Organic Chemistry 19-20
Semester 1 Final Exam Study Guide

- ✓ The final exam will be all multiple-choice and true false.
- ✓ Do not bring electronic devices to the exam. This includes cell phones, tablets, game systems. If I see them I will take them.
- ✓ There will be no rest room passes until you are done with the test.
- ✓ This study guide will be worth daily points for completing the assigned portions.
- ✓ BRING A PENCIL!!! Don't come to your final without one.

"Success is a state of mind. If you want success, start thinking of yourself as a success."

- ✓ Keys to success:
  - Review old labs and homework.
  - Complete this study guide using notes, labs, diagrams, the book, and old assignments.
  - Don't wait until Wednesday or Thursday before finals to get help.
  - Start studying early. Remember, you have all winter break to relax.
  - Use old study guides in addition to this study guide for help and extra practice. Be sure to focus on what this study guide covers, but those old study guides help a lot.
  - Be prepared.

Final exam will cover chapters 1, 2, 3, 4, and 7.

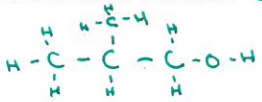
1st Semester Finals Schedule					
Wednesday, January 15th		Thursday, January 16th		Friday, January 17th	
Resource	8:10-9:40	Resource	8:10-9:40	Resource	8:10-8:45
5th period	9:50-11:20	1st period	9:50-11:20	3rd period	8:50-10:20
6th period	12:20-1:50	2nd period	12:20-1:50	4th Period	10:30- 12:00
7th period	2:00-3:30	Resource	2:00-3:30	Busses Leave	12:30
				8th period make-up	12:30-3:30

Chapter 1 Bonding & Isomerism (18 Questions):

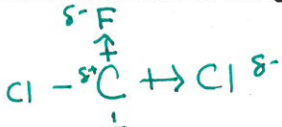
1. What charge does the ion carry when each of the following elements reacts to form an ionic compound: Al, Li, S, H. ← can be +1 or −1
   +3 +1 −2

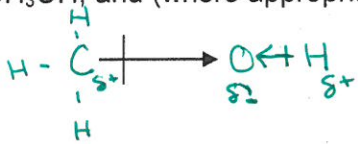
2. Which is the more electropositive element: (Na) or Al, (B) or C, B or (Al). (Circle correct choice.)

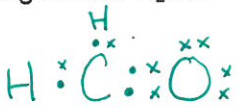
3. Which is the more electronegative element: O or (F), (O) or N, (F) or C. (Circle correct choice.)

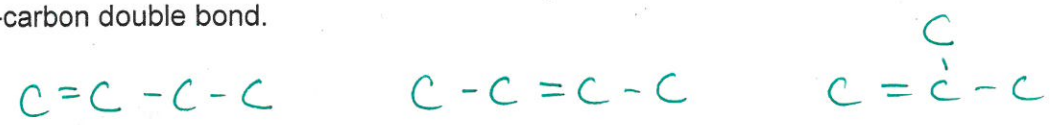
4. For $(CH_3)_2CHCH_2OH$, list the following::
   a. Molecular formula $C_4H_{10}O$ or C_4H_9OH
   b. Abbreviated/condensed structural formula given
   c. Full structural formula 
   d. Skeletal formula 
   e. Line segment 

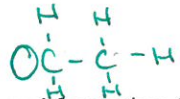
5. Diagram the polarity of the N-Cl bond and of the S-O bond with δ+ and δ-.
   
   

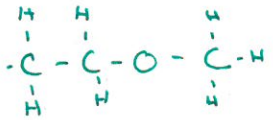
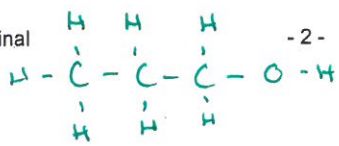
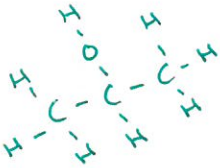
6. Draw the full structural formula of the refrigerant dichlorodifluoromethane and indicate the polarity of the bonds.
   

