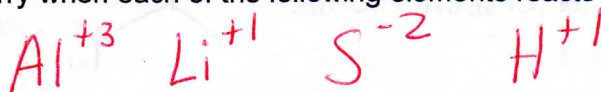


Chapter 1 Bonding & Isomerism:

1. What charge the ion will carry when each of the following elements reacts to form an ionic compound: Al, Li, S, H.



2. Which is the more electropositive element: Na or Al, B or C, B or Al. (Circle correct choice.)

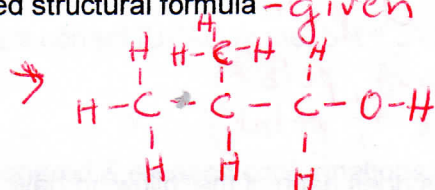
3. Which is the more electronegative element: O or F, O or N, F or C. (Circle correct choice.)

4. For $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$, list the following::

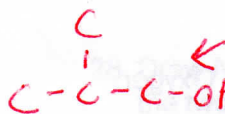
a. Molecular formula $\text{C}_4\text{H}_9\text{OH}$ or $\text{C}_4\text{H}_{10}\text{O}$

b. Abbreviated/condensed structural formula - given

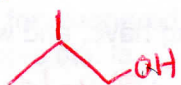
c. Full structural formula



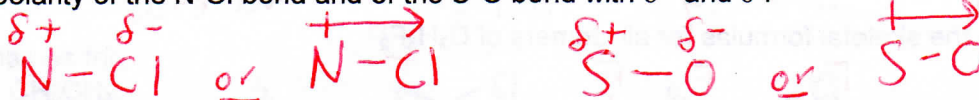
d. Skeletal formula



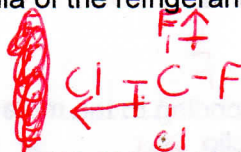
e. Line segment



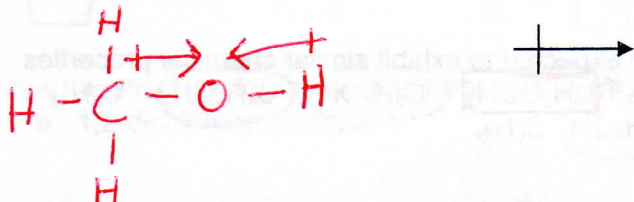
5. Diagram the polarity of the N-Cl bond and of the S-O bond with δ^+ and δ^- .



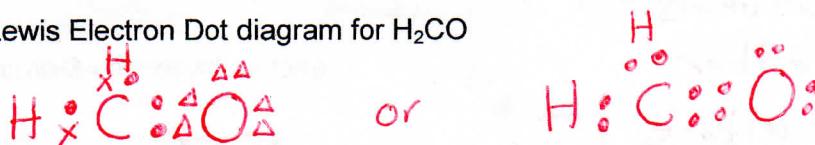
6. Draw the full structural formula of the refrigerant dichlorodifluoromethane and indicate the polarity of the bonds.



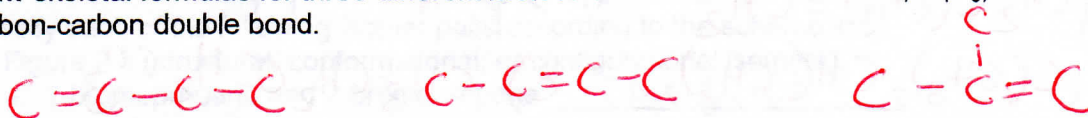
7. Draw the formula for methanol, CH_3OH , and (where appropriate) indicate bond polarity with an arrow.



8. Draw the Lewis Electron Dot diagram for H_2CO



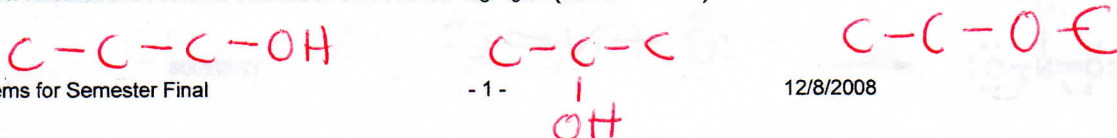
9. Draw skeletal formulas for three different molecules that have the formula, C_4H_8 , and have one carbon-carbon double bond.



