

BIOLOGY SEMESTER GOALS

1. Assume and practice responsible lab safety behaviors.
2. Read and interpret science passages.
3. Read and interpret data tables and graphs.
4. Learn all the stuff listed in the following units below.

UNIT ONE: SCIENTIFIC METHOD AND MACROMOLECULES **Chapters 1 (omit 1.2) and 2**

1. Explain and provide examples of the five characteristics of life.
2. List and explain the five steps of the scientific method.
3. Interpret data expressed graphically.
4. Construct an appropriate graph based on dependent and independent variables.
5. Identify and compare the structure and function of the four macromolecules.
6. Explain the relationship between elements, compounds, and bonds.
7. Explain the “Lock and Key” model for how enzymes catalyze biological reactions.
8. Explain the effects of temperature, pH, surface area, and amount of enzyme, amount of substrate on enzyme reaction rate.
9. Distinguish between acids, bases, and neutral substances using a pH scale.
10. Determine a relationship between metabolism, homeostasis, and biological chemical reactions.

BIOLOGY LAB SAFETY RULES

To make the science laboratory a safe place to work, you must assume responsibility for your own safety and that of your classmates. Here are some safety rules to help you to protect yourself and others from injury in the laboratory. If you do not follow these rules, your teacher will ask you to leave the classroom and report to your dean.

Work in a careful, organized manner. Horseplay, practical jokes, or disruptive behavior are dangerous and will not be tolerated.

Do not perform unauthorized experiments.

Place all books and packs safely under your desk. Keep aisles clear at all times. During laboratories, no food or beverage is to be consumed during any laboratory activity.

Never taste any chemical substance unless you are specifically directed to do so by your teacher.

Handle all chemicals carefully. Check the label on all containers before removing contents. Never mix droppers between containers.

Keep your work table clean, dry, and uncluttered. At the end of the laboratory period, clean up your work area and return all materials to the proper place.

Inform your teacher if a piece of equipment breaks. Broken glass should be wrapped paper before it is discarded in the trash.

Goggles must be worn during labs that have potential for eye injury. Your teacher will provide you with goggles for these lab days. Do not remove the goggles until your teacher instructs you to do so.

When you are heating material in a test tube, use a test tube holder. Never point the contents at another person, as hot materials sometimes “pop” and fly out of the tubes.

If hot plates are present in the classroom, steer clear. They may still be hot from the previous class.

Sterile technique must be used when working with bacteria. Follow all disposal instructions.

Wash hands before leaving the laboratory following any activity in which you handled plant or animal material, DNA, bacteria or yeast.

Keep solid materials out of all sinks.

Never place objects or chemicals in electrical outlets.

Do not use any electrical equipment with frayed cords, loose connections, or exposed wires. Report such equipment to your teacher.

When using the microscope, keep the cord wrapped around the base. Pull the cord from the outlet only by the plug. Carry microscopes at waist level, using two hands.

Dissection equipment should be handled cautiously to avoid cuts and punctures. Scalpels and razor blades must always be carried in a container. If a wound occurs, report it to your teacher

Animals in the classroom should be handled and cared for only by students designated by the teacher. Any animal bites should be reported immediately

Mammals and birds are protected by law. Do not capture or bring them to school under any circumstance.

Students are not to venture out of their assigned lab station area unless specifically directed by the teacher.

Never return unused chemicals to stock bottles. Follow your teacher's instructions for proper disposal of all wastes.

Long hair must be tied back during any laboratory which uses a flame.

Ask the teacher for assistance when uncertain of proper and safe procedures.

Know the location and use of all safety equipment.

Use the space below to diagram the lab room and indicate locations of: fire blanket, fire extinguisher, exit(s), eye wash station, and emergency gas shut off switch

Biology Making Graphs and Data Tables

Scientific conclusions are based on carefully measured data. Usually, scientists report data in several ways. They record it in data tables, show it in graphs, and explain it in words. Today you will learn the proper ways to create data tables and graphs. This is a skill you will need throughout the year. **Don't forget to use a ruler!!!**

Data Tables

Tables are used to record data. Let's say for example that you are recording the heights and ages of five different people. You could use a data table as shown below:

<u>Person</u>	<u>Height(cm)</u>	<u>Age(years)</u>
Joe 53		1
Chris	105	5
John	137	10
Mike	168	15
Dave	180	20

Notice that each column is labeled, and units are specified when needed. If you write the units at the top of the column, it is not necessary to repeat them for each measurement. Units must always be indicated in the table.