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

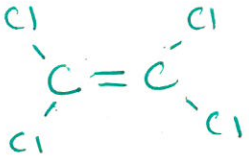
8. Draw the Lewis Electron Dot diagram for H_2CO
   

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

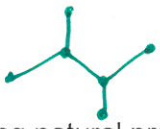
10. Does C_2H_5 represent a stable molecule? no, there are not enough H to bond with carbon.
    

11. Draw structural formulas for all isomers of C_3H_8O (there are 3).
    
    
    

12. Write a structural formula that shows all bonds for $CCl_2=CCl_2$



13. Write a line-segment for $(CH_3)_2CHCH(CH_3)_2$.



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

c. limonene — alkene

d. testosterone — • alkene • ketone • alcohol

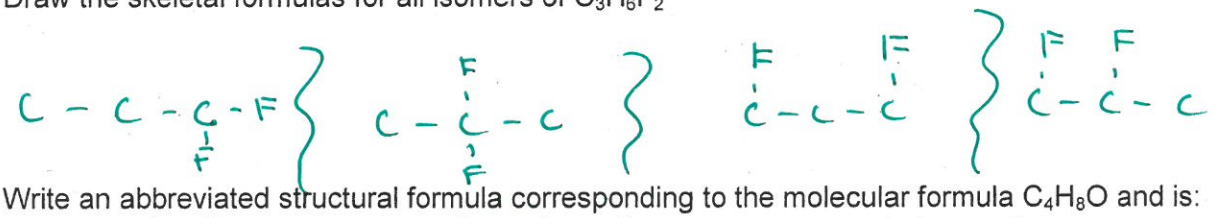
15. Are the following ionic or covalent? If covalent, is it polar or non-polar?

a. Br_2 covalent / nonpolar
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?

Element	Oxygen	Fluorine	Carbon	Hydrogen
Valence Electron	6	7	4	1
Valence	2	1	4	1

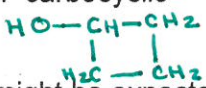
17. Draw the skeletal formulas for all isomers of $C_3H_6F_2$



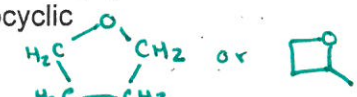
18. Write an abbreviated structural formula corresponding to the molecular formula C_4H_8O and is:

a. Acyclic (many possible) $CH_3CH_2CH=CHOH$

b. carbocyclic



c. heterocyclic



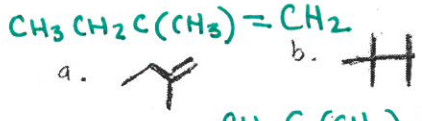
19. Divide the following into groups that might be expected to exhibit similar chemical properties. List the characteristic that defines each group: C_5H_{12} CH_3OCH_3 C_3H_7OH C_4H_9OH C_8H_{18} $CH_3OCH_2CH_3$ $HOCH_2CH_2OH$ CH_3OH C_6H_{14}

— = alcohol

⬭ = alkane

none = ether

20. Write abbreviated formula for:



a. $CH_3CH_2C(CH_3)=CH_2$

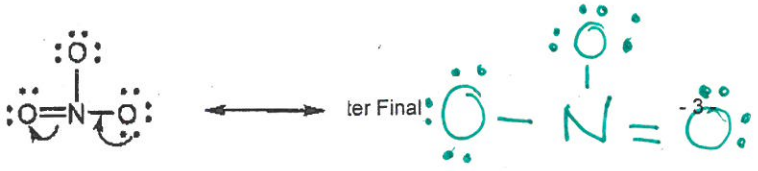
b. $CH_3C(CH_3)_2CH(CH_3)_2$ or $C(CH_3)_3CH(CH_3)_2$

c. $CH_3CH_2OCH_2CH_3$

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

2e⁻ 1e⁻

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



23. Thinking Critically: As you flip through your notes and past lab activities from chapter one, are there any topics left out? If so list them below and provide an example for each.

