CH 221 Fall 2025: **Problem Set #4** *Instructions*

Step One:

• Learn the material for Problem Set #4 by reading Chapter 4 of the textbook and/or by watching the videos found on the website (https://mhchem.org/221video)

• **Try the problems** for Problem Set #4 found on the next pages on your own first. Write your answers in the space provided or write your answers on separate paper (your choice.) Include your name on your problem set!

Step Two:

Watch the recitation video for Problem Set #4:

http://mhchem.org/1/4

Self correct *all* **of the problems** while viewing the video. Mark correct problems with a star (or other similar mark), and correct all incorrect problems (show the correct answer and the steps required to achieve it.)

Step Three:

Turn the Problem Set in at the beginning of recitation to the instructor on Monday, October 27 (section L1), Tuesday, October 28 (section L2) Wednesday, October 29 (section L3) or Friday, October 31 (section L4) The graded problem set will be returned to you the following week during recitation.

Do not include this page to avoid a point penalty; your front page should be page II-4-3.

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

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CH 221 Problem Set #4

<u>Name</u>:

Complete the problem set on your own first using these sheets for your work or separate paper (your choice.) Self correct your work (*all problems!*) using the recitation video for this problem set, found here: http://mhchem.org/1/4

* Covering: Chapter Four and Chapter Guide Four

* *Important Tables and/or Constants:* periodic table (http://mhchem.org/pertab), "**Electronegativities**" *Handout* (at the end of this problem set), "**Geometry and Polarity Guide**" (*Handout*, https://mhchem.org/geopo)

1. Complete the following.

<u>Element</u>	<u>Group</u> <u>Number</u>	<u># valence</u> electrons	<u># core electrons</u>	<u>More than</u> <u>four pairs</u> <u>possible</u>	<u>Less than four pairs</u> possible
Ν	VA	5	2	no	no
С					
Cl					
Kr					
Si					
Se					
Al					

Draw a Lewis structure for each of the following molecules or ions.
a. BF4¹⁻

 $b. \ CS_2$

 $c.\ NO_2^{\text{-1-}}$

d. SOCl₂

- 3. Draw a Lewis structure for each of the following molecules or ions.
 - a. BrF5

b. IF_3

c. $IBr_{2^{1-}}$

 $d. \quad BrF_{2^{1+}}$

- 4. Draw a Lewis structure for each of the following molecules or ions. Describe the electron-pair geometry (EPG) and the molecular geometry (MG) around the central atom.
 - a. $ClF_{2^{1+}}$ (note: this is one Cl atom, 2 F atoms, and a + 1 charge)

b. $SnCl_{3^{1-}}$

c. BCl₃

 $d. CS_2$

5. Draw a Lewis structure of each of the following molecules or ions. Describe the electron-pair geometry and the molecular geometry around the central atom.

a. $SiF_{6^{2-}}$

 $b. \ PF_5$

 $c. \ SF_4$

 $d. \ XeF_4$

6. Give approximate values for the indicated bond angles. *Hint: draw the Lewis structure!*a. Cl-S-Cl in SCl₂

b. N-N-O in N_2O

c. Bond angles 1 - 5 in phenylalanine (*right*), one of the natural amino acids and a "breakdown" product of aspartame.



- 7. Determine the formal charge on each atom in the following molecules or ions: *Draw Lewis structures!*a. HCO₂¹⁻ (formate ion)
 - b. HCO₂H (formic acid)
 - c. CO_2 (two resonance forms). Which resonance form should be more stable?
- 8. For each of the bonds listed below, tell which atom is the more negatively charged. Use values of electronegativity to support your answer.
 - a. C-N
 - b. C-H
 - c. C-Br
 - d. S-O

9. Considering both formal charge and electronegativities, predict on which atom or atoms the positive charge resides in the following cations: *Draw Lewis structures!*

a. H_3O^+

b. NH4+

 $c.\ NO_{2^+}$

d. NF₄+

10. Determine if the following molecules are polar or nonpolar. Use a table of electronegativities to determine the most polar bond in the molecules below. *Draw Lewis structures!*a. CS₂

 $b.\ CF_4$

c. PCl₃

d. CO

Electronegativity Values

