CHEMISTRY 131, Inorganic Chemistry

University of Vermont
Spring Semester, 2013

Professor Christopher Landry

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Office: Cook A134
Office hours: Tues 2:00 – 3:30pm
Thurs 9:30 – 11:00am
or by appointment

Background:

Inorganic chemistry deals with the properties of all of the elements in the periodic table, ranging from metals to nonmetals. The differences in physical properties and reactivities of the elements implies that inorganic chemistry bridges many areas of study, from materials science and spectroscopy to biochemistry. In this course, our primary interest will be to develop a basic understanding of bonding that can be applied to a variety of inorganic molecules. This will allow us to explore selected areas in more detail, such as solid state chemistry, organometallics and catalysis, and bioinorganic chemistry.

Textbooks:

Miessler & Tarr, *Inorganic Chemistry*, Custom Edition for UVM	required	1269060767
Vincent, *Molecular Symmetry and Group Theory,* 2nd Ed., 2001.	recommended	0471489395
Shriver & Atkins, *Inorganic Chemistry,* 4th Ed., 2006.	reference	0716748789
Huheey, Keiter, & Keiter, *Inorganic Chemistry: Principles of Structure and Reactivity,* 4th Ed., 1997.	reference	006042995X

Organization:

10 Quizzes, 100 pts. (22%)
2 Tests, 200 pts. (44%)
Final Exam, 150 pts. (33%)
450 total points.

Test Schedule:

Test #1: Monday, Feb. 25, 7-9 pm, Angell B112
Test #2: Monday, Apr. 8, 7-9 pm, Angell B112
Final Exam: Tuesday, May 7, 7:30am, Angell B112

Quiz Schedule:

(all Fridays): January 25; February 1, 8, 15, 22; March 15, 22, 29; April 5, 19, 26.

No Class:

Monday, January 21; Monday, February 18; Monday–Friday, March 4-8.

Quizzes will cover recent lecture material (i.e., from the previous week); 11 are given, and the lowest quiz score is dropped. They are normally given in class every Friday and take 10 to 15 minutes to complete. Occasionally they will be given as group activities, whether in-class or take-home. Quizzes are not given on the Friday after a test. **Tests** will cover new material (i.e. test 2 will cover material introduced after test 1, etc.). They will be given at 7 pm on the dates listed above. They typically will take between one and two hours. The **final exam** is semi-cumulative; it mainly covers new material, but will include a several questions on important material from previous topics.

The instructor reserves the right to change everything, with notice.

Class Schedule
Chem 131, Spring 2013

Date	Chapter/section	Reading	Topics	Assessment
Week 1	M: 1.0	1 – 6	atomic reactivity, inorganic vs. organic chemistry	
1/14 – 1/18	W: 1.1 – 1.2	19 - 23	periodic table, wave-particle duality	
	F: 2.0 – 2.1	24 - 27	probability, electron wavefunction	**no quiz**
Week 2	M: **no class**	--	--	
1/21 – 1/25	W: 2.2 – 2.3	27 - 39	quantum numbers, orbitals, nodes	
	F: 2.4	39 - 45	shielding, effective nuclear charge	Quiz #1
Week 3	M: 2.5	45 – 49	periodic properties	
1/28 – 2/1	3.1	55 – 56	Lewis diagrams	
	W: 3.1 – 3.2	56 – 63	drawing Lewis and VSEPR structures	
	F: 3.2	64 – 74	features influencing 3D molecular structure	Quiz #2
Week 4	M: 3.3 – 3.4	77 – 82	polarity, hydrogen bonding	
2/4 – 2/8	5.1	140 – 141	formation of molecular orbitals	
	W: 5.1	141 – 145	bonding, antibonding, nonbonding orbitals	
	F: 5.2	146 – 157	homonuclear diatomics, bond order	Quiz #3
Week 5	M: 5.3	95 – 106	VSEPR model, polarity	
2/11 – 2/15	W: --	--	comparison of covalent bonding models	
	F: 4.1	87 – 93	molecular symmetry, symmetry elements	Quiz #4
Week 6	M: **no class**	--	--	
2/18 – 2/22	W: 4.2	93 – 103	point groups	
	F: 4.4	114 – 115	point group practice, chirality, polarity	Quiz #5
Week 7	M: --	--	test review	**Test #1**
2/25 – 3/1	W: 4.3	103 – 108	matrices, characters, representations	
	F: 4.3	108 – 114	character tables	**no quiz**
Week 8	M: **no class**	--	--	
3/4 – 3/8	W: **no class**	--	**Spring Break**	
	F: **no class**	--	--	
Week 9	M: handout	--	group theory: bonding in AH_n molecules	
3/11 – 3/15	W: handout	--	group theory: bonding in AX_n molecules	
	F: handout	--	MO diagram practice	Quiz #6

Week 10	M:	7.1	233 – 239	coordination compounds, chelates, ligands	
3/18 – 3/22	W:	7.3	244 – 258	isomerism and chirality of metal complexes	
	F:	8.3	286 – 289	ligand field theory	Quiz #7
Week 11	M:	8.3	289 – 296	π donors/acceptors, strong/weak field	
3/25 – 3/29	W:	8.3	299 – 305	non-octahedral environments	
		8.5 – 8.6	315 – 320		
	F:	handout	--	spectrochemical series, magnetism	Quiz #8
Week 12	M:	9.0 – 9.3	331 – 344	intro organometallic chem, 18 electron rule	
4/1 – 4/5	W:	9.4	344 – 356	CO, NO, H_2 bonding modes	
	F:	9.5	359 – 367	π systems	Quiz #9
Week 13	M:	--	--	test review	**Test #2**
4/8 – 4/12	W:	--	--	examples of catalytic organometallic processes	
	F:	11.0 – 11.1	447 – 449	bioinorganic chemistry, amino acids, porphyrin	**no quiz**
Week 14	M:	11.1	449 – 453	heme-containing metalloproteins	
4/15 – 4/19	W:	11.2 – 11.3	456 – 463	other Fe proteins, Zn and Cu proteins	
	F:	11.4	463 – 464	Fe clusters, nitrogenase, "ox-phos" system	Quiz #10
Week 15	M:	6.0 – 6.1	196 – 203	metallic bonding, unit cells, packing	
4/22 – 4/26	W:	6.1 – 6.2	203 – 212	binary ionic solids, structure types, energetics of ionic solids	
	F:	6.3	212 – 219	electronic properties of metals, band structure, diodes	Quiz #11
Week 16	M:	catch up	--	--	
4/29 – 5/3	W:	catch up	--	--	
	F:	**no class**	--	--	

KEY SKILLS:

- Understand and explain periodic trends and unique reactivity patterns
- Recognize molecular symmetry
- Create qualitative molecular orbital diagrams for simple molecules and complexes
- Understand bonding and reactivity of transition metal complexes
- Describe the roles of metals in biological systems
- Rationalize bonding in solids