Draw electron-dot formulas for the following ionic species. Show the formal charges on individual atoms in each ion.

* 1. chlorate ion, ClO3¯
  2. bicarbonate ion, HCO3¯
  3. sulfite ion, SO32¯
  4. perchlorate ion, ClO4¯

Draw electron-dot formulas for all the contributors to the resonance hybrid structures of the carbonate ion, CO32¯. What is the charge on each atom in each contributor? Using curved arrows, show how the electron pairs move to interconvert the three structures.

Which one of the following chair conformations will be more stable? Explain your answer by drawing conformational structures.

* 1. cis-1-t-butyl-4-methylcyclohexane
  2. trans-1-t-butyl-4-methylcyclohexane

Write an equation for the reaction of 3-methyl-2-hexene with each of the following reagents:

* 1. bromine
  2. KMnO4, OH¯
  3. H2O, H+
  4. BH3 followed by H2O2, OH¯
  5. hydrogen (Pt catalyst)
  6. hydrogen bromide

Write an equation for and show every step in the mechanism of the acid-catalyzed hydration of 2-methyl-1-pentene.

Write out all steps in the mechanism for the reaction of aniline with bromine in the presence of FeBr3 catalyst.

Which of the following substances can exist in an optically active form? Draw structures, and locate with an asterisk all chiral centers in each compound.

* 1. 2-methylbutane
  2. 1,2,3,4-tetrachloropentane

How many stereoisomers are possible for each of the following substances? Draw them, and name each by the R-S and E-Z conventions.

* 1. 4-bromo-2-hexene
  2. 3,4-dibromo-2-hexene

Select an alkyl halide and a nucleophile that will give each of the following products:

* 1. (CH3)2CHOCH3
  2. CH3CH2C≡CCH2Cl
  3. (CH3)2CHCH2SCH3
  4. (CH3CH2CH2)2NH2+ Br¯

Determine the order of reactivity for (CH3)2CHCH2I, (CH3)3CI, and CH3CHICH2CH3 reacting with:

* 1. CH3CH2O¯K+
  2. CH3CH2OH (ethanol)