Chemistry Final Review

**Chapter 1: Matter and Change**

1. What is Mass? What is Volume?

2. How does the composition of a pure compound differ from that of a mixture?

3. Define ‘Property’. How are properties useful in classifying materials?

4. Define chemical property. List two examples of chemical properties.

5. Distinguish between a physical change and a chemical change.

6. In terms of shape and volume, how do solids, liquids, and gasses compare?

7. What is meant by a change in state?

8. Identify the reactants and products in the following reaction:
 Potassium + Water → Potassium Hydroxide + Hydrogen

9. What is the significance of the vertical columns of the periodic table? What is the significance of the horizontal rows?

10. Compare the physical properties of metals, nonmetals, metalloids, and noble gasses, and describe where in the periodic table each of these kinds of elements is located.

11. An unknown element is shiny and is found to be a good conductor of electricity. What other properties would you predict for it?

12. Define physical property. List two examples of physical properties.

13. How can you tell the difference between an element and a compound?

14. Identify each of the following as either a physical change or a chemical change. **Explain** your answer
 A piece of wood is sawed in half.

 Milk turns sour.

 Melted butter solidifies in the refrigerator.

15. Write a brief paragraph that shows that you understand the following terms and the relationships between them: atom, molecule, compound, and element.

**Chapter 2: Measurements and Calculations**

16. Identify the SI unit that would be most appropriate for measuring the **mass** (mg,g,kg) of each of the following objects:
a notebook: \_\_\_\_\_\_\_\_\_\_ a coin: \_\_\_\_\_\_\_\_\_ an elephant: \_\_\_\_\_\_\_\_\_\_\_

17. Identify the SI unit that would be most appropriate for measuring the **length** (mm,cm,m,km)of each of the following objects:
width of a gym: \_\_\_\_\_\_\_\_\_\_\_ length of a finger: \_\_\_\_\_\_\_\_
distance between Worcester and Boston: \_\_\_\_\_\_\_\_\_\_\_\_\_

18. What is the volume in cubic meters of a rectangular solid that is 0.25m long, 6.1m wide and 4.9m high?

19. Find the density of a material, given that a 5.03g sample occupies 3.24mL. $D=\frac{m}{v}$

20. A sample of a substance that has a density of 0.824 g/mL has a mass of 0.451g. Calculate the volume of the sample. $V= \frac{m}{d}$

21. Convert 92.25m to km. Convert 92.25m to cm.

**Chapter 3: Atoms- The Building Blocks of Matter**

22. What is an atom? What are the two regions that make up all atoms and what subatomic particles are in those regions?

23. Summarize Rutherford’s model of the atom, and explain how he developed this model based on the results of his famous gold-foil experiment.

24. What number uniquely identifies an element, the atomic number or the mass number? Explain why.

25. What are isotopes? How are the isotopes of an element alike and how are they different?

26. Three isotopes of argon occur in nature, $$, $$, and $$. Calculate the average atomic mass of argon (2 decimal places is enough) given the following relative atomic masses and abundances of each of the isotopes: argon-36 0.337%, argon-38 0.063%, argon-40 99.600%.

27. What is the nucleus of the atom? Who is credited with the discovery of the atomic nucleus? Identify the two kinds of particles that make up the nucleus.

28. What is an electron?

**Chapter 4: Arrangement of Electrons in Atoms**

29. Explain the following rules for Electron Configurations: Aufbau Principle, Hund’s Rule, Pauli Exclusion Principle.

30. What is meant by the highest occupied energy level in an atom?

31. What are inner-shell electrons?

32. Write the electron-configuration notation for the element whose atoms contain the following number of electrons:

3electrons: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6electrons: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8electrons: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 13electrons: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

33. What is a noble-gas configuration?

34. How does noble-gas notation simplify writing an atom’s electron configuration?

35. Write the noble-gas notation for the following elements:
Cl: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ca: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Se: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

36. What information can you get from the following Noble gas notation: [Ne]3s2

37. Identify the following atoms on the basis of its electron configuration:

 \_\_\_\_\_\_\_ 1s22s22p1
 \_\_\_\_\_\_\_1s22s22p5
 \_\_\_\_\_\_\_[Ne]3s2
 \_\_\_\_\_\_\_[Ne]3s23p2
 \_\_\_\_\_\_\_[Ne]3s23p5
 \_\_\_\_\_\_\_[Ar]4s1
 \_\_\_\_\_\_\_[Ar]3d64s2

**Chapter 5: The Periodic Law**

38. State the periodic Law. How is the periodic law demonstrated within the **groups** of the periodic table?

39. How do the electron configurations within the same group of elements compare?

40. How do the electron configurations within the Noble Gas family of elements explain why they are relatively un-reactive?

