CHEMISTRY
Summer School Semester 2 Exam Study Guide

Bring the following items to the exam: absolutely NO sharing allowed

- sharpened pencils and eraser
- calculator (check your batteries)

Study Card (3" by 5" index card):

- name in upper right corner on front side
- you may write anything you want on one side with the exception of worked examples.
- this card will be turned in at the end of the exam
- any card not meeting the above requirement cannot be used in the exam.

Format of the exam:

- 40 points of multiple choice
- 60 points of free response
- Exam counts 15% of the semester grade

Multiple Choice Topics:

- Calculate and correctly express the molar mass of a compound given the formula (C7)
- Perform "mole highway calculations" (C7)
- Determine the density of a gas at STP (C7)
- Identify a formula as empirical or molecular (C7)
- Calculate an empirical formula from percent composition data (C7)
- Calculate the molar mass of a substance given its empirical formula and molar mass (C7)
- Determine the percent composition of a compound given its formula (C7)
- Identify the seven diatomic elements (C7)
- Interpret balanced equations in terms of representative particles, moles and masses (C9)
- Perform stoichiometric calculations (i.e. mole-mole, mass-mass, mass-volume) (C9)
- Perform calculations to identify the limiting and excess reagents of a reaction (C9)
- Calculate the percent yield of a reaction (C9)
- Compare and constrast endothermic and exothermic reactions (C11)
- Explain the pattern of a heating curve (C11)
- Distinguish between heat, energy, enthalpy (C11)
- Use the gas laws to describe pressure, temperature, moles and volume affects on each other (C12)
- Perform calculations using the gas laws (C12)
- Identify and define the state changes of condensation, evaporation, freezing, melting (C10)
- Use the VSEPR model to determine and compare molecular geometry (C16)
- Classify bonds as nonpolar covalent, polar covalent, or ionic (C16)
- Identify characteristics of water molecules and use them to explain water's unique properties (C17)
- Given formulas, identify substances that are electrolytes vs. nonelectrolytes in aqueous solution (C18)
- Distinguish between unsaturated, saturated and supersaturated solutions (C18)
- Given formulas, determine the i value, i.e. number of particles, a substance produces when dissolved in solution (C18)
- Compare and contrast the properties of acids and bases including simple calculations (C20)
- Identify the names of common lab acids and bases (C20)
- Perform simple calculation of acid-base stiochiometry (C21)

Free Response Review Problems: (Answers on next page)

1. How many moles AND atoms is 21.3 g sample of chromium? (C7)

2. a) How many oxygen atoms are in 2.50 mol $Cr(NO_3)_3$? (C7)

   b) What is the percent by mass of chromium in $Cr(NO_3)_3$? (C7)

3. Use the following balanced equation for the combustion of butane gas to answer the following questions:

   $2C_4H_{10}\ (g) + 13O_2\ (g) \rightarrow\ 8CO_2\ (g) + 10H_2O\ (g) + 5718\ kJ$

   a) If 25.0 g of butane reacts, what mass AND volume at STP of carbon dioxide gas is produced? (C9)

   b) If 25.0 g of butane reacts, calculate ΔH in kJ (C11)

   c) Is this reaction endothermic or exothermic? (C11)

4. Determine the specific heat of iron when it releases 753 J of heat to the water in a coffee cup calorimeter. The initial temperature of the 22.7 g sample of iron was 92.0°C and the final temperature of the water in the calorimeter was measured to be 24.0°C. (C11)

5. How much energy would be released to condense a 35.5 g sample of steam at 115°C to liquid water at 60.0°C? (C11)

6. At what temperature in °C will a mixture of 8.00 g of oxygen gas and 2.00 g of helium gas exert a pressure of 6.00 atm in a 1.85-L cylinder tank? (C12)

7. Write the Lewis structure, identify the geometry, central atom hybridization, and polarity/nonpolarity of the following species:

   a) NH_3 b) H_2CO c) H_2O

   d) C_2H_6 e) CO_2 f) C_2H_2

8. What mass in grams of $KClO_3$ must be dissolved in 275 mL of water to make a 0.500 M solution? (C18)

9. Determine the freezing point of a solution that is made by adding 2.50 g of $KClO_3$ to 50.0 g of water. (C18)

10. a) What is the molarity of an aqueous solution of 4.50 g of NaOH in 500. mL total volume? (C18)

    b) What is pH and pOH of the solution? (C20)

11. a) What is the pH and pOH of a 2.50×10^{-3} M solution of HCl? (C20.2)

    b) What is the pH and pOH of a 1.50×10^{-3} M solution of NaOH?

12. A 15.0 mL sample of 0.250*M* $HNO_3(aq)$ is titrated to the end point with a 25.0 mL sample of KOH(aq).

    a) Write a balanced equation to represent the neutralization reaction

    b) Calculate the concentration of the KOH(aq). (C21.1)

Answers to Semester 2 Practice Final Exam

1. 0.409 mol; 2.46×10^{23} atoms

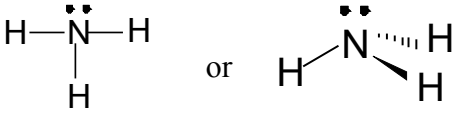
2a. 1.35×10^{25} oxygen atoms b. 21.9 % chromium

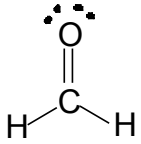
3a. 75.7 g and 38.5 L at STP b. -1.23×10^{3} kJ c. exothermic

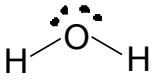
4. 0.488 J/(g • °C)

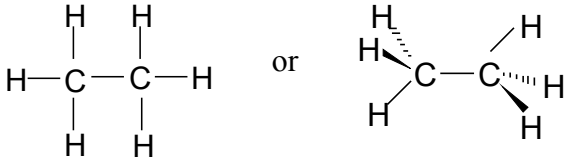
5. 87.4 kJ

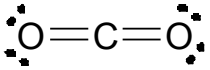
6. –92.9°C

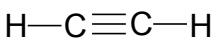
7. a.  trigonal pyramid (polar)

b.  trigonal planar (polar)

c.  V-shape (polar)

d.  tetrahedral – around C (non-polar)

e.  linear (non-polar)

f.  linear (non-polar)

8. 16.9 g

9. –1.52°C

10a. 0.225 mol/L b. pH = 13.352; pOH = 0.648

11a. pH = 2.60; pOH = 11.40 b. pH = 11.18; pOH = 2.82

12a. $HNO_{3\,(aq)} + KOH_{\,(aq)} \rightarrow H_2O_{\,(l)} + KNO_{3\,(aq)}$ b. 0.15 mol/L