2nd Semester Chemistry Final Study Guide

1. What is avagadro's number?

2. Determine the amount of moles in 9.50 grams of silver.

3. Determine the amount of moles in 258 grams of copper(I) oxide.

4. What should be the percent composition of oxygen be in magnesium hydroxide?

5. Convert 2.95 g C_2H_2 into moles.

6. Convert $5.00x10^{56}$ molecules of C_4H_{10} into grams.

7. What is the percent mass of calcium in $CaCl_2 \cdot 2H_2O$?

8. Determine the empirical formula for C_8H_{14}.

9. Determine the empirical formula when an unknown substance is found to be composed of 1.38g sodium, 1.56g chromium, and 1.92g oxygen.

10. Determine the empirical formula when an unknown substance is found to be composed of 89.9% carbon and 10.1% hydrogen.

11. Balance the following equation: $\_\_Mg(OH)_2 + \_\_HCl \rightarrow \_\_MgCl_2 + \_\_H_2O$

12. Balance the following equation: $\_\_Br_2 + \_\_K \rightarrow \_\_KBr$

13. Balance the following equation: $\_\_C_4H_8 + \_\_ O_2 \rightarrow \_\_CO_2 + \_\_ H_2O$

14. When you add water to solid ammonium nitrate the solution becomes much cooler. What type of reaction is this?

15. Adding sodium and chlorine together creates a violent reaction that releases a lot of heat and produces sodium chloride. What type of reaction is this?

16. The process of boiling water is a(n) _____ reaction.

17. The process of freezing water into ice cubes in the freezer is a(n) _____ reaction.

18. Balance this reaction: $O_2 + Ca \rightarrow CaO$

19. Using the unbalanced equation below, calculate how many moles of sodium hydroxide would be produced from reacting 25 moles of sodium in excess water.

$$Na + H_2O \rightarrow H_2 + NaOH$$

20. When hydrochloric acid (HCl) is combined calcium hydroxide, it produces a calcium chloride and water. Once this equation is balanced, what would be the coefficient in front of the hydrochloric acid?

21. Using stoichiometry Sydney figures that a certain reaction should produce 7.75 grams of paradichlorobenzen. However, measuring the same amounts in lab as she calculated she only came up with 6.21 grams of PDCB. What was Sydney's percent yield?

22. Sodium carbonate and copper metal can be formed from reacting copper (II) carbonate with sodium. How many moles of copper would be produced from using 23 moles of sodium in excess copper (II) carbonate?

23. There is approximately _____ atoms in 6.8 moles of iron.

24. 8.33 grams of tin would be composed of _____ atoms.

Copper (II) chloride ($CuCl_2$; 0.95g) was dissolved in water and a piece of aluminum wire (Al; 0.50 g) was placed in the solution. The blue color due to copper (II) chloride soon faded and a red precipitate of solid copper was observed.

Unbalanced reaction: $CuCl_2(aq) + Al(s) \rightarrow AlCl_3(aq) + Cu(s)$

25. Balance the equation from the passage above.

26. How many grams of copper metal would you expect to be formed from the problem above?

27. After conducting the lab 0.15 grams of copper was obtained. What is the percent yield from this experiment?

If 20.0 grams of sodium phosphate and 20.0 grams of magnesium chloride are reacted together in the following reaction:

Unbalanced

$\_\_Na_3PO_4 + \_\_MgCl_2 \rightarrow \_\_NaCl + Mg_3(PO_4)_2$

28. Balance the reaction above.

29. What is the limiting reactant for the reaction above?

30. Once the above reaction has run to completion how many grams of sodium phosphate will be left?

31. If an 8.1 g solution contains 0.076 g of NaCl, what is the percent composition of the solute?

32. What is the percent composition of 0.29 moles of hydrogen fluoride in a 25 gram solution?

33. What is the molarity of 3.5 mols NaOH in a 2.5 liter solution?

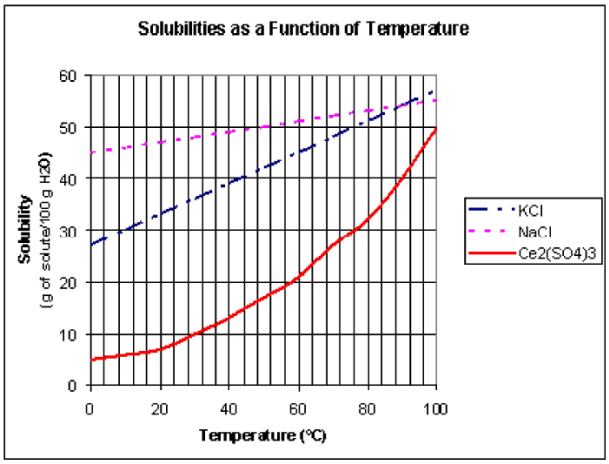
34. If you have a 1.5 molar solution of HCl, how many moles would be in a 0.62 liter sample?

