Happy Monday!!!

ID's On Please!

Agenda:

1. Lab Antifreeze Class Data
2. Work on Formal Lab Report

HW: Finish Formal Lab Report
(Due Friday)
# Chemistry-Writing Lab Reports

## Pre-lab Section

**Title:**

**Driving Question:** Two sentences

- Explain the question being investigated. (Should not be phrased in a way that can be answered with a yes or no.)
- Explain briefly how the experiment or investigation will be done

**Variables:**

- **Dependent variable(s)** (Responding variable. What the experiment is designed to measure or test.)
- **Independent variable** (The “I” variable. The variable you change.)
- **Controlled variables** (2-3 things you will try to keep consistent to keep things “fair”.)

**Prediction / Hypothesis:** (Two sentences)

- Predict how you think the dependent variable will respond
- Explain the reasoning behind your prediction

**Procedure:** A picture procedure: Notes surrounding pictures that summarize what needs to be done in lab. *(Begin each lab by underlining verbs and circling nouns in the procedure. Include a picture and notes for each circle.)*
Data collection, presentation and at-home write-up

Evidence: Observations and/or data collected during the lab. Data tables should be completely labeled. **All numbers should include units!** Calculations must show work. Graphs must be done on **graph paper or computer.**

Questions: Answers must be written in complete sentences that begin by restating the question. Be specific and don’t use “it, them, they” if possible.

Conclusion: One or two paragraphs.
First paragraph:
1. Restate the driving question in past tense.
2. Respond to the driving question by providing an analysis of the data. Write by making **specific claims** followed by specific **evidence** from the lab. “I learned that... Evidence that supports this from the lab is... Use/discuss class data when possible.
3. Prediction / Hypothesis. Discuss if your prediction right or wrong?
4. Discuss how does this lab relate to the current topic/learning target being studied?

Second paragraph: Error Analysis (When appropriate)
Describe something that may have affected the **dependent variable.** Describe a specific cause and the specific effect that the error would have on the value of the dependent variable.
ChemCom XTRA
Unit 2B.8 Phase Changes Part II:
The Effect of Antifreeze on the Boiling and Freezing Points of Water

In Lab 2B.8 you investigated how the temperature of water changed as energy was added. The temperature/time graph should have looked similar to the two graphs on the right. The “Boiling Point” can be found by measuring the exact temperature at which the temperature begins to flat line. For pure water, the melting point should be close to 0 deg C and the boiling point should be close to 100 deg C.

In your car, antifreeze is added to alter the freezing and melting point of the water used in the coolant system. In this lab, we will investigate how the boiling point of water changes as different amounts of antifreeze are added to the water.
**Procedure:**
Each group will do the lab with a different combination of water and antifreeze. The class data will then be shared so that everyone has a full data set.

Calculate the percent antifreeze in each solution listed in the table below. Use a graduated cylinder to measure out the correct amount of antifreeze and water for your group. Mix the solution together in a 100 mL beaker. Launch the B.B Vernier program on the computer and set up the equipment to measure the temperature while heat is added using a hotplate.

Hit “collect” and then stir constantly until the mixture has boiled for about five minutes. Autoscale the graph and use the “X=” button to scroll over the heating curve. Determine the boiling point of the solution by finding the temperature on the graph where the slope changes abruptly and the temperature begins to remain fairly constant.

Dump the used solution into the “waste” beaker and then wash your equipment off thoroughly. Antifreeze is poisonous and it should not be left on any of the equipment.

Add your data to the “class data table.” Find the average boiling point of each solution and then prepare a X-Y scatter plot of the data showing the Average Boiling Point vs. % Antifreeze in Solution. Draw a best fit line using either a straight line or smooth curve.
<table>
<thead>
<tr>
<th>Groups</th>
<th>mL of Water</th>
<th>mL of Antifreeze</th>
<th>% antifreeze</th>
<th>Boiling Points (deg C)</th>
<th>Average Boiling Points (deg C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 7</td>
<td>65</td>
<td>10</td>
<td>$\frac{10}{15} \times 100 = 66.7$%</td>
<td>100.9</td>
<td>100.1</td>
</tr>
<tr>
<td>2, 8</td>
<td>55</td>
<td>20</td>
<td>100</td>
<td>102.1</td>
<td>-102.7 °C</td>
</tr>
<tr>
<td>3, 9</td>
<td>40</td>
<td>35</td>
<td>100</td>
<td>106 °C</td>
<td>108.7</td>
</tr>
<tr>
<td>4, 10</td>
<td>20</td>
<td>55</td>
<td>100</td>
<td>119.0</td>
<td>120 °C</td>
</tr>
<tr>
<td>5, 11</td>
<td>10</td>
<td>65</td>
<td>100</td>
<td>150.9</td>
<td>138.1 °C/142.4 °C</td>
</tr>
<tr>
<td>6, 12</td>
<td>0</td>
<td>75</td>
<td>100</td>
<td>191.2</td>
<td>191.2 °C</td>
</tr>
</tbody>
</table>

