

IB Chemistry Year 1 Summer Assignment

The purpose of this summer assignment is to ensure you remember key information and skills from Chemistry I, and to help you refresh things you may have forgotten, so you will not be behind at the beginning of the school year. Complete the following assignment on separate paper, preferably in a bound notebook. Additionally, you are to complete this assignment in the order it has been assigned. If you complete the assignment at the pace I have laid out for you, it should not be too time consuming, it should serve its purpose well, and we should all be ready for a great new school year. If you do not, you will be completely overwhelmed by this assignment and unprepared for the coming school year. The course will be taught with the expectation that you have mastery and fluency with the fundamentals included in this assignment. If you need additional information beyond what I have provided for you in the boxes, your Chemistry I notes or internet resources should prove useful.

Additionally, you will have a quiz over elements, ions, and compounds EVERY week. Your first quiz will be over elements 1-54; you must know element names with the correct spelling and the corresponding chemical symbol. Start reviewing your monatomic and polyatomic ions so you know them.

Step 1: Join the class Remind (IB Chemistry HL 2022-2024):

→ Text @westibchem to the number 81010

Step 2: Complete this Google form so I can add you to the summer Canvas Course:

→ <https://tinyurl.com/westibchem>

On Canvas you will ...

- turn in summer work here (every 2 weeks).
- find answer keys following submission to check/correct work and resubmit.
- find the first few chapters of the IB textbook to look at if you want to preview the content and course expectations in relation to Chemistry 1.
- find a link to the digital version of the Chemistry 1 textbook as a reference for the summer assignment.

Week One (May 25 - 28)

Review of significant figures, scientific notation, metric conversions, density, & nomenclature:

Significant figures

- Count all numbers as significant except for leading and trailing zeros –placeholders
- Addition and subtraction: Keep the same number of places before or after the decimal as the number with the fewest places before or after the decimal.
- Multiplication and division: The answer should have the same number of significant figures as the number with the fewest total significant figures.

Scientific notation

- Move the decimal until you obtain a number equal to or greater than one and less than ten.
- Count how many places you moved the decimal in order to obtain your exponent. If you moved the decimal to the left, the exponent is positive; if you moved to the right, the exponent is negative.
 - Ex.: $105000 = 1.05 \times 10^5$, $0.0032 = 3.2 \times 10^{-3}$
- Addition and subtraction: Since decimal places must line up, exponents have to be the same. Add or subtract the numbers; exponents do not change.
- Multiplication: Multiply the numbers, and add the exponents.
- Division: Divide the numbers, and subtract the exponents.

Metric conversions & Dimensional analysis

- Review metric units and prefixes

- Metric Prefixes

Prefix	Example conversion
Mega- (M)	$1 \text{ Mg} = 10^6 \text{ g}$
kilo- (k)	$1 \text{ kJ} = 10^3 \text{ J}$
hecto- (h)	$1 \text{ hm} = 100 \text{ m}$
deca- (da)	$1 \text{ dag} = 10 \text{ g}$
BASE	
deci- (d)	$10 \text{ dm} = 1 \text{ m}$
centi- (c)	$100 \text{ cs} = 1 \text{ s}$
milli- (m)	$10^3 \text{ mg} = 1 \text{ g}$
micro- (μ)	$10^6 \text{ }\mu\text{g} = 1 \text{ g}$
nano- (n)	$10^9 \text{ nm} = 1 \text{ m}$
pico- (p)	$10^{12} \text{ pg} = 1 \text{ g}$

- $1 \text{ dm}^3 = 1 \text{ L}$; $1 \text{ cm}^3 = 1 \text{ mL}$ ** IB uses dm^3 and cm^3 NOT L and mL
- Use dimensional analysis/"train tracks" to convert units. Remember to line up conversion factors so the units you are trying to get rid of divide out and you are left with the desired units.
 - If units are squared or cubed, the entire conversion factor must be squared or cubed, i.e. $1 \text{ dm}^3 = (10 \text{ cm})^3 = 1000 \text{ cm}^3$.

