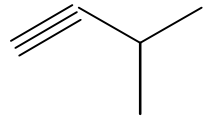
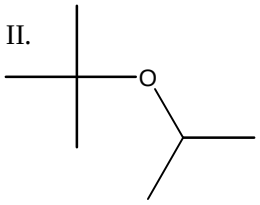
Chem 233: Problem Set #2 (on Chapter 2)

1. For each line (skeletal) structure shown below, write a structural formula which includes all hydrogen atoms.

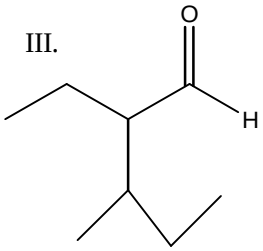
I.



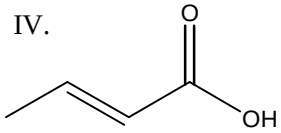
II.



III.



IV.



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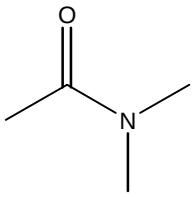
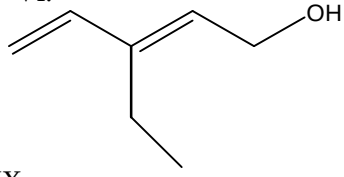
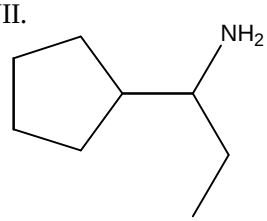


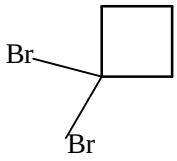
VI.



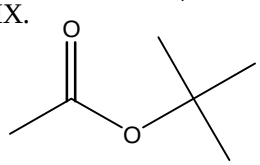
VII.



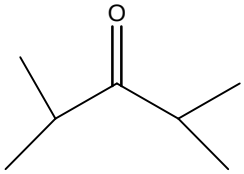
VIII.



IX.

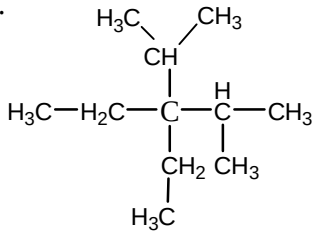


X.

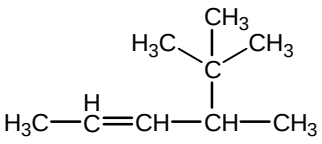


2. Draw the following structural formulas as line (skeletal) structures.

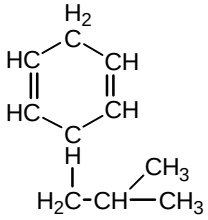
A.



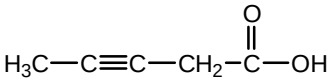
B.



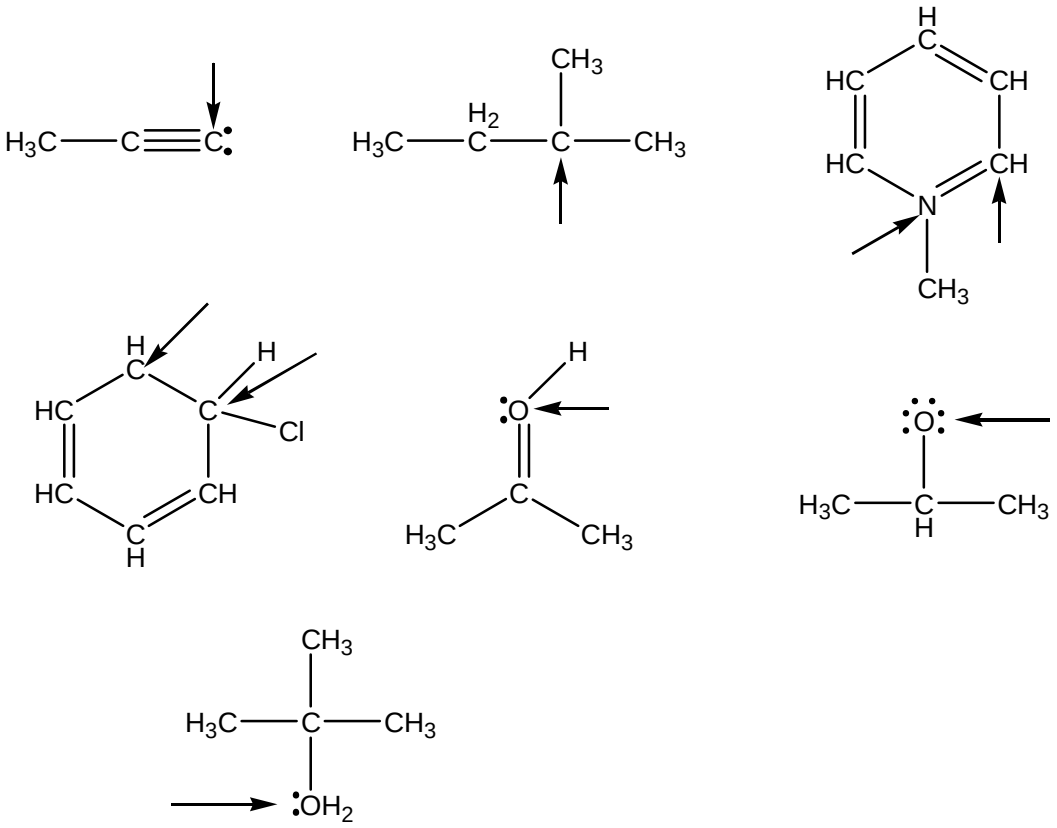
C.



