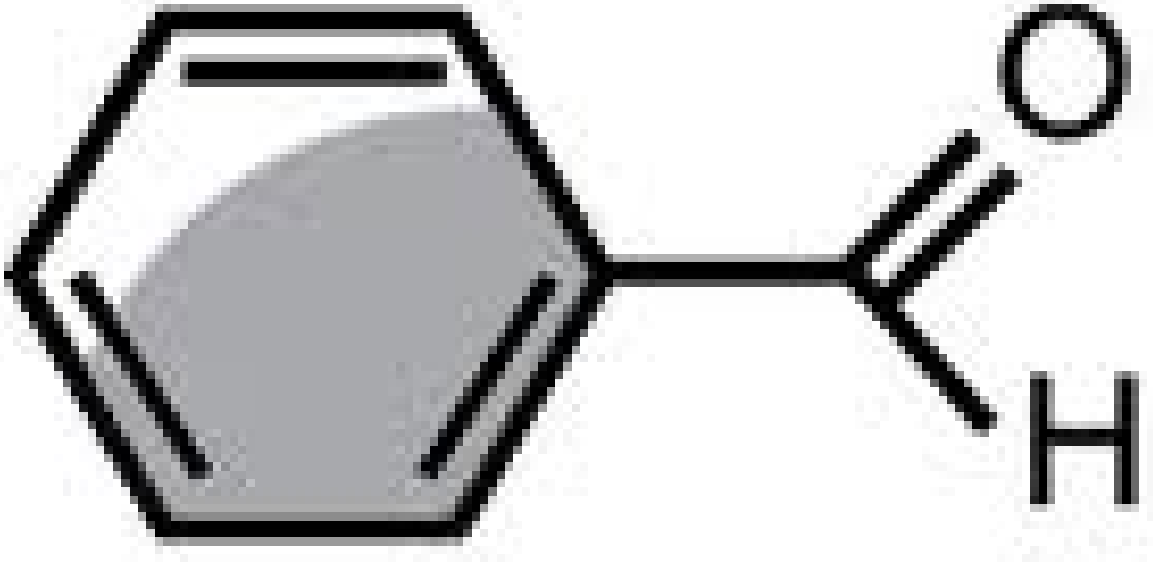
Organic chemistry



Organic Chemistry

Organic chemistry is
- the study of carbon and its compounds
- associated with living things

Organic compounds are <u>all</u> compounds of carbon EXCEPT: oxides, carbides, carbonates, + cyanides
eg → ($\underline{C}O$, $\underline{C}O_2$) ($Si\underline{C}$) ($Na_2\underline{C}O_3$) ($H\underline{C}N$)

The exception examples + all other substances are INORGANIC.

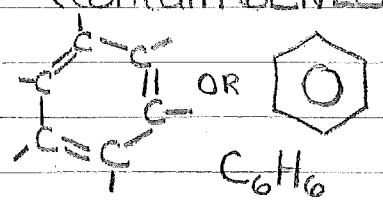
Organic Compounds

-see divisions on flowchart on following page-

Organic Compounds

Hydrocarbons (containing "C" + "H" only)

aromatics (contain BENZENE)



C_6H_6

straight chain aliphatics and cyclic hydrocarbons

alkanes
only SINGLE bonds between C's eg -C-C-

alkenes
DOUBLE bond between C's eg >C=C<

alkynes
TRIPLE bond between C's eg -C≡C-

SATURATED
- only SINGLE bonds between C's + ∴ MAX. possible H's.

UNSATURATED
- multiple C to C bonds
- LESS than max H's.

alkanes → straight chain, cyclic → General Formula C_nH_{2n+2}

alkenes → straight chain, cyclic → C_nH_{2n}

straight chain alkynes → C_nH_{2n-2}

Hydrocarbons with Functional Groups (containing other atoms and "C" + "H")

Halocarbons (have halogens)

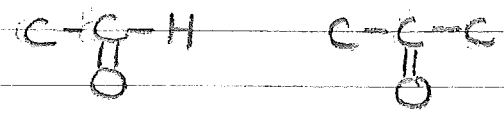
Ethers (have C-O-C)

Alcohols (have -OH)

Esters
have -COOC or -C(=O)-O-C

Carboxylic Acids
(have -COOH or -C(=O)-O-H)

Aldehydes + Ketones



Important Biological Compounds

Carbohydrates
$(CH_{2n}O)_x$

Lipids
(esters of glycerol + carboxylic (fatty) acids)

Amino Acids + Proteins
- $-NH_2$ (amino)
- $-COOH$ (carboxylic acid group)

Nucleic Acids
(DNA + RNA)

Sometimes there is more than one = bond in a compound. The location of the = bonds are numbered (as before) and a prefix corresponding to the number of = bonds is inserted in front of "ene".

eg

1,3-pentadiene

↑ two = bonds

Common Aliphatic Hydrocarbons

	alkane	alkene	alkyne
1st member of the group	CH_4	C_2H_4	C_2H_2
	methane	ethene	ethyne
use →	heating homes	starting cmpd	welding
*5th member of the group	C_5H_{12}	C_6H_{12}	C_6H_{10}
	pentane	hexene	hexyne

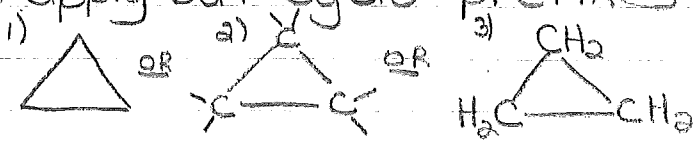
Some Physical Properties

- alkanes, alkenes + alkynes are all NONPOLAR + ∴ INSOLUBLE in water (+ other polar solvents)
- alkenes have fewer H's than similar alkanes, ∴ alkenes have: ↓e^-'s, ↓LDF; + ↓B.P.'s + ↓M.P.'s
- alkynes show a REVERSAL of this trend as they are more compact + have better intermolecular bonds
- alkenes + alkynes are more reactive than alkanes

The Cyclos (eg cycloalkanes + cycloalkenes)

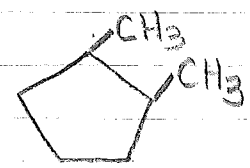
- "C" can form rings (cyclos) as well as straight chains
- the same naming rules apply but "cyclo" prefixes the parent:

a) cyclopropane



b) cyclobutene

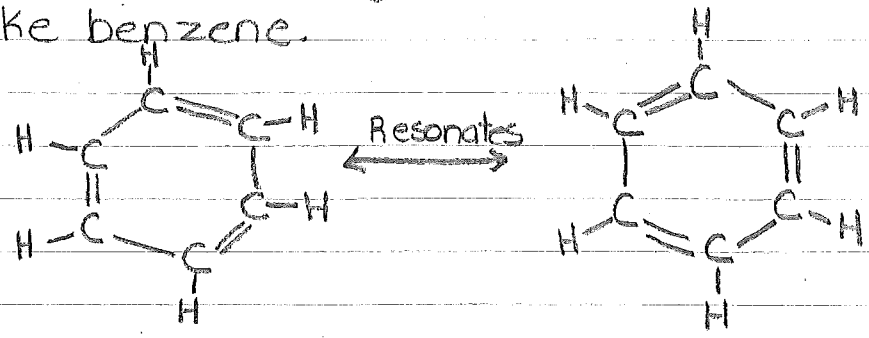
c) 1,2-dimethylcyclopentane



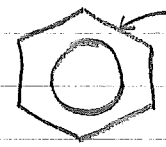
Aromatics

- Aromatic compounds are hydrocarbons containing benzene ($C_6H_{6(l)}$) or have bonding like benzene.

- Benzene C_6H_6



In fact the C-C bonds in benzene are NOT true single or double bonds but a HYBRID bond type ∴ the structure of benzene is often shown as:



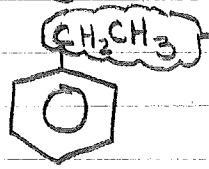
not true single or double bonds.

(arenes - benzene-like hydrocarbons)

Naming Aromatics

- The rules for naming benzene compounds are similar to "anes".

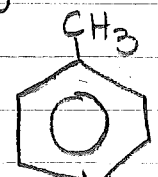
eg 1)



note: this branch can also be shown as: $-\underset{|}{C}-\underset{|}{C}-$ OR C_2H_5

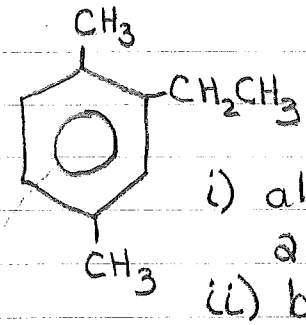
ethyl benzene

eg 2)



methyl benzene
common name: toluene

eg 3)



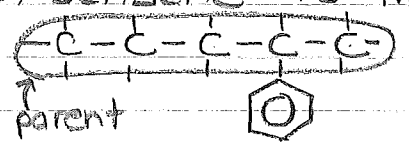
branches still get lowest #'s

i) alphabetically:
2-ethyl-1,4-dimethylbenzene

ii) by complexity:
1,4-dimethyl-2-ethylbenzene

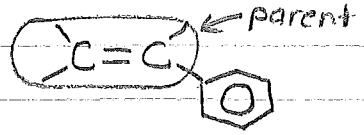
- When <u>benzene</u> is a <u>branch</u> it is called <u>PHENYL</u>.
- This occurs when:

i) benzene is NOT attached to an end C.

eg 

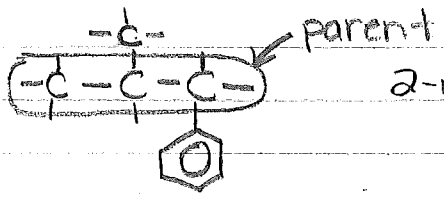
2-phenylpentane

ii) the branch contains a double bond it becomes the parent (& benzene the branch)

eg 

phenylethene

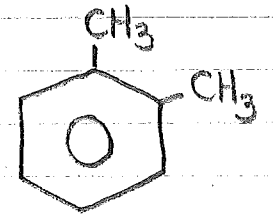
iii) the branch is branched

eg 

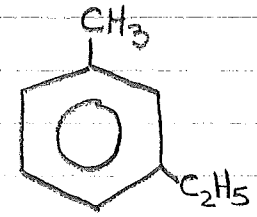
2-methyl-1-phenylpropane

- When benzene <u>only has 2 branches</u> there is an additional naming system:

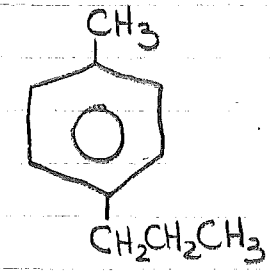
o-	m-	p-
ortho = 1, 2	meta = 1, 3	para = 1, 4



1, 2-dimethylbenzene
<u>OR</u> o-dimethylbenzene



1-methyl-3-ethylbenzene
m-methylethylbenzene



1-methyl-4-propylbenzene
p-methylpropylbenzene

(Branches can be more complicated than those we have studied.

Halocarbons/Haloalkanes

- hydrocarbons with a halogen (F, Cl, Br, I) in place of one or more hydrogens.

