

Honors Biology Summer Assignment

Bonus Due Date: Wednesday, August 9, 2017

Final Due Date of First Draft for full credit: Friday, August 25, 2017.

What:

- First draft of a formal lab report over a self-created experiment AND a bound daily experiment journal.
 - This will be a revision process in which students will turn in no more than three drafts of a lab report that Mrs. Harvey will edit and return for students to make improvements on before the final graded draft is turned in.
- The experiment journal will not be edited, what is turned in will be the final draft of the journal.
 - Follow the guidelines listed in “**Step 4 Test**” below for what to include in the journal

Purpose:

- The study of the characteristics of life, specifically apply the characteristics of growth and development to the germination of a red bean seed.
- Review and apply experimental design elements to a problem.
- Learn how a dicotyledon seed germinates.
- Learn which factors affect the germination of a dicot and how they affect the rate of growth and development.
- Communicate scientific findings for peer review in the form of a formal lab report.

How:

- 1. Problem:** Identify which problem you would like to study:
 - How does temperature affect the growth and development of a red bean seed?
 - How does soil type affect the growth and development of a red bean seed?
 - How does light affect the growth and development of a red bean seed?
- 2. Research:** Read pages 6-9 & 17-25 in Miller and Levine Biology textbook and/or Mrs. Harvey’s Experimental Design Notes and Characteristics of Life Notes on Mrs. Harvey’s Moodle Page. Additionally, read the links provided on Mrs. Harvey’s Moodle page for dicot germination research and use Google, as necessary.
 - Understand all vocabulary words to use in design of lab - Independent variable, dependent variable, control group, experimental group, controlled variable (also called a constant), etc.
 - Know how a good experiment is designed
 - Know what the characteristics of life are and how they are described
 - Know how a dicot germinates – including the order of appearance of each organ of the plant
- 3. Hypothesize:** Write a background (including the points below) that leads to your hypothesis (should be the last line of your background). It should be written using the terminology that you found on Moodle and through your personal research on Google.
 - What defines an organism as being alive
 - Explains each characteristic of life, including examples of each
 - Specifically, what growth and development are and how they are different from each other
 - Explain what growth and development look like in a plant.
 - Explain how a seed develops into a plant – including the order in which each part develops and what it turns into as the plant grows.
 - Explain what happens from the time the seed is planted until the first leaves – not the cotyledons, the first leaves - appear.
 - Should list what factors are necessary for seeds to germinate and develop

- Write your hypothesis in a single If/Then statement format as the final sentence of your background.
 - In short, all of the writing before your hypothesis is to lead your reader to understand why you chose your hypothesis! Yes, it is an educated guess...but that means that you are educating your reader about what made you decide on what you thought would happen.

4. **Test:** Design, set up, and fill in on your lab report how you will test your hypothesis

- Write, in numbered, list form, what steps you took/will take to test your hypothesis. This should be typed directly below your background.
- Do not write inherent things like “gather materials”
- How you write your steps will show me how well you understand the purpose of control groups, variables, constants, etc. You do not need to write these in the steps, but should think about them as you design the experiment.
- Follow your steps.
- Use the following general format for your experiment, no need to retype this in your lab report. Simply say “follow general seed germination guidelines as outlined by Mrs. Harvey”:
 - **Day 1:**
 1. In your notebook, write the date, sketch a picture of the outside of a red bean, and label the picture.
 2. Put 20 red beans in a plastic cup without soil. Pour water into the cup until it is about an inch over the surface of the red beans. Leave the beans in the water over night.
 3. Take a picture of the beans in the cups with the camera **making sure your face is in the picture**. Put the picture in your notebook on day 1.
 - **Day 2:**
 1. In your notebook, record the date. Describe the beans in the cup – noting any changes in the beans – changes in size, shape, color, texture, etc. Make a sketch of a bean that was soaked overnight in the cup as it now looks.
 2. Take the skin off of the bean and open it. It should open naturally into two halves. There should be an embryo plant inside the bean. Sketch the opened bean in your notebook and use the attached information to label the opened bean seed.
 3. Take a picture of the opened bean seed **making sure your face is in the picture**.
 4. Get at least four (more would be better) empty clear plastic cups and put potting soil in the cups until the soil* is about an inch from the top of each cup. Place your bean seeds in the cup so that you can see them from the outside. You should **place them less an inch below the soil** all around the cup. You want them to be up **against the plastic sides of the cup** so you can watch them through the plastic. Use a minimum of four cups, five beans to a cup, so that you will have at least two control and two experimental bean cups. Do not plant the one you dissected. Water them so that the soil is moist but not soupy! Mark your cups as experimental and control. (* If you are testing if soil is necessary this will have to be adjusted in the experimental group)
 5. Take a picture of the control and experimental beans in the cups after you plant them **making sure your face is in the picture**.
 - **Day 3 until Day 14:**
 1. In your notebook, record the date. Describe any changes in the bean seeds in both groups and make sketches of the bean seeds each day. Take a picture of the at least one of the experimental bean seed each day **making sure your face is in it**.
 2. As the bean seed develops you will see new structures appear – the new structures are making it change its form and so is evidence that it is developing! The attached handout will

