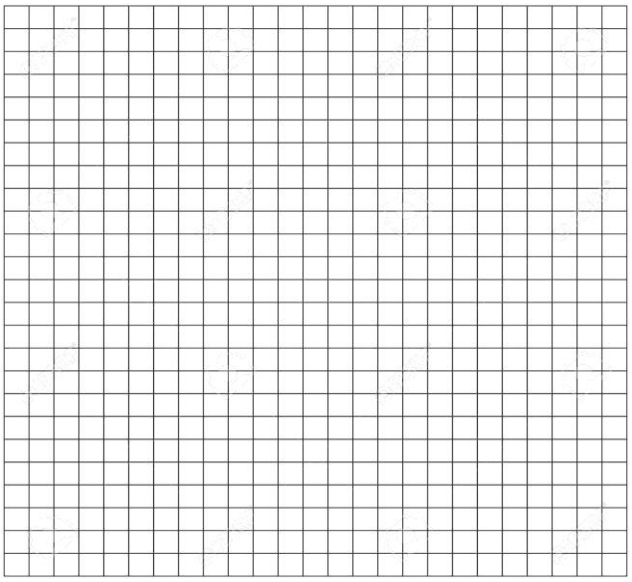
Part B: Types of Graphs

Describe when you would use each type of graph and provide an example. Include labels and titles.

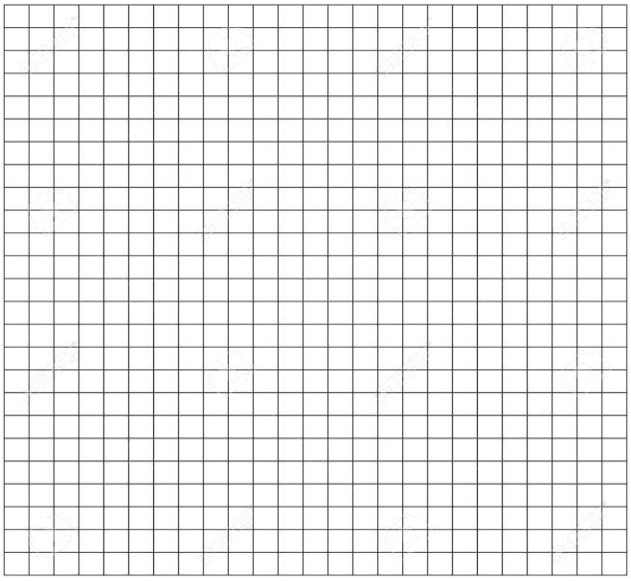
Line Graph:



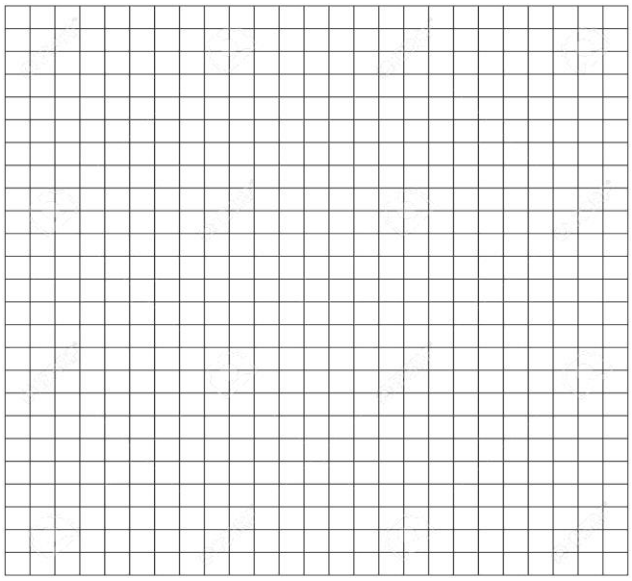
Scatter Graph:



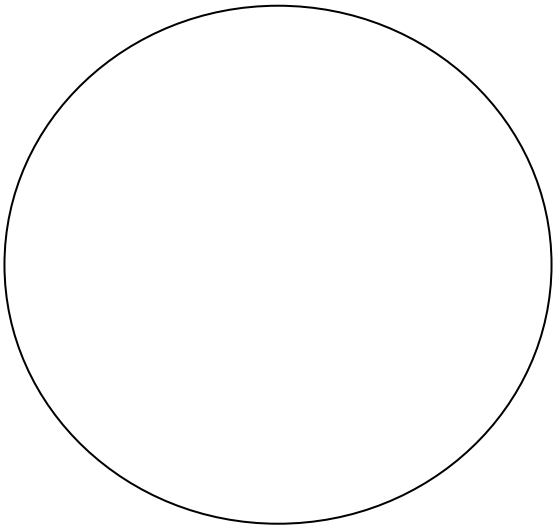
Bar Graph:



Histogram:



Pie Graph:



Directions for Part C: Throughout the course, we will complete Chi-Square tests on our data sets. To give you an introduction to this topic that we will begin on the second day of school, please watch this Bozeman Science video on Chi-Square: https://www.youtube.com/watch?v=WXPBoFDqNVk Once you have watched the video, please complete the following problem:

Using the Wet/Dry data at the end of the video, solve for the Chi-Square value and explain if there is any statistically significant difference between the observed and expected data. Please show all of your work.

