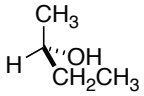
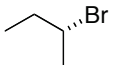
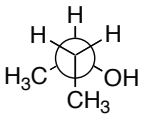
CHM 1321 A
Sample Mid Term 1
(Answers Provided in Color)

1) Identify the stereochemical relationship between the following molecules (enantiomers, diastereomers, same molecule, meso compound) (**3 Points**)

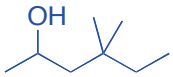
a)  and  relationship Same

b)  and (R)-2-bromobutane relationship Same

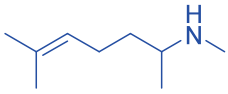
c)  and  relationship Enantiomers

2) Draw the following as line structures: (**4 points**)

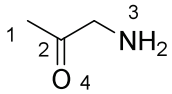
a) 4,4-dimethylhexan-2-ol



b) $(CH_3)_2CCHCH_2CH_2CHCH_3NHCH_3$

 2

3) For the following compound:



a) What is the hybridization of both carbons, the nitrogen and the oxygen? (**4 points**)

C_1 = sp^3
C_2 = sp^2
N_3 = sp^3
O_4 = sp^2

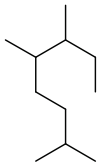
b) What is the geometry of both carbons, the nitrogen and the oxygen? (**4 points**)

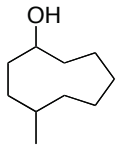
C_1 = tetrahedral
C_2 = trigonal
N_3 = tetrahedral
O_4 = trigonal

c) What type of molecular orbitals connect the following pairs of atoms? (**4 points**)

C_1 and C_2 = σ
C_2 and O_4 = $\sigma + \pi$
N_3 and H = σ

4) Give IUPAC names for the following: (**6 points**)

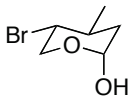
a)  2,5,6-trimethyloctane 3

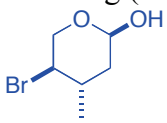
b) 

4-methylcyclononanol (3)

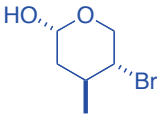
5) For the following:

a) Draw the "flat" line structure of the following (be sure to indicate stereochemistry). **(3 points)**

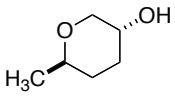




or

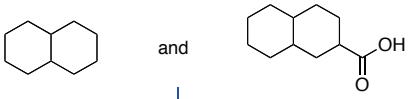


b) Draw <u>both</u> chair conformations of the following compound. Indicate which form is the most stable **(6 points)**

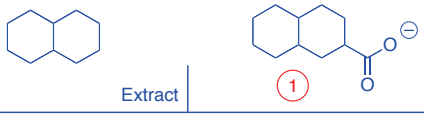


most stable (1)

6) Use a flow chart to illustrate how you could separate a mixture of the following compounds using an extraction. Be sure to include all steps. **(9 points)**

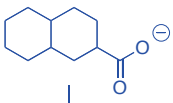


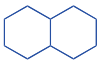
(1) Add Et_2O (or other organic solvent)
Add NaOH in H_2O



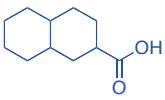
(1)

H_2O — Extract — Et_2O

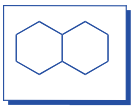
(1) 

(1) 

Add Et_2O
Add HCl
(1)



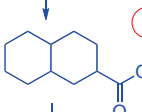
1) Dry over $MgSO_4$
2) remove Et_2O
(1)



(1) Extract

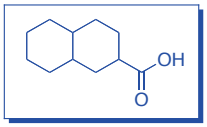
H_2O — NaCl

Et_2O

(1) 

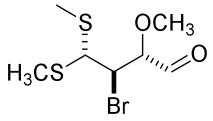
(1)

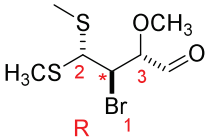
1) Dry over $MgSO_4$
2) remove Et_2O

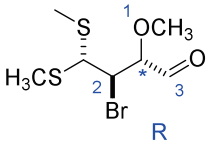


7) For the following compounds
   a) show the stereogenic centre(s) by labeling them with a star (*)(**4 points**)
   b) determine the priorities of the substituents on each stereogenic centre. For compounds with more than one centre, make sure you clearly indicate which priorities refer to which centre. (re-drawing the structure helps) (**8 points**)
   c) Determine the configuration of each stereocentre (**4 points**)

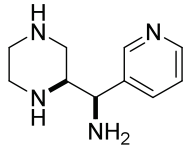
(i)

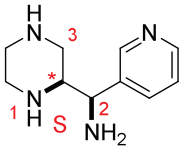


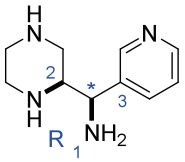




(ii)

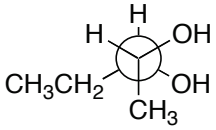


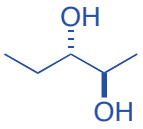




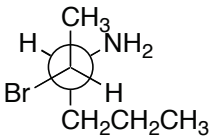
8) For each compound shown below, convert the structure to zig-zag (line) notation. (**4 points**)

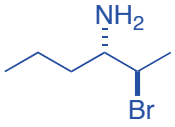
(a)





(b)





9) The specific rotation of the (S) form of Viagra is -20.0°. A third world drug maker is selling Viagra on the internet. To save money, the company makes a mixture of the active (R) form and the inactive (and toxic) (S) form. The FDA confiscates the shipment of this "counterfeit" Viagra and measures the optical rotation. If the value of the specific rotation is +5°, what is the composition of the mixture (how much R form and how much S form)? (**7 points**)

the rotation of the sample is positive so the R isomer is in excess

(1) optical purity = $\frac{[\alpha]_{sample}}{[\alpha]_{pure}}$ X 100 %

(1) 25 % = $\frac{5°}{20°}$ X 100 % (1)

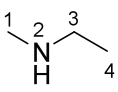
ee = optical purity = $\frac{|R - S|}{S + R}$ X 100 % (1) S + R = 100 (1)

(1) 25 % = $\frac{100 - 2S}{100}$ X 100 %

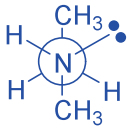
S = 37.5

Mixture is 37.5 % S isomer and 62.5 % R isomer (1)

10) For the following compound, draw the appropriate Newman projection along the N2-C3 bond of the following:



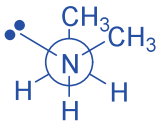
a) The <u>most</u> stable conformer and name the conformer. (**4 Points**)



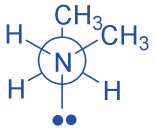
3

Anti-Staggered (1)

b) The second most stable conformer and name the conformer. (**4 Points)**



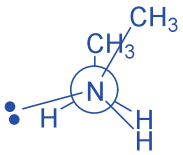
3 or



3

Gauche Staggered (1)

c) The least stable conformer and name the conformer. (**4 Points)**



3

Eclipsed (1)