show you what to expect and give you information to use to label the developing seed. (You may have to remove the seed from the soil to see it – if you do, do so very carefully and return it to the soil so it is in the same position.)

3. Use a ruler to measure the new structures as they appear. Measure them each day from the first day that they appear and record the measurements in a labeled table your notebook each day. As they increase in size, growth is occurring. (If you have to remove the seed from the soil to measure its parts do, do so very carefully if you damage the parts it may not grow – once parts are above ground measure from the top of the soil.)
 - **If you have no growth after 3 or 4 days**, start over OR email me for suggestions – do not come to school and say that your beans did not grow. If you have to start over more than once email me.

5. **Analyze:** Create both a data table and graph of plant growth and development to log daily results.

- You will need to track each plant's daily growth in cm for both roots and stem, find a daily average growth for both the experimental and control groups, and provide a column for qualitative data in a single data table. This means your lab report should contain ONE data table with all data.
- For your graph, you will need a multi-line graph to compare the average daily growth for both the experimental and control groups. Be sure to use proper titles, axis labels, and a key so I know what I am looking at. Please also try to Google how to create and insert a line graph from Excel into a Word document. There are several videos out there for help. If you cannot figure this out, then you may hand draw this part. Keep track of your data for use in your typed lab report.
- This comes directly after the Procedure in your lab report.

6. **Conclude:** Type a conclusion to explain if your hypothesis is supported or rejected, citing data as evidence. Include the following information:

- whether you accepted or rejected your hypothesis (if your data was insufficient to determine this, you may say that you could neither accept or reject because your data was inconclusive).
- the relationship between your IV and DV (direct, indirect, or inclusive (no relationship))
- summarize what happened to the experimental group
- compare the experimental group to the control group—where the outcomes different?
- what happened during your experiment that could have made your data less reliable (could have made them less accurate or could have affected how well they were collected)
- what would you change next time to make your experiment closer to perfect?
- how could the results of your experiment be used in real life?
- what additional experiments could be done to have more information about your question?
 - Look on Mrs. Harvey's Moodle page for a [sample "Excellent" lab report](#) (click hyperlink to go to sample lab report).
- This comes directly after the analysis section of your lab report

*** Please check Mrs. Harvey's Moodle for announcements of summer "help" dates. This will be one or two days in July/early August in which students may bring their typed lab report in and we will sit together to edit it.

7. **Works Cited:** Provide a bibliography of sources used during research directly following your conclusion.

- You may use your school provided email to set up an account in easybib.com to help you create your bibliography.
- Go to the school's library page for a links on this task.

Grading:

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Name _____

The checklist below will be used to grade the lab journal portion of your summer assignment. This portion is worth 80 pts.

- _____ Complete Assignment Turned in on August 9, 2017 **(8 pts. bonus)**
 - ** Including the first draft of your formal lab report!
- _____ Complete Assignment Turned in on August 25, 2017
 - ** Including the first draft of your formal lab report!

- _____ Pictures turned in **(10 pts.)**
- _____ Bound Notebook turned in **(6 pts.)**
- _____ Lab Report Draft #1 turned in on time **(10 pts.)**

- _____ Experiment: Days 1 and 2 **(14 pts.)**
 - _____ Date recorded each day
 - _____ Sketch of bean before soaking labeled correctly (Day 1)
 - _____ Sketch of opened bean labeled correctly (Day 2)
 - _____ Description of beans
 - _____ Picture of student and beans in cup of water (Day 1)
 - _____ Picture of student and opened bean seed (Day 2)
 - _____ Picture of student with control and experimental bean cups (Day 2)

- _____ Experiment: Days 3 to 14 **(40 pts.)**
 - _____ Date recorded each day **(6 pts.)**
 - _____ Described changes in control and experimental beans each day **(7 pts.)**
 - _____ Sketched bean development each day **(7 pts.)**
 - _____ Sketches had correct labels of parts as they emerged **(7 pts.)**
 - _____ Daily growth recorded in table **(7 pts.)**
 - _____ Had pictures of beans each day **(6 pts.)**

- _____ Total for lab journal portion of assignment **(80 pts.)**

The rubric on the next page will be used to grade the lab report portion of your summer assignment. This portion is worth 60 pts.