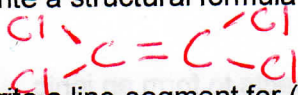
10. Does C_2H_5 represent a stable molecule?

No - can't draw a structure to fill all valences so that C has 4 bonds & H has 1

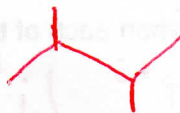
11. Draw structural formulas for all isomers of $\text{C}_3\text{H}_8\text{O}$ (there are 3).



12. Write a structural formula that shows all bonds for $\text{CCl}_2=\text{CCl}_2$



13. Write a line-segment for $(\text{CH}_3)_2\text{CHCH}(\text{CH}_3)_2$.



14. What functional groups can you find in the following natural products? (Their formulas are given in Figures 1.11 and 1.12, pages 33-34)

a. geraniol
alkene
alcohol

b. muscone
Ketone
(alkane too)

c. limonene
alkene

d. testosterone
Ketone
alcohol
alkene

15. Are the following ionic or covalent? If covalent, is it polar or non-polar?

- a. Br_2 - covalent, non polar
- b. LiBr - ionic
- c. SiCl_4 - covalent, polar
- d. KCl - ionic
- e. PCl_3 - covalent, polar
- f. P_2O_5 - covalent, polar

16. How many valence electrons does each of the following have, and what is its valence? Oxygen

Fluorine

7

Carbon

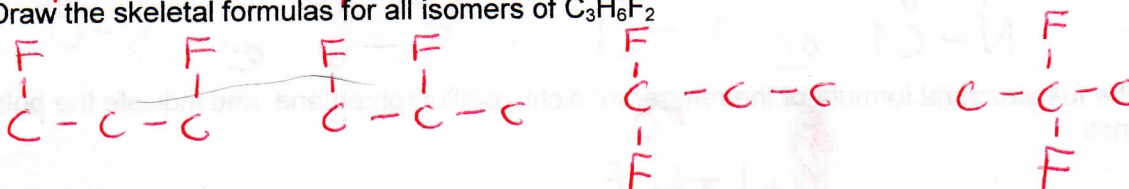
4

Hydrogen

1

← # valence e-
← valence

17. Draw the skeletal formulas for all isomers of $\text{C}_3\text{H}_6\text{F}_2$

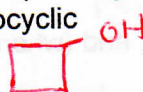
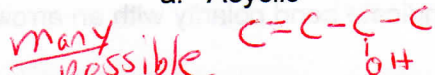


18. Write an abbreviated structural formula corresponding to the molecular formula $\text{C}_4\text{H}_8\text{O}$ and is:

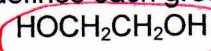
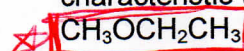
a. Acyclic

b. carbocyclic

c. heterocyclic



19. Divide the following into groups that might be expected to exhibit similar chemical properties. List the characteristic that defines each group: C_5H_{12} , CH_3OCH_3 , $\text{C}_3\text{H}_7\text{OH}$, $\text{C}_4\text{H}_9\text{OH}$, C_8H_{18}

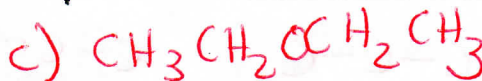
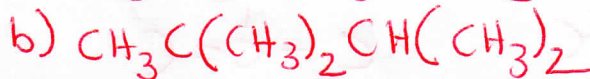
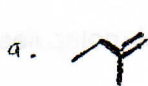
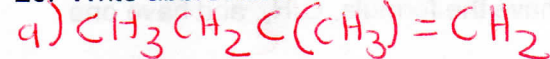


circled = alcohols

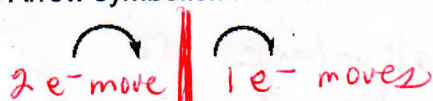
* \square = ether

no circle or box = alkane

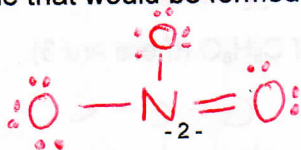
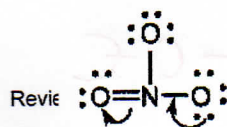
20. Write abbreviated formula for:



21. Arrow symbolism: What is the difference in meaning between the following 2 arrows?



22. Draw a diagram of the molecule that would be formed based on the arrows:



Chapter 2 Alkanes & cycloalkanes; Conformational & Geometric Isomerism

23. What is the molecular formula of an alkane with 20 carbon atoms? An alkene? An alkyne?

alkane $C_{20}H_{42}$ / alkene $C_{20}H_{40}$ / alkyne $C_{20}H_{38}$

24. Which of the following are alkanes?

a. C_8H_{16}

b. C_7H_{16}

c. C_7H_{18}

d. $C_{27}H_{56}$

No

Yes

No

Yes

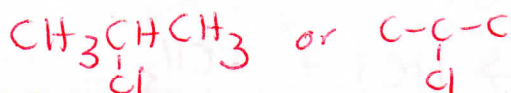
25. Give the correct IUPAC name for CH_2BrCl .

bromochloromethane or 1-bromo-1-chloromethane

26. Write the formula for each of the following compounds:

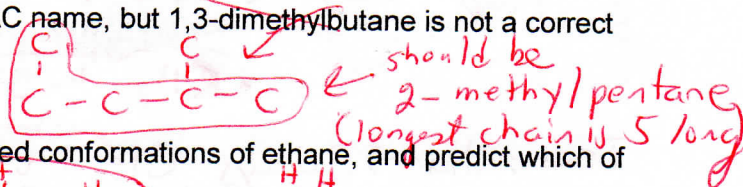
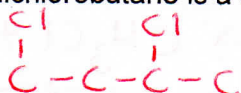
a. 2-chloropropane

b. all alkyl fluorides



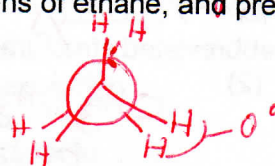
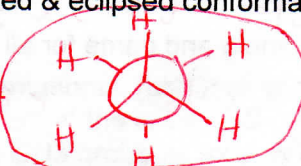
R-F

27. Explain why 1,3-dichlorobutane is a correct IUPAC name, but 1,3-dimethylbutane is not a correct IUPAC name.



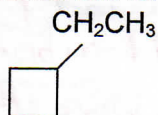
28. Draw Newman projections for staggered & eclipsed conformations of ethane, and predict which of the two conformations is more stable.

more stable



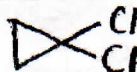
29. Give IUPAC names for:

a.



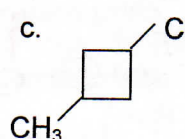
ethyl cyclobutane

b.



1,1-dichloro cyclopropane

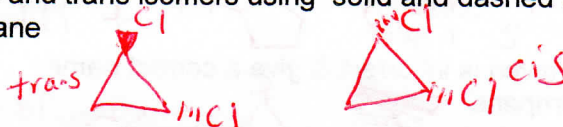
c.



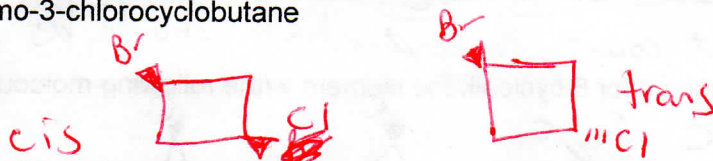
1-chloro-3-methyl cyclobutane

30. Draw the structure for the cis and trans isomers using solid and dashed wedges:

a. 1,2-dichlorocyclopropane



b. 1-bromo-3-chlorocyclobutane



31. Classify each of the following isomer pairs according to the scheme in Figure 2.5 (structural, conformational, or configurational isomers):