35. How many grams of NaOH would you need to make a 0.25 liter, 1.5 molar solution in water?

36. How many moles of NaCl would be in a 3.0 liter solution that has a molarity of 2.0?

37. Water is a _____ compound and the oxygen side has a _____ charge.

Use the graph below to answer the following questions:



38. At what temperature does NaCl and KCl have the same solubility?

39. Using the graph above, what is the solubility of $Ce_2(SO_4)_3$ at 85º C?

40. If 1.75 g of gas at 90.0 kPa pressure dissolves in 1.0 liters of water at 29°C, how much will dissolve in 1.0 liters of water at 15.0 kPa pressure at the same temperature?

41. A mixture of solute and solvent is known as a(n) _____.

42. If a molecule has an uneven distribution of electron density, it is best described as _____.

43. The weak bond that is formed between two water molecules is called _____.

44. When 25.0 grams of a nonionic substance is dissolved in 2.00 kg of water, the observed freezing point of depression of the solution is 0.93ºC. If k_f for water is 1.86ºC / m, what is the molar mass of the substance?

45. What is the boiling point of a 1.75 m solution of NaCl in water? (The boiling point elevation constant, k_b, for water is 0.5 ºC/m)

46. A solution contains equal masses of glucose (molar mass 180) and toluene (molar mass 90). What is the mole fraction of glucose in the solution?

47. $MgO(s) \rightarrow Mg^{2+}(aq) + O^{2+}(aq)$ occurs at higher temperatures and $Mg^{2+}(aq) + O^{2+}(aq) \rightarrow MgO(s)$ occurs at lower temperatures. These two reactions can be combined what type of an arrow?

48. Explain what chemical equilibrium means. Give an example of it.

49. What is the correct equilibrium expression for $N_2O_{4(g)} \rightarrow 2\ NO_{2(g)}$?

50. What is the correct equilibrium expression for $CO_{(g)} + 3\ H_{2(g)} \rightarrow CH_{4(g)} + H_2O_{(g)}$?

51. What is the correct equilibrium expression for $2\ H_2O_{(g)} \rightarrow 2\ H_{2(g)} + O_{2(g)}$?

52. Explain what enthalpy is. What is its symbol?

53. In terms of free energy, explain how it ties into chemical reactions.

54. What is the correct equilibrium expression for $C_2H_5OH_{(l)} \rightarrow C_2H_5OH_{(g)}$?

55. What is the correct equilibrium expression for $CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$?

56. What does a small or large K_{sp} indicate?

57. Barium carbonate has a K_{sp} of 2.58×10^{-9}. If enough was placed into pure water to allow it to reach equilibrium, what would be the concentrations of barium and carbonate ions in solution?

59. Rachel adds NOBr(g), NO(g), and Br_2(g) into a sealed flask and records the concentration of each gas once they reach equilibrium. If she finds the concentrations to be NOBr = 0.460 M, NO = 0.100 M, and Br_2 = 0.300 M what would be the value of K?

60. If a solution has a H^+ concentration of 10^{-4} then what must the OH^- concentration be?

For the reaction A + 2B + C → D the following experimental data was collected. Experiment Initial Concentration of Reactants (M) Initial Rate of Formation of

Experiment	Initial Concentration of Reactants (M)			Initial Rate of Formation of D (M/sec)
	[A]	[B]	[C]	
1	3.0	0.75	2.6	4
2	3.0	0.75	1.3	2
3	6.0	0.75	2.6	16
4	3.0	1.5	2.6	8
5	6.0	1.5	1.3	*x*

61. Which experiments would you use to analyze the rate order for reactant A?

62. Which experiments would you use to analyze the rate order for reactant B?

63. Which experiments would you use to analyze the rate order for reactant C?

64. What order is reactant A?

65. What order is reactant B?

66. What order is reactant C?

67. What is the value of k (include the units)?

For the reaction 3A + B + 2C → D the following experimental data was collected. Experiment Initial Concentration of Reactants (M) Initial Rate of Formation