AP Biology Assignment #2: Designing a Controlled Experiment

Directions: When Collegeboard™ changed the AP Biology curriculum a few years ago, they placed a major emphasis on the ability to design and conduct a controlled experiment. These are skills that you practiced in Honors Biology, but you will enhance in AP Biology. Please complete the following activity on experimental design.

STEP 1: DEFINING THE PROBLEM

Every scientific investigation begins with the question that the scientist wants to answer. The questions addressed by scientific inquiry are based on observations or on information gained through previous research, or on a combination of both. Just because a question can be answered doesn't mean that it can be answered *scientifically*.

1. Review the following questions and decide which of them you think can be answered by scientific inquiry. Please circle the questions you have selected.

   - What is the cause of AIDS?
   - Are serial killers evil by nature?
   - Why is the grass green?
   - What is the best recipe for chocolate chip cookies?
   - When will the Big Earthquake hit San Francisco?
   - How can the maximum yield be obtained from a peanut field?
   - Does watching television cause children to have shorter attention spans?

2. How did you decide what questions can be answered scientifically?

STEP 2: IDENTIFYING THE DEPENDENT VARIABLE(S)

The **dependent variable** is what the investigator measures (or counts or records). It is what the investigator thinks will vary during the experiment. For example, he may want to study peanut growth. One possible dependent variable is the height of the peanut plants.

3. Name some other aspects of peanut growth that can be measured.

STEP 3: IDENTIFYING THE INDEPENDENT VARIABLE

The **independent variable** is what the investigator deliberately varies during the experiment. It is chosen because the investigator thinks it will affect the dependent variable.

4. Name some factors that might affect the number of peanuts produced by peanut plants.

In many cases, the investigator does not manipulate the independent variable directly. He collects data and uses the data to evaluate the hypothesis, rather than doing a direct experiment. For example, the hypothesis that more crimes are committed during a full moon can be tested scientifically. The number of crimes committed is the dependent variable and can be measured from police reports. The phase of the moon is the independent variable. The investigator cannot deliberately change the phase of the moon, but can collect data during any phase he chooses.

Although many hypotheses about biological phenomena cannot be tested by direct manipulation of the independent variable, they can be evaluated scientifically by collecting data that could prove the hypothesis false. This is an important method in the study of evolution, where the investigator is attempting to test hypotheses about events of the past.

The investigator can measure as many dependent variables as he thinks are important indicators of peanut growth. By contrast he must choose only one independent variable to investigate in an experiment. For example, if the scientist wants to investigate the effect that the amount of fertilizer has on peanut growth, he will use different amounts of fertilizer on different plants; the independent variable is amount of fertilizer.

5. Why is the scientist limited to one independent variable per experiment?

Time is frequently used as the independent variable. The investigator hypothesizes that the dependent variable will change over the course of time. For example, he may want to study the diversity of soil bacteria found during different months of the year. However, the units of time used may be anywhere from seconds to years, depending upon the system being studied.

6. Identify the dependent and independent variables in the following examples.

a. Height of bean plants is recorded daily for 2 weeks.

Dependent variable:_____

Independent variable:_____

b. Guinea pigs are kept at different temperatures for 6 weeks. Percent weight gain is recorded.

Dependent variable:_____

Independent variable:_____

c. The diversity of algal species is calculated for a coastal area before and after an oil spill.

Dependent variable:_____

Independent variable:_____

d. Light absorption by a pigment is measured for red, blue, green, and yellow light.

Dependent variable:_____

Independent variable:_____

e. Batches of seeds are soaked in salt solutions of different concentrations, and

germination is counted for each batch.

Dependent variable:_____

Independent variable:_____

f. An investigator hypothesizes that the adult weight of a dog is higher when it has fewer littermates.

Dependent variable:_____

Independent variable:_____

STEP 4: IDENTIFYING THE STANDARDIZED VARIABLES

A third type of variable is the **standardized variable or controlled variable**. Standardized variables are factors that are kept equal in all treatments, so that any changes in the dependent variable can be attributed to the changes the investigator made in the independent variable.

Since the investigator's purpose is to study the effect of one particular independent variable, he must try to eliminate the possibility that other variables are influencing the outcome. This is accomplished by keeping the other variables at constant levels, in other words, by *standardizing* these variables. For example, if the scientist has chosen the amount of fertilizer as the independent variable, he wants to be sure that there are no differences in the type of fertilizer used. He would use the same formulation and same brand of fertilizer throughout the experiment.