Graphs

Dependent and Independent variables

There are many different types of graphs that are used to convey data. In this class, we will mainly use bar graphs and line graphs. Both of these graphs use two axis-horizontal (x-axis) and vertical (y-axis). The first thing you need to decide is which variable goes on which axis.

The independent variable is the one that affects the other variable. If there are only two variables, it is the one that the experimenter has control over. It goes on the x-axis. The dependent variable is the one that is being measured. It goes on the y-axis. _____

___If you were going to graph height and age from the Table A above, which variable would be the independent variable? _____

Setting Up Axes

When setting up your axis, you have to use as much room as possible. In order to do this, you must do some planning.

1. Determine the highest value you will need on your axis.
2. Count the number of lines you have on your graph paper.
3. Divide the by the highest value by the number of lines. This gives you how many units each line will be worth.
4. Label your axis with the name of the measurement and the units. Put the units in parenthesis.
5. Number your axis. You need not number every line. Choose an even increment like 10's or 5's.



Scientific Method With M&Ms

Today we are going to practice the steps of the scientific method with M&Ms. Do not eat the data until we are finished!

What are two **questions** you might have about a bag of M&Ms candy?

Make a **hypothesis** for the questions we are going to investigate.

Open your group's bag of M&Ms and collect your individual **data**. Use a ruler to draw a data table that will hold the data from all groups. Your data table should have a title, and all columns should be labeled. Make sure to include units of measurement if needed. Put the data table on the back of your graph paper.

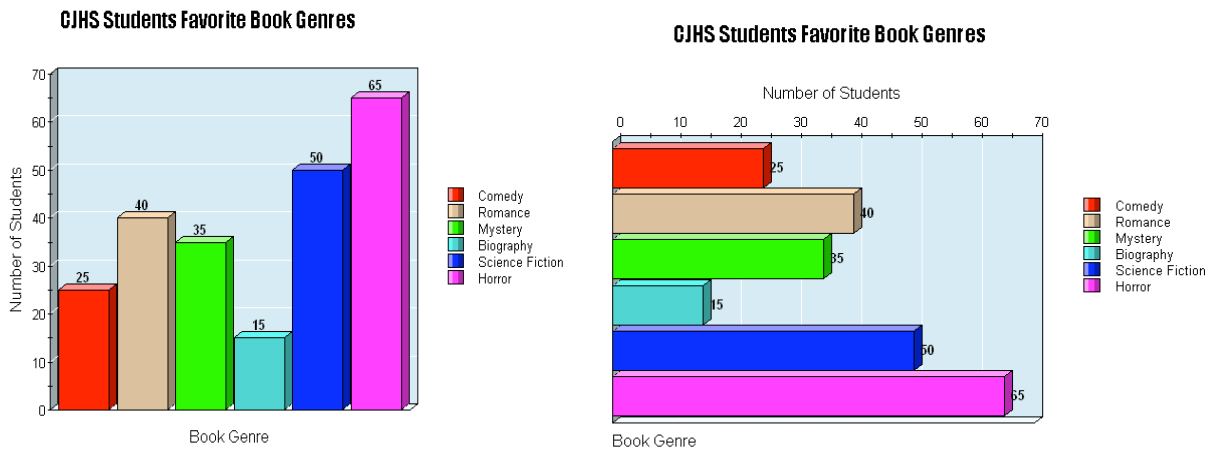
1. Look at the data for the class. Did all groups get the same answers for each question?

2. What are two things we could do to more reliably predict the **results** of an experiment?

3. What **conclusions** can you draw from this experiment?

Scientific conclusions are based on carefully measured data. Scientists can report data in several ways. They record it in data tables as you did in this investigation. They also show it in graphs. It is important to use the correct type of graph for your data so that it gives a meaningful picture of what you found.