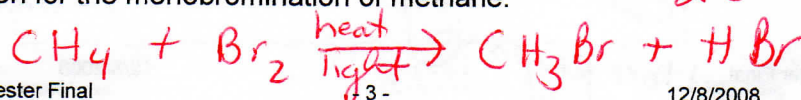
a. 1-bromopropane and 2-bromopropane structural

b. cis- and trans-1,2-dimethylcyclohexane configurational

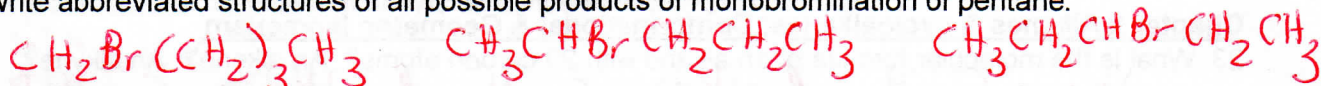
32. Which represents the more oxidized form of carbon, (a) methanol (CH_3OH) or formaldehyde ($CH_2=O$)? (b) methanol or dimethyl ether (CH_3OCH_3)?

neither - both equally oxidized,
 $\frac{1C-O}{1C} = 1$ $\frac{2C-O}{2C} = 1$

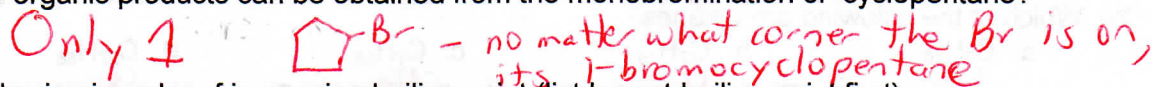
33. Write an equation for the monobromination of methane.



34. Write abbreviated structures of all possible products of monobromination of pentane.



35. How many organic products can be obtained from the monobromination of cyclopentane?

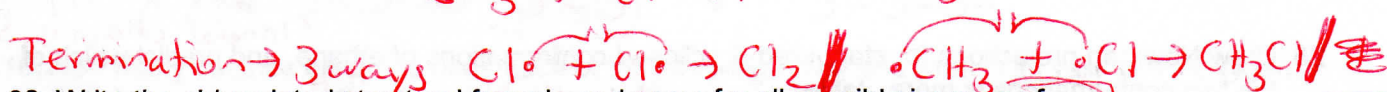
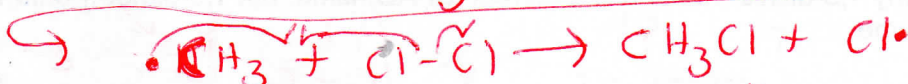
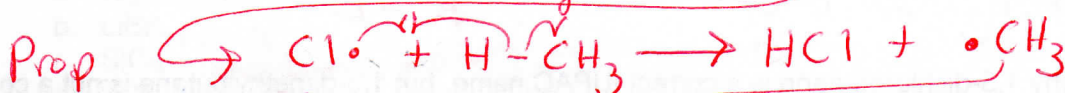
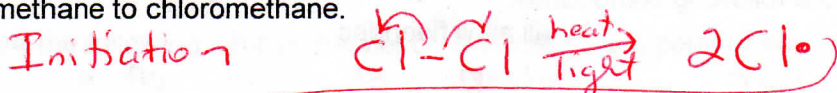


36. List the following in order of increasing boiling point (list lowest boiling point first)

A. 2-methylhexane B. Heptane C. 3,3-dimethylpentane D. Hexane E. 2-methyl-pentane

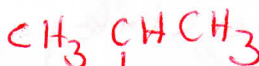
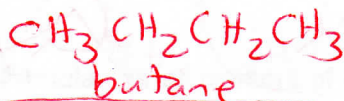


37. Write equations for all the steps (initiation, propagation, termination) in the free radical chlorination of methane to chloromethane.

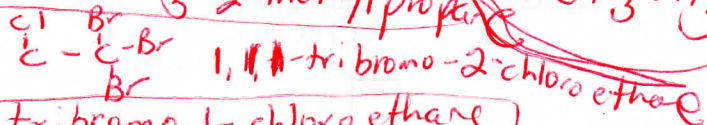
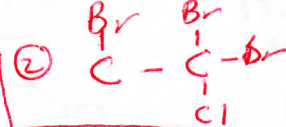
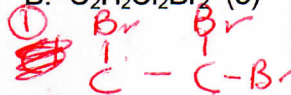


38. Write the abbreviated structural formula and name for all possible isomers of:

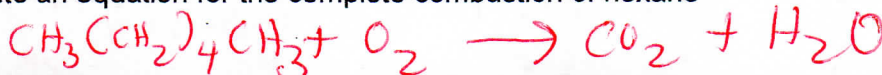
A. C_4H_{10} (2)