7. What other variables would have to be standardized in this experiment?

STEP 5: WRITING THE HYPOTHESIS

A scientific question is usually phrased more formally as a **hypothesis**, which is simply a statement of the scientist's educated guess at the answer to the question. A hypothesis is usable only if the question can be answered "no". If it can be answered "no", then the hypothesis can be proven false. The nature of science is such that we can prove a hypothesis false by presenting evidence from an investigation that does not support the hypothesis. But we cannot prove a hypothesis true. We can only support the hypothesis with evidence from *this particular investigation*.

Scientific knowledge is thus an accumulation of evidence in support of hypotheses: it is not to be regarded as absolute truth. Hypotheses are accepted only on a trial basis. Future investigations may be able to prove any hypothesis false. Current scientific studies you read about in the newspaper (for example, investigations of the effects of caffeine) are sometimes quite preliminary and therefore tentative in nature. Often, studies are published whose results contradict each other. However, this does not mean that scientific knowledge is flimsy and unreliable. Much of the information in your textbook, for example, is based upon many experiments carried out by numerous scientists over a period of time.

The scientific method, then applies only to hypotheses that can be proven false through experimentation. (There are other types of scientific investigation, such as observation and comparison that do not involve hypothesis testing.) It is essential to understand this in order to understand what is and is not possible to learn through science. Consider, for example, this hypothesis: More people behave immorally when there is a full

moon than at any other time of the month. The phase of the moon is certainly a well-defined and measurable factor, but morality is not scientifically measurable. Thus there is no experiment that can be performed to test the hypothesis.

8. Propose a testable hypothesis for human behavior during a full moon.

9. Which of the following would be useful as scientific hypotheses? Give the reason for your decisions.

a. Plants absorb water through their leaves as well as through their roots.

b. Mice require calcium for developing strong bones.

c. Dogs are happy when you feed them steak.

d. The higher the intelligence of an animal, the more easily it can be domesticated.

e. HIV (human immunodeficiency virus) can be transmitted by cat fleas.

The investigator devises an experiment or collects data that could prove the hypothesis false. He should also think through the possible outcomes of the experiment (whether the hypothesis is supported or proven false) and make predictions about the effect of the independent variable on the dependent variable in each situation. For example, a scientist has made the following hypothesis: Increasing the amount of fertilizer applied will increase the number of peanuts produced. He has designed an experiment in which different amounts of fertilizer are added to plots of land and the number of peanuts yielded per plot is measured. The predictions should state specifically how the dependent variable will change in relation to the independent variable and must be stated as an If … Then statement. The general format for an If … Then statement is “if the independent variable is changed in this way, then the dependent variable will change this way.” For example, if the amount of fertilizer applied to a field is doubled, then the number of peanuts produced will double. Or, if the temperature of the reactants in a chemical reaction increases, then the rate of the reaction will increase.

10. Write a hypothesis for each of the following:
a. Guinea pigs are kept at different temperatures for 6 weeks. Percent weight gain is recorded.

b. Batches of seeds are soaked in salt solutions of different concentrations and the number of seeds that germinate is counted for each batch.

STEP 6: SETTING THE LEVELS OF TREATMENT

Once the investigator has decided what the independent variable for an experiment should be, he must also determine how to change or vary the independent variable. The values set for the independent variable are called the **levels of treatment**.
For example, an experiment measuring the effect of fertilizer on peanut yield has five treatments. In each treatment, peanuts are grown on a 100 m^2 plot of ground, and a different amount of fertilizer is applied to each plot. The levels of treatment in this experiment are set as 200 g, 400 g, 600 g, 800 g, and 1000 g fertilizer/100 m^2 .

The investigator's judgment in setting levels of treatment is usually based on prior knowledge of the system. For example, if the purpose of the experiment is to investigate the effect of temperature on weight gain in guinea pigs, the scientist should have enough knowledge of guinea pigs to use appropriate temperatures. Subjecting the animals to extremely high or low temperatures can kill them and no useful data would be obtained. Likewise, the scientist attempting to determine how much fertilizer to apply to peanut fields needs to know something about the amounts typically used so he could vary the treatments around those levels.

STEP 7: IDENTIFYING THE CONTROL TREATMENT

It is also necessary to include **control treatments** in an experiment. A control treatment is a treatment in which the independent variable is either eliminated or is set at a standard value. The results of the control treatment are compared to the results of the experimental treatments. In the fertilizer example, the investigator must be sure that the peanuts don't grow just as well with no fertilizer at all. The control would be a treatment in which no fertilizer is applied. An experiment on the effect of temperature on guinea pigs, however, cannot have a "no temperature" treatment. Instead, the scientist will use a standard temperature as the control and will compare weight gain at other temperatures to weight gain at the standard temperature.

11. Describe what an appropriate control treatment would be for each of the following examples.

a. An investigator studies the amount of alcohol produced by yeast when it is incubated with different types of sugar.

