Welcome to Chem Up!

An Introduction to Basic Chemistry Concepts

As you come in:
1. Please sign in.
2. Please create a name plate to take to your seat.

Agenda for Day 1

- Course Expectations and Succeeding Online
- Measurement
- States of Matter
- Elements and the Periodic Table
  - Note Taking and I Spy game
- Scientific Method
  - Coke and Mentos Experiment

Course Expectations and Succeeding Online

- Read your Syllabus!
  - Look for items such as grading scale, assignment due dates and rubrics, required texts and materials, and the professor’s contact information.
  - The syllabus is your primary guide and first place to refer to for most of the questions you have in an online or face to face class.
  - Be sure to log on to online classes within the first 24 hours. If you do not log on to the course within the first few day, you will be dropped from the course.

Materials for Class
- Notebook
- Textbook
- Pen/Pencils
- Highlighter or colored pencils
- May need a calculator

Materials for Lab
- There may be a separate lab book required
- All labs require closed toe shoes
- May need a lab coat or googles
- All of this will be noted in your syllabus
Course Expectations and Succeeding Online

- Learn to Navigate Falcon Online.
- Both online and face to face classes utilize Falcon Online.
- Content Tab - Your syllabus and other content your instructor feels is important will be found here (lecture notes, videos, etc.)
  - Remember, if your teacher took the time to create it, it is probably important.
- Dropbox - This is where online assignments will be submitted.
- Discussion - Some classes require discussion posts as part of your class participation.
- Quizzes and Grades tabs - The name says it all.

Measurement

- Why do we take measurements?
- What are some types of measurement?
- What are some common units of these measurements?
- What types of instruments do we use to take these measurements?

Units of Measurement and Their Abbreviations

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Metric</th>
<th>SI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>meter (m)</td>
<td>meter (m)</td>
</tr>
<tr>
<td>Volume</td>
<td>liter (L)</td>
<td>cubic meter (m³)</td>
</tr>
<tr>
<td>Mass</td>
<td>gram (g)</td>
<td>kilogram (kg)</td>
</tr>
<tr>
<td>Temperature</td>
<td>degree Celsius (°C)</td>
<td>kelvin (K)</td>
</tr>
<tr>
<td>Time</td>
<td>second (s)</td>
<td>second (s)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metric Prefix</th>
<th>Symbol</th>
<th>Multiplier</th>
<th>Exponential</th>
<th>Scientific Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>yocto</td>
<td>y</td>
<td>10⁻²⁴</td>
<td>1.0 x 10⁻²⁴</td>
<td>y</td>
</tr>
<tr>
<td>zepto</td>
<td>z</td>
<td>10⁻²¹</td>
<td>1.0 x 10⁻²¹</td>
<td>z</td>
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<tr>
<td>atto</td>
<td>a</td>
<td>10⁻¹⁸</td>
<td>1.0 x 10⁻¹⁸</td>
<td>a</td>
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<td>femto</td>
<td>f</td>
<td>10⁻¹⁵</td>
<td>1.0 x 10⁻¹⁵</td>
<td>f</td>
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<td>pico</td>
<td>p</td>
<td>10⁻¹²</td>
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<td>n</td>
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<td>1.0 x 10⁻⁹</td>
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<td>µ</td>
<td>10⁻⁶</td>
<td>1.0 x 10⁻⁶</td>
<td>µ</td>
</tr>
<tr>
<td>milli</td>
<td>m</td>
<td>10⁻³</td>
<td>1.0 x 10⁻³</td>
<td>m</td>
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<td>10⁻²</td>
<td>1.0 x 10⁻²</td>
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<td>10⁻¹</td>
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<td>da</td>
<td>10</td>
<td>1.0 x 10³</td>
<td>da</td>
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<td>hecto</td>
<td>ha</td>
<td>10³</td>
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<td>ha</td>
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<tr>
<td>kilo</td>
<td>k</td>
<td>10⁶</td>
<td>1.0 x 10⁶</td>
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</tr>
<tr>
<td>mega</td>
<td>M</td>
<td>10⁹</td>
<td>1.0 x 10⁹</td>
<td>M</td>
</tr>
<tr>
<td>giga</td>
<td>G</td>
<td>10¹²</td>
<td>1.0 x 10¹²</td>
<td>G</td>
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<td>tera</td>
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<td>10¹⁵</td>
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<td>1.0 x 10¹⁸</td>
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<td>exa</td>
<td>E</td>
<td>10²¹</td>
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<td>E</td>
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<td>Z</td>
<td>10²⁴</td>
<td>1.0 x 10²⁴</td>
<td>Z</td>
</tr>
<tr>
<td>yotta</td>
<td>Y</td>
<td>1.0 x 10³⁶</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>
Writing Equivalencies

