IB Chemistry SL – Summer Assignment – 2014

Welcome to the IB Program and IB Chemistry SL! This summer assignment is designed as a review of the major concepts from Honors Chemistry that will be developed further in IB Chemistry SL. In addition to developing your knowledge of advanced chemical concepts, you will also explore chemical relationships through designing and performing labs. You will take a test over these review topics during the second week of school. Please take the time to carefully go through these topics, review the concepts, and memorize the necessary material, or you will not be prepared for this course. IB Chemistry SL is designed to prepare you for the IB Chemistry SL Exam in May 2015 – this course will not adequately prepare you to take the AP Chemistry Exam. A list of internet sites has been provided below to help guide your review.

Supply List: Please purchase the following supplies prior to the first day of class.

- Graphing calculator
- Ruler
- 1.5 inch three-ring binder
- 13 dividers
- Notebook paper
- Blue or black pens
- Pencils
- I also strongly encourage you to purchase a study book for the IB Chemistry Exam. I recommend (however, you may purchase a different one): IB Chemistry: Study Guide: Oxford IB Diploma Program (Paperback), by Geoffrey Neuss, Publication Date: November 17, 2012, ISBN-10: 0198390025, ISBN-13: 978-0198390022, Edition: 2

Internet Sources:

Khan Academy Chemistry: https://www.khanacademy.org/science/chemistry
ChemGuide – UK (very helpful throughout the year, as it is specific to IB Chemistry): http://www.chemguide.co.uk/
Chemistry Lectures: http://www.chemtopics.com/lectures.htm

Content to Memorize:

- Elements: memorize the names & symbols for elements with the following atomic #'s (1-38),(45-57),(78-89), 92
- Polyatomic Ions: You must know the formula and charge for each

-1		-2	
Acetate	CH_3COO^{-1} or $C_2H_3O_2^{-1}$	Carbonate	CO_3^{-2}
Bromate	BrO_3^{-1}	Chromate	CrO_4^{-2}
Chlorate	ClO_3^{-1}	Oxalate	$C_2O_4^{-2}$
Chlorite	ClO_2^{-1}	Peroxide	O_2^{-2}
Cyanide	CN^{-1}	Sulfate	SO_4^{-2}
Hydrogen carbonate or Bicarbonate	HCO_3^{-1}	Sulfite	SO_3^{-2}
Hydroxide	OH^{-1}	-3	
Hypochlorite	ClO^{-1}	Borate	BO_3^{-3}
Iodate	IO_3^{-1}	Citrate	$C_6H_5O_7^{-3}$
Nitrate	NO_3^{-1}	Phosphate	PO_4^{-3}
Nitrite	NO_2^{-1}	Phosphite	PO_3^{-3}
Perchlorate	ClO_4^{-1}	+1	
Permanganate	MnO_4^{-1}	Ammonium	NH_4^{+1}

- Charges of Groups 1, 2, 3, 5, 6, and 7 on the periodic table
- Strong Acids (as required for IB): HCl, HNO_3, H_2SO_4
- Strong Bases (as required for IB): NaOH, KOH, RbOH, $Ba(OH)_2$
- SI Units:

Property	Unit	Symbol
Mass	kilogram	kg
Time	second	s
Temperature	Kelvin	K
Volume	cubic meter	m^3
Pressure	Pascal	Pa

Vocabulary: Use a trusted source on the internet and/or your Honors Chemistry notebook to define the following terms in your own words. Create a note card for each term.

1) Element
2) Atom
3) Compound
4) Proton
5) Neutron
6) Electron
7) Isotope
8) Ion
9) Half-life
10) Relative atomic mass
11) Period (as on the periodic table)
12) Group (as on the periodic table)
13) Transition elements
14) Alkali metals
15) Alkaline earth metals
16) Halogens
17) Noble gases
18) Ionization energy
19) Atomic radius
20) Electronegativity
21) Melting point
22) Boiling point
23) Ionic bond
24) Covalent bond
25) Cation
26) Anion
27) Conductivity
28) Avogadro's constant (number)
29) Molecular Formula
30) Empirical Formula
31) Sublimation
32) Reactants
33) Products
34) Solute
35) Solvent
36) Solution
37) Precipitate (as in chemistry)
38) Molarity
39) Aqueous
40) Saturated
41) Unsaturated
42) STP
43) Enthalpy
44) Exothermic reaction
45) Endothermic reaction
46) Hess's Law
47) Kinetic Molecular Theory
48) Catalyst
49) Equilibrium
50) Le Chatelier's Principle
51) Titration
52) Strong Acid
53) Weak Acid
54) Conjugate Acid
55) Conjugate Base
56) Bronsted-Lowry Acid
57) Bronsted-Lowry Base
58) Lewis Acid
59) Lewis Base
60) pH
61) Amphoteric
62) Neutralization reaction

Quantitative Chemistry: Solve the following problems, showing all of your work. Include units and the appropriate number of significant figures in your answers. If you are struggling, use the internet sources provided above to review.

