Miami-Dade College

Course Description, Prerequisites, Co-requisites, and Competencies

CHM 4406

Intermediate Inorganic Chemistry for Secondary Science Teachers
3 credits

Course Description: This course is designed to expand and deepen the student's knowledge of general inorganic chemistry. Topics covered include: bonding theories, nuclear chemistry, coordination chemistry, chemical periodicity, qualitative analysis, and metal and nonmetal chemistry. This course addresses several specific Sunshine State Standards, subject matter competencies, and pedagogy pertinent to the discipline and required certification.

(3 hr. lecture)

Prerequisites: CHM 3200, 3200L, 3120 and 3120L with a grade of C or better.

Co-requisites: CHS 4450L

Competency 1: The student will demonstrate knowledge of molecular structure and covalent bonding theories by:

a. Explaining the basic tenets of valance shell electron pair repulsion (VSEPR) theory and applying those tenets to predict molecular and electronic geometries.
b. Predicting molecular polarity.
c. Analyzing the hybrid orbitals used in molecular bonding.
d. Explaining the basic tenets of valence bond (VB) theory and applying those tenets.
e. Comparing and contrasting sigma (σ) and pi (π) bonding.
f. Explaining the basic tenets of molecular orbital (MO) theory and applying those tenets.

Competency 2: The student will demonstrate knowledge of coordination chemistry by:

a. Identifying, characterizing, and writing formulas of coordination compounds.
b. Recognizing metals that form soluble ammine and aquo complexes in aqueous solutions and writing the formulas for these complexes.
c. Appropriately using the terminology that describes coordination compounds.

d. Applying the International System of Pure and Applied Chemistry (IUPAC) system of nomenclature to coordination compounds.
e. Recognizing, describing, and writing isomers of coordination compounds [ionization, hydrate, coordination, linkage, geometric, and optical isomers].
f. Describing and utilizing the crystal field theory of bonding in coordination compounds.
g. Explaining the origin of color in complex species.
h. Using the spectrochemical series to explain the color of a series of complexes.

Competency 3: The student will demonstrate knowledge of nuclear chemistry by:

a. Describing the composition of the atomic nucleus.
b. Describing the relationships between neutron-proton ratio and nuclear stability.
c. Explaining the band of stability.
d. Calculating mass deficiency and nuclear binding stability.
e. Describing the common types of radiation emitted when nuclei undergo radioactive decay.
f. Describing methods of detecting radiation.
g. Writing and balancing equations that describe nuclear reactions.
h. Predicting the different kinds of nuclear reactions that radionuclides can undergo depending on their relative position to the band of stability.
i. Describing methods of detecting radiation.
j. Performing kinetic calculations associated with radioactive decay.
k. Plotting exponential decay curves.
l. Describing methods of artificially transmuting elements.
m. Interpreting the disintegration series of radionuclides.
n. Describing nuclear reactions that are induced by bombardment of nuclei with particles.
o. Comparing and contrasting nuclear fission and fusion.
p. Analyzing nuclear waste management issues.
q. Evaluating the impact that nuclear chemistry has on areas such as nutrition, industry, medicine, agriculture and the environment.

Competency4: The student will demonstrate knowledge of the crystal state by:

a. Describing the regular structure of crystalline solids.
b. Relating the properties of different types of solids to the bonding or interaction among particles in these solids.
c. Visualizing some common simple arrangements of atoms in a solid.

d. Carrying out calculations relating atomic arrangement, density, unit cell size, and ionic and atomic radii in some simple crystalline arrangements.

Competency 5: The student will demonstrate knowledge of representative and transition element chemistry by:

a. Describing the properties, uses, occurrence, periodicity, and reactions of the alkali metals, alkaline earth metals, post-transition metals, and transition metals.

b. Describing the properties, occurrence, uses, periodicity, and reactions of noble gases, halogens, chalcogens, VA, and IVA non-metals.

Competency 6: The student will demonstrate knowledge of qualitative analysis by:

a. Explaining the chemical principles involved in a qualitative analysis schematic.