Time: 85 minutes

Chemistry 101
Lab. Final

June 20, 1999
H. Deeb

Family Name: _____

First Name: _____

Student No: _____

Section: _____

Name of Instructor: _____

Grading :

I ...../60

II...../16

III...../13

IV...../21

Total: /110

GOOD LUCK

1)(60 pts) **Circle the letter that precedes the correct answer in each of the following. (There is only one correct answer. No double penalty).**

- **Which of the following statements is wrong?**

a- A luminous flame is yellow.
b- A non-luminous flame indicates complete combustion.
c- If yellow flame is obtained while lighting on the bunsen burner, close the holes at the base of the burner slightly.
d- Incomplete combustion is usually accompanied by production of pollutants.

- **Which of the following statements is wrong?**

a- The electronic balance is more precise than the Mettler balance.
b- The Mettler balance is the most precise balance used.
c- Weighing using the electronic balance is faster than weighing using the Mettler balance.
d- Heavy weights (above 150g) cannot be weighed on the Mettler balance.

- **To deliver exactly 12.00 ml of a certain solution, use:**

a- A 100 ml graduated cylinder ✓
b- A 25 ml pipet ✓
c- A 50 ml buret ✗
d- A 100 ml volumetric flask ✗

- **Express the answer to the following operation, using correct number of significant figures:**

$$\frac{5.6792 + 0.6 + 4.33}{2.436 \times 10^{-3}}$$

a- 4.355×10^{3}
b- 4×10^{3}
c- 4.35×10^{3}
d- 4.36×10^{3}

- **Express the answer to the following in scientific notation:**

$$\frac{0.0095 + (8.5 \times 10^{-3})}{0.00027}$$

a- 6.7×10^{1}
b- 67
c- 6.66×10^{1}
d- 0.667×10^{2}

• How much $Na_2C_2O_4$ (grams) is needed to prepare 500.0 ml of 0.6289 M solution.

a- 168.6 g
b- 0.3145 g
c- 42.15 g
d- none of the above

• An experimental measurement gave 95.264 ml answer compared with the accepted value 98.012 ml.

a- 2.804
b- 2.885
c- 1.0288
d- 0.97196

• The absolute uncertainty of measurements done in transferring 80 ml of solution using a 50 ml buret that was filled twice is:

a- ±0.04 ml
b- ±0.02 ml
c- ±0.08 ml
d- ±0.2 ml

• Consider the following measurement of the same length.
Which is the most precise?

a- 34.0 cm
b- 34.00 cm
c- 34 cm
d- the precision cannot be predicted.

• If 2 drops of phenol phthalein is added to each of the following flasks. which solution will change to pink?

a- Flask 1: contains 10.0 ml of 0.1 MHCl and 10.0 ml of 0.1 M NaOH.
b- Flask 2: contains 15.0 ml of 0.1 MHCl and 10.0 ml of 1 M NaOH.
c- Flask 3: contains 25.0 ml of 0.6 M KHP and 40.0 ml of 0.5 M KOH.
d- Flask 4: contains 50.0 ml of 0.1 M oxalic acid.

• Which of the following is the only correct safety rule?

a- Some chemicals can be tasted to identify their nature.
b- Open sandals can be worn in the laboratory.
c- Never pour water into concentrated acid.
d- Wipe any spilled chemical after you finish the experiment.

- **Which of the following completely soluble salts has the highest molar concentration of NH_4^+.**

a- 0.1 M $(NH_4)_2 CO_3$
b- 0.1 M NH_4Cl
c- 0.2 M NH_4Br
d- 0.09 M $(NH_4)_3 PO_3$

- **When 10.0 ml of 0.50 M Na_2CO_3 reacts with 10.0 ml of 1.0 M $CaCl_2$, the nb. of moles of $CaCO_3$ produced is:**

a- 5.0×10^{-3} moles
b- 5.0 moles
c- 1.5×10^{-3} moles
d- 1.0×10^{-3} moles

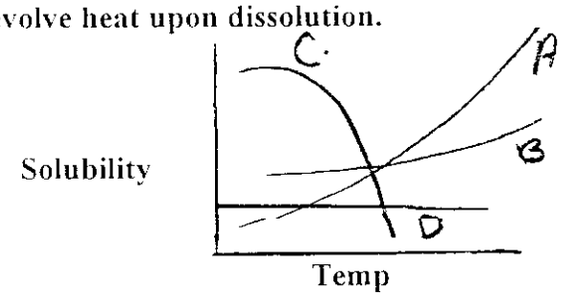
- **What is the normality (N) of a 1 M solution of H_2SO_4 that reacts with KOH in a reaction that displaces the two protons.**

$= 2$ equivalent =

$N = \frac{\text{equivalent weight}}{2}$

a- 2 N
b- 4 N
c- 1 N
d- 0.5 N

- **Given the following solubility graph for some compounds in water. Which compound will evolve heat upon dissolution.**



a- A
b- B
c- C
d- D

- **The solubility of sodium chloride is 35.7 g/100 ml of H_2O at 0°C. Assume 200 ml of H_2O at 0°C are placed in a beaker and sodium chloride sample is added. Which of the following solutions represent a saturated solution at 0°C.**

a- If 45.8 g of NaCl is added.
b- 1.22 mole of NaCl is added.
c- 0.61 mole of NaCl is added.
d- 35.8 g of NaCl is added.

