

Chemistry 2A Semester Exam(2015-2016) Objectives

1. Know how to apply the gas laws (Charles, Boyles, Gay –Lussac, Combined and Ideal)
2. Be ready to solve for moles, grams or molar mass given the ideal gas law. If you are asked to solve for molar mass, you would be given grams and all other variables.
Solve for moles. Grams/moles = molar mass
3. Know the graphs that relate to Charles', Boyles, and Gay-Lussac gas laws.
4. Know that equal volumes of gases at the same temperature and pressure have the same number of molecules. (Avogadro's law)
5. Know the conditions of temperature and pressure that a gas can be subjected to that would make it act the most "ideal". (No attraction to another gas particle.)
6. Know your sig fig rules for multiplying/dividing and adding /subtracting.
7. Know why you would use distillation. (What property of a substance would make you use this?)
8. Know why you would use filtration. (What property of a substance would make you use this?)
9. Know the difference between a chemical and a physical change.
10. Be ready to calculate the molar mass of a hydrate.
11. Know your mole road map. Moles to grams, grams to moles, grams to molecules, moles to molecules, Liters to molecules, Liters to grams
12. Know how to calculate empirical formulas
Mass to grams/Grams to moles/Divide by small/multiply until whole.
13. Know how to use the empirical formula to determine the molecular formula.
14. Know how to use percent composition to calculate the percent by mass in a substance. (Example: How many grams of oxygen are in 100.0g of water?)
15. Know how to write formulas using charges of ions.
16. Know how to write a net ionic equation.
17. Know how to do stoichiometry. (Three steps: change original number to moles/
Look at the ratio/Solve)
18. Know how to balance an equation
19. Know the parts of a potential energy diagram. How do you calculate the activation energy?
20. Know how to solve for K_{eq} when given an equation and the molarity values. Don't forget: Only use gases in K_{eq} problems. Be ready to determine the K_{eq} expression if given the equation.
21. Know how to calculate electrons, protons, and neutrons when given a symbol and a mass number.
22. Know what the rate determining step is and why it is important in regards to reaction rates.
23. Know the properties of the alkali metals, halogens, and noble gases.
24. Know how to determine electron configuration. Review Hund's rule, Pauli's exclusion principle.
25. Know your periodic trends of atomic radius, electronegativity, ionization energy
26. Know how to draw molecular shapes when given a formula.
27. Know how to do half life problems.
28. Know how to do dilution problems: $M_1V_1 = M_2V_2$ (Undiluted on left, Diluted on right)

29. Know how to do mole fraction problems . Calculate the moles of each individual atom or molecule. Add up all mole amounts. Divide the one you need by the total moles.
30. Know how Le Chatelier's principle is applied when temperature is lowered or raised, concentration is changed, or pressure is changed.
31. Know how to write half reactions for reduction or oxidation
32. Know that an alcohol is an organic molecule with OH in the formula. Example CH_3OH or $\text{C}_2\text{H}_5\text{OH}$
33. Know that all organic molecules have carbon in them.
34. Know that a solution with the most hydronium has the lowest pH.
35. Know that a solution with the most hydroxide has the highest pH.
36. Know that $\text{pH} + \text{pOH} = 14$
37. Know how to calculate the concentration if given the pH or pOH.
38. Know that K_w is 1.0×10^{-14} and you can use it to solve for hydronium or hydroxide concentration.
39. Know the difference between an ionic and a covalent bond. Can you give examples?
40. Know what a Bronsted-Lowry acid or base is. Know how to recognize one.
41. Know what an Arrhenius acid or base is. Know how to recognize one.
42. Know the physical properties of ionic compounds in regards to conductivity as a solid, if melted, or dissolved in water. Know the relative melting point of an ionic solid compared to a covalent solid.
43. Know how to draw Lewis structures of all of the diatomic molecules.
44. Know your density formula and how to apply it.
45. Know how to record measurements correctly using a measuring device.
46. Know what a phase diagram is and what phase changes the lines represent.
47. Know how to name compounds using the Stock system.
48. Know how to read a manometer.
49. Know how to calculate percent yield (actual/theoretical then times 100)
50. Know the difference between heat and temperature.
51. Know how to solve for how much heat is given off or absorbed if given a balanced thermochemical equation.
52. Know how a catalyst speeds up a chemical reaction.
53. Know that elements in the same group have similar chemical properties.
54. Know how to calculate an average atomic mass.
55. Know what isoelectronic means. Can you give examples?
56. Know how to balance a nuclear equation.
57. Know how to read a solubility graph.
58. Know how to write a dissociation equation.
59. Know the difference between a strong and a weak acid in terms of degree of ionization.
60. Know how to determine the oxidation number if given a formula.
61. Know how to solve for Molarity and molality
62. Know how to calculate the molarity of ions if given K_{sp} .
63. Know how you can speed up or slow down a chemical reaction.
64. Know how to correctly write formulas using polyatomic ions.

