Hello,

I wanted to share the summer homework for those continuing in Chemistry after PreIB Chemistry. The purpose of this homework is so that you do not forget (or to remind you) certain skills that you covered in PreIB Chemistry.

A useful way to do this homework is to try the problems first. Then, if you want, I have attached a resource to use (although you may prefer a website that you have used recently). The questions do follow the chapter essentially in order for the chapter provided which is a review of key topics from this year. The source is an IB source (It says SL on the link but the SL and the HL chapter are identical for this concept) so molarity which is moles of solute/Liter of solution, M, which is a concentration term, is represented as moles of solute/decimeter of solution (which is the same as a liter). Reading is always great, but application is even better (trying problems). The old saying, you learn from your mistakes is so useful in this case. Once you try a problem, if you are not sure how to do it, then look it up. If you have to look it up, make your work color coded. Say, try the problem initially in pencil, then correct it or once you look it up if you are not sure, write this in say ink.. and so on. The different colors represent what you remember and then what you had to look up. Then in the future, the idea is to be careful and try to make the same mistakes. This allows you to own the topic and remember it better.

They will be due by the August the first day of school and a quiz will happen shortly after, once we have reviewed the material.

You can work on this now or wait closer to when school starts and then it becomes an assessment of what you remember. It will count as a grade of an A to start but it must be completed. It is optional but highly recommended so that you start the year in a good place. The Junior year is tough, so starting out in a good place is helpful. Have a great summer and if you ever have any questions, feel free to email me, I will check my email every couple of days.

Thanks In Advance and look forward to seeing you next year.

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The Periodic Table of the Elements

1 **H** Hydrogen 1.00794																	2 **He** Helium 4.003
3 **Li** Lithium 6.941	4 **Be** Beryllium 9.012182											5 **B** Boron 10.811	6 **C** Carbon 12.0107	7 **N** Nitrogen 14.00674	8 **O** Oxygen 15.9994	9 **F** Fluorine 18.9984032	10 **Ne** Neon 20.1797
11 **Na** Sodium 22.989770	12 **Mg** Magnesium 24.3050											13 **Al** Aluminum 26.981538	14 **Si** Silicon 28.0855	15 **P** Phosphorus 30.973761	16 **S** Sulfur 32.066	17 **Cl** Chlorine 35.4527	18 **Ar** Argon 39.948
19 **K** Potassium 39.0983	20 **Ca** Calcium 40.078	21 **Sc** Scandium 44.955910	22 **Ti** Titanium 47.867	23 **V** Vanadium 50.9415	24 **Cr** Chromium 51.9961	25 **Mn** Manganese 54.938049	26 **Fe** Iron 55.845	27 **Co** Cobalt 58.933200	28 **Ni** Nickel 58.6934	29 **Cu** Copper 63.546	30 **Zn** Zinc 65.39	31 **Ga** Gallium 69.723	32 **Ge** Germanium 72.61	33 **As** Arsenic 74.92160	34 **Se** Selenium 78.96	35 **Br** Bromine 79.904	36 **Kr** Krypton 83.80
37 **Rb** Rubidium 85.4678	38 **Sr** Strontium 87.62	39 **Y** Yttrium 88.90585	40 **Zr** Zirconium 91.224	41 **Nb** Niobium 92.90638	42 **Mo** Molybdenum 95.94	43 **Tc** Technetium (98)	44 **Ru** Ruthenium 101.07	45 **Rh** Rhodium 102.90550	46 **Pd** Palladium 106.42	47 **Ag** Silver 107.8682	48 **Cd** Cadmium 112.411	49 **In** Indium 114.818	50 **Sn** Tin 118.710	51 **Sb** Antimony 121.760	52 **Te** Tellurium 127.60	53 **I** Iodine 126.90447	54 **Xe** Xenon 131.29
55 **Cs** Cesium 132.90545	56 **Ba** Barium 137.327	57 **La** Lanthanum 138.9055	72 **Hf** Hafnium 178.49	73 **Ta** Tantalum 180.9479	74 **W** Tungsten 183.84	75 **Re** Rhenium 186.207	76 **Os** Osmium 190.23	77 **Ir** Iridium 192.217	78 **Pt** Platinum 195.078	79 **Au** Gold 196.96655	80 **Hg** Mercury 200.59	81 **Tl** Thallium 204.3833	82 **Pb** Lead 207.2	83 **Bi** Bismuth 208.98038	84 **Po** Polonium (209)	85 **At** Astatine (210)	86 **Rn** Radon (222)
87 **Fr** Francium (223)	88 **Ra** Radium (226)	89 **Ac** Actinium (227)	104 **Rf** Rutherfordium (261)	105 **Db** Dubnium (262)	106 **Sg** Seaborgium (263)	107 **Bh** Bohrium (262)	108 **Hs** Hassium (265)	109 **Mt** Meitnerium (266)	110 (269)	111 (272)	112 (277)	113	114				

