# Chem 2401 Introductory Organic Chemistry (I)

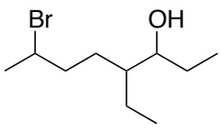
## Sample Quiz 1

*October 1, 2014*

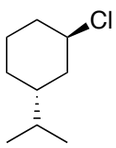
Dr. Y. Zhao  Name: _____

Total **50** pts  MUN ID: _____

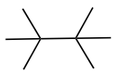
**1. Provide names (systematic or common) for the following structures.**



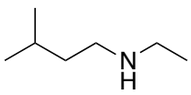

**7-bromo-4-ethyl-3-octanol**



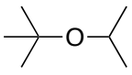

***trans*-1-chloro-4-isopropylcyclohexane**



**2,2,3,3-tetramethylbutane**

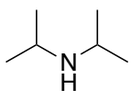



***N*-ethyl-3-methyl-1-butanamine** or **ethylisopentylamine**

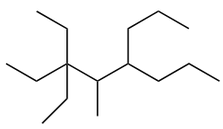


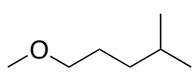

**2-isopropoxy-2-methylpropane** or ***tert*-butyl isopropyl ether**

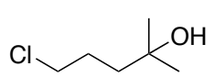
**2. Draw the structures of the following compounds.**

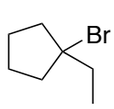
*N*,*N*-diisopropylamine _____ 

_____

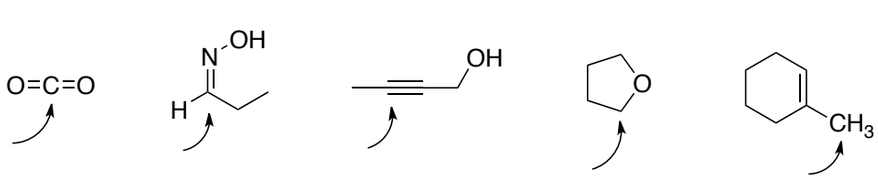
3,3-Diethyl-4-methyl-5-propyloctane___  _____

isohexyl methyl ether _____  _____

5-chloro-2-methyl-2-pentanol_____  _____

1-bromo-1-ethylcyclopentane _____  _____

**3. Indicate the hybridization state for each of the atoms to which the arrows are pointing.**

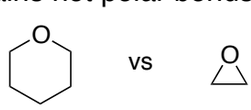



sp sp2 sp sp3 sp3

**4. Compare the molecular dipole moments for the following pairs of compounds.**

(A) $CH_3OCH_3$ vs $CH_3CH_2CH_3$

Dimethyl ether is more polar because it has two polar C-O bonds and the bond angle is about 110 degree. The partial alignment of the two polar bonds gives the molecule a permanent dipole moment larger than that of propane which contains not polar bonds at all.

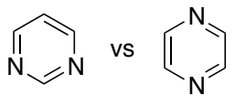
(B) 


Oxirane (right) has a larger dipole moment than tetrahydropyran (left), because the two C-O bonds in oxirane has a much smaller angle, which

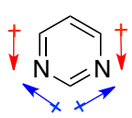
makes better alignment of the bond dipole moments.

(C) 

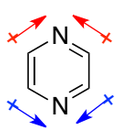

The structure on the left has a smaller molecular dipole moment than the structure on the right. The two polar C-Cl bonds are nearly perpendicular in the left structure, while the C-Cl bonds are parallel in the right structure.

(D) 


Pyrimidine (left) is has a larger dipole moment than pyrazine (right). The structure of pyrazine has the two electronegative nitrogen atoms at the opposite positions of the six-membered ring, which gives a zero net dipole moment. For pyrimidine, dipole moment is greater than zero.



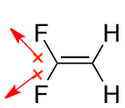

The sum of bond dipole moments is greater than zero.



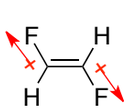

Zero net dipole moment

(E) 


1,1-Difluoroethene (left) has greater molecular dipole moment than *trans*-1,2-difluoroethene.

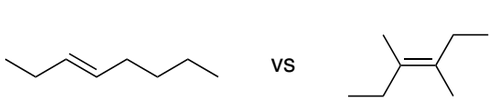



The sum of bond dipole moments is greater than zero.




Zero net dipole moment

**5. Which of the following compound has the <u>lower</u> boiling point, and why?**

(A) 

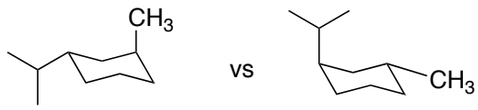

The linear shaped alkene (left) has a higher boiling point than that of the branched alkene (right). The more branched substituents, the weaker is the intermolecular attraction (van der Waals forces).

(B) 


The primary amine (left) has a higher boiling than that of the secondary amine (right), because the primary amine has two hydrogen atoms that can form hydrogen bonds, while the secondary amine has only one hydrogen atom that can form hydrogen bond.

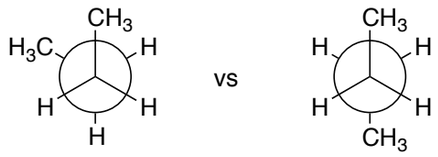
**6. Compare the stability of the conformers provided below.**

(A)



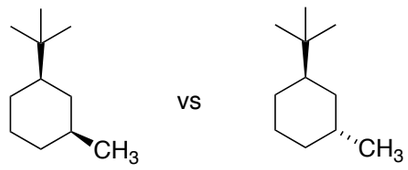

The left conformation is more stable, because it has the large isopropyl group on the equatorial position.

(B)

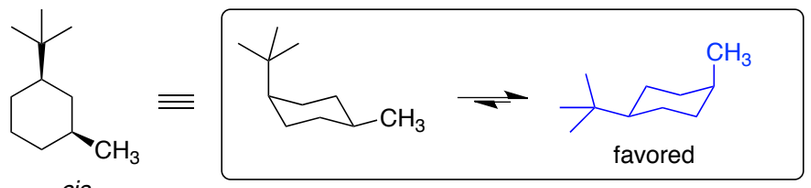


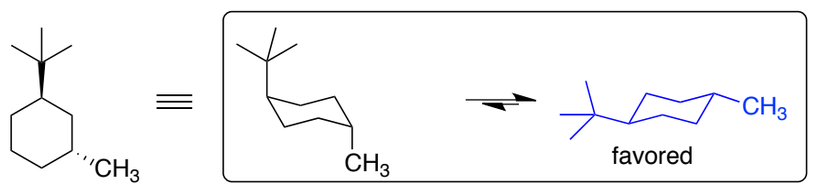

The right conformation is more stable, because it has the methyl groups in the *anti* orientation.

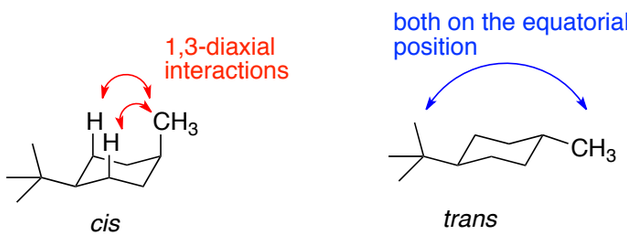
(C)




The *trans* isomer is more stable, because it allows the two substituents to both take the equatorial bonds.

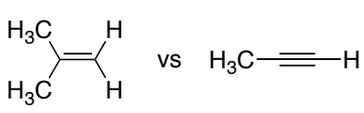



**7. Which of the following compound is a <u>stronger</u> acid, and why?**

(A)




Alkyne (right) is more acidic than alkene (left). The alkynyl carbon is sp

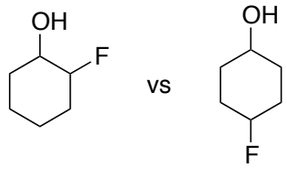
hybridization, which makes the C-H more polar.

(B) 


The alcohol (left) is a stronger acid, because oxygen has a greater electronegativity than nitrogen.

(C) 


The carboxylic acid (left) is more acidic, because of resonance effect.

(D) 


The 2-fluorocyclohexanol (left) is more acid, because it has a stronger inductive effect.

**8. Acetic acid has a p$K_a$ of 4.8. In an aqueous solution of acetic acid, the pH value is detected to be 6.8, and the concentration of acetate ion ($OAc^-$) is 0.2 M. Calculate the concentration of undissociated acetic acid (HOAc) in the solution.**

According to Henderson-Hasselbach equation,

pH = pKa + log ([$OAc^-$]/[HOAc]),

PH = 6.8, pKa = 4.8, [$OAc^-$] = 0.2 M

So, 6.8 = 4.8 + log(0.2/[HOAc]), [HOAc] = 0.002 M