Chemistry 2A Semester II Final Review

Chapter 1

1. State possible changes in state and identify whether they are endothermic or exothermic. Are these physical changes or chemical changes?
2. What is the difference between a physical and a chemical change? State examples.
3. Be able to state one method to physically separate the following mixtures:
 - a. two different liquids
 - b. insoluble solid in a liquid
 - c. solid dissolved in a liquidWhat do distillation, filtration and chromatography have in common?

Chapter 2

4. Determine the number of significant numbers in a measurement. (Ex. 305.0, 0.002)
How do you determine the number of significant numbers when measuring with a graduated cylinder or metric ruler or buret?
5. Be able to add, subtract, multiply or divide using significant numbers. a. $27 + 273 = ?$
b. $300.0 - 1.006 = ?$ c. $4.6 \times 0.02 = ?$ d. $430 / 3.56 = ?$ e. $11.8 + 6.02 + 5.005 = ?$
6. If a cube has an edge of 0.50 cm and a mass of 3.20 g, what is its density?
7. State the SI base units for length, mass, temperature and amount of a substance.
8. What is the Kelvin scale? How is it different from the Celsius scale?
 $200^{\circ}\text{C} = ? \text{K}$ $25 \text{K} = ?^{\circ}\text{C}$

Chapter 3

9. What are the three main subatomic particles, their charge, relative mass and location in the atom.
10. Fill out the table below:

	Atomic #	# of protons	# of neutrons	# of electrons	Mass number
$^{31}_{15}\text{P}^{-3}$					
Uranium-234					

Chapter 4

11. Predict the electron configurations and orbital diagrams for the elements.
Know the exceptions to the aufbau principle and why they exist?
Examples: Write the electron configurations for the following elements or ions: N, K^{+} , Cu, Br^{-1} , P
Which of the above are isoelectronic?
Draw the orbital diagrams for P and K^{+} .
How many unpaired electrons are found in P?
12. Naturally occurring Silver consists of 51.839% Ag-107 that has an atomic mass of 106.905 amu and 48.161% of Ag-109 with atomic mass 108.904 amu. What is the atomic mass of silver?

Chapter 5

13. Be able to locate metals, nonmetals, metalloids, alkali metals alkaline earth metals, halogens and transition metals.
Which of the families conduct electricity as solids? Where are the most active metals? Nonmetals?
Which of the above combine to form ionic compounds?
Which combine to form covalent compounds? Which compounds conduct a current only when melted?
14. What are the charges of the ions that are from families IA, IIA, IIIA, VA, VIA, and VIIA? Which families can form compounds with each other and in what ratio?
15. How does the radius change as the atomic number increases in a period? Why?
How does the radius change as the atomic number increases in a family? Why?

Determine which in each pair has the larger radius:

- a. Ca, Ba b. Cs, Ba c. Cl, P d. Sn, Sr e. Br, I

How does an ionic radius differ between a metal and a nonmetal? Why?

16. What is ionization energy? How does the ionization energy change as the atomic number increases in a period? Why?

How does the ionization energy as the atomic number increases in a family? Why?

Determine which in each pair has the greater ionization energy:

- a. Ca, Ba b. Cs, Ba c. Cl, P d. Sn, Sr e. Br, I

17. What is electronegativity?

How does the electronegativity change as the atomic number increases in a period? Why?

How does the electronegativity change as the atomic number increases in a family? Why?

