

# CHEMISTRY 1060

## CHEMICAL STRUCTURE and REACTIVITY

A Summer Program for high-ability High School Students who have completed a one year high school honor's chemistry course.

Directed and taught by:

Professors Ronald O. Ragsdale and Gothard C. Grey

6 weeks, 130 hours of class and lab, 12 hours of seminars. A daily program from 7:00 am to 12:30 pm.

Preceded by an orientation and a lab check-in and lecture.

**Texts:** Kotz & Treichel, Chemistry & Chemical Reactivity 4<sup>th</sup> ed.

Basolo and Johnson, Coordination Chemistry

5 Handouts

Problem assignments: 200 graded problems

### **Course outline:**

#### Review and extension:

Names, ionic compounds, acids, bases

Reactions, redox, moles

#### Periodic Table:

Quantum numbers, orbitals

Electron configuration, Paramagnetism

Periodic properties

#### Energy and Structure:

Ionic solids

Enthalpy, Bond Energies, Born-Haber Cycle

#### Bonding and Structure:

Lewis Structures, Lewis Acid & Base

VSEPR, Shape and Polarity, Hybridization

Molecular Orbitals, diagrams, MO shapes, multiple bonds

#### Coordination Chemistry:

Transition metals, Lewis Acid-Base reactions

Ligands, synthesis reactions

Nomenclature

Isomerism, optical, geometric, bonding

Bridging ligands

Ligand field, crystal field

Geometry and crystal field splitting, Jahn-Teller effect

Paramagnetism

Spectra, spectrochemical series

Ligand replacement, trans effect

Organic Chemistry:

Nomenclature, hydrocarbons, functional groups

Typical reactions

Optical isomers, configurations

Polymers

Infrared spectra and functional groups

Laboratory:

17 Experiments (most experiments require 2 lab periods) an in house lab manual

**Laboratory work:**

Density of a metal

Analytical balance use

Identification and Reactions of

Types of reactions

Some Inorganic Compounds

9 Solutions and an Unknown

Qualitative Analysis

Some Chemical Properties of

Synthesis reactions, multistep

Chromium and Manganese

Relative Stabilities of Complex Ions

Ligand replacement

And Precipitates of Copper(II)

Determination of the Formula of a

Job's Method; Making Solutions,

Complex Ion by Spectrophotometry

Spectrophotometer use

Synthesis of Some Coordination Compounds

Multistep synthesis,

Synthesis of a Coordination Compound of Iron

Suction filtration, Crystallization

The Chemistry of Silver and the

Photographic Process

Analysis of  $\text{Ag}^+$ ,  $\text{Pb}^{2+}$  and  $\text{Hg}_2^{2+}$

Qualitative Analysis

Synthesis of Aspirin

Organic Synthesis

Analgesic Drug Analysis by TLC

Organic analytical,

Thin Layer Chromatography

Synthesis of Esters

Organic Synthesis

Polymer Synthesis and Properties

Experimental Method, Polymer synthesis

Determination of Functional Groups by IR

Spectral Interpretation

Exams:

5 – 1 ¼ hr exams

1 – Final, 2 hr exam