SCIENTIFIC METHOD LAB REPORT: AP Biology

Include a Title (1 pts*): "The Effect of (A) on (B)"   40pts
Example: The Effect of pH on the Activity of the Enzyme Lactase.

I. Introduction (5 pts*)
a. Background
Present a review of the topic. Place the research/experiment in the proper context of biology. Relate your experiment to the concepts learned in class. Review prior research directly related to the experiment. (If needed, answer any prelab questions in this section)

Example: Protein structure determines enzyme function. The shape of the active site controls the catalytic properties of the enzyme. Because of this, most enzymes work within a narrow range of environmental/cellular conditions. In particular, changes in pH, temperature and salinity will significantly affect enzyme function but altering protein structure. This research focused on the effect of changes in pH on enzyme activity. Changes in pH causes changes in hydrogen (H_+) and hydroxyl (OH_-) ions in solution. These changes in charge in the solution disrupt the secondary, tertiary and quaternary levels of structure of the proteins thereby changing the shape of the active site of the enzyme as the protein begins to denature. In this research, an experiment was undertaken to test the effect of pH on the function of the enzyme lactase. Lactase digests the disaccharide milk sugar, lactose, into the monosaccharides, glucose and galactose... **note:** first person (I, we) is not used anywhere in a scientific report, except in the conclusion

b. Hypothesis
"If this relationship exists, then when (A) is changed by (increasing, decreasing, etc.) it will cause (B) to change in a specific way (increase, decrease, etc.)
(in some cases, there may be more than one hypothesis)

Example: If pH affects enzyme function, then when the pH is increased or decreased from pH 8 (the pH of thesmall intestines) the rate of lactose digestion by lactase will decrease.

II. Methods and Procedures (8 pts*)

a. Materials
List the materials used in the experiment.
- If using a computer simulation, explain what the simulation is using or representing/showing

b. Variables: Discuss the variables used in this experiment

  i. **Independent Variable:** State the independent (or manipulated) variable(s), the (A) in your hypothesis. State how the independent variable will be modified. If it is measured, it must have units.
  Example: The independent variable is the pH of the milk at integer values from pH 4.0 to pH 12.0.

  ii. **Dependent Variable:** State the dependent (or measured) variable(s), the (B) in your hypothesis. It must have units and must be measurable.
  Example: The dependent variable is the production of glucose (the product of lactose digestion) in grams per mL of milk.

  iii. **Constants (Confounding variables)**
  List all of the variables that will be kept constant during the experiment. Be thorough.
  Example: Milk from the same source and same brand of glucose test strips were used for all the samples as well as the same beaker and pH meter.

  iv. **Control (positive, negative, a base line, or all three)**
  List the control(s) used in the experiment and explain what they were controlling for. If there is not a specific control group, what is the baseline, or what is used for comparison?
  Example: The pH 8.0 trial served as the positive control since it is known that this is the pH of the "native" environment of lactase function in the small intestines. All data will be compared to this control.
c. Procedures
Describe the procedures in summary steps, but in sufficient detail so that others can understand what you did. Do not just copy the steps from the lab instructions if they are given to you. *This can be in list format.*

III. Results (12 pts*)
a. Replication / Sample Size
State the number of overall trials, as well as trials for each modification of the independent variable if applicable. Usually, a minimum of three trials for each modification of the independent variable ensures accuracy, unless told otherwise. Be sure to also present the average of your data from the trials, if applicable.

Example: pH was tested at 9 different levels. Each pH trial was repeated 3 times and averages were taken.

b. Data

Organize the collected data in a data table. Provide a title for your data table. The title of the data table should describe the research and include both variables (A) and (B). Describe each data table in the text of your report.
Example

Table 1. The Effect of pH on Lactase Activity

	Glucose production (grams/ml of milk)								
	pH 4.0	pH 5.0	pH 6.0	pH 7.0	pH 8.0	pH 9.0	pH 10.0	pH 11.0	pH 12.0
Trial 1									
Trial 2									
Trial 3									
Average									

c. **Graph** (and explain)

Present the data in a graph: independent variable on the x-axis vs. the dependent variable on the y-axis in the appropriate graph form (line vs. bar) with proper X and Y axis labels, keys, and numerical scales. Under the graph, provide a description, discuss the trends in the data (but do not interpret yet). Highlight the most noteworthy datum points if needed.

Example: Graph 1 depicts the amount of glucose found in each of the samples after the milk was treated first with a specific pH buffer and then with lactase enzyme. The graph shows that the optimal pH for enzymatic activity of lactase is pH 8.0. The graph also indicates the enzymatic activity decreased sharply when the pH was either increased or decreased from this optimal with no activity below pH 5.0 or above pH 11.0...

d. Statistical Methods (if applicable)

Discuss the statistical tests used to describe or test the data, if needed. Describe what the statistical method shows. Include or attach work for the equations.

Example: Chi-Square test to accept or reject a null hypothesis, Hardy-Weinberg equation to test for variation

IV. Conclusions (10 pts*)

a. Answer any analysis question provided in the lab. Continue to (b) if no questions are provided.

b. Write a paragraph or two discussing the implications of the data. Include any information not disused in the analysis questions. What do your results mean when you consider the original question or hypothesis. Discuss whether the hypothesis was supported or not supported by the data. Point out the statistical significance of your results if applicable. Relate your conclusions to the concepts learned in class. Discuss any source of error. Could improvements be made? If the results are unexpected or contradictory, you should attempt to explain and point out possible avenues for further research.

Example: Enzyme function is determined by protein structure. The shape of the active site is the critical determining factor for enzyme activity, because that is the catalytic site. Lactase digests the milk sugar, lactose, into the monosaccharides, glucose and galactose. During the experiment, the activity of lactase was measured by the production of glucose in the milk samples. Optimal lactase activity was found at pH 8.0. This is the pH of the lumen of the small intestine where lactase functions in the human body. The enzyme has evolved to function within this environment so the protein has been selected for optimal functioning at this pH. As the hypothesis predicted, enzyme activity declined sharply as the pH decreased or increased beyond this optimum, thus the experimental hypothesis was supported. The change in pH causes changes in hydrogen (H_+) and hydroxyl (OH_-) ions in solution. These changes in charge in the solution disrupt the secondary, tertiary and quaternary levels of structure of the proteins thereby degrading the active site of the enzyme as the protein begins to denature...

V. Work Cited (1-2 pts*)

Include all published works consulted in your research. List in bibliographic form using MLA or APA style formatting. Use the following resources for help.
http://www.citefast.com/
http://www.bibme.org/
http://owl.english.purdue.edu/owl/resource/560/01/

* 2-3 pts for neatness, format and headings. MUST BE HANDWRITTEN!!!!

*note: your instructor reserves the right to modify the point scale based on the complexity of the lab

Skeleton Outline: (You can use this as an outline to write your report, as you need to include headings for each section)

I. Introduction
  a. Background
  b. Hypothesis

II. Methods and Procedures

  a. Materials:
  b. Variables
    i. Independent Variable:
    ii. Dependent Variable:
    iii. Constants:
    iv. Controls:
  c. Procedures:

III. Results
  a. Replication / Sample Size
  b. Data: table
  c. Graph:
  d. Statistical Methods (if applicable)

IV. Conclusions
    analysis question
    conclusion

V. Work Cited