Determine which in each pair has the greater electronegativity:

- a. Ca, Ba b. Cs, Ba c. Cl, P d. Sn, Sr e. Br, I

Chapter 6

18. Be able to write out dot and structural formulas for single, double and triple covalent bonds.

Example: Draw Lewis dot diagrams for CH_4 , NH_3 , C_2H_6 , N_2 , O_2

Draw structural formulas for the above.

Which of the molecules is a polar molecule?

19. What is the VSEPR theory? Predict the common shapes of the following molecules. Write out their dot formulas.

BI_3 , BeF_2 , CCl_4 , NH_3 , H_2S , SiO_2 , PF_5

Which of the above molecules are polar?

Which of the above compounds has polar bonds, but is a nonpolar molecule?

20. How do covalent compounds differ from ionic compounds in terms of melting point, solubility in water, conductivity in water and solubility in methanol.
21. Relate the structure and bonding of the four types of solids (Ionic, molecular, network solid and metallic). How do these characteristics relate to the other properties of these solids? (Boiling point, Melting point, conductivity, etc.)
22. a. Describe the different types of intermolecular forces (hydrogen bonding, dipole-dipole and dispersion) and state examples of molecules that exhibit each. Diagram a hydrogen bond between water molecules.
- b. Explain which intermolecular force is responsible for Br_2 having a higher melting point than F_2 ?

Chapter 7

23. Identify and name the ionic and molecular compounds. FeCl_3 , FeCl_2 , CuO , SO_2 , N_2O , P_2O_5 , $\text{Ca}(\text{OH})_2$, Na_2SO_4 , Na_2SO_3 . Which of the compounds contains both ionic and covalent bonds?
24. Be able to write proper ionic compound formulas.
Example: Write the formulas for the following: Sodium sulfate, Ammonium carbonate, Iron(II) oxide, Silver chlorate, Barium nitride, Calcium nitrate
25. a. What is the mass of 2 moles of NH_3 ? 1 atom of N?
b. 8.5×10^{18} atoms of Xe = ? moles of Xe.
c. How many O atoms are in one formula unit of $\text{Pb}(\text{NO}_3)_2$
d. 192 g of $(\text{NH}_4)_2\text{CO}_3$ = ? moles How many grams of C are in 192 grams of $(\text{NH}_3)_2\text{CO}_3$?
e. What is the mass of 8.2 L of hydrogen gas at STP?
f. What is the molar mass of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$? What is the % water?
26. a. Determine the empirical formula of a sample of Iron and Oxygen, that 104.7 grams Fe and 44.96 g O.
b. What is the % P in $\text{Ca}_3(\text{PO}_4)_2$? What mass of P would be in 800 g of $\text{Ca}_3(\text{PO}_4)_2$?
27. What is the molecular formula?
What is the empirical formula of a compound that is 19.54 % C, 57.67 % Cl and 22.79% N? The molecular mass is 184.5. What is the molecular formula?

Chapters 8

28. Fill in any blanks with the proper formulas and balance the equation. Identify each type of reaction. Which reaction is always exothermic?

- | | Type |
|---|-------|
| a. $\text{HCl(aq)} + \text{Li(s)} \rightarrow \text{LiCl(aq)} + \text{H}_2(\text{g})$ _____ | _____ |
| b. $\text{H}_2\text{SO}_4(\text{aq}) + \text{Ca(OH)}_2(\text{aq}) \rightarrow \text{CaSO}_4(\text{aq}) + \text{H}_2\text{O(l)}$ _____ | _____ |
| c. $\text{C}_4\text{H}_6(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O(g)} + \text{_____}$ _____ | _____ |
| d. $\text{KCl(aq)} + \text{AgNO}_3(\text{aq}) \rightarrow \text{_____} + \text{_____}$ _____ | _____ |

29. Write the net ionic equations for a and d above.

Chapter 9

30. Be able to determine the number of moles or reactants or products involved in a chemical reaction, using mole ratios. Use the following equation to answer the questions: $4 \text{Al} + 3 \text{O}_2 \rightarrow 2 \text{Al}_2\text{O}_3$

- 8 moles of oxygen gas will react to form how many grams of Aluminum oxide?
- If 18 moles of Al react with 18 moles of oxygen, ? moles of product will form.