*Class data table. (Include a copy in your final lab)*

*4th Period*
<table>
<thead>
<tr>
<th>Groups</th>
<th>mL of Water</th>
<th>mL of Antifreeze</th>
<th>% antifreeze</th>
<th>Boiling Points (deg C)</th>
<th>Average Boiling Point (deg C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 7</td>
<td>65</td>
<td>10</td>
<td></td>
<td>100.5</td>
<td>102.7</td>
</tr>
<tr>
<td>2, 8</td>
<td>55</td>
<td>20</td>
<td></td>
<td>103.2°C</td>
<td>102.8</td>
</tr>
<tr>
<td>3, 9</td>
<td>40</td>
<td>35</td>
<td></td>
<td>106.5</td>
<td>107.2</td>
</tr>
<tr>
<td>4, 10</td>
<td>20</td>
<td>55</td>
<td></td>
<td>121.5</td>
<td>113.5</td>
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<tr>
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<td>10</td>
<td>65</td>
<td></td>
<td>157.5</td>
<td>157.5</td>
</tr>
<tr>
<td>6, 12</td>
<td>0</td>
<td>75</td>
<td></td>
<td>191.2°C</td>
<td>191.2</td>
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</table>
**7th Period**
Class data table. (Include a copy in your final lab)

<table>
<thead>
<tr>
<th>Groups</th>
<th>mL of Water</th>
<th>mL of Antifreeze</th>
<th>% antifreeze</th>
<th>Boiling Points (deg C)</th>
<th>Average Boiling Point (deg C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 7</td>
<td>65</td>
<td>10</td>
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<td>102.4</td>
<td><strong>102.1</strong></td>
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<tr>
<td>2, 8</td>
<td>55</td>
<td>20</td>
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<td><strong>127.6°C</strong></td>
<td><strong>105.7</strong></td>
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<tr>
<td>3, 9, 10</td>
<td>40</td>
<td>35</td>
<td></td>
<td><strong>122.3°C</strong></td>
<td><strong>120.1</strong></td>
</tr>
<tr>
<td>4, 10</td>
<td>20</td>
<td>55</td>
<td></td>
<td></td>
<td><em>154.0°C</em></td>
</tr>
<tr>
<td>5, 11</td>
<td>10</td>
<td>65</td>
<td></td>
<td></td>
<td><em>191.2°C</em></td>
</tr>
<tr>
<td>6, 12</td>
<td>0</td>
<td>75</td>
<td></td>
<td></td>
<td><em>191.2°C</em></td>
</tr>
</tbody>
</table>
Questions:
Protection from boiling...
1. Describe two ways that the heating curve of the solutions differed from the heating curve of pure water.
2. What combination of water and antifreeze had the greatest effect on the boiling point? (Provide evidence to support your claim)

See the next page for questions 3-7.
Questions
Protection from freezing...
3. According to Chart-1, what is the coldest temperature that you can protect your engine from using ethylene glycol?
4. According to Chart-1, what type and percent solution will provide the lowest temperature protection?
5. Ethylene glycol is used in most antifreeze. One downside to ethylene glycol is that it is poisonous and tastes good to animals. If your car leaks, and your dog drinks the antifreeze, they usually die. Propylene glycol is a safer alternative. It is not poisonous and still provides protection. Chart-1 shows freezing protection provided by both solutions. What are two differences between the propylene glycol and the ethylene glycol freezing protection curves?
6. Use Chart-2 to answer the following question: If you had a car with a 13-quart cooling system, how many quarts of antifreeze should you use to provide safety for your car during a Chicago winter? Support your claim with evidence.

7. According to the Chart-1, why shouldn’t pure ethylene glycol antifreeze be used in the coolant system of your car?