Density

- Density = mass/volume
- Units (IB): g cm^{-3} (read as grams per centimeters cubed--same as g/ml) or g dm^{-3} (same as g/l)

Nomenclature

- Ionic: a metal and a nonmetal or a polyatomic ion and a counter ion
Remember, charges must balance out to an overall charge of zero.
 - Name the cation first, then the anion.
 - For metals that
 - only have one possible charge, simply name the metal
 - have more than one possible charge, the charge must be indicated
 - Write the name of the metal followed by roman numerals in parentheses to indicate the charge (stock system),
i.e. iron (III)—Fe³⁺ vs. iron (II)—Fe²⁺
 - For nonmetals (second element), change the ending to -ide
- Covalent: 2 nonmetals or a metalloid and a nonmetal
 - Name the elements in the order in which they appear.
 - Do not change the name of the first element; change the ending of the second element to -ide.
 - Add prefixes to each element to indicate the number of atoms of that element. (Omit the “mono” prefix on the first element.)
- Acids: Compounds beginning with hydrogen
 - Binary acids: hydrogen + one other element
 - Add the prefix “hydro-” and change the ending of the element to “-ic”
 - Oxyacids: hydrogen + a polyatomic ion containing oxygen
 - Do not add a prefix
 - If the polyatomic ion ends in -ite, change the ending to -ous.
 - If the polyatomic ion ends in -ate, change the ending to -ic.

1. How many significant figures does each of the numbers contain?

- a. 0.0278 meter
- b. 1.3 centimeter
- c. 1.00 foot
- d. 8021 yards
- e. 7.98 x10⁻³ pounds

2. Round the following numbers to three significant figures.

- a. 4325
- b. 6.873 x 10³
- c. 0.17354

3. Make the following conversions:

- a. 65 kg to grams
- b. 750 micrograms to grams
- c. 0.25 nanometers to cm
- d. 23.8 milligrams to kg

4. Express the following numbers in scientific notation with the indicated number of significant figures:

- a. 0.0000098765 (5 sig. figs)
- b. 10,000 (2 sig. figs)

5. Express the following as ordinary numbers (standard notation):

- a. 7.51 x 10⁻⁷
- b. 5.43 x 10⁰

6. Perform the indicated operations and round your answers to the proper number of significant figures. Assume that all answers were obtained from measurements.

- a. (2.11 x 10⁻³) + (1.54 x 10⁻³)
- b. (1.54 x 10⁻³) + (2.11 x 10⁻²)
- c. (4.56 + 18.7)/(1.23 x 10²)
- d. (1.23 x 10⁻²)(4.56 + 1.87)

7. How many cubic meters (m³) are there in 1.773 x 10⁵ cubic decimeters (dm³)?

8. The density of silver is 10.5 g/cm³. What volume of silver metal will have a mass of exactly 2500.0 grams?

9. What is the mass of 215 dm³ of hydrogen sulfide gas if the density of hydrogen sulfide is 1.54 g dm⁻³ (g/dm³)?

10. 28.5 grams of iron shot is added to a graduated cylinder containing 45.5 cm³ of water. The water level rises to the 49.1 cm³ mark. From this information, calculate the density of iron.

11. A rectangular block of copper metal weighs 1896 grams. The dimensions of the block are 8.4 cm by 5.5 cm by 4.6 cm. From this data, what is the density of copper?

12. The helium gas stored inside a large weather balloon weighs 13.558 grams. What is the volume of this balloon if the density of helium is 0.1786 g dm^{-3} ?

13. Write the name of the following compounds:

- | | | | |
|-------------------------------|-----------------------------|-----------------------------|---------------------------|
| a. KF | f. NH_4Cl | j. $\text{Ba}(\text{OH})_2$ | n. KrF_2 |
| b. CaSO_4 | g. NH_4NO_3 | k. FeCl_3 | o. NaCl |
| c. HCl | h. IF_5 | l. HF | p. P_2O_5 |
| d. SbCl_3 | i. NaHCO_3 | m. PbSO_4 | |
| e. As_4O_{10} | | | |

14. Write the formula for the following compounds:

- | | | |
|------------------------|---------------------------|----------------------------|
| a. ammonium sulfide | g. diphosphorus pentoxide | m. zinc sulfate |
| b. cupric bromide | h. cupric hydroxide | n. antimony (III) chloride |
| c. aluminum sulfate | i. calcium fluoride | o. silver sulfide |
| d. potassium nitrite | j. tin (II) nitrate | p. magnesium hydroxide |
| e. ferrous carbonate | k. silver cyanide | q. ammonium carbonate |
| f. lead (II) phosphate | l. ammonium sulfite | r. nickel (II) acetate |

Week Two (May 29 – June 4)

Review of atomic structure & chemical reactions:

Atomic structure:

- An atom is made up of protons and neutrons (both found in the nucleus) and electrons (found in the orbitals surrounding the nucleus).
- The atomic number of an element is equal to the number of protons.
- The mass number (different than the average atomic mass) is the sum of the protons and neutrons.
- A charge written in the upper right corner indicates that electrons have been lost or gained.