D.

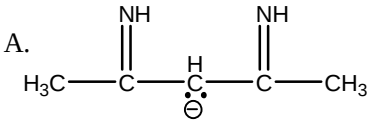


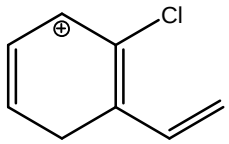
3. Calculate formal charges for each atom indicated with an arrow.

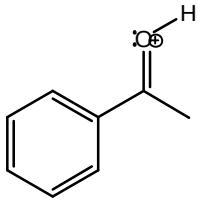


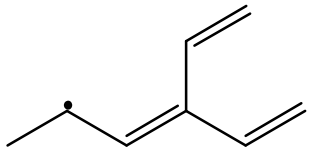
4. Draw all possible resonance structures for nitrite, NO_2^-. Calculate the formal charges on all atoms in each resonance structure. Show with curved arrows how one resonance structure can be converted to the other by movement of electron pairs. Draw a picture of the resonance hybrid and indicate the N-O bond orders in this hybrid.

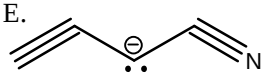
5. Draw all possible resonance structures for each of the following. Indicate whether or not each resonance structure is of equivalent energy to the original.

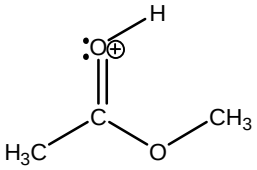
A. 

B. 

C. 

D. 

E. 

F. 

6. Indicate which of the following reactions will proceed as written, i.e., such that at equilibrium products are favored over reactants.

A. $HCO_2H + NO_3^- \longrightarrow CO_2H^- + HNO_3$
(pK_A values: HCO_2H = 3.75, HNO_3=-1.3)

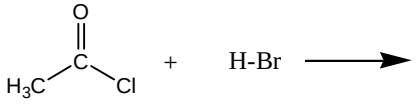
B. $HCO_2H + CH_3CH_2O^- \longrightarrow CO_2H^- + CH_3CH_2OH$
(pK_A values: HCO_2H = 3.75, CH_3CH_2OH=16.00)

C. $CH_3CH_2OH + OH^- \longrightarrow CH_3CH_2O^- + H_2O$
(pK_A values: CH_3CH_2OH=16.00; H_2O=15.74)

7. Arrange the following acids in order of decreasing acid strength. For each, give the chemical formula of the conjugate base. Arrange the conjugate bases in order of decreasing base strength.

Acid:	$C_6H_5NH_3^+$	CH_3OH	NH_4^+	C_6H_5OH	C_6H_5COOH
pK_A:	4.60	15.5	9.4	10.00	4.17

8. Use curved arrows to show the reaction between the Lewis acid-base pairs given below.

A. 

B.