NAME (PRINT CLEARLY)_____

I am on my honor that I will not discuss the contents of this exam with anyone until after 6:00 pm on Monday, October 28, and will notify Dr. Brush if I am made aware of any cases of academic dishonesty.

I understand and agree to these conditions (signature)_____

CHEM 243 ORGANIC CHEMISTRY I
Exam II (version-1), Friday, October 25, 2024

Answer all questions in the space provided, continuing on the back if necessary. **Read each question carefully and be sure to answer all parts to each question!** This exam is worth a total of 150 points.

Exams will be returned within one week. An answer key to this exam will be linked to the course web page.

(34) 1. _____

(46) 2. _____

(15) 3. _____

(13) 4. _____

(14) 5. _____

(14) 6. _____

Sub-total (136) = _____ x 1.103 = _____

Total Points: _____ (150) = _____%

Total Worksheet Points to date: _____ = _____%

Class Grade Estimate:

Exam I (150) _____ + Exam II (150) _____ + WS% x 1.5 _____ = _____ (SUM)

SUM / 4.5 = _____% (raw class % - does not include project grade or lab grade)

IF YOU DO NOT UNDERSTAND A QUESTION, PLEASE ASK FOR AN EXPLANATION!

1. (34 Points) Answer the following questions as indicated.

(a) Are the following statements about <u>conformers</u> **TRUE** or **FALSE**?

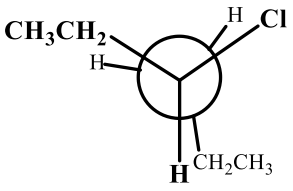
_____ maximum cyclohexane stability occurs when the largest functional group is in an axial position

_____ a stable Newman projection will have the largest substituents anti to each other

_____ in cyclohexane ring-flip conformers, the axial and equatorial substituents switch positions

_____ conformers and constitutional isomers are essentially the same type of isomer

(b) Rank these Newman Projections in order of their relative stability (1 = least stable…….4 = most stable).



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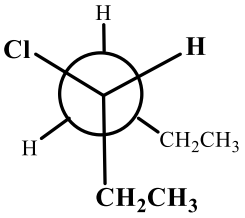

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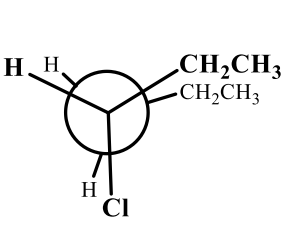

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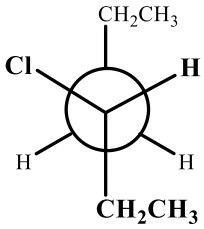
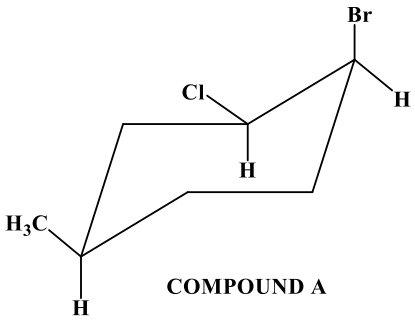


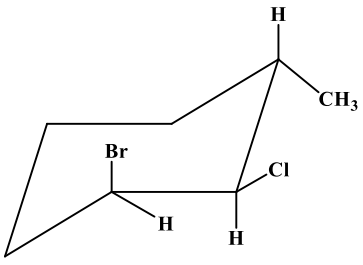
_____

(c) Consider **Compound (A)** drawn at the right. Identify the relationship of each compound below to Compound (A):

Conformer, Constitutional Isomer, or Different:



COMPOUND A



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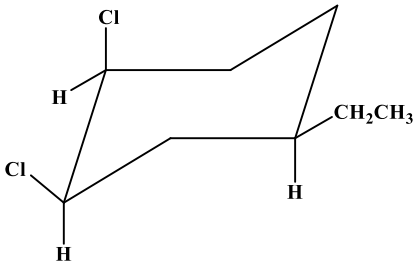

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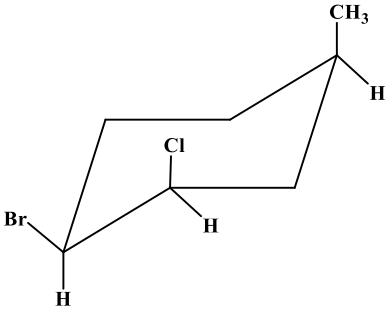


_____

(d) Are the following statements about <u>stereoisomers</u> **TRUE** or **FALSE**?

