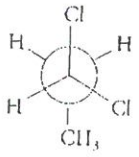
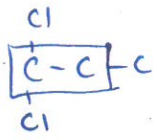
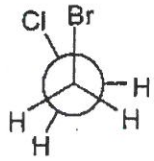
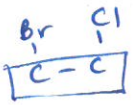
44. Name the molecules below.





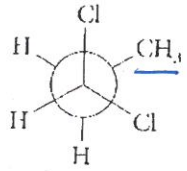
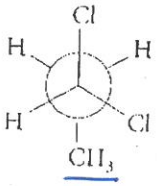
1,1-dichloropropane



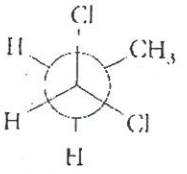
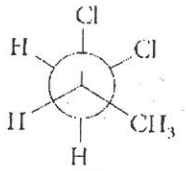


1-bromo-2-chloroethane

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. $CH_3CHCH_2CH_2CH_3$ (with CH_3 below) and $CH_3CH_2CH_2CHCH_3$ (with CH_3 below) identical (same name)

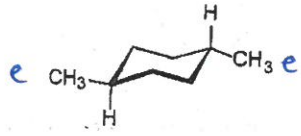
46. Boat & chair isomers:

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

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

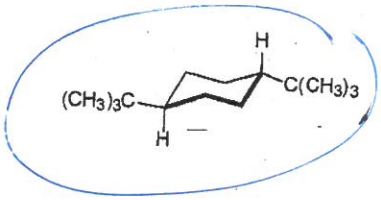
C. Label each CH3 group as axial or equatorial.

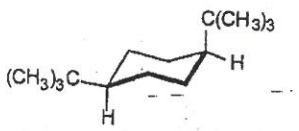
D. Name the molecule, including a cis or trans prefix.



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)

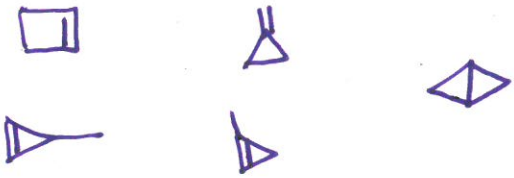
48. What are all the structural possibilities for C_4H_6? (4-acyclic & 5 cyclic. List 5 of them.)

C≡C-C-C

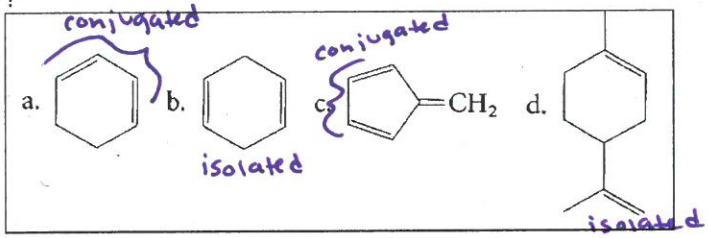
C=C=C-C

C-C≡C-C

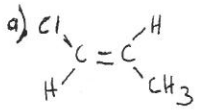
C=C-C=C



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.

a) 

trans-1-chloropropene

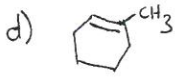
b. $(CH_3)_2C=C(CH_3)_2$

2,3-dimethyl-2-butene

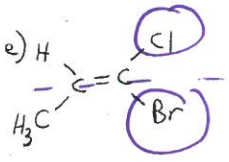
c. $CH{\equiv}CCH(CH_3)CH{=}CH_2$

3-Methylpent-1-en-4-yne

3-Methyl-1-penten-4-yne

d) 

1-methylcyclohexene

e) 