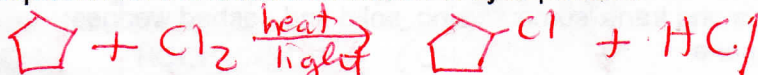
B. $\text{C}_2\text{H}_2\text{Cl}_2\text{Br}_2$ (3)



39. Write an equation for the complete combustion of hexane

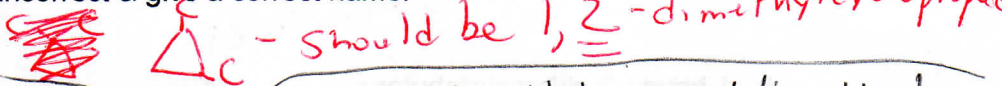


40. Write an equation for the monochlorination of cyclopentane

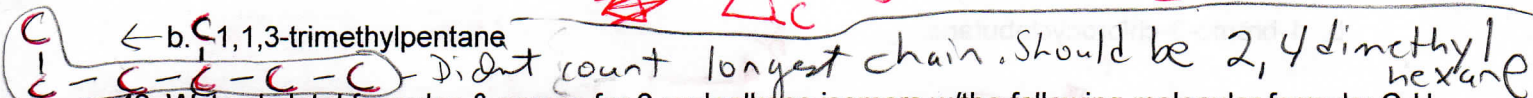


41. Explain why the name given is incorrect & give a correct name:

a. 1,3-dimethylcyclopropane



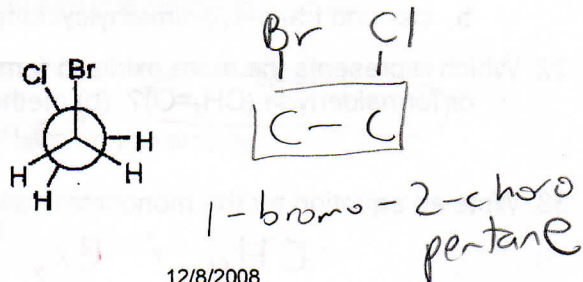
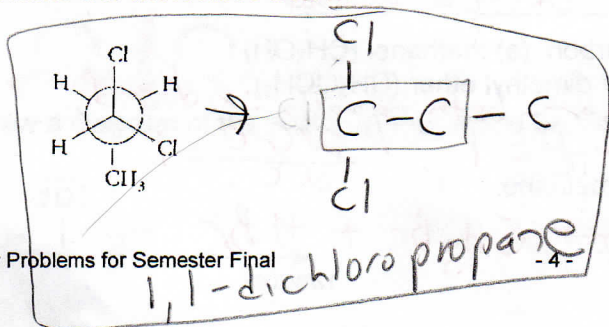
b. 1,1,3-trimethylpentane



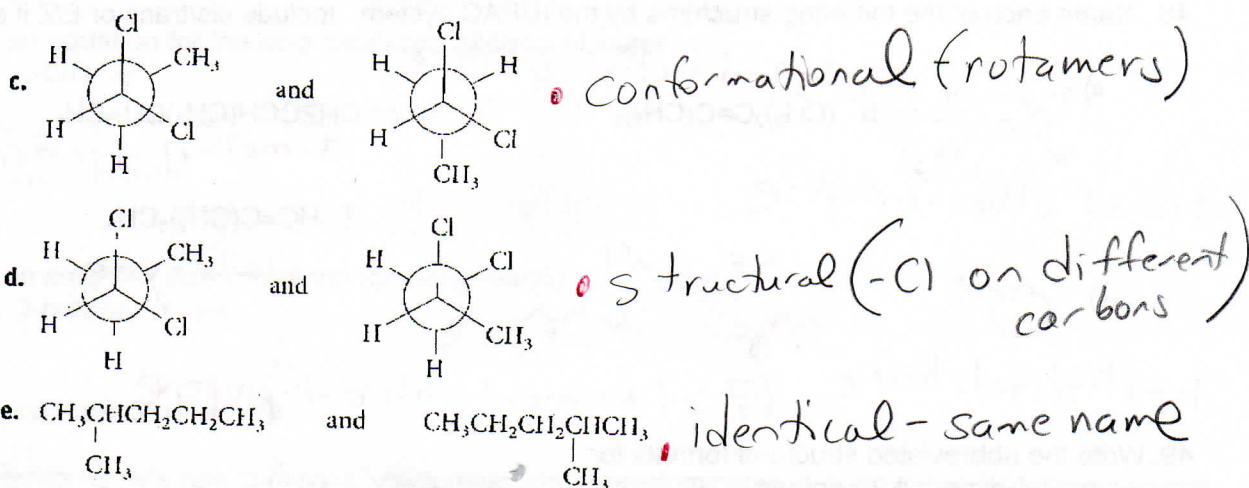
42. Write skeletal formulas & names for 6 cycloalkane isomers w/the following molecular formula: C_5H_{10}