Experiment	Initial Concentration of Reactants (M)			Initial Rate of Formation of D (M/sec)
	[A]	[B]	[C]	
1	0.100	1.333	0.025	1.000
2	0.020	0.050	0.025	y
3	0.020	1.333	0.600	0.960
4	0.100	0.075	0.025	1.000
5	0.020	0.075	0.025	0.040
6	0.050	2.000	z	2.900

68. Which experiments would be most useful to analyze reactant B?

69. What is the rate order for reactant A?

70. What is the value of k (include the units)?

71. What does y equal?

72. What does z equal?

For the reaction 2 A + B + 3C → D the following experimental data was collected.

Experiment	Initial Concentration of Reactants (M)			Initial Rate of Formation of D (M/sec)
	[A]	[B]	[C]	
1	0.10	0.10	0.10	0.20
2	0.20	0.10	0.10	0.40
3	0.20	0.20	0.050	0.10
4	0.20	0.20	0.10	0.40

73. What is the order of reactant B?

74. What is the rate law constant (k) for the above experimental data?

75. List all of the factors that can speed up a chemical reaction.

76. What could you do to make yeast dough rise more slowly? List as many reasonable ideas as you can.

77. Explain the collision theory.

78. Increasing the pressure increases the rate of reaction certain reactions. List factors that those reactions would need to have.

79. What is a transition state?

80. Explain the meaning of a reaction mechanism.

81. What is an intermediate?

82. Define thermodynamics.

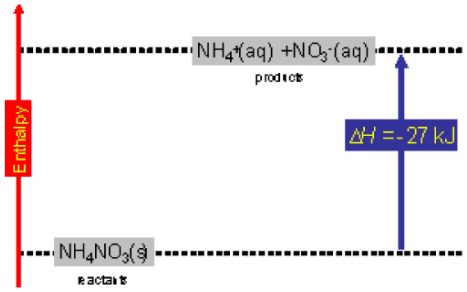
83. If doubling the concentration of a reactant quadruples the rate of the reaction, the concentration of the reactant appears in the rate law with an exponent of what?

84. Describe what chemical kinetics is.

86. The rate for a reaction between reactants L, M, and N is proportional to the cube of [L] and the square of [M]. What is the rate law for this reaction?

87. What is a substance that slows down chemical processes is called?

88. Explain how energy relates to the reactants and products in endothermic and exothermic reactions.



89. What is wrong with the energy diagram above?

90. How much heat is evolved when 25 grams of methanol is burned to completion?

91. Determine the spontaneity of a reaction that is exothermic reactions and has an increase in entropy.

92. Calculate the enthalpy change when 15.0 grams of ammonia is synthesized in the following reaction.

$$N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g) + 92.0\ kJ$$

93. Energy cannot be created nor destroyed but can be converted in chemical processes is known as the _____ law of thermodynamics.

94. If a process is spontaneous in one direction, then it cannot be spontaneous in the reverse direction is know as the _____ law of thermodynamics.

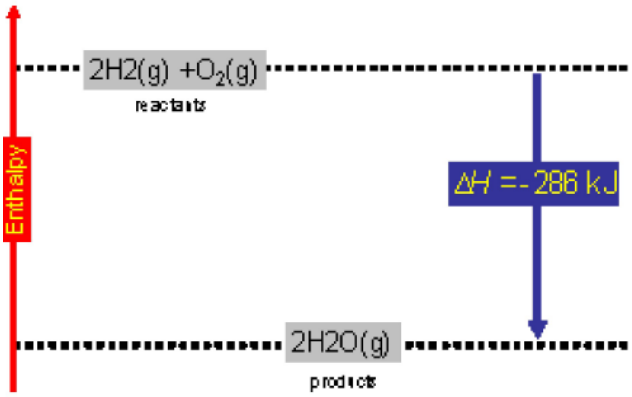
95. Explain the relationship between the enthalpy of the universe, surroundings, and system.

96. When bonds are formed, energy is released or absorbed?

97. The products have weaker bonds than the reactants in which type of reaction? Exothermic or endothermic?

98. Coupled reactions can make a _____ reaction occur through a series of _____ reactions. (Place positive or negative values to either H, S, or G in the previous blanks).

99. A reaction has a H of 5000 J and S of 500 J/K would it be spontaneous or not? Would you need additional information?



100. What type of reaction is associated with the energy changes above?