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

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

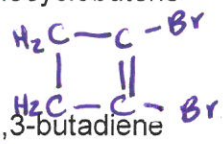
1-hexyne

51. Write the abbreviated structural formula for:

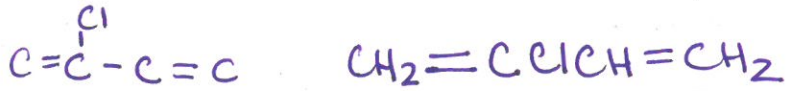
a. 2,4-dimethyl-2-pentane

b. 2-hexyne

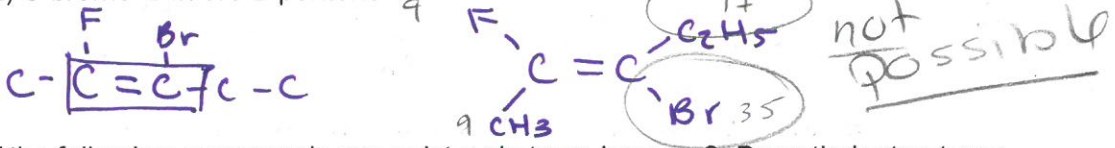
c. 1,2-dibromocyclobutene



d. 2-chloro-1,3-butadiene

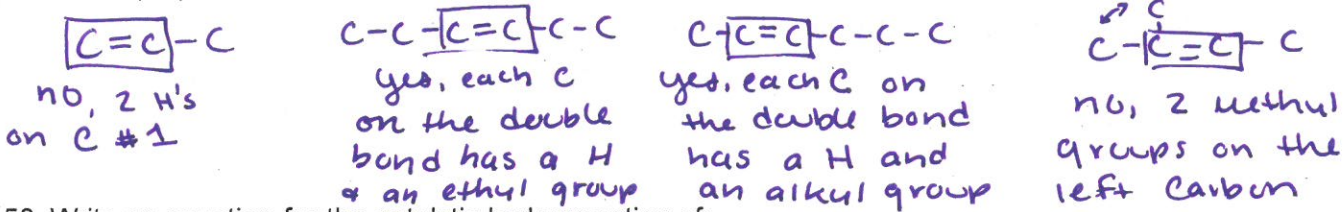


e. (E)-3-bromo-2-fluoro-2-pentene



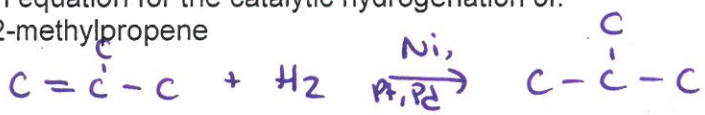
52. Which of the following compounds can exist a cis-trans isomers? Draw their structures.

a. propene b. 3-hexene c. 2-hexene d. 2-methyl-2-butene



53. Write an equation for the catalytic hydrogenation of:

a. 2-methylpropene



b. 1,2-dimethylcyclobutene

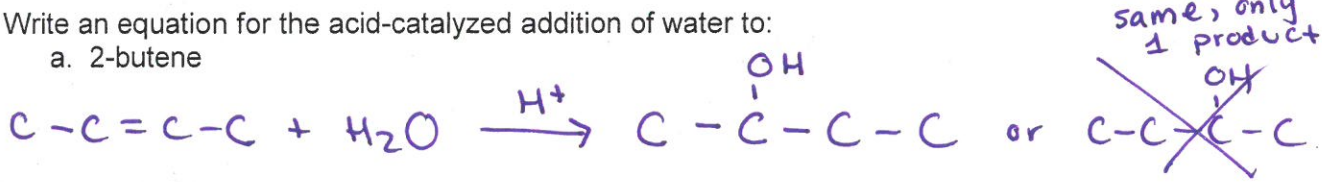
54. Write an equation for the reaction of bromine at room temperature with:

a. 1-butene

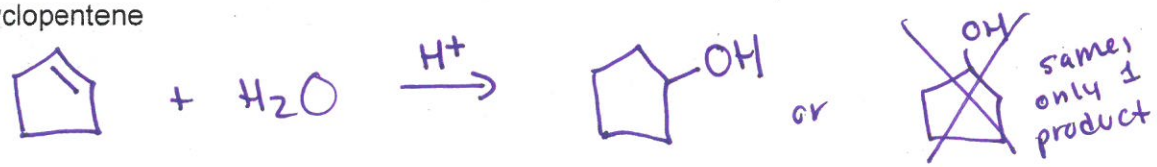
b. cyclohexene

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

a. 2-butene

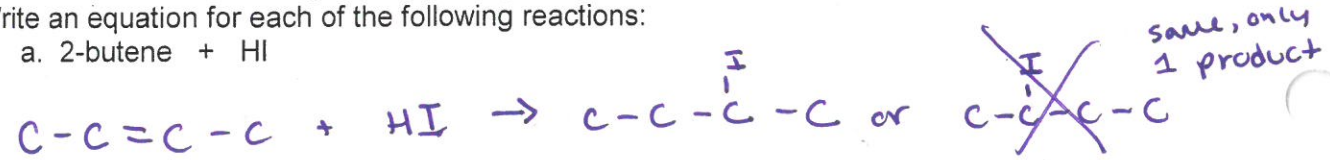


b. cyclopentene

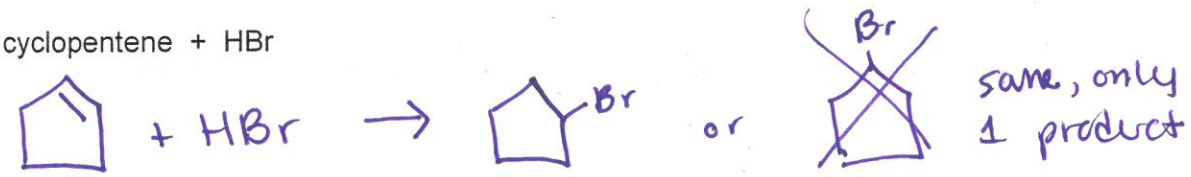


56. Write an equation for each of the following reactions:

a. 2-butene + HI

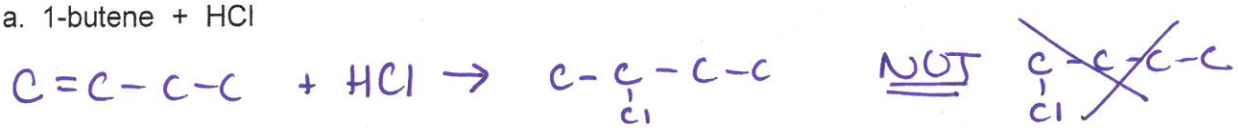


b. cyclopentene + HBr

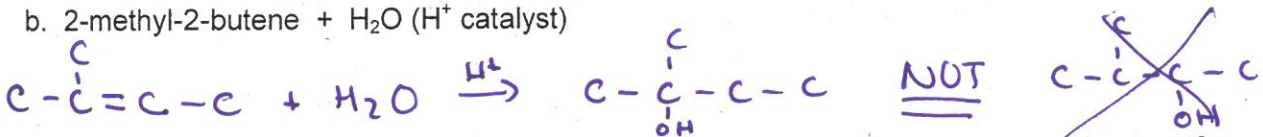


57. Use Markovnikov's rule to predict which regioisomer predominates in each of the following reactions:

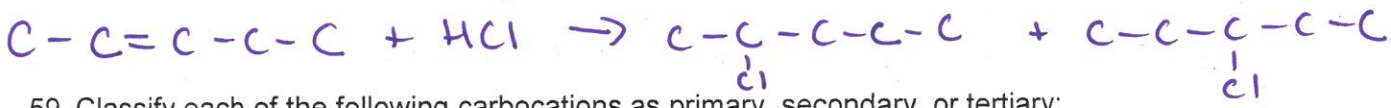
a. 1-butene + HCl



b. 2-methyl-2-butene + H_2O (H^+ catalyst)



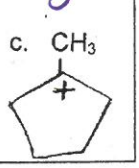
58. What two products are possible from the addition of HCl to 2-pentene? Does one predominant? no
Why or why not? Both C's of the original alkene have the same # of Hydrogen.



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

a. $CH_3\overset{+}{C}HCH_2CH_3$ — 2°

b. $(CH_3)_2\overset{+}{C}HCH_2$ — 1°

c.  — 3°

60. Which carbocation in Question #~~57~~ 59 above is most stable? Least stable?

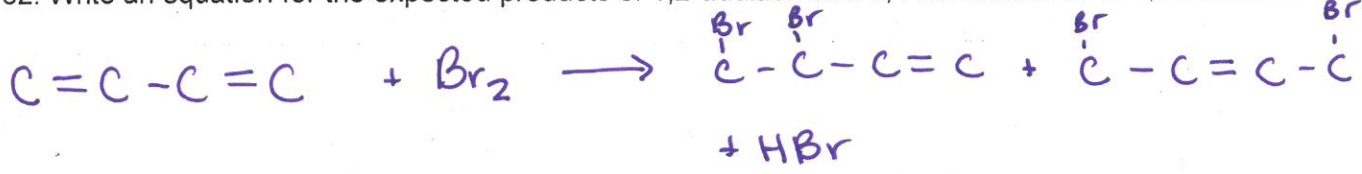
3° (c) / 1° (b)

61. 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.

$CH_2=CHCH=CH_2$

C #1 has more H originally than C #2

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



63. Which alkene will give only acetone, $(CH_3)_2C=O$, as the ozonolysis product? If only 1 product, it is symmetrical on both sides.

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

64. Write equations for the following reactions:

a. $CH_3C{\equiv}CH + Cl_2$ (1 mol) ⟶ $CH_3C(Cl)=CH(Cl)$

b. $CH_3C{\equiv}CH + 2Cl_2$ (2 mol) ⟶ $CH_3C(Cl)_2-CH(Cl)_2$

c. 1-butyne + HBr (1 and 2 mol) ← Markovnikov's Rule

1 mol $C{\equiv}C-C-C + HBr \rightarrow C=C(Br)-C-C$

2 mol $C{\equiv}C-C-C + 2HBr \rightarrow C-C(Br)_2-C-C$

65. Write an equation for the hydrogenation of 3-hexyne using Lindlar's catalyst.

$C-C-C{\equiv}C-C-C + H_2 \xrightarrow{\text{Lindlar's}}$ (cis-3-hexene) Must be cis!

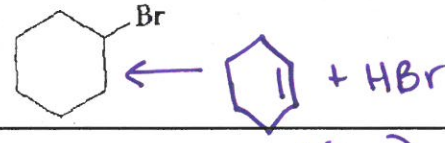
66. What reactant will react by addition with what unsaturated hydrocarbon to form each of the following?

a. $CH_3CHClCHClCH_3 \leftarrow CH_3CH=CHCH_3 + Cl_2$

c. $(CH_3)_3COH \leftarrow$ (2-methyl-2-propanol) $\xleftarrow{H^+}$ (2-methyl-2-propen-1-ol) $+ H_2O$

$C-C{\equiv}C-C + 2Cl_2 \rightarrow$

f. $CH_3CCl_2CCl_2CH_3$

d.  ← + HBr

Adds to 4 C's (+3 p)

67. Does a carbon with four single bonds have....

A. sp^3, sp^2 or sp orbitals around it?

B. Any p orbitals around it? NO

68. What is an sp^3 orbital? A hybrid orbital formed by a combination of 1s + 3p orbitals (spreading out e^-) to ↓ total energy level.

69. Describe the structure of a pi bond. lateral / horizontal / indirect sharing of e^-

a. What type of orbitals combine to make a pi bond? 2 p orbitals

b. Where do you find pi bonds in a molecule? In double + triple bonds between adjacent carbons.

70. What type of bond is formed between the carbon and each hydrogen in methane? sigma (σ)

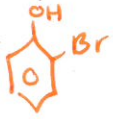
71. Thinking Critically: As you flip through your notes and past lab activities from chapter three, are there any topics left out? If so list them below and provide an example for each.