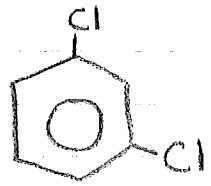
Naming

- the halogen substituents are numbered and ALPHABETIZED like an ordinary branch

eg 1)

2-bromo-1-chloro-3-fluoropropane

eg 2)



1,3-dichlorobenzene
m-dichlorobenzene

$C_6H_4Cl_2$

- note examples on top of p 617 (A+W)
- read tables 26.3 (p 618) + 26.4 (p 619) (A+W)

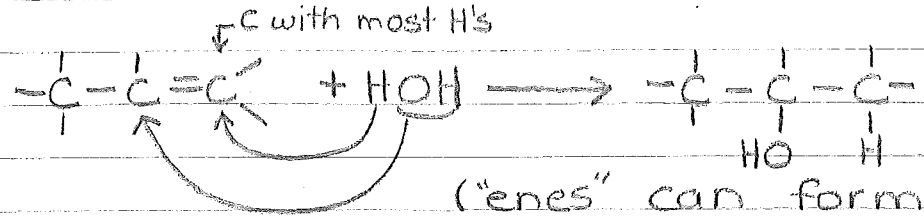
Reactions Forming Haloalkanes

A. Substitution with ALKANES or BENZENE

alkane or benzene + halogen $X-X$ ⟶ haloalkane + acid HX

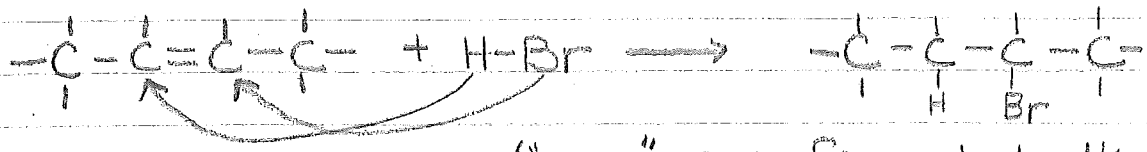
B. Addition with an ALKENE or ALKYNE whereby the substance added to break the = or ≡ bond can be: hydrogen H-H
- any halogen (X-X)
- hydrogen halide (HX)
- water (HOH)
- other acids (eg $HClO_3$)

a) addition of water



("enes" can form alcohols)

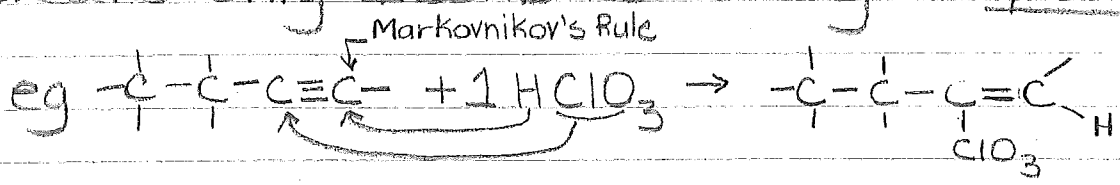
b) addition of H-X (eg HBr)



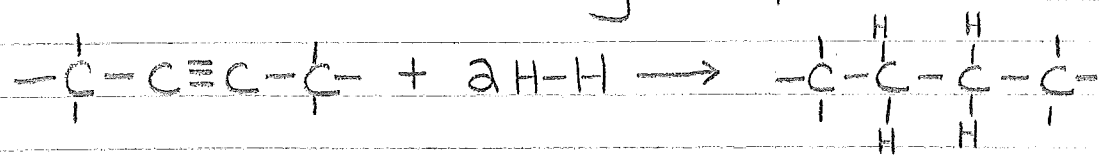
("enes" can form haloalkanes)

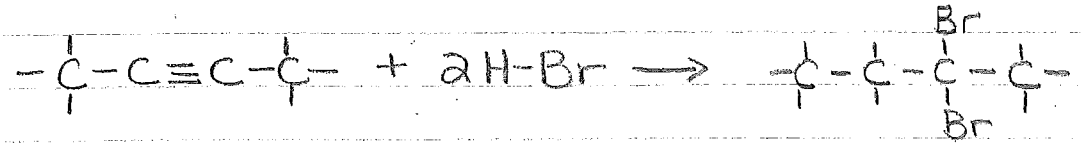
Addition Reactions and Alkynes

- addition to alkynes occurs in a similar manner to alkenes except:
  i) addition of <u>1 MOLE</u> of a REACTANT breaks only 1 BOND converting the <u>"yne" to "ene"</u>

eg 

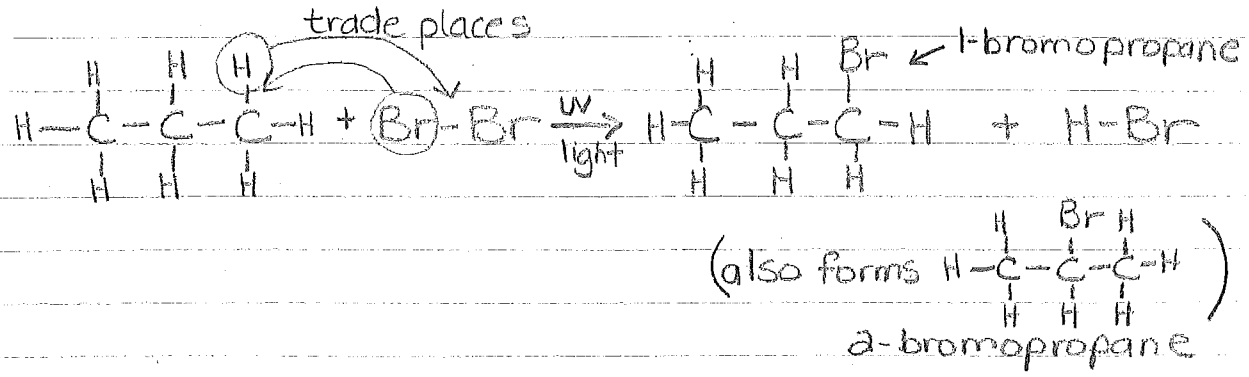
ii) addition of <u>2 MOLES</u> (or more, ie. <u>EXCESS</u>) breaks 2 BONDS converting the <u>"yne" to an "ane"</u>.



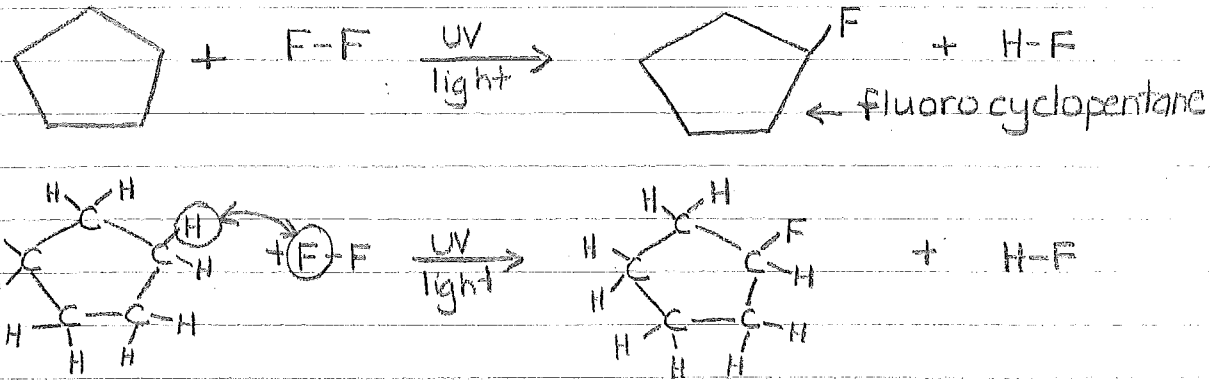


More Examples of Substitution Reactions

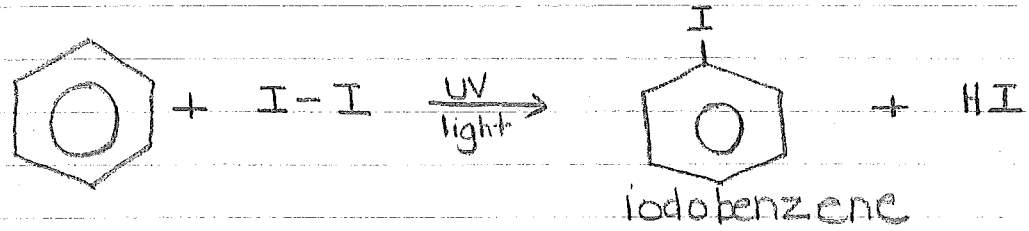
eg 1)



eg 2)

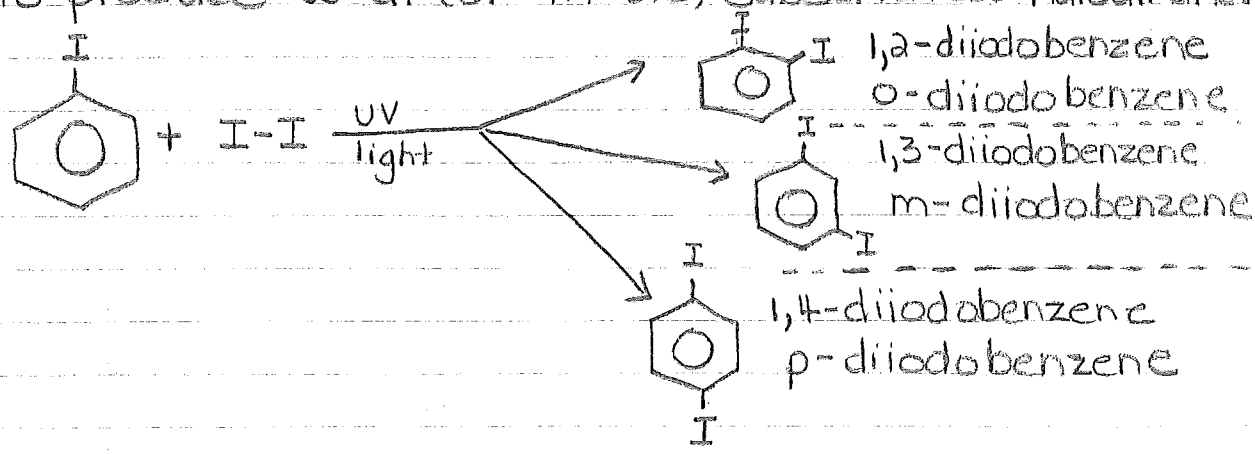


eg 3)



- The product (haloalkane) can be further reacted to produce a di (or tri etc) substituted haloalkane:

eg



+ HI

Addition Reactions

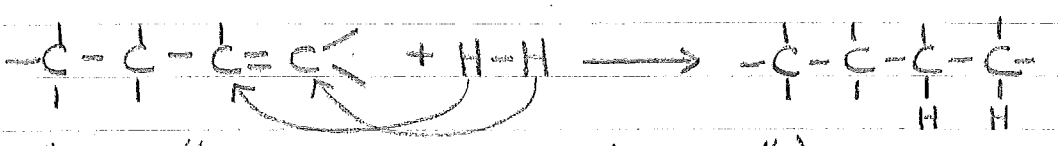
- Addition reactions are characteristic of alkenes and alkynes.

- The substance "added" to the "ene" or "yne" breaks the double or triple bond.