_____ stereoisomers must have different formulas and connectivity

_____ all chiral carbons must be sp3 hybridized with tetrahedral geometry

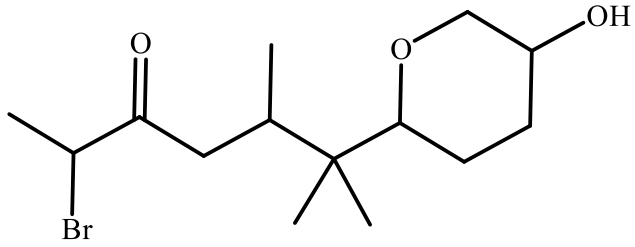
_____ a mixture of two enantiomers is called a racemic mixture

_____ enantiomers have the same formula and connectivity, but opposite configurations

_____ diastereomers have the same melting points and boiling points

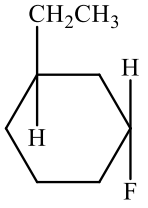
_____ stereoisomers with configurations of (1R, 3S, 4R) and (1S, 3R, 4R) represent diastereomers

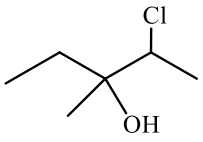
(e) Place a large "dot" (●) on each chiral carbon in the molecule drawn to the right.

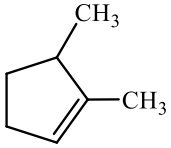


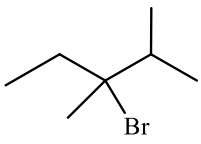
(f) Based on you answer to (e), what is the maximum number of stereoisomers? _____

(g) Which of the following molecules will have at least one diastereomer? CIRCLE your choice(s).







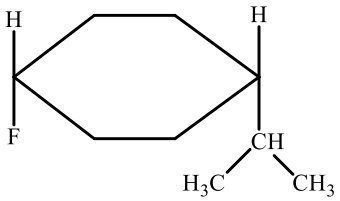


(h) <u>Explain</u> your answer to question (g) above.

2. (46 Points) Nomenclature.

- If a name is given draw an accurate zig-zag structure, using wedge and dash bonds for all chiral carbons.
- If a structure is drawn, give the IUPAC name where you assign configurations using the proper R/S prefix.

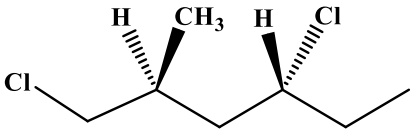
(a)



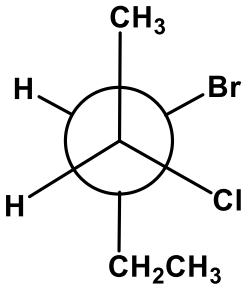
(use cis/trans designations, NOT R or S)

(b) (2R, 3R)-1-cyclopropyl-2-fluoro-3-methyl pentane

(c)

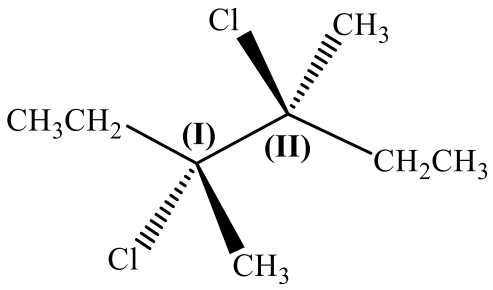


(d) Draw an accurate zig-zag line structure for the following Newman Projection. Be sure to draw the correct 3D orientation at any chiral carbon with wedge and dash bonds. **DO NOT name the compound.**



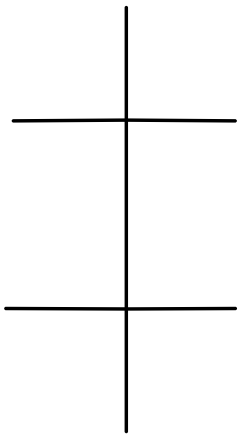
(e) In the molecule drawn to the right, label each chiral center with the correct R/S configuration (fill in the blanks below). **DO NOT** name this compound.

(I) _____ (II) _____



(f) Using the template at the right, draw a Fisher projection for the compound in (e).

The atoms or groups with the lowest priorities must be on the vertical axes.

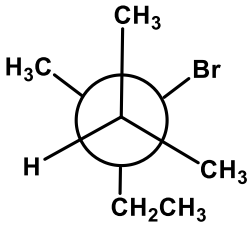


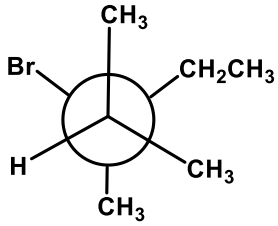
(g) Based on your **Fisher Projection** above, is this a meso compound? Circle: **YES** or **NO**

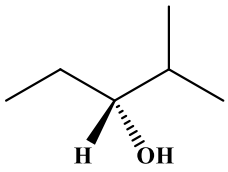
(h) EXPLAIN your answer to (g).

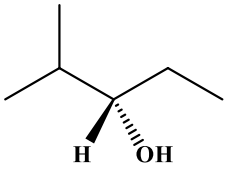
3. (15 Points) How are the following pairs of compounds related?

