Kwantlen Polytechnice University
CHEQ 1094 Sample Final Exam 2 **Time allowed: 3 hours**

(Solubility table, activity series of metals, and all relevant constants would be given)

1. The following are properties of the element zirconium; classify them as physical or chemical properties. **[3]**

a) reacts with hot HCl(g) _____

b) melting point = 1852^{o}C _____

c) reacts with silicon at high temperature _____

2. Classify the following changes as physical or chemical. **[3]**

a) tearing up a piece of paper _____

b) burning sugar _____

c) dissolving sugar in water _____

3. How many significant figures? **[4]**

a) 0.004196 _____ **c)** 4068 _____

b) 2.00 x 10^{-3} _____ **d)** 90.09 _____

4. Express the following in scientific notation to have three significant figures. **[2]**

a) 8,720,000

b) 0.006285

5. **a)** The lowest recorded temperature in the world was recorded as -89.2^{o}C at the Soviet Antarctic Station on July 23, 1983. What is this temperature in ^{o}F? **[2]**

b) The highest recorded temperature in the world was recorded as 136.4^{o}F at Azizia, Libya, in the Sahara desert on September 13, 1922. What is this temperature in ^{o}C? **[2]**

6. Perform the following conversions.

a) 25.9 km to mm **[2]**

b) 13.6 g/mL to kg/m^3 **[2]**

c) 3655 square feet to square meters (12.0 inches = 1ft, 1 inch = 2.54 cm) **[3]**

7. How many grams of gold will have the same volume as 100.0 g of copper? Densities (g/cm^3) of copper and gold are 8.96 and19.32, respectively. **[2]**

8. Much of iron is obtained from the mineral magnetite, which has a density of 5.2 g/cm^3 and contains 72.4 % iron by mass. How many cubic meters of magnetite are needed to supply 1000 kg of iron? **[3]**

9. **a)** It takes 1368 J to raise the temperature of 45.6 g of lead by 13.3°C. What is the specific heat of lead? **[2]**

b) How much energy is needed to raise the temperature of 850 g block of aluminum from 22.8°C to 94.6°C? Specific heat of aluminum is 0.900 J/g °C. **[2]**

10. **a)** An ion contains 50 protons, 68 neutrons, and 48 electrons. Give its isotopic or nuclide symbol. **[1.5]**

b) How many protons , neutrons, and electrons are in $^{59}Co^{3+}$? **[1.5]**

c) Identify each of the following elements: **[6]**

i) A noble gas with 54 protons _____

ii) A member of the oxygen family. The anion with 2- charge contains 36 electrons. _____

iii) A member of the alkaline earth family. The 2+ ion has 18 electrons. _____

iv) How many elements are there in period # 4? _____

v) Write the formula of a diatomic elementary substance that is a liquid at 25°C. _____

vi) Give the symbol of the most active alkali metal. _____

11. Calculate the atomic mass to four significant digits for antimony, given the following: **[3]**

Isotope	**Atomic Mass(amu)**	**% Abundance**
Sb-121	120.9038	57.25
Sb-123	122.9041	42.75

12. Write the formula for each of the following: **[6]**

a) Copper(I) carbonate _____

b) Iron(II) nitrite _____

c) Diphosphorous pentoxide _____

d) Hydrosulfuric acid _____

e) Cobalt (II) chloride hexahydrate _____

f) Ammonium sulfate _____

13. Write the correct name for each of the following: **[6]**

a) $AgNO_3$ _____

b) H_2SO_4 _____

c) $Mg(OH)_2$ _____

d) SnO_2 _____

e) Hg_2Cl_2 _____

f) NH_3 _____

14. Balance the following equations: **[4]**

a) $P_4 + Cl_2 \rightarrow PCl_5$

b) $NH_4NO_3 \rightarrow N_2O + H_2O$

c) $C_3H_5N_3O_9 \rightarrow N_2 + CO_2 + H_2O + O_2$

d) $HNCO + NO \rightarrow N_2 + H_2O + CO_2$

15. Complete and balance the following reactions. Give the proper states of substances. In each case there is a reaction. **[12]**

a) $Pb(NO_3)_2(aq) + HCl(aq) \rightarrow$

b) $Al(OH)_3(s) + HNO_3(aq) \rightarrow$

c) $Ca(s) + H_2O(l) \rightarrow$

d) $CaCO_3(s) \xrightarrow{\Delta}$

e) $Ca(OH)_2(aq) + H_3PO_4(aq) \rightarrow$

f) $C_7H_6O_3(s) + O_2(g) \xrightarrow{\Delta}$ (combustion)

16. Aspartame is an artificial sweetner which is 160 times sweeter thans sucrose (table sugar) when dissolved in water. It is marketed as Nutra-Sweet. The molecular formula of aspartame is $C_{14}H_{18}N_2O_5$.

a) Calculate the molar mass of aspartame. **[2]** _____

b) How many moles of molecules are in 10.0 g of aspartame? **[2]**

c) How many molecules are in 5.00 g of aspartame? **[1]**

d) How many atoms of nitrogen are in 10.0 g of aspartame? **[2]**

e) What is the mass of one molecule of aspartame? **[2]**

17. Monosodium glutamate (MSG), a food-flavor enhancer, has been blamed for "Chinese restaurant syndrome," the symptoms of which are headaches and chest pains. MSG has the following composition by mass: 35.51 % C, 4.77 % H, 37.85 % O, 8.29 % N, and 13.60 % Na.

a) Calculate the simplest (empirical) formula of MSG. **[5]**

b) What is its molecular formula if its molar mass is 169? **[2]**

18. The fertilizer ammonium sulfate is prepared by the following reaction.

$$2\ NH_3(g) + H_2SO_4(aq) \rightarrow (NH_4)_2SO_4(aq)$$

The yield of the reaction is 87.0 %. How many grams of NH_3 are needed to produce 445 grams of ammonium sulfate? **[3]**

19. Consider the reaction

$$MnO_2 + 4\ HCl \rightarrow MnCl_2 + Cl_2 + 2\ H_2O$$

If 0.86 mole of MnO_2 and 48.2 g of HCl react,

a) Which is the limiting reagent? **[4]**

b) How many grams of chlorine will be produced? **[2]**

c) How many grams of which reactant are left unused? **[3]**

20. Calculate the mass of NaOH required to prepare a 500.0 mL solution of concentration 2.80 M. **[2]**

21. How many moles of Cl^- are present in 60.0 mL of 0.100 M $MgCl_2$ solution? **[2]**

22. Calculate the volume in mL of a solution required to provide 0.85 g of acetic acid, CH_3COOH, from a 0.30 M solution of the acid. **[2]**

23. A 46.2 mL of 0.568 M KOH solution is mixed with an 80.5 mL of 1.396 M KOH solution. The resulting solution is mixed with 228 mL of water. Calculate the molarity of KOH in the final solution. **[3]**

24. An aqueous solution containing 12.0% NaOH by mass has a density of 1.131 g/mL. Calculate the molarity of NaOH in the solution. **[3]**

25. How many mL of a 0.610 M NaOH solution are needed to completely neutralize 20.0 mL of a 0.245 M H_2SO_4? **[3]**

$2\ NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2\ H_2O(l)$

26. Write the net-ionic equations for the following reactions. **[4]**

a) $2\ HCl(aq) + Ba(OH)_2(aq) \rightarrow BaCl_2(aq) + 2\ H_2O(l)$

b) $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$

27. How much heat is given off when 1.00 kg of CH_3OH is burned according to the reaction? **[2]**

$CH_3OH(l) + 3/2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(l) + 728\ kJ$