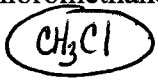
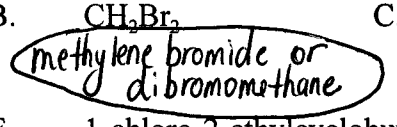
Chem 231 Problem Set #2 (on Chapter 2)

1. Name or draw structures for the following compounds. (Where appropriate, give both common and IUPAC names.)

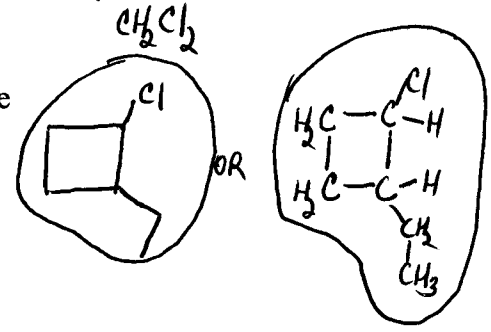
A. chloromethane



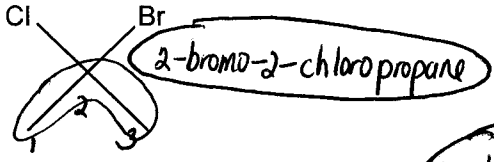
B. CH_2Br_2



C. methylene chloride

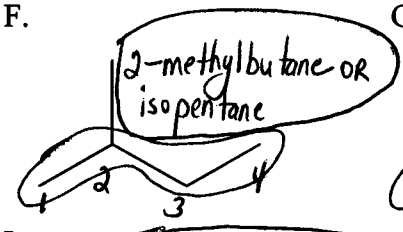


D.

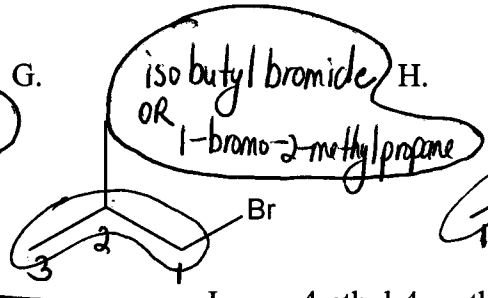


E. 1-chloro-2-ethylcyclobutane

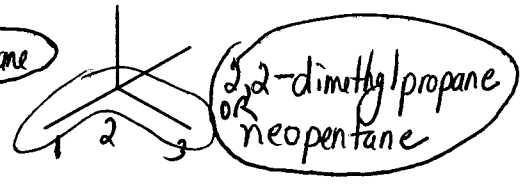
F.



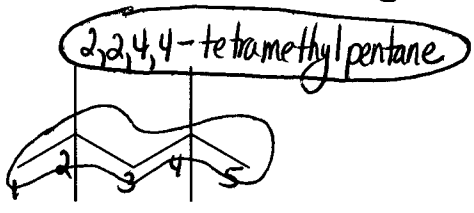
G.



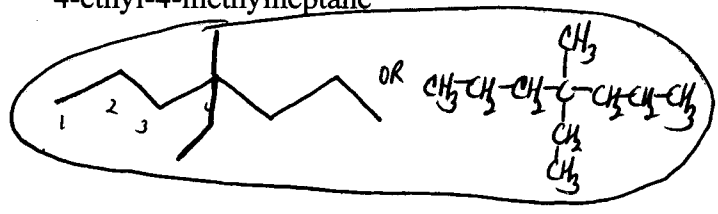
H.



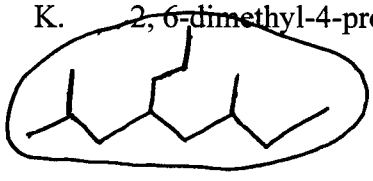
I.



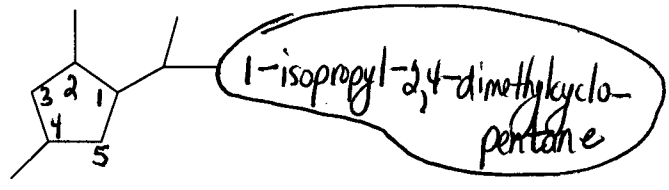
J. 4-ethyl-4-methylheptane



K. ~~2, 6-dimethyl-4-propyloctane~~

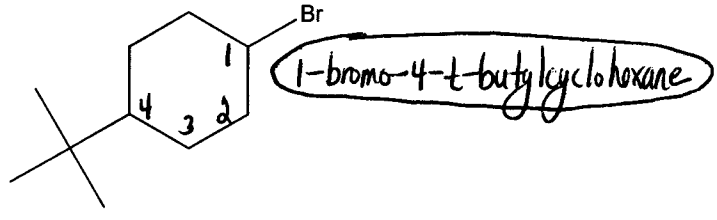


L.