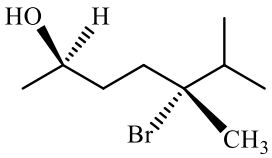
Constitutional Isomers **Conformers** **Enantiomers** **Diastereomers**

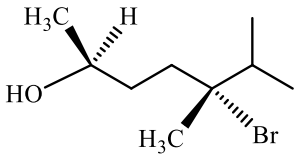


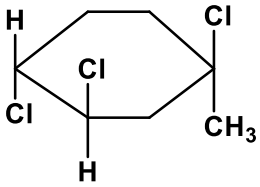


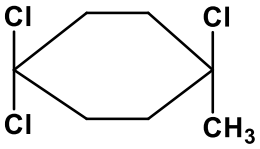


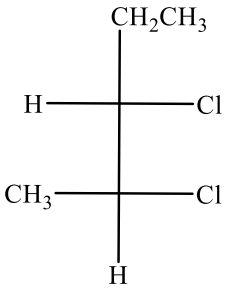


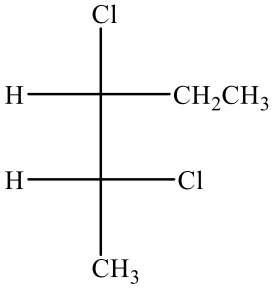




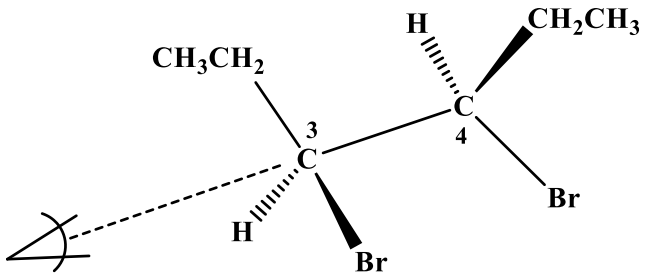


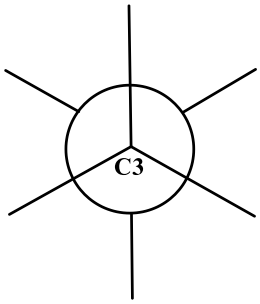
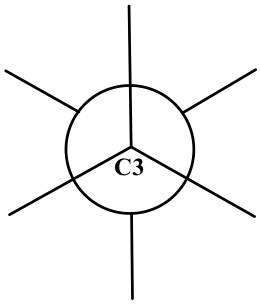






4. (13 Points) Alkane Conformations.
Consider the 3D "zig-zag" structure for the compound drawn at the right, and the **Left-to-Right** view looking at C3 and down the C3-C4 bond:



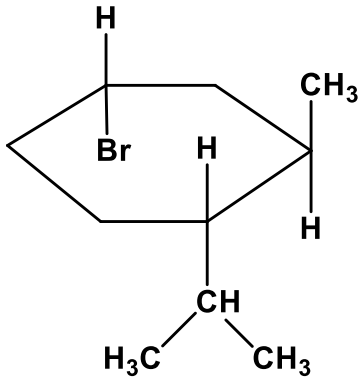
(a) **CONFORMER A.** Draw a Newman Projection looking **at C3** and down the **C3-C4** bond.	(b) **CONFORMER B.** Rotate Conformer A so that the two **Br atoms are anti** to each other:
	

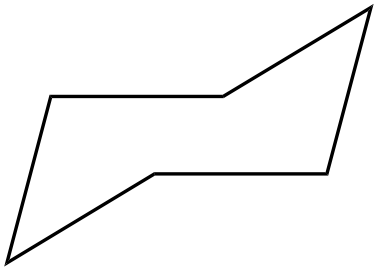
(c) **CIRCLE** the most stable conformer, and **EXPLAIN** your answer.

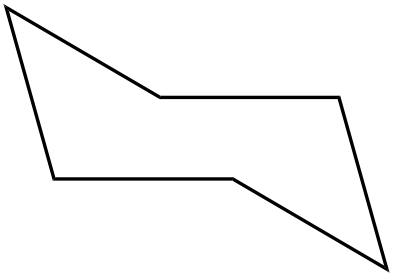
5. (14 points) Cyclohexane Conformations.

(a) Using the chair templates below, draw both chair conformers of Compound A, drawn at the right. Be sure to include the three H atoms.

Compound A



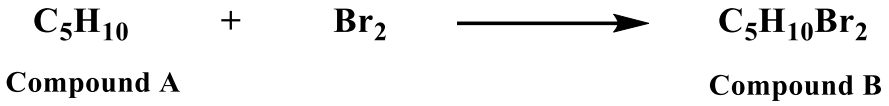




(b) <u>CIRCLE</u> the most stable conformer, and **<u>EXPLAIN</u>** your answer.

6. (14 points) Calculations: % Yield. Be sure to use correct <u>significant figures</u>.

0.2211 g of Compound A were reacted with 6.000 g of Bromine (Br_2), forming 0.6741 g of Compound B:



Complete **boxes a-f** in the following table to determine the **Limiting Reactant** and to calculate the **% Yield**.

Compound	**Molecular mass**	**grams**	**moles**	**(c) Place an "X" in the box of the Limiting Reactant**
Compound A	70.13 g/mole	0.2211 g	**(a)**	
Br_2	159.8 g/mole	6.000 g	**(b)**	
Compound	**Molecular mass**	**grams**	**moles**	
Compound B	229.9 g/mole	0.6741 g	**(d)**	
(e) Theoretical Yield of Compound B (in moles) =			**(f) % Yield =**	

You are <u>required</u> to show all calculations below: