

## CHEM 241 – 3 CREDITS – INORGANIC CHEMISTRY I: INTRODUCTION TO PERIODICITY AND VALENCE THEORY

### 1. GENERAL INFORMATION

<b>Course Format:</b>	Lecture 51	---Th-	18:00-20:45	CC-320 LOY
	Lab 52TL	M-----	18:30-22:30	Wet: SP-210, Dry: SP-S185.07
	Lab 56	Only for students granted a lab exemption from <i>both</i> wet & dry labs.		

<b>Professor:</b>	<b>Dr. Ashlee Howarth</b> (ashlee.howarth@concordia.ca) Office hours (Zoom): Tuesday 5:00pm-6:00pm, and Friday 1:30pm-2:30pm (book on Moodle)
<b>Lab coordinator:</b>	<b>Jennifer Romero</b> (jennifer.romero@concordia.ca) Office hours: by appointment (for issues regarding wet and dry labs, absences, lab report extensions)

**TAs:** Refer to page 7 for contact information and office hours.

**Moodle site:** CHEM-241-51-2234 (slides, dry labs, solutions manual, submission links, etc...)

### 2. COURSE DESCRIPTION

The structure of the atom; the periodic table; properties of atoms, covalent bonding treatments including Lewis theory, valence shell electron pair repulsion theory of structure, valence bond and molecular orbital theory. Crystal field theory applied to the structure and properties of transition metal complexes. Bonding theories of metallic materials and semi-conductors. Lectures and laboratory.

**Prerequisites:** CHEM 205, 206; PHYS 204, 206, 224, 226; MATH 203, 205; or equivalents for *all* of these.

### 3. OBJECTIVES

You should acquire familiarity with the concepts used to describe the bonding and some properties of a variety of types of compounds. You should be able to understand the ways in which structural and bonding information is presented for known molecules AND you should develop some predictive skills.

### 4. TERRITORIAL ACKNOWLEDGEMENT

I would like to begin by acknowledging that Concordia University is located on unceded Indigenous lands. The Kanien'kehá:ka Nation is recognized as the custodians of the lands and waters on which we gather today. Tiohtià:ke/Montréal is historically known as a gathering place for many First Nations. Today, it is home to a diverse population of Indigenous and other peoples. We respect the continued connections with the past, present and future in our ongoing relationships with Indigenous and other peoples within the Montreal community.

### 5. SCHEDULE

**Important dates:** Lectures begin: Thursday January 18<sup>th</sup>  
 Labs begin: Monday January 22<sup>nd</sup> (check-in & dry lab #1)  
 Deadline to withdraw with tuition refund (DNE): Monday January 29<sup>th</sup>  
 Midterm exam: Thursday February 22<sup>nd</sup>  
 CHEM 101 quiz closes: Sunday February 18, 2024 at 11:55 pm  
 Deadline to withdraw (DISC): Wednesday April 17<sup>th</sup>  
 Lectures end: Thursday April 11<sup>th</sup>  
 Last day to hand in lab reports: Monday April 15<sup>th</sup>  
 Exam period: Starts Thursday April 18<sup>th</sup>  
 Final exam date(s): **TBD by final exams office**

### 6. COURSE MATERIALS (Obtainable from Follett)

**Readings List** Miessler *et al* 5<sup>th</sup> Ed. Ch.1-3, 5, 7, parts of 6, 9-12 + gen. chem. text readings (p.6 of syllabus).

**Textbook** "*Inorganic Chemistry*", G. L. Miessler, P. J. Fischer & D. A. Tarr, Pearson, 5<sup>th</sup> Ed. (Chem 341 too) as hard copy or e-book (120-day access; www.coursesmart.com)

+ any General Chemistry text you already have (e.g., Kotz, Zumdahl, Petrucci, *etc.*)

**Optional** “*Student Solutions Manual for Inorganic Chemistry*”, G. L. Miessler, P. J. Fischer & D. A. Tarr, Pearson, 5<sup>th</sup> Ed. (relevant sections will be posted on Moodle)

