Practice Problems for Final Exam

Know and understand the vocabulary, concepts and theory of the 5 laboratory experiments

1. (10 pts) The following data were obtained for the standardization of HCl with NaOH:
   (From Experiment #1)
   Initial volume of HCl = 0.03 mL
   Final volume of HCl = 35.18 mL
   Initail volume of NaOH = 0.15 mL
   Final volume of NaOH = 54.12 mL

   Calculate the concentration of HCl if the NaOH concentration is 0.1523 M

2. (? pt.) In the back titration of aspirin, an excess amount of NaOH was reacted with aspirin and the excess was then back titrated with HCl. Suppose a 0.4567 g sample of aspirin was reacted with 43.012 mL of 0.1345 M NaOH and back titrated with 12.15 mL of 0.1124 M HCl to reach the endpoint. (**From experiment #1)**

   Calculate the weight percent of aspirin in the sample.

   Calculate the mg of Aspirin in a tablet if the mass of one tablet is 0.3750 g.

3. (? Pts) The absorbance of four standard Fe^{2+} solutions were measured to obtain a calibration curve that gave the following best fit line **(from Experiment #5)**

$y = 0.14432x + 0.001434$

A vitamin tablet was dissolved and diluted to 250 mL in a volumetric flask. Then 20 mL of that solution was removed and diluted to 100 mL in a volumetric flask. The absorbance of this solution was measured to be 0.853.

Calculate the concentration of Fe (μg/mL) in the 100 mL volumetric flask.

Calculate the **mg Fe^{2+}** per vitamin tablet.

4. (? Pts.) From each pair below, circle the choice that corresponds to higher energy.
λ = wavelength **(From experiment #4)**
υ = frequency

a. $\lambda = 250$ nm or $\lambda = 600$ nm

b. $\upsilon = 10^{16}$ Hz or $\upsilon = 10^{12}$ Hz

c. Infrared Radiation or X- rays

d. Ultraviolet Radiation or Visible light

e. microwaves or gamma rays

5. (? pts.) An EDTA solution was standardized with a known $CaCO_3$ solution. 0.2343 g of $CaCO_3$ was dissolved, transferred to a 250 mL volumetric flask, and filled to the mark. 25.00 mL of this solution was placed in an Erlenmeyer flask using a transfer pipet. 22.35 mL EDTA was required to titrate the $CaCO_3$ solution to its endpoint. (**From experiment #2)**

Calculate the concentration (in ppm) of the EDTA solution.

6. (?pts.) Water hardness is determined by the amount of Ca^{2+} and Mg^{2+} in the water. A known EDTA solution can be used to titrate water and determine its water hardness since EDTA forms complexes with metal cations. Suppose it takes 22.54 mL of a 0.01222 M EDTA solution to reach the endpoint when titrating a 25.00 mL sample of water. Assuming that only Ca^{2+} and Mg^{2+} exist in the water solution, calculate the water hardness level (you know the units). (**From experiment #2)**

7. (? pts.) Balance the following reaction and answer the questions: **(from experiment #3)**

$$Fe^{2+} + MnO_4^- \longrightarrow Mn^{2+} + Fe^{3+}$$

7a. Label the oxidizing agent
7 b. Label the reducing agent.
7c. What was the total number of electrons transferred?

8. If 32.44 mL of a 0.03433 M MnO_4^- solution was used to titrate the Fe^{2+} in a sample that had a mass of 0.8834 g, then what is the mass of Fe^{2+} in the sample? (**From experiment #3)**

8a. What is the % wt. of Fe^{2+} in the sample?

9. (?pts.) An FM station broadcasts classical music at 93.5 MHz (1 MHz = 10^6 Hz). Find the wavelength in meters (m), nanometers (nm) and angstroms (Å) of these radio waves. (**From experiment #4)**

m_____. nm _____. Å_____.

10. (?pts) Ozone absorbs light having wavelengths of 220 nm thus protecting organisms on the Earth's surface from this high-energy UV radiation emitted from the sun. What is the frequency and energy of **one** of these photons? What is the energy of **a mole** (kJ/mol) of these photons? (**From experiment #4)**

11. (?pts) The ground state electron configuration of Li is $1s^2 2s^1$. The energy required to excite the valence electron in Li to the configuration of $1s^2 2s^0 2p^1$ is 178.5 KJ/mole. When the molecule relaxes it will emit photons of the same energy. Calculate the wavelength (in nm), and frequency (in Hz) of the emitted photons? (**From experiment #4)**

11 (?pts.) Balance the following redox reactions: (**From experiment #3)**

$$Al + H_2SO_4 \longrightarrow Al_2(SO_4)_3 + H_2$$

$$Cu + HNO_3 \longrightarrow Cu(NO_3)_2 + NO_2$$

$$Cr_2O_7^{2-} + C_2O_4^{2-} \longrightarrow Cr^{3+} + CO_2$$

12. (?pts.) What value of absorbance corresponds to 45.0% T? (**From experiment #5)**

If a 0.100 M solution exhibits 45.0% T at some wavelength, what will be the % T for a 0.200 M solution of the same substance at the same wavelength?

13. What is the molarity of a solution of H_2SO_4 if its concentration is 85% (w/w) and its specific gravity is 1.48 kg/L? (**From experiment #1)**

14. **)** Correctly spell the name of the teaching assistant for your Chemistry 208 lab section