Bar Graphs



Bar graphs are used when one variable is not numerically continuous. For example, if you were to graph the favorite book genres of CJHS students, you would use a bar graph because "book genre" is not a numerically continuous variable. It is also important to correctly decide which variable should go on each axis. Look at the two graphs above. Which one shows a more meaningful picture of your data? **The dependent variable (what is being measured) always goes on the y-axis. (vertical) The independent variable (the factor that affects the other variable) always goes on the x-axis. (horizontal)** In the above example, we are measuring the number of students who like each type of book, so the number of students (dependent var.) goes on the y-axis.

Your M&M data has one variable that is not numerically continuous, so it should be represented in a bar graph. Use the graph paper provided to graph your M&M color data.

Which variable will you put on the x-axis? _____

Which variable will you put on the y-axis? _____

Setting up your axes:

1. Determine the highest value you will need on each axis, and count the lines on your graph paper.
2. Calculate how many lines you can use so that each unit is divided equally. You do not have to number every line. Choose an increment that makes sense for your data.
3. Label each axis with the correct titles and units.

Line Graphs

Line graphs are used when both sets of data are numerically continuous. For example, if you wanted to graph the height of a child at various ages, you would have continuous numbers as the variables for each axis. You still need to decide which is the independent and dependent variable to plot the data correctly.

Use the data in the chart below to make a line graph.

Jimmy's Height From Age 1-8

Height	Age
72 cm	1
85 cm	2
95 cm	3
110 cm	4
117 cm	5
124 cm	6
130 cm	7
138 cm	8

Which variable will you put on the x-axis?

Which variable will you put on the y-axis?

Explain the reasoning for your choices.

Doing Science Experiments!

Some people think of science as just a bunch of facts and diagrams. Really, it's much more than that! Science is a process which helps scientists find out how the world works. For this activity, you will be scientists and **DO SCIENCE!** You will have an opportunity to design and run your own experiment.

The Scientific Method is a systematic way to study the world. Write a definition for the following vocabulary important in the scientific method.

Hypothesis

Experimental variable (ONLY 1)

Controlled variables

Dependent variable

Independent variable

Materials used

Experimental procedure

We have examined different parts of the scientific method. You will now apply these to your own experiment. Use this sheet to help you, but write all information on separate paper, using complete sentences. Because scientists collaborate, you will be working in groups of four. You will be given 20 radish seeds, 2 ziplock bags, and 2 paper towels. Using these materials and any others you find necessary, you will design your own simple experiment to test the effect of a variable on the germination rate of radish seeds. Your group will decide on a variable to test, but your design must be approved by your teacher!! Not all materials will be allowed.

A. Brainstorm and come up with **three** different hypotheses that you can test. Be as specific as possible and use an: If. . . . then. . . . statement. Also, list at least **3** safety precautions needed to be taken during the experiment.

1.

2

3

B. With your group, you will choose one idea to use for your experiment. Record the following in your notebook:

Hypothesis

Experimental variable (ONLY 1)

Controlled variables

Dependent variable

Independent variable

Materials used

Experimental procedure

Once your experiment has been approved by your teacher you may set up your experiment. You will be observing your seeds for the next four days, so you'll need to set up a data table as well. Remember, everyone in your group will turn in a paper, so everyone has to be keeping track of what is going on. The following sections will have to be included in your final paper. This paper will be due on _____, so you are advised to start it tonight. You will at least be able to get the observation/introduction, hypothesis, and procedure sections completed.

The paper must be either **neatly written or typed.**

Title(The Effect of -----on-----)(1 pt)

Observation/Introduction(4 pts)

What is it that made your group decide to test what you are testing?

Be sure to explain what seeds and germination have to do with your experiment.

Hypothesis(2 pts)

Predict what will happen.

Use an If...then statement.

Procedure(10 pts)

What materials are you using?

What variables are important in this experiment?

Which variables will be controlled? How?

Which variable will be tested in your experiment? How?

Explain your procedure in a step by step manner. Be very thorough in explaining your experiment.

Remember, someone else should be able to repeat the experiment exactly.

Results(6 pts)

Create your own data tables and graphs. Do not forget to use proper axis labels, units, title, and scales. **Use graph paper and a ruler.**

Describe your results in words as well.

Discussion/Conclusion(10 pts) Number the discussion questions for labs.