Nitrogen- 15 (3-) anion

Mass Number \rightarrow $^{15}\text{N}^{3-}$ \leftarrow ion charge

Atomic # \rightarrow 7

7 protons

8 neutrons (15-7)

10 electrons (normally 7 but 3- means gains 3 electrons)

Chemical reactions:

- Remember to add coefficients to balance all equations.
- Do not forget the seven diatomic elements.
- Review the five reaction types: synthesis, decomposition, single replacement, double replacement, and combustion: How to classify them and predict products

15. Express the following numbers with the indicated number of significant figures.

a. 1000 (2 sig figs)

b. 43,927 (3 sig figs)

c. 0.000286 (3 sig figs)

16. How many cubic meters (m^3) are there in 4312 cubic centimeters (cm^3)?

17. A cylindrical glass tube of length 27.75 cm and the radius 2.00 cm is filled with argon gas. The empty tube weighs 188.25 grams and the tube filled with argon weighs 188.87 grams. Use the data to calculate the density of argon gas. (Volume of a cylinder = $\pi r^2 h$.)

16. Complete the following table

Element/Ion	Atomic Number	Mass Number	# Protons	# Neutrons	# Electrons
^1H					
$^1\text{H}^{+1}$					
^{12}C					
$^7\text{Li}^{+}$					
$^{35}\text{Cl}^{-1}$					
^{39}K					
$^{24}\text{Mg}^{+2}$					

17. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:

- Aluminum nitrate (aq) + sodium hydroxide (aq) \rightarrow aluminum hydroxide (s) + sodium nitrate (aq)
- Potassium chlorate (s) \rightarrow potassium chloride (s) + oxygen (g)
- Phosphoric acid (aq) + magnesium hydroxide (aq) \rightarrow magnesium phosphate (s) + water (l)
- Ammonium nitrite (s) \rightarrow nitrogen (g) + water (l)
- Iron (s) + silver acetate (aq) \rightarrow iron (II) acetate (aq) + silver (s)
- Ammonium sulfide (aq) + iron (II) nitrate (aq) \rightarrow ammonium nitrate (aq) + iron (II) sulfide (s)

18. Write the name of the following compounds:

- KMnO_4
- NiI_2
- Cu_2CO_3
- AgClO_4
- $\text{Mg}(\text{NO}_3)_2$
- FeCrO_4
- Hg_2O_2

19. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:

- Calcium hydroxide (aq) + nitric acid (aq) \rightarrow
- Zinc chloride (aq) + ammonium sulfide (aq) \rightarrow
- Silver acetate (aq) + potassium chromate (aq) \rightarrow

SUBMIT WEEKS 1 & 2 ON Canvas Summer Course

Use answer key (published the day after the due date) to check and correct any questions missed. Then, submit your corrected work.

Week Three (June 5-11)

Review of stoichiometry:

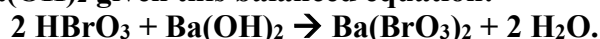
You must have a balanced chemical equation first.

Line up conversion factors using dimensional analysis.

- grams ↔ moles, same substance: use molar mass
 - particles ↔ moles, same substance: Avogadro's number (6.022×10^{23} particles = 1 mol)
 - volume of a gas ↔ moles, at STP: use standard molar volume (22.42 L = 1 mol)
 - volume of a solution ↔ moles: use molarity (Molarity = moles of solute/ liter of solution)
 - moles one substance ↔ moles another substance: use mole ratio (coefficients in balanced equation)
- ***Key step in all stoichiometry problems.

Limiting reactant problems: when you have more than one given, solve for all to determine the limiting reactant and the amount of product formed.

