The Foundations of Chemistry

Unit 1

"Chemistry The Central Science", Brown, LeMay, Bursten, and Murphy , 11th Edition.

Suggested Reading

Chapter 1

Sections 1.1-1.6

Suggested Problems (Blackboard)

Unit 1 Foundations Problems

previous exam questions and great practice

Suggested Problems (Text)

1.8, 23, 25, 35, 37, 39, 43, 45, 47, 53

The Foundations of Chemistry

Unit 1

- Chemistry is the branch of science devoted to the study of matter, its composition, its properties, and the changes it undergoes and the energy that accompanies this process.

- Chemistry touches our lives everyday from, the function of the human body, to the treatment of illness, to the synthetic fibers in the carpet and in our clothes, to the gas we fill our cars with; to helping feed the worlds populations. There can be drastic worldwide impact from the discoveries of chemistry, for example, with the advent of a process to make ammonia cheaply transformed agriculture today with the production of fertilizers, pesticides and herbicides, which require ammonia.

Some Important Definitions

Since chemistry is the study of matter, what is matter?

Matter, is anything that has *mass* and occupies space.

Matter can be divided into **three classes**;

Elements, a pure substance which can not be broken down into simpler substances in a chemical reaction.

Compounds, a pure substance made up of two or more elements in a fixed ratio.

Mixtures, a substance made up of two or more compounds.

Matter exists as **three phases**;

Solid, consists of particles which exist in a defined rigid shape. These particles are the most tightly packed together. Solids do not vary much with temperature and pressure.

Liquid, particles which do not hold their shape and may flow and take the shape of their container, but they are confined to a given volume. These particles are spaced farther apart than solids. Liquids are very hard to compress.

Gas, the particles of a gas will always fill any container, they are capable of infinite expansion. These particles are widely spaced apart and can be compressed to change volume.

Important Definitions Cont.

What is mass?

Mass is observed as a body's resistance to acceleration. The quantity of matter in an object. There is a fundamental difference between mass and weight, mass is independent of location. The two are always directly proportional to each other.

Energy, the capacity of a substance to do work or transfer heat. There are two main types of energy, potential energy and kinetic energy.

Kinetic Energy, the energy of motion. A body in motion. Kinetic energy increases with the speed of the object and the weight of the object.

Potential Energy, stored energy. The most important form of potential energy for this course is the **chemical energy**, the energy stored within chemical substances.

The Law of Conservation of Matter and Energy

Matter and Energy can not be created or destroyed, only converted to different forms.

Unit Conversions

Scientific notation

In chemistry and often other sciences the numbers we deal with are often very large or very small. We simplify by using Scientific Notation.

The general format is ;

2.03×10^5

Only one digit before the decimal and the X 10 represents how many zeroes we are cutting out.

Conversion of units is very important in this course!! We will use this almost everyday!!

Basic math principles work here. Remember what you want is on the top and what you have is on the bottom. See class examples.

Significant Figures

- In science we have a set of rules to follow when dealing with numbers.
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- An **exact number** is a number which has been **counted** or **defined**, thus any of the conversions and/or constant we use are exact numbers. Exact numbers have an infinite number of significant figures!!
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- An **inexact** number is a number with a point of uncertainty. In other words, an inexact number is a measurement, which often relies on instruments and human judgments for accuracy, as in weighing a sample in lab.

Significant Figures

What to do when handling numbers in this course;

1. Determine if the number is exact or inexact. Recall that an exact number is a counted number, a constant, or a conversion factor. If the number is exact consider the number of significant figures to be infinite.

2. If the number is inexact, for example a measured number, we must consider significant figures.

All integers are significant figures!! The last integer is the position of uncertainty.

3. Zeroes are the tricky part….

a. Do you have a decimal point?

If yes, you are able to determine the number of significant figures.

If no, then you need more information in order to determine the number of significant figures.

b. If you have a decimal point, convert your number to scientific notation.

c. **Zeroes at the beginning are not significant.**

d. **Zeroes at the end with a decimal are always significant.**

e. **Zeroes in the middle are always significant.**

4. Determine the number of significant figures for each inexact number in all calculations.

5. You can only report your answer with the smallest number of significant numbers present in the problem.

Dimensional Analysis

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This is a systematic way of solving numerical problems.

Keeping it simple…..

Every number in a problem will have some units, 1.00 g/mL for density, 2.00 g for mass…and so on

We use these units to guide our logic to the right answer in the correct units.

Same units can cancel each other in an algebraic fashion.

For example, you need 30 cans for a party, the price is $2.15 for a six-pack, what will this cost you?

What do we know?

2.15 dollars/six pack 1 six pack = 6 cans

What do we want?

Dollars for 30 cans.

At the end of our problem we want only dollars left.

This problem solving strategy is one of the most important concepts we will use all semester!!