Prologue – Chemistry: An Introduction

1) Sec A – Chemistry is the study of the composition of substances and the changes that substances undergo. Energy is also studied since most chemical reactions either evolve energy (exothermic) or occur because of the addition of energy (endothermic).

2) Sec B – Problem Solving and The Scientific Method – A logical approach to the solution of problems that lend themselves to investigation. There are distinct phases in applying the scientific method to solve problems:

   a) Observations – Scientists make observations when they note and record facts about natural phenomena. An experiment is a series of observations carried out under controlled conditions. The observations recorded from an experiment constitute data.

   b) An hypothesis is an attempt to explain the data from an experiment or observations by use of a descriptive model.

   c) A theory is a thoroughly tested model that explains the results of an experiment or observations. That is, it is a well-established hypothesis. A theory must explain all the known and relevant facts. It cannot be selective.

   d) A scientific law is a concise statement of fact that summarizes the results of a broad variety of observations and experiments, and to which no exceptions are known. A scientific law describes a natural phenomenon, but it does not attempt to explain the phenomenon. A law is a given and does not have to be proven.

   Note that in common usage the term "theory" is more often really no more than an hypothesis. This often leads to confusion between scientists and others. I am as likely to offhandedly say that I have "a theory" of why something happens when that "theory" may really be no more that a guess, or an attempt at an explanation (ie., an hypothesis). Moreover, sometimes a scientific law might be referred to as a natural law (because it summarizes something in nature) which is different than the "natural law" which refers to the use of reason to analyze human nature and deduce binding rules of moral behavior.

3) Sec C – Learning Chemistry – Chemistry is an experimental science. Most advances in chemistry are the results of observations and experiments, although the setting these days is usually a laboratory with controlled conditions.

   Compared with other subjects, chemistry is commonly perceived to be more difficult. There is some justification for this perception. For one thing, chemistry has a very specialized vocabulary. At first chemistry is like learning a new language. Furthermore, some of the concepts are abstract. Nevertheless, with diligence you can complete this course successfully and perhaps even pleasurably.

   You will find that chemistry is much more than numbers, formulas, and abstract theories. It is a logical discipline brimming with interesting ideas and applications. It is all around us if we just bother to look! Furthermore, learning chemistry is a dynamic process, not

merely a regurgitation of facts.

4) Four Basic Branches of Chemistry (This information is NOT in your book.) These branches are generally described as: Physical Chemistry, Analytical Chemistry, Organic Chemistry, and Inorganic Chemistry.

   a) Physical Chemistry – This area of chemistry is a field of science that applies the laws of physics to elucidate the properties of chemical substances and clarify the characteristics of chemical phenomena. The term physical chemistry is usually applied to the study of the physical properties of substances, such as vapor pressure, surface tension, viscosity, refractive index, density, and crystallography, as well as to the study of the so-called classical aspects of the behavior of chemical systems, such as thermal properties, equilibria, rates of reactions, mechanisms of reactions, and ionization phenomena. In its more theoretical aspects, physical chemistry attempts to explain spectral properties of substances in terms of fundamental quantum theory; the interaction of energy with matter; the nature of chemical bonding; the relationships correlating the number and energy states of electrons in atoms and molecules with the observable properties shown by these systems; and the electrical, thermal, and mechanical effects of individual electrons and protons on solids and liquids.

   b) Analytical Chemistry – This is the area of chemistry which deals with the separation, identification and the determination of the components in a sample. It also traditionally includes the study of chemical equilibrium and statistical treatment of data.

   c) Organic Chemistry – This is the branch of chemistry which deals with substances that contain the element carbon. The name "organic" comes from the realization that most of these substances originally came from living sources.

   d) Inorganic Chemistry – This area of chemistry deals with substances that contain all the other elements other than carbon. The name "inorganic" originally indicated that theses substances were not from living sources.

   There are other areas such a biochemistry, quantum chemistry, radiochemistry, etc. but these could be considered parts or combinations of the above.

5) The Periodic Table and Chemical Symbols – The Periodic Table is one of the important things (perhaps THE most important thing) we are going to be studying in chemistry. In fact, we will be studying it, using it, and relying on it throughout the entire year.

   The Periodic Table lists its building blocks as elements. Each element is represented by a symbol that consists of one or two letters of the name of the element. The first letter is always capitalized. If a second letter is needed, it must be lower case. Some element symbols are derived from older Latin names. (iron = Fe, from Latin name of ferrum) Like chemistry as a whole, it is a living process, not just a list.