**Lab Manual** “*Chem.241 Wet Labs*”, Dept. of Chem. & Biochem., Concordia (rev. Fall ‘22 - not older)  
 “*Dry Labs*”: see the Moodle site

**Other Equipment** iClicker device or iClicker Reef subscription – **required** for in-class participation.

## 7. GRADING

To pass CHEM 241, **you must pass both the course work and the laboratory work**, by obtaining at least 50% on the course work (class participation, quizzes, midterm and final exam) and at least 60% on the laboratory work. A failure in the laboratory part carries an automatic “R” grade, and a good lab mark will not compensate for a failure in the coursework. The final grade will be weighted as follows:

Lab Work - (Wet Labs)	10%
Lab Work - (Dry Labs)	10%
Class participation	10% (need an iClicker OR a Reef subscription on smartphone/tablet/laptop)
Graded quizzes	15% (1 review quiz (3%) + 4 course material quizzes (3% each))
Midterm Exam*	20%
Final Exam*	35% (in April, scheduled by the Exams Office)

\*The midterm examination will cover all material taught in the period preceding it. The final examination will cover the entire course.

The **grading scheme** is as follows:

A mark ≥	0%	40	50.00	53.33	56.67	60.00	63.33	66.67	70.00	73.33	76.67	80.00	83.33	86.67
and <	40	50	53.33	56.67	60.00	63.33	66.67	70.00	73.33	76.67	80.00	83.33	86.67	100%
gets an:	R	F	D–	D	D+	C–	C	C+	B–	B	B+	A–	A	A+

*NB: if you do not complete “Chem101” (see syllabus, p.4), you will earn an INC notation, and a grade one step lower than you would otherwise deserve (for example “B/INC” instead of “B+”).*

**Important: to pass CHEM 241, you must pass the theory part and the lab parts separately.**

- **Theory pass:** class participation + quizzes + midterm exam + final exam ≥ 40/80
- **Theory fail, even if you passed the lab:** < 40/80 “F” (Fail)
- **Lab pass:** wet + dry labs ≥ 12/20, and no more than 1 lab incomplete, excused or not. (If you do not complete a lab for a legitimate reason, it will be excused, but not more than 1 time.)
- **Lab fail:** you will receive an automatic “R” grade, *whatever your theory mark might be.*

**Note:** students receiving a DISC grade in this course will be required to repeat all components of the course if they retake it

For the midterm and final examinations, only non-programmable calculators will be accepted. The Faculties of Engineering and of Arts & Science have selected and recommend two inexpensive models: the Sharp EL-531 and the Casio FX-300MS. Note: the ENCS sticker is NOT required.

*In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.*

## 8. LABORATORY INFORMATION (more details p.7)

The labs in CHEM 241 will further your experience of the practical aspects of inorganic chemistry and the concepts studied in class. Laboratory performance is graded on the understanding of experimental work and the report. During the **second week** of term, you will receive instructions from the lab coordinator. Each section will be divided into two groups which will alternate weekly for the rest of the term, between:

- Wet Labs. These are conventional (small scale) experiments. Your TA/demonstrators(s) will tell you which experiment you will perform in which week. A printed lab manual is sold in the University bookstore and can also be downloaded from the Moodle web site.

**You will not be permitted to complete the laboratory experiment if you have not completed and submitted the appropriate prelab exercise.**

- Dry Labs. These are computer-based exercises illustrating concepts in the course for which wet labs are not feasible.

More details can be found in the lab instruction pages (p.7) of this syllabus. Pay extra attention to the **scientific significance** and the **scientific presentation** in your reports. A good report goes beyond superficial questions and is based on **critical thinking**. In other words, you have to ask yourself constantly why certain things are being done during the experiment, and then relate this to your knowledge.

