



**SUMMER-17 EXAMINATION**  
**Model Answer**

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**Important Instructions to examiners:**

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.





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	examples: mixtures of gases. 7) solid in solid examples: copper in gold, zinc in copper	
1-c	<b>Uses of alkynes:</b> 1. Ethyne is useful for artificial ripening and preservation of fruits. 2. It is useful in acetylene lamps to generate light. 3. Ethyne is used to prepare various organic compounds. 4. It is also useful to manufacture important organic compounds like acetic acid, acetaldehyde, ethyl alcohol and polymers like PVC...etc. 5. It is useful to produce an oxyacetylene flame. 6. is widely used as a fuel and a chemical building block. 7. Acetylene is used to volatilize carbon in radiocarbon dating. 8. Acetylene is sometimes used for carburization (that is, hardening) of steel when the object is too large to fit into a furnace	½ mark each for any 4
1-d	Reasons of separate classification of aromatic compounds: 1. aromatic hydroxy compounds (phenol) are acidic, whereas aliphatic hydroxyl compounds( alcohols) are neutral 2. Aromatic compounds give nitro derivatives, when heated with Concentrated nitric acid. In case of aliphatic compounds, the nitro derivatives are not formed easily 3. Aromatic halogen compounds are much less reactive than aliphatic halogen compounds 4. Aromatic compounds- Benzene Aliphatic compounds- Alkanes, alkenes, alkynes	1 mark each for any 2
1-e	<b>Classification of alcohols:</b>	2



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	<p>Monohydric alcohols are further classified as primary, secondary &amp; tertiary alcohols according as the carbon atom to which the hydroxyl group is attached, is primary, secondary &amp; tertiary carbon atom.</p> <p>Primary alcohol contain the primary alcoholic group, <math>-\text{CH}_2\text{OH}</math>, e.g. methanol <math>\text{CH}_3\text{OH}</math></p> <p>Secondary alcohol <math>-(\text{CH}_3)_2\text{CHOH}</math> isopropyl alcohol</p> <p>Tertiary alcohol <math>-(\text{CH}_3)_3\text{COH}</math> tert-butyl alcohol</p>													
1-f	<p>(i) Amide</p> <p>(ii) esters</p>	<p>1</p> <p>1</p>												
1-g	<p><b>Cycloalkanes are also called Alicyclic compounds:</b></p> <p>These are cyclic compounds composed of ring of carbon atoms with properties similar to aliphatic compounds.</p> <p>Ex: cyclopropane, cyclobutane and cyclohexane...etc</p>	<p>1</p> <p>1</p>												
1-h	<p><b>Differences between alcohols and phenol</b></p> <table border="1"><thead><tr><th>PHENOL</th><th>ALCOHOL</th></tr></thead><tbody><tr><td>phenol reacts with <math>\text{FeCl}_3</math> whereas normal</td><td>alcohol can not</td></tr><tr><td>Phenols are acidic</td><td>Alcohols are not acidic</td></tr><tr><td>Phenols are acidic and dissolve in a basic solution.</td><td>Alcohols are not acidic and will not dissolve in a basic solution</td></tr><tr><td>When phenol react with <math>\text{FeCl}_3</math> it changes its colour from green to purple.</td><td>Alcohols produce no color change.</td></tr><tr><td>Phenols produce a brown tarry mass when combined with chromic acid</td><td>Not observe in alcohol</td></tr></tbody></table>	PHENOL	ALCOHOL	phenol reacts with $\text{FeCl}_3$ whereas normal	alcohol can not	Phenols are acidic	Alcohols are not acidic	Phenols are acidic and dissolve in a basic solution.	Alcohols are not acidic and will not dissolve in a basic solution	When phenol react with $\text{FeCl}_3$ it changes its colour from green to purple.	Alcohols produce no color change.	Phenols produce a brown tarry mass when combined with chromic acid	Not observe in alcohol	<p>½ mark each for any 4</p>
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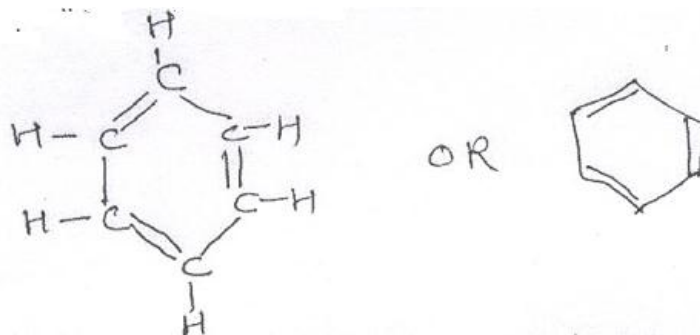


