**2016- 2017 End of Year Pre-AP Biology Student Agenda**

**\*\*Do NOT lose this document!\*\***

**5/8-Monday**.: Teacher-led review of lab report requirements, how to write a good title, question and purpose, how to frame a question, express relationships using variables (ex. negative, positive), how to write a hypothesis, and methodology section/experimental design**. Bring USB flash drive everyday through May 23**. **Bring in gelatin package, folder w/brads, & USB flash drive by 5/12-Fri.**

Students will then work in groups on the lab proposal by writing on their lab handout which, when complete, will be submitted to their teacher. They will then type the following and corresponding information in a google document: title, question and purpose, hypothesis, and methodology section/experimental design.

* Teacher setup for all days: give student handout of daily activities, 1 copy of lab report rubric per student, a class set of sample student lab report for review, and 4 copies of peer editing rubric per student
* Specifically Review:
	+ Each group is responsible for their own supplies except laboratory equipment- such as pineapples (fresh or canned) and Jell-O. Restrict your experiment to that requiring test tubes.
	+ Before turning in your draft proposal, make sure that you know how to make gelatin and the quantities of materials involved!
	+ **Your experiment must involve quantitative data! No qualitative studies will be accepted.**
	+ The research proposal must be approved before the student is allowed to collect data
	+ Lab report requirements:
		- 12 point Times New Roman font
		- Double Spaced
		- 1 inch margins
		- All measurements must be in metric
		- Always write in third person. For example, "Researchers first need to determine participants" (written in the third person) conveys a more formal, objective tone than "You first need to determine participants" (second person) and "I first needed to determine participants" (first person). Instructors, institutions and publishers generally require writing in the third person to maintain a more formal tone.
		- Write in Full Sentences except for the materials list which is bulleted and the procedures which is numbered
		- Proper grammar, spelling, and punctuation are expected at all times and lack thereof will usually be penalized. Needless to say, avoid the use of slang or jargon
		- Do not use contractions, ex. “don’t” must be “do not”
		- Do not use abbreviations in text except for units of measure, ex. “PCR” must be polymerase chain reaction.
		- Use past tense when referring to the actual work that you or your group did.
		- Check Spelling
		- Headings should be left-justified, bolded, underlined, and should be separated by 1 line
			* Headings include:
				+ Title
				+ Purpose and Question
				+ Hypothesis
				+ Materials
				+ Procedures
				+ Results
				+ Conclusion
	+ Content:
		- **How to develop a title:** By reading the title, the work being reported should be clear to the reader without having to read the paper itself. The title, "A Biology Lab Report", tells the reader nothing. An example of a good, self-explanatory title would be: "The Effects of Light and Temperature on the Growth of Populations of the Bacterium, *Escherichia coli* ". This title reports exactly what the researcher has done by stating three things:
			* + 1. The environmental factors that were manipulated (light, temperature).
				+ 2. The parameter that was measured (growth).
				+ 3. The specific organism that was studied (the bacterium, *Escherichia coli*).
			* If the title had been only "Effects of Light and Temperature on *Escherichia coli* ", the reader would have to guess which parameters were measured. (That is, were the effects on reproduction, survival, dry weight or something else?) If the title had been "Effect of Environmental Factors on Growth of *Escherichia coli* ", the reader would not know which environmental factors were manipulated. If the title had been "Effects of Light and Temperature on the Growth of an Organism", then the reader would not know which organism was studied. In any of the above cases, the reader would be forced to read more of the paper to understand what the researcher had done.
		- **How to State Problem / Purpose:** The objective is a concise statement in complete sentences outlining the purpose of the experiment. The purpose section of a lab is where you tell the reader your reason for doing the lab in the first place
		- **How to frame a question:** Using the information used to develop a title, develop a question. Questions should be specific.
			* Ex. What is the effect of protease concentration on the rate of amino acid production?
		- **How to develop a research relationship statement:** Clearly indicate the nature of the relationship between the independent and dependent variable and whether that relationship is positive or negative.
			* Ex. Increasing protease concentrations will increase the production of amino acids
		- **How to state a hypothesis**: Possible if\_\_\_\_ then\_\_\_\_\_ statement. Define any variables such as manipulated, measured, controlled and the cause and effect predicted. The hypothesis is a one-line sentence where you discuss how you’ll solve the problem at hand. The statement after “if” is the independent variable. The independent variable is whatever you will do to solve the problem. The statement after “then” is the dependent variable, because what happens will depend on what you did in the first place. Generally, the dependent variable will be the problem you mentioned in the purpose. Your hypothesis must clearly describe your prediction. For example, “If glucose concentration increases, then the amount of water leaving cells will also increase. Therefore, the bag with 20mg of glucose will have less water than the bag with 60mg of glucose.”
		- **How to write the methodology/ experimental design section:** This section explains how and, where relevant, when the experiment was done. The researcher describes the apparatus (include specific metric measurements), the experimental design, methods of gathering data and type of control. The general rule to remember is that the Materials and Methods section should be detailed and clear enough so that any reader knowledgeable in basic scientific techniques could duplicate the study if she/he wished to do so.
		- Use a bulleted point to list the quantity of materials as well as specific measurements of substances first before writing your procedures. The procedures section should be numbered.
		- Make sure your experiment has a control!
		- **DO NOT** write this section as though it were directions in a laboratory exercise book. Instead of writing: “First pour agar into six petri plates. Then inoculate the plates with the bacteria. Then put the plates into the incubator . . .”, simply describe how the experiment was done: “Six 5 cm petri plates were prepared with 3 ml of nutrient agar and inoculated with *E. coli* bacteria. The plates were incubated for ten hours at 37OC.” Ensure that you number each step!