**Incomplete Labs:** If you do not complete a lab, you must provide to the lab coordinator a written excuse appropriately signed (e.g., doctor or employer) within one week or you will receive a grade of **zero**. **No more than ONE absence is allowed.**

**Lab exemptions:** If you have taken CHEM 241 and passed both the wet & dry lab components (>12/20) in Winter 2023 or Fall 2023, you should request a lab exemption. Your previous marks will be used in calculating your grade this term. If you are not satisfied with your old lab grades, you must repeat ALL labs instead of requesting an exemption. If you have not yet applied for a lab exemption, download the application form from the department website at: <https://www.concordia.ca/content/dam/artsci/chemistry/docs/labexempt.pdf>. **To get a lab exemption, you must (1) submit the lab exemption application by Friday January 19<sup>th</sup> at noon to [chemistry.reception@concordia.ca](mailto:chemistry.reception@concordia.ca) AND (2) register in lab section 56 (students in all other lab sections must perform ALL labs). All late lab-exemption requests will be refused.**

## 9. CLASS PARTICIPATION – iCLICKER DEVICE or REEF POLLING SUBSCRIPTION

Teaching & learning research has shown that active participation in class (for grades) significantly improves student engagement and success. Thus, you are required to purchase either (1) an iClicker classroom response device or (2) a subscription to the iClicker Reef Polling System for your smartphone, tablet or laptop. Bring your device to each class. Note: Reef is cheaper than an iClicker, but if you will need a clicker for  $\geq 3$  courses, the clicker itself might be cheaper, and used clickers can be purchased and/or sold back to the bookstore when finished.

Details: A clicker is a response system that enables you to respond to questions posed during class. Your class participation mark will be based on responding to these questions. Because discussion with peers will be involved as well, some advance preparation is a good idea: the questions are in the PowerPoint presentations on the Moodle site. To receive marks, you must register your clicker (see below), so that it is clear which clicker is yours.

Registering your iClicker: any time, log in to [Moodle at moodle.concordia.ca](http://moodle.concordia.ca), then find the “i>clicker” block on the top left and click the [Student Registration link](#). Your iClicker remote ID is found on the bar-code sticker on the back of your iClicker device or displayed on the screen when the remote is turned on. Note: if you choose to use Reef, you still must register in Moodle.

Please be aware that using a clicker belonging to another student in order to fake their presence in the class when they are actually not present would be a form of cheating under the Academic Code of Conduct. ☹

## 10. RIGHTS AND RESPONSIBILITIES OF THE STUDENT

**Read the Moodle site within the first week of classes:**

All course information is provided there. Please read it before the 2<sup>nd</sup> week of class. The information will remain accessible all term for your reference. If you have questions, please ask the professor and/or lab coordinator.

**Be prepared for lectures & labs:**

**Lectures:** Read the lecture materials before class, and then be ready to (i) answer clicker questions (including calculations) during the lecture and (ii) engage in discussion with small groups of classmates, or individual classmates to clarify each other's understanding.

**Labs:** Read the experiment thoroughly, complete the pre-laboratory exercises (individually), and then be ready to (i) complete the laboratory experiments or dry lab tutorial sessions and (ii) write a lab report based on your data (individually).

**Contribute to a positive learning environment:**



with the Code may result in charges and sanctions, as outlined in the Code.

Sexual violence, including sexual harassment and sexual assault, is not tolerated at Concordia. Please see Concordia's policy on sexual violence for more information about awareness and prevention, support for survivors/ victims, responding to disclosures and procedures for reports and complaints. You can also contact the Sexual Assault Resource Centre for information and support. More information and support are available at the Sexual Assault Resource Centre: [concordia.ca/students/sexual-assault](http://concordia.ca/students/sexual-assault), by email [sarc@concordia.ca](mailto:sarc@concordia.ca) or phone 514 848-2424 x 3353

### 11. IP

Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, and video recordings of classes remain the intellectual property of the faculty member. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the Academic Code of Conduct and/or the Code of Rights and Responsibilities. As specified in the Policy on Intellectual Property, the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

### 12. ACADEMIC INTEGRITY (Source: <http://www.concordia.ca/students/academic-integrity.html>)

*Plagiarism:* The most common offense under the Academic Code of Conduct is plagiarism, which the Code defines as “the presentation of the work of another person as one’s own or without proper acknowledgement.” This includes material copied word for word from books, journals, Internet sites, professor’s course notes, etc. It refers to material that is paraphrased but closely resembles the original source. It also includes for example the work of a fellow student, an answer on a quiz, data for a lab report, a paper or assignment completed by another student. It might be a paper purchased from any source. Plagiarism does not refer to words alone –it can refer to copying images, graphs, tables and ideas. “Presentation” is not limited to written work. It includes oral presentations, computer assignment and artistic works. Finally, if you translate the work of another person into any other language and do not cite the source, this is also plagiarism.

*In Simple Words:* Do not copy, paraphrase or translate anything from anywhere without saying where you obtained it!

### 13. CONCORDIA UNIVERSITY SERVICES FOR STUDENTS (partial list)

- Counselling & Psychological services: <http://cdev.concordia.ca/>
- Accessibility services: <http://www.concordia.ca/students/accessibility.html>
- Concordia Library Citation & Style Guides: <http://library.concordia.ca/help/howto/citations.html>
- Academic Integrity Website: <https://www.concordia.ca/students/academic-integrity.html>
- Student Advocacy Office: <https://www.concordia.ca/offices/advocacy.html>
- Financial Aid & Awards: <http://www.concordia.ca/offices/faao.html>
- Student Success Centre: <http://www.concordia.ca/students/success.html>
- New Student Program: <http://newstudent.concordia.ca/>
- Health Services: <https://www.concordia.ca/students/health.html>

## CHEM 241 – TOPICS COVERED IN COURSE (+ TOPICS TO RE-MASTER FIRST ON YOUR OWN)

Readings come from Inorganic Chemistry by Miessler, Fischer and Tarr, 5th Ed. AND from any general chemistry textbook (e.g., Chemistry & Chemical Reactivity by Kotz, Treichel, Townsend & Treichel, 9th Ed.). Sometimes, lectures will go into greater or lesser detail than the textbook - **lectures guide how deeply you should learn the material**. There may be additional reading assignments (e.g., journal articles) announced in class. Any readings may form the basis for clicker questions and/or exam questions.

### CRITICAL REVIEW (on own): QUIZZED DURING LAB CHECK-IN!

**Topics from:** *Chemistry & Chemical Reactivity Kotz et al, 9<sup>th</sup> Ed.*  
(or any recent *General Chemistry textbook*)

#### Atomic Structure (Kotz 9<sup>th</sup> Ch.6):

Atomic line spectra & the (inaccurate) Bohr model of the atom  
Quantum model: wave-particle duality, quantum #s, shapes of orbitals  
Electron spin, the Pauli exclusion principle  
DO: *Kotz Ch.6 #24,60,68,78; OR Miessler Ch.2 #1,3,15,16,46(spd)*

#### Electron Configurations & Chemical Periodicity (Kotz 9<sup>th</sup> Ch.7):

Atomic subshell energies (orbital-filling order)  
Electron configurations of atoms & ions (aufbau principle, Hund's rule)  
Atomic properties & periodic trends (size, ionization E, electron affinity)  
DO: *Kotz Ch.7 #45,46,53,70 OR Miessler Ch.2 #23,26,33,44*

#### Covalent Bonding & Molecular Structure (Kotz 9<sup>th</sup> Ch.8):

Lewis structures, formal charge, resonance, exceptions to octet rule  
Molecular shape (VSEPR) & molecular polarity  
Bond order, length & energy  
DO: *Kotz Ch.8 #34,37,75,21-23,78; OR Miessler Ch.3 #4,5,8-10,13,16*

#### Valence Bond Theory (Kotz 9<sup>th</sup> Ch.9.1 in part):

Hybridization of atomic orbitals: memorize link to geometry  
DO: *Kotz Ch.9 #7,29,30,35*

#### The Chemistry of Acids & Bases (Kotz 9<sup>th</sup> Ch.16.10):

Lewis concept of acids & bases  
DO: *Kotz Ch.16 #79,80,117; OR Miessler Ch.6 #1,2,20*

#### Nuclear Structure & Isotopes (Kotz 9<sup>th</sup> Ch.2):

Protons, neutrons, atomic number, mass number  
DO: *Kotz Ch.2 #18,98*

### CHEM 241 - INORGANIC CHEMISTRY I:

UNDERLINED = SELF-STUDY BEFORE CLASS (NOT "TAUGHT")

**Topics from both textbooks: Kotz 9<sup>th</sup> & Miessler 5<sup>th</sup>**

#### Introduction to Inorganic Chemistry (Miessler Ch.1):

1.1-2. What is Inorganic Chemistry? vs Organic Chemistry

#### Atomic Structure & Periodicity (Miessler Ch.2):

- 2.1. Historical Development of Atomic Theory
  - 2.1.1. The Periodic Table
  - 2.1.2. Discovery of Subatomic Particles & the Bohr Atom
- 2.2. The Schrodinger Equation
  - 2.2.1. The Particle in a Box
  - 2.2.2. Quantum Numbers & Atomic Wave Functions
  - 2.2.3. The Aufbau Principle
  - 2.2.4. Shielding
- 2.3. Periodic Properties of Elements: FOCUS ON CAUSE
  - 2.3.1. Ionization Energy
  - 2.3.2. Electron Affinity
  - 2.3.3. Covalent and Ionic Radii

#### Simple Bonding Theory (Miessler Ch.3):

- 3.1. Lewis Electron-Dot Diagrams
  - 3.1.1-3 Resonance, Higher e<sup>-</sup> Counts, Formal Charge
  - 3.1.4 Multiple Bonds in Be & B Compounds
- 3.2. Valence Shell Electron-Pair Repulsion Theory
  - 3.2.1-2 Lone-Pair Repulsion, Multiple Bonds
  - 3.2.3. Electronegativity & Atomic Size Effects
  - 3.2.4. Ligand Close Packing
- 3.3-4 Molecular Polarity, Hydrogen Bonding

#### Valence Bond Theory (Kotz Ch. 9.1-9.2 + lecture slides):

Orbital overlap model of bonding,  $\sigma$  and  $\pi$  bonding

**Limitations: hybridization, hypervalency, resonance**

#### Molecular Orbital Theory (Kotz Ch.9.3 + Miessler Ch. 5)

Principles of MO theory: orbital symmetry, delocalization

- 5.1. Formation of Molecular Orbitals from Atomic Orbitals
  - 5.1.1-3 Molecular Orbitals from s Orbitals, p Orbitals, d Orbitals
  - 5.1.4. Nonbonding Orbitals & Other Factors
- 5.2. Homonuclear Diatomic Molecules
  - 5.2.1. Molecular Orbitals
  - 5.2.2. Orbital Mixing
  - 5.2.3. Diatomic Molecules of the 1<sup>st</sup> & 2<sup>nd</sup> Periods
  - 5.2.4. Photoelectron Spectroscopy
- 5.3. Heteronuclear Diatomic Molecules
  - 5.3.1. Polar Bonds
  - 5.3.2. Ionic Compounds & Molecular Orbitals
- 5.4. Molecular Orbitals for Larger Molecules
  - 5.4.1 to 5.4.3 Linear & Bent AX<sub>2</sub> molecules
  - 5.4.4 to 5.4.5 AX<sub>3</sub> molecules

#### Crystalline Solid State (Kotz Ch.12.4 + Miessler Ch. 7.3):

- 7.3. MOs & Band Structure: Bonding in Metals & Semiconductors
  - 7.3.1. Diodes, Photoelectric Effect, Light-Emitting Diodes

#### Crystalline Solid State (Kotz Ch.12.1-2 + Miessler Ch. 7.1-2 in part)

- 7.1. Formulas & Structures
  - 7.1.1. Simple Structures (e.g., metals)
  - 7.1.2. Structures of Binary Compounds (e.g., ionic compounds)
  - 7.1.3. Radius Ratio
- 7.2 Thermodynamics of Ionic Crystal Formation
  - 7.2.2 Solubility, Ion Size, and HSAB

#### Coordination Chem. (Kotz Ch.22 + Miessler Ch. 6.4, 6.6, 9-12 parts)

Properties of the Transition Elements, review of oxidation states

Coordination compounds: structure, bonding, colour, magnetism

- 6.4 Lewis Acid-Base Concept & Frontier Orbitals
- 6.6 Hard and Soft Acids and Bases (in part)
  - 6.6.1 Theory of Hard and Soft Acids and Bases
- 9.1. History
- 9.2. Nomenclature
- 9.3. Isomerism: Stereoisomers, 4- vs 6-Coordination, Chirality, Constitutional isomers, Separation of isomers...
- 9.4. Coordination Numbers & Structures
- 10.1. Experimental Evidence for Electronic Structures: Thermodynamic data, Magnetic Susceptibility, Electronic Spectra, Shapes
- 10.2. Bonding Theories: Crystal-field theory
- 10.3. Ligand Field Theory (in part, only sections listed below)
  - 10.3.2. Orbital Splitting & Electron Spin
  - 10.3.3. Ligand Field Stabilization Energy
- 10.4. Angular Overlap (in part, only sections listed below)
  - 10.4.4. The Spectrochemical Series
- 10.6 Four- & Six-Coordinate Preferences
- 11.1 Absorption of Light
- 11.3 Electronic Spectra of Coordination Compounds (in part)
  - 11.3.1 Selection Rules
  - 11.3.7 Charge-Transfer Spectra
- 12.4 Experimental Evidence in Octahedral Substitution (in part)
  - 12.4.5 The Kinetic Chelate Effect

#### Nuclear Reactions & Radioactivity (Kotz Ch.25 + lecture slides):

Genesis of the elements in stars

Stability of atomic nuclei, radioactive decay

Nuclear reaction types, nuclear fission & nuclear fusion

Applications of nuclear chemistry

## CHEM 241 – Laboratory Instructions

**Coordinator:** Jennifer Romero  
Office: SP 234.01  
Hours : email for appointment  
✉: jennifer.romero@concordia.ca

**Wet lab TA:** Christopher Copeman  
Office: HU 435.00  
Hours: Thurs 1:30-2:30pm  
✉: Christopher.copeman@mail.concordia.ca

**Dry lab TA:** Hadi Rammal  
Office: SP 201.14  
Hours: Thurs 1:30-2:30pm  
✉: hadi.rammal@mail.concordia.ca

### 1. WET LABS

#### Wet Laboratory Experiments

The complete lab manual is available in the Concordia Bookstore (Loyola) and on the course Moodle web site. It includes safety information with which you should be familiar before being allowed to begin the experiments. You will be required to sign a form attesting that you have read the information.

The five experiments in the manual are listed below. You will be told the order/schedule for doing them during the check-in period, and the schedules will be posted on Moodle.

- Paper Chromatography Separation of Inorganic Cations
- The Nine-Solution Problem
- Copper: Its Chemical Transformations. Preparation of Copper(II) Compounds with Glycine
- Semiconductors: Preparation of Semiconducting Thin Films
- Synthesis of Isostructural Zr<sub>6</sub>-Based Metal–Organic Frameworks

It is probably cheaper to buy the complete manual from the Bookstore, rather than print it yourself from the Moodle site. If any of the diagrams are not reproduced well in the bookstore version, or if you need to print a clean copy of the report forms, refer to the downloadable files on the Moodle site.

