**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-2), 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**?

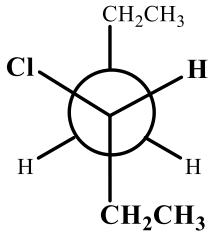
_____ maximum cyclohexane stability occurs when the largest functional group is in an equatorial position

_____ the least 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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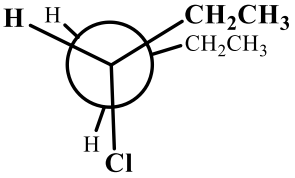


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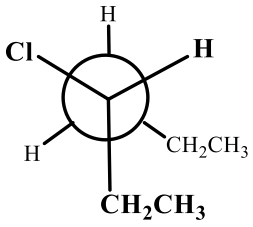


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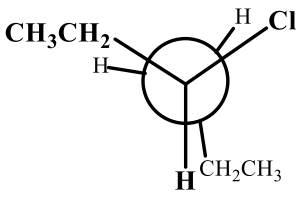


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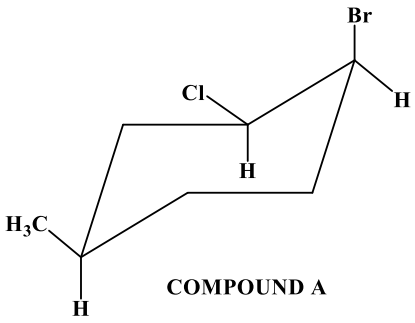
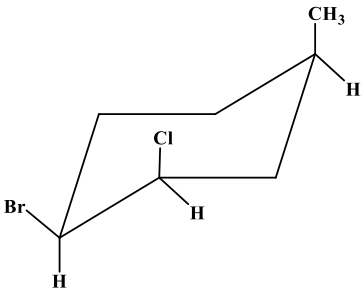
(c) Consider **Compound (A)** drawn at the right. Identify the relationship of each compound Compound (A):

**Conformer, Constitutional Isomer, or Different:**

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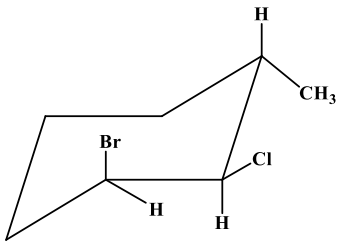


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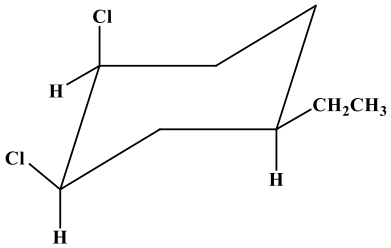


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(d) Are the following statements about <u>stereoisomers</u> **TRUE** or **FALSE**?

_____ stereoisomers must have the same formulas and connectivity

_____ diastereomers have the same melting points and boiling points

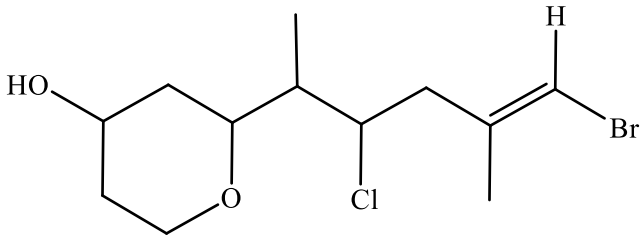
_____ a racemic mixture is a mixture of two enantiomers

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

_____ all chiral carbons must be sp3 hybridized with tetrahedral geometry

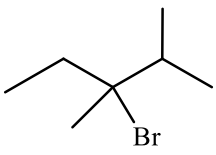
_____ stereoisomers with configurations of (1R, 3S, 4R) and (1S, 3R, 4S) represent diastereomers

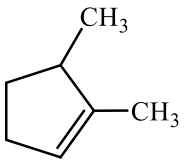
(e) Place a large "dot" (●) on each chiral carbon in the molecule drawn to the right.

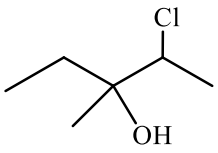


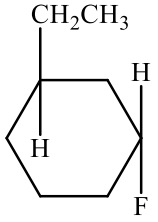

(f) Based on you answer to (e), what is the maximum number of stereoisomers? _____

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



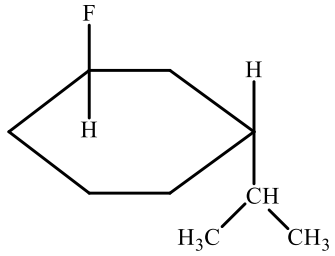




(h) <u>Explain</u> your answer to question (g) above.

**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.

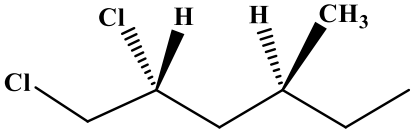
(a)



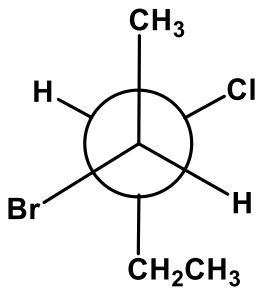

**(use cis/trans designations, NOT R or S)**

(b) (2S, 3R)-5-cyclopropyl-2-fluoro-3-methyl pentane

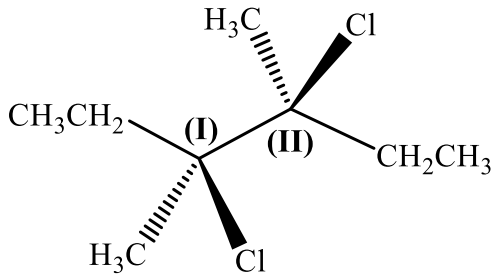
(c)




(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.**



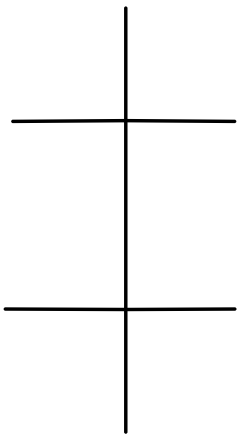
(e) In the molecule drawn to the right, label each chiral center with the correct R/S configuration (fill in the blanks below). **DO NOT** name this compound.