Write a paragraph addressing **each** of the following questions:

1. What can you conclude from your data and why?
2. Was your hypothesis supported? Why or why not?
3. What were 3 possible sources of error in your experiment. Explain how each could effect your data.
4. What would you do as a follow-up experiment?

Neatness(Up to 4 pts)

ANALYSIS OF SCIENTIFIC EXPERIMENTS

In order to create and perform scientific experiments, you must first become aware of the parts that are involved in designing an appropriate experiment. There are 6 main components of a well-designed experiment:

1. One experimental variable is being tested.
2. All other variables of the experiment are controlled (constant).
3. There are adequate number of trials.
4. There is adequate sample size (number of individuals per group per trial).
5. Sufficient experimental time is allowed and frequency of measurements is adequate.
6. Ethical treatment of all animal test subjects are employed.

Read the following passages several times before answering the questions below. All graphs must be handwritten on graph paper and all questions must be answered using complete sentences.

Experiment 1: Compost and Bean Plants

After studying about recycling, members of John's biology class investigated the effect of various recycled products on plant growth. John's lab group compared the effect of different aged grass compost on bean plants. Compost is organic material that is being naturally recycled by insects and bacteria. The process of composting releases nutrients that are necessary for plants and animals. John's group hypothesized that older grass compost would produce taller bean plants. Three flats of bean plants with 25 plants per flat were grown for 5 days. After five days, the plants were fertilized as follows: (a) Flat A: 450 g of three-month-old compost, (b) Flat B: 450 g of six-month-old compost, (c) Flat C: 0g compost. The plants were then allowed to grow for 25 days, receiving the same amount of sunlight and water each day. On the last day of the experiment, the group recorded the height of the plants in centimeters.

1. What is the hypothesis for John's experiment?
2. What is the independent variable? (Hint: This is changed by the experimenter)
3. What is the dependent variable? (Hint: This is what is being measured.)
4. What is the the experimental variable?
5. What are the controlled variables?
6. Where there enough samples present in each group?
7. Where there enough trials performed for each group?

8. Use the following data table to construct a graph:

The effect of compost age on plant height over 25 days

Age of compost	Average plant height after 25 days (cm)
3 months	45.69
6 months	60.25
no compost	38.73

Based upon the data and graph, was John's hypothesis supported? Explain

Experiment 2: Perfumes and Bee's Behavior

Johanna read that chemical X, present in some perfumes, attracts bees. Because the perfume brand ingredients are secret, she decided to test four, random perfumes for the presence of chemical X. She placed a saucer containing 10 mL of the first perfume three meters from the hive. She recorded the number of bees to emerge from the hive and land in or on the saucer within a 30 minute period. She then removed the saucer and waited another 30 minutes before repeating the steps with perfume numbers 2, 3, and 4. All experiments were conducted on the same day when all conditions including air temperature, wind speed, and wind direction were all the same.

1. What is the hypothesis for this experiment?
2. What is the independent variable?
3. What is the dependent variable?
4. Is there a control group in this experiment? Explain.
5. Were there enough trials performed? Explain.

Answer question numbers 6 and 7 using the data table below:

Perfume Number	Number of Bees Attracted in 30 minutes
1	31
2	22
3	15
4	9

6. Can Johanna conclude there is more chemical X present in Perfume #1? Explain your answer.

7. Construct the appropriate graph for the data above. Be sure to include all necessary parts for a graph.

Experiment 3: Aloe vera and Planaria

Jackie read that *Aloe vera* promoted healing of burned tissue. She decided to investigate the effect of varying amounts of *Aloe vera* on the regeneration of *Planaria*. *Planaria* are flat worms that range in size of 2-10 mm in length. They are commonly located in freshwater ponds and streams. *Planaria* have a unique characteristic in which they can re grow body parts that are eaten by a predator. Jackie bisected 12 *Planaria* to obtain 12 heads and 12 tails for each experimental group. She applied concentrations of 0%, 10%, 20%, and 30% *Aloe vera* to the groups of heads and tails. Fifteen mL of each *Aloe vera* solution was created. All *Planaria* were maintained in a growth chamber of fresh water with identical food, temperature, and humidity. On Day 15, Jackie observed the regeneration of the *Planaria* parts and categorized development as full, partial or none.