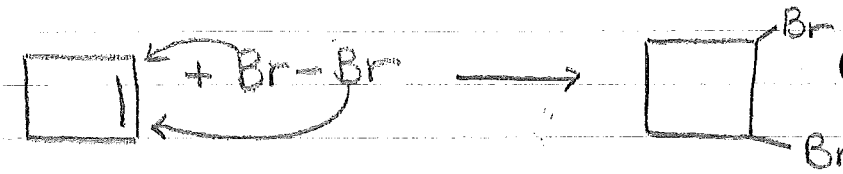
- A variety of substances (hydrogen, halogens, hydrogen (alkyl) halide, water, acids) can be used for addition reactions.

- The nature and type of product formed is dependant on the substance used.

eg 1) Addition of H_2 or halogens to an alkene

a) 

("enes" can form "anes")

b) 

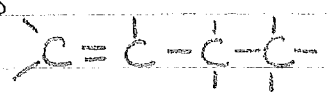
("enes" can form haloalkanes)

eg 2) Addition of unsymmetrical reagents such as H-OH, H-X (+ acids like $H-ClO_3$)

<u>Markovnikov's Rule</u>: When unsymmetrical reagents are added to alkenes, the <u>positive group</u> (<u>usually the 1st hydrogen</u>) <u>adds to the C</u> (in the = bond) that already has the <u>most H's</u>.

Draw all possible structural isomers for:

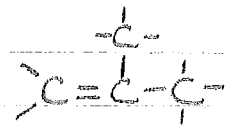
a. C_4H_8

① 

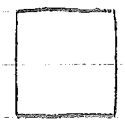
1-butene

② 

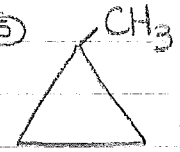
2-butene

③ 

methyl propene

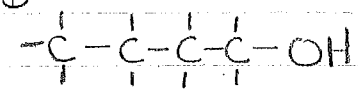
④ 

cyclobutane

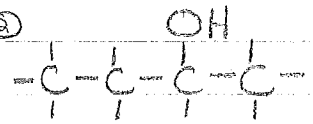
⑤ 

methylcyclopropane

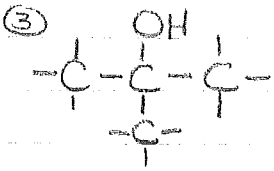
b. $C_4H_{10}O$

① 

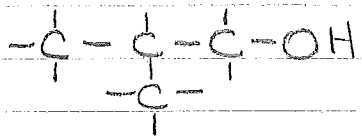
1-butanol

② 

2-butanol

③ 

methyl 2-propanol

④ 

methyl-1-propanol

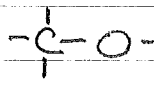
⑤ 

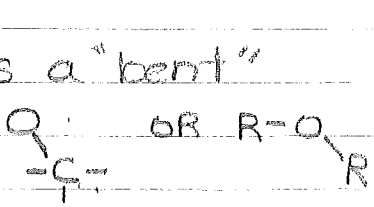
methyl propyl ether

⑥ 

diethyl ether

Ethers

- functional group:  OR R–O–R

- remember: oxygen actually has a "bent" shape so ethers are: 

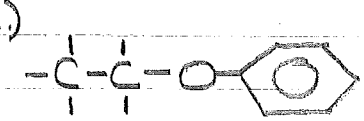
Naming

- name each carbon chain (on either side of the oxygen) ALPHABETICALLY as a branch and then add the word "ether".

eg 1)

methyl propyl ether

eg 2)



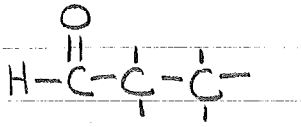
ethyl phenyl ether

- read pg 626 (A+W) + see examples (p 627)

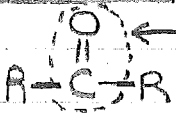
* Aldehydes/Alkanals

- functional group:  carbonyl group

- Naming: name ends in "al" (similar to alcohols as their name end in "ol")

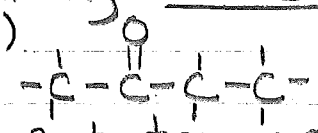
eg  propanal

* Ketones/Alkanones

- functional group:  carbonyl group

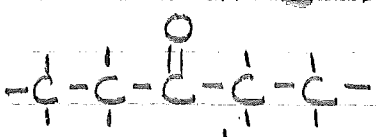
- Naming: # the  and end the name in "one"

eg 1)



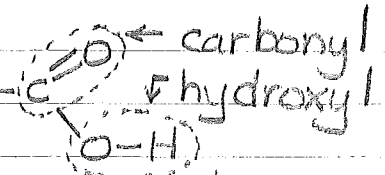
2-butanone

eg 2)



3-pentanone

* Carboxylic Acids/Alkanoic Acids
(Fatty Acids)

- functional group: -COOH i.e. 

- Naming: count the total # of C's, including the "C" in the carboxylic acid group, change the ending to "_oic" acid

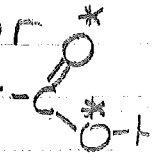
eg.  butanoic acid

- Draw and name the first 6 carboxylic acids:

	structural formula	name
1.		
2.		
3.		
4.		
5.		
6		

- straight chain carboxylic acids are sometimes called Fatty Acids (in biology).

- read pages 632-633 (A+W) + note oxidation (LEO) and reduction (GER) reactions.

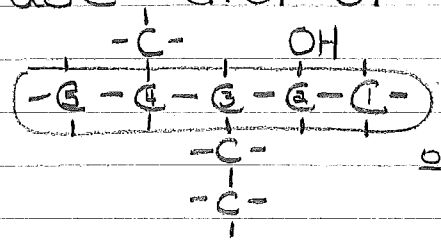
- the presence of -OH group allows for H-bonding. Two H bonding sites exist: 
- the longer the nonpolar carbon chain the less soluble the carboxylic acid is in polar solvents such as water.
- due to the ("double") H-bonding, carboxylic acids have higher B.P's + M.P's than similar sized other organic compounds.

* Alcohols/Alkanols

- functional group: –OH (hydroxyl group)
  ∴ H-bonding exists in alcohols (see previous notes)

- Naming alcohols is similar to "enes" + "ynes":
  i) find the longest continuous "C" chain containing the –OH. Circle it. It is the parent
  ii) # the C's so the –OH gets the LOWEST #.
  iii) # + name the branches, # the position of the –OH + name the parent (END in OL)
  iv) if there are 2 or more –OH's use "diol" or "triol" etc.

eg 1)



4-methyl-3-ethyl-2-pentanol
OR 3-ethyl-4-methyl-2-pentanol

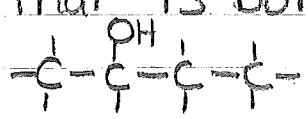
eg 2)

1,2,3-propanetriol

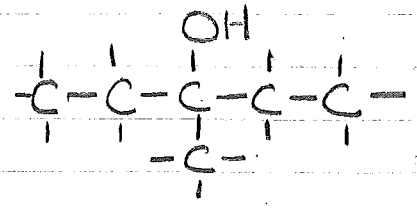
Primary, Secondary + Tertiary Alcohols

- Primary alcohol (1°) → –OH is on END "C", which is only directly bonded to 1 other C:

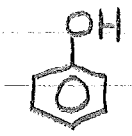
- Secondary alcohol (2°), the –OH is bonded to a "C" that is bonded to 2 other "C"s directly:



- Tertiary alcohol (3°), the –OH is bonded to a "C" that is bonded to 3 other C's:



• benzene as an alcohol is called PHENOL, C_6H_5OH :



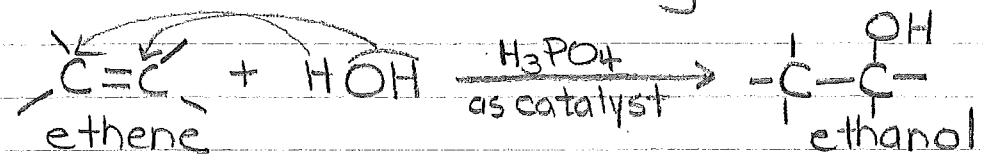
(see A+W p 622 for more naming eg's)

Preparation of Alcohols

1. Ethanol (the alcohol in alcoholic beverages) can be prepared by the fermentation (anarobic respiration) of sugars such as glucose: $2C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$

2. Alcohols for industrial purposes can be prepared by an addition reaction (using HOH and an alkene) using an acid catalyst:

eg

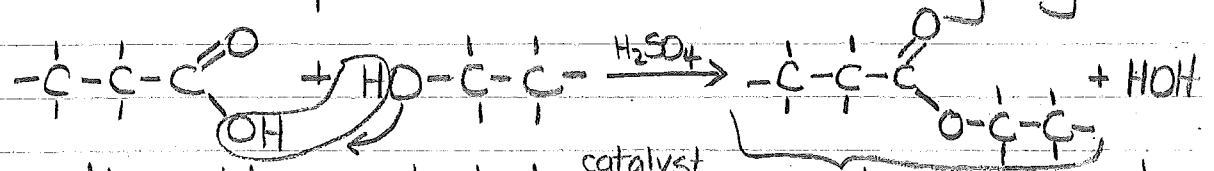


Reactions of Alcohols

1. Esterification

When alkanols are heated with alkanoic acids in the presence of $H_2SO_{4(aq)}$ they undergo esterification, producing sweet smelling compounds called ESTERS which are used as artificial perfumes and flavoring agents.

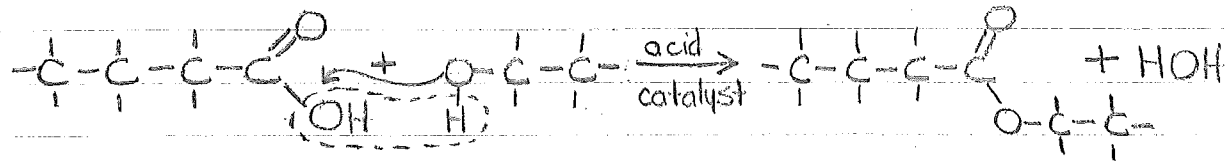
eg 1)



carboxylic acid + alcohol $\xrightarrow{\text{catalyst}}$ ester + water

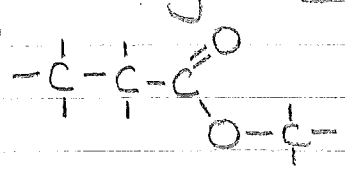
Esters

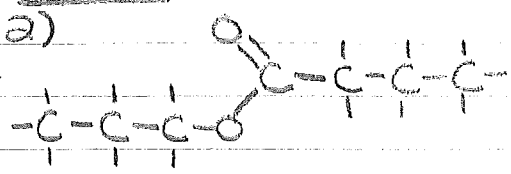
- functional group: $R-\overset{\overset{O}{\|}}{C}-O-R$ ← from the carboxylic acid; from the alcohol
  (OR R-COOR, 1st "O" is always $\overset{O}{\overset{\|}{C}}$)
- an ester is formed when an alcohol reacts with a carboxylic acid + HOH is removed
- esters produce characteristic artificial odours and flavors.

eg 

Naming Esters

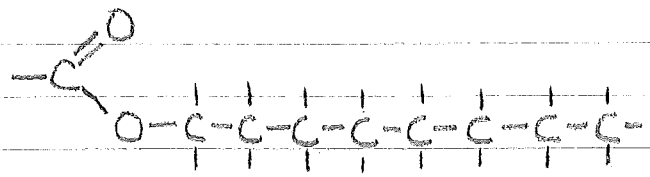
- name the alcohol (single bond "O") part 1st and end in "YL" (like a branch)
- name the acid part (double bond "O") last + change "oic" to "oate"

