

Chemistry 0094 R10  
Fall 2000  
Test #3

Wednesday, November 22, 2000

Time: 2 hours

Name: \_\_\_\_\_

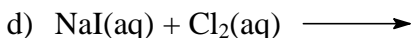
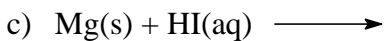
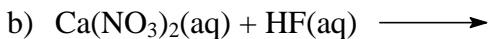
Student Number: \_\_\_\_\_

*This exam consists of **five** pages of questions and a periodic table. Please ensure that you have a complete paper and, if you do not, obtain one from me **immediately**. Good luck!*

*Avogadro's number, should you need it, is  $6.0221367 \times 10^{23} \text{ mol}^{-1}$ .*

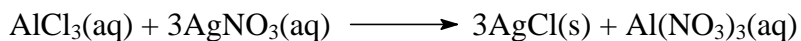
*Note: **all** work must be shown for a question in order to receive **any** credit for that question.*

- 1) **[8 marks]** Complete and balance the following reactions. Provide the molecular, full ionic, and net ionic equations in each case. Indicate the phases of all products and reactants, and assume that a reaction occurs in each case.



- 2) **[2 marks]** Calculate the mass of a single atom of  $^{12}_6\text{C}$  in grams.
- 3) **[2 marks]** How many phosphorus atoms are there in 0.3 moles of  $\text{Ca}_3(\text{PO}_4)_2$ ?
- 4) **[6 marks total]** Estrone is a component of estrogen (a female hormone). Estrone is 79.963% carbon, 8.202% hydrogen, and the rest oxygen:
- a) **[3 marks]** What is the empirical formula of Estrone?
- b) **[3 marks]** Estrone has a molar mass of 270.371 grams. What is the molecular formula of Estrone?

- 5) **[4 marks]** In one experiment, 5.0000 grams of an impure sample of  $\text{AlCl}_3$  was dissolved in water and reacted with excess  $\text{AgNO}_3$ :



The solid collected had a mass of 4.0000 grams. What was the percent by mass of  $\text{AlCl}_3$  in the original sample?  $\text{AgCl}$  has a molar mass of 143.3209 grams, and  $\text{AlCl}_3$  has a molar mass of 133.3396 grams.

- 6) **[4 marks]** A 50.00 mL sample of solution **A**, which had  $[\text{NaCl}] = 2.000 \text{ M}$ , was taken and diluted to a certain volume to form solution **B**. 25.00 mL of solution **B** was taken and diluted to form 250.0 mL of solution **C**, which had  $[\text{NaCl}] = 0.05000 \text{ M}$ . How many mL of solution **B** were made?

7) **[9 marks total]** Methyl salicylate is a compound used in “oil of wintergreen” flavouring. It is known to contain carbon, hydrogen, and oxygen:

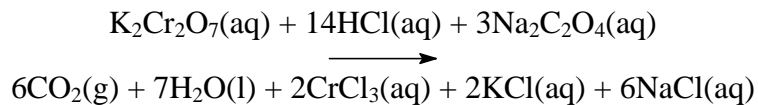
a) **[5 marks]** In one experiment, a 1.1105-gram sample of methyl salicylate was burned and 2.5697 grams of  $\text{CO}_2$  and 0.5260 grams  $\text{H}_2\text{O}$  collected. What is the empirical formula of methyl salicylate? The molar masses of  $\text{CO}_2$  and  $\text{H}_2\text{O}$  are 44.010 grams and 18.0153 grams respectively.

b) **[4 marks]** In another experiment, 1.7683 grams of methyl salicylate were reacted with 20.96 mL of 1.109 M KOH:

methyl salicylate + 2KOH  $\longrightarrow$  products

What is the molecular formula of methyl salicylate?

- 8) **[6 marks total]** It took 23.12 mL of 0.1184 M  $\text{K}_2\text{Cr}_2\text{O}_7$  to standardize a 15.00 mL sample of  $\text{Na}_2\text{C}_2\text{O}_4$ :



- a) **[3 marks]** What was the concentration of the  $\text{Na}_2\text{C}_2\text{O}_4$  in the 15.00 mL sample?
- b) **[3 marks]** What was the concentration of KCl after the reaction?
- 9) **[4 marks]** Pure NaCl has a molar mass of 58.4425 grams. A certain NaCl solution had a density of 1.016 g/mL and was 3.00 percent NaCl by mass. What (in moles/L) is the concentration of NaCl in this solution?