Lab write-ups are a common part of many science courses and research careers. This write-up will serve as a tool to formally assess (KS: 50 pts) your technical lab skills, as well as your understanding of the concepts in this particular lab and organic molecules unit. In addition, there will be a lab practical (KS: 20pts) on this content.

This packet includes:
- Practice for identifying independent variables, dependent variables, and controls
- Practice for how to read nutrition facts labels
- Part 1 of the organic molecules lab
  - Step-by-step procedure for completing Part 1 of the lab.
  - Accurate findings in Part 1 are necessary to successfully complete Part 2.
  - You will need to “fill in the blanks” in this lab
  - This should be referenced as an exemplary model for your lab write-up.
- Part 2 of the organic molecules lab (instructions)
  - Brief instructions for successfully completing the write-up are listed here.
- A rubric for grading your write-up of part two of this lab
  - Reference this in order to view point breakdowns and to review expectations for each section of your write-up.

Independent Variables, Dependent Variables and Controls Practice

Let’s say that you are going to do an experiment to determine which of three fertilizers will help plants to grow the biggest. Before you would begin a test or investigation, you would need to think of all of the factors (besides the fertilizer) that might affect the outcomes of the experiment. These may include: plant type, amount of water, amount of sunlight, soil type, and temperature. These factors are called variables. A variable is something that can be measured or manipulated in an experiment.
There are two types of variables that exist in most experiments: Independent and dependent variables.

- Independent variables are factors that can be controlled or manipulated by the researcher.
- Dependent variables are factors that are measurable and change because of the independent variable. (The dependent variable depends on the independent variable.)

It is also important that each experiment has a control. A control is something that all other test results can be compared to. In this case, you would want to have the same type of plant that is receiving the same amount of sunlight and water as the others, but would receive NO fertilizer. This would show that any of this plant's growth is not due to the fertilizer.

**Let's pick out the dependent and independent variables for this experiment!**

**Independent Variable:**

**Dependent Variable:**

Use your knowledge of dependent and independent variables identify each in the following situations:

1. We want to find out if the amount of time that students study is related to their quiz scores.
   a. Independent Variable: __________________________
   b. Dependent Variable: __________________________

2. A teacher was curious if a money reward would influence performance on a test taken at the end of the course. Half the students were offered $5 for receiving an ‘A’ on the test, the other half were not offered money.
   a. Independent Variable: __________________________
   b. Dependent Variable: __________________________

3. A researcher hypothesizes that blondes really do have more fun. To test this hypothesis, she interviews a natural brunette who has recently become a blonde to determine if there is any change in the amount of fun she has.
   a. Independent Variable: __________________________
   b. Dependent Variable: __________________________

4. Angelo wants to find out if the color of his mom's birdhouse is related to the number of birds that fly in and out of it.
   a. Independent Variable: __________________________
   b. Dependent Variable: __________________________

5. A doctor is testing whether a new medication, “Root-tastic” will cause people to drink more root beer soda. To test this, she gives 100 people “Root-tastic” for one month and 100 people a placebo drug.
   a. Independent Variable: __________________________
   b. Dependent Variable: __________________________

6. Carmen wants to know if the type of food she gives her dog Fido for breakfast affects how many times a day Fido barks.
   a. Independent Variable: __________________________
   b. Dependent Variable: __________________________
Nutrition Facts Labels Practice

Nutrition Facts labels contain a detailed analysis of a specific food product and hold nutrition recommendations from the Institute of Medicine of the U.S. National Academy of Sciences. The goal of Nutrition Facts labels is to make it easier on the average consumer to monitor his recommended daily intake of nutrients. To understand nutrition labels, you must first take an interest in what your body needs to function properly, and what and how much you eat everyday. There are many diets advertised, but a good rule for navigating through the maze of options is to follow USDA guidelines for a balanced diet in every meal. A balanced diet consists of: carbohydrates from fiber-rich fruits, vegetables and grains; protein from lean meat, fish, beans, eggs, and dairy products; and fat, preferably from unsaturated fats, found in fish, nut, and vegetable oil. (eHOW.com)

Example:

Macaroni & Cheese

<table>
<thead>
<tr>
<th>Serving Size</th>
<th>Serving Size 3.5 oz (98g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servings Per Container</td>
<td>about 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amount Per Serving</th>
<th>Calories 320</th>
<th>Calories from Fat 90</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Daily Value*</td>
<td>15%</td>
<td>30%</td>
</tr>
<tr>
<td>Total Fat</td>
<td>10g</td>
<td>8%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>6g</td>
<td>30%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>25mg</td>
<td>30%</td>
</tr>
<tr>
<td>Sodium</td>
<td>730mg</td>
<td>15%</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>44g</td>
<td>4%</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>1g</td>
<td>4%</td>
</tr>
<tr>
<td>Sugars</td>
<td>4g</td>
<td>15%</td>
</tr>
<tr>
<td>Protein</td>
<td>14g</td>
<td>20%</td>
</tr>
</tbody>
</table>

*Percent Daily Values (DV) are based on a 2,000 calorie diet.