1. What is the hypothesis in this experiment?

2. What is the independent variable?

3. What is the dependent variable?

4. What is (are) the experimental variable(s)?

5. What are the controlled variables?

6. Were there enough samples? Explain.

7. Were there enough trials? Explain.

8. How could Jackie's method of data collection be improved? Explain at least two ways.

Biological Macromolecules

	CARBOHYDRATE	LIPID	PROTEIN	NUCLEIC ACID
ELEMENTS				
MONOMER UNIT AND EXAMPLES				
MONOMERS JOINED BY				
POLYMER AND EXAMPLES				
POLYMERS BROKEN BY				
FUNCTIONS WITHIN LIVING ORGANISMS				

ENZYME LABS

OBJECTIVE:

To test for the presence of enzymes in fruit and the specificity of those enzymes, as well as to identify and show the susceptibility of enzymes to certain environmental factors (temperature and pH) originating in the enzyme's environment. The classes will be divided into 3 groups. Each group will run one of the labs and present the data to the other groups. **ALL GROUPS SHOULD READ THE PROCEDURE FOR ALL OF THE LABS. ALL GROUPS NEED TO ANSWER THE QUESTION ON p 20 AND FOLLOW THE LAB WRITE UP FORMAT ON p 20.**

BACKGROUND:

You have eaten Jell-O and may have made some yourself. They may have noticed a warning in the directions NOT to add fresh pineapple to the mixture. Doing so will cause the gelatin to remain in the liquid state, even after prolonged refrigeration. This is due to the presence of certain proteolytic enzymes in the fruit, which digest or denature the protein molecules present in the gelatin.

What Fruits and Meats Contain Enzymes that Digest Protein?

MATERIALS:

Per Group:

- Knox gelatin
- 9 nut cups
- pipettes
- 1 spoon

Per class: **THE TEACHER HAS ALREADY PREPARED FOR YOU!! HE IS GOOD!!!!**

- Boiling water
 - Cold water
 - 2 measuring spoons
 - Adolph's meat tenderizer solution*
 - * peroxide
 - pureed FRESH fruit with juice filtered from pulp (or frozen juice concentrate, thawed) and meats
 - pineapple
 - apple
 - kiwi fruit
 - orange
 - fig
 - Adolph's solution(already mixed)
 - fish(may contain catalase and enzyme that reacts with and breaks down hydrogen peroxide)
 - liver(may contain catalase and enzyme that reacts with and breaks down hydrogen peroxide)
 - refrigerator
- Use straight hydrogen peroxide.

PROCEDURE:

1. Per groups of 3 number the containers from 1 - 9. Add you initials to the cup. Write small and neatly so that you can see the results.
2. Prepare gelatin in measuring cup using only half of the recommended boiling and cold-water amounts given in the package directions. Stir well with spoon until all gelatin is dissolved.
3. Place 3 ml of the designated fruit juice into each nut cup. **Use a separate pipette for each fruit. Failure to do so may result in mixing of juices and inaccurate results!
 - cup 1 - water only
 - cup 2 - pineapple
 - cup 3 - apple
 - cup 4 - kiwi
 - cup 5 - orange
 - cup 6 - fig
 - cup 7 -- Adolph's solution
 - cup 8 - fish
 - cup 9 liver
4. Add 10-ml. of gelatin mixture to cups 1-7. Stir well to ensure proper mixing.
5. To cups 8 and 9 add hydrogen peroxide. Bubbling indicates the presents of the enzyme catalase. Record the reaction. Clean the cups after you are done.
6. Refrigerate the other nut cups overnight.
7. Construct a data table to record you observations and results.
8. On day 2, check the contents of each nut cup for solidification of the contents. Record the observations in your data table.

What Effect Does Temperature Have on Enzyme Action?

BACKGROUND:

An enzyme's function is related to the 3-dimensional structure of its molecule. This structure can be altered by heat, thus causing the enzyme to lose its normal function. In Lab II, students will test the effect of temperature on the ability of the proteolytic enzyme bromelain (found in pineapple) to digest gelatin.

