# Chemistry 2$^{nd}$ Semester Final Exam Review

**Chemical Bonds**
1. Give a physical description of how the atoms and molecules are arranged in solids, liquids, and gases.
2. Use the information from the previous question to describe the shape and volume for each phase (state) of matter.
3. List the three phases of matter in order of increasing intermolecular attractions.
4. Why do the atoms and molecules in liquids move in a random pattern relative to one another instead of being in a solid form?

**Conservation of Matter and Stoichiometry**
5. The atomic mass unit and the mole are defined using what isotope?
6. Balance the following equations:
   a. $Al_2O_3 + Cl_2 + C \rightarrow AlCl_3 + CO$
   b. $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$
   c. $P + O_2 \rightarrow P_2O_5$
7. What isotope is used to define one mole?
8. How many particles (atoms or molecules) are in one mole?
9. Find the molar mass for the following chemical formulas:
   a. $ZnF_2$
   b. $Al_2(SO_4)_3$
   c. $NH_4IO_3$
10. How many moles are in 4.37 kg of NaOH?
11. How many atoms are in 2075 g of He?
12. What volume will 92.31 g of $CO_2$ occupy at STP?
13. How many grams of sodium hydroxide are needed to react with 6.23 g of barium bromide? $NaOH + BaBr_2 \rightarrow NaBr + Ba(OH)_2$
14. In the reaction, $2 Mg + O_2 \rightarrow 2 MgO$, if 100.0 g of magnesium reacts with 50.0 g of oxygen, what mass of product is produced?

**Gases and Their Properties**
15. What is the kinetic molecular theory?
16. How do gases create pressure, use KMT to support your answer.
17. Explain diffusion, use KMT to support your answer.
18. Is Boyle's law direct or inverse? Charles's Law? Gay-Lussac's Law?
19. If 735 L of a gas is at 3.11 atm and 34$^o$C, what is its temperature at 6.11 atm and 235 L?
20. If 12.2 mL of a gas is at 178$^o$C, what is its volume at 53.0$^o$C?
21. What are the values of STP? What is the meaning behind STP?
22. What is the lowest temperature possible? What is it called?

**Acids and Bases**
23. What are the major observable properties of acids, bases, and salt solutions?
24. What gas is produced when an acid reacts with a metal?
25. What is the Arrhenius definition for acids and bases?
26. What is the Brønsted-Lowry definition for acids and bases?
27. Describe the dissociation (ionization) of strong acids and bases versus weak acids and bases.
28. List the 6 strong acids and state the rule for strong bases.
29. What are the pH values for acids? Bases?
30. What is more acidic, a solution with a pH of 2 or 5? What is more basic, a solution with a pH of 8 or 13?
31. What is the pH value for a neutral substance?
32. List the color for each indicator in an acid solution and a base solution: phenolphthalein, red litmus, and blue litmus.

**Solutions**
33. What is a solute? Solvent?

34. Describe the dissolving process at the molecular level by using the concept of random molecular motion.
35. What three factors affect the dissolving process?
36. When 5.20 g of salt is added to 5000 g of water, what is the concentration in parts per million (ppm)?
37. How many grams of KOH would you need to make 750. mL of solution with a concentration of 5.5% by mass?
38. If you add 25 g of $CaCl_2$ to 1000. mL of water, what would the concentration of the solution be in grams/liter?
39. What is the molarity of a solution that contains 78.2 grams of NaCl in 4.25 liters of solution?

**Chemical Thermodynamics**
40. What happens to atoms or molecules as their temperature is increased?
41. Describe heat flow.
42. What is the difference between an exothermic reaction and an endothermic reaction?
43. Draw an energy diagram for an endothermic and exothermic reaction.
44. Are the following changes of state exothermic or endothermic:
   a. An ice cube melting
   b. Dry ice subliming to carbon dioxide
   c. Water vapor condensing on a mirror
   d. Water freezing into an ice cube
45. How many calories are needed to raise 450. grams of water from 21.0$^o$C to 85.5$^o$C?
46. How many grams of water can be heated 46.0$^o$C by 34.8 kJ?

**Reaction Rates**
47. Define reaction rate.
48. What are the units for reaction rate?
49. Describe what happens to the concentration of reactants during a chemical reaction. Products?
50. What happens to the reaction rate when there is an increase in concentration? Temperature? Pressure?
51. What is a catalyst? How does the addition of a catalyst affect the rate of a reaction?
52. Draw an energy diagram for a catalyzed reaction.

**Chemical Equilibrium**
53. Define equilibrium.
54. What is Le Chatelier's Principle?
55. Which direction will the following reaction shift if: $H_2(g) + I_2(g) + 50.9 kJ \leftrightarrow 2 HI(g)$
   a. Add HI
   b. Decrease temperature
   c. Increase pressure
   d. Remove $I_2$
56. Which direction will the following reaction shift if: $PCl_3(g) + Cl_2(g) \leftrightarrow PCl_5(g) + heat$
   a. Add $PCl_3$
   b. Remove $Cl_2$
   c. Add heat
   d. Decrease pressure

**True/False**
57. The quantity *one mole* is set by defining one mole of carbon 12 atoms to have a mass of exactly 12 grams.
58. Acids are hydrogen-ion-accepting and bases are hydrogen-ion-donating substances.
59. Energy is absorbed when a material condenses or freezes and is absorbed when a material evaporates or melts.
60. The rate of a reaction is the decrease in concentration or reactants or the increase of products with time.
61. A catalyst increases the rate of a reaction by raising the activation energy of a reaction.