#### Wet Lab Rules

1. You must arrive on time for all labs. Teaching assistants, lab instructors or technical staff may refuse admission to students arriving late.
2. Contact lenses are strictly forbidden.
3. Safety glasses and lab coats are mandatory.
4. Long hair must be tied back.
5. For safety reasons, cell phones may be used as calculators or cameras, but nothing else! You must remove your gloves before using your cell phone as there is a danger of transferring chemicals to your skin.
6. Prelabs (see below) must be completed before the scheduled lab date and checked by the teaching assistant before being allowed entry to the laboratory.
7. Lab reports are due one week after the experiment is performed and must be uploaded using the appropriate Moodle link before your lab session. The link is set to close by 11:59 pm on the due date, otherwise they may be considered a day late. There is no auto-extension of lab reports. Extension must be requested from the lab coordinator. Exception: **the last lab report must be handed in absolutely no later than Monday April 15<sup>th</sup>** (this may be <2 weeks after your scheduled experiment; if this is >2 weeks after you performed the experiment, late penalties will apply). All reports should be handed in via Moodle, hardcopies and email submissions will not be accepted.
8. Late lab reports are subject to a 10% per day penalty (≤3 days late) or a grade of zero (≥ 4 days late). All reports should be handed in using the correct link on Moodle. Documents must be a single merged pdf file. Only 1 document can be submitted per submission link.
9. Your TA is required to mark your lab reports, so that you can receive feedback, two weeks after you hand them in. This way you can learn from your mistakes. Please let the lab coordinator and the professor know immediately if your TA is late with their marking.
10. You must submit all medical/employer notes **within one week** to the lab coordinator, Jennifer Romero (not your TA), in the case of an incomplete lab.
11. You are required to inform the lab coordinator *in advance* if you foresee a conflict with completing a lab, for example due to a religious holiday.

#### Lab Reports for Wet Labs

- Please consult the individual experiments for details.
- You must prepare a written prelab shown in-person to your TA for the wet lab. You will not be permitted to attend the lab unless the prelab has been done. If the TA believes that your prelab is incomplete, you will not be allowed to complete that experiment and will receive a mark of zero. The prelab must be attached to the lab report uploaded on Moodle.
- Prelabs and lab reports must be identified with the experiment number and title, and must include your name, student number and date.
- Each lab has some questions to be answered and submitted with your lab report.
- Each lab describes the basics of what should be included in the report. There is a tear-out form on which to record your observations and data. This information must be included as part of the report.

### Grading of Wet Labs

You will be graded out of a total of 20 marks.

### 2. DRY LAB “EXPERIMENTS”

- Molecular Models in Inorganic Chemistry
- Lewis Bonding Theory and VSEPR Theory
- The Bohr Atom - The Electronic Spectrum of Hydrogen
- The Probabilistic Interpretation of Atomic Orbitals
- Molecular Orbital theory - Linear Combinations of Atomic Orbitals

These “dry labs”, available only on the Moodle site, involve computer exercises which:

- **must be worked on** (at least in part) during your scheduled lab period on Chemistry/Biochemistry Department computers in SP-S185.07 where a teaching assistant will be available to help you. **The sessions for the dry labs are mandatory.** Inform the lab coordinator if you cannot attend a dry lab session.
- **have prelab questions that must be completed and submitted via Moodle before performing the experiment (the VSEPR dry lab is an exception, and does not have a prelab component).**
- can be finished on your own time.

The dry labs are to be done in the specific order above, connected approximately to the lecture schedule.

You *must* hand in your dry lab reports to your TA via Moodle by the deadline (one week after they are scheduled). Make sure you know when that is! The exception: **the last dry lab must be handed in no later than Monday April 15<sup>th</sup>.**

Your TA is required to mark the reports so that they can provide feedback two weeks after you hand them in so that you can learn from your mistakes. Please let the professor and/or lab instructor know immediately if your TA is late doing his or her marking.

### Lab Reports for Dry Labs

1. You have to answer all questions found on the web page of each Dry Lab. The answers should be concise, yet complete. Late lab reports are subject to a 10% per day penalty ( $\leq 3$  days late) or a grade of zero ( $\geq 4$  days late). All reports should be handed in using the correct link on Moodle. Documents must be a single merged pdf file. Only 1 document can be submitted per submission link. The link is set to close by 11:59 pm on the due date.
2. There is no auto-extension of lab reports. Extension must be requested from the lab coordinator. All reports should be handed in via Moodle, hardcopies and email submissions will not be accepted.

### Grading of Dry Labs

You will be graded out of a total of 10 marks. The number of marks allotted to each question is indicated on the web pages.