- _____ Total for lab report portion of assignment **(60 pts.)**

- _____ Total for summer assignment **(140 pts.)**

Lab Report Content Rubric

Criteria	Unsatisfactory (2)	Needs Improvement (4)	Satisfactory (6)	Exemplary (8)
<u>Introduction</u>	Missing three of the following: - what you are going to do - why the study is performed - contains hypothesis in correct format - explanation of science concepts	Missing two of the following: - what you are going to do - why the study is performed - contains hypothesis in correct format - explanation of science concepts	Missing one of the following: - what you are going to do - why the study is performed - contains hypothesis in correct format - explanation of science concepts	Has all of the following: - what you are going to do - why the study is performed - contains hypothesis in correct format - explanation of science concepts
<u>Lab Procedure</u>	Missing three of the following: - Steps in order - Detail shown - Used correct terminology/units - Can be repeated	Missing two of the following: - Steps in order - Detail shown - Used correct terminology/units - Can be repeated	Missing one of the following: - Steps in order - Detail shown - Used correct terminology/units - Can be repeated	Has all of the following: - Steps in order - Detail shown - Used correct terminology/units - Can be repeated
<u>Data Table</u>	Missing three of the following: - Title (correct) - Independent variable label - Dependent variable label - Units for all numbers	Missing two of the following: - Title (correct) - Independent variable label - Dependent variable label - Units for all numbers	Missing one of the following: - Title (correct) - Independent variable label - Dependent variable label - Units for all numbers	Has all of the following: - Title (correct) - Independent variable label - Dependent variable label - Units for all numbers
<u>Graph</u>	Missing three of the following: - Title (correct) - Independent variable label - Dependent variable label - Correct types - Correct numbering on axis	Missing two of the following: - Title (correct) - Independent variable label - Dependent variable label - Correct type - Correct numbering on axis	Missing one of the following: - Title (correct) - Independent variable label - Dependent variable label - Correct lines/bars - Correct numbering on axis	Has all of the following: - Title (correct) - Independent variable label - Dependent variable label - Correct type - Correct numbering on axis
<u>Conclusion Questions</u>	Missing three of the following: - Restate hypothesis to accept or reject - Summarized what happened with each group and how the graph shows this - Described errors	Missing two of the following: - Restate hypothesis to accept or reject - Summarized what happened with each group and how the graph shows this - Described errors	Missing one of the following: - Restate hypothesis to accept or reject - Summarized what happened with each group and how the graph shows this - Described errors	Has all of the following: - Restate hypothesis to accept or reject - Summarized what happened with each group and how the graph shows this - Described errors
<u>Conclusion Analysis</u>	Missing three of the following: - Accurately explained why hypothesis was accepted or rejected - How error could affect or be improved upon - How real life connection is used - What other questions should we look at?	Missing two of the following: - Accurately explained why hypothesis was accepted or rejected - How error could affect or be improved upon - How real life connection is used - What other questions should we look at?	Missing one of the following: - Accurately explained why hypothesis was accepted or rejected - How error could affect data or be improved upon - How real life connection is used - What other questions should we look at?	Has all of the following: - Accurately explained why hypothesis was accepted or rejected - How error could affect or be improved upon - How real life connection is used - What other questions should we look at?

Lab Report Mechanics Rubric

Criteria	Unsatisfactory (1)	Needs Improvement (2)	Satisfactory (3)	Exemplary (4)
<u>Technology</u>	Three or more of the requirements not typed:	Two of the requirements not typed:	One of the requirements not typed:	Has all of the following typed: - Hypothesis - Procedure - Data table - Graph (ok to draw) - Conclusion
<u>Writing</u>	Has multiple mistakes in the following: - Correct spelling/grammar - works cited - Scientific terminology - Correct format (font, size)	Has 3-4 mistakes in the following: - Correct spelling/grammar - works cited - Scientific terminology - Correct format (font, size)	Has 1-2 mistakes in the following: - Correct spelling/grammar - works cited - Scientific terminology - Correct format (font, size)	Has all of the following: - Correct spelling/grammar - works cited - Scientific terminology - Correct format (standard font, 12 pt size, double spaced)
<u>Professionalism</u>	Has 1 or fewer of the requirements met	Has two of the requirements met	Has 3 of the requirements met	Has all of the following: - All drafts turned in on time - Copies of all handouts and drafts attached to graded report - corrected all grammar mistakes based on editor marks - correct all content mistakes based on editor marks