- Formal charge
- s/p orbitals + hybridization

Chapter 2 Alkanes & cycloalkanes; Conformational & Geometric Isomerism (23 Questions)

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

$C_{20}H_{42}$ $C_{20}H_{40}$ $C_{20}H_{38}$

25. Which of the following are alkanes?

a. C_8H_{16} b. C_7H_{16} c. C_7H_{18} d. $C_{27}H_{56}$

26. Give the correct IUPAC name for CH_2BrCl.

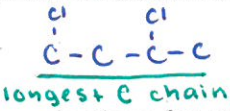
bromochloromethane

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

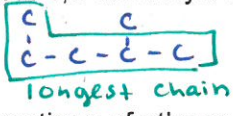
a. 2-chloropropane b. all alkyl fluorides

$CH_3CHClCH_3$ $C_nH_{(2n+1)}F$

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



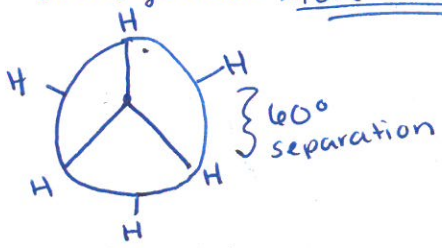
longest C chain



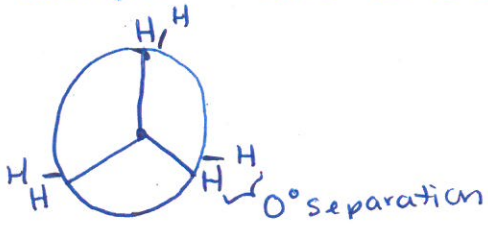
longest chain is 5C long

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

Staggered - more stable



Eclipsed - less stable



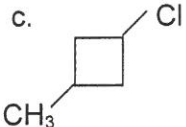
30. Give IUPAC names for:

a. 

ethylcyclobutane

b. 

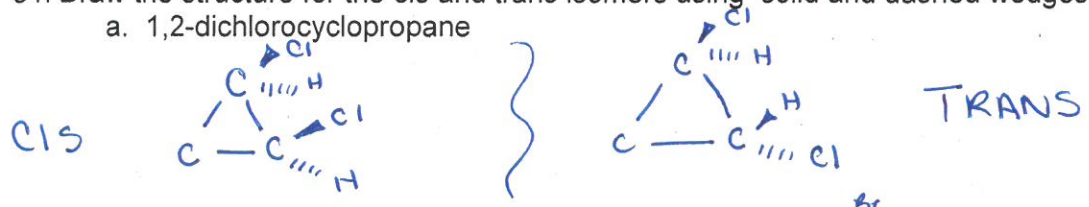
1,1-dichlorocyclopropane

c. 

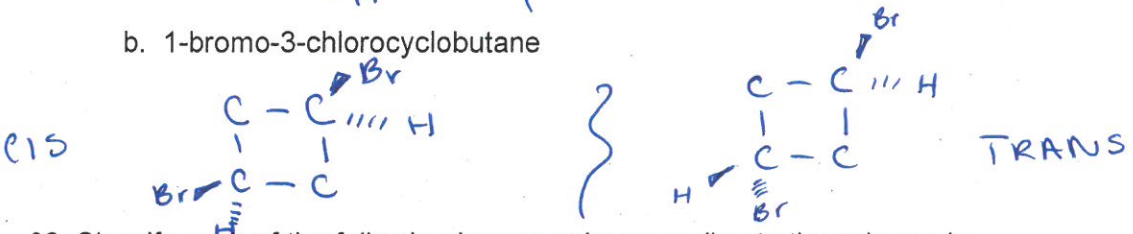
1-chloro-3-methyl cyclobutane

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

a. 1,2-dichlorocyclopropane



b. 1-bromo-3-chlorocyclobutane



32. 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

33. 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)?

more bonds to oxygen

equally oxidized →

Methanol $\frac{1C-O}{1C} = 1$

dimethyl ether $\frac{2C-O}{2C} = 1$

34. Write an equation for the monobromination of methane.

$$CH_4 + Br_2 \xrightarrow[\text{light}]{\text{heat}} CH_3Br + HBr$$

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

$CH_3(CH_2)_3CH_2Br$ $CH_3(CH_2)_2CHBrCH_3$ $CH_3CH_2CHBrCH_2CH_3$

36. How many organic products can be obtained from the monobromination of cyclopentane? 1

← no matter where Br is attached, you begin counting on the ring with Br on C 1.

