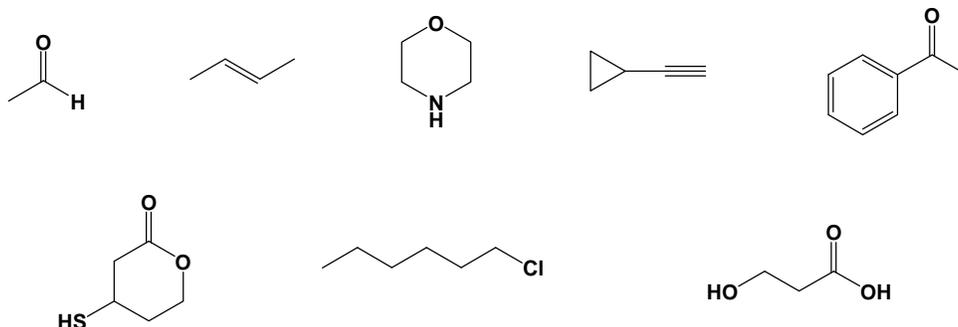


**HOMEWORK PROBLEMS: FUNCTIONAL GROUPS & ALKANES**

1. Provide the functional groups, excluding alkanes, present in each molecule:



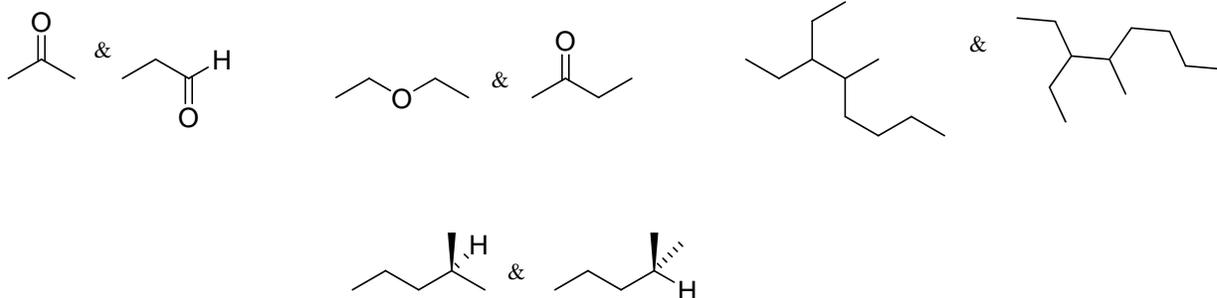
2. For the molecules in question 1, identify all  $4^\circ$  carbons and all  $1^\circ$  hydrogens.

3. Consider the two functional groups, aldehyde and amide, to answer the following questions:

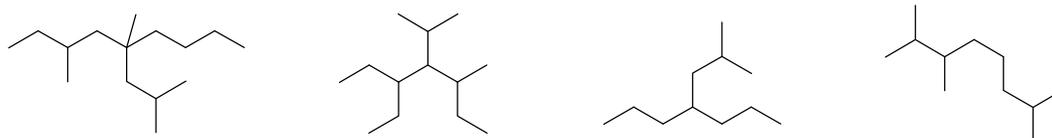
(a) Which do you think has a shorter C=O bond? Explain (hint, think resonance).

(b) Which do you think is a more reactive Lewis Acid? Explain.

4. Describe the relationship between the following pairs of molecules as identical, constitutional isomers, or completely different compounds.



5. Provide the complete IUPAC name for each of the following compounds:

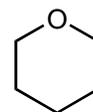
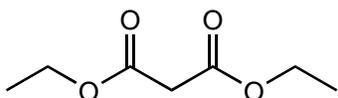
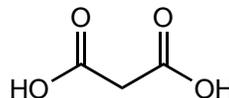
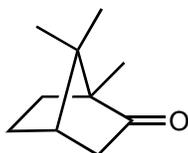
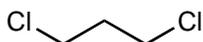
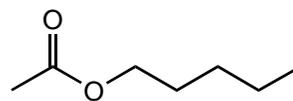
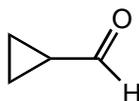
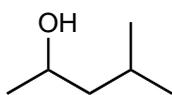


6. Draw the skeletal structure for each of the following compounds:

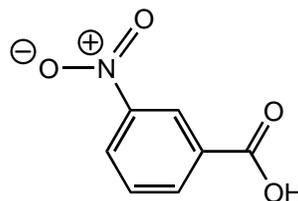
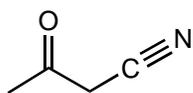
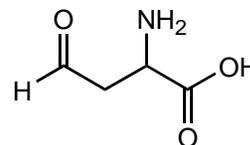
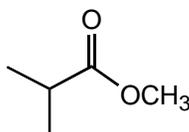
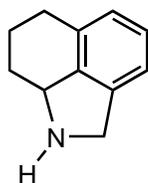
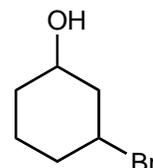
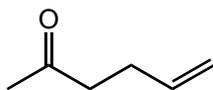
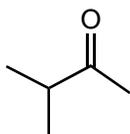
3,3-dimethylpentane  
 1-chloro-2,4,4-trimethylpentane  
 2-(1,2-dimethylpropyl)-4-propyldecane  
 3,4-diethyl-2-methylhexane  
 \*\* one of these names is incorrect, which one is it?

7. Draw the nine constitutional isomers of  $C_7H_{16}$ .

8. The following molecules only have a single functional group. Identify to which class of organic compounds each molecule belongs based on its functional group.

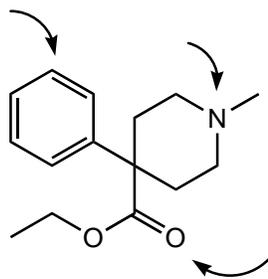


9. Label the functional groups in the molecules below. For each compound, fill in the assumed nonbonding electron pairs and the assumed hydrogens. All atoms are neutral unless a charge is shown. For additional practice, assign the hybridization/geometry for each atom.

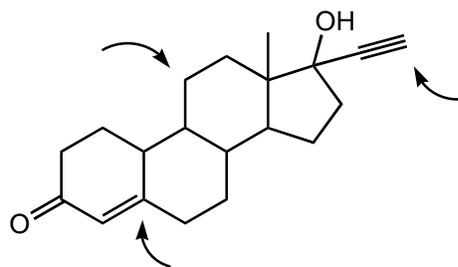


**10.** Below are shown two common pharmaceuticals: meperidine (Demerol), which is an analgesic (pain-killer), and norethindrone, a synthetic hormone used in birth control pills.

- For each, circle and name any functional groups you can identify.
- For each atom marked with an arrow, determine the local geometry.
- Determine the molecular formula for each compound.



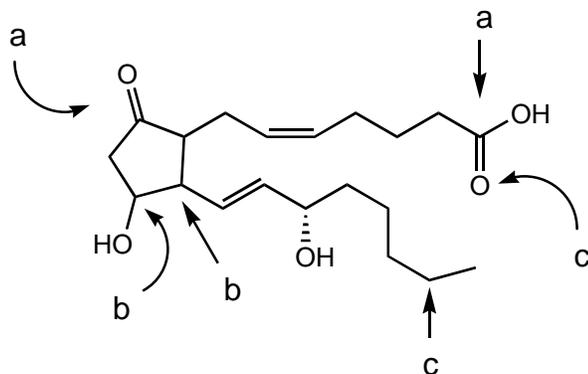
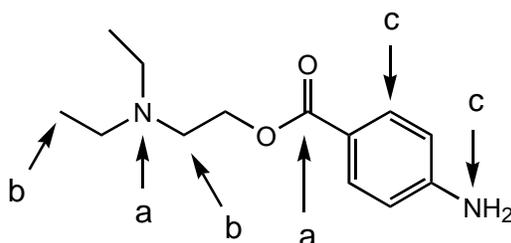
meperidine