MATERIALS:

Per group:

- 1 pkg. Knox gelatin, prepared according to procedure in LAB I.
- 10 nut cups
- pipettes
- water bath
- thermometer
- hot plate
- frozen pineapple juice concentrate, thawed
- boiling water
- cold water
- ice bath
- refrigerator

PROCEDURE:

1. Number nut cup from 1 - 10. Label the remaining cup as "RT" (room temperature).
2. Each group will put their 9 cups in the designated temperatures. In the freezer, in boiling water, in the refrigerator and at room temperature all to be determined that day. Record the temperature on your nut cups.
3. Add 3 ml pineapple juice to each cup.
4. Heat (or cool) each nut cup to the appropriate temperature as decided upon in Step 2. Leave nut cup "RT" at room temperature.
5. Add 10 ml gelatin to each cup. Shake well to ensure proper mixing.
6. Construct a data table to record your observations and results.
7. Refrigerate nut cups overnight.
8. On day 2, check each nut cup for liquidity of the contents. Record observations.

ANALYSIS:

1. At what temperature were the first signs of liquidity observed?

2. What do you conclude about the temperature at which bromelain's molecular structure is altered?

3. Why do detergents have enzymes in them? What would you expect the enzymes in detergent to break down?

4. **YOU ARE ALL RESPONSIBLE FOR THESE LAST 3 QUESTIONS TOO. YOU NEED TO WRITE YOUR CONCLUSION USING THE CONCEPT GENERALIZATION TERMS ON PAGE 20.**

4. Read about enzymes in your text. What is the relationship between a catalyst and an enzyme? Does liver tissue contain an enzyme? Does potato tissue contain an enzyme? Explain.

5. How and why does pH affect enzymes?

6. How and why does temperature affect enzymes?

CONCLUSION:

This section of your lab report will be at least 2 paragraphs. Prove to me that you understand what you have learned from doing this experiment. Summarize what you learned in lab and underline these words as you use them in your summary:

enzyme	catalyst	temperature	pH	optimal temperature
animal tissue	substrate	active site	denature	optimal pH

YOUR LAB REPORT WILL CONSIST OF THE FOLLOWING PARTS:

0. Name, date, period

I. TITLE

II. PURPOSE: Why are we doing these experiments?

III. HYPOTHESIS-- already written in your data chart, *no need to rewrite*

IV. DATA -- your data charts should be neatly completed

V. ANALYSIS QUESTIONS -- answer the questions at the end of the procedure sheet using complete sentences

VI. CONCLUSION --see packet p. 21 and write a paragraph using words listed

Neatness is important! Take pride in your work!

I WOULD PREFER, AND STRONGLY ENCOURAGE, ALL LAB REPORTS TO BE TYPED. THINK ABOUT WHAT YOU ARE DOING IN CLASS. THE REPORT SHOULD BE LOGICAL AND CONCISE.

IF YOU HAVE **ANY** QUESTIONS, PLEASE ASK ME OR ANOTHER MEMBER OF THE CLASS.

Enzymes

Background:

You are the head of a biological research team that has been gathering data about the various life forms living in or near an alkaline hot spring in Arkansas. You have just returned from having been at the alkaline hot spring site for many weeks. It is now time to get down to some serious research and analyze the data you've collected.

Things seem to be going well when suddenly you discover the labels on three of your collection bottles have come off during shipment. You remember that you collected three different digestive enzymes in these bottles. You also remember collecting one of the enzymes from a group of bacteria that live right in the middle of the alkaline hot spring. The other two enzymes came from the digestive tract of a strange little mammal called a Mondoni, which lives at the edge of the spring.

You realize that if you go ahead and analyze the enzymes, you may find out which enzymes belong to what creature. You relabel the bottles A, B, and C and begin your analysis.

Procedure:

Using the data table provided, plot graphs of each enzyme on your graphs. Clearly label your graphs with proper titles. Plot all three enzymes on the same graph, using different colored pencil for each enzyme. There should be two graphs for each enzyme. Use a smooth flowing, best fit line to connect the points on your graphs for each enzyme. When you have finished your graphs, answer the questions in the analysis section.

