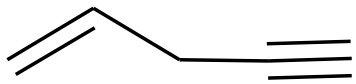
ChemV12A, Organic Chemistry I

1.) Consider the neutralization reaction between sodium hydroxide (NaOH) and methanol (CH_3OH). (Hint: Recall that NaOH is a strong base) (30 pts)

a.) Show the arrow-pushing mechanism for this reaction. Complete Lewis structures must be used (e.g., all atoms, bonds, lone pairs, and formal charges).

b.) The pKa for methanol is 14 and the pKa for water is 16. In which **direction** (forward or reverse) will the above equilibrium move? _____

2.) Consider the organic molecule depicted below. Use the provided structure to answer the following questions. (18 pts)

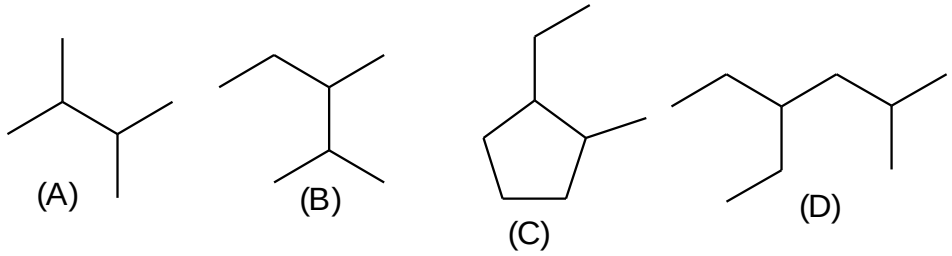


a.) Label the **hybridization** at each carbon.

b.) What is the overall molecular formula for the above structure? _____

c.) Label which hydrogen will be the most acidic and **explain** why.

3.) Give the correct IUPAC names for the following compounds. (20 pts, 5 pts ea)



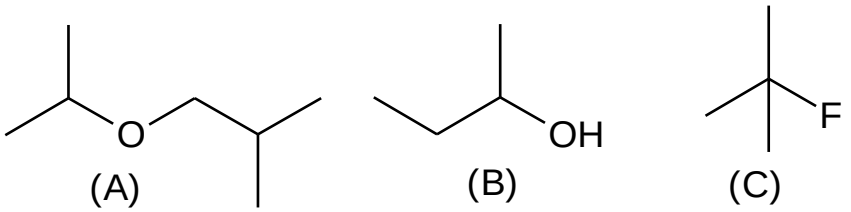
(A) _____

(B) _____

(C) _____

(D) _____

4.) Consider the following pair of molecules. (34 pts)



a.) Give **both** the IUPAC and the common name for structure (A).

IUPAC: _____

COMMON: _____

b.) Give **both** the IUPAC and the common name for structure (B).

IUPAC: _____

COMMON: _____

c.) Give **both** the IUPAC and the common name for structure (C).

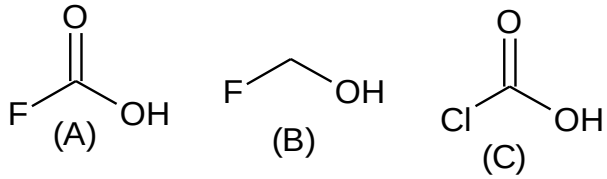
IUPAC: _____

COMMON: _____

d.) Is structure (B) more likely to behave as an **acid** or a **base**? **Explain**.

5.) Give the **balanced equation** for the acid-base neutralization between *tert*-butanol ($(CH_3)_3COH$, pKa = 18) and methylamine (CH_3NH_2, pKa = 40). **Label** the (1) acid, (2) base, (3) conjugate acid, and (4) conjugate base. (16 pts)

6.) Consider the following molecules. (25 pts)



a.) Arrange the molecules (A-C) by **increasing acidity,** starting with the **weakest**.

b.) **Explain** your reasoning in (a).

7.) Draw the molecular orbital diagram for He_2^+. Determine its **bond order** and whether it is stable or unstable. (14 pts)

8.) Do sp^4 hybrids exist? Why or why not? (8 pts)

PAGE 3: _____