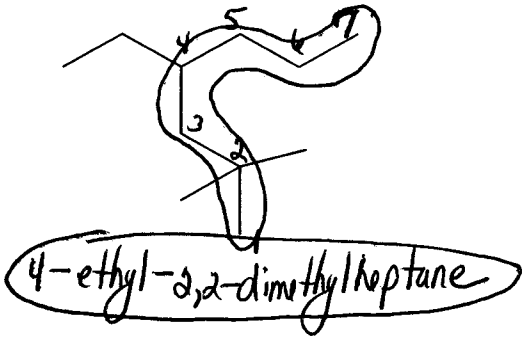


M. chloroform

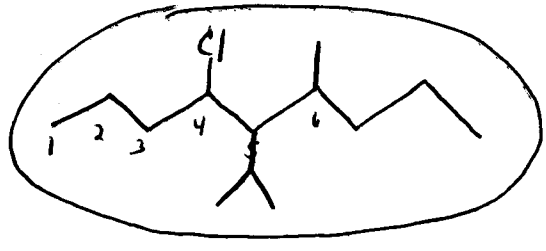
N.



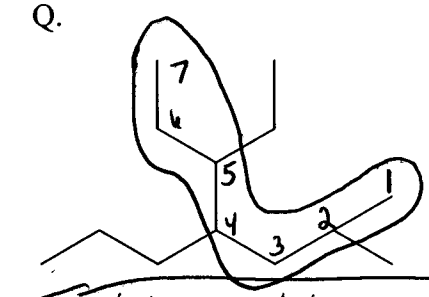
O.



P. 4-chloro-5-isopropyl-6-methylnonane

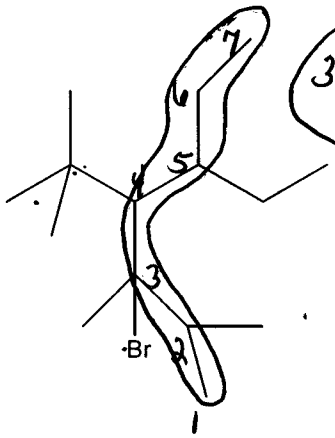


Q.



5-ethyl-2-methyl-4-propylheptane

R.



3-bromo-4-t-butyl-5-ethyl-2,3-dimethylheptane

2. For the following sets of organic compounds, arrange in order from highest boiling point to lowest boiling point. Give a short explanation for the given boiling point order.

A. propane vs. hexane

C_3H_8 C_6H_{14}

BP: $C_6H_{14} > C_3H_8$ Straight chain C_6H_{14} has stronger LDFs than straight chain C_3H_8 so higher BP.

B. 2,3,3-trimethylbutane vs. heptane vs. 3,3-dimethylpentane

branched chain branched chain

Note: All have the chemical formula C_7H_{16}.

For same chemical formula as amt branch ↑ BP ↓

BP: Heptane > 3,3-dimethylpentane > 2,3,3-trimethylheptane.

C. 2,3-dimethylbutane vs. 1-hexanol (~~structural formula: $CH_3(CH_2)_4CH_2OH$~~) vs. hexane

BP: 1-hexanol > hexane > 2,3-dimethylbutane

↑ H-bonding thus higher BP

Same chemical formula as hexane but branched thus lower BP.

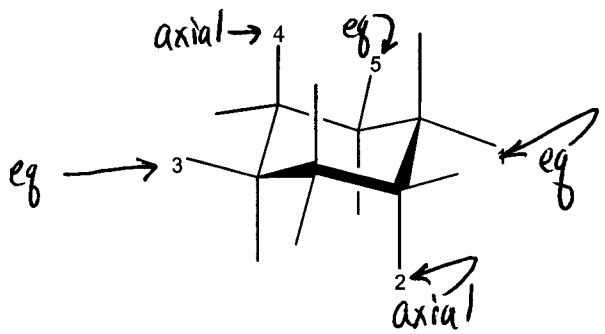
3. Consider the alkane 2,3-dimethylbutane.

A. Draw a structural formula for 2,3-dimethylbutane.

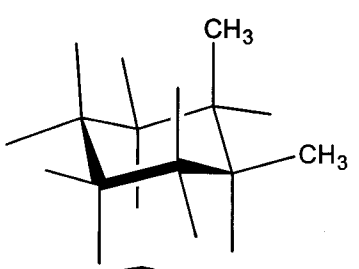
B. Focusing on the C2-C3 bond, draw Newman projections for all possible staggered and eclipsed conformations. Rank the conformations in order of decreasing stability.