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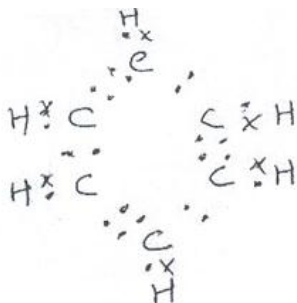
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the structure for benzene having cyclic arrangement of six carbon atoms with alternate single and double bonds and one hydrogen attached to each carbon atom.



Electronic structure of benzene may be represented as :-



In the structure of benzene, all six carbon atoms in benzene are  $sp^2$  hybridised. The  $sp^2$  hybrid orbitals overlap with each other & with a orbitals of the six hydrogen atoms forming C-C & C-H  $\sigma$  bonds. Since the  $\sigma$  bonds result the overlap of planar  $sp^2$  orbitals, all carbon & hydrogen atoms in benzene lie in the same plane. All bond angles are  $120^\circ$ . Also each carbon atom in benzene possess an unhybridized p-orbitals containing electron. These p-orbitals are perpendicular to the plane of  $\sigma$  bonds. The lateral



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overlap of these p-orbitals produces a  $\pi$  molecular orbital containing six electrons. The six electrons of p-orbitals cover all six carbon atoms, and are said to be delocalized. As a result of delocalization is formed a stronger  $\pi$  bond and a more stable molecule.

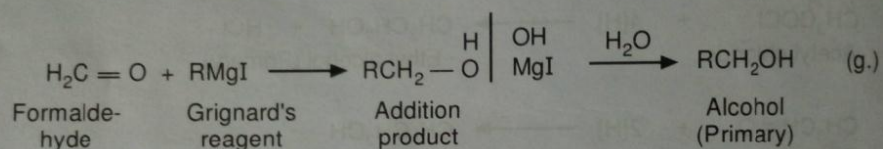
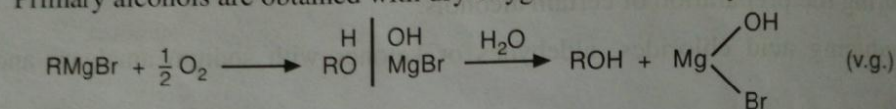
2-d

**Preparation of alcohol by Grignard reagent:**

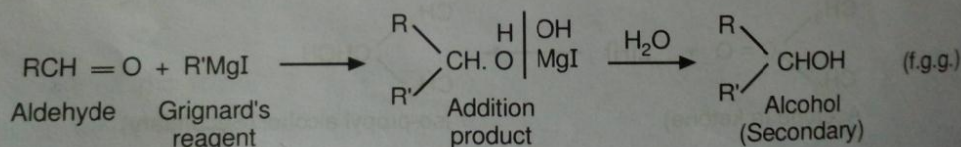
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With the help of Grignard reagent, primary, secondary & tertiary alcohols may be prepared by means of a Grignard's reagent & an appropriate carbonyl compound (an aldehyde or ketone). The addition products first formed are decomposed with water to give alcohol.

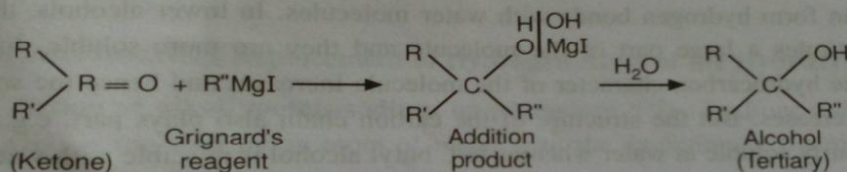
(i) Primary alcohols are obtained with dry oxygen or formaldehyde.