Control Treatment:_____

b. The effect of light intensity on photosynthesis is measured by collecting oxygen produced by a plant.

Control Treatment:_____

c. The effect of NutraSweet sweetener on tumor development in laboratory rats is investigated.

Control Treatment:_____

d. Subjects are given squares of paper that have been soaked in a bitter-tasting chemical. The investigator records whether each person can taste the chemical.

Control Treatment:_____

e. A solution is made up to simulate stomach acid at pH 2. Maalox antacid is added to the solution in small amounts, and the pH is measured after each addition.

Control Treatment:_____

STEP 8: DETERMINING REPLICATION

Another essential aspect of experimental design is **replication**. Replicating the experiment means that the scientist repeats the experiment numerous times using exactly the same conditions to see if the results are consistent. Being able to replicate a result increases our confidence in it. However, we shouldn't expect to get

exactly the same answer each time, because a certain amount of variation is normal in biological systems. Replicating the experiment lets us see how much variation there is and obtain an average result from different trials.

A concept related to replication is **sample size**. It is risky to draw conclusions based upon too few samples. For instance, suppose a scientist is testing the effects of fertilizer on peanut production. He plants four peanut plants and applies a different amount of fertilizer to each plant. Two of the plants die.

12. Can he conclude that the amounts of fertilizer used on those plants were lethal? What other factors might have affected the results?

STEP 9: WRITING THE METHOD

After formulating a hypothesis and selecting the independent and dependent variables, the investigator must find a method to measure the dependent variable; otherwise, there is no experiment. Methods are learned by reading articles published by other scientists and by talking to other scientists who are knowledgeable in the field. For example, a scientist who is testing the effect of fertilizer on peanuts would read about peanut growth and various factors that affect it. He would learn the accepted methods for evaluating peanut yield. He would also read about different types of fertilizers and their composition, their uses on different soil types, and methods of application. The scientist might also get in touch with other scientists who study peanuts and fertilizers and learn about their work. Scientists often do this by attending conferences where other scientists present results of investigations they have completed.

QUESTIONS

13. A group of students hypothesizes that the amount of alcohol produced in fermentation depends on the amount of glucose supplied to the yeast. They want to use 5%, 10%, 15%, 20%, 25%, and 30% glucose solutions.

    a. What is the independent variable?

    b. What is the dependent variable?

    c. What control treatment should be used?

    d. What variables should be standardized?

14. Having learned the optimum sugar concentration, the students next decide to investigate whether different strains of yeast ferment glucose to produce different amounts of alcohol. Briefly explain how this experiment would be set up.

15. A group of students wants to study the effect of temperature on bacterial growth. To get bacteria, they leave Petri dishes of nutrient agar open on a shelf. They then put the dishes in different places: an incubator (37^{o}C), a refrigerator (10^{o}C), and a freezer (0^{o}C). Bacterial growth is measured by estimating the percentage of each dish covered by bacteria at the end of a 3 - day growth period.

    a. What is the independent variable?

    b. What is the dependent variable?

    c. What variables should be standardized?

16. A team of scientists is testing a new drug, XYZ, on AIDS patients. They expect patients to develop fewer AIDS-related illnesses when given the drug, but they don't expect XYZ to cure AIDS.

    a. What hypothesis are the scientists testing?

    b. What is the independent variable?

    c. What is the dependent variable?

    d. What control treatment would be used?

    e. What variables should the researchers standardize?

17. Design a controlled experiment to determine the effect of exercise on heart rate.

Problem (in the form of a question)	
Independent Variable	
Dependent Variable	
Standardized or Controlled Variables (at least 3)	
Hypothesis ("If…then…because…" statement)	
Levels of Treatment (values set for the independent variable)	
Control Treatment or Group (independent variable either eliminated or set to standard value)	
Replication	

Method (what steps you will follow)	
Expected Results	
Explanation of Expected Results	

AP Biology Assignment #3: Chapter 2 Active Reading Guide: The Chemical Context of Life

Directions: You will need to access the online textbook to complete this assignment. Chapter 2 starts on page 19 of the textbook. Read the chapter and answer the questions. This chapter covers the basics that you may have learned in chemistry class. You are expected to know this information coming into AP Biology.

Section 1

1. Define and give an example of the following terms:

Term	Definition
matter:	
element:	
compound:	

3. What four elements make up 96% of all living matter?

4. What is the difference between an *essential element* and a *trace element*?

Section 2

4. Sketch a model of an atom of helium, showing the electrons, protons, neutrons, and atomic nucleus.

5. What is the atomic number of helium? _____ Its atomic mass? _____

Here are some more terms that you should firmly grasp. Define each term.