**(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.**

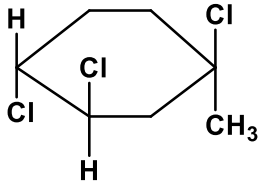


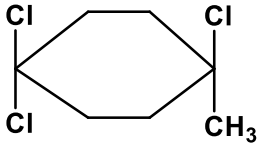
(g) Based on your **Fisher Projection** above, is this a meso compound? Circle: **YES** or **NO**

(h) EXPLAIN your answer to (g).

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

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

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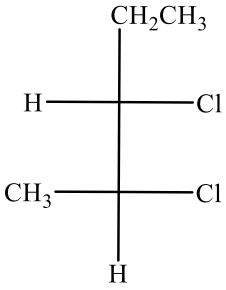


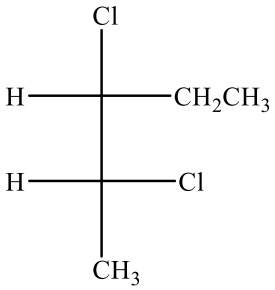


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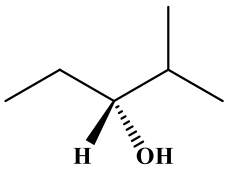


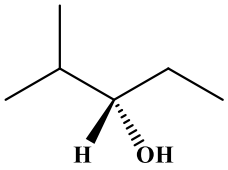


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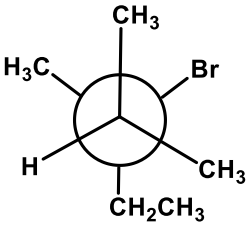


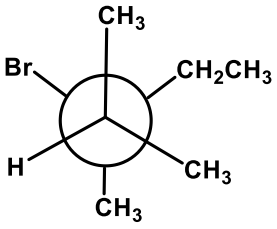


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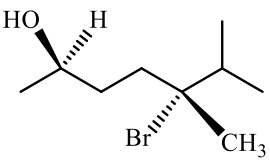


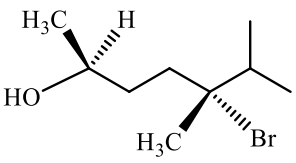


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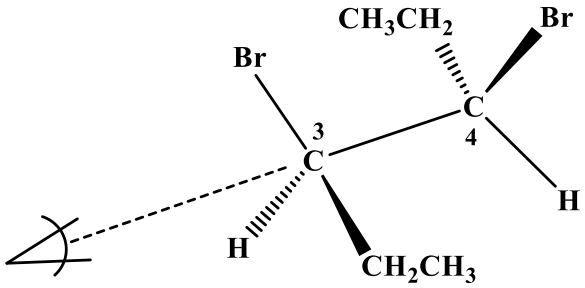
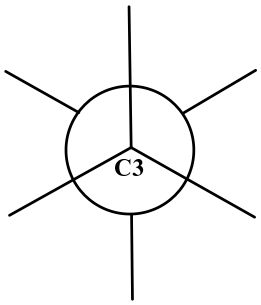
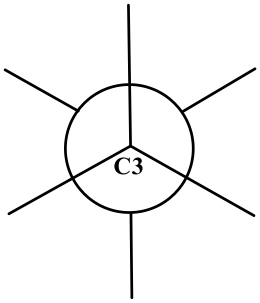
**4. (13 Points) Alkane Conformations**.
Consider the 3D "zig-zag" structure for the compound drawn at the right, and the **Left-to-Right** view looking at C3 and down the C3-C4 bond:



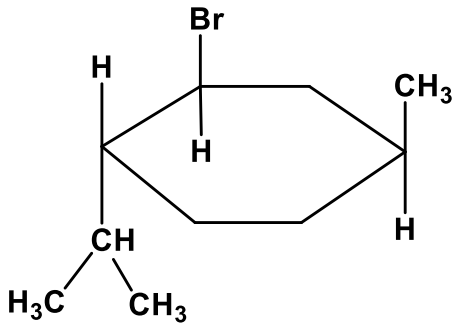

| (a) **CONFORMER A.** Draw a Newman Projection looking **at C3** and down the C3-C4 bond. | (b) **CONFORMER B.** Rotate Conformer A so that the two **Br atoms are anti** to each other: |
|---|---|
|   |   |

(c) **CIRCLE** the most stable conformer. **<u>Explain</u>** your answer.

**5. (10 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.

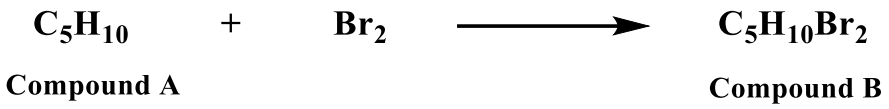
**Compound A**




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

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

0.2503 g of Compound A were reacted with 5.000 g of Bromine ($Br_2$), forming 0.6198 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 | 0.2503 g | **(a)** | |
| **$Br_2$** | 159.8 g/mole | 5.000 g | **(b)** | |
| | | | | |
| **Compound** | **Molecular mass** | **grams** | **moles** | |
| **Compound B** | 229.9 g/mole | 0.6198 g | **(d)** | |
| | | | | |
| **(e) Theoretical Yield of Compound B (in moles) =** | | | **(f) % Yield =** | |

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