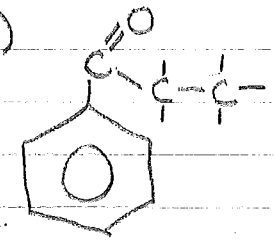
eg 1) 

eg 2) 

eg 3) $CH_3CH_2COOCH_3$

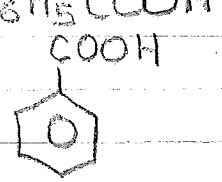
eg 4) $CH_3(CH_2)_7COO(CH_2)_4CH_3$

eg 5) 

eg 6) 

hint

C_6H_5COOH is benzoic acid

OR 

Important Biological Compounds

1. Carbohydrates (eg starch, sugar, wood, cotton)
   - general formula $C_n(H_2O)_x$
   - aldehydes and ketones

   a) monosaccharides - single ring sugars
      eg glucose, fructose : $C_6H_{12}O_6$ (p693 A+W)

   d) disaccharides - two monosaccharide rings joined together
      eg. sucrose, lactose : $C_{12}H_{22}O_{11}$

   c) polysaccharides - many monosaccharides linked together
      eg. starch, cellulose,

2. Lipids
   - fats, oils + waxes
   - insoluble in water
   - esters of fatty (carboxylic) acids + alcohols
   - triglycerides are simple lipids

3. Amino Acids
   - contain an amino ($-NH_2$) group and a carboxylic acid group ($-COOH$) (p642 A+W)
   - 2 amino acids bond together to form a dipeptide
   - the bond joining amino acids together is called a peptide bond.
   - enzymes, hormones and cell membranes are made of proteins
   - 100's of amino acids join together to form a protein.

4. Nucleic Acids - DNA + RNA

- DNA is found in the nucleus of cells + makes up the chromosomes (fig 26.28 p.646 A+W)
- nucleic acids are made up of units called nucleotides
- nucleotides are composed of a phosphate group, a sugar (ribose in RNA + deoxyribose in DNA) and a nitrogen base
- H bonding holds double helix of DNA together (fig 26.28 A+W)

Cracking

- Cracking is the process whereby a large hydrocarbon molecules is broken into smaller pieces, usually by the addition of hydrogen.

eg. $C_{10}H_{22} + H_2 \longrightarrow C_4H_{10} + \_\_\_\_\_$

decane + hydrogen $\longrightarrow$ butane + _____

Polymerization

- The process of joining many small units together to form a large molecule.

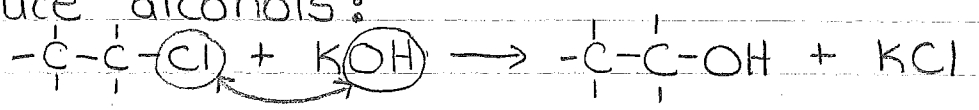
eg formation of : a) starch from glucose units
b) proteins from peptides (from amino acids)
c) polyethylene (plastic) from ethene

Additional Info

- Many organic substances have common names and/or uses:

CH_3OH	methanol	wood alcohol
C_2H_5OH	ethanol	grain alcohol
CH_4	methane	natural gas (heating)
C_8H_{18}	octane	component of gasoline
C_2H_4	ethene	} starting compound for polymers like plastic
C_3H_6	propene	
C_2H_2	ethyne	acetylene (welding)

- Esters and aldehydes can produce characteristic odors
- Chlorofluorocarbons (halocarbons) are harmful to the environment as they destroy the ozone layer
- Alkenes and alkynes undergo oxidation with $KMnO_4$ causing a color change from purple to brown.
- Some common aromatic compounds are:
  - TNT - trinitrotoluene (dynamite)
  - DDT - insecticide
  - ASA - acetylsalycic acid (aspirin)
- Halocarbons can react with metal hydroxides to produce alcohols:



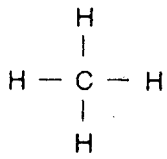
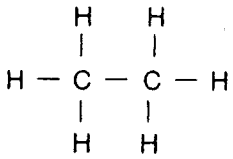
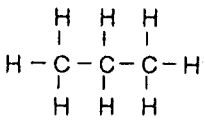
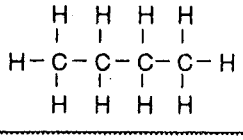
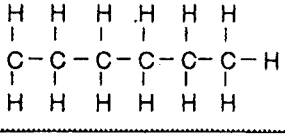
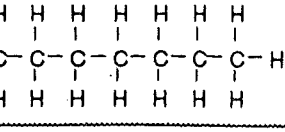
- Amine $R-NH_2$ Amide $R-C(=O)-N-$
- Ether $-C-O-C-$

ORGANIC CHEMISTRY

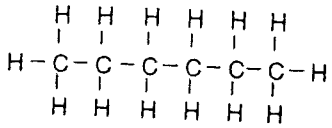
Alkanes

Pages 193 - 196

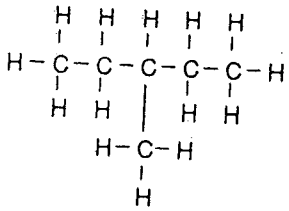
1. Complete the following table:

NAME	MOLECULAR FORMULA	CONDENSED STRUCTURAL FORMULA	STRUCTURAL FORMULA
methane	CH_4	CH_4	
ethane	C_2H_6	$CH_3–CH_3$	
propane	C_3H_8	$CH_3 – CH_2 – CH_3$	
butane	C_4H_{10}	$CH_3–CH_2–CH_2–CH_3$	
hexane	C_6H_{14}	$CH_3–CH_2–CH_2–CH_2–CH_2–CH_3$	
heptane	C_7H_{16}	$CH_3–CH_2–CH_2–CH_2–CH_2–CH_2–CH_3$	

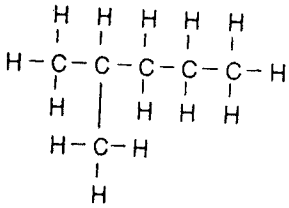
2. Draw structural formulas for and name the five isomers of C_6H_{14}.



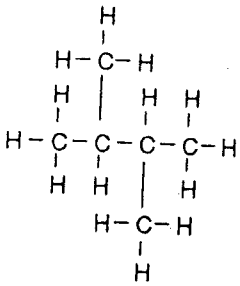
n-hexane



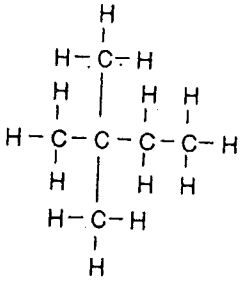
3-methylpentane



2-methylpentane



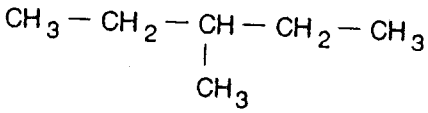
2, 3-dimethylbutane



2, 2-dimethylbutane

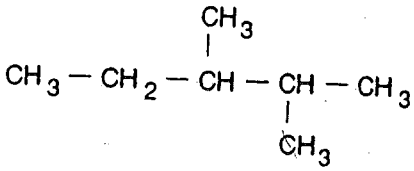
3. Name each of the following compounds:

a.



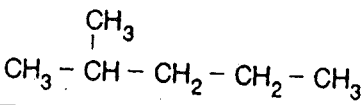
3-methylpentane

b.



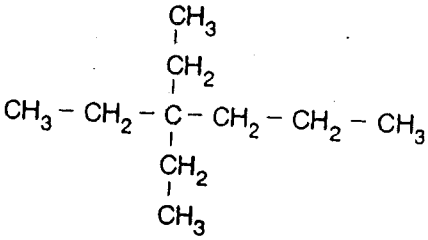
2,3-dimethylpentane

c.



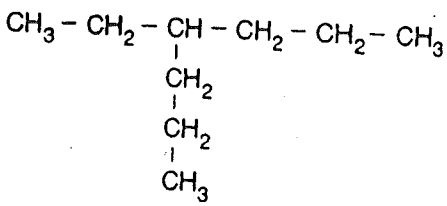
2-methylpentane

d.



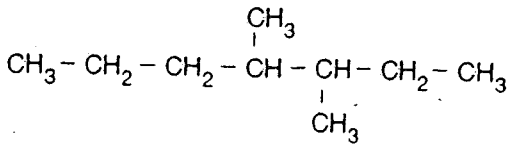
3,3-diethylhexane

e.



4-ethylheptane

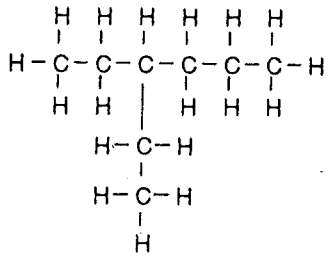
f.



