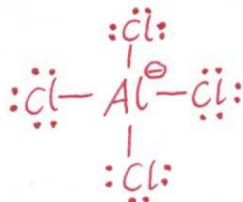


1. A) Provide Lewis structures for the following compounds. Show all unshared electrons and formal charges. (6 pts)

a) CO_2



b) AlCl_4^-



B) Predict the geometry of the following molecules using the VSEPR model. (6 pts)

a) BF_4^-

Tetrahedron

b) PCl_3

Trigonal pyramidal

C) For each of the following molecules: draw one additional resonance structure and use curved-arrow notation to show how the second resonance structure can be derived from the first. Show all unshared electrons and formal charges. (6 pts)



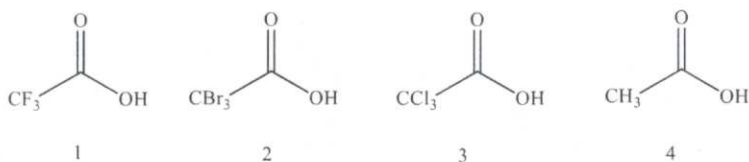
2. A) Which of the following are likely to act as Lewis acids and which as Lewis bases. (6 pts)



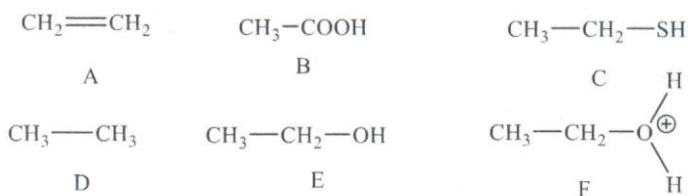
Lewis acids: *AlCl_3 Ag^\oplus $\text{B}(\text{OH})_3$*

Lewis bases: *NH_3 $\ominus\text{CH}_3$ I^\ominus*

B) Rank the following acids in strength from weakest acid to strongest acid. (3 pts)



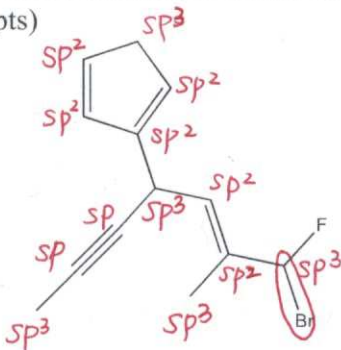
C) Rank the following acids in strength from weakest acid to strongest acid. (3 pts)



