CHEMISTRY
Summer School Semester 1 Exam
Study Guide

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

- sharpened pencils and eraser
- calculator (check your batteries)
- index card cheat sheet (see below)

Index Card Cheat Sheet:

- you may bring in an index card (3 inch by 5 inch)
- you may write anything you want on ONE side
- this card will be turn in at the end of the exam for two extra credit points on your exam

Format of the exam:

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

Chapter/Topics covered on the exam:

- explain in order (i.e. observation, hypothesis, experiment) the steps of the scientific method (1.3)
- identify examples of physical vs. chemical properties/changes (2.1)
- distinguish between states (i.e. solid, liquid & gas) of matter in terms of volume and shape (2.1)
- classify examples of matter as pure substances (i.e. element or compound) or mixtures (i.e. homogeneous or heterogeneous) (2.3, Fig. 2.8 p. 38)
- explain the law of conservation of mass and how it applies to balanced chemical equations (2.4)
- identify if an observation is qualitative or quantitative (3.1)
- use scientific notation to express numbers and in calculations (3.1)
- distinguish between accuracy and precision of a measurement (3.2)
- determine the number of significant figures in a measurement (3.2)
- round for correct number of significant figures after addition/subtraction and multiplication/division (3.2)
- perform conversions between common units of measurement in chemistry (3.3)
- calculate density using correct significant figures and units given experimental data (3.4)
- identify major historical contributions to atomic structure (i.e. Dalton, Thomson, Rutherford, Bohr, Chadwick) (5.1)
- distinguish among protons, electron and neutrons in terms of relative mass, charge, location in atom and what they "determine" in an atom (5.2)
- identify atomic number and mass number of an isotope; use them to calculate the number of protons, neutrons and electrons in an atom (5.3)
- explain how isotopes of an element are similar and different (5.3)
- calculate the average atomic mass of an element given isotope percentage information (5.3)
- explain the arrangement of the modern periodic table (i.e. increasing atom number, periods/series, groups/families) (5.4)
- identify the groups/families (i.e. alkali metal, alkaline earth metals, halogens, noble gases) and other areas (i.e. representative vs. transition elements) (5.4)
- classify an element as a metal, metalloid or nonmetal (5.4)
- compare and contrast the three types of nuclear radiation in terms of particle released, penetrating power, etc.(28.1)
- write balanced nuclear equations to represent alpha and beta decay (28.1-28.2)

- explain using the "band of stability" idea why some nuclei are stable and some are radioactive (28.2)
- calculate and explain half-life (28.2)
- identify on the periodic table the elements that are only radioactive (i.e. $Z > 82$) (28.2)
- distinguish between the s, p, d, and f orbitals (i.e. number of each orbital, total number of electrons in each orbital) (13.1)
- write electron configuration for atoms and ions, including important exceptions in the transition metals (13.2, 15.1)
- use electron configurations to classify elements in their families/regions on the periodic table (i.e. alkali metals are s^1, alkaline earth metals are s^2, halogens are s^2p^5, noble gases are s^2p^6) (14.1)
- given a pair or several elements, use periodic trend information to identify decreasing/increasing atomic radii, ionic radii, first ionization energy, electronegativity (14.2)
- compare and contrast the characteristics of ionic and molecular compounds (6.1)
- name and write the formulas for the seven diatomic elements (6.2)
- use a chemical formula to identify the number of atoms of an element in a representative particle of a compound (i.e. $Ca(NO_3)_2$ has six oxygen atoms) (2.3, 6.2)
- use rules of nomenclature to name and write formulas for ionic and molecular compounds (6.3-6.6)
- use the periodic table to determine the charges of monatomic ions (6.3)
- write electron dot structures for atoms and ions of the representative elements (15.1-15.2)
- use electron dot structures to justify the formula for an ionic compound (15.2)
- write balanced chemical equations including state symbols to represent chemical reactions (8.1)
- classify a chemical reaction as combination, decomposition, combustion, single replacement, or double replacement (8.2)
- predict products of a chemical reaction based on reaction type (8.2-8.3)
- for a precipitation reaction, write both a full balanced equation and a net ionic equation including state symbols; identify the spectator ions (8.3)

Review Problems:

- **One of the best methods of exam review is going over your chapter tests**
- **The questions on the free response of the exam will be the same format as on chapter tests; see review problems on next sheet**

CHEMISTRY
Semester 1 Exam Review Problems

1. Calculate the density of a substance with a mass of 4.65 g and a volume of 1.9 cm^3. (Show formula used, set-up work, units and report your answer to the correct number of significant figures.)

