Palestine Technical University- Kadoorie

Course's Name: General Chemistry lab (2)
Course's Number: 10550106
Exam's Period: 60 min (11:00 – 12:00)
Questions' Number: 5
Total Mark: : 30
Pages' Number: 4

Instructor's Name: .....
Student's Name:.....
Student's Number:.....
Section's Number:.....
Exam's Date: 12/9/2013

Final Exam
Summer Semester 2013/2012

(Molar masses: Cl_2 = 70.90 g/mol, $CaCO_3$ = 100.1 g/mol)

(Q1) 6 Points

A 10.0-mL volume of Ultra Bleach is diluted to 100 mL in a volumetric ask. A 25.0-mL sample of this solution is analyzed according to the procedure in the bleach analysis experiment. Given that 30.75 mL of 0.135 *M* $Na_2S_2O_3$ are needed to reach the stoichiometric point, answer the following questions.

a- How many grams of available Cl_2 are in the titrated sample?

b- How many grams of Ultra Bleach are analyzed? Assume that the density of bleach is 1.084 g/mL.

c- Calculate the percent available chlorine in the Ultra Bleach.

(Q2) 6 Points

(Q3) A- Define the alkalinity of water?

C- A chemist titrates a 50.0-mL water sample to the methyl orange endpoint with 24 mL of a 0.0120 *M* HCl standard solution, What is the "T" alkalinity of the solution expressed in ppm $CaCO_3$? (Assume density =1.00 g/mL)

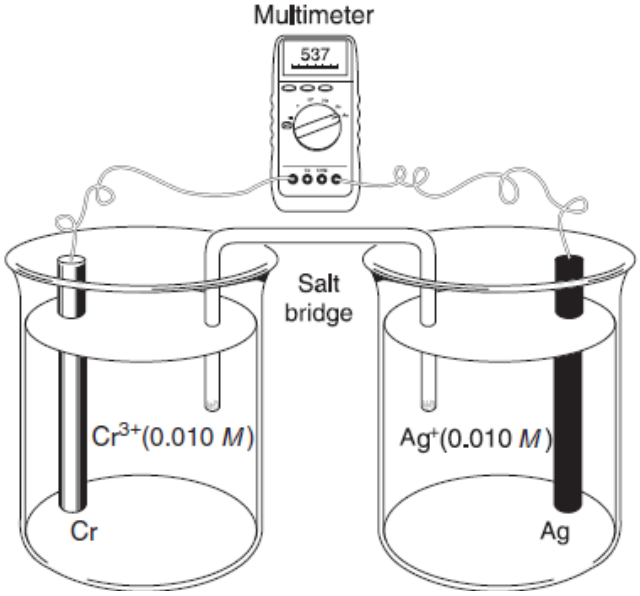
D- If 12 ml of a 0.0120 *M* HCl standard solution was needed to titrate the above sample to the Phenolphthalein endpoint what type of ions contributing to alkalinity water does the above sample have?

(Q3) **7 Points**

Consider a galvanic cell consisting of the following tow redox couples:

Ag^{+} (0.010 M) + $e^{-} \rightarrow Ag_{(s)}$ E_o= +0.80 V

Cr^{3+} (0.010 M) + $3e^{-} \rightarrow Cr_{(s)}$ E_o= -0.74



a- Write the equation for the half-reaction occurring at the cathode?

b- Write the equation for the half-reaction occurring at the anode?

c- Write the equation for the cell reaction?

d- What is the standard cell potential E^{o}_{cell} for the cell?

e- Realizing the nonstandard concentration, what is the actual cell potential E_{cell} for the cell?

Hint: Use the Nernst equation (what is the value of n)

Nernst equation: $E_{cell} = E^{\circ}_{cell} - \frac{0.0592}{n} \log Q$

(Q4) 6 Points

A saturated solution of magnesium hydroxide (commonly called *milk of magnesium*) is prepared and the excess solid magnesium hydroxide is allowed to settle. A 25.0-mL aliquot of the saturated solution is withdrawn and transferred to an Erlenmeyer ask, and two drops of methyl orange indicator are added. A 0.00053 *M* HCl solution (titrant) is dispensed from a buret into the solution (analyte). The solution turns from yellow to a very faint red-orange after the addition of 13.2 mL.

a. How many moles of hydroxide ion are neutralized in the analysis?

b. What is the molar concentration of the hydroxide ion in the saturated solution?

c. What is the molar solubility of magnesium hydroxide?

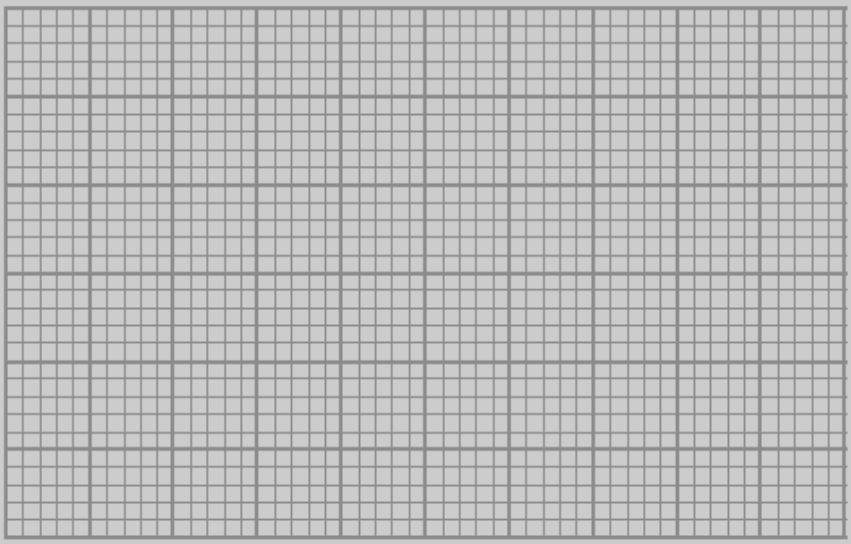
d. What is the solubility product, *K*sp, for magnesium hydroxide?

e. Does the molar solubility of magnesium hydroxide increase, decrease, or remain unchanged with the addition magnesium chloride to the solution? Explain.

(Q5) **5 Points**

Data in the following table were obtained for the titration of a 0.297-g sample of a solid, monoprotic weak acid with a 0.150 *M* KOH solution. Plot (at right) pH (ordinate) versus V_{KOH} (abscissa).

V_{KOH} added (mL)	pH
0.00	1.96
2.00	2.22
4.00	2.46
7.00	2.77
10.00	3.06
12.00	3.29
14.00	3.60
16.00	4.26
17.00	11.08
18.00	11.67
20.00	12.05
25.00	12.40



a. What volume of the KOH solution is required to reach the stoichiometric point?

b. What is the pH at the stoichiometric point?

c. What is the pK_a of the weak acid?

d. Calculate the number of moles of weak acid analyzed.

e. What is the molar mass of the solid weak acid, expressed to the correct number of signi cant gures?