Happy Monday!!

Agenda:
1. Homework Answers: Extra Practice: D.7 Acids, Bases, pH Scale SG: 11-12
2. Ocean Acidification Lab Graphs/Discussion
3. Notes: Pollution Page 10
4. Identifying major air contaminants page 13

HW: Finish page 13
UNIT 2
D.7 EXTRA PRACTICE: ACIDS, BASES, AND THE pH SCALE

Answer the following questions using your knowledge of acids, bases, and the pH scale.

1. What is the pH scale?
   - Measured the acidic, basic, or neutral character of a solution.
   - Acids: start w/ H
   - Bases: end w/ OH

2. Indicate the pH range for the following:
   a. Acid
      - 0 - 7
   b. Base
      - 7 - 14
   c. Neutral
      - 7

3. What atom is present in many acids?
   - \( \text{H}^+ \) (Hydrogen)

4. What ion is present in many bases?
   - \( \text{OH}^- \) (hydroxide)

5. What is the formula for the following?
   a. Nitric acid
      - \( \text{HNO}_3 \)
   b. Sulfuric acid
      - \( \text{H}_2\text{SO}_4 \)
   c. Phosphoric acid
      - \( \text{H}_3\text{PO}_4 \)
   d. Potassium hydroxide
      - \( \text{KOH} \)
   e. Water
      - \( \text{H}_2\text{O} \)
   f. Calcium hydroxide
      - \( \text{Ca(OH)}_2 \)
6. List 3 compounds that are neutral: 
   WATER, SALT, SUGAR

7. What is an alkaline solution? 
   basic (OH^- > H^+)

8. Using Figure 2.67 in your textbook, provide the pH for the following:
   a. Lemons
   b. Drain cleaner
   c. Eggs
   d. Oranges
   e. Household ammonia

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<tr>
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<tbody>
<tr>
<td></td>
<td>2</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>B</td>
<td></td>
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</tbody>
</table>

9. Determine whether the following pH values indicate a neutral, acidic, or basic substance:
   a. pH = 5.5
   b. pH = 7.0
   c. pH = 6.5
   d. pH = 7.5
   e. pH = 12

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<tbody>
<tr>
<td></td>
<td>Acidic</td>
<td>Neutral</td>
<td>Acidic</td>
</tr>
<tr>
<td></td>
<td>Acidic</td>
<td>Basic</td>
<td>basic</td>
</tr>
</tbody>
</table>

10. Tomatoes have a pH = 4 and water has a pH = 7. How many more times acidic are tomatoes than water?

\[
1000 \text{ H}^+ \quad \text{7 - 6 - 5 - 4} \quad 10 \times 100 \times 1000 \times \text{10000x}
\]

11. Household ammonia has a pH = 12 and water has a pH = 7. How many more times basic is household ammonia than water?

\[
\text{OH}^- \quad 100,000 \quad \text{7 - 8 - 9 - 10 - 11 - 12} \quad 10 \times 100 \times 1000 \times 10000 \times 100,000
\]
ChemCom
Unit 2 CD
Human Impact on the Atmosphere

Ocean Acidification:
Data collected shows a strong correlation between humans burning fossil fuels and an increased level of carbon dioxide in the atmosphere. In this lab we will determine the effect that increased carbon dioxide exposure has on the pH of a model “ocean”.

Computer Set Up:
1. Plug a pH probe into the Vernier box and launch LoggerPro
2. Set up the experiment by customizing in the EXPERIMENT menu: Experiment, Data Collection: Set the following:
   a. Mode: Time Based
   b. Length: 20 Units: Minutes

Equipment Set Up:
1. Carefully unscrew the storage bottle so that the top screw cap remains on the pH probe.
2. Fill a 250 mL beaker with about 100 mL of water. Place the beaker on a stir plate. Add a paperclip and make sure that the stir plate stirs the water without heating.
3. Carefully clamp the pH probe so that it hangs with the bulb under water but not touching the bottom. ($75.00 if it hits the bottom and breaks!)
Calibrating the pH to Simulate an Ocean:
1. Hit the “Collect” button to begin collecting pH data before you start calibrating.
2. Your instructor will provide 0.1 M HCl and 0.1 M NaOH to use for calibration. Add drops of acid or base as necessary to adjust the pH so that it is within 0.3 pH units of the pH of seawater. (See page 251 Figure 2.67) Be patient and wait for the pH to stabilize before adding additional acid or base.
3. When the pH of your beaker is within 0.3 pH units of ocean water and remains constant, your calibration is complete. Hit “stop”. Hit the “Autoscale button” so that your graph fills the graphing area. Print out your calibration graph and add the annotations described below...

Graph Analysis/Annotation:
1. Draw a HORIZONTAL line with a marker across the entire graph at pH-7.
2. Label the part of the graph with acidic pH’s “ACID”. Label the part of the graph with basic pH’s “Base”.
3. Draw arrows that point to each part of the graph where you added acid or base to adjust the pH. Label each arrow with “added HCl” or “added NaOH”. 

acid

base
Testing the impact of increased Carbon Dioxide Levels:

1. Hit the “Collect” button again to begin collecting pH data. Collect about 2 minutes of baseline data.
(Safety note: Safety glasses are a must! Do not breath in while using the straw!)