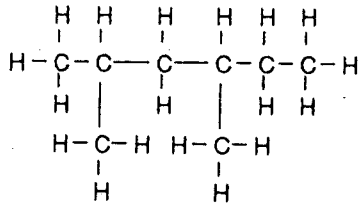
3,4-dimethylheptane

4. Write structural formulas for the following compounds:

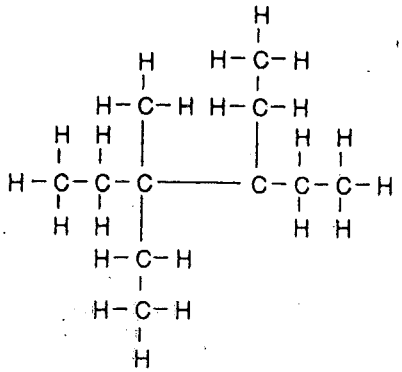
a. 3-ethylhexane



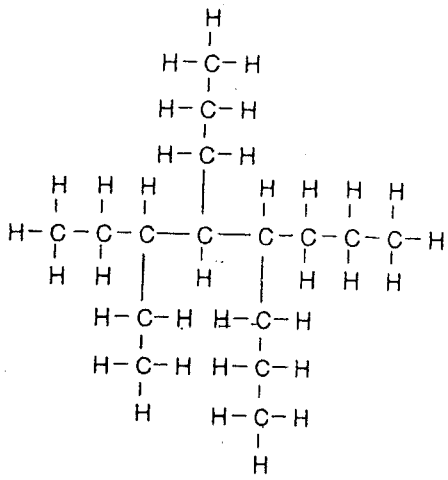
b. 2,4-dimethylhexane



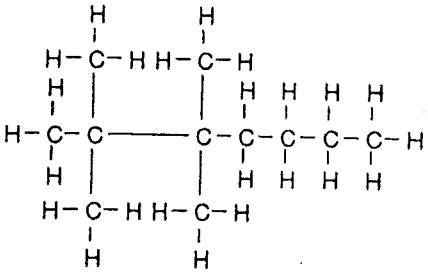
c. 3,4-diethyl-3-methylhexane



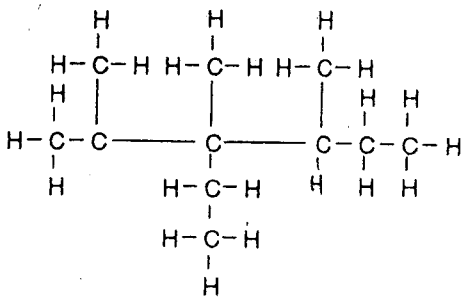
d. 3-ethyl-4,5-dipropyloctane



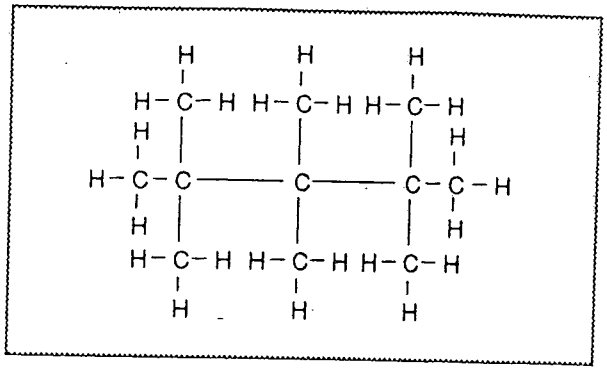
e. 2,2,3,3-tetramethylheptane



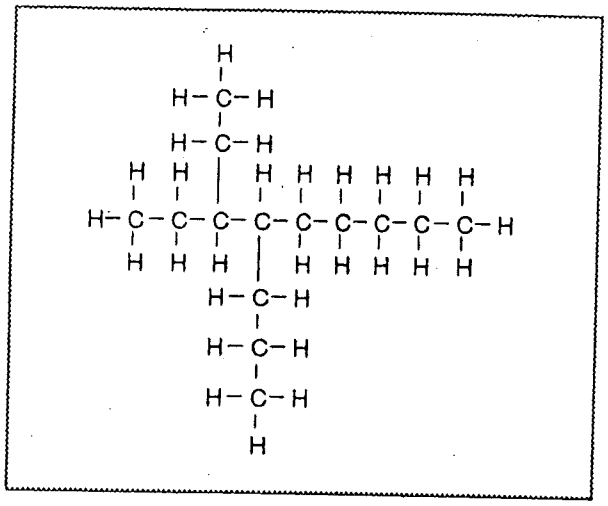
f. 3-ethyl-2,3,4-trimethylhexane



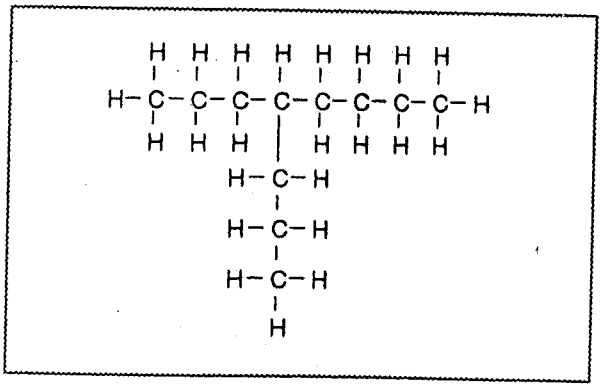
g. 2,2,3,3,4,4-hexamethylpentane



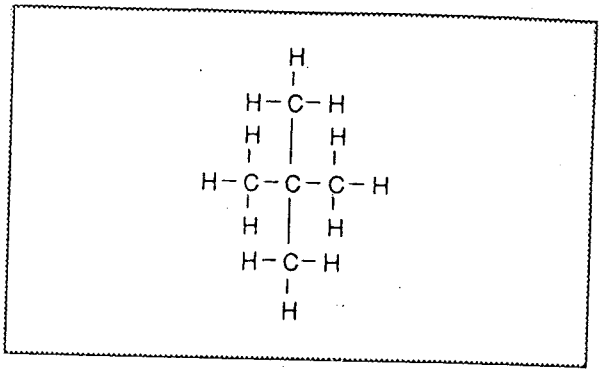
h. 3-ethyl-4-propylnonane



i. 4-propyloctane



j. 2,2-dimethylpropane



Alkenes, Alkynes, Aromatics

Pages 201 - 204

1. Give the IUPAC name for each of the following compounds:

a. $CH_3 - CH_2 - CH_2 - CH = CH - CH_3$

2-hexene

b. $CH_3 - CH = C(CH_3) - CH_3$

2-methyl-2-butene

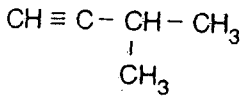
c. $CH_2 = CH - C(CH_3)_2 - CH_2 - CH_3$

3,3-dimethyl-1-pentene

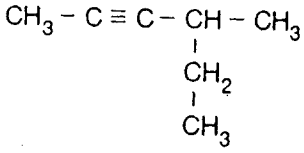
d. $CH_3 - CH = CH - CH(CH_2 - CH_3) - CH_2 - CH_3$

4-ethyl-2-hexene

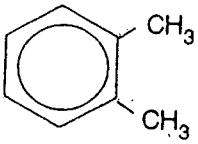
48

e. 

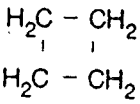
3-methyl-1-butyne

f. 

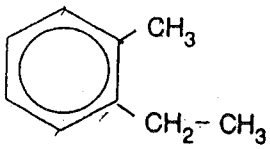
4-methyl-2-hexyne

g. 

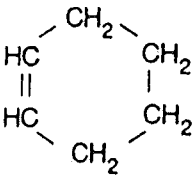
1,2-dimethylbenzene

h. 

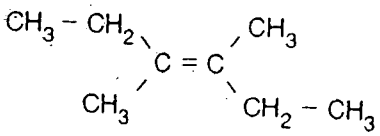
cyclobutane

i. 

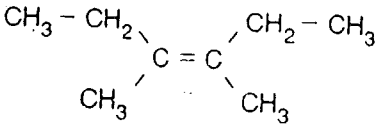
1-ethyl-2-methylbenzene

j. 

cyclohexene

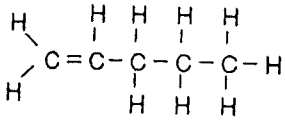
k. 

trans 3,4-dimethyl-3-hexene

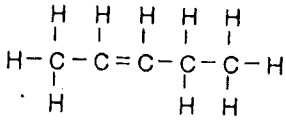
l. 

cis 3,4-dimethyl-3-hexene

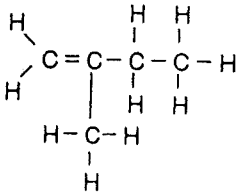
2. Draw the structural formulas and give names for three noncyclic isomers of C_5H_{10}.



1-pentene

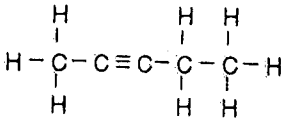


2-pentene



2-methyl-1-butene

3. Draw the structural formulas and give names for three noncyclic isomers of C_5H_8.



2-pentyne

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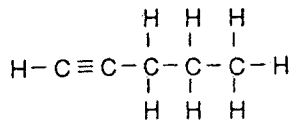
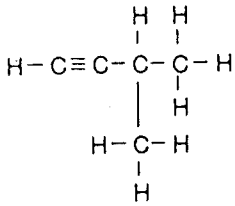


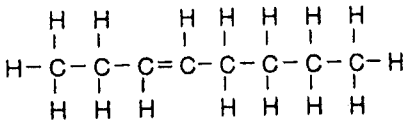
1-pentyne



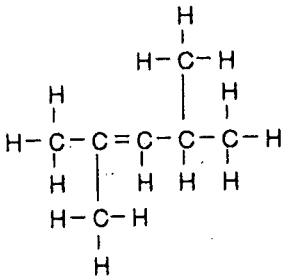
3-methyl-1-butyne

4. Draw structural formulas for:

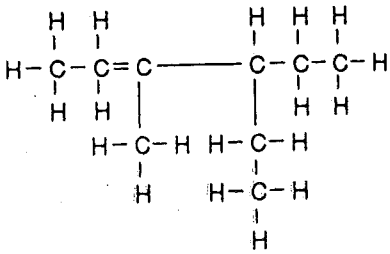
a. 3-octene



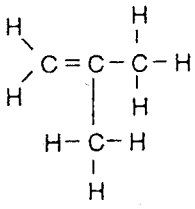
b. 2,4-dimethyl-2-pentene



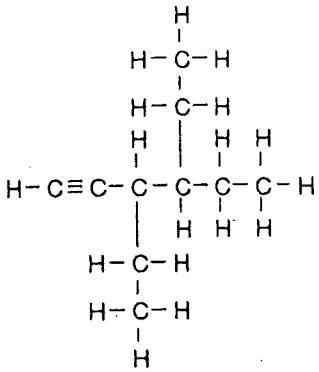
c. 4-ethyl-3-methyl-2-hexene



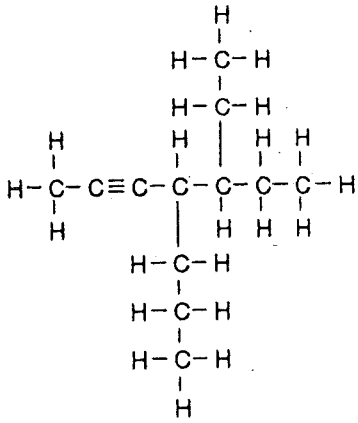
d. 2-methylpropene



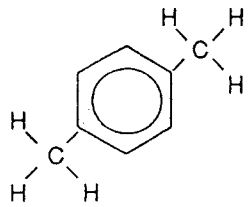
e. 3,4-diethyl-1-hexyne



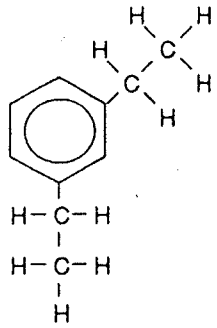
f. 5-ethyl-4-propyl-2-heptyne



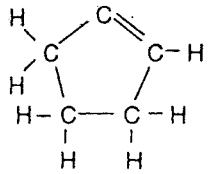
g. 1,4-dimethylbenzene



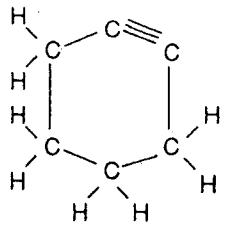
h. 1,3-diethylbenzene



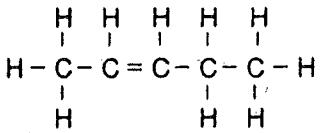
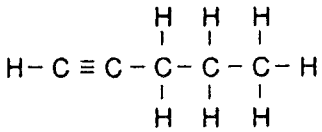
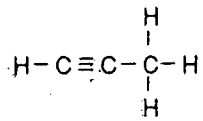
i. cyclopentene



j. cyclohexyne



5. Complete the following table:

NAME	MOLECULAR FORMULA	STRUCTURAL FORMULA
2-pentene	C_5H_{10}	
1-pentyne	C_5H_8	
propyne	C_3H_4	

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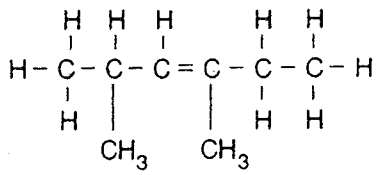
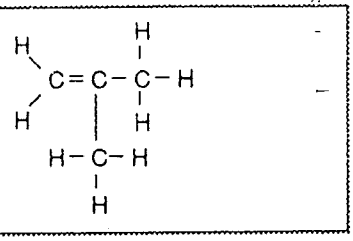
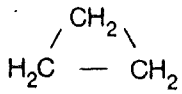
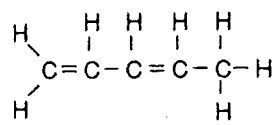
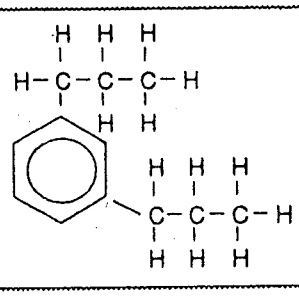
NAME	MOLECULAR FORMULA	STRUCTURAL FORMULA
2-4-dimethyl-3-hexene	C_8H_{16}	
2-methylpropene	C_4H_8	
cyclopropane	C_3H_6	
1,3-pentadiene	C_5H_8	
1,3-dipropylbenzene	$C_{12}H_{18}$	

Hydrocarbon Reactions

Pages 208 - 209

1. Write a balanced equation to represent the following **combustion** reactions:

   a. Combustion of butane in very short supply of oxygen.