Term	**Definition**
neutron:	
proton:	
electron:	
atomic mass:	
atomic number:	
isotope:	
electron shells:	
energy:	

7. Consider the entry in the periodic table for carbon.

   What is the atomic mass? _____ What is the atomic number? _____

   How many electrons does carbon have? _____ How many neutrons? _____

8. What are *isotopes*? Use carbon as an example.

9. Explain radioactive isotopes and one medical application that uses them.

10. Which is the only subatomic particle that is directly involved in the chemical reactions between atoms?

11. What is *potential energy*?

12. Explain which has more potential energy in each pair:
    a. boy at the top of a slide/boy at the bottom

    b. electron in the first energy shell/electron in the third energy shell

    c. water/glucose

13. What determines the chemical behavior of an atom?

14. Sketch an electron distribution diagram for sodium:

    7. How many valence electrons does it have? _____
       Circle the valence electron(s).

    8. How many protons does it have? _____

Section 3

15. Define *molecule*.

16. Now, refer back to your definition of a *compound* and fill in the following chart:

	Molecule? (y/n)	Compound? (y/n)	Molecular Formula	Structural Formula
Water				
Carbon Dioxide				
Methane				
Oxygen				

17. What type of bond is seen in O_2? Explain what this means.

18. What is meant by *electronegativity*?

19. Explain the difference between a *nonpolar covalent bond* and a *polar covalent bond*.

20. Make an electron distribution diagram of water. Which element is most electronegative? Why is water considered a *polar* molecule? Label the regions that are more positive or more negative. (This is a very important concept. Spend some time with this one!)

21. Another bond type is the *ionic bond*. Explain what is happening in Figure 2.10.

22. What two elements are involved above?

23. Define *anion* and *cation*. In the preceding example, which is the anion?

24. What is a *hydrogen bond*? Indicate where the hydrogen bond occurs in Figure 2.12.

25. Explain *van der Waals interactions*. Though they represent very weak attractions, when these interactions are numerous they can stick a gecko to the ceiling!

26. Here is a list of the types of bonds and interactions discussed in this section. Place them in order from the strongest to the weakest: hydrogen bonds, covalent bonds, ionic bonds, van der Waals interactions.

STRONG

WEAK

27. Use morphine and endorphins as examples to explain why molecular shape is crucial in biology.

Section 4

28. Write the chemical shorthand equation for photosynthesis. Label the *reactants* and the *products*.

29. For the equation you just wrote,
    How many molecules of carbon dioxide are there? _____

    How many molecules of glucose? _____

    How many elements in glucose? _____

30. What is meant by *dynamic equilibrium*? Does this imply equal concentrations of each reactant and product?

Section 5

31. What is a *polar molecule*? Why is water considered polar?

32. Explain *hydrogen bonding*. How many hydrogen bonds can a single water molecule form?

33. Distinguish between *cohesion* and *adhesion*.

34. Which is demonstrated when you see beads of water on a waxed car hood?

35. Which property explains the ability of a water strider to walk on water?

36. The calorie is a unit of heat. Define *calorie*.

37. Water has high *specific heat*. What does this mean? How does water's specific heat compare to alcohol's specific heat?

38. Explain how hydrogen bonding contributes to water's high specific heat.

39. Summarize how water's high specific heat contributes to the moderation of temperature. How is this property important to life?

40. Define *evaporation*. What is *heat of vaporization*? Explain at least three effects of this property on living organisms.

41. Ice floats! So what? Consider what would happen if ponds and other bodies of water accumulated ice at the bottom. Describe why this property of water is important.

42. Now, explain *why* ice floats. Why is 4°C the critical temperature?

43. Review and define these terms:

Term	**Definition**
solvent:	
solution:	
solute:	

44. Consider coffee to which you have added sugar. Which of these is the solvent? Which is the solute?

45. Explain why water is such a fine solvent.

46. Distinguish between *hydrophobic* and *hydrophilic substances*. Give an example of each.

47. You already know that some materials, such as olive oil, will not dissolve in water. In fact, oil will float on top of water. Explain this property in terms of hydrogen bonding.

48. Now, let's do a little work that will enable you to prepare solutions. Read the section on solute concentrations carefully, and show the calculations here for preparing a 1-molar solution of sucrose. Steps to help you do this follow. The first step is done for you. Fill in the rest.

    Steps to prepare a solution: a. Write the molecular formula.

    $C_{12}H_{22}O_{11}$

    b. Use the periodic table (on Page B-1) to calculate the mass of each element. Multiply by the number of atoms of the element. (For example, O has a mass of 16. Therefore, one mole of O has a mass of 16 x 11 = 176 g/mole.)

    c. Add the masses of each element in the molecule.

Add this mass of the compound to water to bring it to a volume of 1 liter. This makes 1 liter of a 1 *M* (1-molar) solution.

49. Can you prepare 1 liter of a 0.5-molar *glucose* solution? Show your work here.

50. Define *molarity.*

51. What two ions form when water dissociates?

52. What is the concentration of each ion in pure water at 25°C?

53. *pH* is defined as the negative log of the hydrogen ion concentration [H^+]. Explain how water is assigned a pH of 7.