For answers see last page of key.

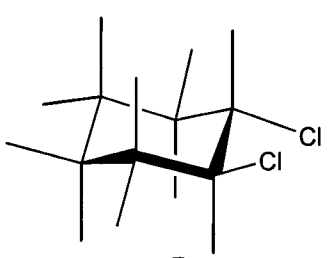
4. Label the numbered positions as axial or equatorial.



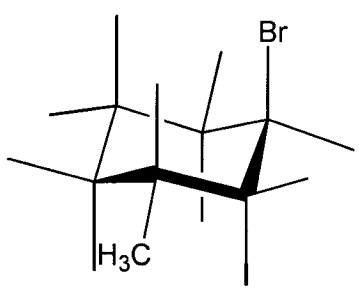
5. Label the following as cis or trans:



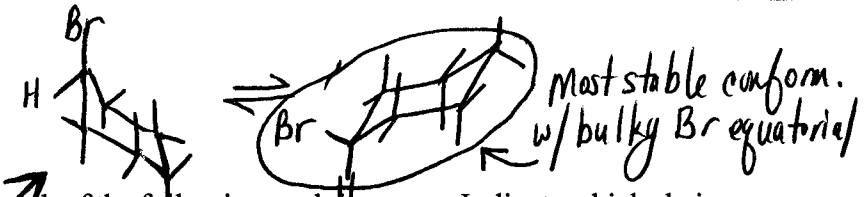
cis because CH_3 groups on same side of ring



trans because Cl groups on opposite sides of ring



trans because Br + CH_3 on opposite sides of ring.

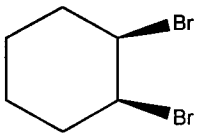


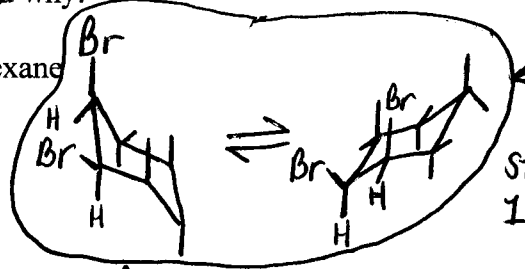
6. Draw both chair conformations for each of the following cyclohexanes. Indicate which chair conformation is more stable and why.