**5/9 and 5/10-Tuesday and Wednesday:** Continue to work in groups on the lab report proposal then **submit it to the teacher** for approval. When finalized, students will submit lab proposal for approval to teacher before progressing further. Teacher will grant approval, suggest modifications, or deny submission. If students need to modify their proposal, they must modify their proposal before submitting another proposal for approval. Students cannot advance further without approval. **Each group must submit a list of lab supplies needed to teacher by the end of the period on 5/10- specifying the quantity and sizes, ex. 4 200ml beakers.**

Students can then type the following information (title, question and purpose, hypothesis, and methodology section/experimental design) and each student individually prints 2 copies when complete. **Bring printed copies (2 per student) of rough draft for part 1 of lab report on 5/11.**

**5/11-Thursday:** 2 Peer critiques of printed copies of the draft lab report using peer editing handout. Students will critique two other student’s lab reports using the peer editing handout. Students will focus only on the following sections on the handout- formatting, introduction, materials, and procedures. Work must be shown to 2 other students in another group. Each student will then make corrections to lab report draft based on student feedback from peers.

**5/12- Friday**: Students will learn how to make gelatin (emphasis on procedures – using metric- and maintaining appropriate concentrations on packaging so not diluted or too concentrated), and how to write the results and conclusion section of the lab report and then continue to make final corrections to lab report (where appropriate). Students will also determine their roles during the lab- pineapple cutter, note-taker (measurements, quantities, and deviations from procedures), and gelatin maker.

* Specifically review:
	+ **How to write a results section:** Here the researcher presents **summarized** data for inspection **using narrative text** and, where appropriate, tables and figures to display summarized data. Only the results are presented. No interpretation of the data or conclusions about what the data might mean are given in this section. Data assembled in tables and/or figures should **supplement** the text and present the data in an easily understandable form. **Do not present raw data!** If tables and/or figures are used, **they must be accompanied by narrative text**. Do not repeat extensively in the text the data you have presented in tables and figures. But, do not restrict yourself to passing comments either. (For example, only stating that "Results are shown in Table 1." is not appropriate.) The text **describes** the data presented in the tables and figures and calls attention to the important data that the researcher will discuss in the Discussion section and will use to support Conclusions. (Rules to follow when constructing and presenting figures and tables are presented in a later section of this guide.)
		- This is the core section of your lab report and before you begin writing it, you should gather together any and all data and/or observations you made during the experiment. Numerical data are best represented in tables or graphs. Your results should state only what you found in your experiment, not what you expected to find or what you were supposed to have observed. Be sure to write in the past tense, passive voice, and avoid use of the pronouns “I” and “we”.
			* Example: *The recrystallized benzoic acid appeared as a powdery, white solid weighing 0.67 g (54% recovery) and had a melting range of 98-101 °C*
		- **Therefore your results section must have a summary of your results written in paragraph form and in the past-tense FIRST, then include your table followed by your graph.**
		- **Calculations-** You may be required to provide sample calculations in your laboratory report. These calculations are meant to demonstrate your ability to use raw, experimental data to determine the value you set out to measure. When you place a sample calculation in your report, always keep significant figures and units in mind. Your calculation may include a general word description of the mathematical operation or a displayed equation.
		- **Tables:** Tables are used to list related data and should be formatted with readability and efficiency in mind. Use the table feature of Word to prepare neatly organized tables. This is done by clicking on the Table menu option, followed by Insert, and then Table. A dialog box will open which will allow you to choose the dimensions of the table. Always select one more row than your need. The top row will be used to label each column. Labels should be as short as possible, yet provide enough information such that the reader understands the content of each column. Units should also be given when applicable. All tables should be consecutively numbered for easy reference within the text of your laboratory report.
			* Example:

Table 1: Summary of recrystallization experiment

|  |  |  |  |
| --- | --- | --- | --- |
| Sample  | % yield  | MP (C)  | Appearance  |
| 1  | 57.23  | 135.2  | White, crystalline  |
| 2  | 55.27  | 136.0  | White, powder  |
| 3  | 55.98  | 135.8  | Slightly yellow crystals  |

* + - **Graphs:** (if applicable): Always create representations of your data in graphical form. Graphs must have the following:
1. Be completed in Excel and copied into your word document. You can watch the 7 minute YouTube video on how to use excel for graphing, (<https://www.youtube.com/watch?v=Xn7Sd5Uu42A>
2. The graph (not just the axes) should cover at least 35-50% of the page. Small graphs are unacceptable.
3. Each axis must have a clear label followed by the metric units of the labeled quantity in parenthesis.
4. The scale used on each axis must be clearly stated and easy to read.
5. All plotted points must be small and made clear and easy to read.
6. Write a title above each graph. The title should not be a repeat of the axis labels. It should clearly differentiate the graph from any others. For example, “Graph II—The force on the 0.5 kg Cart Versus Its Resulting Acceleration” is much clearer than “Graph II—Force Versus Acceleration”
7. Must not possess loud colors- be conservative with your choice of colors. This is a professional report.
* **How to write the Conclusion section-** The conclusion section is the place to reflect on your actual data and observations as they relate to the experiment in a logical manner. You must write about your results in a way that describes how they support (or not) the objective(s) of the lab. Exclude those points that are not relevant to your experiment. This is the part of the lab where you can explain or rationalize errant data or describe possible sources of error and how they may have affected the outcome of the experiment. Even if your experiment was a complete disaster you can still write an excellent lab report, as long as you understand what went wrong and can explain it, and the discussion section is where you can do that. In the end you should relate back to the introduction section and come to a definitive conclusion. Write in the past tense and use technical prose. Avoid opinions and feelings, and use of the personal pronouns "I" and/or "we."
	+ Here, the researcher **interprets** the data in terms of any patterns that were observed, any relationships among experimental variables that are important and any correlations between variables that are discernible. The author should include any explanations of how the results differed from those hypothesized, or how the results were either different from or similar to those of any related experiments performed by other researchers. Remember that experiments do not always need to show major differences or trends to be important. "Negative" results also need to be explained and may represent something important--perhaps a new or changed focus for your research.
	+ Effectively communicate your answers to the summary questions. **Assume the reader of your report has not read the questions in the lab handout.** All answers should be written in complete sentences that do not require the reader to guess what the question was. The answers to questions should **NEVER** begin with the words “it” or “they”. For example, in responding to the question: “What can you conclude from your velocity versus time graph about the acceleration of the cart?” A proper response would be “Since the velocity versus time graph is a straight line, the acceleration of the object is constant.
	+ You should start by writing at least one sentence using the RAISE method and then discuss the summary questions IN DETAIL from the pineapple lab handout (also in paragraph form). Remember, all work should be in paragraph form and written in the third person! Be very detailed in your conclusion, using terms such as substrate, denature, etc. where applicable.
* **Well written conclusions follow “RAISE” method for Effective Data Analysis**
1. **R**estate the Problem, Prediction or Hypothesis
	* + 1. What was the purpose of the lab?
			2. How does the lab we performed relate to what we are studying in class?
2. **A**nalyze data: describe trends in the observations/make inferences based on the observations
3. **I**nclude **S**upport by citing relevant data
4. **E**xplain/Extend your conclusion/claim using additional research and answer the following answers in detail
	* + 1. What problems did you have during the lab? Did you have to modify your procedure?
			2. Do your results make sense? If not, why? What are sources of error?
			3. If you were to repeat this lab in the future, how would you modify or improve the procedure?

**5/15 and 5/16-Monday & Tuesday:** Students will perform the Lab; Data collection (2 days maximum). **Teacher will provide knives for cutting fruit and gelatin if needed.**

Students may also modify their procedures and update this on their lab report and materials section as well as start/continue typing their results section and conclusions. Graphs and tables must be embedded in lab report. **The results, graphs, tables, and conclusion section are not to be completed in groups, but individually**. You can watch the 7 minute YouTube video on how to use excel for graphing, (<https://www.youtube.com/watch?v=Xn7Sd5Uu42A>).

**5/17-Wednesday:** **Officially DUE**: **First section of lab report (title, question and purpose, hypothesis, and methodology section/experimental design) - one per group at the beginning of the period**. See rubric for grading- sections to be graded are first 4 rows only for a maximum of 18 points (include max 3 point for format).

 -Discuss expectations for the 2nd half of lab report (tables, excel for graphing, titles of graphics, conclusion, etc.)

 -Begin working independently on 2nd half of lab report (typing, editing, etc.)

**5/18-Thursday:** Students may also start/continue typing their results section and conclusions.

**5/19-Friday:** Students continue to type results and conclusion section. Each student prints 2 copies.

**5/22-Monday**: **2 printed copies of rough draft for 2nd part of lab report due for every student**. Peer critique of typed results and conclusion section. Students must give their report to 2 students in other groups for critique. Students can then edit their report based on student feedback individually. Students will focus only on the following sections on the handout- formatting, data section, and conclusion. **No group collaboration is allowed!**

**5/23-Tuesday**: Students will complete their modifications and finalize lab report. This is the last day to work in class on the lab report.

**5/24-Wednesday:** **DUE:** **Each student will submit their completed lab report (2nd part of lab report only) at the beginning of the period**. See rubric for grading. Assignment valued at 33 points**. Additionally, the summary questions from the “Pineapple Enzymes & Jell-o Molds” handout is due.**

 **NO LATE WORK will be accepted.**

* The rest of the class period is devoted to working on the final exam review.

**5/25-Thursday:** Work on final exam test review

**5/26-6/1-Friday-Thursday:** Final Exams