54. To go a step further, the product of H^+ and OH^- concentrations is constant at 10^{-14}.

$$[H^+]\,[OH^-] = 10^{-14}$$

Water, which is neutral with a pH of 7, has an equal number of H^+ and OH^- ions. Now, define

Acid:

Base:

55. Because the pH scale is logarithmic, each numerical change represents a 10X change in ion concentration.
    a. How many times more acidic is a pH of 3 compared to a pH of 5? _____
    b. How many times more basic is a pH of 12 compared to a pH of 8? _____
    c. Explain the difference between a pH of 8 and a pH of 12 in terms of H^+ concentration.

56. Even a slight change in pH can be harmful! How do *buffers* moderate pH change?

57. Exercise will result in the production of CO_2, which will acidify the blood. Explain the buffering system that minimizes blood pH changes.

58. *Acid precipitation* is increasing. What is the pH of uncontaminated rain?

59. Give two reasons precipitation is more acidic today compared to 1900.

60. What products of fossil fuel burning contribute to acid precipitation?

61. Discuss how CO_2 emissions affect marine life and ecosystems.

AP Biology Assignment #4: Chapter 3 Active Reading Guide: Carbon and the Molecular Diversity of Life

Directions: You will need to access the online textbook to complete this assignment. Chapter 3 starts on page 40 of the textbook. Read the chapter and answer the questions. This chapter covers some of the biochemistry that you learned in Honors Biology.

Section 1

1. Make an electron distribution diagram of carbon. It is essential that you know the answers to these questions:

   a. How many valence electrons does carbon have? _____

   b. How many bonds can carbon form? _____

   c. What type of bonds does it form with other elements? _____

2. Carbon chains form skeletons. List here the types of skeletons that can be formed.

3. What is a *hydrocarbon*? Name two. Are hydrocarbons hydrophobic or hydrophilic?

4. Define *functional group*.

5. There are seven chemical groups important in biological processes that you should know. Using Figure 3.5 in your text, complete the following chart.

	Hydroxyl	**Carbonyl**	**Carboxyl**	**Amino**	**Sulfhydryl**	**Phosphate**	**Methyl**
Structure							
Example							
Functional Properties							

6. You will need to master the chart and the information in it. Using the functional groups above, see if you can answer the following prompts:

   a. —NH_2 _____

   b. Can form cross-links that stabilize protein structure _____

   c. Key component of ATP _____

   d. Can affect gene expression _____

   e. CH_3 _____

   f. Is always polar _____

   g. Determines the two groups of sugars _____

   h. Has acidic properties _____

   i. —COOH _____

   j. Acts as a base _____

Section 2

7. The large molecules of all living things fall into just four main classes. Name them.

8. Circle the three classes that are called *macromolecules* in #8. Define *macromolecule*.

9. What is a *polymer*? What is a *monomer*?

10. Monomers are connected in what type of reaction? What occurs in this reaction?

11. Large molecules (polymers) are converted to monomers in what type of reaction?

12. The root words of *hydrolysis* will be used many times to form other words you will learn this year. What does each root word mean?
    hydro–

    lysis–

13. Consider the following reaction:

    $C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11}$

    a. The equation is not balanced; it is missing a molecule of water. Write it in on the correct side of the equation.

    $C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11}$

    b. Polymers are assembled and broken down in two types of reactions: *dehydration synthesis* and *hydrolysis.* Which kind of reaction is this?

    c. Is $C_6H_{12}O_6$ (glucose) a monomer, or a polymer? _____

    d. To summarize, when two monomers are joined, a molecule of _____ is always removed.

Section 3

14. Let's look at carbohydrates, which include sugars and starches. First, what are the monomers of all carbohydrates?

15. Most monosaccharides are some multiple of (CH_2O). For example, ribose is a 5-carbon sugar with the formula $C_5H_{10}O_5$. It is a pentose sugar. (From the root *penta–,* meaning five.) What is the formula of a hexose sugar?

16. Notice that all sugars have the same two functional groups. Name them:
    C=O

    –OH

17. What is the difference between an *aldehyde sugar* and a *ketone sugar*?

18. So, as a quick review, all hexose sugars have the same chemical formula: $C_6H_{12}O_6$.
    What is the term for compounds that have the same molecular formulas but different structural formulas?

19. Refer to Figure 3.8 (b) in your textbook showing the abbreviated ring structure of glucose. Where are all the carbons? Pay attention to the numbering system. This will be important as we progress in our study.

20. Let's look at our reaction in question 14 again:

$$C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11} + H_2O$$

Notice that two monomers are joined to make a polymer. Since the monomers are monosaccharides, the polymer is a *disaccharide*. Three disaccharides have the formula $C_{12}H_{22}O_{11}$. Name them below and fill out the chart.