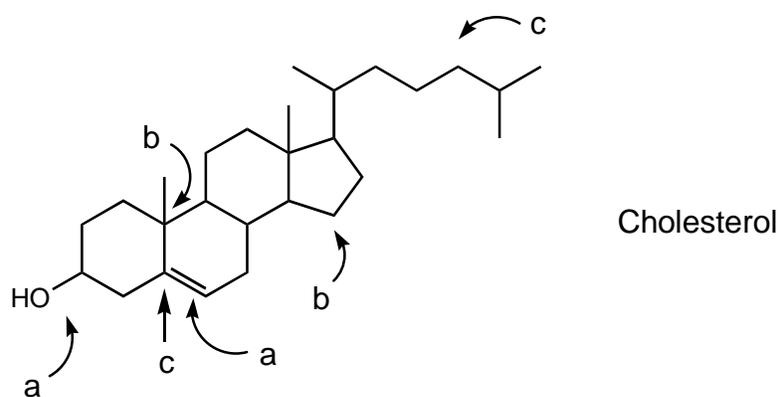
norethindrone

**11.** For the molecules below, give the information requested by the letter scheme.

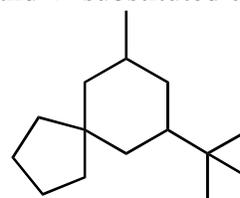
- name these functional groups.
- give the degree of substitution for these carbons.
- give the hybridization of these atoms.

Prostaglandin E<sub>2</sub>

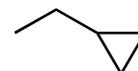
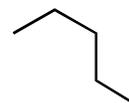
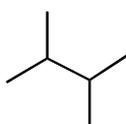
Novocain



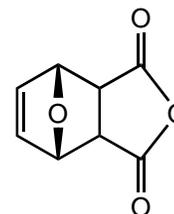
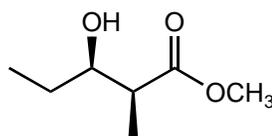
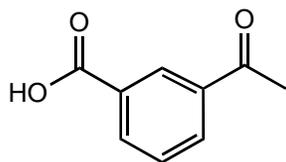
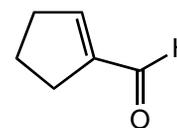
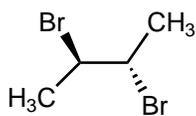
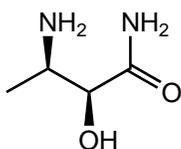
12. For the molecules below, determine the number of 1°, 2°, 3°, and 4° substituted carbons.



13. For the compounds below, determine which are isomers of each other. What kind of isomers are they?

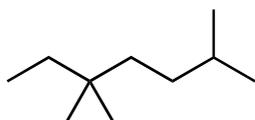


14. Label the functional groups in the molecules below.

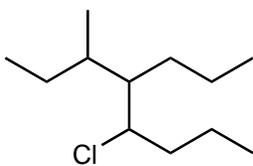


15. Name the following compounds using IUPAC nomenclature.

a.

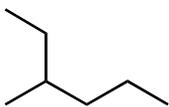


b.

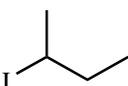


16. Name the following compounds using IUPAC nomenclature.

a.

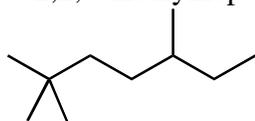


b.

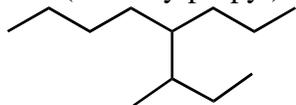


17. The names given for the following structures are wrong. Specify the errors in naming, and give the correct names.

a. 2,2,5-methylheptane



b. 5-(1-methylpropyl)octane



18. Draw the skeletal (line/angle) formulas for the following.

a. 3-ethyl-5-methyl-4-(1-methylethyl)octane

b. 2-bromo-1-ethyl-3-propylcyclohexane

c. 3-(1-methylcyclopropyl)-4-propylheptane

d. *cis*-2-ethyl-1,1,3-trimethylcyclopentane

19. Draw the skeletal(line/angle) formulas for the following.

a. 3-ethyl-5-methyloctane

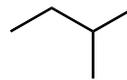
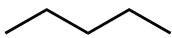
b. 1-bromo-3-isopropylcyclohexane

20. Rank the following compounds from lowest boiling point to highest boiling point. Justify your answers with brief explanations.

butane; 2-methylpropane; pentane; propane

21. For each set, identify which compounds are isomers, and indicate what type of isomers they are.

a.



b.