A. bromocyclohexane

B. *cis*-1,2-dibromocyclohexane

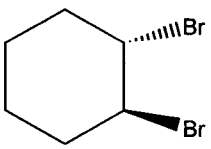
same side of ring

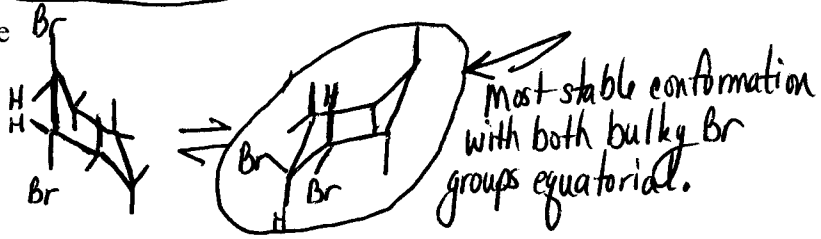




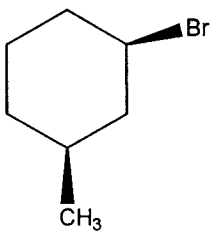
C. *trans*-1,2-dibromocyclohexane

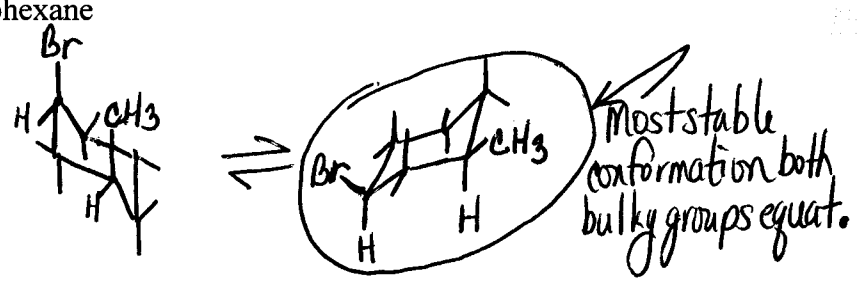
opposite sides of ring





D. *cis*-1-bromo-3-methylcyclohexane



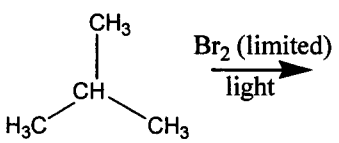


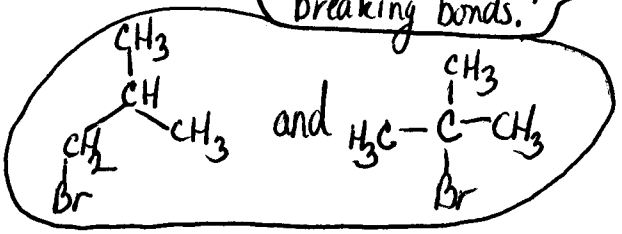
E. Are the molecules given in B and C conformational isomers of one another? Why or why not? No, the molecules given in B+C are not conformational isomers because they are NOT interconvertible by rotation about a single (σ) bond. The molecules given in B+C are configurational (or geometric cis-trans) isomers + are only interconvertible by breaking bonds.

7. Give all possible products for the following reactions.

A. $CH_3CH_2CH_3 + 5O_2 \xrightarrow{\text{spark}} 3CO_2 + 4H_2O$

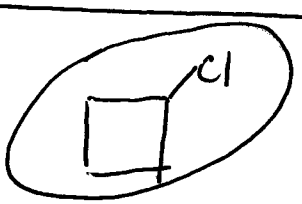
B.





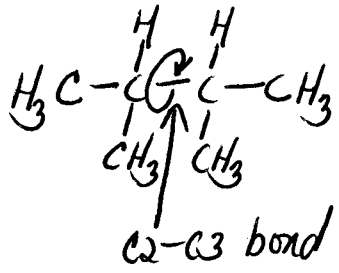
C. $CH_4 \xrightarrow[\text{light}]{Cl_2, \text{ excess}}$ CH_3Cl and CH_2Cl_2 and $CHCl_3$ and CCl_4

D. cyclobutane + Cl_2 (limited) $\xrightarrow{\text{light}}$

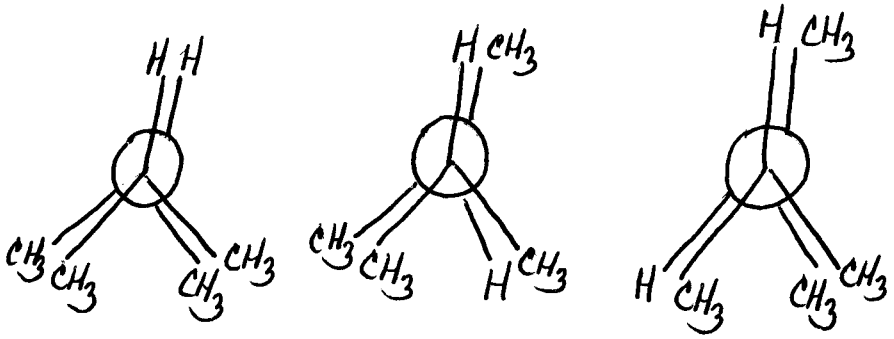


Answers to Question #3

3A.

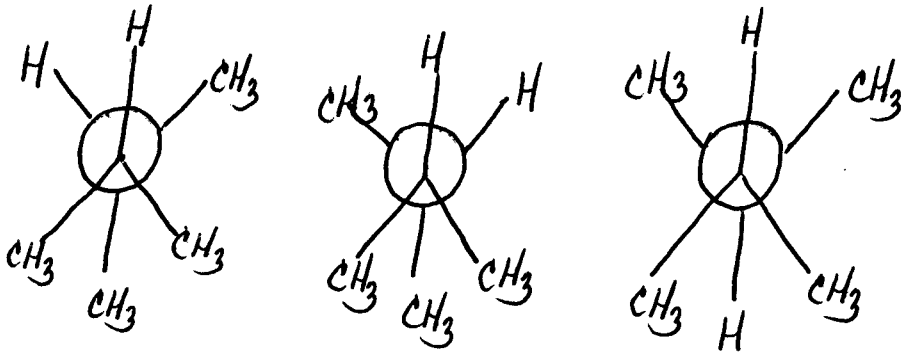


3B.



I II III

Eclipsed Conformations



IV V VI

Staggered confirmations

VI > IV, V > II, III > I

VI: most stable — least amt of steric strain + torsional strain

I: Least stable — lots of steric hindrance + lots of torsional strain.