Answer the following questions based on the nutrition fact label above.

1. List 3 organic molecules that we studied that are also present in the nutrition facts above:
   i. ________________________________________________
   ii. ________________________________________________
   iii. ________________________________________________

2. What is the typical amount of mac and cheese should a person eat in a serving? _______________
3. How many servings are in this box of mac and cheese? _______________
4. Calculate the total amount of mac and cheese in this package. _______________
5. If you ate a single serving, what percent of your daily value of saturated fat did you eat? _______________
6. If you ate the whole box, what percent of your daily value of saturated fat did you eat? _______________
7. What is the average person’s recommended calorie intake? _______________

(www.foodcourt.com and http://www.cfasan.fda.gov/~dms/FlQuiz5b.html)
Title/Purpose:

Testing for Organic Molecules Lab – Part 1
What are the characteristics of Positive and Negative Results When Testing for Organic Molecules?

Hypothesis:

In this experiment, I expect to use various indicators that show a positive result in the presence of the organic molecule being tested, and I expect a negative result in the absence of the organic molecule. I believe this will happen because the indicators are designed to determine the presence or absence of a specific organic molecule.

Introduction:

Over the past few weeks we have been talking about organic chemistry: the chemistry of life. Complex organic molecules exist because of carbon’s unique ability to form covalent bonds with other carbon atoms. Now it is time to look at some specific types of organic molecules that are found in foods. During this exercise we will be testing for the presence and absence of lipids, starches, simple sugars and proteins in known positive and negative solutions to see what this looks like.

The independent variables in this experiment are the variables that are within the control of the experimenter; these are the circumstances that are varied in order to find how they affect the dependent variable. In this experiment, the independent variables are the organic molecules: lipids, starch, sugar, and protein. The dependent variable is the variable that changes as a result of the independent variable. In this experiment, the dependent variable is the color/observations made with the positive and negative results.

The pure, deionized water stands as the control in this experiment, because we know for a fact that this should test negative for all organic molecules. This is the standard to which we will compare our positive results.

Materials and Safety Considerations:

- Safety goggles *Caution: Safety goggles must be worn at all times during this lab to prevent eye injury.
- Pencil
- Test tube rack
- Six 5mL test tubes
- 17 drops of deionized water
- Boiling water bath *Caution: The hot plate, boiling water, and hot glass can cause severe burns.
- 2 Test tube tongs
- Known solutions:
  - 2 drops of lipids (vegetable oil)
  - 5 drops of polysaccharide solution (corn starch and water solution)
  - 5 drops of monosaccharide solution (dextrose sugar and water solution)
  - 5 drops of protein solution (albumen and water solution)
- Testing reagents:
  - 1 piece of brown paper towel (at least 10cm X 20cm)
  - 3 drops of iodine *Caution: Iodine can stain skin and clothing. Use with care.
  - 5 drops of Benedict’s reagent *Caution: Benedict’s reagent can irritate your skin and burn your eyes. Use with care.
  - 5 drops biuret reagent
**Procedure:**

**Lipid test:**
1) Draw two approximately 2cm circles on the brown paper towel piece.
2) Put no more than 2 drops of water in one circle.
3) Put no more than 2 drops of lipids in the other circle.
4) Let the towel sit for approximately 15 minutes. To quicken the process, you can pick up and wave the towel in the air.
5) Record your results in the data table.

**Protein test:**
6) Obtain two clean test tubes and place them in the left side of the test tube rack. The first will be the control/negative test (water), and the second will be the positive test for proteins.
7) In the first test tube, add 5 drops of water.
8) Next, add 5 drops of biuret reagent to the first tube.
9) Agitate test tube.
10) Record detailed observations in the data table.
11) In the second test tube, add 5 drops of protein solution.
12) Next, add 5 drops of biuret reagent to the second tube.
13) Agitate test tube
14) Record detailed observations in the data table.

