

Chemistry 362
Goals for Chapters 10, 11, 14, 16, 18 and Environmental Chemistry

The Group I Elements

1. Know the properties of the alkali metals. Know that they are easily ionized to M^+ cations but not to the M^{2+} cations. Know that the metals themselves are relatively soft. Be able to explain these properties.
2. Know and be able to explain why lithium is different from all the other alkali metals.
3. Know how the alkali metals react with water, nitrogen (in the case of Li) and oxygen. Know which metals form oxides, peroxides and superoxides.
4. Understand what occurs when alkali metals are dissolved in liquid ammonia.
5. Know the basic reactivity patterns of the oxides of the alkali metals as discussed in class. Know that the oxides are basic when dissolved in water and why.
6. Understand the differences in the hydration spheres of the alkali metal cations.
7. Understand how crown ethers and cryptates are used to facilitate the formation of solutions of alkali metal cations.
8. Review the reactivity patterns of the alkali metals as shown on pages 301 and 302 of the text.

The Group II Elements

1. Understand the key differences in the properties of the alkaline earth metals as compared to the alkali metals and why they occur.
2. Know that Be exhibits a high degree of covalency, as compared to the other group II metals, in its compounds and be able to explain why this is so.
3. Be able to describe the polymerization of beryllium halides in the condensed phase.
4. Be familiar with the oxides of the alkaline earth metals and their properties. Are they basic or acidic?
5. Understand the differences between the chemistry of Be, Mg and the rest of the alkaline earth metals.

Carbon

1. Be able to describe the bonding in the three allotropes of carbon: graphite, diamond and fullerenes.
2. Know the preparations for carbon dioxide and carbon monoxide.
3. Know that carbon monoxide and cyanide are both toxic in the human body. CO attacks the iron heme in the blood and CN^- attacks the copper heme in the mitochondria.
4. Be familiar with some of the uses of carbon dioxide in industry.
5. Understand that in water: $\text{CO}_{2(\text{aq})} + \text{H}_2\text{O} \leftrightarrow \text{H}_2\text{CO}_{3(\text{aq})}$.
6. Understand that cyanide is a weak base.

Nitrogen

1. Know the Haber-Bosch process for nitrogen fixation and the importance it has played in our world.
2. Be familiar with the formation of amides and ammonium ions from ammonia.
3. Know what nitride is.
4. What is nitric acid? Know the Ostwald process for making it. Be able to describe important applications of nitric acid.

Oxygen

1. Know the two allotropes of oxygen.
2. Know how oxygen is produced and used in nature. Understand why it's important to maintain a certain level of oxygen in the atmosphere.
3. Be familiar with major industrial uses of O_2 .
4. Be familiar with the properties of O_3 as discussed in the lectures.
5. Know the difference between acidic, basic and amphoteric oxides. Be able to give examples of each case.
6. Be able to predict if a transition metal oxide is basic, acidic or amphoteric.
7. Know the properties of peroxides.

Environmental Chemistry

1. Be able to describe what the greenhouse effect is. What is it's role in the environment?
2. Be able to discuss what the following groups/treaties are:
The IPCC
The Montreal Protocol
The Kyoto Protocol
3. Be familiar with the basic findings (what were the biggest problems found) of the Houston Air Quality Study in 2007, the single largest air quality study performed to date.
4. Be able to discuss the formation of haze particles. Know that they actually help to offset the effect of combat global warming.
5. Be able to discuss the roles of H_2O , CO_2 , SO_x , NO_x and O_3 in the atmosphere as was discussed in class.
6. Be able to discuss the pros and cons of employing fossil fuels or nuclear power as a source of energy in terms of the environment.
8. Know the chemical reactions discussed in the notes regarding the reactions of NO_x gases and CO from automobile exhaust (Three-way catalytic converter reactions).