Chapter 4 Aromatic Compounds (24 Questions)

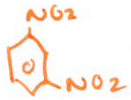
72. Draw the structure of:

a. *p*-nitrotoluene

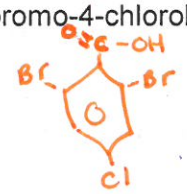
b. *o*-bromophenol



c. *m*-dinitrobenzene

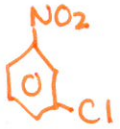


d. *2,6*-dibromo-4-chlorobenzoic acid

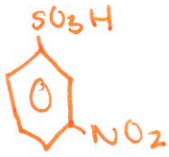


73. Indicate the main monosubstitution products:

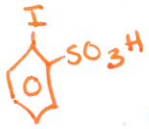
a. Nitrobenzene + chlorine (Fe catalyst)



b. Benzenesulfonic acid + HNO3 (H2SO4 catalyst) →



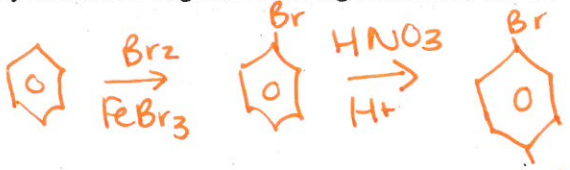
c. Iodobenzene + H2SO4 + SO3 →



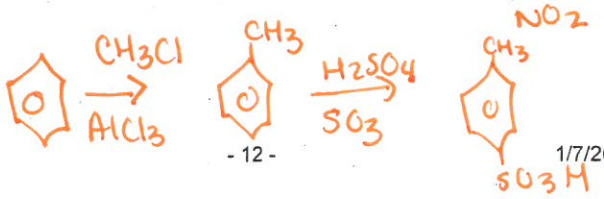
+

74. Using benzene or toluene as the only aromatic organic starting material, devise a synthesis for the following:

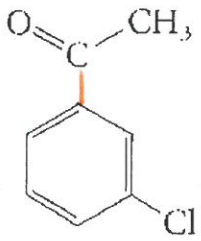
d. P-bromonitrobenzene

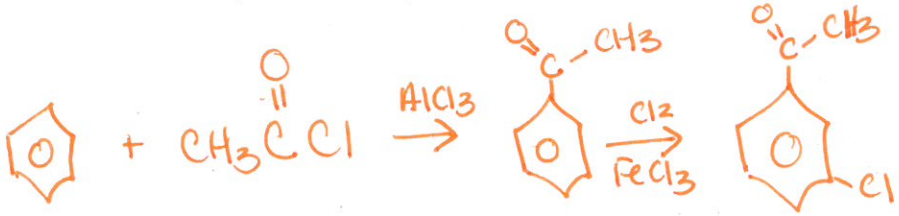


e. P-methylsulfonicacid

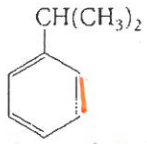


74 Continued: Using benzene or toluene as the only aromatic organic starting material, devise a synthesis for the following:

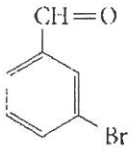




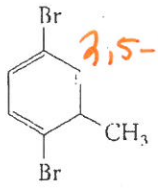
75. Name:

a. 

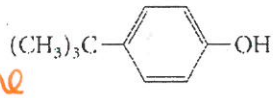
2-phenyl propane

b. 

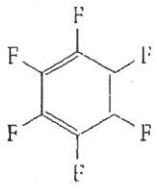
m-bromoacteo phenone
m-bromobenzaldehyde

d. 

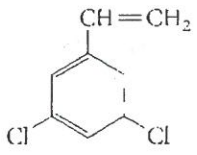
3,5-dibromotoluene

e. 

p (1,1-dimethylethyl) phenol

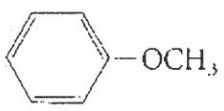
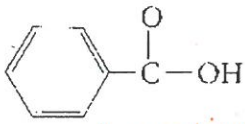
g. 

hexafluorobenzene

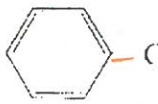
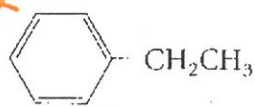
h. 

3,5-dichlorostyrene

76. Which compound is more reactive toward electrophilic substitution (for example nitration)?

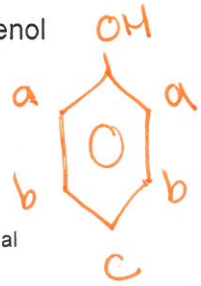
a.  or 

O/P - Activater m - deactivater

b.  or 

O/P deactivater O/P activater

77. Draw an example of each for phenol
   a. O placement
   b. M placement
   c. P placement



78. What is an activator? A substituent that speeds up a rxn.

a. How do you recognize them?

o/p directors

b. What molecules are the exception to this rule?