(ii) Secondary alcohols are prepared with aldehydes other than formaldehyde.



(iii) Tertiary alcohols may be prepared with ketones.



**Preparation of alcohol from alkyl halides**

2) Alkyl halides react with aqueous sodium hydroxide to form alcohols.





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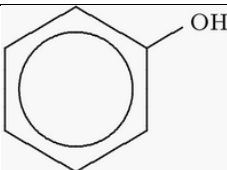
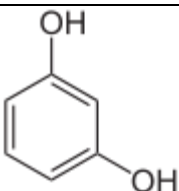
	<p>1) <math>C_2H_5I + KOH \rightarrow C_2H_5OH + KI</math> Ethyl iodide (aqueous) ethanol</p> <p>2) <math>CH_3Br + AgOH \rightarrow CH_3OH + AgBr</math> methyl bromide moist methyl alcohol</p>	<b>2</b>				
2-e	<p><b>Ostwald's theory</b> considers indicator to be a weak acid or base whose unionised forms differently coloured. In presence of acid or base, ie pH change, there is ionization of indicator and hence the colour change appears.</p> <p>For example phenolphthalein phenolphthalein is a weak acid (PhH)</p> $PhH \rightleftharpoons Ph^- + H^+ \dots\dots\dots(1)$ <p>(colourless (Pink in base) in acid)</p> $H^+ + OH^- \rightleftharpoons H_2O$ <p>In presence of an acid (H<sup>+</sup>) equilibrium (1) is displaced towards the left hand side (a case of LeChatelier's principle); when strong base like NaOH is added, this equilibrium is displaced towards right hand side and there is colour change from colourless to pink when pH changes. This indicator is not suitable for titrating weak base since weak base can't furnish enough OH<sup>-</sup> that can react with H<sup>+</sup> of the phenolphthalein and can impart pink colour only after excess of weak base is added.</p>	<b>4</b>				
2-f	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;">Mono Hydric Phenol</td> <td style="width: 50%; padding: 5px;">Di Hydric Pheno</td> </tr> <tr> <td style="padding: 5px;">Those aromatic phenols which contains only one OH group are</td> <td style="padding: 5px;">Those aromatic phenols which contain two OH groups are called</td> </tr> </table>	Mono Hydric Phenol	Di Hydric Pheno	Those aromatic phenols which contains only one OH group are	Those aromatic phenols which contain two OH groups are called	<b>2</b>
Mono Hydric Phenol	Di Hydric Pheno					
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	called Mono Hydric Phenol.	Di Hydric Phenol.	
			
	<b>Uses of phenol : (any two)</b> 1) The main use of phenol is as a feedstock for phenolic resins, bisphenol A and caprolactam (an intermediate in the production of nylon-6). 2) It is used in the manufacture of many products including insulation materials, adhesives, lacquers, paint, rubber, ink, dyes, illuminating gases, perfumes, soaps. 3) Also used in embalming and research laboratories. It is a product of the decomposition of organic materials, liquid manure, and the atmospheric degradation of benzene. 4) It is found in some commercial disinfectants, antiseptics, lotions and ointments. 5) Phenol is active against a wide range of microorganisms, and there are some medical and pharmaceutical applications including topical anaesthetic and ear drops, sclerosing agent. 6) It is used in dermatology for chemical face peeling		<b>2</b>
3	<b>Any 4</b>		<b>16</b>
3-a	<b>Nitration:</b> When benzene is treated with mixture of conc. $H_2SO_4$ and conc $HNO_3$ below		<b>2</b>

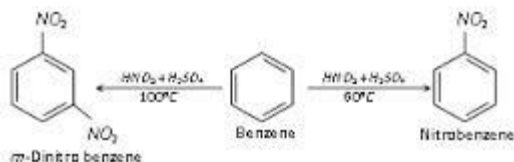


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60°C benzene gives nitrobenzene while above this temperature the main product is m-Dinitro benzene.



**Sulphonation:**

When Benzene is treated with hot conc. Sulphuric acid then formation of Benzene Sulphonic acid takes place



2

3-b

**Baeyer's Angle Strain Theory :**

- Van't Hoff and Lebel proposed tetrahedral geometry of carbon.
- The bond angle is of 109° 28' (or 109.5°) for carbon atom in tetrahedral geometry (methane molecule).
- Baeyer observed different bond angles for different cycloalkanes and also observed some different properties and stability. —
- On this basis, he proposed angle strain theory.
- The theory explains reactivity and stability of cycloalkanes.
- Baeyer proposed that the optimum overlap of atomic orbitals is achieved for bond angle of 109.5°. In short, it is ideal bond angle for alkane compounds.
- Effective and optimum overlap of atomic orbitals produces maximum bond strength and stable molecule.

4



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- If bond angles deviate from the ideal then ring produce strain.
- Higher the strain higher the instability.
- Higher strain produce increased reactivity and increases heat of combustion.
- Baeyer proposed “any deviation of bond angle from ideal bond angle value (109.5o ) will produce a strain in molecule. Higher the deviation lesser the instability”.
- Baeyer’s theory is based upon some assumptions as following. 1. All ring systems are planar. Deviation from normal tetrahedral angles results in to instable cycloalkanes. 2. The large ring systems involve negative strain hence do not exists. 3. The bond angles in cyclohexane and higher cycloalkanes (cycloheptane, cyclooctane, cyclononane.....) are not larger than 109.5o because the carbon rings of those compounds are not planar (flat) but they are puckered (Wrinkled).
- The ring of cyclopropane is triangle. All the three angles are of 60 o in place of 109.5o (normal bond angle for carbon atom) to adjust them into triangle ring system.
- In same manner, cyclobutane is square and the bond angles are of 90o in place of 109.5o (normal bond angle for carbon atom) to adjust them into square ring system.
- The deviation for cyclopropane and cyclobutane ring systems then normal tetrahedral angle will produce strain in ring. The ring strain will make them unstable as compare to molecules having tetrahedral bond angle.
- 
- So, cyclopropane and cyclobutane will easily undergo ring opening reactions to form more stable open chain compounds.
- Now compare the stability of cyclopropane and cyclobutane



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- The bond angle in cyclopropane is  $60^\circ$ . The normal tetrahedral bond angle value is  $109.5^\circ$ . That is why, deviation = (normal tetrahedral bond angle) – (actual bond angle) Deviation =  $109.5^\circ - 60 = 49.5^\circ$  The bond angle in cyclobutane is  $90^\circ$ . The normal tetrahedral bond angle value is  $109.5^\circ$ . That is why, deviation = (normal tetrahedral bond angle) – (actual bond angle) Deviation =  $109.5^\circ - 90 = 19.5^\circ$ . Deviation for cyclopropane is  $49.5^\circ$  Deviation for cyclobutane is  $19.5^\circ$  The deviation is higher for cyclopropane than cyclobutane therefore cyclopropane is more prone to undergo ring opening reactions. As a result of this, the strain is more in cyclopropane as compare to cyclobutane. It will make cyclopropane less stable than cyclobutane. So, cyclopropane easily undergoes ring opening reaction as compare to cyclobutane. According to Baeyer, the relative order of stability for some common cycloalkanes is as under. Cyclopentane > Cyclohexane > Cyclobutane > Cyclopropane Actual observed order of stability for these cycloalkanes is as under. Cyclohexane > Cyclopentane > Cyclobutane > Cyclopropane According to Baeyer, the bond angle in cyclopentane is  $108^\circ$  (the geometry is pentagonal) that is very close to tetrahedral angle ( $109.5^\circ$ ), so it is almost free from ring strain. Baeyer also proposed some facts for cyclohexanes that stood incorrect later on.
- Cyclohexane is unstable ring due to higher ring strain.
  - It is difficult to synthesize for cyclohexane and higher ring systems as deviation from the normal tetrahedral value ( $109.5^\circ$ ) would be larger.
  - The larger deviation will result into more strain and the ring system will be unstable. In conclusion, Baeyer proposed that ring systems smaller or larger than cyclopentane or cyclohexane are unstable due to higher ring strain. Therefore, he assumed that cyclopropane and cyclobutane easily undergo ring opening reaction whereas larger ring systems are difficult to synthesize.



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3-c	<p><b>Rules of IUPAC nomenclature: (any 4)</b></p> <ol style="list-style-type: none"><li>1. Identify the longest carbon chain. This chain is called the parent chain.</li><li>2. Identify all of the substituents (groups appending from the parent chain).</li><li>3. Number the carbons of the parent chain from the end that gives the substituents the lowest numbers. When comparing a series of numbers, the series that is the "lowest" is the one which contains the lowest number at the occasion of the first difference. If two or more side chains are in equivalent positions, assign the lowest number to the one which will come first in the name.</li><li>4. If the same substituent occurs more than once, the location of each point on which the substituent occurs is given. In addition, the number of times the substituent group occurs is indicated by a prefix (di, tri, tetra, etc.).</li><li>5. If there are two or more different substituents they are listed in alphabetical order using the base name (ignore the prefixes). The only prefix which <b>is</b> used when putting the substituents in alphabetical order is <b>iso</b> as in isopropyl or isobutyl. The prefixes sec- and tert- are not used in determining alphabetical order except when compared with each other.</li><li>6. If chains of equal length are competing for selection as the parent chain, then the choice goes in series to:<ol style="list-style-type: none"><li>a) the chain which has the greatest number of side chains.</li><li>b) the chain whose substituents have the lowest- numbers.</li><li>c) the chain having the greatest number of carbon atoms in the smaller side chain.</li></ol></li></ol>	1 mark each



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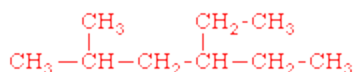
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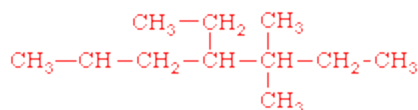
d) the chain having the least branched side chains.

7. A cyclic (ring) hydrocarbon is designated by the prefix **cyclo-** which appears directly in front of the base name.

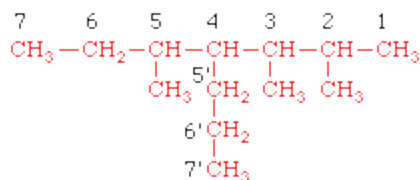
In summary, the name of the compound is written out with the substituents in alphabetical order followed by the base name (derived from the number of carbons in the parent chain). Commas are used between numbers and dashes are used between letters and numbers. There are **no** spaces in the name.



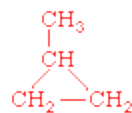
4-ethyl-2-methylhexane



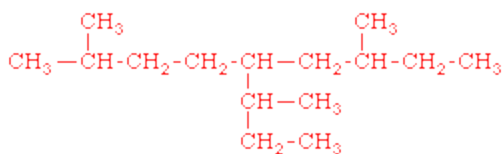
4-ethyl-3,3-dimethylheptane



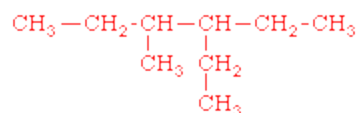
2,3,5-trimethyl-4-propylheptane  
(NOT: 2,3-dimethyl-4-sec-butylheptane)



methylcyclopropane



5-sec-butyl-2,7-dimethylnonane



3-ethyl-4-methylhexane

*Any one example should be given mark*

3-d

**p-x diagram:**

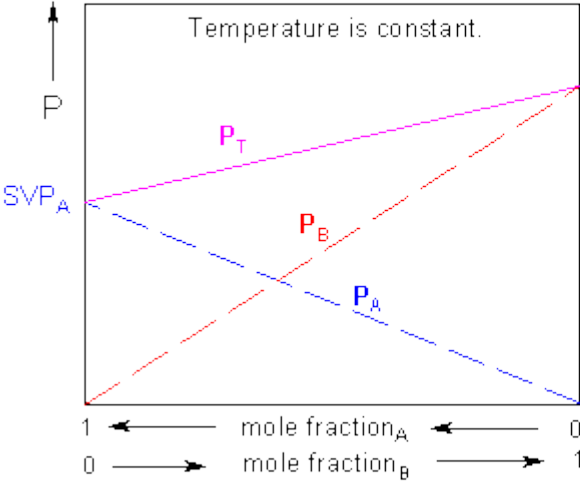
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	<p>Pressure - Composition graph - An Ideal Solution</p>  <p>where A could be : <math>C_2H_5OH</math> and B could be : <math>CH_3OH</math></p>	
3-e	<p><b>Preparation of alcohol from</b></p> <p><b>i) ketone:</b></p> $RMgBr + \begin{array}{c} O \\    \\ R'-C-R'' \end{array} \xrightarrow[2. H_3O^+]{1. Ether} \begin{array}{c} R \\   \\ R'-C-OH \\   \\ R'' \end{array}$ <p>The image above shows the synthesis of an alcohol from a ketone reacted with</p>	2





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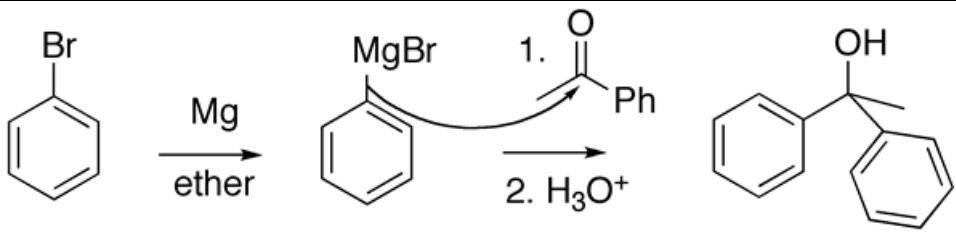
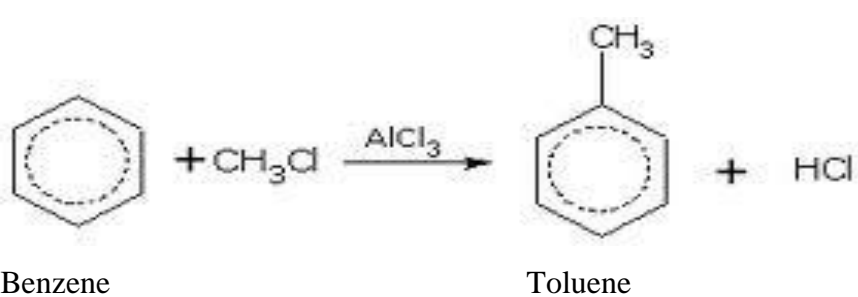
	<p>a Grignard reagent. When a ketone is the target of the Grignard's attack, the result is a tertiary alcohol.</p> <p><b>ii) by reduction:</b></p> <p>reduce carbonyl groups and acid chlorides is through the catalytic addition of hydrogen. Just like the C=C bond, the C=O bond is capable of adding one mole of hydrogen. The catalyst typically used to accomplish this is called <b>Raney Nickel</b>.</p> $\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{H} \\ \text{aldehyde} \end{array} \xrightarrow[\text{Raney Ni}]{\text{H}_2} \text{RCH}_2\text{OH} \quad \text{primary alcohol}$ $\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{R} \\ \text{ketone} \end{array} \xrightarrow[\text{Raney Ni}]{\text{H}_2} \begin{array}{c} \text{OH} \\   \\ \text{R}-\text{C}-\text{R} \end{array} \quad \text{secondary alcohol}$ $\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{Cl} \\ \text{acid} \\ \text{chloride} \end{array} \xrightarrow[\text{Raney Ni}]{\text{H}_2} \text{RCH}_2\text{OH} \quad \text{primary alcohol}$	2
3-f	i) <b>Grignard's reagents:</b>	2



