

CHM 1321

Problem set 3

In this assignment:

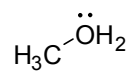
- Drawing Lewis structures and assigning formal charges
- Analyzing the effects of intermolecular forces
- Conformational analysis

1) Draw Lewis structures for the following molecules. Identify the hybridization of the underlined atoms.

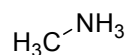
- $\underline{\text{Al}}\text{Cl}_3$
- $\underline{\text{B}}\text{F}_3$
- $\underline{\text{C}}\text{H}_3\underline{\text{N}}\text{O}_2$
- $(\text{CH}_3)_3\underline{\text{C}}^+$
- Pentanal
- Propanoic acid
- Formaldehyde
- Acetaldehyde
- 2-Methylpentan-1-ol
- 3-Methylpentan-1-amine

2) Each structure below is missing a charge. Assign formal charges to show which atom bears the charge. All the lone pairs have been shown.

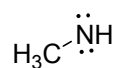
a.



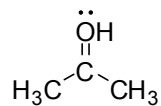
b.



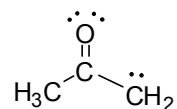
c.



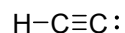
d.



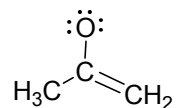
e.



f.



g.

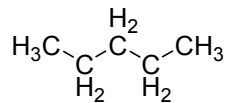


3)

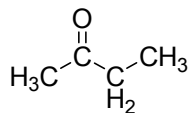
a. Convert each of the following molecules to a line structure

b. Name each compound

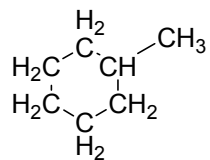
i.



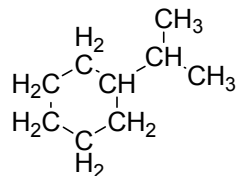
ii.



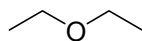
iii.



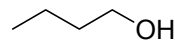
iv.



4) Diethyl ether and 1-butanol have similar solubilities in water, but their boiling points are very different. Explain why these compounds have similar solubility properties but different boiling points.

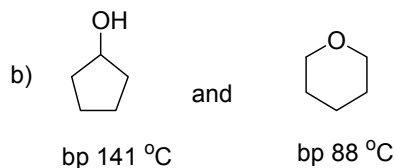
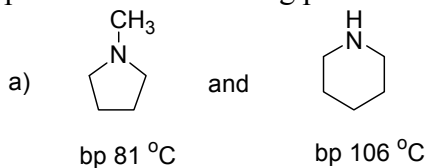


solubility 8.4 mL in 100 mL H_2O
bp 35 °C



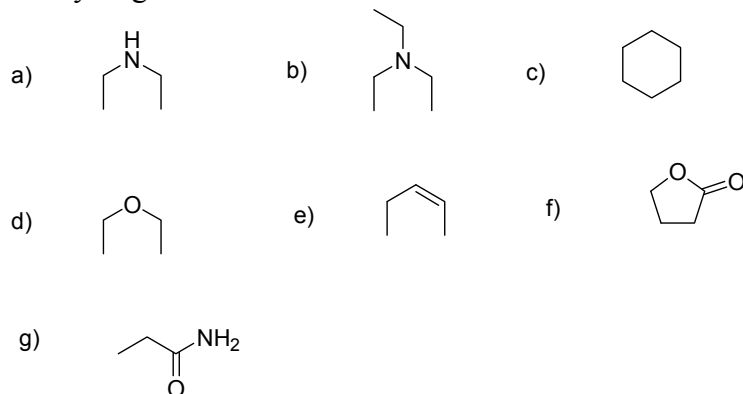
solubility 8.9 mL in 100 mL H_2O
bp 118 °C

5) Explain the difference in boiling point for the following pairs of compounds:



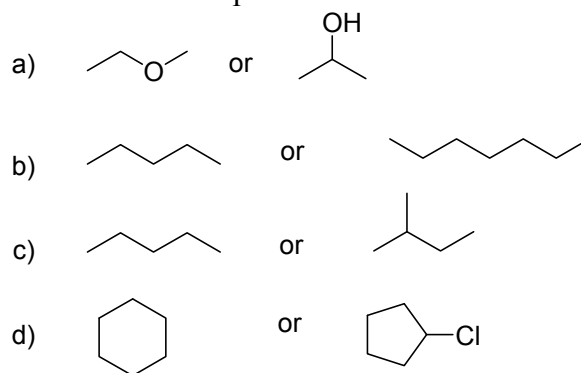
6)

- i. Identify the functional group in each of the following molecules
- ii. Which of the following compounds can form hydrogen bonds in the pure state? Which can form hydrogen bonds with water?

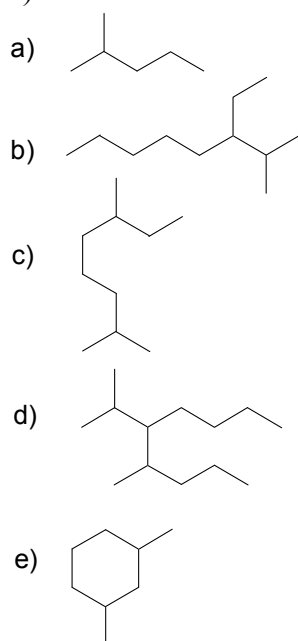


7)