1) Convert 4,672,000,000 into scientific notation.
2) Convert 0.000005210 into scientific notation.
3) Convert 50.0 g to milligrams.
4) Convert 150. mL to liters.
5) How many significant figures are in the number 4.0070×10^{12}?
6) An object has a mass of 40.1g and occupies a volume of 8.20 mL. What is the density of the object?
7) Calculate the percent yield if 28.0g of $MgCl_2$ is produced, but 32.0g of $MgCl_2$ should have been produced.
8) How many atoms are in 52.4g of nickel?
9) 6.00g of water contains how many moles of water?
10) What is the molar mass of methane?
11) How many hydrogen atoms are in 3.0 moles of ethanol, C_2H_5OH?
12) What is the empirical formula of glucose, $C_6H_{12}O_6$?
13) A compound with an empirical formula of CH_2 has a molecular mass of 42.09. What is its molecular formula?
14) A compound of nickel has a mass composition of 37.9% nickel, 20.7% sulfur, and 41.4% oxygen. What is its empirical formula?
15) Aluminum and iron(III) oxide react to form iron and aluminum oxide. What mass of iron is produced from the reaction of 21.4g of aluminum and 91.3g of iron(III) oxide? What is the limiting reactant? What is the excess reactant?
16) What volume of nitrogen forms when 100. g of ammonia, NH_3, decomposes completely into its elements at STP?
17) A helium party balloon has a volume of 12.0L. At room temperature (25°C) the internal pressure is 1.05atm. Calculate the number of moles of helium in the balloon.
18) The gas left in a used aerosol can is at a pressure of 1.00atm at 27.0°C. If this can is thrown into a fire, what is the pressure of the gas when its temperature reaches 927 °C?
19) The volume of a gas is 20.0L at 275K and 92.1kPa. Find its volume at STP.

20) A solution is made by dissolving 17.0g of lithium iodide in enough water to make 387mL of solution. What is the molarity of the solution?
21) What volume of 18.0M sulfuric acid is required to prepare 16.5L of 0.126M sulfuric acid?
22) Calculate the $[OH^-]$ in a solution that has a pH of 3.70.
23) A solution has a pH of 4.37. What is the $[H^+]$ in the solution?
24) A 100.0g sample of N-16 decays to 12.5g in 30.0 seconds. What is the half-life of N-16?
25) A 15.6g sample of ethanol absorbs 868J of heat. If the initial temperature of the ethanol was 21.5°C, what is the final temperature of the ethanol?
26) Given the following two reactions and corresponding enthalpy changes,

I. $2C_{(s)} + O_{2\,(g)} \longrightarrow 2CO_{(g)}$ $\Delta H = -221.0$ kJ

II. $2H_{2\,(g)} + O_{2\,(g)} \longrightarrow 2H_2O_{(g)}$ $\Delta H = -483.6$ kJ

Compute the change in enthalpy for the following reaction.

$H_2O_{(g)} + C_{(s)} \longrightarrow CO\,(g) + H_{2(g)}$ $\Delta H = ?$ kJ

Concept Review: Answer the conceptual questions below. If you don't remember a topic, use the internet sources provided above to review.

1) Determine the number of protons, neutrons, and electrons for each:
    a. Sulfur
    b. Chloride
    c. Calcium ion
    d. ^{127}I
2) Which is larger? Ca or Ca^{+2} Why?
3) Which is larger? F or F^{-1} Why?
4) Why is sodium larger than chlorine?
5) Why is fluorine smaller than iodine?
6) Why does it take less energy to remove an electron from Potassium than from Bromine?
7) List the following elements in order from smallest to largest electronegativity: Magnesium, Sulfur, Francium
8) Write full length electron configurations for Na, Al, and Cl^{1-}
9) Draw dot diagrams for Nitrogen and Fluorine.
10) Draw the Lewis structures for NH_3 and CO_2.
11) Write and balance chemical equations for:
    a. The combustion of methane
    b. The single replacement reaction of zinc and hydrochloric acid
    c. The neutralization reaction of sulfuric acid and sodium hydroxide
    d. The decomposition of dinitrogen pentoxide.
12) Endothermic reactions have a (negative/positive) ΔH, and the products are (more/less) stable than the reactants.
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14) Why are aqueous solutions of ionic compounds considered electrolytes?
15) Consider the following reaction: $N_{2(g)} + 3H_{2(g)} \leftrightarrow 2NH_{3(g)}$ $\Delta H = -93$ kJ/mol
    a. How would increasing the volume of the container affect the equilibrium? the value of K_{eq}?
    b. How would increasing the temperature affect the equilibrium? the value of K_{eq}?
    c. How would removing NH_3 affect the equilibrium? the value of K_{eq}?
16) Determine the conjugate acid-base pairs: $H_2SO_3 + H_2O \leftrightarrow HSO_3^{-1} + H_3O^{+1}$
17) Label each as a Lewis acid or Lewis base: BF_3, NH_3