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Metric (SI)</th>
<th>U.S.</th>
<th>Metric-U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>1 km = 1000 m</td>
<td>1 ft = 12 in.</td>
<td>2.54 cm = 1 in. (exact)</td>
</tr>
<tr>
<td></td>
<td>1 m = 1000 mm</td>
<td>1 yd = 3 ft.</td>
<td>1 m = 39.37 in.</td>
</tr>
<tr>
<td></td>
<td>1 cm = 10 mm</td>
<td>1 mi = 5280 ft</td>
<td>1 km = 0.6214 mi</td>
</tr>
<tr>
<td>Volume</td>
<td>1 L = 1000 mL</td>
<td>1 qt = 4 cups</td>
<td>1 L = 1.057 qt</td>
</tr>
<tr>
<td></td>
<td>1 mL = 100 mL</td>
<td>1 pt = 2 qts</td>
<td>946.3 mL = 1 qt</td>
</tr>
<tr>
<td></td>
<td>1 mL = 1 cm³</td>
<td>1 gal = 4 qts</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>1 kg = 1000 g</td>
<td>1 lb = 16 oz</td>
<td>1 kg = 2.205 lb</td>
</tr>
<tr>
<td></td>
<td>1 g = 1000 mg</td>
<td></td>
<td>453.6 g = 1 lb</td>
</tr>
<tr>
<td>Time</td>
<td>1 h = 60 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 min = 60 s</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example Problems from Worksheet

- How many minutes are in 2.5 h?

\[
2.5 \text{ h} \times \frac{60 \text{ min}}{1 \text{ h}} = 150 \text{ min}
\]

- A bucket contains 4.65 L water. How many gallons of water is that?

\[
4.65 \text{ L} \times \frac{1.057 \text{ qt}}{1 \text{ L}} \times \frac{1 \text{ gal}}{4 \text{ qt}} = 1.23 \text{ gal}
\]

Unit Conversion Using Equivalencies

An international group of zookeepers with successful breeding programs made the following animal exchanges last year. Using the same bartering system, how many oryxes can a zoo obtain in exchange for 15 flamingos?

3 oryxes = 1 tiger
2 flamingos = 1 anteater
1 camel = 6 anteaters
5 lemurs = 1 rhino
1 rhino = 4 monkeys
3 lemurs = 1 camel
3 monkeys = 1 tiger
1 rhino = 4 oryxes

Step 1 Given 15 flamingos Need oryxes
Step 2 Plan flamingos → anteaters → camels → lemurs → rhinos → oryxes
Step 3 Conversion Factors

\[
(15 \text{ flamingos}) \left( \frac{1 \text{ anteater}}{2 \text{ flamingos}} \right) \left( \frac{1 \text{ camel}}{6 \text{ anteaters}} \right) \left( \frac{3 \text{ lemurs}}{1 \text{ camel}} \right) \left( \frac{1 \text{ rhino}}{5 \text{ lemurs}} \right) \left( \frac{4 \text{ oryxes}}{1 \text{ rhino}} \right) = 3 \text{ oryxes}
\]

SKILLS TO HELP YOU SUCCEED

Taking Effective Notes...

Before Class

- Read assigned material before class. Use any outlines or PowerPoints posted online as your guide.
- It is a good idea to print or download online outlines/PowerPoints to bring to class.
- Keep a pen/pencil, highlighter, colored pencils, and your notebook in one place so you can easily bring from home to class.
- Always use the same notebook for your notes.
SKILLS TO HELP YOU SUCCEED

Taking Effective Notes...

During Class

- Do not miss, come late, or leave any class early. Sit where you will be able to see and hear the instructor.
- Date each entry at the top of the page.
- Learn to abbreviate and form your own system of "shorthand". Do not try to write in complete sentences, you won’t be able to keep up.
- If the instructor emphasizes a concept’s importance or repeats it more than once, highlight that portion of your notes with your highlighter.

After Class

- Place a question mark next to anything you don’t understand. Ask the instructor or tutor for clarification, or look up the concept in the textbook. Don’t wait! Most content builds off previous information.
- Review your notes the day of class prior to going to sleep. Fill in any gaps.
- Rework sample problems on a separate paper and then compare your answer to the original.
- Study the subject matter in sessions no longer than 30 minutes with 100% focus and concentration.

Useful Study Technique(s)

Write as much relevant information on your periodic table as possible. Mark it up! Make it work for you!

- Annotate / Add side notes
- Color code
- Organize information

Matter

- What is matter?
  - Matter is anything that has mass and takes up space.
- What are the states of matter?