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	 <p>ii) <b>Friedel-Crafts reaction:</b> Benzene reacts at room temperature with a chloro alkane (for example, chloromethane or chloro ethane) in the presence of aluminium chloride as a catalyst. It is known as <b>Friedel-Crafts reaction of benzene</b></p>  <p>Benzene + CH<sub>3</sub>Cl <math>\xrightarrow{\text{AlCl}_3}</math> Toluene + HCl</p>	2
4	<b>Any 4</b>	<b>16</b>
4-a	<b>i) Aromatic compound:</b> <ul style="list-style-type: none"><li>• Its most widely-produced derivatives include styrene, which is used to make polymers and plastics, phenol for resins and adhesives (via cumene), and cyclohexane, which is used in the manufacture of Nylon.</li><li>• Smaller amounts of benzene are used to make some types of rubbers, lubricants, dyes, detergents, drugs, explosives, napalm and pesticides</li></ul> <b>ii) phenol:</b>	2



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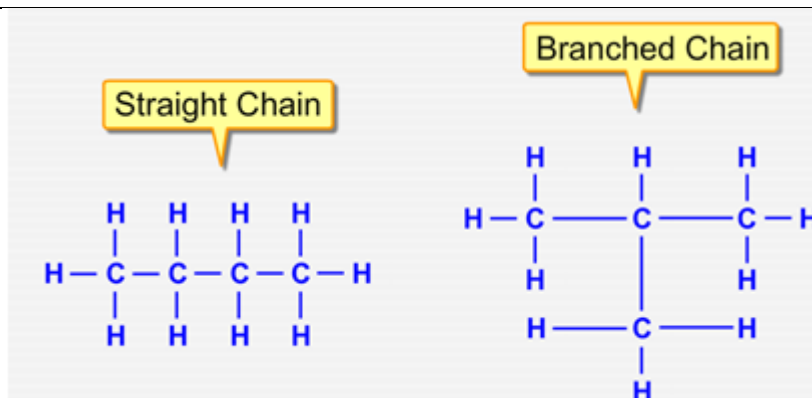
	<ul style="list-style-type: none"><li>• Phenol is also used in the preparation of cosmetics including sunscreens, hair dyes, and skin lightening preparations</li><li>• In cosmetic surgery, phenol serves as an exfoliant.</li><li>• It is also used in phenolization, a surgical procedure used to treat an ingrown nail, in which it is applied to the nail bed to prevent regrowth of nails.</li></ul>	2
4-b	<p style="text-align: center;">Organic compounds</p> <pre>graph TD     OC[Organic compounds] --&gt; OCA[Open chain compounds or Acyclic compounds]     OC --&gt; OCC[Closed chain or ring compounds or cyclic compounds]     OCA --&gt; OS[Saturated]     OCA --&gt; OU[Unsaturated]     OCC --&gt; HC[Homocyclic or Carbocyclic]     OCC --&gt; HET[Heterocyclic]     HC --&gt; HA[Alicyclic]     HC --&gt; HAA[Aromatic]     HAA --&gt; HBA[Benzenoid]     HAA --&gt; HNB[Non-benzenoid]     HET --&gt; AL[Alicyclic]     HET --&gt; AR[Aromatic]</pre> <p>simplify and systematize the study of organic compounds classified on the basis of their structure as, open chain (or) acyclic compounds and closed chain (or) cyclic (or) ring compounds. Open chain compounds are also known as aliphatic compounds. Open chain (or) acyclic compounds are compounds in which carbon atoms are linked by straight (or) branched chains.</p>	4



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Ex: For straight chain compounds: Butene, Butyne, Pentyl alcohol, Acetone...etc

For branched chain compounds: Isobutane, Isobutylene. In a cyclic (or) ring (or) closed chain compound, the carbon atom and any other atom (if any) are joined together to form a closed chain.

Ex: In cyclohexane the six carbon atoms join together and form a closed Chain.

Cyclic compounds can be further classified as- Homocyclic compounds and heterocyclic compounds.

Homocyclic compounds are those in which the ring consists of only carbon atoms.

Ex: In cyclohexane the ring consist of only carbon atoms.

