**CHM 101 A**

**Preparation for Exam 4**
**Chapters 10, 11, 12, 13**

1. Give qualitative descriptions of the intermolecular forces operating between molecules (London dispersion, dipole-dipole, hydrogen-bonding). Understand how these differ from covalent and ionic bonds.
2. Predict what types of intermolecular forces should be present in the liquid state of a given substance, and explain physical properties on the basis of intermolecular attractions and molecular motion.
3. Predict relative intermolecular force strength and relative boiling points for substances given their formulas.
4. Define vapor pressure, and predict relative vapor pressures for substances based on intermolecular force strength.
5. Identify types of solids and the forces that hold particles together in these solids.

6. Describe how solutions form in terms of overcoming and forming intermolecular forces. What are the signs of $\Delta E$ for each component of the solution process?
7. Describe the role *energy* and *entropy* play in solution formation. Predict relative solubilities using "like-dissolves-like."
8. Distinguish between *unsaturated* and *saturated* solutions. What is a *supersaturated* solution?
9. What information does a *solubility* value give? What are the units on solubility? Given the solubility of a substance in water, describe a solution after a certain amount of solid has been added to a given amount of water.
10. Explain how pressure and temperature affect gas solubility.
11. What is a colligative property?
12. Define osmosis, and predict the direction of molecular flow across a semi-permeable membrane.
13. Describe how vapor pressure, boiling point, freezing point (melting point), and osmotic pressure change when the concentration of solute is increased in a solution. Compare the boiling points or freezing points of solutions of molecular and ionic solutes.

14. Describe the factors that affect the rate of a chemical reaction.
15. Identify a catalyst and describe its role in a chemical reaction.
16. Define equilibrium in terms of rates of forward and reverse reactions, and in terms of the amounts of reactants and products at equilibrium.
17. Use Le Chatelier's principle to describe changes in concentrations of reactants and products when a reactant or product is added or removed from the system.

18. Define an acid and base according to the Bronsted-Lowry model.
19. Given the formula for an acid or base, write the formula for its conjugate base or conjugate acid.
20. Given an equation for an acid-base reaction that reaches equilibrium, identify the acid and base reactants and the acid and base products.
21. Describe the differences between strong and weak acids and bases.
22. Explain the significance of an acid-ionization constant, $K_a$. Use $K_a$ values to rank acids from weakest to strongest.
23. Describe the conditions for an acidic, basic or neutral solution in terms of pH, hydronium ion concentration, and hydroxide ion concentration.
24. Convert between $[H_3O^+]$ and $[OH^-]$ for an aqueous solution
25. Calculate pH of a solution givn the hydronium ion concentration or the hydroxide ion concentration.
26. What happens to the hydronium ion concentration when the pH goes up (or down) by 1 unit (or 2, 3, 4…)?