43. Name the molecules below.



44. Are the following structural isomers, conformational, configurational, or identical?



45. Boat & chair isomers:

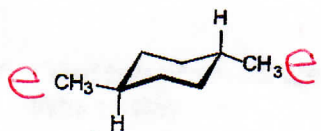
A. What type of isomers are they; conformational, rotamers or structural?

B. Is the diagram at the left a boat or chair?

C. Label each CH₃ group as axial or equatorial.

D. Name the molecule, including a cis or trans prefix.

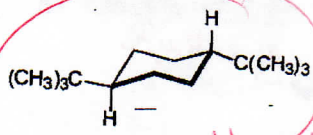
E. How would a ring flip affect axial/equatorial positions and cis/trans orientation?



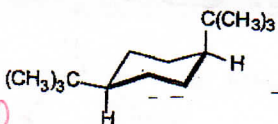
trans 1,4-dimethylcyclohexane

change

stays same



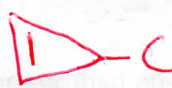
both equatorial



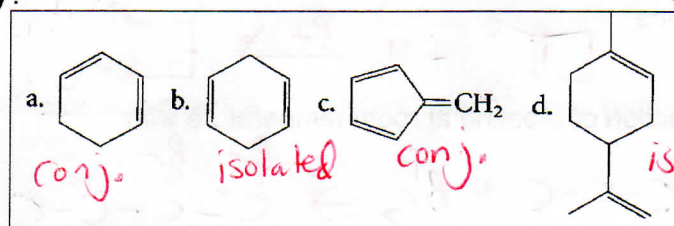
F. Which molecule is more stable? Circle it and explain why.

Chapter 3 Alkenes & Alkynes

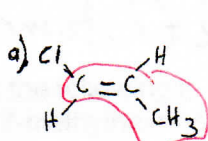
46. What are all the structural possibilities for C₄H₆? (4-acyclic & 5 cyclic. List 5 of them.)



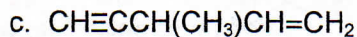
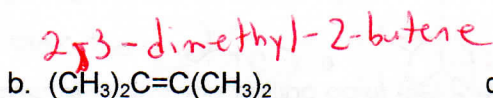
47. Which of the following compounds have conjugated multiple bonds? If not conjugated, what kind of bonds are they?



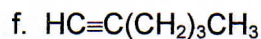
48. Name each of the following structures by the IUPAC system. Include cis/trans or E/Z if appropriate.