20. Determine the moles of barium bromate that can be prepared from 7.000 moles of each HBrO₃ and Ba(OH)₂ given this balanced equation:



21. How many molecules of ammonia would be produced if 13.4 grams of nitrogen gas reacted at STP? $\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \rightarrow 2 \text{NH}_3(\text{g})$

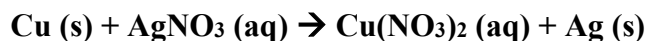
22. $6 \text{NaOH} + 2 \text{Al} \rightarrow 2 \text{Na}_3\text{AlO}_3 + 3 \text{H}_2$

- a. **What mass of Na₃AlO₃ can be formed from 165.0 grams of sodium hydroxide?**
- b. **How many moles of NaOH are required to produce 3.0 grams of hydrogen?**

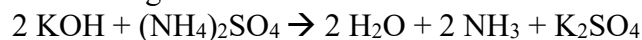
23. $4 \text{FeCr}_2\text{O}_7 + 8 \text{K}_2\text{CO}_3 + \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3 + 8 \text{K}_2\text{CrO}_4 + 8 \text{CO}_2$

How many grams of iron (II) dichromate are required to produce 44.0 grams of carbon dioxide?

24. What volume of oxygen gas will be required to produce 23.7 grams of mercury (I) oxide at STP?



25. If 20.0 grams of KOH react with 15.0 grams of (NH₄)₂SO₄, calculate the moles of K₂SO₄ produced. Identify the limiting reactant.



26. What reactant is limiting if 3000 cm³ of Cl₂ at STP react with a solution containing 25.0 grams of NaBr? $\text{Cl}_2 + 2 \text{NaBr} \rightarrow \text{Br}_2 + 2 \text{NaCl}$

27. Write the formula for the following compounds

- | | | |
|-----------------------|----------------------|-------------------|
| a. Ammonium phosphate | c. Potassium sulfide | f. Sulfurous acid |
| b. Iron (II) chlorite | d. Tin (II) bromide | g. Zinc bisulfite |
| | e. Lithium chromate | h. Sodium sulfite |

28. Write the names of the following compounds:

- | | | |
|--|--------------------------------------|--|
| a. Hg ₂ SO ₄ | d. N ₂ O ₃ | g. Sn ₃ (PO ₄) ₂ |
| b. KH | e. N ₂ O | h. H ₂ O ₂ |
| c. Co ₂ (SO ₃) ₃ | f. Fe(NO ₃) ₂ | |

29. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:

- a. Sulfuric acid (aq) + potassium hydroxide (aq) →
- b. Mercury (II) sulfate (aq) + ammonium nitrate (aq) →
- c. Zinc (s) + sulfuric acid (aq) →

Week Four (June 12 - 18)

Review of Periodic Table & electron configuration:

Review the Periodic Table, trends, and electron configuration.

Orbital Notation (“Electron in a box”)

Remember how to use your Periodic Table to determine electron configuration.

- Period tells you the main energy level being filled
- “Block” tells you the energy sublevel being filled
- Column within the block tells you the number of electrons in that sublevel.

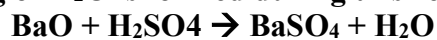
Shorthand electron configuration (Noble Gas configuration)

- 1) Step one, go up one row and all the way over to the Noble Gas (Group 18). Write the element symbol in square brackets []
 - 2) Start at the next element (Beginning of the row the element is in) and write the remainder of the electron configuration.
- Example for iron: $[\text{Ar}]4s^23d^6$

- 30. a. What name is given to the elements in a vertical column on the periodic table?**
b. What name is given to the elements in a horizontal row on the periodic table?
31. a. What is the most active metal?
b. What is the most active nonmetal?
c. What are the least reactive elements on the Periodic Table?
- 32. What is the significance of the zig zag line running diagonally down and to the right near the right side of the periodic table?**
33. What is electron affinity?
- 34. What element has the lowest ionization energy?**
35. How many electrons are in the valence shell of:
 - a. the Halogens?
 - b. the Oxygen family?
 - c. the alkali metals?
 - d. the boron family?
 - e. the neon gases?
 - f. the alkaline earth metals?
 - g. the carbon family?
 - h. the nitrogen family?
- 36. a. Why do atomic radii decrease from left to right within a period?**
b. Why do they decrease down a group?
37. Arrange each of the following in order of increasing atomic radii:
 - a. the alkaline earth metals
 - b. the main group elements in the third period
 - c. C, Si, Sn, Pb
38. Arrange the following in order of decreasing radius: Br, I, Se, Li.
- 39. Why does ionization energy increase from left to right across a period?**
40. Arrange the members of each of the following sets of elements in order of increasing first ionization energy:
 - a. the alkali metals
 - b. the halogens
 - c. the elements in the second period
 - d. Br, Cl, B, Ga, Cs, and H
41. Write the electron configuration (long way) for:
 - a. palladium.
 - b. sulfur
 - c. francium
42. Write the orbital notation (boxes) for:
 - a. scandium
 - b. magnesium
 - c. cadmium
43. Write the electron configuration using the Noble Gas core method (shorthand) for:
 - a. radium.
 - b. lead
 - c. californium
44. Make the following conversions:
 - a. 9.57×10^{-8} mm to nm
 - b. 2.00 L to mL
 - c. 35.38 mL to L
 - d. 5000 cm^3 to mL
- 45. Find the mass of 250.0 cm^3 of benzene. The density of benzene is 0.90 g cm^{-3} .**

46. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:
- barium carbonate (s) + hydrochloric acid (aq) \rightarrow
 - chlorine (g) + magnesium iodide (aq) \rightarrow
 - aluminum sulfate (aq) + calcium phosphate (s) \rightarrow
 - iron (s) + hydrochloric acid (aq) \rightarrow

47. If 81.00 g of H₂O is formed during this reaction, what mass of BaO was used?



SUBMIT WEEKS 3 & 4 on Canvas Summer Course

Remember to use answer key (published the day after the due date) to check and correct any questions missed. Then, submit your corrected work.

60. Write the formulas for the following compounds:
- | | | |
|-----------------------------|-----------------------|------------------------------|
| a. silver oxide | e. barium hypobromite | g. chromium (II) bicarbonate |
| b. mercury (II) perchlorate | k. ammonium hydroxide | h. hydrochloric acid |
| c. oxygen difluoride | f. cobalt (II) iodide | i. aluminum bisulfite |
| d. acetic acid | | j. cobalt (III) sulfate |
61. Write the name of the following compounds:
- | | | |
|--------------|-------------|--------------|
| a. N_2O_5 | d. $CuCO_3$ | g. MgI_2 |
| b. $SnCrO_4$ | e. ClO_2 | h. $NaCN$ |
| c. Al_2O_3 | f. CuS | i. Hg_3N_2 |
62. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:
- cobalt (III) hydroxide (aq) + nitric acid (aq) \rightarrow
 - bromine (l) + sodium iodide (aq) \rightarrow
 - ammonium sulfate (aq) + calcium hydroxide (aq) \rightarrow
63. $CaCl_2 + 2 AgNO_3 \rightarrow 2 AgCl + Ca(NO_3)_2$
 How many grams of AgCl could be produced from 78.00 grams of $CaCl_2$?

Week Six (June 26 - July 2)

Review of gases:

Remember temperature must be in Kelvin anytime you are working with gases.

At STP (100 kPa and 273 K) 1 mol of a gas has a volume of 22.7 dm³.

[These numbers are slightly different from the ones you used in Chemistry I.]

Remember, at constant pressure and temperature conditions, equal volumes of gases contain equal moles, so coefficients in a balanced chemical equation can be used as volume ratios for gases.

Combined gas law -- Use for changing conditions of a single gas.

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

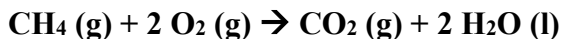
Ideal gas law -- Use when mass or moles of a gas are referred to, and you are not at STP.

$$PV = nRT \quad R = 8.3145 \frac{kPa \cdot dm^3}{mol \cdot K}$$

Dalton's law -- For a mixture of gases, the total pressure is equal to the sum of partial pressures of the individual gases.

$$P_{total} = P_1 + P_2 + P_3 \dots$$

64. A rigid container holds a gas at a pressure of 56kPa at $-100.^{\circ}C$. What will the pressure be when the temperature is increased to $200.^{\circ}C$?
65. What is the volume at STP of a sample of carbon dioxide? What is the volume at STP of a sample of CO_2 that has a volume of 75.0 cm³ at $30.0^{\circ}C$ and 98kPa?
66. What is the volume of a sample of oxygen gas that has a mass of 50.0 grams and is under a pressure of 122kPa at $27.0^{\circ}C$?
67. If 20.0 dm³ of methane, CH_4 , react with 200.0 dm³ of oxygen, calculate the mass of carbon dioxide produced at STP.



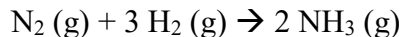
68. If 20.0 grams of KOH react with 15.0 grams of $(\text{NH}_4)_2\text{SO}_4$, calculate the following:



- the mass of NH_3 produced
- the cm^3 of NH_3 produced at STP

69. Determine the total pressure of a gas mixture that contains CO, Ne, and He if the partial pressures of the gases are $P_{\text{CO}} = 1.53 \text{ atm}$, $P_{\text{Ne}} = 0.82 \text{ atm}$, and $P_{\text{He}} = 0.34 \text{ atm}$.

70. Ammonia is produced by the reaction of nitrogen and hydrogen according to this balanced equation:



What volume of ammonia would be produced if 13.4 grams of hydrogen gas reacted at STP?

71. Calculate the density of helium in g/dm^3 if a balloon with a capacity of 5.00 dm^3 holds 0.890 grams.

72. Write the formulas for the following compounds:

- | | | |
|------------------------|-------------------------|----------------|
| a. nitrogen triiodide | c. iron (II) chromate | e. ammonia |
| b. calcium perchlorate | d. iron (III) carbonate | f. nitric acid |

73. Write the name of the following compounds:

- | | | |
|-------------------|----------------------------|--------------------------|
| a. NaOH | d. P_3H_5 | g. CsF |
| b. NI_3 | e. UF_6 | h. CO |
| c. ClF_3 | f. Cl_2O_3 | i. Cu_2S |

74. Write the electron configuration using the Noble Gas shorthand for gold.

75. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:

- Ammonium nitrite (s) \rightarrow nitrogen (g) + water (l)
- Ammonia (g) + oxygen (g) \rightarrow nitrogen (II) oxide (g) + water (l)
- Magnesium hydroxide (aq) + phosphoric acid (aq) \rightarrow magnesium phosphate (s) + water (l)

76. Calcium dihydrogen phosphate is an important fertilizer. What is the percent phosphorus in $\text{Ca}(\text{H}_2\text{PO}_4)_2$?

77. Two compounds are analyzed and found to contain:

- 0.89 grams K, 1.18 grams Cr, and 1.27 grams O
- 1.03 grams K, 0.69 grams Cr, and 0.84 grams O

Determine the empirical formulas for these two compounds.

SUBMIT WEEKS 5 & 6 on Canvas Summer Course

Remember to use answer key (published the day after the due date) to check and correct any questions missed. Then, submit your corrected work.

96. Nitrogen gas in a steel cylinder is under a pressure of 1520 kPa at 27°C. What will be the pressure in the tank if the tank is left in the sun and the temperature rises to 55°C?
97. If 20.0 dm³ of methane, CH₄, (measured at STP) reacts with excess oxygen in a combustion reaction, calculate the mass of water produced.

Week Eight (July 10 - 16)

Review Drawing Covalent Lewis Dot Structures

1. Find total number of valence electrons
2. Arrange atoms – singleton atom is usually in the middle.
*** If carbon is present, it ALWAYS goes in the middle. Hydrogen is NEVER in the middle (only forms 1 bond).
3. Form covalent bonds between atoms (1 bond = 2 electrons).
4. Arrange remaining electrons to give each atom a full valence shell (8 electrons=octet). Exceptions:
*** H is full with 2 electrons. Be is stable with 4 electrons. B is stable with 6 electrons.
5. If there aren't enough electrons to give all atoms a full valence shell, form double or triple bonds.

98. Draw Lewis dot structures for the following molecules:

- | | | |
|--------------------|---------------------|----------------------------------|
| a. BF ₃ | c. NH ₃ | e. CH ₃ Cl |
| b. SO ₃ | d. H ₂ O | f. C ₂ H ₆ |

99. How many significant figures does each of the numbers contain?

- | | |
|--------------------------------|----------------------------------|
| a. 0.2003 ton | c. 1 x 10 ¹² atoms |
| b. 4.69 x 10 ⁴ tons | d. 1.73 x 10 ²⁴ atoms |

100. Mercury metal is poured into a graduated cylinder that holds exactly 22.5 cm³. The mercury used to fill the cylinder weighs 306.0 grams. From this information, calculate the density of the mercury in g cm⁻³ (g/cm³)

101. Write the names for the following compounds:

- | | | | | |
|----------------|----------------------|---------------------|----------------------|---------------------|
| a. KHC | b. SbCl ₅ | d. PCl ₃ | f. IF ₇ | h. CCl ₄ |
| O ₃ | c. HgO | e. PBr ₅ | g. Cl ₂ O | i. NO |

102. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:

- a. Calcium oxide (s) + diphosphorus pentoxide (s) → calcium phosphate (s)
- b. Sodium carbonate (aq) + sulfuric acid (aq) → sodium sulfate (aq) + carbon dioxide (g) + water (l)
- c. Iron (II) sulfide (s) + hydrochloric acid (aq) →

103. The sugar substitute sodium benzosulfimide (sodium saccharin) has a sweetness of about 500 times that of regular sugar. Calculate the percentage of sodium and carbon in the sweetener if its formula is C₇H₄O₃SNNa.