31. Be able to calculate the masses of reactants or products in a reaction, given data in moles, mass or liters at STP.

Consider the following reaction: $\text{C}_2\text{H}_6(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O(g)} + \text{CO}_2(\text{g})$

Balance the equation.

- How many liters of oxygen will react with 168 grams of ethane(C_2H_6)?
- 22 liters of oxygen will react with excess ethane to produce how many grams of carbon dioxide?
- 45 g of oxygen gas reacts with 60 g of ethane. How many moles of carbon dioxide will be produced?

Chapter 10

Draw a phase diagram. Label the solid, liquid and gas phases. Label the 6 phase changes.

Chapter 11

33. Which gases would diffuse faster: CO , CO_2 , Cl_2 , H_2 or I_2 ? Which gas would have the highest kinetic energy if they are all at the same temperature and pressure? Which gases would not be safe to breathe?

34. What is Avogadro's Hypothesis?

- If 6.05×10^{14} molecules of gas A occupy a 1 liter flask at 1.0 atm and 25°C , how many molecules of gas B will occupy the same flask at the same pressure and temperature?
- At STP, one mole of gas = ? liters. = ? molecules.
- 88.0 g of CO_2 will occupy ? liters at STP.
- 242 liters of a gas will contain ? molecules at STP?

35. 80.00 liters of a gas at 762 mmHg and 22°C would occupy what volume at the same pressure and 44°C ?

36. What volume will 56 g of nitrogen gas occupy at 1.4 atm and 30°C ?

37. 80.00 liters of a gas at 762 mmHg and 22°C would occupy what volume at 15°C and 750 mmHg?

38. If a gas is in a closed vessel, how can conditions be changed to increase the pressure of the gas? How would one increase the kinetic energy of the gas? What conditions would be necessary to change the gas to a liquid?

39. Gases behave as ideal gases under what two conditions?

40. In an open ended manometer, if the atmospheric pressure is 100 kPa and the

- mercury in the arm open to the atmosphere is 150 mm higher than the other arm, what is the pressure of the gas?
- mercury in the arm open to the atmosphere is 200 mm lower than the other arm, what is the pressure of the gas?

Chapters 12

What is the difference between a saturated and an unsaturated solution?

42. Be able to read a solubility graph.

If a substance dissolves exothermically, what factor would speed up the solubility?

43. What is the difference between Molarity and Molality. Do following problems:

- If 733 grams of CaCl_2 are mixed to make 500 mL of solution, what is the molarity?

b. What volume of 12 M HCl is needed to make 300 mL of a 0.5 M solution of HCl?

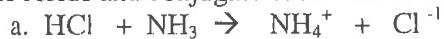
Chapter 13

44. Which would lower the freezing point more? NaCl, AlCl₃, C₆H₁₂O₆, or NaBr₂?

Chapter 14

45. What is a Bronsted-Lowry Acid? Conjugate Base? Bronsted-Lowry Base? Conjugate Acid?

Identify the Acids and conjugate bases and bases and conjugate acids in the following reactions



46. What are two examples of Arrhenius bases and Arrhenius acids?

47. What are characteristics of strong acids and bases? How is K_a related to the strength of an acid ?

Chapter 15

48. What is the mathematical equation for the determination of pH? How are pH and pOH related? How are [H₃O⁺] and [OH⁻] related? What is K_w? What pH values are most acidic? Most basic?

a. If [H⁺] = 3.2 × 10⁻³ then [OH⁻] =

b. If [OH⁻] = 8.6 × 10⁻², then [H₃O⁺] =

c. Which [H₃O⁺] is more acidic? 4 × 10⁻³ M, 4 × 10⁻⁸ M, 4 × 10⁻¹² M, 4 × 10⁻¹⁴ M

d. If the pH = 4.50, then what is the [OH⁻]?

49. Titration: a. What is the Molarity of NaOH if 27.50 mL of a 0.150 M HCl solution neutralizes 15.00 mL of NaOH?

Chapter 16

50. Describe the difference between endothermic and exothermic reaction.

In which would the energy be a reactant? Product?

In which would the surroundings become cold? Hot?

