

# CHM 1321

## Problem set 1

- 1) Draw Lewis structures, showing all unshared electrons, for the following molecules:
- |   |  |  |
|---|--|--|
| (a) $\text{CH}_3\text{NH}_2$  | (b) $\text{CH}_2\text{CH}_2$                     | (c) $\text{C}_2\text{H}_2$   |
| (d) $\text{CH}_3\text{CH}_2\text{CHO}$                                | (e) $\text{CH}_3\text{CH}_2\text{OH}_2^+$        | (f) $(\text{CH}_3)_3\text{N}$  |
| (g) $\text{CH}_3\text{CN}$  | (h) $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$ | (i) $\text{CH}_3\text{NCO}$  |
| (j) $\text{CH}_2\text{CHCH}(\text{OH})\text{CH}_2\text{CO}_2\text{H}$ | (k) $\text{NCCH}_2\text{COCH}_2\text{CHO}$       | (l) $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{C}(\text{CH}_2\text{CH}_3)_2\text{CHO}$ |
| (m) $(\text{CH}_3)_3\text{C}^+$                                       | (n) $\text{CH}_3\text{CH}_2\text{O}^-$           | (o) $\text{CH}_3\text{CHCHCH}_2\text{CHCHCOOH}$  |
| (p) $\text{HC}(\text{O})\text{N}(\text{CH}_3)_2$                      |  |  |
- 2) There is a small portion of the periodic table that you must know to do organic chemistry. Construct this from memory including the group numbers, numbers of valence electrons, and electronegativities.
- 3) Draw structures for
- Two compounds with the formula  $\text{C}_4\text{H}_{10}$
  - Three compounds with the formula  $\text{C}_3\text{H}_8\text{O}_2$
  - Two compounds with the formula  $\text{C}_2\text{H}_7\text{N}$
  - Five compounds of formula  $\text{C}_3\text{H}_6\text{O}$
- 4) Name all the compounds in Question 3.
- 5) Show the direction of the dipole moments of the following bonds. Use two methods.
- (a) C-Cl (b) C-H (c) C-N (d) C-O (e) C-B (f) N-H (g) O-H (h) C-Br
- 6) Draw the shape of s and p orbitals including phasing. Show the resulting shapes following  $\text{sp}$ ,  $\text{sp}_2$  and  $\text{sp}_3$  hybridization.
- 7) For each molecule below:
- Draw complete molecular orbital structures using the LCAO method.
  - Label the atomic orbitals used to make the bonds ( $\text{p}$ ,  $\text{sp}$ ,  $\text{sp}^2$ ,  $\text{sp}^3$ )
  - Label the bonds ( $\sigma$ ,  $\pi$ ).
  - Indicate the geometry of each atom (linear, trigonal planar, tetrahedral).
- (a)  $\text{CH}_3\text{CH}_2\text{NH}_2$  (b)  $\text{CH}_3\text{CO}_2\text{H}$  (c)  $\text{CH}_3\text{CHCHCH}_2\text{CH}_3$  (d)  $\text{CH}_3\text{NO}_2$  (e)  $\text{CH}_3\text{CN}$   
(f)  $\text{CH}_3\text{OCH}_3$