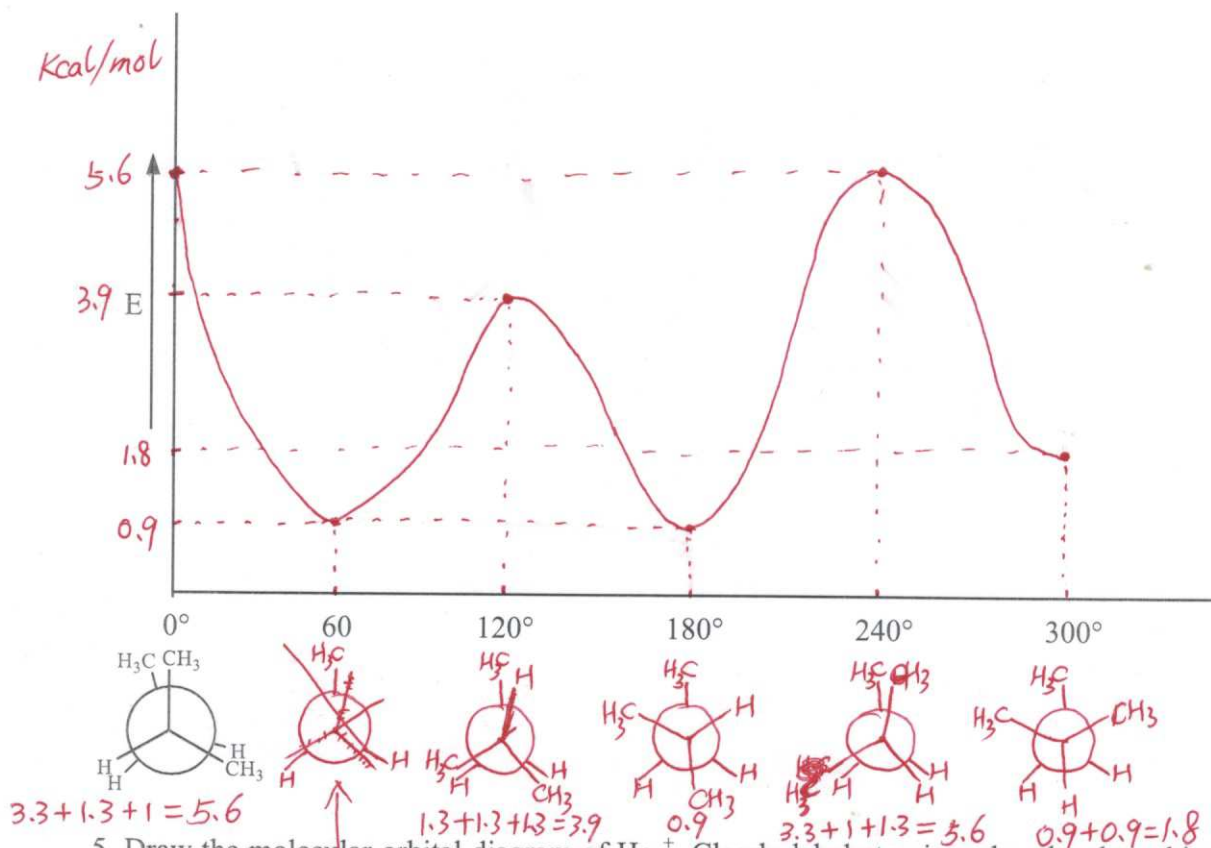
3. A) Please draw an alkane with 5 carbons, none of which are primary and exactly 2 of which are tertiary. (4 pts)



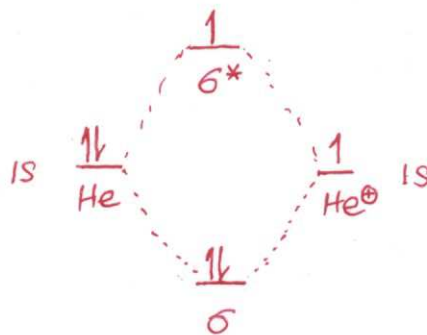
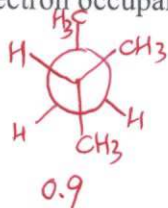
B) What is the hybridization of each carbon atom in the following molecule? (3 pts) Circle the longest chemical bond. (3 pts)



4. Draw an energy diagram for rotation about the C—C bond in 2,3-dimethylbutane. Draw the Newman projections for the dihedral angles 60°, 120°, 180°, 240° and 300°. (18 pts)

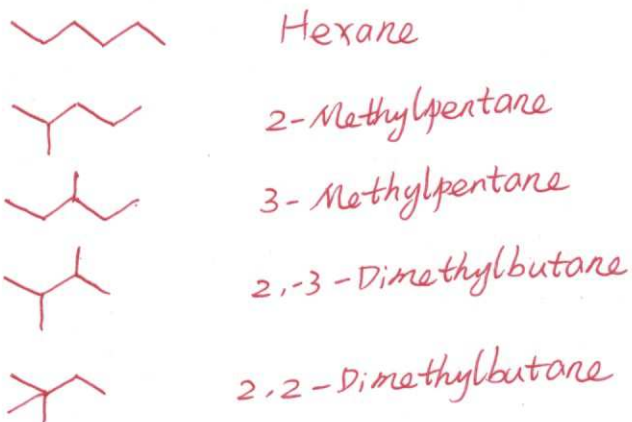


5. Draw the molecular orbital diagram of He_2^+ . Clearly label atomic and molecular orbitals, and indicate electron occupancy in each of these. (6 pts)