37. 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

E < D < C < A < B

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

initiation: $Cl-Cl \xrightarrow[\text{light}]{\text{heat}} 2\,Cl\cdot$ (chlorine radical) — form radicals with reactant

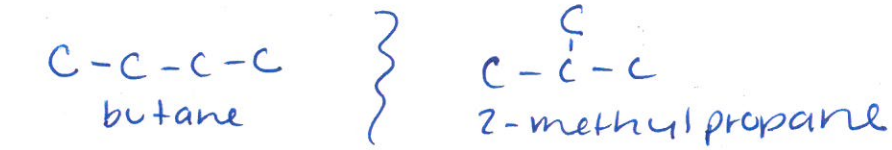
propagation:
$Cl\cdot + H-CH_3 \rightarrow HCl + \cdot CH_3$
$\cdot CH_3 + Cl-Cl \rightarrow CH_3Cl + \cdot Cl$
— use 1 radical to make another radical

termination:
$\cdot Cl + \cdot Cl \rightarrow Cl_2$
$\cdot CH_3 + \cdot CH_3 \rightarrow CH_3CH_3$
$\cdot Cl + \cdot CH_3 \rightarrow CH_3Cl$
— combine all radicals made

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

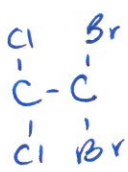
A. C_4H_{10} (2)

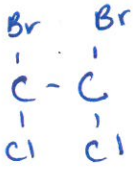
C-C-C-C butane



2-methylpropane

B. $C_2H_2Cl_2Br_2$ (3)

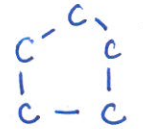

1,1-dibromo-2,2-dichloroethane


1,2-dibromo-1,2-dichloroethane.

40. Write an equation for the complete combustion of hexane

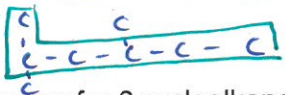
$CH_3(CH_2)_4CH_3 + O_2 \rightarrow CO_2 + H_2O$

41. Write an equation for the monochlorination of cyclopentane


$+ Cl_2 \xrightarrow[\text{light}]{\text{heat}}$ 
$+ HCl$

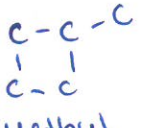
42. Explain why the name given is incorrect & give a correct name:

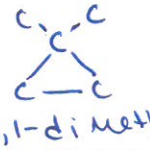
a. 1,3-dimethylcyclopropane → 1,2-dimethylcyclopropane → count for lowest sum.

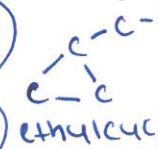
b. 1,1,3-trimethylpentane  2,4-dimethylhexane → find longest carbon chain

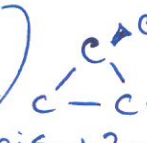
43. Write skeletal formulas & names for 6 cycloalkane isomers w/the following molecular formula: C_5H_{10}


cyclopentane


1-methylcyclobutane or methylcyclobutane

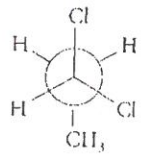

1,1-dimethylcyclopropane

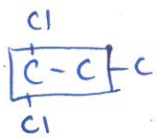

ethylcyclopropane


cis-1,2-dimethylcyclopropane

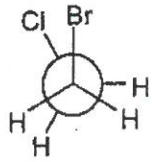

trans-1,2-dimethylcyclopropane

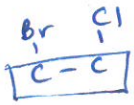
44. Name the molecules below.





