Chemistry 101 PRACTICE FINAL EXAMINATION Fall 2006

Maximum possible is 200 points. Each question is worth 25 points.

1.1 In this course you have learned about mass spectrometry as a method of determining molecular mass. Describe how a mass spectrometer does this. A sketch will help.

1.2 Elemental chlorine is a mixture of two isotopes, 35-Cl, 75.8% and 37-Cl, 24.2%. How does this lead to the observed atomic mass of chlorine? Be QUANTITATIVE.

1.3 In the mass spectrum of elemental chlorine, Cl_2, at what mass is the most intense peak located? Explain.

2.1 In the jewelry trade gold is described as being of n karats when it contains n parts of gold to (24-n) parts of copper. The copper in a sample of n karat gold reacts with concentrated nitric acid followed by heating to yield copper oxide, CuO, quantitatively. The gold is unaffected. A 0.500 g sample of n karat gold is treated in this way to yield 0.156g of CuO. What is the value of n?

2.2 How many protons and neutrons are present in the nuclei of Cu and Au (gold)?

3. Phthalic acid, H2Phth, molar mass 166.0 g/mol, is a diprotic acid. A 0.283 g sample of phthalic acid is neutralized by 24.3 mL of a solution of sodium hydroxide, NaOH.
3.1 Write the balanced stoichiometric reaction for the reaction. Which are the spectator ions?

3.2 Calculate the molarity of the sodium hydroxide solution.

3.3 The sodium hydroxide solution is now used to neutralize propionic acid, HPr, a monoprotic acid. Write the balanced stoichiometric equation for this reaction.

3.4 100.0 mL of a propionic acid solution is fully neutralized by 27.3 mL of the sodium hydroxide solution. Calculate the molarity of the propionic acid solution.

4.1 What is the mass in g of PbI_2 (very insoluble) that is precipitated when 12.0 mL of 0.0400M lead nitrate, $Pb(NO_3)_2$ solution is mixed with 23.0 mL of 0.0125M sodium iodide, NaI, solution? Write the balanced stoichiometric equation for the reaction.

4.2 The standard molar enthalpy of combustion of ethanol(l) is -1371 kJ/mol. Use the data in Appendix J to calculate the standard enthalpy of formation of liquid ethanol.

5.1 How does Bohr's theory of the hydrogen atom explain the observed line spectrum of the hydrogen atom? (I expect only a qualitative answer).

5.2 Calculate the energy in J and wavelength in nm for the transition from n = 5 to n = 2 in the hydrogen atom.

6.1 Sketch an orbital for an electron in the hydrogen atom that has n = 2 and l = 1. Explain carefully what it is that you are sketching.

6.2 What is the maximum number of electrons in a single atom that can have the following quantum numbers: n = 4, l = 3? Explain your answer.

6.3 Give ground state electron configurations for the following atoms or ions:

(a)Be (b) Ge (c)V5+ (d) Se2-

7. Draw Lewis structures for the following molecules or ions; show ALL bonding and lone pair electrons either as dots : or dashes - Relative positions of nuclei are given.

7.1 OCl-

7.2

H N H

Cl

7.3

F N N F

7.4

H C N

7.5 PO_4^{3-}

O

O P O

O

8. True or false? Circle your choice. No explanations required.

8.1 The number of significant digits in 60. g is two.	T	F
8.2 A millimeter is shorter than a centimeter.	T	F
8.3 One Kelvin is smaller than one degree C.	T	F
8.4 Isotopes of an element have the same atomic mass.	T	F
8.5 The most stable ion of barium is Ba2+	T	F
8.6 RbI is not likely to be a strong electrolyte.	T	F
8.7 Na is below hydrogen in the activity series.	T	F
8.8 Infrared radiation delivers more energy per quantum than ultraviolet radiation	T	F
8.9 The second ionization energy of an atom is always smaller than the first ionization energy	T	F
8.10 The Born-Haber cycle is a means of transportation	T	F