trans-1-chloro-1-propene



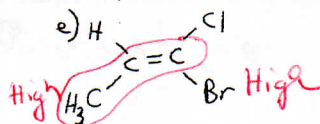
3-methyl-1-pentene-4-yne



1-hexyne



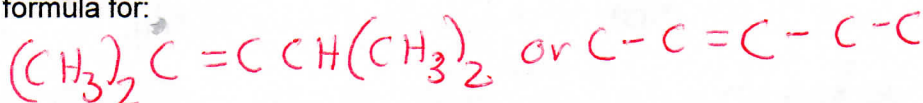
1-methylcyclohexene



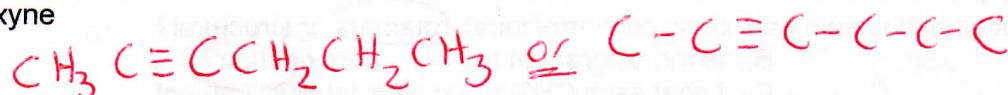
(Z)-1-bromo-1-chloro-1-propene

49. Write the abbreviated structural formula for:

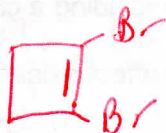
a. 2,4-dimethyl-2-pentane



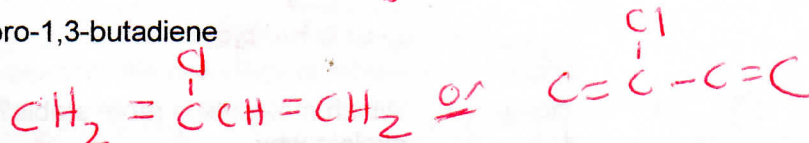
b. 2-hexyne



c. 1,2-dibromocyclobutene

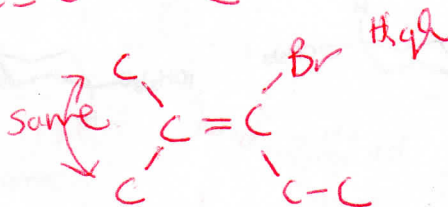


d. 2-chloro-1,3-butadiene



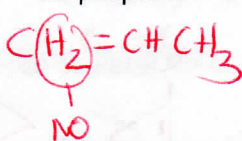
e. ~~(E)~~-3-bromo-2-methyl-2-pentene

not possible

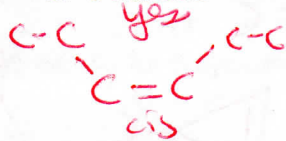


50. Which of the following compounds can exist as cis-trans isomers? Draw their structures.

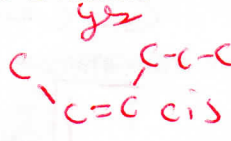
a. propene



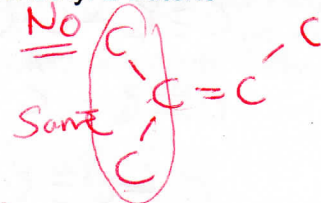
b. 3-hexene



c. 2-hexene

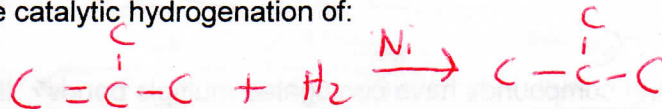


d. 2-methyl-2-butene

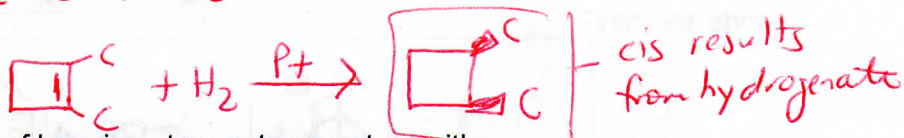


51. Write an equation for the catalytic hydrogenation of:

a. 2-methylpropene

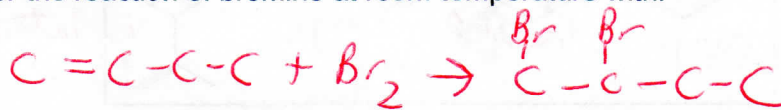


b. 1,2-dimethylcyclobutene

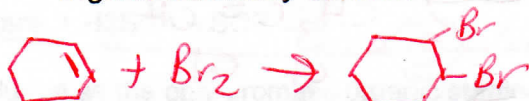


52. Write an equation for the reaction of bromine at room temperature with:

a. 1-butene

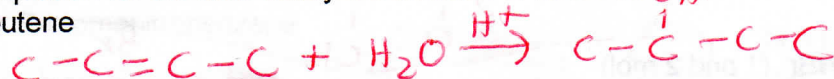


b. cyclohexene

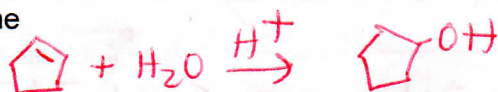


