



COMPLEMENTI DI CHIMICA INORGANICA E LABORATORIO

CHIM/03 - 6 CFU - 1° Semester

Teaching Staff

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Office Hours: Lunedì, Mercoledì e Venerdì ore 9-11, ed alla fine di ogni lezione

LEARNING OBJECTIVES

Acquire knowledge about metallic and ionic solids, polyelectronic atom, electronic states, crystal field and MO theories, inorganic and organometallic materials.

DETAILED COURSE CONTENT

1. SOLID STATE (12-hour module)

Crystal structures: chemical and crystallographic repeat unit, connection and coordination numbers, coordination polyhedra; octahedral and tetrahedral structures. Crystallographic parameters. Classification of solids; metallic solids, symmetry elements, packing of spheres, compact structures: hexagonal (hcp) and cubic compact (ccp) structures, body centered cubic structure. Not compact structures. Overview of the band theory; insulators, semiconductors and metals. Ionic radii and binary and ternary ionic solids. Important crystal structures: sodium chloride, cesium chloride, fluorite, rutile, zinc blende and wurtzite. Interstitial systems in compact structures: perovskites and spinels. Lattice energy, Madelung constant, Born-Haber cycle. Covalent solids; molecular solids. Outline of defects in solids.

2. TRANSITION ELEMENTS (10-hour module)

Particles and waves, the structure of the hydrogen atom, electronic configurations of atoms and ions; ionic radii. Polyelectronic atom, Russell-Saunders coupling, spin-orbit coupling. Magnetic properties. General characteristics of transition elements.

3. CFT-LFT-MO THEORIES (14 hour module)

Outline of element and symmetry operations. Classification of ligands: as donor atom; mono- and polydentate; sigma and pi ligands. Crystal field and ligand field theories. MO theory. Octahedral tetrahedral and square planar complexes. Spectrochemical series of ligands. 18 electron rule. High-spin

and low spin complexes. Jahn-Teller effect. Notes on the electronic spectra. Coordination complexes and formation constants of complexes. Stability of complex ions in aqueous solution. Chelation and macrocycle effects.

4. SYSTEMATIC for Classes of compounds (16-hour form)

Chemistry of the elements of the first transition series: general characteristics; preparation, properties and use of the elements. Common compounds: synthesis and reactivity. Organometallic complexes of industrial use. Metal alkyls, alkylidenes, carbenes, carbonyl compounds, cyclopentadienyl compounds. Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu.

TEXTBOOK INFORMATION

- 1) F. ALBERT COTTON, GEOFFREY WILKINSON, CARLOS A. MURILLO, MANFRED BOCHMANN, Advanced Inorganic Chemistry, 6th Edition - Wiley
 - 2) N. N. GREENWOOD, A. EARNSMAW, Chimica degli Elementi - Piccin
 - 3) W. W. PORTERFIELD, Chimica Inorganica - Zanichelli
 - 4) SHRIVER, ATLINS, LANGFORD, Chimica Inorganica - Zanichelli
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