104. SnO₂ is reduced by carbon according to this reaction: SnO₂ + C → Sn + CO₂.

- a. What volume of CO₂ are produced if 300.0 grams of tin are produced at STP?
- b. How many grams of SnO₂ are required to produce 1800.0 grams of tin?

105. If 20.0 grams of hydrogen gas react with 15.0 grams of nitrogen, which gas is the limiting reactant? How many dm³ of ammonia will be produced? Assume the reaction takes place at STP.

106. Determine the number of mass of solute to prepare these solutions:

- a. 2.00 dm³ of a 0.50 mol dm⁻³ Cu(NO₃)₂ solution.
- b. 16.00 mL of a 0.415 M Pb(NO₃)₂ solution.

107. Sea water contains roughly 28.0 grams of NaCl per liter. What is the molarity of sodium chloride in sea water?
108. White lead contains 80.1% lead, 16.5% oxygen, 3.10% carbon, and 0.260% hydrogen. What is the formula of this compound?
109. Compare the elements Na, B, Al, and C with regard to the following properties:
- Which has the largest atomic radius?
 - Which has the largest electron affinity?
 - Place the elements in order of increasing ionization energy.
110. Which has the largest ionization energy: N, P, or As? Why?
111. A mass of air occupies a volume of 5.7 dm^3 at a pressure of 53 kPa. What is the new pressure if the same mass of air at the same temperature is transferred to a 2.0 dm^3 container?
112. What is the mass of ethyl alcohol that exactly fills a 200.0 cm^3 container? The density of ethyl alcohol is 0.789 g/cm^3 .

SUBMIT WEEKS 7 & 8 on Canvas Summer Course

Remember to use answer key (published the day after the due date) to check and correct any questions missed. Then, submit your corrected work.

Week Nine (July 17 - 23)

113. Draw Lewis dot structures for the following molecules:
a. BeF_2 b. SO_2 c. NCl_3 d. H_2S
114. Write the electron configuration (long way) for silicon.
115. Write the orbital notation (boxes) for nitrogen.
116. Write the electron configuration using the Noble Gas shorthand for arsenic.
117. A sample of seawater has a mass of 159 grams and has a volume of 156 cm^3 . What is its density?
118. Write the names of the following compounds:
a. XeF_4 d. H_3BO_3 g. NaBr j. Hg_2O
b. CaH_2 e. I_2O_5 h. $\text{Li}_2\text{Cr}_2\text{O}_4$ k. $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$
c. As_4O_6 f. PbO i. SO_3 l. $\text{Al}(\text{OH})_3$
119. Write the formulas for the following:
a. Calcium sulfide e. Sulfuric acid i. Perchloric acid
b. Zinc permanganate f. Aluminum oxide j. Iron (II) phosphate
c. Hydrobromic acid g. Cobalt (II) bisulfate k. Lead (II) oxide
d. Hydrogen cyanide h. Barium carbonate l. Cobaltic chlorate
120. Calculate the percentage composition of the following:
a. HgO b. Na_2S
121. For the reaction $2 \text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{Mn}_2\text{O}_7 + \text{H}_2\text{O}$,
how many moles of Mn_2O_7 can be formed from 196.0 grams of KMnO_4 ?
122. **KOH with a mass of 50.0 grams is neutralized by 20.0 grams of sulfuric acid. The products are potassium sulfate and water. Calculate the amount in moles of potassium sulfate produced.**
123. What is the temperature of the gas inside a 750 cm^3 balloon filled with 0.300 grams of H_2 gas? The pressure of the balloon is 110 kPa.
124. **How many grams of water vapor will be produced when 1.18 grams of oxygen react completely with hydrogen to form water?**
125. What mass in grams of KCl is needed to make 2.50 dm^3 of a 0.50 mol dm^{-3} KCl solution?
126. **What is the molarity of a solution containing 12.0 grams of NaOH in 250.0 mL of solution?**
127. Which has the larger radius, Br or Br^- ? Why?
128. **Arrange the members of each of the following sets of elements in order of increasing electronegativities:**
a. S, Na, Mg, Cl c. Se, Ba, F, Si, Sc
b. P, N, Sb, Bi
129. A sample of a compound is analyzed found to contain 0.89g K , 1.18g Cr , and 1.27g O . Determine the empirical formula for this compound.

