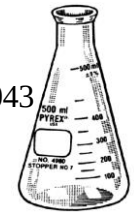
SYLLABUS
Chemistry 305
Spring, 2017

DESCRIPTIVE INORGANIC CHEMISTRY

Instructor: Robert D. Pike
Integrated Science Center 2043
phone: (757) 221-2555
email: rdpike@wm.edu



Office Hours:
Tuesday 9:00–10:30 am
Thursday 1:30–3:00 pm
(and by appointment)

Course Goals and Rationale: The goals of the course are twofold: (a) to complete the coverage of general chemistry begun in Chemistry 103 including principles of bonding, structure, equilibrium, thermodynamics, electrochemistry, and nuclear chemistry and (b) to present the rich and diverse chemistry of the elements. The course is primarily intended for chemistry concentrators, but also satisfies requirements for biology, geology, neuroscience, and pre-health science students.

Texts: J. E. McMurray & R. C. Fay, *General Chemistry: Atoms First*, 2nd ed. Pearson Prentice Hall: Upper Saddle River, NJ, ISBN: 978-0321809261 (2014).

Andy Weir, *The Martian*, Broadway Books, New York, NY, ISBN: 978-0553418026 (2014).

Lectures: Monday, Wednesday, Friday, 12:00–12:50 pm, Integrated Science Center 1127

Examinations: (20% for each of the higher scores, 10% for the lowest score)
February 17, March 22, April 19

All exam material comes from the course lectures/slides/handouts. The textbook is intended to supplement and amplify this material. *The Martian* material is treated in the problem sets, but is not specifically covered on any of the exams.

Make-up tests are not typically permitted. If you must miss an exam, please let me know at least one week in advance so that we can arrange for you to take the exam early.

Final Examination: (30%) In-class, closed-book, cumulative. May 2, 9:00 am

Writing: (10%) Term paper (about ten pages) on a topic of your choosing related to the wonders of chemistry, perhaps suggested from your reading in *The Martian*.

Problem Sets: (10%) Two types for each unit covered:
1) Practice end-of-chapter problems in text (not graded, answers found in the back of the text).
2) Hand-out problem sets, including questions associated with *The Martian* (graded).

Course Topics, Lecture Dates, Reading Assignments & Practice Problems:

Topic	Lecture Dates	Reading & Practice Problems in McMurray/Fay	Readings in *The Martian*
I. Bonding Orbitals and periodic trends Covalent bonding: localized picture Covalent bonding: molecular orbitals	1/18, 1/20, 1/22, 1/25, 1/27, 1/30	**2**: 62, 64, 66, 68, 80, 82, 86 **4**: 40, 52, 62, 70 **5**: 32, 34, 54, 56	Chapters 1–2
II. Structure States, phases and interparticle forces Closest packing and metals Ionic structures Defect structures	2/1, 2/3, 2/6, 2/8, 2/10	**10**: 24, 46, 76 **21**: 52, 62, 70, 76	Chapters 3–5
III. Equilibrium Solubility products The basics of acid/base chemistry Polyprotic acids Buffers Titrations	2/13, 2/15, 2/20, 2/22	**13**: 38, 44, 48 **14**: 46, 64, 66, 72, 78, 80, 84, 90, 94, 96, 100 **15**: 42, 44, 54, 60, 66, 72, 78, 80	Chapters 6–10
IV. Thermodynamics & Electrochemistry Enthalpy and the 1st law Entropy, free energy, and the 2nd law Voltaic cells, $E°$ The Nernst equation Electrolytic cells Energy	2/24, 2/27, 3/1, 3/3, 3/13	**16**: 36, 38, 52, 54, 60, 68, 70, 78, 86, 96, 104 **17**: 38, 46, 48, 50, 56, 66, 72, 78, 88, 104	Chapters 11–14
V. Main Group Chemistry Hydrogen Groups 1 and 2 Groups 13−17	3/15, 3/17, 3/20, 3/24, 3/27, 3/29, 3/31, 4/3	**18**: 36, 42, 56, 62, 70, 72 **19**: 28, 32, 38, 44, 68, 84, 90, 98	Chapters 15–18
VI. Transition Metal Chemistry Oxidation states and ligands Coordination complexes Crystal field theory The 18-Electron rule	4/5, 4/7, 4/10, 4/12, 4/14, 4/17, 4/21	**20**: 32, 46, 54, 72, 76, 102, 106, 108, 110, 114, 122, 134	Chapters 19–22
VII. Nuclear Chemistry Nuclear stability and decay Transmutation of elements Fission and fusion	4/24, 4/26, 4/28	**22**: 12, 28, 30, 32, 42	Chapters 23–26