

# Introduction to Inorganic Chemistry

CHMB31H3 F

## Syllabus

Some of the introductory topics you met already during the CHMA10 and CHMA11 courses. What we have to do now is make a review, build up on this previous knowledge and connect it to the inorganic chemistry. The relevant chapters from your CHMA10 and CHMA11 textbook (General chemistry: Principles & modern applications by Petrucci, Harwood, Herring, and Madura) are listed for these topics! In general it would not be a bad idea if you could have a look at the CHMA10 and CHM11 lecture notes and textbook chapters that cover the following:

- Structure of atoms
- Periodic table
- Gases and liquids
- Chemical bonding
- Principles of chemical equilibrium
- Acids and bases
- Thermochemistry
- Electrochemistry

I know this looks like a lot of stuff. We'll go over all these topics during the lectures (sooner or later). You could go over them if you want to 'warm- up' a little bit before we start so you have more time to deal with new material!

Here are our topics with relevant chapters. For example, GC 9 next to a topic stands for the above general chemistry textbook

Chapter 9 which you use if you want to refresh old knowledge; IC 3 stands for our textbook Housecroft and Sharpe "Inorganic Chemistry, Chapter 3 which we use in this course!

1. Inorganic chemistry - a general introduction to the discipline and our course
2. The Elements - what are they? (GC 3.1; IC 1)
  - a. Atoms and their structure (GC 8; IC 1)
  - b. Electronic structure (GC 8; IC 1.2 - 1.7)
  - c. Structure of nucleus (GC 25; IC 3.1- 3.2), radioactivity (IC 3.3), fission and fusion (IC 3.4 - 3.8)
  - d. Nucleosynthesis: the birth of elements in stars and laboratory (basics of stellar and interstellar inorganic chemistry and artificial nuclear reactions)
3. The Periodic Table revisited (mostly based on lecture notes!)
  - a. 'Subgroups' of periodic table
  - b. Sizes of atoms and ions (GC 9.3)
  - c. Electronegativity, electron affinity and ionization energies (IC 1.10)
  - d. The relationships among elements
4. Molecules and compounds
  - a. Shapes of and bonding in polyatomic molecules (IC 2 & 5)
  - b. Short introduction to molecular symmetry (IC 4.1- 4.3)
  - c. Bond orders and bond strengths
  - d. Basics of molecular orbital theory
5. Basic classes of inorganic compounds and reactions
6. Structure of solids (IC 6)
7. Reduction and Oxidation. Electrochemistry (a very brief revision! - IC 8)

8. Hydrogen (IC 10)
9. The Group 1 elements (IC 11)
10. The Group 2 elements (IC 12)
11. The Group 13 elements (IC 13)
12. Special topic I - Inorganic chemistry in nature I:  
Introduction to inorganic chemistry in living systems and medicinal inorganic chemistry (review of Hydrogen and Groups 1, 2 and 13)
13. The Group 14 elements (IC14)
14. Special topic II - Inorganic chemistry in nature II:  
Introduction to mineralogy, Silicate minerals
15. The Group 15 elements (IC 15)
16. The Group 16 elements (IC 16)
17. Special topic III - Inorganic Chemistry in nature III:  
Inorganic chemistry of atmosphere and gaseous giant planets (review of Groups 14 - 16)
18. The Group 17 elements (IC 17)
19. The Group 18 elements (IC 18)
20. Special topic IV: Chloro-alkali industry (introduction to basic chemical industry - review of groups 17 and 18)
21. Special topic V: Introduction to solid state chemistry (if time permits)
22. Review of main-group chemistry (Hydrogen, Groups 1, 2 and 13-18)

More specific readings and problems from your textbook will be given to you at the end of each lecture in your lecture notes. The lecture notes will be uploaded on the UTSC intranet regularly in *pdf* format. These notes are giving you the overview of important concepts, ideas etc. They will be your primary source - master them first and after move to the textbook to expand your knowledge and (if you want to) check other sources. The knowledge

of material from both lecture notes and relevant textbook readings is expected. Topics 1 - 7 are reviews and expansion of CHMA10 and CHMA11 materials thus we will not spend much time on them during the lectures. This does not mean that you will not be tested on this material - its solid knowledge is essential for inorganic chemistry.

### **CHMB31 Resources**

#### *Textbook:*

Housecroft C.E., Sharpe A. G. **Inorganic chemistry**. 3<sup>rd</sup> edition.  
Harlow: Pearson- Prentice Hall; 2008.

This is commonly used inorganic chemistry textbook at our university. It is also used for Intermediate inorganic chemistry course (CHMC31) so for those who decide to further explore the world of transition metals and enroll in CHMC31 can hold on to this book.

#### *Other suggested books*

Greenwood N.N., Earnshaw A. **Chemistry of the Elements**. 2<sup>nd</sup> edition. Oxford: Butterworth-Heinemann, 1997. (Call No. QD466 .G74 1997 SCAR this book will be placed on 24 hour short- term loan; available also on-line at <http://simplelink.library.utoronto.ca/url.cfm/2717>)

This is an excellent inorganic chemistry textbook but it is an advanced reading. If you would like to explore and learn more about the elements, their properties and compounds, this book is

a great starting point. It covers in particular detail the elements, their properties and compounds.

Miessler G.L., Tarr D.A. **Inorganic Chemistry**. 3<sup>rd</sup> edition. Upper Saddle River: Pearson Education; 2004. (Call No. QD151.3 .M54 2004)

Huheey J.E., Keiter E.A., Keiter R. L. **Inorganic chemistry: Principles of structure and reactivity**. 4<sup>th</sup> edition. New York: HarperCollins College Publishers; 1993. (Call No. QD151.2 .H84 1993 SCAR)

*Some popular books (non-textbooks) on chemical elements:*

Atkins P.W. **The Periodic Kingdom: A journey into the land of the chemical elements**. New York: Basic Books; 1995. (Call No. QD466 .A845 1995 SCAR)

Emsley, J. **Nature's building blocks: An A-Z guide to the elements**. Oxford: Oxford University Press; 2001. (Call No. QD466 .E486 2001 SCAR)

Ball, P. **The ingredients: A guided tour of the elements**. Oxford: Oxford University Press; 2002.

There are many other popular science books dealing with the elements, their birth and occurrence, their compounds and history. Some of them can be found in UTSC library!

*On the web*

VISUAL ELEMENTS PERIODIC TABLE

[www.rsc.org/chemsoc/visualelements/pages/periodic\\_table.html](http://www.rsc.org/chemsoc/visualelements/pages/periodic_table.html)

A beautiful and artistic representation of periodic table and the elements and

WEBELEMENTS

[www.webelements.com](http://www.webelements.com)

Provides a lot of data for each element (but I find it a bit messy)

PERIODIC TABLE AT LOS ALAMOS NATIONAL LABORATORY

[periodic.lanl.gov/default.htm](http://periodic.lanl.gov/default.htm)

Simple periodic table with basic information for each element.

WEBMINERAL

[www.webmineral.com](http://www.webmineral.com)

Minerals are only one place where we can find inorganic chemistry in nature.

THE GUIDED TOURS OF METALLOPROTEINS

<http://www.chem.utoronto.ca/coursenotes/GTM/main.htm>

The other place where we find inorganic chemistry is in us and all other living creatures!