Name _____

Period _____

# *FALL SEMESTER EXAM REVIEW, Part 1*

## I. The BIG Picture

*Complete the following with a word or phrase.*

Chemistry is the study of matter. Matter is anything that has mass and volume. There are 2 basic kinds of matter: pure substances and mixtures. Pure substances can be elements or compounds. NaCl is an example of a compound; while sodium is an example of an element. Mixtures can be homogeneous or heterogeneous. Gatorade is an example of a homogeneous mixture; while Raisin Bran is an example of a heterogeneous mixture.

All matter is made up of atoms, which are the smallest particles of an element that still retain the properties of that element. Atoms consist of a densely-packed nucleus held together by a nuclear force and surrounded by a cloud of electrons. Most of an atom is empty space and most of the mass of an atom is contained in the nucleus. In the nucleus are protons and neutrons. The proton has a mass 2000 times greater than the electron. The number of protons determines the atomic number. Isotopes are atoms of the same element with the same number of protons, but different numbers of neutrons. For example, fluorine-18 has 9 protons and 9 neutrons, while fluorine-20 has 9 protons and 11 neutrons. The weighted average of the masses of all the isotopes for an element is called the average atomic mass.

Electrons in an atom can be found in electron cloud surrounding the nucleus. Each energy level has different kinds of sublevels and each sublevel has different numbers of orbitals, each of which can hold 2 electrons. The s, p, d, f all have a different shapes and that is why they can each hold a different number of electrons.

In a neutral atom, the number of protons equals the number of electrons. An atom that has gained or lost electrons is called an ion. An atom will gain or lose electrons to achieve the electron configuration of the closest noble gas. Atoms do this by combining with other atoms or molecules. For example, sodium will lose 1 electron while reacting with chlorine, which will gain one electron.

The number of electrons lost or gained by an atom is called the oxidation number. Atoms that lose electrons are called cations and their oxidation number is positive. Atoms that gain electrons are called anions and their oxidation number is negative. Groups of atoms that are bonded together and carry a charge are called polyatomic ions.

The periodic table depicts the 91 naturally-occurring elements and several synthetic elements. Elements are arranged in rows by increasing atomic number and in columns by similar chemical properties. Rows are called periods and columns are called groups. All elements in the same group have the same number of valence electrons and that is why they have similar chemical properties. The period number tells us the energy level for the valence electrons of that element. Valence electrons are the number of electrons in the s and p orbitals at the highest energy level for that element. All elements to the left of the staircase are metals (except hydrogen).

In order to achieve stable electron configurations, elements will combine with each other to form compounds. Compounds can be either ionic or molecular. Ionic compounds have at least one metal element in them and are solids at RT. All chemical reactions follow laws of conservation of mass and matter. The total mass of the reactants must equal the total mass of the products. The total number of atoms of each element on the reactant side must equal the total number of atoms of each element on the product side.

Chemical bond formation is exothermic (releases energy). Chemical bond breaking requires the absorption of energy and is endothermic. There are 4 types of chemical bonds. The ionic bond forms when a metal atom transfers one or more valence electrons to a non-metal atom. The covalent bond forms when an atom shares one or more valence electrons with another atom. These atoms are usually non-metals. The sharing of electrons may be equal or unequal. Covalent bonds that share equally are called non-polar covalent and bonds formed by unequal sharing are called polar covalent. The metallic bond forms between metal atoms. The valence electrons are delocalized and shared over the entire structure. A quantitative way to determine the type of bond is to calculate the electronegativity difference between the atoms in the bond. The shape of a molecule can be determined using VSEPR theory. This theory states that lone pairs and bonded pairs of electrons around the central atom repel and take positions that minimize the repulsive force.

## Part II. Questions/Problems

1. Mixture or pure substance?
   a. Dr. Pepper mixture
   b. glucose ($C_6H_{12}O_6$) substance
   c. air mixture
2. Homogeneous or heterogeneous?
   a. unopened Dr. Pepper heterogeneous
   b. flat Dr. Pepper homogeneous
   c. an orange heterogeneous
3. Physical property or chemical property?
   a. shiny physical
   b. conducts electricity physical
   c. forms an oxide when exposed to oxygen chemical
4. Physical change or chemical change?
   a. digesting food chemical
   b. cooking steak chemical
   c. evaporating gasoline physical
5. Convert to scientific notation:
   a. 4,384.537 $4.384537 \times 10^{3}$
   b. 4,384, 000 $4.384 \times 10^{6}$
   c. 0.00000043840 $4.3840 \times 10^{-7}$
6. Convert to normal numbers
   a. $6.2308 \times 10^{5}$ 623,080
   b. $3.1400 \times 10^{-3}$ 0.0031400
7. Convert:
   a. 2573 mm to km $2.57 \times 10^{-3}$ km
   b. 803.5 cm to feet 26.4 ft
   c. 0.056 gallons to mL 212 mL

8. Write with 3 sig figs
   a. 129876 $1.30 \times 10^{5}$
   b. 3128.56 3130
   c. 0.00870034 0.00870

9. Determine the number of sig figs in:
   a. 0.0005600 4
   b. 11111110000000 7
   c. 202020202.202002 15
   d. 5.6700 x $10^{-4}$ 5

10. Calculate the following and report the answer with the correct number of sig figs:
    a. 45.0 + 655.098 700.098 → 700.1
    b. 46.8 x 6599 308833.2 → 309000
    c. 32.98 / 4.1 8.0439 → 8.0
    d. 63.41 – 25.432 37.978 → 37.98

11. A student determined that a 57.9 g metal cylinder has a volume of 38.32 $cm^3$. What is the density of the metal cylinder. 1.51 $g/cm^3$

12. Diamond had a density of 3.52 $g/cm^3$. What is the volume of a diamond with a mass of 115,g? 32.7 $cm^3$

13. Write the two ways of writing an isotope of Boron with 5 neutrons. $^{10}_{5}B$ Boron-10

14. What is the mass of 78.6 mL of isopropyl alcohol (d=0.89 g/mL)? 70.0 g

15. Determine the number of protons, neutrons and electrons in a neutral atom of silicon-29. p=14, n=15, e=14
16. Europium has two naturally-occurring isotopes: europium-151 with an abundance of 47.82% and europium-153 with an abundance of 52.18%. Determine the average atomic mass for europium.
    152.0436 amu
17. Put these scientists in timeline order:
    Bohr, Chadwick, Dalton, Democritus, Rutherford, Thompson
    6 5 2 1 4 3
18. Identify the contribution of each:
    a. Bohr planetary model
    b. Chadwick discovered neutron
    c. Rutherford nuclear model, discovered proton, discovered nucleus
    d. Thompson plum pudding model, discovered electrons

19. What is a mole? SI unit for the amount of a substance, 1 mol = $6.02 \times 10^{23}$ atoms, molecules, F. units

20. Determine how many atoms are in 332 g of gold? $1.01 \times 10^{24}$ atoms gold

21. What is the molar mass of lead? 207.2 g/mol

22. Determine the number of moles in 2.65 kg of lead. 12.8 mol Pb

23. Determine the mass of 0.52 moles of lead. 108 g Pb

**Part III**

1. Arrange in correct time order:
   Bohr model, Rutherford model, plum-pudding model, quantum-mechanical model
   Plum-pudding, Rutherford model, Bohr, quantum-mechanical

2. Consider the following electron configuration: $1s^2 2s^2 2p^6 3s^2 3p^4$
   a. What is the highest energy level? 3
   b. How many electrons are in the 2p level? 6
   c. How many valence electrons? 6
   d. What element is this? Sulfur (S)

3. Complete the table below.

| Energy Level | 1 | 2 | | 3 | | | 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| sublevels | s | s | p | s | p | d | s | p | d | f |
| # of orbitals | 1 | 1 | 3 | 1 | 3 | 5 | 1 | 3 | 5 | 7 |
| total # of electrons at that sublevel | 2 | 8 | | 18 | | | 32 | | | |

4. Write the complete electron configuration for potassium.
   $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$
5. Write the shorthand(noble-gas) configuration for silver.
   $[Kr]5s^2\ 4d^9$
6. What sublevel are the transition metals in the $6^{th}$ period filling
   5d
7. The last electron for a halogen in the $4^{th}$ period goes where?
   4p
8. Metal or non-metal?
   a. strontium Metal
   b. boron Non-metal
   c. antimony metal
   d. arsenic non-metal

9. What is the number of valence electrons for
   a. alkalis 1
   b. alkaline earth 2
   c. halogens 7
   d. noble gases 8 (except for Helium which has 2)

10. Which group?
   a. most reactive metal alkali (1)
   b. non-reactive Noble gases (18)
   c. most reactive non-metals halogens (17)
   d. mainly gases noble gases (18)

11. Which is bigger?
   a. Mg or Sr Sr
   b. Mg or S Mg

12. Which has higher ionization energy?
   a. Mg or Sr Mg
   b. Mg or S S

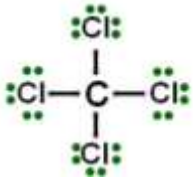
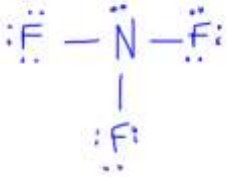
13. Which is more electronegative?
   a. Mg or Sr Mg
   b. Mg or S S

14. Write the ion
   a. K or $K^+$ K
   b. Cl or $Cl^-$ $Cl^-$

15. Write the formula
   a. barium hydroxide $Ba(OH)_2$
   b. chromium (III) sulfide $Cr_2S_3$
   c. diphosphorous pentoxide $P_2O_5$
   d. potassium phosphate $K_2PO_4$

16. Write the name
   a. $CuCO_3$ copper (II) carbonate
   b. $K_2S$ potassium sulfide
   c. $S_3Cl_5$ trisulfur pentachloride
   d. $MgSO_4$ magnesium sulfate
   e. $Na_2O$ sodium oxide

17. Draw the Electron Dot and Lewis structures:
   a) C
   b) $Br_2$
   c) $CCl_4$
   d) $NF_3$
   e) KCl


18. Determine the molecular shape. Which is non-polar?
   a) $H_20$ angular/bent (polar)
   b) $BF_3$ trigonal planar (Non-polar)
   c) $N_2$ linear (non-polar)
   d) $PBr_3$ trigonal pyramidal (polar)