58 **Ce** Cerium 140.116	59 **Pr** Praseodymium 140.90765	60 **Nd** Neodymium 144.24	61 **Pm** Promethium (145)	62 **Sm** Samarium 150.36	63 **Eu** Europium 151.964	64 **Gd** Gadolinium 157.25	65 **Tb** Terbium 158.92534	66 **Dy** Dysprosium 162.50	67 **Ho** Holmium 164.93032	68 **Er** Erbium 167.26	69 **Tm** Thulium 168.93421	70 **Yb** Ytterbium 173.04	71 **Lu** Lutetium 174.967
90 **Th** Thorium 232.0381	91 **Pa** Protactinium 231.03588	92 **U** Uranium 238.0289	93 **Np** Neptunium (237)	94 **Pu** Plutonium (244)	95 **Am** Americium (243)	96 **Cm** Curium (247)	97 **Bk** Berkelium (247)	98 **Cf** Californium (251)	99 **Es** Einsteinium (252)	100 **Fm** Fermium (257)	101 **Md** Mendelevium (258)	102 **No** Nobelium (259)	103 **Lr** Lawrencium (262)

It is necessary for you to have a periodic table and polyatomic ion list for reference plus a calculator. These questions will be reviewed generally during the first week of school for AP Students and the first and second week or so for SL students. One Mole = 6.02×10^{23} molecules or pieces. Make an attempt to express the answers in the correct number of **significant figures**. R = 0l0821 L-atm/mole K; at STP 1 mole of a gas occupies 22.4 L; °C + 273 = K; $M_aV_a = M_bV_b$ or $M_1V_1 = M_2V_2$. Some equations may need balancing.

1. Balance and write the following chemical equations for the reactions listed.
    a. The decomposition of Copper (II) Carbonate ($CuCO_3$) into Copper (II) oxide (CuO) and Carbon Dioxide (CO_2).
    b. The combustion of Magnesium metal (Mg) and Oxygen gas (O_2) to form Magnesium Oxide (MgO).
    c. The neutralization of sulfuric acid (H_2SO_4) and Sodium Hydroxide(NaOH) to make Sodium Sulfate (Na_2SO_4) and Water(H_2O).
    d. The synthesis of Ammonia (NH_3) from Nitrogen (N_2) and Hydrogen gases (H_2).
    e. The combustion of Ethane (C_2H_6) to form Carbon dioxide(CO_2) and water.
2. Balance the following reactions:
    a. $CH_3CH_2OH + O_2 \rightarrow CO_2 + H_2O$
    b. $H_2O_2 + N_2H_4 \rightarrow N_2 + O_2 + H_2O$
    c. $O_2 + NH_3 \rightarrow NO + H_2O$
    d. $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$
3. For this question apply the state symbols for the reactions in number 1 a-e.
4. How many Hydrogen atoms are in the following giving the correct significant figures in the answer:
    a. 0.020 moles of CH_3CH_2OH
    b. 2.50 moles of water
    c. 0.100 moles of $Ca(HCO_3)_2$
    d. If propane C_3H_8 has 0.200 moles of C in the formula, how many moles of H are present?
5. Calculate the molar mass for the following formulas:
    a. $Ca_3(PO_4)_2$ b. Vitamin C: $C_6H_8O_6$ c. Sodium Thiosulfate Pentahydrate $Na_2S_2O_3 \cdot 5H_20$
6. Find the mass of 0.475 moles of Calcium Arsenate $Ca_3(AsO_4)_2$ which is widely used as a pesticide.
7. How many moles of carbon dioxide are there in 66 grams of CO_2?
8. How many moles of Chloride ions (Cl^-) are in 0.50 grams of $CuCl_2$?
9. How many Carbon atoms are in 36.55 grams of a diamond (which is pure Carbon)?
10. What is the mass of 0.500 moles of sucrose ($C_{12}H_{22}O_{11}$)?
11. The following compounds are used to make commercial fertilizers, which one has the highest percent Nitrogen by mass? NH_3, $CO(NH_2)_2$, $(NH_4)_2SO_4$
12. If it takes 0.050 grams of $CaCO_3$ to write your name on a piece of cardboard once you subtract the mass of the cardboard, how many atoms of Carbon does it take to write your name?
13. Iron can be reduced according to the following equation $Fe_2O_3 + 3H_2 \rightarrow 2Fe + 3H_2O$
    a. How many moles of Fe can be made from 1.25 moles of Fe_2O_3?
    b. How many moles of H_2 are needed to make 3.75 moles of Fe?
    c. If the reaction yields 12.50 moles of water, how many moles of Fe_2O_3 was used up?