Disaccharide	Formed from Which Two Monosaccharides?	Found Where?

Have you noticed that all the sugars end in *–ose*? This root word means sugar.

21. What is a *glycosidic linkage*?

22. Refer to Figure 3.11 (b), which shows 1–4 glycosidic linkages. Translate and explain this terminology in terms of carbon numbering.

23. There are two categories of *polysaccharides*. Name them and give examples.

Type of Polysaccharide	Examples

24. Why can you not digest cellulose? What organisms can?

25. Let's review some key points about the carbohydrates. Each prompt below describes a unique carbohydrate. Name the correct carbohydrate for each.

    a. Has 1–4 B glucose linkages _____

    b. Is a storage polysaccharide produced by vertebrates; stored in your liver _____

    c. Two monomers of this form maltose _____

    d. Glucose + _____ form sucrose

    e. Monosaccharide commonly called "fruit sugar" _____

    f. "Milk sugar" _____

    g. Structural polysaccharide that gives cockroaches their crunch _____

    h. Malt sugar; used to brew beer _____

    i. Structural polysaccharide that comprises plant cell walls _____

Section 4

26. Lipids include fats, waxes, oils, phospholipids, and steroids. What characteristic do all lipids share?

27. What are the building blocks of *fats*?

28. If a fat is composed of three fatty acids and one glycerol molecule, how many water molecules will be removed to form it? Again, what is this process called?

29. What are ester linkages?

30. Name two saturated fats.

31. Draw a fatty acid chain that is eight carbons long and is *unsaturated*. Circle the element in your chain that makes it unsaturated, and explain what this means.

32. Name two unsaturated fats.

33. Why are many unsaturated fats liquid at room temperature?

34. What is a *trans fat*? Why should you limit them in your diet?

35. List four important functions of fats.

36. Why are the “tails” hydrophobic?

37. Which of the fatty acid chains in Figure 3.13 (b) in your textbook is unsaturated? How do you know it is unsaturated?

38. A phospholipid has a glycerol attached to a phosphate group and two fatty acid chains. The head is hydrophilic, and the tail is hydrophobic. Now, sketch the phospholipid bilayer structure of a plasma membrane. Label the hydrophilc heads, hydrophobic tails, and location of water.

39. Study your sketch. Why are the tails all located in the interior?

40. Refer to Figure 3.15 in your textbook. Some people refer to this structure as three hexagons and a doghouse. What is it?

41. What are other examples of steroids?

Section 5

42. Figure 3.16 is an important one! It shows many different functions of proteins. Select any five types of proteins and summarize each type here.

Type of Protein	Function	Example

43. The monomers of proteins are *amino acids*. Sketch an amino acid here. Label the *alpha* or *central carbon*, *amino group*, *carboxyl group*, and *R group*.

44. What is represented by *R*? How many are there?

45. Study Figure 3.17 in your textbook. See if you can understand why some R groups are nonpolar, some polar, and others electrically charged (acidic or basic). If you were given an R group, could you place it in the correct group? Work on the R groups until you can see common elements in each category.

46. Define these terms:

Term	Definition
peptide bond	
dipeptide	
polypeptide	

47. There are four levels of protein structure. Refer to Figure 3.21, and summarize each level in the following table.

Level of Protein Structure	Explanation	Example
Primary		
Secondary		
α Helix		
β Pleated Sheet		
Tertiary		
Quaternary		

48. Enzymes are globular proteins that exhibit at least tertiary structure. As you study Figure 3.22 in your text, explain each interaction that folds this protein fragment.

49. Do you remember when we said, “To change the structure, change the function”? Explain how this principle applies to sickle-cell disease. Why is the structure changed?

50. Besides mutation, which changes the primary structure of a protein, protein structure can be changed by denaturation. Define *denaturation*, and give at least three ways a protein may become denatured.

51. Chaperone proteins or chaperonins assist in the proper folding of proteins. Explain the process.

Section 6

The nucleic acids DNA and RNA will be the core topics of Chapter 17. For now, you should just review the general functions and know the components.

52. The flow of genetic information is from DNA → RNA → protein. Use Figure 3.25 to explain the process.

53. The components of a nucleic acid are a *sugar*, a *nitrogenous base*, and a *phosphate group*. Make a quick sketch of a nucleotide.

54. Notice that there are five nitrogen bases. Which four are found in DNA?

55. Which four are found in RNA?

56. How do ribose and deoxyribose sugars differ?

57. In Watson and Crick's model of DNA, what is the shape of the molecule called?

58. Why are the strands said to be *antiparallel*?

59. What two molecules make up the "uprights"?

60. What molecules make up the "rungs"?

61. In a DNA double helix, a region along one DNA strand has this sequence of nitrogenous bases: 5'-T A G G C C T-3'
    Write the complementary strand. Indicate the 5' and 3' ends of the new strand.

