Chemistry 205 – Inorganic Chemistry I
Exam 3 (May 24, 2002)

Partial credit will be given for work shown. The answer by itself is not satisfactory for full credit.

Academic Honesty Policy: Intentionally using or attempting to use unauthorized materials, information or study aids in any academic exercise, OR intentionally or knowingly helping or attempting to help someone else to commit an act of academic dishonesty, such as knowingly allowing another to copy information during an examination or other academic exercise constitutes Academic Dishonesty and is **punishable with a possible grade of F** in this course!!!

INFORMATION THAT MAY BE OF USE TO YOU IN THE EXAM

$$\Delta G° = \Delta H° - T\Delta S°$$

Periodic Table

Name:_____

Use Chemical Equations When Appropriate

6 pts   1. Explain briefly why sheets of aluminum do not oxidize completely to aluminum oxide even though aluminum is a highly reactive metal.

12 pts   2. Explain using bonding theory why the three allotropes of carbon are unique. Diamond is an extremely hard substance, graphite is slippery, and fullerenes (bucky balls) are soluble in organic solvents.

12 pts   3. A solution of the hydrogen phosphate ion is basic, whereas the dihydrogen phosphate ion is acidic. Write chemical equilibria for the predominant reactions that account for this difference in behavior. Approximate their pK_a or pK_b whichever is more appropriate.

8 pts   4. Explain either how sulfur is extracted from sulfur deposits (Frasch process) or how sulfur is obtained from coal or petroleum feedstocks (Claus process).

6 pts   5. Suggest an explanation for why fluorine gas is so reactive toward other nonmetals.

6 pts   6. Why is argon (thermal conductivity 0.017 $Js^{-1}m^{-1}K^{-1}$ at 0°C) more commonly used as a thermal insulation layer in glass windows than xenon (thermal conductivity 0.005 $Js^{-1}m^{-1}K^{-1}$ at 0°C)?

15 pts   7. Discuss the importance and relevant equations to three of the following four: Haber, Hall-Heroult, Ostwald, or Contact Processes.

8 pts   8. a) Deduce the formula of the transition metal complex pentammineaquaruthenium(II) chloride
       b) Provide systematic names for the compound $K_4[Fe(CN)_6]$.

9 pts   9. Draw the geometric and optical isomers for the $[Co(en)_2Cl_2]^+$ ion.

18 pts   10. Complete 6 of the following 8 reactions (These do not need to be balanced). State which ones should not be graded otherwise the first 6 will be counted.
       a) calcium carbonate and heat
       b) magnesium and dinitrogen and heat
       c) heating a solution of ammonium nitrate
       d) heating tetraphosphorusdecaoxide with excess carbon
       e) phosphorus pentachloride and excess water
       f) iron(II) sulfide and hydrochloric acid
       g) dihydrogen tetrasulfide and hexasulfur dichloride
       h) iodine monochloride and water.

Bonus: 6pts I_2 is not very soluble in water. Why? There are a number of traditional methods to increase the solubility of a substance in a solvent such as heating it up, crushing it, etc. There is also a way to drastically increase the solubility of iodine via reaction chemistry. Show this reaction.