Halogens

c. What happens to reaction rate if you have 2 activators on a benzene ring?

Rxn occurs 2x as fast

d. What happens to reaction rate if you have an activator with a deactivator on a benzene ring? They cancel, runs at normal benzene rate

79. What is a deactivator? A substituent that slows a rxn.

a. How do you recognize them?

m-directors & halogens

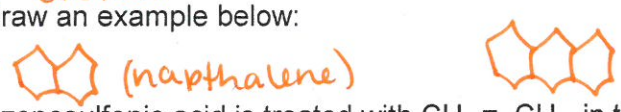
b. What happens to reaction rate if you have 2 deactivators on a benzene ring?

Rxn occurs 2x as slow.

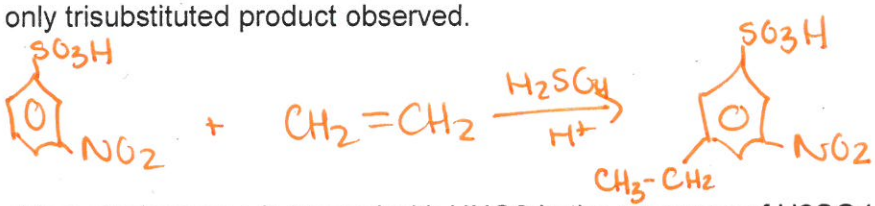
80. What is a polycyclic molecule?

A molecule containing multiple joined rings sharing a side (fused)

a. Draw an example below:

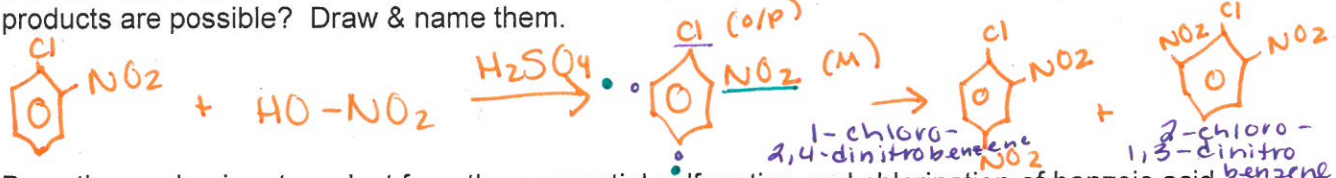


81. If m-nitrobenzenesulfonic acid is treated with $CH_2 = CH_2$ in the presence of H2SO4, draw and name the only trisubstituted product observed.

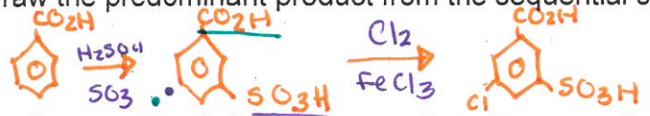


5-ethyl-3-nitro benzenesulfonic acid.

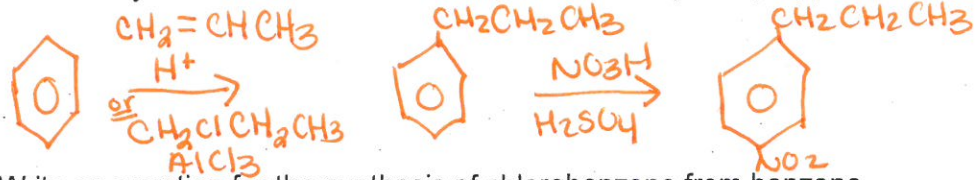
82. If o-chloronitrobenzene is treated with HNO3 in the presence of H2SO4, how many trisubstituted products are possible? Draw & name them.



83. Draw the predominant product from the sequential sulfonation and chlorination of benzoic acid.



84. Devise a synthesis for the conversion of benzene to p-nitropropylbenzene.



85. Write an equation for the synthesis of chlorobenzene from benzene