II)16 points) Explain briefly each of the following.

a- During titration of an unknown monoprotic acid against NaOH, the end point is mistakenly surpassed by adding more NaOH. How this will affect the molar concentration of the unknown acid? Explain.

b- During titration of an unknown monoprotic acid against NaOH, an air bubble is originally trapped in the buret, but disappears during titration. How this will affect the molar concentration of the unknown acid?

c- Explain the effect of adding $H^{\oplus}$ to the following equilibrium reaction.

$$Cu(H_2O)_4^{-2}{}_{(aq)} + 4NH_{3(aq)} \rightleftharpoons Cu(NH_3)_4^{+2}{}_{(aq)} + 4H_2O_{(l)}$$

d- Explain the effect of increasing the temperature on the following equilibrium reaction :

$$2NO_2\,(g) \rightleftharpoons N_2O_4\,(g) + 58\ KJ$$

- **38.4 ml of 0.150 M NaOH solution is required to titrate 25.2 ml of oxalic acid solution. The molarity of oxalic acid solution is:**

a- 0.229 M
b- 0.114 M
c- 5.76×10^{-3} M
d- 0.457 M

- **When ammonium nitrite (NH_4NO_2) is heated it decomposes to give nitrogen gas.**

$$NH_4NO_2\ (s) \rightarrow N_2\ (g) + 2H_2O\ (l)$$

This property is used to inflate tennis balls.
Calculate the quantity in grams of NH_4NO_2 needed to inflate a tennis ball to a volume of 86.2 ml at 1.20 atm. and 22°C.

a- 0.247 g
b- 4.27 g
c- 0.274 g
d- none of the above.

- **The dissolution process of NH_4NO_3 is endothermic; therfore:**

a- The hydration energy of NH_4NO_3 is greater than its lattice energy.
b- The hydration energy of NH_4NO_3 is smaller than its lattice energy.
c- The dissolution process of NH_4NO_3 does not depend on temperature.
d- We can not prepare a saturated solution of NH_4NO_3.

- **Which of the following forms a white precipitate when treated with ammonium carbonate?**

a- $LiNO_3$
b- $Al(NO_3)_3$
c- $NaNO_3$
d- $Fe(NO_3)_2$

III)(13 points) Jacques Charle's (1746-1823) was one of those adventurous Frenchmen who constructed and ascended in balloons. In August 1783, Charle's decided to employ hydrogen instead of hot air. He used 2000 g of Fe in excess acid to produce the gas via:

$$2Fe\,(s) + 6H^{+}\,(aq) \rightarrow 2Fe^{+3}\,(aq) + 3H_2\,(g)$$

a- Assuming 1.00 atm pressure and 30.0°C (warm Summer afternoon), how big (what volume in L) was his balloon? Show your calculation.

b- The above reaction is a redox reaction.

1. What is the reducing agent?

2. Calculate the equivalent weight of the reducing agent.

3. To how many equivalents does the volume of H_2 produced in part (a) corresponds?

c- We have generated $H_2(g)$ in Chem. 101 using a different metal. What was the metal used? Write complete balanced equation.

IV) (21 points)

1- Complete and balance each of the following chemical equation by writing the missing reactant(s) and/or product(s).

a- $2pb(NO_3)_{2(s)} \xrightarrow{\text{heat}}$

b- $\quad + OH^-_{(aq)} \rightleftharpoons CrO_4^{=}{}_{(aq)} +$

c- $CO(H_2O)_6^{+2}{}_{(aq)} + 2Cl^-_{(aq)} \xrightarrow{\text{heat}}$

d- $Al^{+3}_{(aq)} + S^{=}_{(aq)} + H_2O_{(l)} \rightarrow$

e- $\quad \rightarrow 2FeS_{(s)} + S_{(s)}$

f- $Fe^{+3}_{(aq)} - CO_3^{=}{}_{(aq)} + H_2O_{(l)} \rightarrow$

2- How can you differentiate between each of the following ion pairs by visual chemical means? Mention the reagent used and observations.

a- $Al^{+3}_{(aq)}$ and $Cu^{+2}_{(aq)}$

b- $pb^{+2}_{(aq)}$ and $Fe^{+2}_{(aq)}$

c- $Ag^{+}_{(aq)}$ and $NH_4^{+}{}_{(aq)}$