   $C_4H_{10(g)} + \frac{5}{2}O_{2(g)} \rightarrow 4C_{(s)} + 5H_2O_{(l)}$

   b. Combustion of hexene in limited supply of oxygen.

   $C_6H_{12(g)} + 6O_{2(g)} \rightarrow 6CO_{(g)} + 6H_2O_{(l)}$

   c. Combustion of propane in abundant supply of oxygen.

   $C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(g)}$

   d. Combustion of benzene in very short supply of oxygen.

   $C_6H_{6(g)} + \frac{3}{2}O_{2(g)} \rightarrow 6C_{(s)} + 3H_2O_{(l)}$

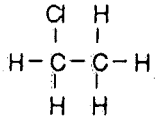
   e. Combustion of ethyne in abundant supply of oxygen.

   $C_2H_{2(g)} + \frac{5}{2}O_{2(g)} \rightarrow 2CO_{2(g)} + H_2O_{(l)}$

2. Write a balanced equation to represent the following **substitution** reactions. Represent the organic product with a structural formula and name it. (Primary or next product only)

   a. $C_2H_{6(g)} + Cl_{2(g)} \rightarrow$

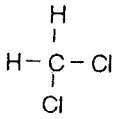
   $C_2H_{6(g)} + Cl_{2(g)} \rightarrow C_2H_5Cl_{(g)} + HCl_{(g)}$

   chloroethane

   b. $CH_3Cl_{(g)} + Cl_{2(g)} \rightarrow$

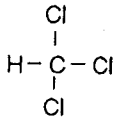
   $CH_3Cl_{(g)} + Cl_{2(g)} \rightarrow CH_2Cl_{2(g)} + HCl_{(g)}$

   dichloromethane

   c. $CH_2Cl_{2(g)} + Cl_{2(g)} \rightarrow$

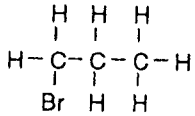
   $CH_2Cl_{2(g)} + Cl_{2(g)} \rightarrow CHCl_{3(g)} + HCl_{(g)}$

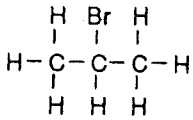
   trichloromethane

   d. $C_3H_{8(g)} + Br_{2(g)} \rightarrow$
   (Two possible isomers--show and name both)

   $C_3H_{8(g)} + Br_{2(g)} \rightarrow C_3H_7Br_{(g)} + HBr_{(g)}$

   1-bromopropane

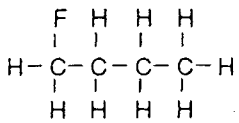
   

   2-bromopropane

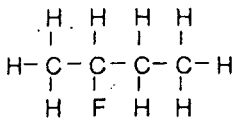
   Remember, the Br can replace any hydrogen in the C_3H_8 reactant.

e. $C_4H_{10(g)} + F_{2(g)} \rightarrow$
(Two possible products--show and name both)

$C_4H_{10(g)} + F_{2(g)} \rightarrow C_4H_9F_{(g)} + HF_{(g)}$



1-fluorobutane

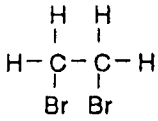


2-fluorobutane

3. Write a balanced equation to represent the following **addition** reactions. Represent the organic product with a structural formula and name it.

a. ethene + $Br_{2(g)} \rightarrow$

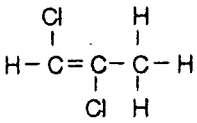
$C_2H_{4(g)} + Br_{2(g)} \rightarrow C_2H_4Br_{2(g)}$



1,2-dibromoethane

b. propyne + $Cl_{2(g)} \rightarrow$

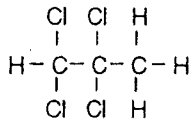
$C_3H_{4(g)} + Cl_{2(g)} \rightarrow C_3H_4Cl_{2(g)}$



1,2-dichloropropene

c. propyne + $2Cl_{2(g)} \rightarrow$

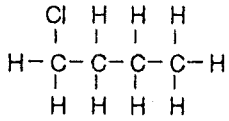
$C_3H_{4(g)} + 2Cl_{2(g)} \rightarrow C_3H_4Cl_{4(g)}$



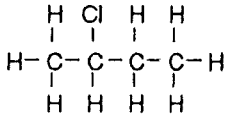
1,1,2,2-tetrachloropropane

d. 1-butene + $HCl_{(g)} \rightarrow$
(Two possible products--show and name both)

$C_4H_{8(g)} + HCl_{(g)} \rightarrow C_4H_9Cl_{(g)}$



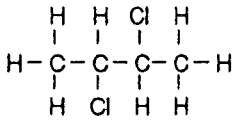
1-chlorobutane



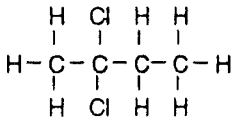
2-chlorobutane

e. 2-butyne + $2HCl_{(g)} \rightarrow$
(Two possible products--show and name both)

$C_4H_{6(g)} + 2HCl_{(g)} \rightarrow C_4H_8Cl_{2(g)}$



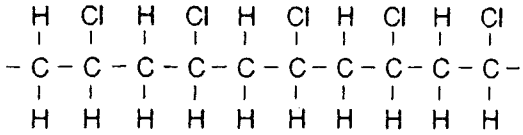
2,3-dichlorobutane

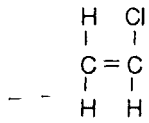


2,2-dichlorobutane

4. Draw the structural formula and give an IUPAC name for the monomer that would produce the following addition polymers:

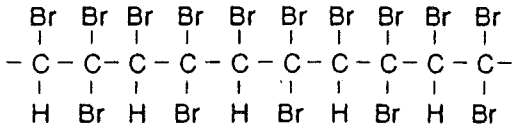
a.

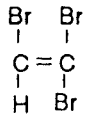




chloroethene

b.

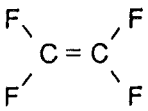


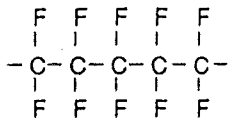


1,1,2-tribromoethene

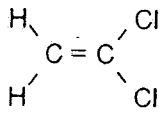
5. Draw a segment of the addition polymer that could be formed from these monomers:

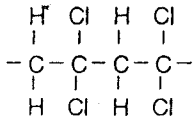
a.





b.



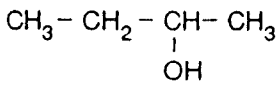


Alcohols, Aldehydes and Ketones

Pages 214 - 216

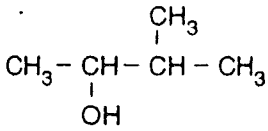
1. Name the following alcohols:

a.



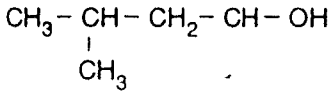
2-butanol

b.



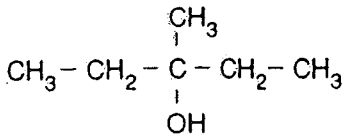
3-methyl-2-butanol

c.



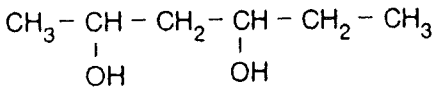
3-methyl-1-butanol

d.



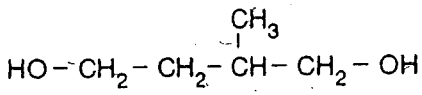
3-methyl-3-pentanol

e.



2,4-hexanediol

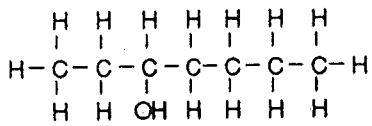
f.



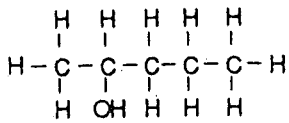
2-methyl-1,4-butanediol

2. Draw structural formulas for the following alcohols:

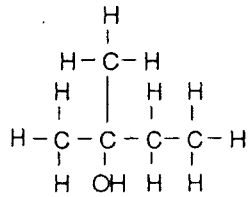
a. 3-heptanol



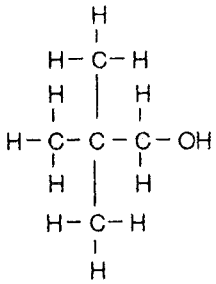
b. 2-pentanol



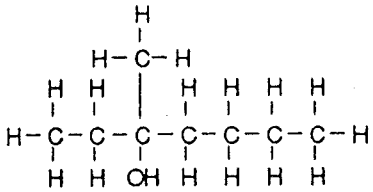
c. 2-methyl-2-butanol



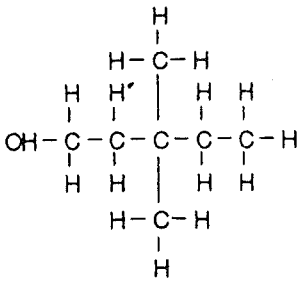
d. 2,2-dimethyl-1-propanol



e. 3-methyl-3-heptanol

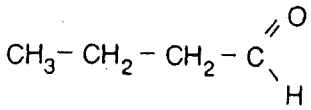


f. 3,3-dimethyl-1-pentanol



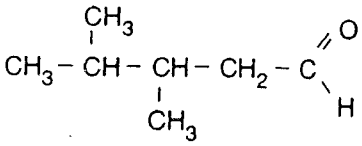
3. Name the following aldehydes:

a.



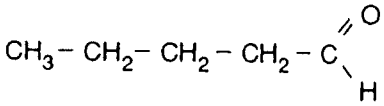
butanal

b.



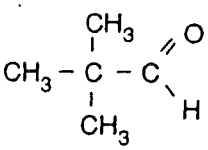
3,4-dimethylpentanal

c.



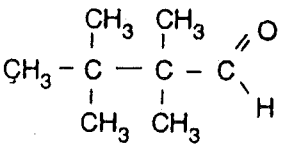
pentanal

d.



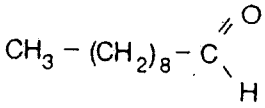
2,2-dimethylpropanal

e.



2,2,3,3-tetramethylbutanal

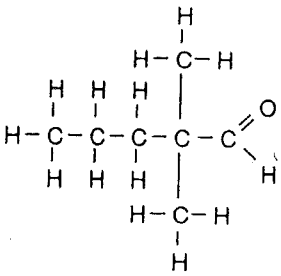
f.