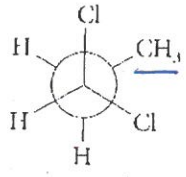
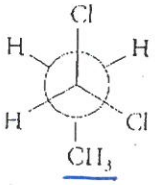
1,1-dichloropropane



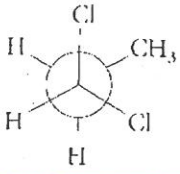
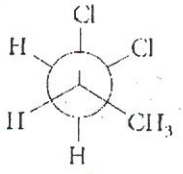


1-bromo-2-chloroethane

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

c.  and 

conformation (rotamers) each CH_3 rotated 120°

d.  and 

structural (Cl is on different C)

e. $CH_3CHCH_2CH_2CH_3$ (CH₃ branch) and $CH_3CH_2CH_2CHCH_3$ (CH₃ branch)

identical (same name)

46. Boat & chair isomers:

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

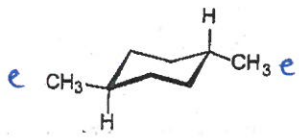
B. Is the diagram at the left a boat or chair?

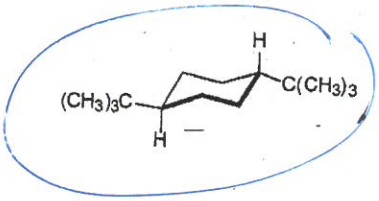
C. Label each CH3 group as axial or equatorial.

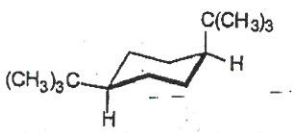
D. Name the molecule, including a cis or trans prefix.

trans-1,4-dimethylcyclohexane

E. How would a ring flip affect axial/equatorial positions and cis/trans orientation? both equatorial methyl groups would become axial but they would still be trans







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

Both substituents are placed equaterially which results in them being farther away from the ring structure creating less repulsion force between molecules.

47. Thinking Critically: As you flip through your notes and past lab activities from chapter two, are there any topics left out? If so list them below and provide an example for each.

Chapter 3 Alkenes & Alkynes (23 Questions)

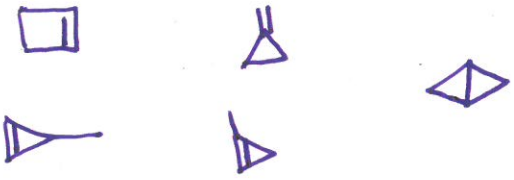
48. What are all the structural possibilities for C_4H_6? (4-acyclic & 5 cyclic. List 5 of them.)

C≡C-C-C

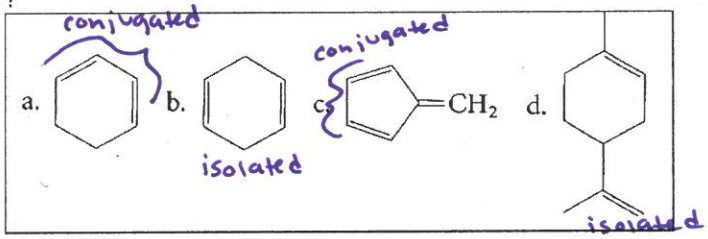
C=C=C-C

C-C≡C-C

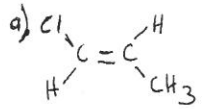
C=C-C=C



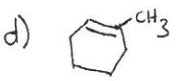
49. Which of the following compounds have conjugated multiple bonds? If not conjugated, what kind of bonds are they?



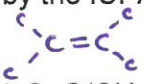
50. Name each of the following structures by the IUPAC system. Include cis/trans or E/Z if appropriate.



trans-1-chloropropene

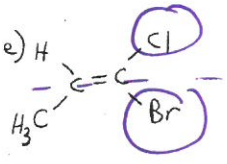


1-methylcyclohexene

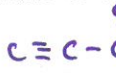


b. $(CH_3)_2C=C(CH_3)_2$

2,3-dimethyl-2-butene



Z-1-bromo-1-chloro-1-propene



c. $CH{\equiv}CCH(CH_3)CH{=}CH_2$

3-Methylpent-1-en-4-yne

3-Methyl-1-penten-4-yne

C≡C-C-C-C-C

f. $HC{\equiv}C(CH_2)_3CH_3$

1-hexyne