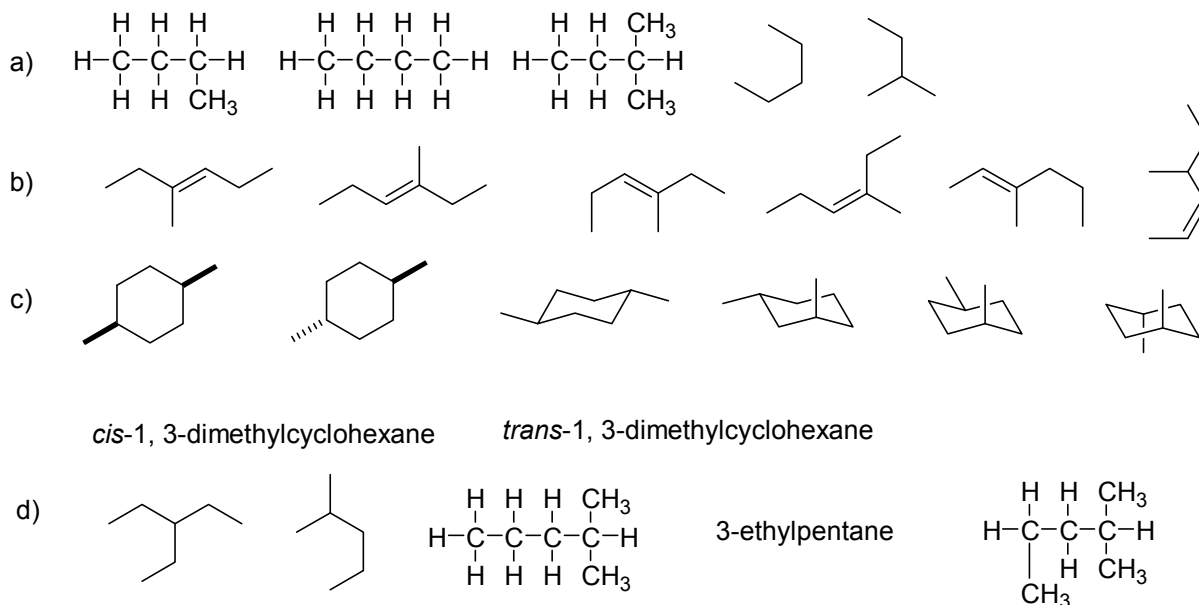
- i. Predict which of the following pairs of compounds will have the higher boiling point and explain your prediction.
- ii. Convert each structure to a Lewis structure (show each bond and lone pair explicitly)
- iii. Provide a name for each compound



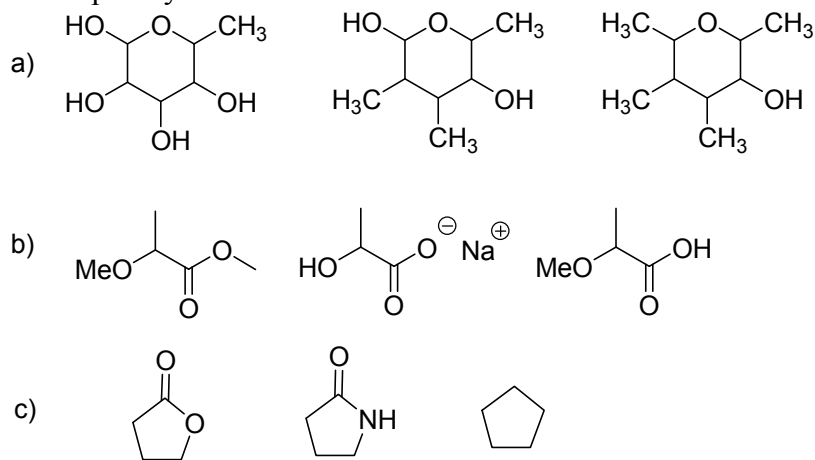
8) Provide names for the following compounds




- 9) Which of the following represent different compounds? Which represent the same compound?
TIP: build models and compare two molecules at a time



- 10) Predict which of the following in each set of compounds will have the highest water solubility. Which will have the lowest? Explain your answers.



- 11) Use a Newman projection, about the indicated bond, to draw the most stable conformer for each compound. What is the least stable conformer of each?

- a) 3-methylpentane about the C2-C3 bond.
b) 3, 3-dimethyl hexane about the C3-C4 bond
c) 1-bromobutane about the C1-C2 bond
d) 

12) Consider *cis*-1, 3-dimethylcyclohexane.

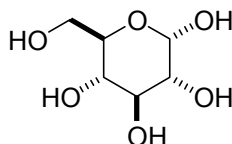
- Draw the two chair conformations using line notation.
- Re-draw the two chair conformations showing all the axial hydrogens.
- Re-draw the two chair conformations showing all the equatorial hydrogens.
- Label the high and low energy conformers in part a.

13) Repeat question 12 for *trans*-1, 2-dimethylcyclohexane. What is the energy difference between the two chair conformations?

14) Draw the two chair conformations of each compound listed below. For each structure, label the substituents (groups other than hydrogen) as being axial and equatorial.

- cis*-1-ethyl-2-isopropylcyclohexane
- trans*-1-ethyl-3-methylcyclohexane
- cis*-1-ethyl-4-methylcyclohexane

15) Draw the most stable form of glucose:



16) Draw the Newman projection of methylcyclohexane about the C1-C2 bond for the most stable and least stable chair conformers (hint see page 170 in the text). Clearly identify which is which, and briefly justify your choice.

17) Draw the Newman projections along the carbon-carbon bond of the carbons bearing the bromines of the two chair conformations of *trans*-1, 3-dibromocyclohexane. Identify the most and least stable conformers (if any).