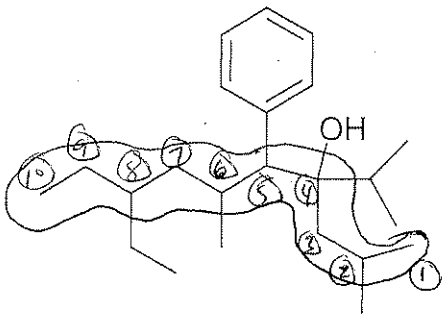
CHEM 2061 – Fall 2008 – **EXAM #2** Name KEY

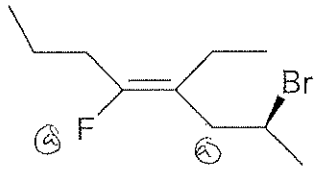
1. (10 pts, 5 each) Give the systematic (IUPAC) names for the following compounds. Be sure to use the E,Z ad R,S nomenclature when necessary.

a)



8-ethyl-4-isopropyl-2,6-dimethyl-5-phenyl-4-decanol

b)



(S) (Z)

↓

(S,Z)-2-bromo-4-ethyl-5-fluoro-4-octene

2. (5 pts) The specific rotation of pure (R)-(+)-glyceraldehye is +8.7°. If the observed specific rotation of a mixture of (R)-glyceraldehye and (S)-glyceraldehye is +1.4°, what percent of the R enantiomer of glyceraldehyde is present in this solution? **(SHOW YOUR WORK)**

$\frac{+1.4}{+8.7} \times 100 = 16.092\%$ ee

100 − 16.092 ← R

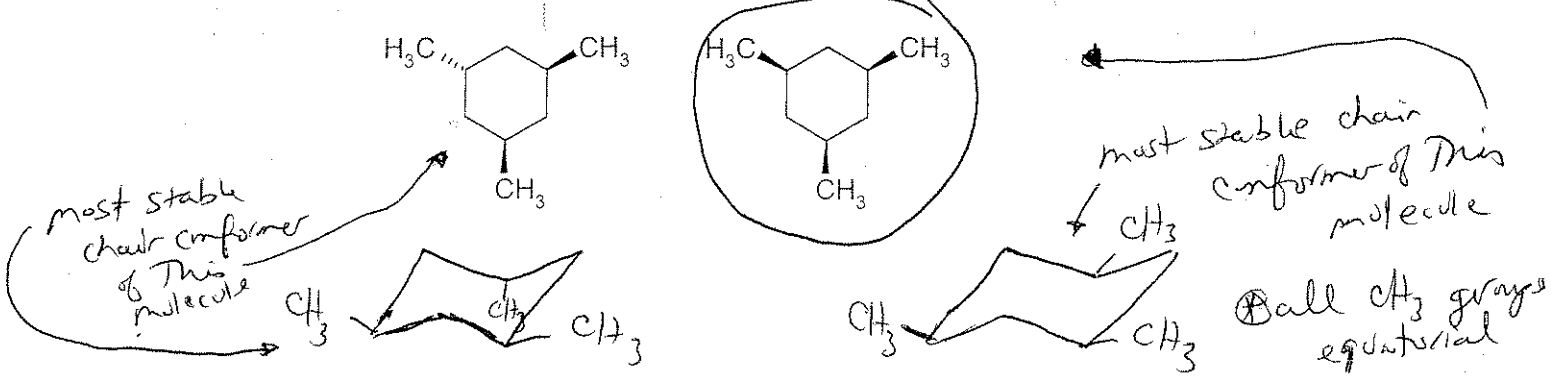
83.908 R+S 50/50 mixture

41.954% R + 41.954% S

16.092 + 41.954 = 58.046% R = 58.05% ⇒ 58% R 2 sig figs

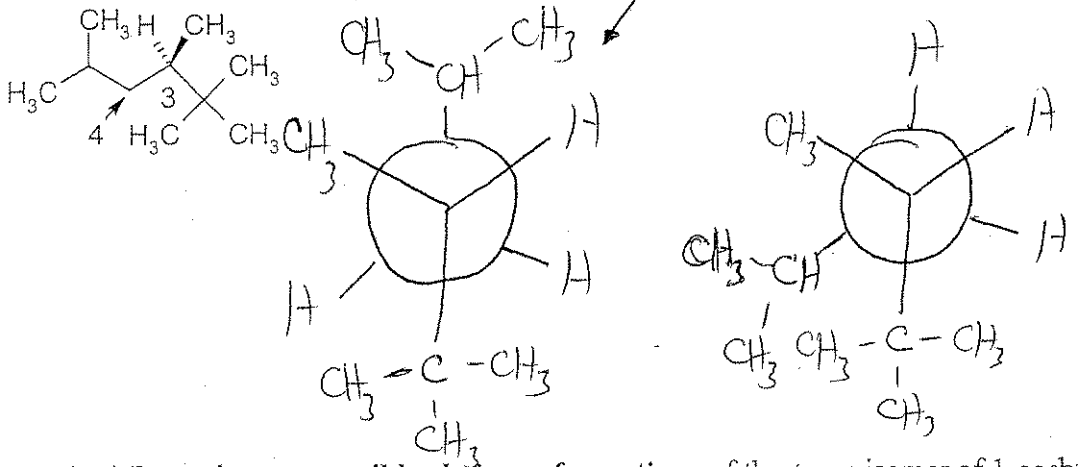
2 | 83.908

3. (4 pts) Which compound in the following pair is more stable? (Circle answer)

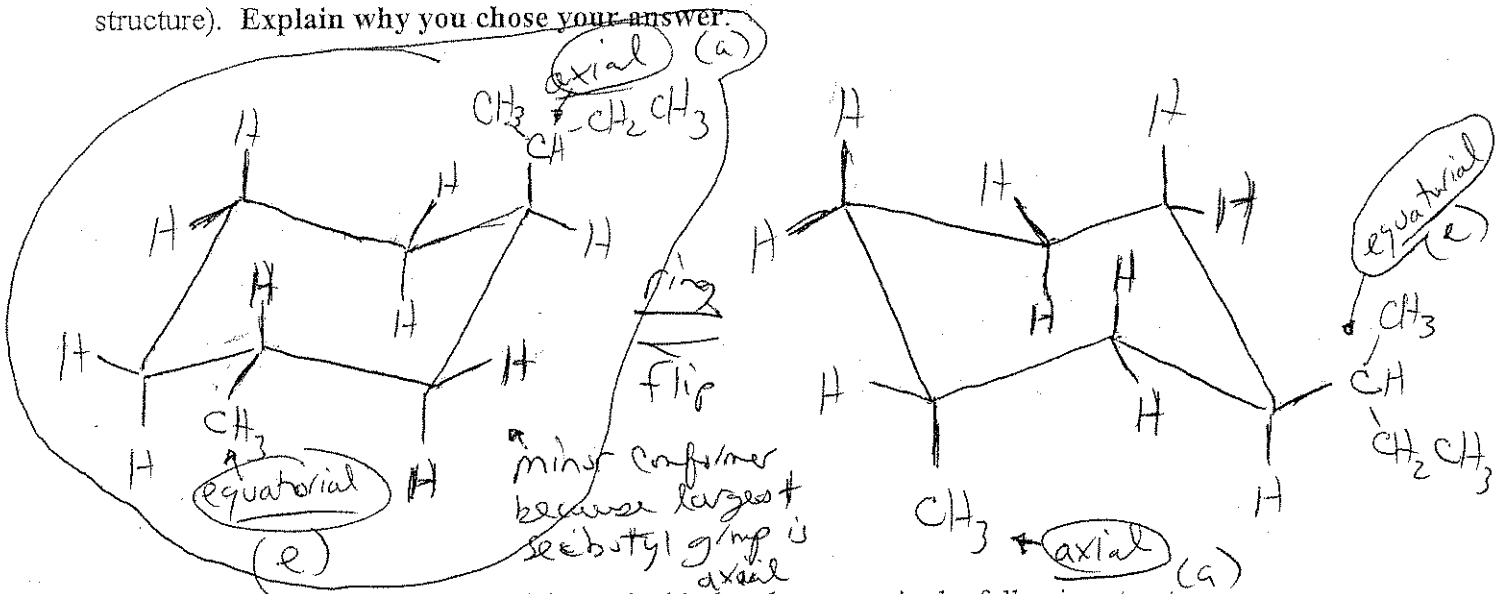


4. (3 pts) Which statement is true regarding the two enantiomers of 2-methyl-1-butanol?
   a) The refractive index of (R)-2-methyl-1-butanol is larger than the refractive index of (S)-2-methyl-1-butanol.
   b) The isomer of 2-methyl-1-butanol that rotates plane polarized light in a clockwise direction (dextrarotary) has the (R) absolute configuration at the chiral center.
   c) The boiling point of (S)-2-methyl-1-butanol is lower than the boiling point of (R)-2-methyl-1-butanol.
   d) An equimolar mixture of (R) and (S)- 2-methyl-1-butanol will not rotate the plane of polarized light.
   e) The S enantiomer is somewhat more soluble than the R enantiomer.

5. (8 pts) Draw the **Newman projections** of the **most stable** and **least stable** <u>STAGGERED</u> conformers for the following molecule where you look down the C3-C4 bond.

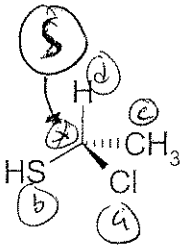


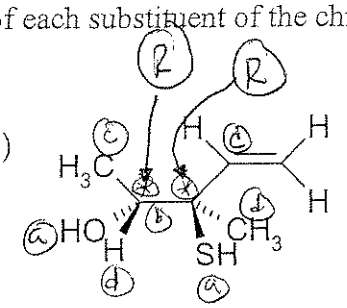
6. (10 pts) a) Draw the **two possible chair conformations** of the ***trans*** isomer of 1-*sec*butyl-3-methylcyclohexane. Carefully label the substituents as being in the axial(a) or equatorial(eq) positions. (*Be sure to **show the correct angles** for all bonds and **show all atoms** in your structures*). b) Circle the structure which would be the <u>minor</u> conformer (<u>least stable</u> chair structure). **Explain why you chose your answer.**

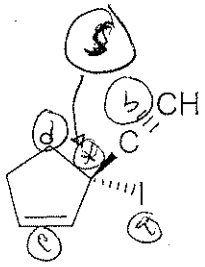


7. (16 pts) **A)** Place an asterisk(*) by each chiral carbon atom in the following structures.

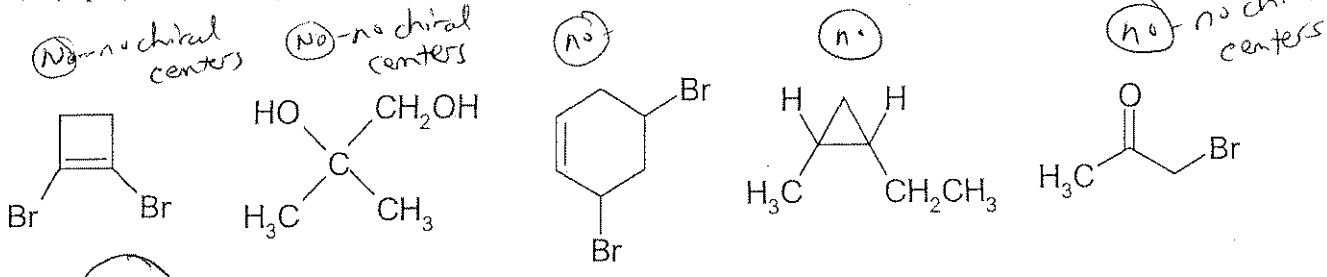
B) For each chiral center, determine whether it has the **R or S configuration**. **SHOW YOUR WORK**, i.e. label the priorities of each substituent of the chiral center.

a) 

b) 

c) 

8. (3 pts) How many of the substances have meso stereoisomers?



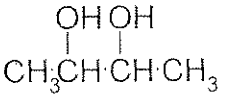
a) 0 b) 1 c) 2 d) 3 e) 4

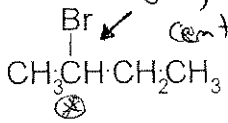
9. (4 pts) Which of the following molecules are **chiral**?

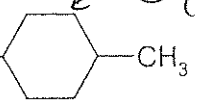
I. 1-chloro-2-methylpropane
II. 3-chloropentane
III. 2-chloropentane
IV. 2-chloro-3-methylbutane

a) I and IV b) II and III c) I and III d) II and IV e) III and IV

10. (3 pts) Which of the following molecules can have both diastereomers and enantiomers?

a) 

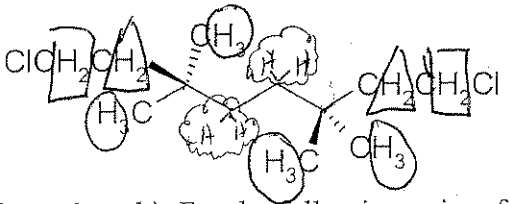
b) 

c) 

d) $CH_3CH{=}CHCH_3$

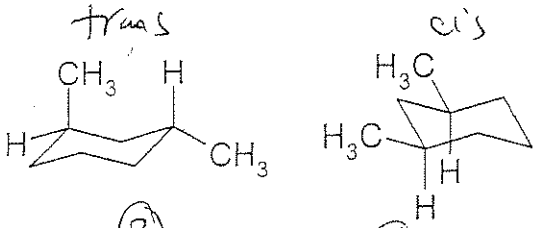
11. (4 pts) How many equivalent sets of hydrogen atoms are in this molecule? 4

(Show your work – draw a circles, squares, triangles, etc. around the different types of hydrogen atoms).

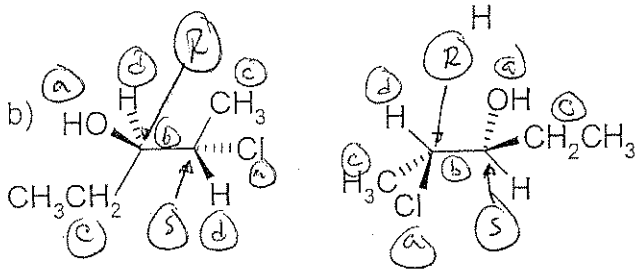


12. (18 pts, 3 each) For the following pairs of compounds, indicate whether they are

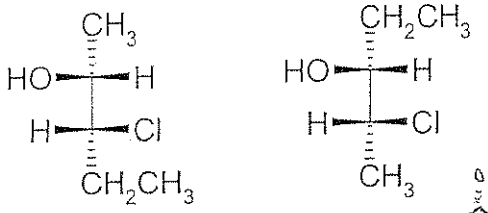
enantiomers, diastereomers, the same compound , or constitutional (structural) isomers.

a) 

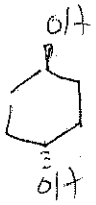
diastereomers

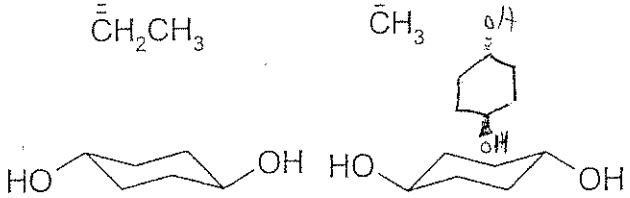
b) 

enantiomers

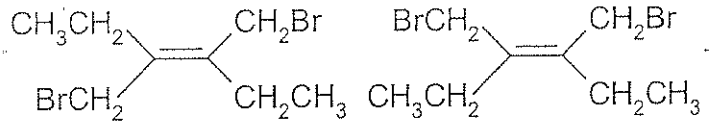
c) 

Constitutional isomers

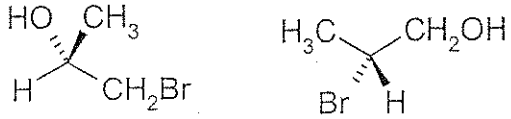


d) 

Same compound

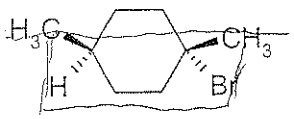
e) 

diastereomers

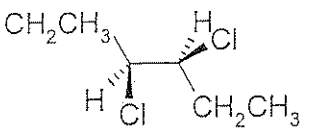
f) 

Constitutional isomers

13. (4 pts, 2 each) Label each of the following compounds as **chiral** or **achiral.**

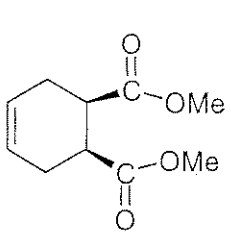
a) 

achiral

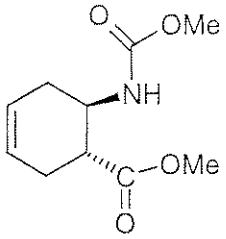
b) 

chiral

14. (8 pts) Answer the questions below for the following compounds:



A



B

a) How many enantiomers does compound A have?
i) none ii) one iii) two iv) three

b) Is compound **A** optically active? **Yes** **No**

c) Is compound **A** a meso compound? **Yes** **No**

d) How many enantiomers does compound **B** have?
i) none ii) one iii) two iv) three

e) Is compound **B** optically active? **Yes** **No**

f) Is compound **B** a meso compound? **Yes** **No**