Welcome to Chemistry!

- Introductions
- Syllabus stuff
- Help is on the way
- Chemistry
How the class works

• Read
• We go over some pieces in class
• Do homework
• Repeat
• Prove knowledge on exam
• Get good grade
• Graduate
• Earn lots of money
• Give back to Hope College
Homework -- CAPA

• Be sure you have your own CAPA sheet
  • normally sitting on shelf outside before class
• Assignments due twice each week
• Homework is the key to success
• Login to CAPA server through chemboard
Quizzes -- Keypads

• Allow instant feedback so I can adjust lecture
• Provide you with more points
  • Get some points for answering
  • Get more for answering correctly
  • Only need most of the points for perfect score
  • Can also get extra credit (later)
• Easy for me to track down multiple keypads
• Be sure keypad number gets on index card
Keypad Example…

Over the summer, I…

1. Traveled exotic lands
2. Traveled to the mall
3. Wore out the controllers on my PlayStation
4. Worked my lousy job to pay about 2% of my tuition
Example #2

The person sitting next to me is...

1. An idiot
2. Brilliant
3. Funny
4. Nonexistent
I need help!

• Peers
  • Classmates: study groups, chemboard (do a post today!)
  • Neighbors: roommate, science major down hall

• Faculty
  • Discussion times: attend any or all
  • Office hours: any or all
    • Not Tues or Thurs for me please, otherwise anytime

• Tutors -- Academic Support Center
What’s with the spiral book thing?

• Printout of many figures from the text

• Should help with taking notes in class
  • Write in it and mark it up!

• Much lighter than the textbook
Let’s do some Chemistry

- **Matter** – anything that has mass and takes up space

- **Chemistry** – the science that studies the properties and interactions of matter
Matter is composed of….

- **Atoms/Elements**
  - Democritus: All matter is made of very small particles – much too small to see – atoms.
  - From the Greek word *atomos* meaning “uncuttable”
  - A single atom still has the properties of that material

- **Molecules/Compounds** – Substances that contain more than one element.
  - For example, water is composed of hydrogen and oxygen
  - The **chemical formula** describes the atomic composition of the elements.
  - Water’s chemical formula is $\text{H}_2\text{O} – 2$ hydrogen atoms and 1 oxygen atom
A hydrogen molecule can be represented by connecting two spheres together, with each sphere representing one hydrogen atom.

Some simple molecules:

- Molecular oxygen
- Water
- Molecular chlorine
- Carbon dioxide
- Ammonia
- Methanol
- Acetylene
- Hydrogen peroxide (a common disinfectant and bleaching agent)
- Sulfur dioxide (a common air pollutant)
- Dinitrogen oxide (laughing gas)
- Acetic acid (vinegar)
- Ethylene (used to make polyethylene plastic)

Notebook p. 3
The Periodic Table

Your Best Friend

- Arranged in order of increasing mass, the periodic table looks like this.
  - Because rows 6 and 8 are quite long, 14 of these elements are separated from the rest.
- Elements in the same column (group) have similar chemical properties
Chemistry is Quantitative

Chemists measure things, for instance

- **Size** – defined by length, area and volume
- **Mass (m)** – the certain quantity of matter
- **Time (t)** – to determine how long it takes for a chemical transformation to take place
- **Temperature (T)** – determines the direction of heat flow
## Magnitude

### unit prefixes

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Number</th>
<th>Exponential Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>tera</td>
<td>T</td>
<td>1,000,000,000,000,000</td>
<td>10^{12}</td>
</tr>
<tr>
<td>giga</td>
<td>G</td>
<td>1,000,000,000</td>
<td>10^{9}</td>
</tr>
<tr>
<td>mega</td>
<td>M</td>
<td>1,000,000</td>
<td>10^{6}</td>
</tr>
<tr>
<td>kilo</td>
<td>k</td>
<td>1000</td>
<td>10^{3}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>10^{0}</td>
</tr>
<tr>
<td>centi</td>
<td>c</td>
<td>0.01</td>
<td>10^{-2}</td>
</tr>
<tr>
<td>milli</td>
<td>m</td>
<td>0.001</td>
<td>10^{-3}</td>
</tr>
<tr>
<td>micro</td>
<td>μ</td>
<td>0.000 001</td>
<td>10^{-6}</td>
</tr>
<tr>
<td>nano</td>
<td>n</td>
<td>0.000 000 001</td>
<td>10^{-9}</td>
</tr>
<tr>
<td>pico</td>
<td>p</td>
<td>0.000 000 000 001</td>
<td>10^{-12}</td>
</tr>
<tr>
<td>femto</td>
<td>f</td>
<td>0.000 000 000 000 001</td>
<td>10^{-15}</td>
</tr>
</tbody>
</table>
Unit Conversions

• We frequently need to convert a measurement from one unit to another.
• When multiplying numbers we also multiply units and when dividing numbers we also divide units.
• Never forget units!
For Example

- The density of water is 1.0 g/mL
- What is the density in lbs/Gal?

$$1.0 \frac{g}{mL} \times \frac{1kg}{1000g} \times \frac{1lb}{0.4536kg} = 0.0022046 \frac{lbs}{mL}$$

$$0.0022046 \frac{lbs}{mL} \times \frac{1000mL}{1L} \times \frac{3.785L}{1Gal} = 8.3 \frac{lb}{Gal}$$

$$1.0 \frac{g}{mL} = 8.3 \frac{lbs}{Gal}$$
Significant Figures

• The number of digits expressed in a numerical value is called the number of significant figures.

• How to determine “sig figs”
  – Read the number from left to right and count all the digits starting with the first non-zero digit
    • 34.023 has 5 sig figs
    • 0.068 has 2 sig figs
    • 0.0680 has 3 sig figs
  – Place a decimal point after the value when its trailing zeros are significant
    • 110 has 2 sig figs
    • 110. has 3 sig figs
1. When *adding* or *subtracting*, the number of decimal places in the result is the number of decimal places in the number with the fewest places.

2. When *multiplying* or *dividing*, the number of significant figures in the result is the same as in the quantity with the fewest significant figures.

3. Postpone adjusting result to the correct number of significant figures until a calculation is complete.

See pp.22-23
Things to do

• Today!
  – Fill out index card and get to me
  – Make sure you can post to Chemboard

• By Friday
  – Read chapts 1 and 2
  – Start CAPA