2. Begin to increase the amount of CO₂ that the “ocean water” is being exposed to by either adding a small piece of dry ice OR by slowly blowing bubbles through a straw into the water.

   **Dry Ice:** If you are using dry ice, continue to add small pieces as they sublime so that there is a constant slow bubbling for five minutes.

   **Straws:** If you are using straws, switch off with your partner as needed so that the flow of CO₂ into the ocean remains fairly constant. Continue to bubble in CO₂ for 5 minutes.

3. Hit “stop”. Push the “Autoscale” button so that the graph fills the entire graphing area.

4. Print out graphs.

**Graph Analysis/Annotation:**

1. Draw a HORIZONTAL line with a marker across the entire graph at pH-7.
2. Label the part of the graph with acidic pH’s “ACID”. Label the part of the graph with basic pH’s “Base”.

3. When carbon dioxide comes in contact with water it makes carbonic acid. **Read the first paragraph of D.8 on page 251.** Copy the chemical equation for the formation of carbonic acid onto your graph. Write the names below the chemical equation of each of the compounds.
Pollutants - Substances found in air that are not normal components of the atmosphere or that are present at elevated concentrations.

Primary Air Pollutants - Directly enter the atmosphere (natural or caused by humans)

Secondary Air Pollutants - Formed in the atmosphere when primary air pollutants reacts with each other or the atmosphere.
Particulate Pollutants - Microscopic particles that enter air from human activities or natural process.
Identifying Major Air Contaminants

Use the graph and two data tables on the next page to answer the following.

1. Overall, what is the main source of US air contaminants?

2. For each source below which contaminant contributes the most pollution?
   a. Transportation ________________________
   b. Industry ______________________________
   c. Fuel combustion _______________________

3. About what percent of total air contaminants does human activity produce?

4. Should you plan an outdoor activity if the Air Quality Index is 195? Explain.
5. Between what hours do the concentrations of nitrogen oxides and hydrocarbons peak? What can cause this?

6. Which substances are at their minimum when ozone (O₃) is at its maximum?

7. Car manufacturers claim that building more Hybrid cars will eliminate all SO₂ in the atmosphere. Is this claim correct?

8. Which pollutant do you think is the worst for one’s health? Explain.
<table>
<thead>
<tr>
<th>Air Quality Index (AQI) Values</th>
<th>Air Quality Description</th>
<th>Particulate Matter (PM) (10 μm diameter) μg/m³</th>
<th>Sulfur Dioxide (24 hour) ppm</th>
<th>Carbon Monoxide (8 hour) ppm</th>
<th>Ground-Level Ozone (1 hour) ppm</th>
<th>Nitrogen Dioxide (1 hour) ppm</th>
<th>Levels of Health Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–50</td>
<td>Good</td>
<td>0.000–0.034</td>
<td>0.0–4.4</td>
<td>Not reported</td>
<td></td>
<td>Satisfactory; little or no risk.</td>
<td></td>
</tr>
<tr>
<td>51–100</td>
<td>Moderate</td>
<td>0.035–0.144</td>
<td>4.5–9.4</td>
<td>Not reported</td>
<td></td>
<td>Acceptable air quality; for some pollutants there may be a moderate health concern for a very small number of people. General public is not likely to be affected.</td>
<td></td>
</tr>
<tr>
<td>101–150</td>
<td>Unhealthy for sensitive groups</td>
<td>0.145–0.224</td>
<td>9.5–12.4</td>
<td>Not reported</td>
<td></td>
<td>Members of sensitive groups may experience health effects. General public is not likely to be affected.</td>
<td></td>
</tr>
<tr>
<td>51–200</td>
<td>Unhealthy</td>
<td>0.225–0.504</td>
<td>12.5–15.4</td>
<td>Not reported</td>
<td></td>
<td>Everyone may begin to experience health effects. Members of sensitive groups may experience serious health effects.</td>
<td></td>
</tr>
<tr>
<td>201–300</td>
<td>Very unhealthy</td>
<td>0.305–0.604</td>
<td>15.5–30.4</td>
<td>0.165–1.24</td>
<td></td>
<td>Health alert; everyone may experience serious health effects.</td>
<td></td>
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<tr>
<td>301–500</td>
<td>Hazardous</td>
<td>0.605–1.002</td>
<td>50.5–50.4</td>
<td>0.405–0.604</td>
<td>1.25–2.04</td>
<td>Health warnings of emergency conditions. The entire population is likely to be affected.</td>
<td></td>
</tr>
</tbody>
</table>

*High-risk group includes elderly people, children, and those with heart or lung diseases.*

**SELECTED U.S. AIR POLLUTANTS (IN 10 METRIC TONS PER YEAR)**

<table>
<thead>
<tr>
<th>Source</th>
<th>CO</th>
<th>Pb</th>
<th>NOx</th>
<th>VOCs</th>
<th>PM2.5</th>
<th>SOx</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major industrial sources</td>
<td>0.0</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Miscellaneous sources</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Totals</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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**Key:**
- CO: Carbon monoxide
- Pb: Lead
- NOx: Nitrogen oxides
- VOCs: Volatile organic compounds
- PM2.5: Particulate matter (< 10 μm diameter)
- SOx: Sulfur dioxide