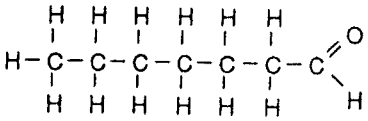
decanal

4. Draw structural formulas for the following aldehydes:

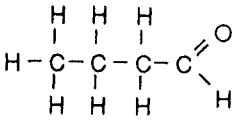
a. 2,2-dimethylpentanal



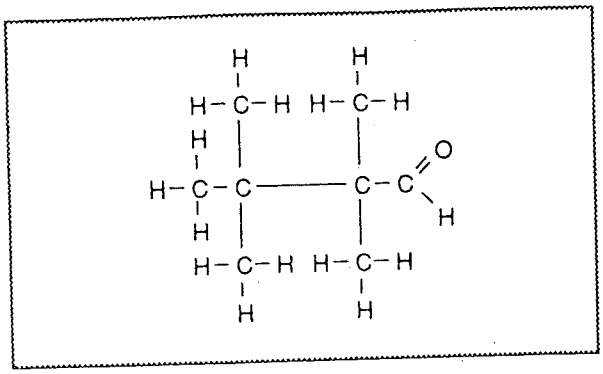
b. heptanal



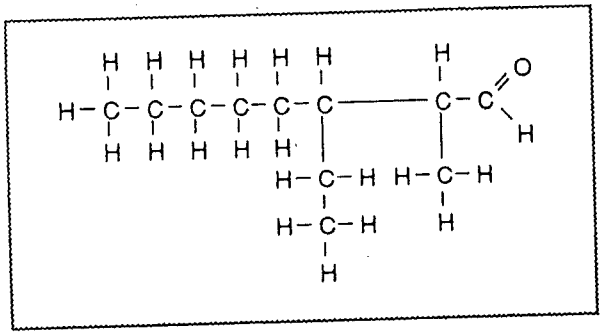
c. butanal



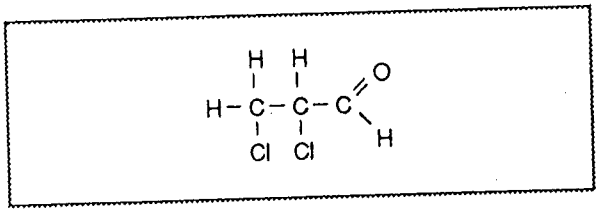
d. 2,2,3,3-tetramethylbutanal



e. 3-ethyl-2-methyloctanal

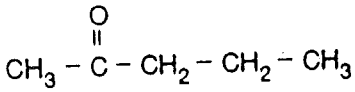


f. 2,3-dichloropropanal



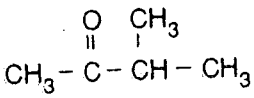
5. Name the following ketones:

a.



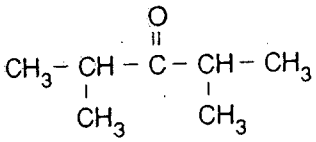
2-pentanone

b.



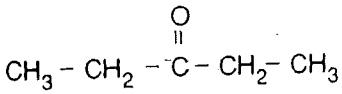
3-methyl-2-butanone

c.



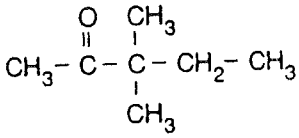
2,4-dimethyl-3-pentanone

d.



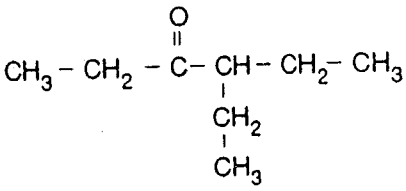
3-pentanone

e.



3,3-dimethyl-2-pentanone

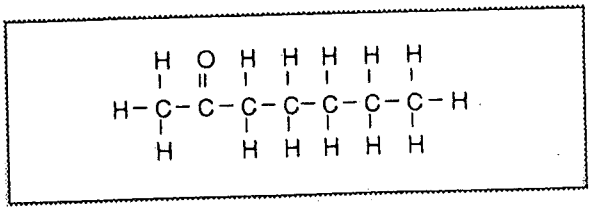
f.



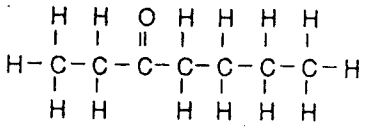
4-ethyl-3-hexanone

6. Draw structural formulas for the following ketones:

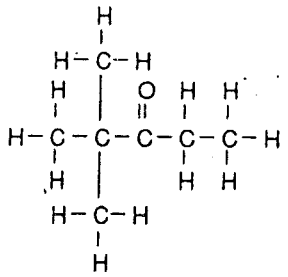
a. 2-heptanone



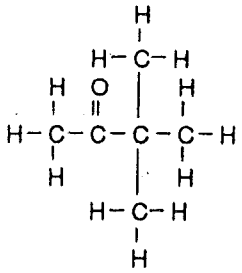
b. 3-heptanone



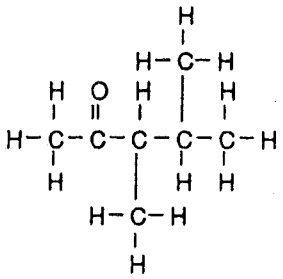
c. 2,2-dimethyl-3-pentanone



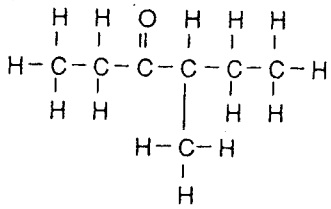
d. 3,3-dimethyl-2-butanone



e. 3,4-dimethyl-2-pentanone



f. 4-methyl-3-hexanone

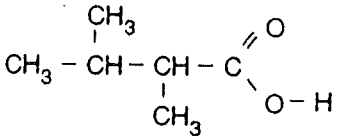


Carboxylic Acids and Esters

Pages 220 - 221

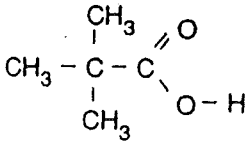
1. Name the following carboxylic acids:

a.



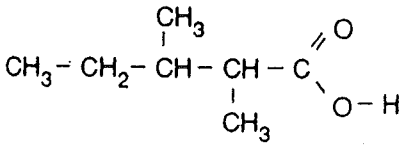
2,3-dimethylbutanoic acid

b.



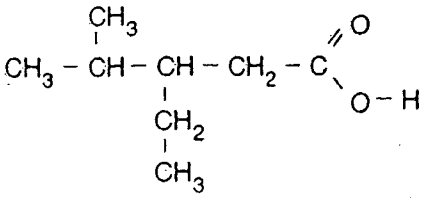
2,2-dimethylpropanoic acid

c.



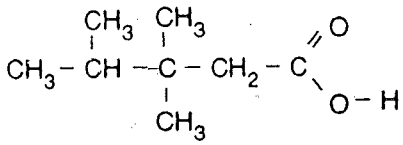
2,3-dimethylpentanoic acid

d.



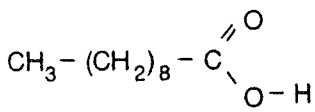
3-ethyl-4-methylpentanoic acid

e.



3,3,4-trimethylpentanoic acid

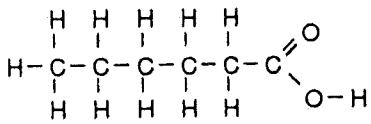
f.



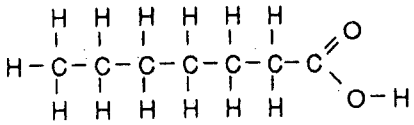
decanoic acid

2. Draw structural formulas for the following carboxylic acids:

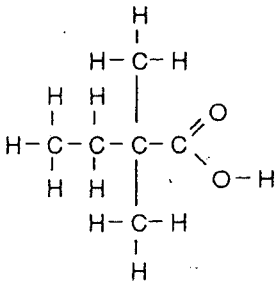
a. hexanoic acid



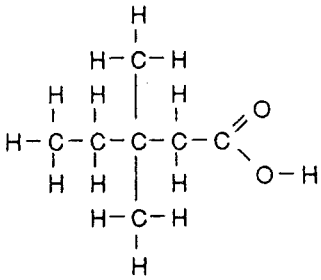
b. heptanoic acid



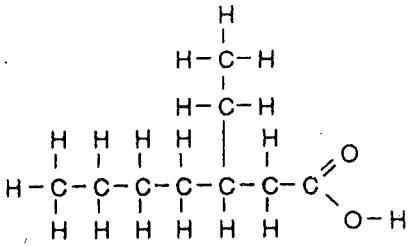
c. 2,2-dimethylbutanoic acid



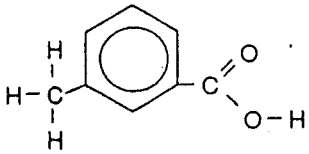
d. 3,3-dimethylpentanoic acid



e. 3-ethylheptanoic acid

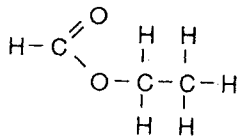


f. 3-methylbenzoic acid



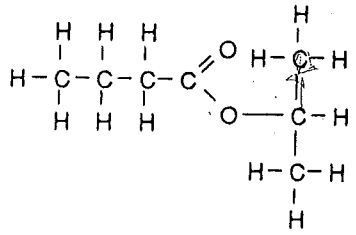
3. Write structural formulas and give the IUPAC name for the esters formed in these esterification reactions:

a. methanoic acid + ethanol →



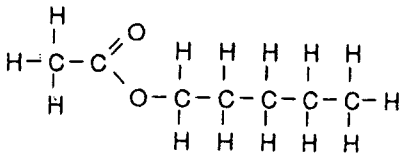
ethyl methanoate

b. butanoic acid + 2-propanol →



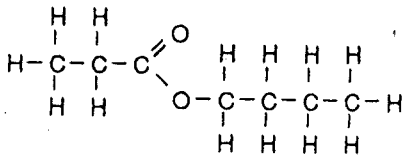
2-propylbutanoate

c. ethanoic acid + 1-pentanol →



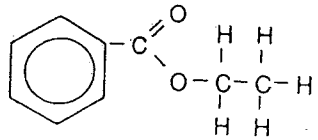
pentyl ethanoate

d. propanoic acid + 1-butanol →



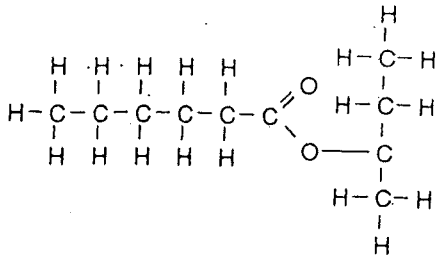
butyl propanoate

e. benzoic acid + ethanol →



ethyl benzenoate

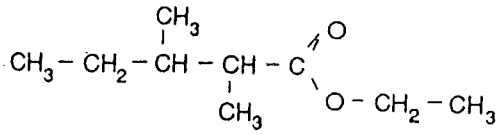
f. hexanoic acid + 2-butanol →



2-butyl hexanoate

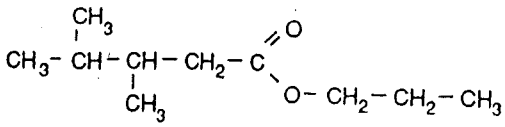
4. Name the following esters:

a.



