

1. A) Give the ground-state electron configuration for each of the following elements (6 pts).

(a) Boron

(b) Oxygen

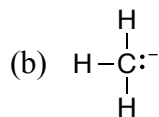
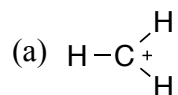
B) Draw a molecule of dichloromethane, CH_2Cl_2 , using wedged, normal, and dashed lines to show its tetrahedral geometry (4 pts).

C) Draw the Lewis structures of the following compounds. Include formal charges in the Lewis structures (6 pts).

(a) CH_2O

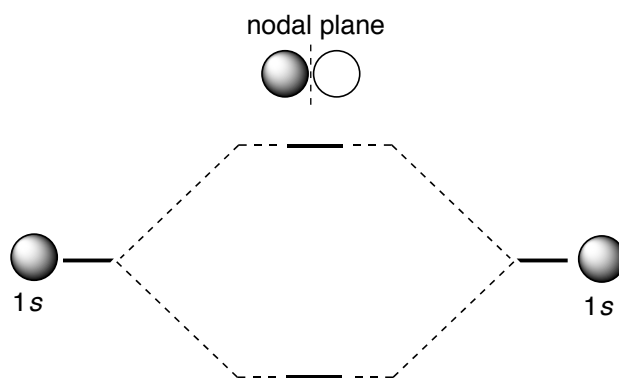
(b) BF_4^-

D) Predict the geometry of the following molecules and ion using the VSEPR model (6 pts).



E) Draw two resonance forms for the acetate ion, $\text{CH}_3\text{-CO}_2^-$. Use the curved-arrow notation to show how the second resonance structure can be derived from the first (6 pts).

F) The following is an orbital interaction diagram for the formation of He_2^+ . Complete the diagram by showing the bonding molecular orbital and adding electrons to the atomic and molecular orbitals (6 pts).

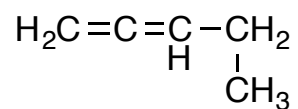


2. A) Draw the structure of an alkane that has one quaternary and one secondary carbon (6 pts).

B) Draw the five constitutional isomers C_6H_{14} . Name all the isomers other than n-hexane (12 pts).

C) Consider 2-methylbutane. Sighting along the C2-C3 bond. Draw a Newman projection of the most stable conformation. Draw a Newman projection of the least stable conformation (6 pts).

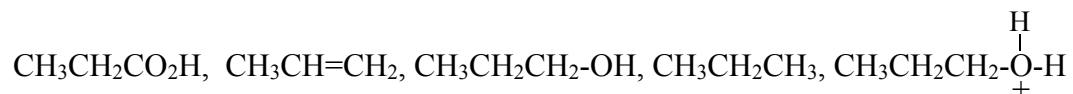
D) What is the hybridization of the carbon atoms in the following molecule. Circle the longest carbon-carbon bond (6 pts).



E) Draw the skeletal structures of the following compounds (6 pts).

- a) 5-*sec*-butyl-6-*tert*-butyl-2,2-dimethyldecane
- b) 1,1,4-trimethylcyclohexane
- c) 1-isopropyl-2-methylcyclobutane

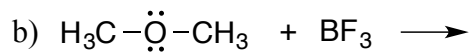
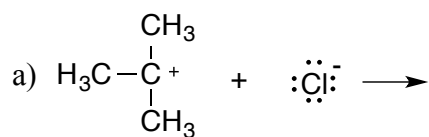
3. A) Rank the following compounds in order of increasing acidity (5 pts).



B) Which of the following are likely to act as Lewis acids and which as Lewis bases (4 pts)?

- a) AlBr_3
- b) $\text{CH}_3\text{CH}_2\text{NH}_2$
- c) BH_3
- d) $\text{CH}_3\text{CH}_2\text{SCH}_3$

C) Give the curved-arrow notation for, and predict the product of, each of the following reactions. Each involves a Lewis acid and a Lewis base (6 pts).



4. Use the curved-arrow notation to indicate the flow of electrons in each of the following transformations (15 pts).