**Polysaccharide test:**
15) Obtain two clean test tubes and place them in the third and fourth slot of the test tube rack. The third will be the control/negative test (water), and the fourth will be the positive test for polysaccharides.
16) In the third test tube, add 5 drops of water.
17) Next, add 5 drops of iodine to the third tube.
18) Record detailed observations in the data table.
19) In the fourth test tube, add 5 drops of polysaccharide solution.
20) Next, add 5 drops of iodine to the fourth tube.
21) Record detailed observations in the data table.

**Monosaccharide test:**
22) Obtain two clean test tubes and place them in the fifth and sixth slot of the test tube rack. The fifth will be the control/negative test (water), and the sixth will be the positive test for monosaccharides.
23) In the fifth test tube, add 5 drops of water.
24) Next, add 5 drops of Benedict’s reagent to the fifth tube.
25) Carefully grasp the test tube with the one of the test tube tongs. Be careful not to squeeze them when the tube is present.
26) Submerge only the lower half of the test tube in the boiling water bath for 1 minute.
27) Remove and record detailed observations in the data table.
28) In the second test tube, add 5 drops of monosaccharide solution.
29) Next, add 5 drops of Benedict’s reagent to the second tube.
30) Carefully grasp the test tube with the other test tube tongs. Be careful not to squeeze them when the tube is present.
31) Submerge the lower half only of the test tube in the boiling water bath for 1 minute.
32) Remove and record detailed observations in the data table.

**Clean up:**
33) Pour all six solutions from the test tubes down the drain. Rinse the sink with water.
34) Clean each tube carefully in warm soapy water with test tube brushes.
35) Rinse with water and carefully shake out excess water. Return the tubes to the rack upside down to air dry.
**Data and Observations:**

Table 1. Positive and Negative Results When Testing for Organic Molecules

<table>
<thead>
<tr>
<th>Organic Molecule</th>
<th>Testing Reagent</th>
<th>Observations of a Negative Result (H₂O)</th>
<th>Observations of a Positive Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipid</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(Vegetable oil)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Albumin &amp; water solution)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Polysaccharides</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Corn starch &amp; water solution)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monosaccharides</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Dextrose sugar &amp; water solution)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Results:**

During the lipid test, the water showed a negative result for lipid. The brown paper appeared ________________ after we let it sit for 15 minutes. The known positive lipid appeared ________________ after it sat on brown paper for 15 minutes. During the protein test, the water showed a negative result for proteins. When the ________________ reagent was added, the solution appeared ________________. The known positive protein solution appeared ________________ when the ________________ reagent was added.

During the polysaccharide test, the water showed a negative result for polysaccharides. When the ________________ reagent was added, the solution appeared ________________. The known positive polysaccharide solution appeared ________________ when the ________________ reagent was added.

During the monosaccharide test, the water showed a negative result for monosaccharides. When the ________________ reagent was added and heated in a boiling water bath for one minute, the solution appeared ________________. The known positive monosaccharide solution appeared ________________ when the ________________ reagent was added and heated for one minute.
Discussion/Conclusion:

In this experiment, I hypothesized that various indicators would show a positive result in the presence of the organic molecule being tested, and a negative result in the absence of that organic molecule (in water). My hypothesis was correct because the indicators showed accurate results for both a positive and negative test.

I know that my hypothesis is correct because ______________________________________________________
____________________________________________________________________________________________.

Refer to the data and make an in-depth analysis: ______________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________

There may have been some experimental error during my experiment. For example, I may have not followed the procedure carefully and accurately. These are the adjustments I made to the procedure: __________________________
____________________________________________________________________________________________
____________________________________________________________________________________________

Also, I may have experienced something I did not expect. Here is what happened: __________________________
____________________________________________________________________________________________
____________________________________________________________________________________________

One practical application of this may be: ______________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________.
Testing for Organic Molecules Lab – Part 2 (instructions)

During the Lab:

Every single person expected to keep a lab journal DURING THE LAB AS YOU GO.
✓ Your teacher may collect this for a separate effort grade.
✓ Materials: Everything you touch should be listed on a materials page right away. If you use it, it should be recorded. See Part 1 for an example.
✓ Procedure: Everything you do, step-by-step, in detail should be recorded on procedure pages. This should be a detailed summary that can be reproduced without error. See Part 1 for an example.
✓ Data table: Detailed observations should be made in a table on a data page. You may want to model it after the data table in Part 1.

Basic outline of procedure:
1. Fill a small test tube with an unknown solution (get this from your teacher).
2. Write the # of your unknown here. Also record this number in your lab notebook. Your findings will be checked for accuracy.
3. Perform the four tests on your unknown solution to see which of the four organic molecules are present.
4. See your teacher when you think that you have identified which of these substances was in your sample. You will be told how many of the four are correct. Re-do the tests if you do not have the results correct.
5. When you have gathered all of your data, you may clean up and begin writing up your lab report.

Post-lab:

Rough Drafts should be:
✓ Typed
✓ Spell-checked
✓ Proofread
✓ You are also expected to write in complete sentences in the entire report.
✓ Your write-up should include the following sections outlined in the rubric.

Final Write-ups should be:
✓ Typed
✓ Spell-checked
✓ Proofread
✓ You are also expected to write in complete sentences in the entire report.
✓ Your write-up should include the following sections outlined in the rubric.
✓ Presented in a polished form.

★ Rough draft due: 2/22A & 2/23B (20 effort pts)
★ Lab Practical: 2/22A & 2/23B (20 KS pts)
★ Final draft due: 3/2A & 3/1B (50 KS pts)
<table>
<thead>
<tr>
<th></th>
<th>ADVANCED 4</th>
<th>PROFICIENT 3</th>
<th>BASIC 2</th>
<th>MINIMAL 1</th>
<th>ABSENT/MISSING 0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title and Purpose</strong> (3pts)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Title and Purpose are not present.</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>Hypothesis</strong> (4pts)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hypothesis is not present.</td>
</tr>
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<td></td>
</tr>
<tr>
<td><strong>Introduction</strong> (3pts)</td>
<td></td>
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<td>Introduction is not present.</td>
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</tr>
<tr>
<td><strong>Materials and Safety</strong> (3pts)</td>
<td></td>
<td></td>
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<td></td>
<td>Materials and Safety precautions are not present.</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td><strong>Procedure</strong> (X2 up to 6 pts)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Procedure not present or steps are incoherent or inaccurate.</td>
</tr>
<tr>
<td>Data and Observations (X3 up to 9pts)</td>
<td>Data collection in the form of charts, tables, graphs, etc. are very neat, labeled correctly, and contain accurate titles, labels, units and other information.</td>
<td>Data collection in the form of charts, tables, graphs, etc. are present. The information is accurate, but contains minor mistakes/omission OR tries to explain “why” things occur.</td>
<td>Data collection is not in the form of a chart, table, or graph. AND/OR Data is incomplete or inaccurate and shows serious inaccuracies.</td>
<td>Data and/or observations are not present or are incoherent.</td>
<td></td>
</tr>
<tr>
<td>Results (X2 up to 6pts)</td>
<td>Data and observations are described in detail in sentence form, but DOES NOT include an explanation of &quot;why&quot;! The reader senses fully what you observed in the lab.</td>
<td>Data and observations are described in sentence form, but may have some missing details or it may explain &quot;why&quot;. The reader has a good sense of what you observed in the lab.</td>
<td>Data and observations lack detail. The reader may have questions about what you observed in the lab, and/or there is an explanation of &quot;why&quot;.</td>
<td>Results are not present or completely non-descript.</td>
<td></td>
</tr>
<tr>
<td>Discussion/Conclusion (X3 up to 12pts)</td>
<td>• Restates the hypothesis. • Supports or refutes hypothesis by referring to data from the lab. • Shows an in-depth analysis of data. • Describes any possible experimental errors. • Makes a solid and realistic connection or application to the real-world.</td>
<td>Is missing one of the main criteria, or does not address two or more of the criteria in sufficient detail.</td>
<td>Is missing two of the main criteria or is missing important/essential details in the other criteria.</td>
<td>Is missing three of the main criteria or seriously fails to properly address most of the criteria. Discussion is not present, or is incoherent.</td>
<td></td>
</tr>
<tr>
<td>Formatting, Spelling, &amp; Grammar (4pts)</td>
<td>Is written in complete sentences or numbered format (where appropriate) and has NO spelling and/or grammatical errors.</td>
<td>Is written in complete sentences or numbered format (where appropriate) and has a few spelling and/or grammatical errors.</td>
<td>Is improperly formatted and contains various spelling and/or grammatical errors.</td>
<td>Has a variety of formatting, spelling, and grammatical errors.</td>
<td></td>
</tr>
</tbody>
</table>

Total (50pts):