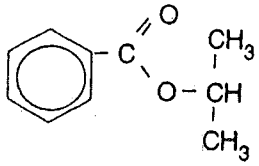
ethyl 2,3-dimethylpentanoate

b.



propyl 3,4-dimethylpentanoate

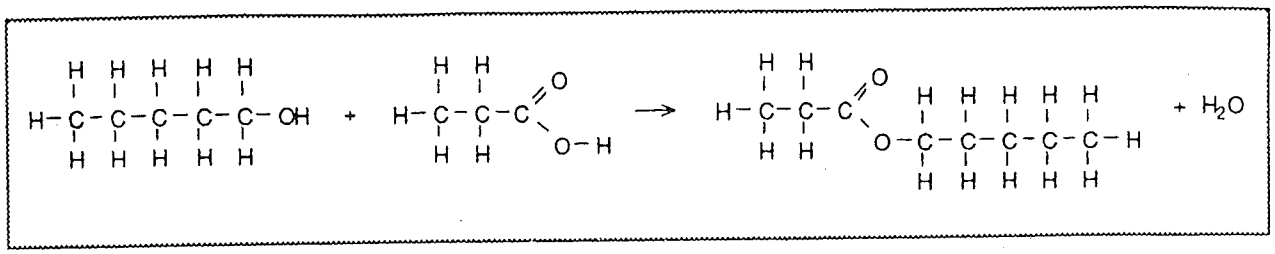
c.



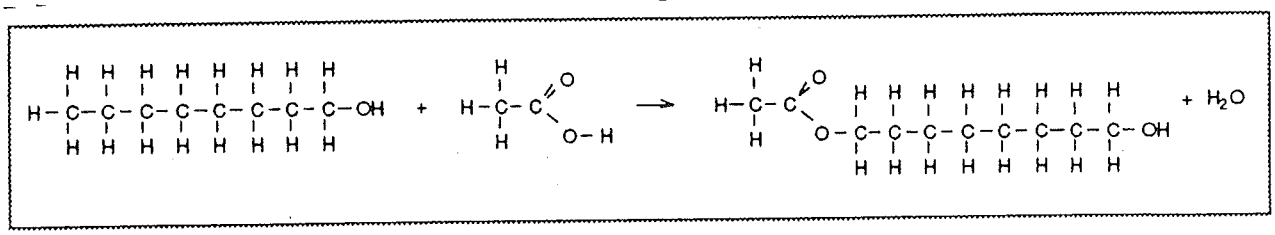
2-propyl benzoate

5. Write the equations to describe the making of

a. pentyl propanoate (apricot flavor)



b. octyl ethanoate (orange flavor)

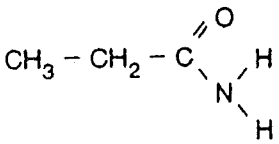


Amides and Amines

Pages 225 - 227

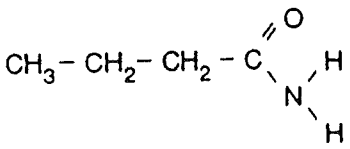
1. Name the following amides:

a.



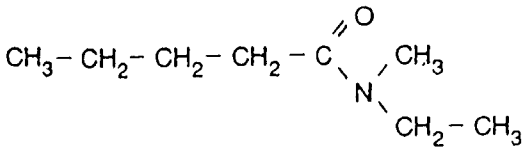
propamide (propanamide)

b.



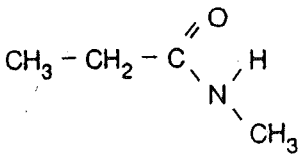
butamide (butanamide)

c.



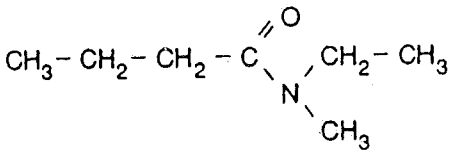
ethylmethylpentamide (pentanamide)

d.



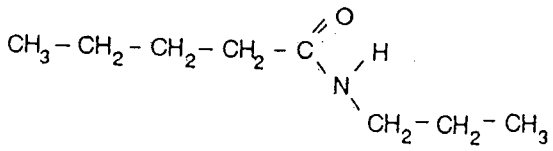
methylpropamide (propanamide)

e.



ethylmethylbutanamide

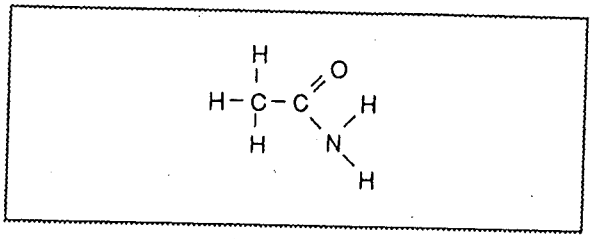
f.



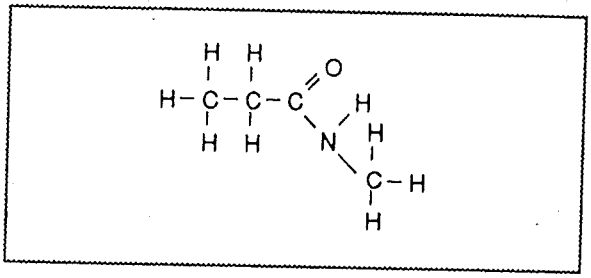
propylpentamide

2. Draw structural formulas for the following amides:

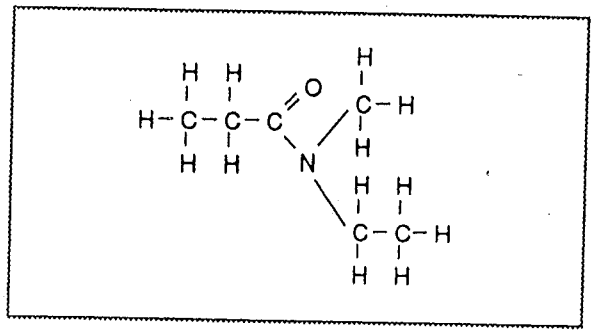
a. ethanamide



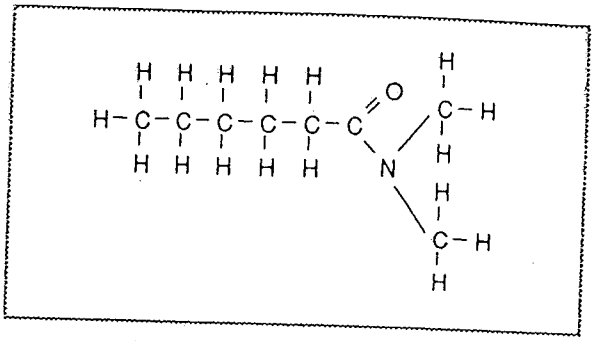
b. methylpropanamide



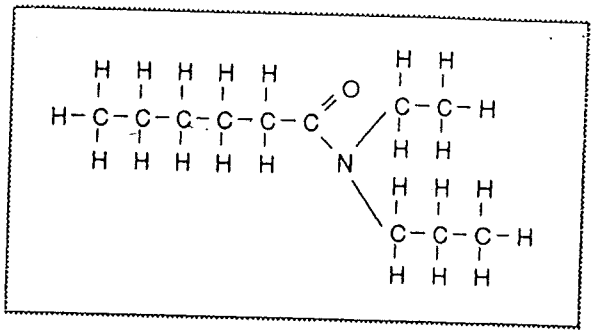
c. methylethylpropanamide



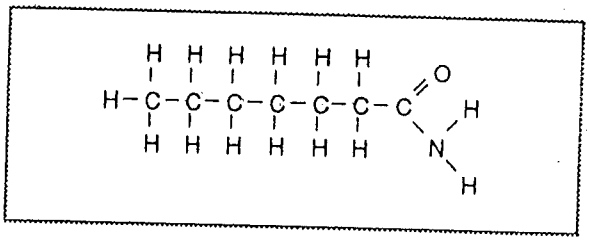
d. dimethylhexanamide



e. ethylpropylhexanamide

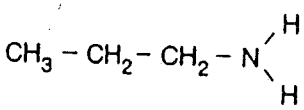


f. heptanamide



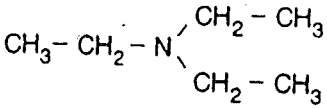
3. Name the following amines:

a.



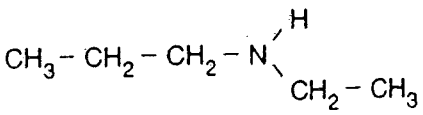
propylamine

b.



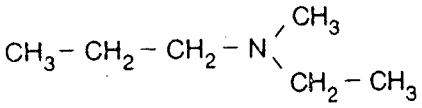
triethylamine

c.



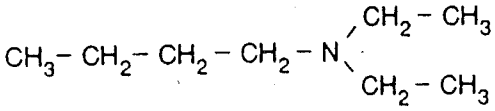
ethyl-propylamine

d.



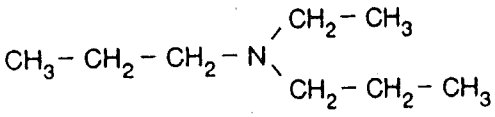
ethyl-methyl-propylamine

e.



butyl-diethylamine

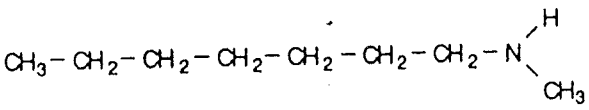
f.



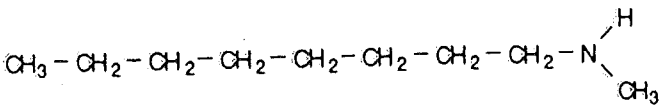
ethyl-dipropylamine

4. Draw structural formulas for the following amines:

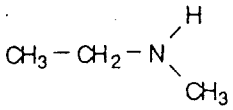
e. heptylamine



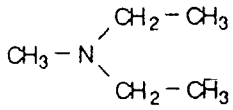
f. methyloctylamine



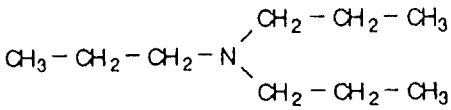
a. ethylmethylamine



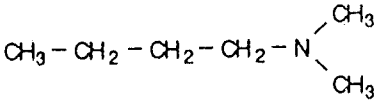
b. diethylmethylamine



c. tripropylamine



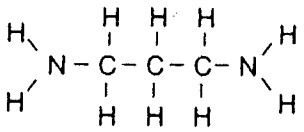
d. dimethylbutylamine



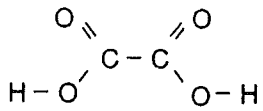
5. Classify the amines in questions 3 and 4 as primary, secondary, or tertiary amines.

3. a) primary	4. a) secondary
b) tertiary	b) tertiary
c) secondary	c) tertiary
d) tertiary	d) tertiary
e) tertiary	e) primary
f) tertiary	f) secondary

6 Two monomers are reacted in a condensation polymerization reaction:

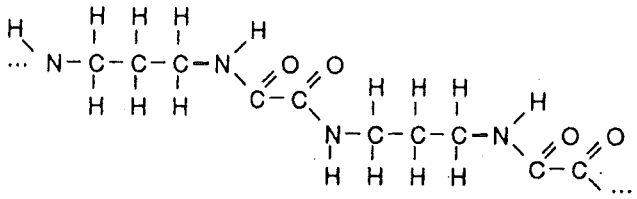


and



1,3-diaminopropane oxalic acid

Draw a segment of the polyamide that can be formed by the condensation polymerization of these two monomers.



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