# *CH 151 Summer 2025:*

# Problem Set #2

## *Instructions*

*Step One:*

- **Learn the material** for Problem Set #2 by **reading Chapter 2 (sections 2.1-2.4) and Chapter 4 (section 4.3)** of the textbook and/or by watching the videos found on the website (https://mhchem.org/151)
- **Try the problems** for Problem Set #2 found on the next pages on your own first. **Write out the answers (and show your work) by hand (on a tablet or paper)**; do not type your answers (and work) to avoid a point penalty. If you write the answers on the problem set itself, you will receive fewer points. Include your name on your problem set!
- If you get stuck on a particular problem, you can watch the recitation video for Problem Set #2, found using this link: **http://mhchem.org/t/b.htm**

*Step Two:*

We will go over Problem Set #2 during recitation. ***Self correct all problems*** of your problem set before turning it in at the end of recitation.

Problem Set #2 will be **due on Wednesday, July 2 at 8 AM**.

*If you have any questions regarding this assignment, please email (mike.russell@mhcc.edu) the instructor! Good luck on this assignment!*

# CH 151 Problem Set #2 - *Chapter 2.1-2.4 and Chapter 4.3*

* **Complete problem set on separate pieces of paper** showing all work, circling final answers, etc.
* Self correct problem set during recitation (**July 2, 8 AM**) before turning in to the instructor

*Covering:* **Chapter Two (sections 2.1 - 2.4 only)** *and* **Chapter Four (section 4.3 only)**
*Important Tables and/or Constants:* 1 mol = $6.022 \times 10^{23}$, periodic table (http://mhchem.org/pertab)

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1. On the basis of its formula, classify each of the following substances as an element or a compound.
    a. AlN
    b. $CO_2$
    c. Co
2. Match the terms **proton neutron**, and **electron** to each of the following subatomic particle descriptions. It is possible that more than one term may apply in a given situation.
    a. has no charge
    b. has a charge equal to but opposite in sign to that of an electron
    c. is not found in the nucleus
    d. has a positive charge
3. Indicate whether each of the following statements about the nucleus of an atom is true or false.
    a. The nucleus accounts for almost all the volume of an atom.
    b. The nucleus can be positively or negatively charged, depending on the identity of the atom.
    c. The nucleus of an atom contains an equal number of protons, neutrons and electrons.
    d. The nucleus of an atom is always positively charged.
4. What is the complete symbol ( ${}^{A}_{Z}X$ ) for neutral atoms composed of the following sets of subatomic particles?
    a. 4 protons, 4 electrons and 5 neutrons
    b. 7 protons, 7 electrons and 8 neutrons
    c. 15 protons, 15 electrons and 16 neutrons
    d. 20 protons, 20 electrons and 28 neutrons
5. Determine the number of protons, electrons, and neutrons in each of the following neutral atoms.
    a. ${}^{35}_{17}Cl$
    b. ${}^{55}_{25}Mn$
    c. ${}^{127}_{53}I$
    d. ${}^{209}_{83}Bi$
6. Four naturally occurring isotopes of the element strontium exist. Knowing that the lightest isotope has a mass number of 84 and that the other isotopes have, respectively, 2, 4, and 5 more neutrons, write the complete symbol ( ${}^{A}_{Z}X$ ) for each of the four isotopes.

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7. Each of the following elements has only two naturally occurring isotopes. Determine, in each case, which isotope is more abundant, using only the atomic mass value for the element that is listed on the periodic table.
    a. $^{10}_{5}B$ and $^{11}_{5}B$
    b. $^{69}_{31}Ga$ and $^{71}_{31}Ga$
    c. $^{107}_{47}Ag$ and $^{109}_{47}Ag$
    d. $^{203}_{81}Tl$ and $^{205}_{81}Tl$
8. Calculate the atomic mass of copper on the basis of the following percent composition and isotopic mass data for the naturally occurring isotopes: **copper-63** : 69.09% (62.9298 amu) , and **copper-65** : 30.91% (64.9278 amu)
9. Name each of the following fixed-charge binary ionic compounds.
    a. BeS
    b. $GaCl_3$
    c. CaO
10. Name each compound in the following pairs of variable-charge binary ionic compounds.
    a. $SnCl_4$ and $SnCl_2$
    b. FeS and $Fe_2S_3$
    c. AuI and AgI
11. Write chemical formulas for both ions in each of the following pairs of polyatomic ions.
    a. nitrate and nitrite
    b. chlorate and perchlorate
    c. phosphate and phosphite
12. In which of the following pairs of compounds are polyatomic ions present in both members of the pair?
    a. $SO_3$ and $CaSO_4$
    b. $NH_4Br$ and KClO
13. Name each compound in the following pairs of polyatomic ion containing compounds.
    a. $CuNO_3$ and $Cu(NO_3)_2$
    b. $Pb_3(PO_4)_2$ and $Pb_3(PO_4)_4$
14. Name the following binary molecular compounds.
    a. $S_4N_2$
    b. $SO_3$
15. Write chemical formulas for the following binary molecular compounds.
    a. disulfur monoxide
    b. tetraphosphorus hexoxide
    c. carbon dioxide
16. Name each of the following compounds as acids.
    a. $HClO_4$
    b. $HClO_3$
    c. $HClO_2$
    d. HClO
    e. HCl

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17. Calculate the molar mass (to 0.01 g/mol) of each of the following substances.
    a. $NaHCO_3$ (baking soda, or sodium bicarbonate)
    b. $Tl_2SO_4$ (thallium(I) sulfate, a rat and ant poison)
18. Calculate the percent element composition for each of the following compounds. (Round off all atomic masses to 0.01 g/mol before using them.)
    a. $C_{10}H_8$ (naphthalene, ingredient in some mothballs)
    b. NaCN (sodium cyanide, used to extract gold from ores)
19. Calculate the number of molecules or atoms present in each of the following:
    a. 4.69 moles CO
    b. 3.752 g of Li
20. Calculate the mass, in grams, of 0.981 mole of each of the following compounds.
    a. $SO_2$
    b. $S_4N_4$
21. Each of the following is a correctly written molecular formula. In each case write the empirical formula for the substance.
    a. $As_4O_6$
    b. $Pb_3S_4$
    c. $C_4H_8$
22. Given the following percent element composition, determine the empirical formula: **47.26% Cu and 52.74% Cl**
23. Determine the molecular formulas of compounds with the following empirical formulas and molecular masses.
    a. $CB_2H_3$, 73.3 amu
    b. $C_5H_{10}O_2$, 102 amu
24. Adipic acid, a compound used in the manufacture of nylon, has a molecular mass of 146 g/mol. Its percent composition by mass is 49.30% C, 6.9l% H, and 43.79% O. Determine the molecular formula of adipic acid.