53. Write an equation for the acid-catalyzed addition of water to:

a. 2-butene

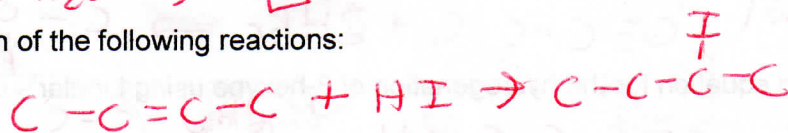


b. cyclopentene



54. Write an equation for each of the following reactions:

a. 2-butene + HI

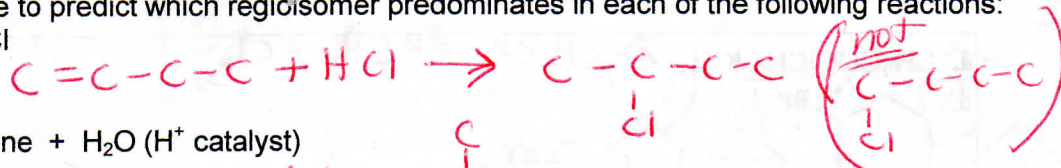
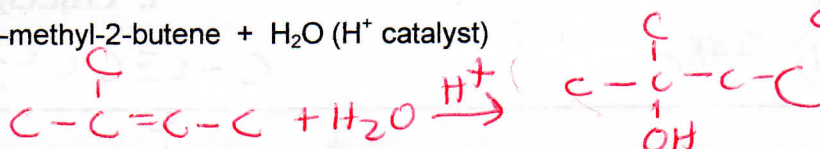
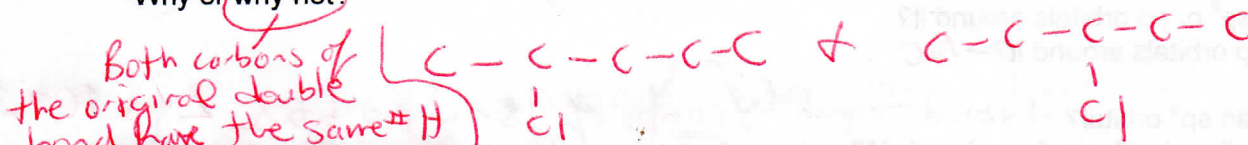


b. cyclopentene + HBr

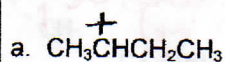


55. Use Markovnikov's rule to predict which regicisomer predominates in each of the following reactions:

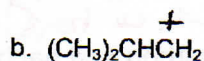
a. 1-butene + HCl

b. 2-methyl-2-butene + H₂O (H⁺ catalyst)56. What two products are possible from the addition of HCl to 2-pentene? Does one predominate? → No
Why or why not?

57. Classify each of the following carbocations as primary, secondary, or tertiary:



2°



1°



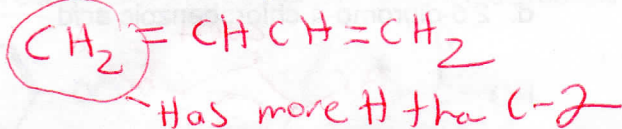
3°



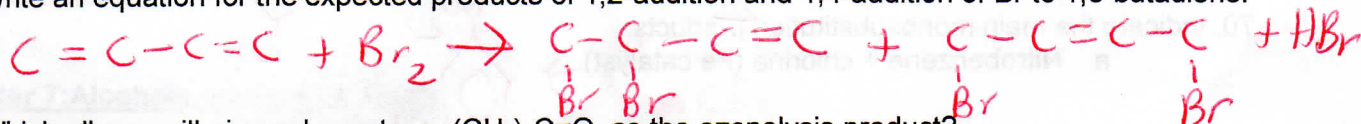
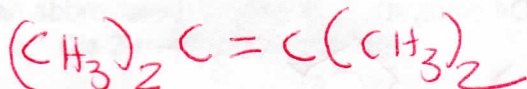
58. Which carbocation in Question #57 above is most stable? Least stable?

3° > 2° > 1°

59. Explain why in the first step in the addition of HBr to 1,3-butadiene, the proton adds to C-1 and not C-2.



60. Write an equation for the expected products of 1,2-addition and 1,4-addition of Br to 1,3-butadiene.

61. Which alkene will give only acetone, (CH₃)₂C=O, as the ozonolysis product?

62. Write equations for the following reactions: