Lewis Structures

To draw a Lewis structure for a molecule or an ion:

1. Write the chemical symbols for the atoms in their bonding sequence as given in the problem.
2. Draw single bonds to connect the atoms.
3. Complete octets around all atoms except H, which gets a "duet".
4. Count available valence electrons.
    a. all outer-shell electrons
    b. each "-" ionic charge represents one more electron
    c. each "+" ionic charge represents one less electron
5. If octets require more electrons than are available, remove electron pairs as needed and move other pairs to form multiple bonds (original single bond plus 1 or 2 more bonds).
    a. H, F, Cl, Br, I form 1 bond
    b. O, S, Se " 2 " bonds
    c. N, P, As " 3 "
    d. C forms " 4 "
6. If octets require more electrons than are available, but none of the atoms involved can form multiple bonds, leave the central atom with a sextet or less.
7. If octets require fewer electrons than are available, add extra electron pairs to the (large) central atom.
8. If the chemical species is ionic, put brackets around the structure and write the charge as a superscript outside the brackets.

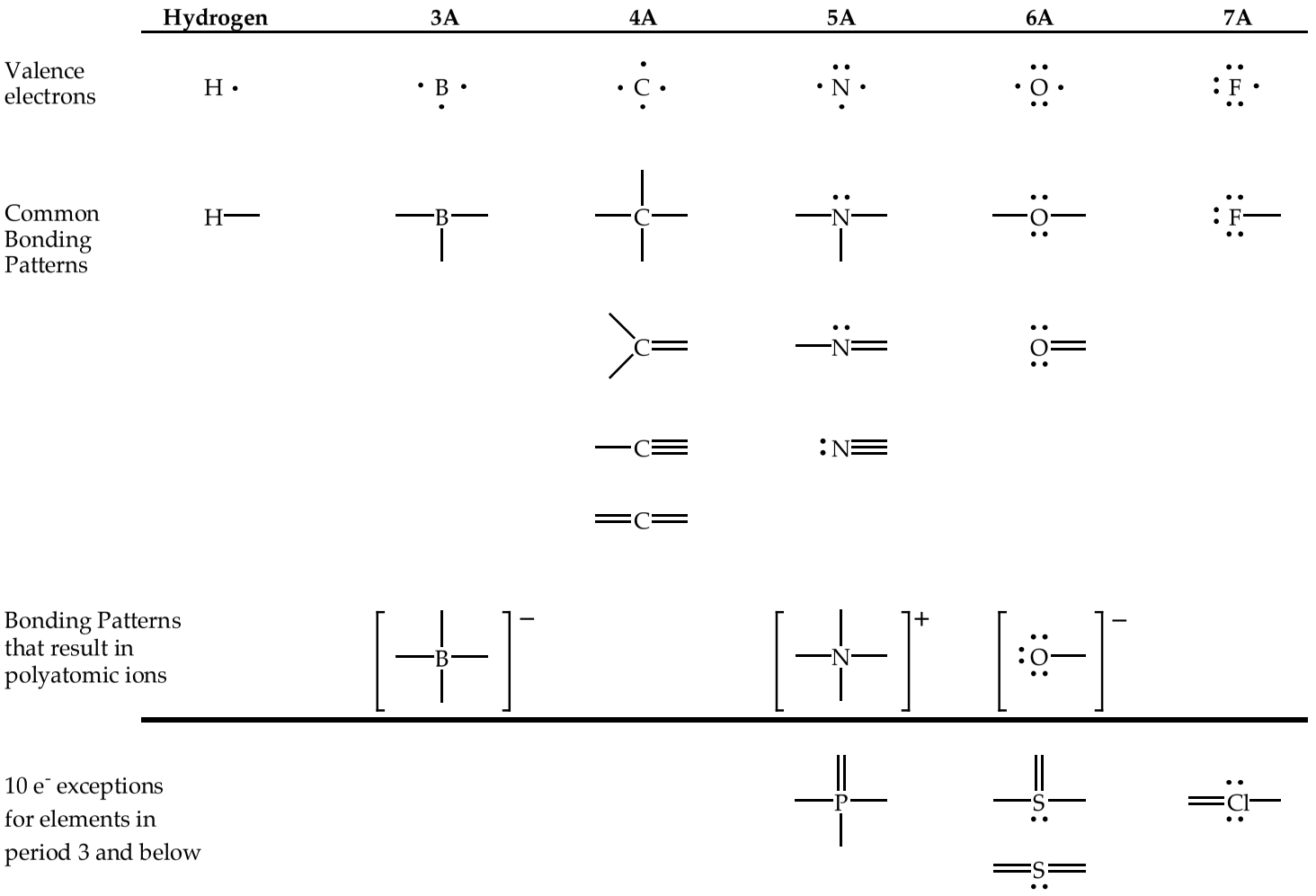
VSEPR

To predict molecular or ionic shapes using valence shell electron pair repulsion (VSEPR) theory:

1. Draw the Lewis structure (see above).
2. Identify the central atom or atoms (you may be asked to do a VSEPR analysis for more than one atom in a structure).
3. For each central atom, note the number of atoms bonded to it and the number of non-bonding electron pairs on it. Remember that the number of atoms bonded to the central atom and the number of bonds on it are not necessarily the same because of the possibility of multiple bonds.
4. Symbolize the central atom as "A", each bonded atom as "X" and each non-bonding electron pair as "E", and write a formula in the form AX_nE_m.
5. Identify the shape around the central atom from the following table, which you must memorize:

Formula	Shape
AX_2	linear
AX_3	trigonal planar
AX_2E	bent (~120°)
AX_4	tetrahedral
AX_3E	trigonal pyramidal
AX_2E_2	bent (~109°)

Lewis Structures - Common Bonding Patterns For Representative Elements



Name_____

Section_____ **Date**_____

Lewis Dot Structure Worksheet

Write the Lewis electron dot structures for the following molecules and ions. The bonding sequence is given where needed.

1. $\underline{N}F_3$

2. $\underline{S}Cl_2$

3. $\underline{S}OCl_2$ (central S)

4. $\underline{C}S_2$

5. $\underline{C}Cl_2F_2$ (central C)

6. C_2H_6O (C-C-O sequence)

7. C_2H_6O (C-O-C sequence)

8. $\underline{N}H_2Cl$ (central nitrogen)

9. $H\underline{Cl}O_2$ (central chlorine, hydrogen attached to oxygen)

10. ClO^-

11. $\underline{P}H_4^+$

12. CH_3-CH_2Cl (C-C-Cl sequence)

13. CN-CO-CN (C-C-C sequence)

14. CCl_3-CHO (C-C sequence)

Use the VSEPR theory to predict the shapes of the following. 1.Draw Lewis dot structures for each case. 2. Describe the shape about each underlined central atom in terms of an expression of the form AX_nE_m and in words (e.g., "linear"). Some structures have more than one indicated central atom. 3. Sketch the shape of each molecule or ion.

15. $\underline{C}OF_2$

16. $\underline{C}F_4$

17. $\underline{P}Br_3$

18. $\underline{C}OS$

19. $\underline{S}O_2$

20. $\underline{Se}Br_2$

21. $\underline{C}H_3$-$\underline{C}O$-CH_3 (C-C-C sequence; give shape for two centers)

22. $\underline{C}H_3$-$\underline{S}H$ (give shape for two centers)

23. Cl$\underline{C}H_2$-$\underline{C}N$ (C-C sequence; give shape for two centers)

24. $\underline{As}H_4^+$

25. $\underline{Cl}O_2^-$

26. O-$\underline{P}$-$\underline{O}$-P-O (i.e., P_2O_3; give shape for two centers)