Week Ten (July 24 – 30)

130. A piece of property is found to be 499 decimeters long. What is the value of this length in centimeters?
131. Calculate the number of kilometers in 105 meters.
132. Write the formulas for the following:
a. Mercury (II) fluoride e. Barium phosphate
b. Potassium permanganate f. Carbonic acid
c. Barium hydroxide g. Phosphorus pentafluoride
d. Calcium carbonate h. Silver oxide

- i. Lead (II) chlorite
- j. Copper (I) chromate

- k. Calcium perchlorate
- l. Acetic acid

133. Write the names of the following compounds:
- a. CuSO_4
 - b. $\text{Cr}(\text{OH})_3$
 - c. HClO
 - d. HClO_2
 - e. HClO_3
 - f. HClO_4
 - g. $\text{Al}(\text{MnO}_4)_3$
134. Write the electron configuration using the Noble Gas shorthand for antimony.
135. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or synthesis/composition) for each of the following:
- a. aluminum acetate (aq) + sodium hydroxide (aq) \rightarrow aluminum hydroxide (s) + sodium acetate (aq)
 - b. Bromine (l) + calcium iodide (aq) \rightarrow calcium bromide (aq) + iodine (s)
 - c. Calcium hydroxide(aq) + phosphoric acid(aq) \rightarrow calcium phosphate(s) + water(l)
136. A zinc sample, which has a mass of 40.0 grams, reacts with 20.0 grams of pure HCl. Zinc chloride and hydrogen gas are produced. Calculate the moles of ZnCl_2 produced.
137. A volume of 3.0 L of air is warmed from 50°C to 100°C . What is the new volume if the pressure remains constant?
138. A sample of gas occupies a volume of 80 mL at a pressure of 0.50 atm and a temperature of 0°C . What will the new volume be at a pressure of 1.50 atm and a temperature of 50°C ?
139. If 20.0 dm^3 of methane, CH_4 , react with 200.0 dm^3 of air, calculate the dm^3 of carbon dioxide gas produced.
- $$\text{CH}_4 (\text{g}) + 2 \text{O}_2 (\text{g}) \rightarrow \text{CO}_2 (\text{g}) + 2 \text{H}_2\text{O} (\text{l})$$
140. How many grams of silver iodide can be produced from 52.38 grams of iodine and unlimited silver? $\text{I}_2 (\text{s}) + 2 \text{Ag} (\text{s}) \rightarrow 2 \text{AgI}$
141. Ammonia is produced by the reaction of nitrogen and hydrogen according to this balanced equation:
- $$\text{N}_2 (\text{g}) + 3 \text{H}_2 (\text{g}) \rightarrow 2 \text{NH}_3 (\text{g})$$
- What mass of ammonia would be produced if 13.4 grams of nitrogen gas reacted?
142. Determine the final volume of a solution in which 8.97 grams of $(\text{NH}_4)_2\text{CO}_3$ is dissolved to make a 0.250 M solution

SUBMIT WEEKS 9 & 10 on Canvas Summer Course

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159. What mass of H_2SO_4 would be needed to make 750.0 mL of a 2.00 M solution?
160. **One compound of chromium contains 57.9% chlorine and a second compound contains 67.3% chlorine. What are the empirical formulas of these two chromium chloride compounds?**
161. Explain the experiments and the contributions of the following to the development of the model of the atom:
- a) Thomson
 - b) Millikan
 - c) Rutherford
 - d) Chadwick

SUBMIT WEEK 11 on Canvas Summer Course

Remember to use answer key (published the day after the due date) to check and correct any questions missed. Then, submit your corrected work.

You will have a quiz over elements, ions, and compounds every week. Your first quiz will be on Friday, August 12th, over elements 1-54; you must know element names with the correct spelling and the corresponding chemical symbol. Start reviewing your monatomic and polyatomic ions so you know them.