

Score (4 pts)		Lectures	4, 5	Name	
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1. Propose structures that meet the following descriptions. Use bond-line notation to draw your structural formulas.

a. ketone with five carbons and one alcohol

b. α -ketoester (i.e., a molecule with a ketone one carbon away from an ester)

c. alkane (no double bonds) with the formula, C_6H_{12}

d. dialdehyde with the formula, $C_4H_6O_2$

e. nitrile with the formula, C_5H_9N

f. β -ketocarboxylic acid (i.e. a molecule with a ketone two carbons away from a carboxylic acid)

g. phenol with a carboxylic acid group adjacent to hydroxyl

h. amino acid (i.e. a carbon atom attached to both a carboxylic acid and an amine)

i. amide with the formula, C_3H_7NO

j. ether with the formula, $C_4H_{10}O$

k. a secondary thiol with 3 carbons

l. alkane with five carbons, one of which is a quaternary carbon

m. a primary alcohol with five carbons

n. hydroxy aldehyde (a compound containing an aldehyde and hydroxy group)

2. Draw an example of a molecule with each of the following functional groups. Then, predict the hybridization of the carbon atom in each.

a. Ketone with 3 C-atoms

b. Nitrile with 1 C-atom

c. Amine with 1 C-atom

3. There are seven constitutional isomers with the formula $C_4H_{10}O$. First, draw all seven. Second, state the meaning of a constitutional isomer.

4. Draw and name (using IUPAC nomenclature) three monobromo derivatives of pentane, $C_5H_{11}Br$.

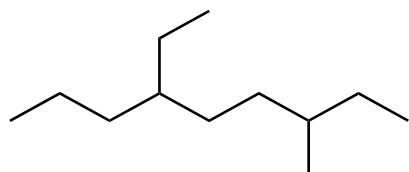
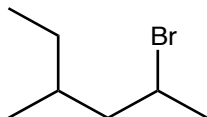
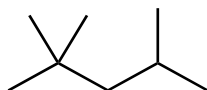
5. Each of the following names is incorrect. Write the correct name underneath and draw the structure

a. 6-methylhexane

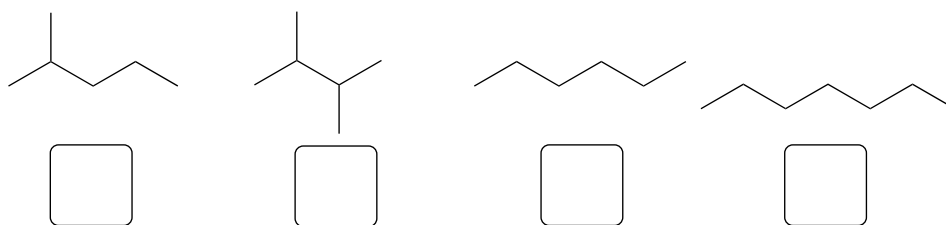
b. 3-isopropylhexane

c. 2-methyl-3-methyl-4-methylpentane

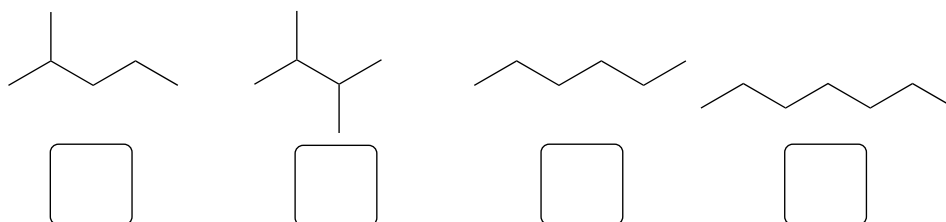
6. Give IUPAC names for the following compounds:



7. Rank the hydrocarbons in order of increasing equilibrium vapor pressure (1 = lowest vapor pressure; 5 = highest vapor pressure).



8. Rank the hydrocarbons in order of increasing boiling point (1 = lowest boiling point; 4 = highest boiling point).



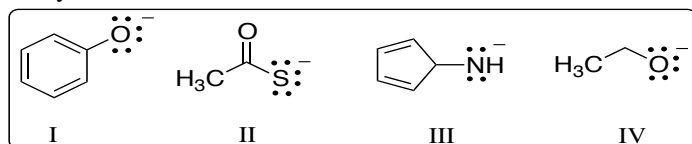
9. Which argument *best* explains why hexafluoroethane has a lower boiling point than ethane?

- there is more hydrogen bonding in ethane
- hexafluoroethane has strong dipole-dipole VWFs
- fluorine is less polarizable than hydrogen
- ethane has fewer London dispersion forces than hexafluoroethane
- none of the above

10. Which *does not* explain why branched alkanes have slightly lower heats of combustion than their unbranched isomers?

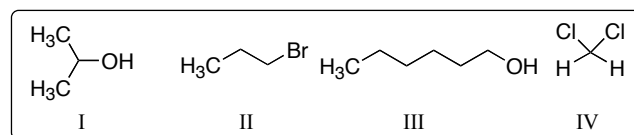
- unbranched alkanes have higher potential energy
- increased branching leads to increased intramolecular induced dipole-induced dipole interactions
- increased branching leads to increased intramolecular London dispersion forces
- more branched alkanes are more stable
- branched alkanes have a lower surface area

11. Which of the following conjugate bases *cannot* be stabilized by resonance?



- I & IV
- III & IV
- I only
- II only
- III only

12. Which compound would you expect to be the *most* soluble in water?



- IV
- III
- II
- I
- none of the compounds above are soluble in water

13. **First**, list the all of the valence orbitals for each atom in the middle column. **Second**, draw the electron configuration diagram for that atom in the right column for just the valence orbitals. You must label the orbitals, include electrons and arrange the orbitals in terms of relative energy. The first one is done for you.

a. unhybridized carbon	2s, 2p, 2p, 2p	
b. sp ² -hybridized carbon		
c. sp ³ -hybridized carbon		
d. carbon atom in ethylene (C ₂ H ₄)		
e. carbon atom in acetylene (C ₂ H ₂)		
f. unhybridized oxygen		
g. sp ³ -hybridized oxygen		
h. oxygen atom in formaldehyde (H ₂ CO)		
i. oxygen atom in carbon dioxide (CO ₂)		
j. nitrogen atom in ammonia (NH ₃)		
k. nitrogen atom in cyanide (CN ⁻)		