2. There are four naturally occurring isotopes of the element chromium. The percent abundance for each is:

Cr-50 = 49.946 amu, 4.345% Cr-52 = 51.941, 83.789%

Cr-53 = 52.941 amu, 9.501% Cr-54 = 53.939 amu, 2.365%

Calculate the average atomic mass of chromium. (Show all work, units and report your answer to the correct number of significant figures.)

3. Write a balanced nuclear equation for each of the following processes.

a. potassium-42 undergoes beta decay

b. uranium-238 undergoes alpha decay

c. electron capture by manganese-50

4. A scientist has a 400 g sample of the radioisotope, phosphorus-32. The half-life of phosphorus-32 is 14.3 days. What mass of the original sample will remain after 71.5 days? Show work or justify your answer.

5. a. Write the full electron configuration and orbital notation/diagram for
   i) iron

   ii) iodine

b. Write the abbreviated electron configuration and orbital notation/diagram for
   i) lead

   ii) silver

6. In the blank following each, put the following groups of elements in order from smallest to largest value for the trend given.

a. atomic radius: Rb Sr Cs Ba _____

b. atomic radius: C Si N P _____

c. first ionization energy: B C Al Si _____

d. first ionization energy: Na K P N _____

e. electronegativity: O S Li Na _____

f. ionic size Ca^{2+} K^{+} Mg^{2+} Na^{+} _____

7. Write either the name or formula for each of the following.

a. FeO _____

b. P_2O_5 _____

c. HCl(aq) _____

d. $(NH_4)_2CrO_4$ _____

e. Mg_3N_2 _____

f. HNO_3(aq) _____

g. CF_4 _____

h. cobalt (II) fluoride _____

i. lead (IV) sulfate _____

j. sulfur hexachloride _____

k. cesium chlorate _____

l. barium hydroxide _____

m. ammonia _____

n. sulfuric acid _____

o. acetic acid _____

8. Consider the reaction between sodium and sulfur, answer the following questions.

a. Write the Lewis dot structure for an atom of each.

b. Using Lewis dot structures show how electrons would be transferred (use the correct number of each atom needed to satisfy the octet rule)

c. Write the Lewis dot structure for the resulting ion of each.

d. Write the formula for the compound formed. _____

e. Write the name of the compound formed. _____

9. For the following precipitation reaction, write the following balanced equations with state symbols.

a. potassium sulfate + barium nitrate → _____

b. full equation: _____

c. net ionic equation: _____

d. spectator ions: _____

10. Write a balanced chemical equation including state symbols to represent the following reaction: Solid potassium chlorate decomposes upon heating to form solid potassium chloride and oxygen gas.

11. For each of the following, balance the equation and classify it in two ways in the blank after each.

a. $Al(s) + O_2(g) \rightarrow Al_2O_3(s)$ _____

b. $RbOH(aq) + Ca(NO_3)_2(aq) \rightarrow RbNO_3(aq) + Ca(OH)_2(s)$ _____

c. $C_4H_8(g) + O_2(g) \rightarrow CO_2(g) + H_2O(g)$ _____

d. $Cs(s) + H_2O(l) \rightarrow CsOH(aq) + H_2(g)$ _____

12. For each of the following, predict the product, balance the equation and classify it in two ways in the blank after it.

a. $Mg(s) + Cu(NO_3)_2(aq) \rightarrow$ _____

b. $HCl(aq) + KOH(aq) \rightarrow$ _____