51. Determine the enthalpy from quantities of reactants or products.

How much heat will be released when 0.02 moles of chlorine gas reacts with excess phosphorus according to the following equation? $2\text{P} + 5\text{Cl}_2 \rightarrow 2\text{PCl}_5$ $\Delta\text{H} = -886 \text{ kJ}$

52. Be able to do the following calorimetry problems. Specific Heat of water = 4.18J/g °C

a. How much heat is required to raise the temperature of 790 g of water from 38.4°C to 85.4°C? (Specific Heat of water = 4.184 J/g°C)

b. In order to determine the specific heat of a metal from our laboratory experiment, what assumption must be made about our calorimeter?

53. What uses could substances with low specific heat have? Uses for high specific heat substances?

Chapter 17

54. Define reaction rate,

55. Draw a P E Diagram where the Potential energy of the reactants = 100 kJ, $\Delta\text{H} = +40 \text{ kJ}$ and

the Activation energy = 60kJ Show the effect of a catalyst. What is ΔH for the reverse reaction? E_a for Reverse?

56. State five factors that will increase the rate of a reaction. Explain each factor according to the collision theory.

57. In a multistep reaction mechanism, which reaction determines the rate?

Chapter 18

58. What is dynamic equilibrium?

59. a. Write the equilibrium expression for the following reaction:



How would this equilibrium be affected if Ag₂C₂H₃O₂ would be added?

- b. energy + $\text{NH}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \leftrightarrow 2\text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$
 a. Write the equilibrium expression (K_b) for the above reaction.
 b. What change would cause the equilibrium to shift left? Right?
 c. How would temperature affect the K_{eq} ?
60. Consider the following reaction: $\text{H}_2 + \text{F}_2 \leftrightarrow 2\text{HF}$
 Determine the K_{eq} if $[\text{H}_2] = 0.03 \text{ M}$, $[\text{HF}] = 0.02 \text{ M}$ and $[\text{F}_2] = 0.03 \text{ M}$
61. a. The K_{sp} for $\text{AgCl} = 1.8 \times 10^{-10}$. If the concentration of $\text{Ag}^+ = 1.3 \times 10^{-4} \text{ M}$, what is the concentration of Cl^- ?
 b. For the following equilibrium: $\text{Mg}(\text{OH})_2 \leftrightarrow \text{Mg}^{+2} + 2\text{OH}^{-1}$, if NaOH was added, how would it affect the solubility of Magnesium hydroxide?

Chapter 19

62. Reduction/Oxidation: a. What is oxidation? Reduction?
 b. Determine the oxidation number of C in the following compounds or ions CO_2 , H_2CO_3 , $\text{HC}_2\text{H}_3\text{O}_2$. Determine the oxidation number of S in BaSO_4 and BaSO_3
 c. For the following equation, identify what is oxidized and what is reduced.
 $\text{Ag}(\text{s}) + \text{HClO}_3(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{H}_2\text{O}(\text{l})$
 Balance the equation.

Chapter 20

63. a. For the following galvanic cell, predict the voltage. Write the cell reaction and half reactions
- | | | |
|--------|--|----------------------------|
| | Au^{+3}/Au | Fe/Fe^{+2} |
| Given: | $\text{Au}^{+3} + 3\text{e}^- \rightarrow \text{Au}$ | 1.50 Volts |
| | $\text{Fe}^{+2} + 2\text{e}^- \rightarrow \text{Fe}$ | -0.44 Volts |
- b. A full cell reaction is: $\text{Zn}^{+2} + \text{Cu} \rightarrow \text{Cu}^{+2} + \text{Zn}$ What is the oxidation half reaction?

Chapter 21

64. What are the three types of radioactivity?
65. Write the formulas for an alpha and beta particle. Be able to fill in the blanks in the following equations and state the particle produced. A) ${}^{230}\text{Th} \rightarrow {}^{226}\text{Ra} + \text{?}$ B) ${}^{14}\text{C} \rightarrow {}^{14}\text{N} + \text{?}$ C) ${}^{223}\text{Fr} \rightarrow {}^{223}\text{Rn} + \text{?}$
66. If the half-life of a substance is 10 days, how much of a 300 g sample would be left after 60 days?

Misc.

67. Draw a typical alkane, alkene and alkyne.
 68. Draw an organic alcohol and acid,
 69. There is mixture of gases containing 5.0 g of N_2 , 4.0 g H_2 , and 2.0 g He . What is the mole fraction of helium?