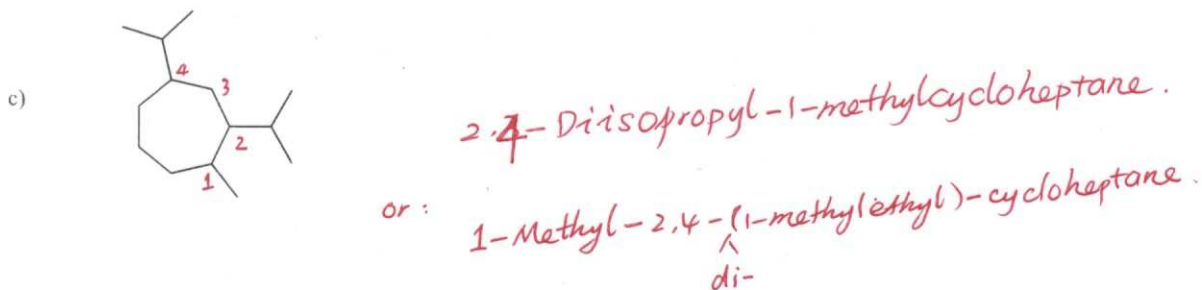
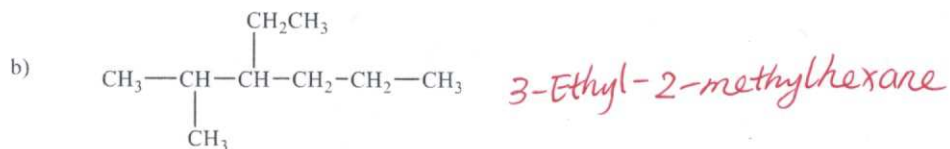
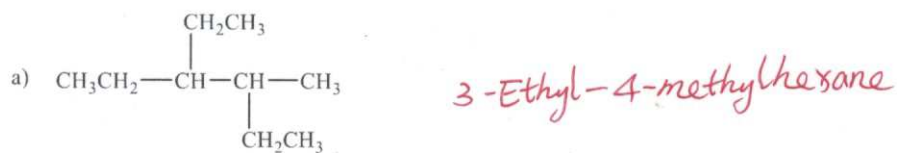


+ 24

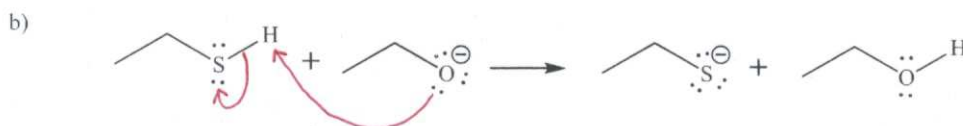
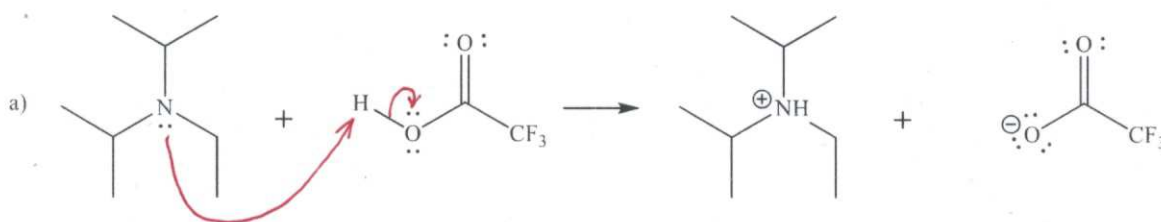
6. A) Draw the structures for all the constitutional isomers of an alkane with the molecular formula C_6H_{14} and provide the IUPAC name for each isomer. (12 pts)



- B) Provide the correct name for the following compounds. (12 pts)



7. A) Provide a curved-arrow notation for each of the following reactions in the left-to-right direction. (6 pts)



B) Provide the product(s) for the following reactions. (6 pts)