41. What information is provided by the specific block location of an element?

42. Which elements are the alkali metals?

43. List four characteristic properties of the alkali metals.

44. Which elements are designated as the alkaline-earth metals?

45. How do their characteristic properties compare with those of the alkali metals?

46. What name is sometimes used to refer to the entire set of d-block elements?

47. What types of elements make up the p block?

48. Which elements are designated as the halogens?

49. List three of characteristic properties of this group.

50. Without looking at a periodic table, identify the period, block, and group in which the elements with the following electron configurations are located.
 a. [Ne]3s23p4 period: \_\_\_\_\_\_\_\_ block: \_\_\_\_\_\_\_\_ group: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b. [Kr]4d105s25p2 period: \_\_\_\_\_\_\_\_ block: \_\_\_\_\_\_\_\_ group: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 c. [Xe]4f145d106s26p5 period: \_\_\_\_\_\_\_\_ block: \_\_\_\_\_\_\_\_ group: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

51. Based on the information given blow, give the group, period, block, and identity (symbol) of each element described

 a. [He]2s2 block:\_\_\_\_ identity: \_\_\_\_
 b. [Ne]3s1 block: \_\_\_\_ identity: \_\_\_\_
 c. [Kr]5s2 block: \_\_\_\_ identity: \_\_\_\_
 d. [Ar]4s2 block: \_\_\_\_ identity: \_\_\_\_
 e. [Ar]3d54s1 block: \_\_\_\_ identity: \_\_\_\_

52. What is atomic radius?

53. What is the atomic radius trend observed across a period and down a group? Explain why this trend is seen.

54. What is electron affinity?

55. What is the electron affinity trend observed across a period and down a group? Explain why this trend is seen.

56. What are valence electrons?

**Chapter 6: Chemical Bonding**

57. What is a chemical bond?

58. Identify and define the three major types of chemical bonding.

59. What is the meaning of the term polar?

60. Distinguish between polar-covalent and non-polar covalent bonds.

61. What is a molecule?

62. Describe the octet rule in terms of noble-gas configurations.

63. What is an ionic compound?

64. What is a polyatomic ion?

65. Give two examples of polyatomic ions.

66. What is metallic bonding?

67. What types of atoms tend to form the following types of bonding: ionic, covalent, metallic?

**Chapter 7: Chemical formulas and Chemical Compounds**

68. Name the following ions:

 a. K+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 b. Mg2+\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 c. Al3+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 d. Cl1- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 e. O2- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 f. Ca2+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

69. Write the formulas for the binary ionic compounds formed between the following elements.

 a. Na+, I- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 b. Ca2+, S2- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 c. Z+, Cl- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 d. Ba2+, F- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 e. Li+, O2- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

70. Give the name of the following binary ionic compounds.

 a. KCl \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 b. CaBr2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 c. Li2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 d. MgCl2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

71. Name each of the following ions:

 a. NH4+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 b. OH-  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 c. NO3- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 d. CO32- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 e. PO43- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 f. N3- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 g. F1- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 h. Br1- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

72. Write the formula and charge for the following ions.

 a. Acetate Ion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 b. Copper (II) Ion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 c. Iron (III) Ion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 d. Sulfate Ion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

73. Name each of the following ionic compounds:

 a. NaCl \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 b. KF \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 c. CaS \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 d. Co(NO3)2  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 e. FePO4  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 f.(NH4)2SO3**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

 **Chapter 10: States of Matter**74. What is surface tension?

75. Define freezing point and boiling point.

76. Can ice be colder than 0oC? Can liquid water be hotter than 1000C? Explain.

77. Describe the structure of a water molecule.

78. Name the type of bond that forms between water molecules and what properties of water result from those types of bonds.

**Chapter 12: Solutions**

79. What is the Tyndall effect and identify one example of this effect.

80. Given an unknown mixture consisting of two or more substances, explain how we could determine whether that mixture is a true solution, a colloid, or a suspension.

81. Explain why a suspension is considered a heterogeneous mixture.

82. Does a solution have to involve a liquid? Explain your answer.

83. What rule of thumb is useful for predicting whether one substance will dissolve in another?

84. What is a solute? What is a solvent?

85. How does temperature affect the rate of a solid dissolving in a liquid?

86. What effect does temperature have on a gas dissolved in a liquid?

87. What factors increase the rate of dissolving for a solid in a liquid?

**Chapter 13: Ions in Aqueous Solutions and Colligative Properties.**
88. What effect do solutes have on the freezing point and boiling point of a liquid?

**Chapter 21: Nuclear Chemistry**

89. Write the nuclear equation for the release of an alpha particle by $$.

90. Write the nuclear equation for the release of a beta particle by $$.

91. What changes in atomic number and mass number occur in each of the following types of radioactive decay.
 a. alpha emission
 b. beta emission
 c. electron capture

92. Define half-life.

93. Explain the difference between nuclear fission and nuclear fusion.

94. Where can each type of nuclear reaction be found?

**Vocabulary words that you should be familiar with…**

Length
Perimeter
Area
Mass
Volume
Density
Water Displacement
Property
Change of State
Boiling Point
Freezing Point
Element
Luster
Conductivity
Malleability
Physical Change
Chemical Change
Solubility
Homogeneous
Heterogeneous
Solution
Pure Substance
Compound
Element
Filtration
Chromatograph
Soluble
Solvent
Solute
Suspension
Colloid
Tyndall Effect
Miscible
Immiscible
Metal
Nonmetal
Metalloid
Cation
Anion
Proton
Neutron
Electron
Atomic Number
Atomic Mass
Electron Configuration
Period
Group
Isotope
Fission
Fusion
Polar
Nonpolar
Ionic
Covalent
Cohesion
Surface Tension
Buoyancy