14. Formulate an equation for the combustion of butane C_4H_{10} and if 2.46 g H_2O made how much butane was burned?
15. Limestone most contains $CaCO_3$, but it also contains many minerals. When heated the Carbonate decomposes into Carbon dioxide and water. A 1.605 gram sample was heated and gave off 0.657 g of CO_2.
    a. Formulate the equation for the thermodecomposition (means heated) of $CaCO_3$.
    b. Determine the percent mass in the $CaCO_3$ in the limestone mixture.
    c. What assumptions must be made when carrying out the calculations.
16. Methanol CH_3OH is a useful fuel and can be made as follows: $CO(g) + 2H_2(g) \rightarrow CH_3OH\ (l)$
    a. Given 12.0 grams of H_2 and 74.5 grams of CO, find the limiting reactant (reagent).
    b. Determine the theoretical yield of CH_3OH.
    c. Calculate the amount of excess reactant that remains once the reaction is complete.
17. The drying solvent 1,2 Dichloroethane is prepared from the following reaction below. Determine the mass of the product that can be formed when 15.40 grams of C_2H_4 and 3.74 grams of Cl_2 were reacted.

$$C_2H_4(g) + Cl_2\ (g) \rightarrow C_2H_4Cl_2\ (l)$$

18. A Chemist has to make 100 grams of Chlorobenzene, C_6H_5Cl from the following reaction: Determine the minimum quantity of benzene C_6H_6 that can be used to achieve this with a yield of 65.0 %. $C_6H_6\ (l) + Cl_2\ (g) \rightarrow C_6H_5Cl\ (l) + HCl\ (l)$
19. How many moles are present in each of the following at STP (Standard temperature and pressure)?
    a. 54.5 L of CH_4
    b. 250.0 cm^3 of CO
    c. 1.0 $meter^3$ of O_2 gas
20. Calculate the volume of each at STP
    a. 44.00 g of N_2
    b. 0.25 moles NH_3
21. Pure Oxygen gas was produced by heating HgO Mercury (II) Oxide. What volume of oxygen (O_2) at STP is released by heating 12.45 grams of HgO? $2HgO\ (l) \rightarrow O_2\ (g) + 2Hg\ (l)$
22. Which sample contains more molecules, 3.14 Liters of Bromine Br_2, or 11.07 g of Cl_2, when measured at the same temperature and pressure?
23. Calcium reacts with water to produce Hydrogen gas: $Ca(s) + 2H_2O\ (l) \rightarrow Ca(OH)_2\ (s) + H_2\ (g)$ Calculate the volume of gas at STP produced when 0.200 g of Ca reacts completely with water.
24. An unknown noble gas has a density of 5.84 grams/Liter at STP. Calculate its molar mass and so identify the gas.
25. Which has the greater density at STP, Helium or Hydrogen?
26. Concentrated nitric acid, HNO_3, is 16.0 Molar when it comes from the Chemical company. What volume would you need to prepare 100.0 cm^3 of 0.50 M HNO_3? M=molar=mole/liter.
27. Calculate the mass of Potassium Hydroxide (KOH) required to prepare 250.0 cm^3 of a 0.200 Molar solution.
28. How many total atoms are present in 0.100 mole of $Ca(OH)_2 \cdot 3H_2O$?
29. What is the total number of Hydrogen atoms in 2.00 moles of C_6H_5Cl?
30. What is the concentration of sodium ions when 10.00 mL (or cm^3) of 0.500 M NaCl is mixed with 50.00 cm^3 of 0.250 M NaCl?