Welcome to the IB Program and IB Chemistry HL! This summer assignment is designed as a review of the major concepts from Honors Chemistry that will be developed further in IB Chemistry HL. In addition to developing your knowledge of advanced chemical concepts, you will also explore chemical relationships through designing and performing labs. You will be required to turn in this assignment on the first day back to school; you will also take an assessment over these review topics during the second week of school. During the first two weeks of class, we will briefly review this material and cover IB specific changes to your chemistry knowledge. All of the material below was covered in Honors Chemistry and is the foundation we will use to master IB Chemistry HL. 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 HL is designed to prepare you for the IB Chemistry HL Exam in May 2021. 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
- 1.5 inch three-ring binder
- 13 dividers
- Blue or black pens
- Pencils
- Notebook paper


**Internet Sources:**
Khan Academy Chemistry: [https://www.khanacademy.org/science/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/](http://www.chemguide.co.uk/)
Chemistry Lectures: [http://www.chemtopics.com/lectures.htm](http://www.chemtopics.com/lectures.htm)

**Content to Memorize:** – Make sure you know this information very thoroughly.
- Elements: memorize the names & symbols for elements with the following atomic #’s (1-54)
- Polyatomic Ions: You must know the formula and charge for each

<table>
<thead>
<tr>
<th>Acetate</th>
<th>CH₃COO⁻² or C₂H₃O₂⁻¹</th>
<th>Carbonate</th>
<th>CO₃²⁻</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromate</td>
<td>BrO₅⁻¹</td>
<td>Chromate</td>
<td>CrO₄⁻²</td>
</tr>
<tr>
<td>Chlorate</td>
<td>ClO₃⁻¹</td>
<td>Oxalate</td>
<td>C₂O₄⁻²</td>
</tr>
<tr>
<td>Chlorite</td>
<td>ClO₂⁻¹</td>
<td>Peroxide</td>
<td>O₂⁻²</td>
</tr>
<tr>
<td>Cyanide</td>
<td>CN⁻¹</td>
<td>Sulfate</td>
<td>SO₄²⁻</td>
</tr>
<tr>
<td>Hydrogen carbonate or Bicarbonate</td>
<td>HCO₃⁻²</td>
<td>Sulfite</td>
<td>SO₃²⁻</td>
</tr>
<tr>
<td>Hydroxide</td>
<td>OH⁻¹</td>
<td>Borate</td>
<td>BO₃⁻³</td>
</tr>
<tr>
<td>Hypochlorite</td>
<td>ClO⁻¹</td>
<td>Citrate</td>
<td>C₆H₅O₂⁻³</td>
</tr>
<tr>
<td>Iodate</td>
<td>IO₃⁻¹</td>
<td>Phosphate</td>
<td>PO₄³⁻</td>
</tr>
<tr>
<td>Nitrate</td>
<td>NO₃⁻¹</td>
<td>Phosphite</td>
<td>PO₃⁻³</td>
</tr>
<tr>
<td>Nitrite</td>
<td>NO₂⁻¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perchlorate</td>
<td>ClO₄²⁻</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permanganate</td>
<td>MnO₄⁻²</td>
<td>Ammonium</td>
<td>NH₄⁺¹</td>
</tr>
</tbody>
</table>

- Charges of Groups 1, 2, 13, 14, 15, 16, and 17 on the periodic table.
- SI Units:

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>Symbol</th>
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</thead>
<tbody>
<tr>
<td>Mass</td>
<td>kilogram</td>
<td>kg</td>
</tr>
<tr>
<td>Time</td>
<td>second</td>
<td>s</td>
</tr>
<tr>
<td>Temperature</td>
<td>Kelvin</td>
<td>K</td>
</tr>
<tr>
<td>Volume</td>
<td>cubic meter</td>
<td>m³</td>
</tr>
<tr>
<td>Pressure</td>
<td>Pascal</td>
<td>Pa</td>
</tr>
</tbody>
</table>
Vocabulary: Use a trusted source on the internet to define the following terms in your own words, and give examples as appropriate. Create a note card for each term.

1) Element 21) Melting point 43) Enthalpy
2) Atom 22) Boiling point 44) Exothermic reaction
3) Compound 23) Ionic bond 45) Endothermic reaction
4) Proton 24) Covalent bond 46) Hess’s Law
5) Neutron 25) Cation 47) Kinetic Molecular Theory
6) Electron 26) Anion 48) Catalyst
7) Isotope 27) Conductivity 49) Equilibrium
8) Ion 28) Avogadro’s constant (number) 50) Le Chatelier’s Principle
9) Half-life 29) Molecular Formula 51) Titration
10) Relative atomic mass 30) Empirical Formula 52) Strong Acid
11) Period (as on the periodic table) 31) Sublimation 53) Weak Acid
12) Group (as on the periodic table) 32) Reactants 54) Conjugate Acid
13) Transition elements 33) Products 55) Conjugate Base
14) Alkali metals 34) Solute 56) Bronsted-Lowry Acid
15) Alkaline earth metals 35) Solvent 57) Bronsted-Lowry Base
16) Halogens 36) Solution 58) Lewis Acid
17) Noble gases 37) Precipitate (as in chemistry) 59) Lewis Base
18) Ionization energy 38) Molarity 60) pH
19) Atomic radius 39) Aqueous 61) Amphoteric
20) Electronegativity 40) Saturated 62) Neutralization reaction
21) Melting point 43) Enthalpy
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23) Ionic bond 45) Endothermic reaction
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37) Precipitate (as in chemistry) 59) Lewis Base
38) Molarity 60) pH
39) Aqueous 61) Amphoteric
40) Saturated 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, refer to your honors chemistry notebook and 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 x 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) How many atoms are in 52.4g of nickel?
8) 6.00g of water contains how many moles of water?
9) What is the molar mass of methane?

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. \(^{127}_{53}\)I
2) Which is larger? Ca or Ca\(^{2+}\) Why?
3) Which is larger? F or F\(^{-}\) 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 double replacement reaction of sodium hydroxide and potassium chloride.
   d. The decomposition of dinitrogen pentoxide.

Work hard to finish the assignment and have a wonderful, safe summer!