Enzyme Data Tables :

pH vs. % ENZYME ACTIVITY

pH	Enzyme A	Enzyme B	Enzyme C
1	0	0	0
2	100%	0	0
3	75%	0	0
4	50%	8%	0
5	23%	22%	0
6	7%	70%	0
7	0	95%	0
8	0	100%	0
9	0	97%	8%
10	0	76%	18%
11	0	20%	35%
12	0	8%	60%
13	0	0	90%
14	0	0	0

Analysis:

1. What is the % activity of Enzyme A at pH 3.5?
2. At what pH do Enzymes B and C have the same % activity?
3. Which enzyme works best in an acidic environment?
4. At which pH would Enzyme C probably have 100% activity?
5. Which enzyme probably came from the digestive tract of the Mondoni?
6. State two reasons why you think this.

TEMPERATURE VS. ENZYME ACTIVITY

Temperature °C	Enzyme A	Enzyme B	Enzyme C
0	5%	0	0
5	13%	0	0
10	26%	10%	0
15	38%	22%	0
20	50%	38%	0
25	65%	54%	0
30	84%	79%	0
35	97%	97%	5%
40	100%	100%	12%
45	30%	80%	23%
50	0	20%	37%
55	0	0	58%
60	0	0	80%
65	0	0	98%
70	0	0	100%
75	0	0	90%
80	0	0	22%
85	0	0	3%
90	0	0	0
95	0	0	0
100	0	0	0

7. Which enzyme probably came from the bacteria living in the alkaline hot spring?
8. State two reasons why you think this is true.
 - a.

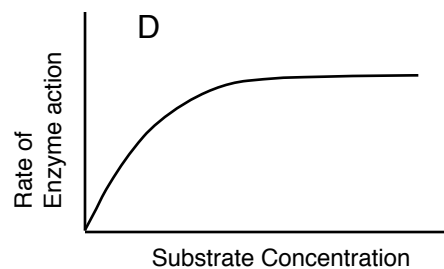
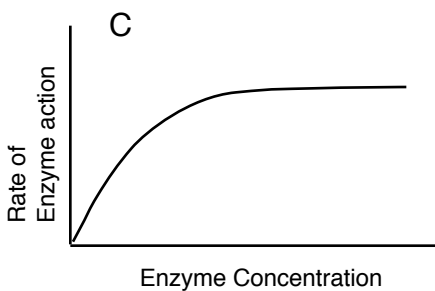
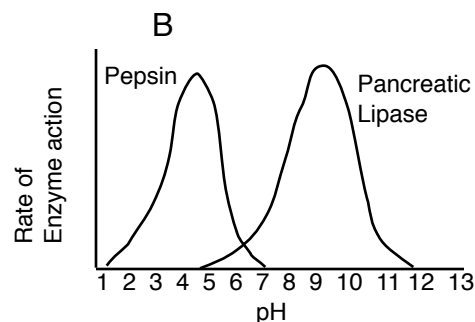
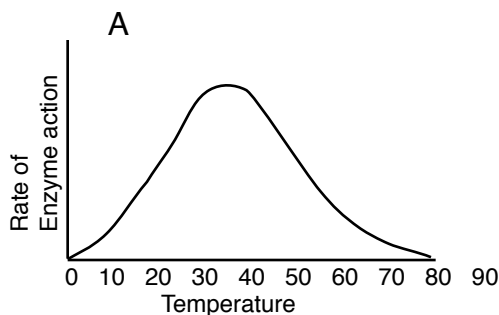
 - b.

9. State which enzyme probably came from the stomach of the Mondoni and **why you think this.**
10. State which enzyme probably came from the intestine of the Mondoni and **why you think this.**
11. Why do enzymes decrease their rates of reactions at temperatures and pH's outside of the range for which they were adapted?

12. Why could it be dangerous for lakes to become acidified or for you to become too hot on a

ENZYMES WORKSHEET

1. Is an enzyme “used up” by the reaction it catalyzes? Explain.
2. In what way does an enzyme affect the reaction it catalyzes? How does the enzyme produce this effect?
3. What is meant by *enzyme specificity*?
4. What is the *active site* of an enzyme?
5. The substance with which an enzyme reacts is its _____.
6. Could life as we know it exist without enzymes? Explain.



Questions 7-10 are based on the graphs above.

