Chemistry Semester One Review- 2014-15

1) Be familiar with properties of matter we have studied. Be familiar with their definitions and how they are used. Which ones are always the same for a substance? (See list below.)

2) What units can be used to measure the following quantities?
   - i) Volume
   - ii) Mass
   - iii) Density
   - iv) Pressure
   - v) Amount
   - vi) Heat
   - vii) Temperature
   - viii) Specific Heat
   - ix) Molar Mass
   - x) Boiling point
   - xi) Melting point
   - xii) Freezing point

3) Know size of metric prefixes and how to convert between them.

4) Identify which metric prefix is appropriate for different situations.

5) Ex: Mass of a paperclip would be measured in grams. The mass of a person would be measured in kilograms

6) Distance to Milwaukee would be measured in kilometers vs. the length of a cell phone would be measured in centimeters.

7) Significant Figures
   a) You should know how many sig figs are in a measurement
   b) You should also know how many to report in your answers to multiplication and division problems.
   c) What kinds of numbers have infinite significant figures (are exact numbers)?

8) You should be able to work with numbers in scientific notation and convert them between standard notation and scientific notation

9) What is an absolute temperature? What units measure absolute temperature? When is it important to use an absolute temperature?

10) We have spent time this year talking about what goes on with the atoms/molecules/ions in chemistry. You should be able to interpret, create, and explain particle pictures illustrating

11) The differences between solids, liquids, and gases.

12) The differences between elements, compounds, and mixtures.

13) Know what energy is and how it is measured.

14) Explain and illustrate what happens to a gas
   a) It is heated at constant pressure
   b) If the pressure is increased at constant temperature
   c) If the number of moles increases at constant pressure
   d) Ex: What happens when a flexible container is heated? (Assume the container doesn't melt or rupture.) How is heating a rigid container different?
   e) Interpret a diagram of a gas
      i) Ex: If the Kelvin temperature in the right box is double the temperature on the right, use arrows to show the difference in temperature.
      ii) If the number of particles in the left container is doubled and the temperature is constant, which of the gases would have a higher pressure and why?

15) We have spent time working on graphical relationships. You should be able to interpret the following different kinds of graphs
   a) Density (m vs.V)
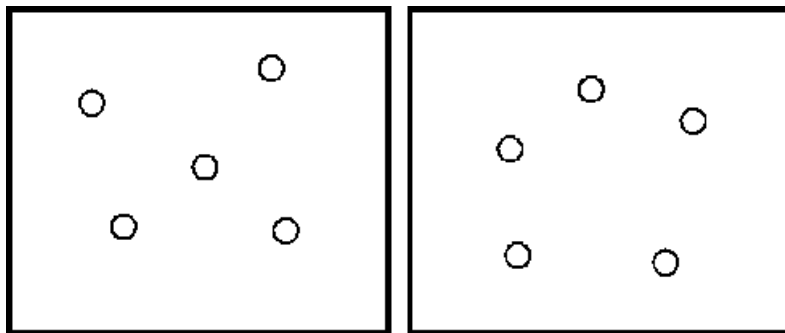
i) Calculate the density of a substance from a graph.
ii) Compare different substances on a m vs V graph.
iii) Calculate m,V or D using a graph or equation.
16) Gas Laws recognize which relationships are direct and inverse and identify the shapes of the graphs.
   a) Direct
      i) P vs. T   ii) P vs. n   iii) V vs. T   iv) V vs. n
   b) Indirect
      i) P vs. V
   c) Use these relationships to predict changes in a gas
      i) Ex. If the pressure of a gas is doubled the volume will _____.
      ii) If I initially have 4.0 L of a gas at a pressure of 1.1 atm, what will the volume be if I increase the pressure to 3.4 atm?
      iii) A toy balloon has an internal pressure of 1.05 atm and a volume of 5.0 L. If the temperature where the balloon is released is 200 C, what will happen to the volume when the balloon rises to an altitude where the pressure is 0.65 atm and the temperature is –150 C?
      iv) Calcium carbonate decomposes at 1200^0 C to form carbon dioxide and calcium oxide. If 25 liters of carbon dioxide are collected at 1200^0 C, what will the volume of this gas be after it cools to 25^0 C?
      v) A small research submarine with a volume of 1.2 x 105 L has an internal pressure of 1.0 atm and an internal temperature of 150 C. If the submarine descends to a depth where the pressure is 150 atm and the temperature is 30 C, what will the volume of the gas inside be if the hull of the submarine breaks?
17) Other things about gases
   a) Understand how a manometer is used to measure gas pressure.
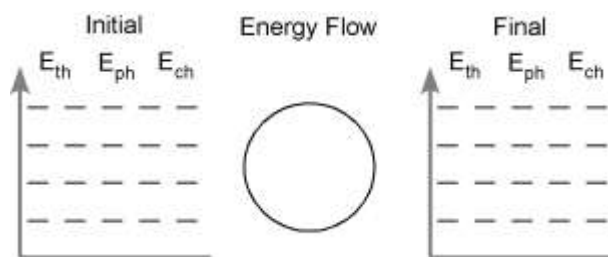   b) What is standard temperature and pressure
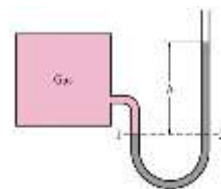
18) Understand the kinds of energy we studied.
   a) Thermal Energy
   b) Phase Energy
   c) Chemical Energy
19) Be able to diagram a situation to describe energy changes
   a) Ex: Some of the water you spilled on your shirt evaporates.
20) Phases of matter
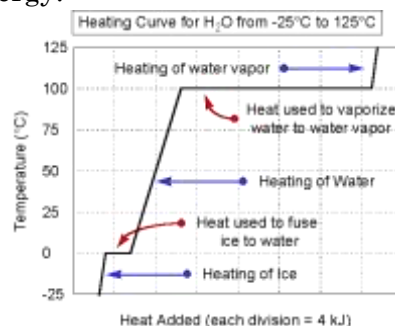   a) Describe phases of matter at the observable and particle level

Initial   Energy Flow   Final
E_{th} E_{ph} E_{ch} E_{th} E_{ph} E_{ch}

   b) You need to be able to relate the observable properties of each phase of matter to a particle level explanation.
      i) EX: Why are gases compressible and solids and liquids are not?
21) When heating a substance that is either changing phases or not changing phase,
   a) Describe what is happening to the particles in terms of spacing (potential energy) and average kinetic energy.
   b) Describe the situation in terms of thermal and phase energy.
22) Draw a graph illustrating the relationship between energy in and temperature as something changes phases.
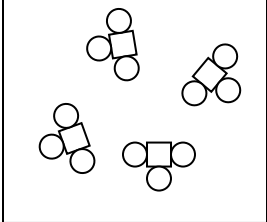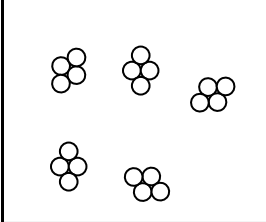   a) Identify which phases are present on an unlabeled graph
   b) identify the melting point/freezing point and boiling point of a substance.
   c) Identify when a phase change is occurring.

Heating Curve for H₂O from -25°C to 125°C

Heating of water vapor

Heat used to vaporize water to water vapor

Heating of Water

Heat used to fuse ice to water

Heating of Ice

Heat Added (each division = 4 kJ)

23) Relate the graph to what is happening on the particle level (Average KE and spacing)
   a) You should be able to describe the difference between heat and temperature.
   b) What do objects at the same temperature have in common?
   c) How does specific heat affect the rate of heating and cooling?
24) You should be able to use $q=mc\Delta T$ to calculate heat, mass, specific heat or temperature.
   a) How much heat energy would be required to raise the temperature of 125 g of ethanol ($C_p= 0.58$ cal/g°C) from 25.0°C to 51.0°C?
25) Draw a particle level picture of a sample of matter that shows the following

a mixture of molecules	atoms of an elemental metal	molecules of an element	a solid compound	a mixture of elements

26) Dalton's Atomic Theory and Laws of Chemistry
   a) Law of conservation of mass is evidence that matter is made of atoms
   b) Atoms of the same element are the same
   c) Law of definite proportions and law of multiple proportions are evidence that atoms are combined in fixed ratios to form compounds.
   d) Avogadro's law and law of conservation of matter is evidence that atoms combine in patterns to form molecules of compounds.
27) What are the differences between how you separate a mixture and a compound?
28) What is the law of definite proportions? How can it be used to identify if something is a compound or not?
29) Understand what a chemical formula means. Be able to go from a drawing to a formula and the reverse.

30)

31)

32) What is the formula if the square is and N and the circles are H's?	33) What is the formula assuming that the circles above are P atoms?

34) What is a mole and why is it useful in chemistry?
35) Be able to calculate a relative mass.
   a) What atom of the periodic table is 2x the mass of a carbon atom?
   b) What atom is 9 times heavier than a hydrogen atom?
   c) If you had two balloons with the same volume, one with hydrogen and one with carbon dioxide, what would be the same about the balloons, number of particles or mass? Which would sink and which would float, why? What would the relative mass of the balloons be?
   d) A mole of aluminum and a mole of iron are sitting in separate containers. What is the same and what is different about those samples?
   e) If you have 5 g of Fe and 5 g of Al, which sample would have the most atoms?

36) What is the meaning of the masses present on the periodic table? What do all the masses have in common?
37) Know what a molar mass is and how to calculate it.
38) Should be able to convert form g→ moles using molar mass
   a) 30 grams of H_3PO_4
   b) 25 grams of HF
   c) 4 moles of $Cu(CN)_2$
   d) 5.6 moles of C_6H_6
39) Should be able to convert form g→ moles →# of particles
   a) How many molecules are there in 24 grams of FeF_3?
   b) How many grams are there in 2.3 x 10^{24} atoms of silver?
40) Percent composition (by mass)
   a) Calculate the percent by mass of phosphorus and chlorine in phosphorus trichloride (PCl_3).
   b) A form of phosphorus called red phosphorus is used in match heads. When 0.062 g of red phosphorus burns in air, and uses 0.080 grams of oxygen from the air to make a compound of phosphorus oxide. What is the percent composition of the compound?
41) Empirical and Molecular Formulas
   a) What does the word empirical mean?
   b) What is the difference between an empirical and a molecular formula?
   c) Determine the empirical formula of a compound that contains 36.5% sodium, 25.4% sulfur, and 38.1% oxygen.
   d) A compound that contains carbon, oxygen, and hydrogen has the percent composition of 40.0g carbon, 6.7g hydrogen, and 53.3 g oxygen. What is the empirical formula for this compound