Chemistry 101 Midterm 2 Practice (Goldwhite)

Name _____   SID_____

Name of lab. instructor _____

This exam is closed book/notes. You may have available writing instruments and a calculator.

Check your copy: you should have 5 questions.
Show how you obtain your answers, so that the grader can give appropriate credit.

Maximum possible is 150 points. Each question is worth 30 points.

Information that may be useful:

$NA = 6.022 \times 10^{23}$ / mol;
$D = m/v$
$c = 3.000 \times 10^{8}$ m/s $h = 6.626 \times 10^{-34}$ Js

electron rest mass $= 9.109 \times 10^{-31}$ kg $nm = 10^{-9}m$

$c = \lambda\nu$ $E = h\nu$ λ $h/m\nu$

   fovalues/kJ/mol: $CO(g)$, -110.5; $CO_2(g)$, -393.5; $H_2O(l)$, -285.8; $H_2O(g)$, -241.8

1. Oxalic acid, H2Ox, molar mass 89.0 g/mol, is a diprotic acid. A 0.115 g sample of oxalic acid is neutralized by 124.3 mL of a solution of calcium hydroxide, $Ca(OH)_2$.
Write the balanced stoichiometric reaction for the reaction.
Which are the spectator ions?

1.2 Calculate the molarity of the calcium hydroxide solution.

1.3 The calcium hydroxide solution is now used to neutralize mesitoic acid, H_3mes, a triprotic acid. Write the balanced stoichiometric equation for this reaction.

1.4 10.0 mL of a mesitoic acid solution is fully neutralized by 82.3 mL of the calcium hydroxide solution. Calculate the molarity of the mesitoic acid solution.

2.1 What is the maximum mass in g of PbI_2 (very insoluble) that can be precipitated when 25.0 mL of 0.0500M lead nitrate, $Pb(NO_3)_2$ solution is mixed with 45.0 mL of 0.0145M sodium iodide, NaI, solution?

2.2 Assuming additive volumes what is the resulting concentration of each ion of the non-limiting reagent?

3. You are making a thermodynamic study. A sample of magnesium oxide, MgO, is added to a beaker containing dilute sulfuric acid, H_2SO_4(aq), which becomes warm to the touch.

3.1 Make an unambiguous choice of system and surroundings and justify your choice.

3.2 Identify transfers of energy and materials into and out of YOUR system that you could monitor.

3.3 Is the dissolution of magnesium oxide in sulfuric acid
 endo- or exo-thermic?

3.4 Explain what you would do and what measurements you would make to produce a quantitative result from this experiment.

4.1 What is the photoelectric effect? What was its significance in developing the modern theory of the atom? (Use a simple sketch to aid your answer.)

4.2 In a photoelectric effect experiment photons of energy 7.25×10^{-19}J are absorbed by a metal surface and electrons with a maximum kinetic energy of 2.85×10^{-19} J are ejected. Determine: (a) the threshold binding energy in J of electrons in this metal surface; (b) the wavelength of the photons used in the experiment; (c) the wavelength of the ejected electrons of maximum KE.

5.1 Define the terms oxidation and reduction and give chemical equations that illustrate your definitions.

5.2 The standard molar enthalpy of combusion of methanol, CH3OH, is 715.0kJ/mol. Use the data on the cover p. to calculate the standard enthalpy of formation of this compound.