AP Biology Assignment #5: Chapter 4 Active Reading Guide: A Tour of the Cell

Directions: You will need to access the online textbook to complete this assignment. Chapter 4 starts on page 66 of the textbook. Read the chapter and answer the questions.

Section 1

1. The study of cells has been limited by their small size, and so they were not seen and described until 1665, when Robert Hooke first looked at dead cells from an oak tree. His contemporary, Anton van Leeuwenhoek, crafted lenses and with the improvements in optical aids, a new world was opened. *Magnification* and *resolving power* limit what can be seen. Explain the difference.

2. The development of electron microscopes has further opened our window on the cell and its organelles. What is considered a major disadvantage of electron microscopes?

3. Study the electron micrographs in your text. Describe the different types of images obtained from:
   scanning electron microscopy (SEM): **transmission**

   electron microscopy (TEM):

4. In *cell fractionation*, whole cells are broken up in a blender, and this slurry is centrifuged several times. Each time, smaller and smaller cell parts are isolated.
   This will isolate different organelles and allow study of their biochemical activities. Which organelles are the smallest ones isolated in this procedure?

Section 2

5. Which two domains consist of prokaryotic cells?

6. A major difference between prokaryotic and eukaryotic cells is the location of their DNA. Describe this difference.

7. Refer to Figure 4.4 and give the function of description of the following structures:

Structure	Function or Description
cell wall	
plasma membrane	
bacterial chromosome	
nucleoid	
cytoplasm	
flagella	

8. Why are cells so small? Explain the relationship of surface area to volume.

9. What are *microvilli*? How do these structures relate to the function of intestinal cells?

Section 3

10. Describe the nuclear envelope. How many layers is it? What connects the layers?

11. What is the *nuclear lamina*? *Nuclear matrix*?

12. Found within the nucleus are the *chromosomes*. They are made of *chromatin*. What are the two components of chromatin? When do the thin chromatin fibers condense to become distinct chromosomes?

13. When are the *nucleoli* visible? What are assembled here?

14. What is the function of *ribosomes*? What are their two components?

15. Ribosomes in any type of organism are all the same, but we distinguish between two types of ribosomes based on where they are found and the destination of the protein product made. Complete this chart to demonstrate this concept.

Type of Ribosome	**Location**	**Product**
Free ribosomes		
Bound ribosomes		

Section 4

16. List all the structures of the *endomembrane system*.

17. The *endoplasmic reticulum (ER)* makes up more than half the total membrane system in many eukaryotic cells. Explain the *lumen*, *transport vesicles*, and the difference between *smooth* and *rough ER*.

18. List and describe three major functions of the smooth ER.

19. Why does alcohol abuse increase tolerance to other drugs such as barbiturates?

20. The rough ER is studded with ribosomes. As proteins are synthesized, they are threaded into the lumen of the rough ER. Some of these proteins have carbohydrates attached to them in the ER to form *glycoproteins*. What does the ER then do with these secretory proteins?

21. Besides packaging secretory proteins into transport vesicles, what is another major function of the rough ER?

22. The transport vesicles formed from the rough ER fuse with the Golgi apparatus. Describe what happens to a transport vesicle and its contents when it arrives at the Golgi apparatus.

23. What is a *lysosome*? What do they contain? What is the pH range inside a lysosome?

24. One function of lysosomes is intracellular digestion of particles engulfed by *phagocytosis*. Describe this process of digestion. What human cells carry out phagocytosis?

25. A second function of lysosomes is to recycle cellular components in a process called *autophagy*. Describe this process.

26. What happens in Tay-Sachs disease? Explain the role of the lysosomes in Tay-Sachs.

27. There are many types of vacuoles. Briefly describe: **food vacuoles**:

    contractile vacuoles:

    central vacuoles in plants (give at least three functions/materials stored here):

28. Explain how the elements of the endomembrane system function together to secrete a protein and to digest a cellular component.

Section 5

29. What is an endosymbiont?

30. What is the *endosymbiont theory*? Summarize three lines of evidence that support the model of endosymbiosis.

31. Mitochondria and chloroplasts are not considered part of the endomembrane system, although they are enclosed by membranes. Sketch a mitochondrion here and label its *outer membrane*, *inner membrane*, *inner membrane space*, *cristae*, *matrix*, and *ribosomes*.

32. Now sketch a chloroplast and label its *outer membrane*, *inner membrane*, *inner membrane space*, *thylakoids*, *granum*, and *stroma*. Notice that the mitochondrion has two membrane compartments, while the chloroplast has three compartments.

33. What is the function of the mitochondria?

34. What is the function of the chloroplasts?

35. Recall the relationship of structure to function. Why is the inner membrane of the mitochondria highly folded? What role do all the individual thylakoid membranes serve? (Notice that you will have the same answer for both questions.)

36. Explain the important role played by *peroxisomes*.