Chemistry – 2014-2015

Utica Community Schools – Semester One Review

Directions:

- You must bring a pencil and calculator to the exam.
- You will be given a periodic table.
- If you complete the entire review sheet by the day of your exam you will be eligible for the curve should one be applied.
- The answers to this review must be on a separate sheet of lined paper. You will first see the objective of each question followed by the question itself. The question is what you are providing the answer to.

Objectives and Questions:

Chapter 1: Thinking a Like a Scientist

1) The labs you do help you process and analyze information. They also teach you how to design labs. Be aware of how lab design works. Think critically about the errors that can occur.
    a. Why we do need multiple trials? Constants? Controls? Variables? Hypotheses?
    b. Define accuracy and precision. It is possible to collect data that is both accurate and precise? Is it possible to collect data that is precise but not accurate?
    c. What can you do when you run a lab to eliminate errors? Please make sure to refer to the equipment, the variables, and the materials used for the lab.
    d. Can theories be modified? How has the atomic theory been modified over time?

Chapter 2: Antacids

1) Know how to identify a compound as an ionic or covalent compound. Covalent compounds are also referred to as molecular compounds.
    a. What types of elements are in binary ionic compounds? Covalent Compounds (also called binary molecular compounds)?
    b. Circle the following formulas that represent ionic compounds. Put a box around those that are covalent/molecular.

NO_2 NaCl $BaCl_2$ CH_4 $PbSO_4$ H_2O_2 Fe_2O_3 $(NH_4)_2CO_3$ PH_3

2) Know how to write the names and formulas for ionic compounds, covalent compounds, acids and bases.
    a. Write the names for the following compounds:
        i. S_4O_6 iii. H_2S v. KOH vii. $Mg(CN)_2$
        ii. $Fe_3(PO_4)_2$ iv. HNO_3 vi. CO viii. HNO_2
    b. Write the formulas for the following compounds:
        i. Silicon dioxide v. potassium fluoride
        ii. Phosphoric acid vi. cesium hypochlorite
        iii. Lithium sulfite vii. Hydrochloric acid
        iv. Tricarbon octahydride viii. Iron (II) oxide
    c. Why do certain compounds require a roman numeral? What block of elements requires them?
3) Be able to predict the products of an acid and base reaction. Know what pH is and how to classify a solution as acidic, basic or neutral. Be familiar with common methods of pH detection.
    a. Based on the following pH's, classify the solutions as acidic, basic, or neutral:
        i. pH = 2 ii. pH = 9.8 iii. pH = 7
    b. List two properties each for acids and bases. Examples include taste, what ion they create, feel, and ability to react with a metal…
    c. What is more acidic, a solution with a pH of 2 or 5? Which is more basic, a pH of 8 or 14?

Chapter 2: Antacids (continued)

d. Indicators, pH Paper and Probes
    i. There are several laboratory techniques for identifying an acid from a base. What are the three methods of detection? Which one is the most accurate?
e. True or False: When an acid reacts with a base in a neutralization reaction, a salt and water form.
f. What are the products of a reaction between nitric acid and lithium hydroxide? What general type of reaction is this? What is the general format for this reaction type?
g. Why is baking soda used to neutralize burns from acids?

4) Know how to balance equations with coefficients, how to translate the word equation to a balanced equation with proper formulas.
    a. Balance the following equations:
        i. $Al + Br_2 \rightarrow AlBr_3$
        ii. $Zn + HCl \rightarrow ZnCl_2 + H_2$
        iii. $H_2O_2 \rightarrow H_2O + O_2$
        iv. $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$
        v. $CrBr_3 + KNO_3 \rightarrow KBr + Cr(NO_3)_3$
    b. What is the Law of Conservation of Matter? How does balancing an equation relate to this law? Draw a picture of a single molecule of hydrogen gas reacting with a single molecule of fluorine gas forming 2 molecules of hydrofluoric acid. Clearly state how this picture obeys the law of conservation of matter.
5) How can you recognize the general format of a double replacement (neutralization) reaction?

Chapter 3: Airbags

1) Be able to define and list examples of chemical change, physical change.
    a. Determine if the following is a physical or chemical change:
    Melting ice, igniting a candle, tearing paper, rusting car, dissolving sugar, reacting an acid with a base
    b. What is happening at the molecular level during a chemical change? Draw a picture of the reaction of hydrogen gas plus oxygen gas to form water. Draw a picture of these molecules showing change. Describe how you know a chemical change has occurred.
2) Know how to describe each of the states of matter in terms of the strength of their attractive forces, their range of motion, their shape, volume and capacity to flow.
    a. Which two states of matter can flow?
    b. Which two states of matter have definite volume? Indefinite shape?
    c. Which two states of matter are the condensed states of matter (Have particles that touch)?
    d. List the three states of matter in order of increasing intermolecular (attractive) forces.
    e. Characterize the motion allowed in the solid state? In the gas state? Why are they different?
    f. Which state of matter can be classified as the most ordered? Least ordered?
    g. Compare the molecular motion of 2 liquids, one having larger particles than the other.
3) Use kinetic theory to describe gases, liquids and solids and use the Gas Laws to solve gas related problems.
    a. Which state of matter is best described as having closely packed particles in fixed positions?
    b. Which state of matter is best described as having particles that are completely separated with random motion?
    c. Write the equations for the relationships listed below:
        i. Pressure and Volume
        ii. Pressure and Temperature
        iii. Volume and Temperature

Chapter 3: Airbags (continued)

d. Solve for an unknown gas variable using the combined gas law.
   i. A gas collected at 275K exerts a pressure of 1.5 atm when it is in a container. How much pressure will the gas exert if the temperature is raised to 278K.

e. What happens to the pressure of a gas if the temperature is increased in a constant volume container? What could happen if you left a bottle of hairspray in the trunk of a car on the hottest of days? Explain why this would happen on the particle level.

f. What happens to the volume of a gas if it is heated? How are volume and temperature related? If one goes up the other _____?
   i. Using the picture below as evidence, construct a graphic relationship between volume and temperature of a confined gas. Put Temp on the y and volume on the x. .

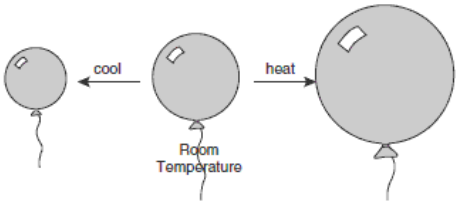
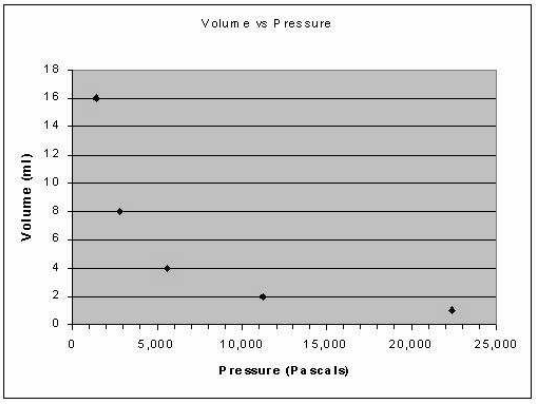


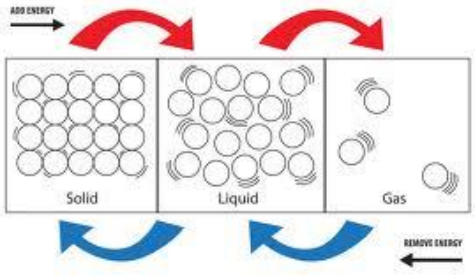
Figure 8.4 Volume–temperature relationship for gases.

g. Use the graph below to answer the following questions:



   i. What does this graph show about the relationship between volume and pressure?
   ii. Finish this statement: When the volume of a gas decreases, the pressure _____?
   iii. Would the particles be closer or farther apart when the volume decreases?

4) Be able to describe the three states of matter according to their order or entropy or chaos:



a. How does this model demonstrate to the reader that solids are more organized than liquids and gases?

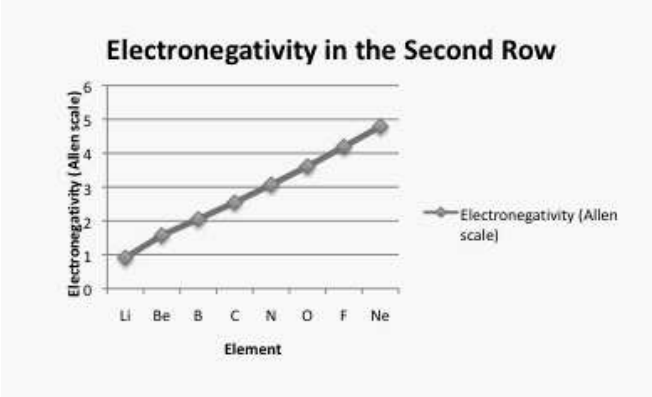
Chapter 4: Glowing Things

1) Know the location and properties of all three major subatomic particles (p^+,n^o,e^-) found on each atom.
    a. What two subatomic particles are found in the nucleus? Describe the nucleus.
    b. Where are electrons located?
    c. Which two particles contribute to the atom's mass? What particle is the atomic number?
    d. All atoms of the same type of element have the same number of which particle?
    e. What must be true for an atom to be considered neutral in charge? How many protons does an atom of boron ALWAYS have?
    f. What particles are attracted to each other? What particles repel? What holds these particles together?
    g. What is the strong force within the atom? Where does it occur? Why is it necessary?
2) Know how to properly classify an element and its reactivity based on its location on the periodic table.
    a. Name and write the symbol of 2 Nonmetals, One semimetal, and 2 metals
    b. Give the family name of Group I, Group 2, Group 17, Group 18. Name one element from each of these families.
    c. Why are elements that are placed in the same column called a family or a group? Which elements would have the same chemical properties as Krypton?
    d. What type of compounds form between metals and nonmetals? Between a Group 1 and a Group 7?
    e. What are the common ion charges of Groups 1,2,13,14,15,16,17,18 (AKA Groups 1A-8A)?
    f. Where are the representative elements? Where are the transition metals?
3) Know how to write electron configurations for elements of Periods 1-4.
    a. Write the electron configuration for the following elements: Iron, Magnesium, and Fluorine.
    b. Write the abbreviated configuration for the elements in part a.
    c. Identify the elements having the following electron configurations:
        i. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$
        ii. [Ne] $3s^2 3p^5$
        iii. Outer Configuration of $3s^1$
4) Know the trends of the periodic table such as atomic size, electronegativity, ionization energy and ionic size.
    a. Define electronegativity. What element has the highest electronegativity? What is the group trend for electronegativity and the period trend for electronegativity?
    b. How is the current periodic table arranged today? Is it based on Atomic Mass or Atomic Number?
    c. Define atomic radius. List the group and periodic trends for atomic size/radius.
    d. Make predictions about an elements radius, ionization energy or electronegativity based on your knowledge of the trends.
        i. Based on the values for sodium below would magnesium's radius be higher or lower then sodium's? Would Magnesium's ionization energy be higher or lower then sodium's?

Element	**Atomic Radius In Distance Units**	**Ionization Energy In Energy Units**
Sodium	132	256

5) Based on periodic trends and the data from the table above, which of the following are the most probable values of the atomic radius and the ionization energy for potassium?

   a. Know how to interpret the trend graphically.
      i. Scientists studied the ionization energy of the second row elements on the periodic table. They found that generally ionization energy increases across the row, as is the case for most rows of the periodic table. They also studied electronegativity, and found that the <u>electronegativity generally increases from left to right across the row</u> as a result of greater nuclear pull. How does the graph prove this trend in electronegativity of elements in the second row?



6) Be familiar with the terms mass number, atomic number, nuclei symbol and charge. Know how to determine the number of subatomic particles present on an atom based on these terms. Know various ways of representing isotopes of an atom.
   a. Determine the mass number, atomic number, proton, neutron and electron count for each Mg:

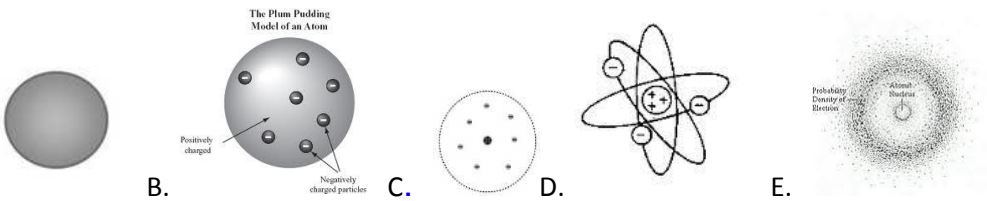
$$^{24}_{12}Mg \qquad ^{26}_{12}Mg^{2+}$$

   b. Write a nuclei symbol, like the ones shown above, for an element with 10 protons, 12 neutrons and 10 electrons. Is this atom neutral? How can you tell?
   c. Write a nuclei symbol for lithium – 7. What does the number after the hyphen tell you?

7) An atom has a mass number of 23 and an atomic number of 11. How many p^+, n^o,and e^-'s are on this atom.

8) Know how to describe the most current model of atom. Be familiar with the shapes of the orbitals of s & p.
   a. Describe the Quantum Mechanical Model of the atom. Is it based on knowing the actual location of the electron or is based on probability?
   b. True or False: The atom is mostly empty space with a small, dense, positive nucleus.

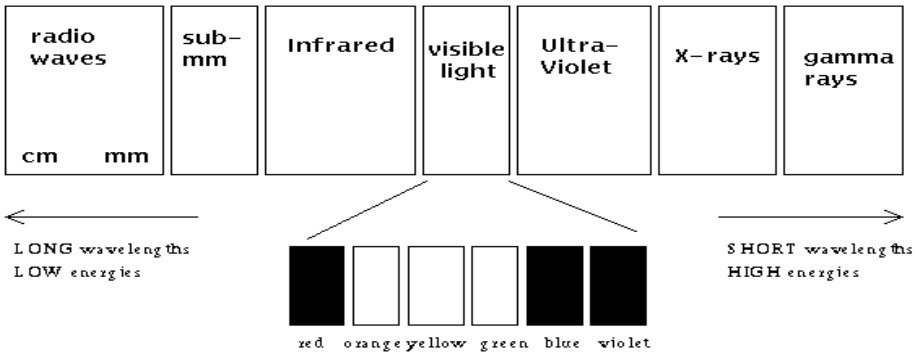
9) Be able to analyze the changing model of the atom over time as a model of the dynamic (changing) nature of science:
   a. Compare model A to model B to model C, D and E. How are they different? How are they alike? What discoveries allowed for a modification of the original model? What model is the most current model of the atom? Who is responsible for model D? What do model D and E have in common with respect to the electrons?



A. B. C. D. E.

Chapter 4: Glowing Things (continued)

10) Understand flame tests and what they have taught us about the atom. Know, how the color emitted relates to the energy of the electron's jump.



a) A student does a flame test on three compounds A, B and C. Which flame represents the emission of an electron at the highest energy state? The following results were obtained:
   i. Compound A creates a Red flame
   ii. Compound B creates a Yellow flame
   iii. Compound C creates a Violet flame

b) Copper produces a green flame test. When is the green light emitted: when the electron moves UP to the excited state or when it moves DOWN to the ground state?

c) Why do different atoms produce different flame test colors?

11) What is true of the relationship between wavelength and frequency based on the picture below? As wavelength increases, frequency _____?