Physical states

- Solid: The molecules that make up a solid are arranged in regular, repeating patterns. They are held firmly in place but can vibrate within a limited area.
- Liquid: The molecules that make up a liquid move easily around one another. They are kept from flying apart by attractive forces between them. Liquids assume the shape of their containers.
- Gas: The molecules that make up a gas fly in all directions at great speeds. They are so far apart that the attractive forces between them are insignificant.
- Plasma: At the very high temperatures of stars, atoms lose their electrons. The mixture of electrons and nuclei that results is the plasma state of matter.
Change of State

- Solids can turn into liquids, and liquids can turn into gasses and back again depending on the temperature and energy input.

Elements

- Elements make up everything. They are the pure substances from which everything else is made.
- Chemical Symbols are one or two letter abbreviations for an element’s name
  - If the chemical symbol contains two letters, the second letter is NOT capitalized.
  - CO - there are two elements present carbon and oxygen
  - Co - chemical symbol for cobalt

The Periodic Table

- In 1872, Dmitri Mendeleev created the periodic table
  - arranged elements by increasing atomic mass
  - arranged elements into groups with similar properties
- Each square on the periodic table represents an element.
  - Each square has the element’s name, atomic number, chemical symbol, and atomic mass.
  - We will discuss the atomic number and atomic mass on Day 2.
Periods and Groups

- On the periodic table elements are arranged according to similar properties in vertical columns called groups.
- Periods are horizontal rows of elements.
  - Period 1 contains two elements: H and He
  - Periods 2 and 3 each contain eight elements:
    - Period 2: Li, Be, B, C, N, O, F, He
    - Period 3: Na, Mg, Al, Si, P, S, Cl, Ar

Group Numbers

Group Numbers, written at the top of each vertical column, are written two ways:
- The letter A is used for the representative elements 1A to 8A and the letter B for the transition elements.
- The numbers 1-18 are used for the columns from left to right.

Some groups have specific names used in addition to the group numbers.
Metals, Nonmetals, and Metalloids

The heavy zigzag line on the periodic table separates the metals from nonmetals. Metalloids border the zigzag line.

Characteristics of Metals, Nonmetals, and Metalloids

<table>
<thead>
<tr>
<th>Metal</th>
<th>Nonmetal</th>
<th>Metalloid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver (Ag)</td>
<td>Antimony (Sb)</td>
<td>Sulfur (S)</td>
</tr>
<tr>
<td>Metal</td>
<td>Metalloid</td>
<td>Nonmetal</td>
</tr>
<tr>
<td>Shiny</td>
<td>Blue-gray, shiny</td>
<td>Dull, yellow</td>
</tr>
<tr>
<td>Extremely ductile</td>
<td>Brittle</td>
<td>Brittle</td>
</tr>
<tr>
<td>Can be hammered into sheets (malleable)</td>
<td>Brittle</td>
<td>Brittle</td>
</tr>
<tr>
<td>Good conductor of heat and electricity</td>
<td>Poor conductor of heat and electricity</td>
<td>Poor conductor of heat and electricity</td>
</tr>
<tr>
<td>Used in coins, jewelry, tableware</td>
<td>Used to harden lead, color glass and plastics</td>
<td>Used in gunpowder, rubber, fungicides</td>
</tr>
<tr>
<td>Density 10.5 g/mL</td>
<td>Density 6.7 g/mL</td>
<td>Density 2.1 g/mL</td>
</tr>
<tr>
<td>Melting point 962 °C</td>
<td>Melting point 630 °C</td>
<td>Melting point 113 °C</td>
</tr>
</tbody>
</table>

Steps in the Scientific Method

- Observation/Question
- Hypothesis
- Experiment
- Data/Results
- Conclusion
- Verify

Study Check

How can you apply this technique to other courses?
Steps in the Scientific Method

Observation/Question
- Gathered through your senses
- A scientist notices something in their natural world

Steps in the Scientific Method

Hypothesis
- A suggested solution to the problem
- Must be testable
- Sometimes written as If…Then… statements
- Predicts an outcome

Steps in the Scientific Method

Experiment
- A procedure to test the hypothesis.
- Variable - factor in the experiment that is being tested

Steps in the Scientific Method

Data
- Results of the experiment
- May be quantitative (numbers) or qualitative (observations)

Steps in the Scientific Method

Results
- Attempts to explain what you discovered from your data/observations
Steps in the Scientific Method

Conclusion
- The answer to the hypothesis based on the data obtained from the experiment

Verify
- In order to verify the results, experiments must be repeated

Questions?

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http://www.daytonastate.edu/asc/ascsciencehandouts.html