7. According to graph **A**, at what temperature is enzyme activity the greatest?
8. According to graph **B**, what is the optimum pH for pepsin? As pH increases above that point, what happens to enzyme activity? Why?
9. According to graph **C**, how does increasing enzyme concentration affect the rate of enzyme action when the substrate concentration remains constant?

10. According to graph **D**, how does increasing substrate concentration affect the rate of enzyme action when enzyme concentration remains constant?

SCIENTIFIC METHOD & MACROMOLECULES REVIEW

Chapters 1 (omit 1.2) and 2

1. Explain and provide examples of the seven characteristics of life.

2. List and explain the six steps of the scientific method.

Define: Controlled variables (constants)

Experimental (independent) variable

Dependent variable

3. Explain the “Lock and Key” model for how enzymes catalyze biological reactions. What is the “lock”? the “key”?

4. Explain the effects of temperature, pH, surface area, and amount of enzyme, amount of substrate on enzyme reaction rate.

5. Distinguish between acids, bases, and neutral substances using a pH scale.

6. What are the 2 main types of bonds formed between atoms?

7. What is the difference between a molecule and compound? Give an example of each.

8. How many atoms are there in $6C_6H_{12}O_6$? _____ How many molecules? _____
How many elements?

9. $2\text{H}_2 + \text{O}_2 \text{-----} > 2\text{H}_2\text{O}$ For this equation, what are the reactant(s)? _____
 What is the product? _____ What does the arrow mean? _____
10. What is required to make or break a chemical bond?
11. What is an organic compound?
12. Sucrose is a _____ formed by joining _____.
13. How are starches and monosaccharides related.
14. Name the starch commonly formed by animals. _____
15. Fats, waxes, and steroids are all known as _____.
16. How are the lipids formed by plants different from those formed by animals? (Hint: Sat vs Unsaturated)
17. A fat molecule is formed by joining one molecule of _____ and three molecules of _____
 How many water molecules are made in this process? _____
18. What 3 elements are found in all carbohydrates? _____
19. What 4 elements are found in all proteins? _____
20. Proteins are composed of chains of many smaller monomer units called _____
21. The chemical bond between 2 amino acids is known as a _____ bond.
22. There are _____ different amino acids.
23. What makes each amino acids different from each other?
24. Name 3 monosaccharides. _____
25. What is the difference between hydrolysis and dehydration synthesis?
26. What is the function of an enzyme?
27. Name 4 factors that affect an enzyme's ability to function? Remember an earlier question.
28. Why is an enzyme "specific"?
29. How can an enzyme's shape be changed? What is it called when a protein's shape is changed?
30. At what pH and temperature would a stomach enzyme work best? Why?

31. What are the building blocks of nucleic acids? How many different types are there?

ff. Describe a relationship between metabolism, homeostasis, and biological chemical reactions.

Concept/Generalizations: Unit 1

A concept generalization is a sentence or two incorporating vocabulary terms in a meaningful sentence. The sentence should not define the terms; rather it should prove that you understand the relationships between the words. Complete the following concept generalizations as we discuss them in class. Be prepared to share your responses with classmates, so write NEATLY! PUT THEM IN YOUR NOTEBOOKS.

1. **SCIENTIFIC METHOD:** Hypothesis, experiment, variable, control, experimental conditions, observation, problem, measurement

2. **GRAPHING:** variable, independent, dependent, axis,

3. **pH:** 1, 7, 14, acid, base, water, vinegar, OH^- , H^+ , hydrogen ion, hydroxide ion, neutral

c

4. **MOLECULES:** bond, shared, electrons, covalent

5. **CARBOHYDRATE:** simple sugar, monosaccharide, disaccharide, polysaccharide, glucose, lactose, glycogen, energy, cellulose, plant, animal

6. **LIPIDS**: fatty acids, glycerol, saturated, fatty acid, unsaturated, fat, phospholipid, cholesterol

7. **AMINO ACIDS**: amino group, carboxyl group, peptide bond, essential amino acid, R groups, 20 types

8. **PROTEINS**: enzymes, amino acids, structure, shape, structural

9. **PROTEIN PROPERTIES**: denatured, heat, pH, optimum range, enzymes, reaction rate

10. **ENZYMES**: substrate, product, activation energy, lock and key, product, optimum condition, denature, catalyst, specificity, active site