Heterocyclic compounds are those in which the ring consists of carbon atoms, as well the other atoms like sulphur, oxygen or nitrogen...etc

Homocyclic compounds can be further classified as alicyclic compounds and



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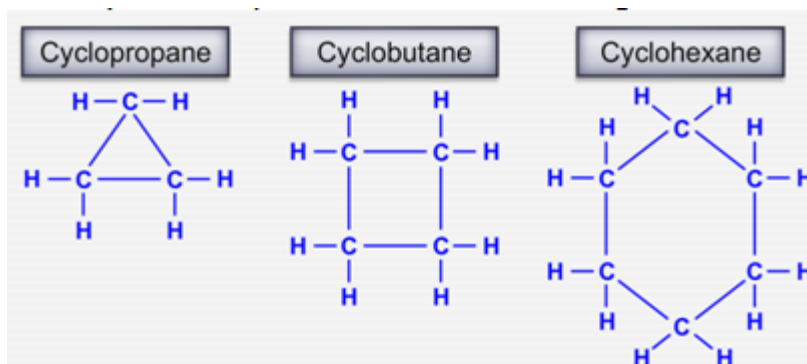
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aromatic compounds on the basis of their characteristic properties.

Homocyclic compounds which resemble aliphatic compounds in their properties are called alicyclic compounds or aliphatic cyclic compounds.

An alicyclic compound consists of a ring which has only carbon atoms.



Ex: cyclopropane, cyclobutane and cyclohexane...etc

Aromatic compounds are benzene and compounds those resemble benzene in their behaviour. Aromatic compounds can be further classified as benzenoid compounds and non-benzenoid compounds on the basis of the presence or absence of benzene ring.

Aromatic compounds containing isolated (or) one or more fused benzene rings and their functional derivatives are known as benzenoid aromatic compounds.

Benzene is the parent compound in Benzenoid derivatives.

A non-benzenoid compound is one that does not contain a benzene ring.

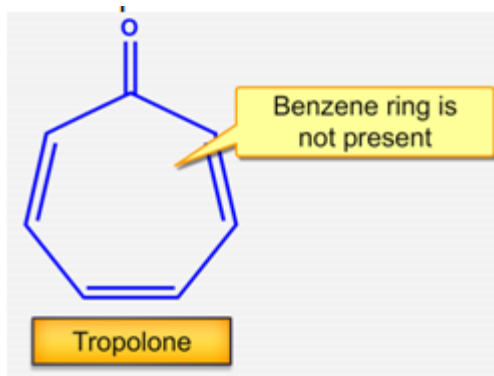


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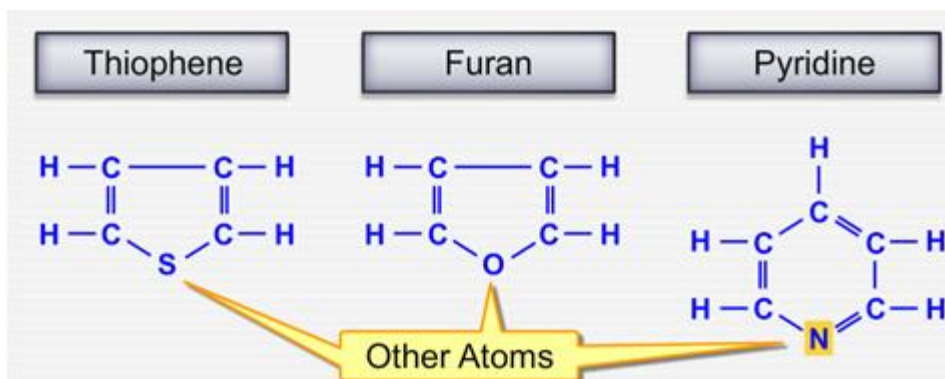
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Ex: Tropolone



The compounds which contain hetero atoms such as Nitrogen or Sulphur or Oxygen in addition to carbon atoms in the ring and resemble benzene in their properties are called Heterocyclic aromatic compounds.

Ex:



Thiophene and Furan are heterocyclic compounds containing hetero atoms Sulphur and Oxygen. Another classification of organic compounds is based on Functional groups.



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	<p>A functional group is an atom or a group of atoms present in a molecule, which determine its characteristic properties.</p> <p>Ex: Hydroxyl group and Carboxylic acid group is the functional group of alcohols and carboxylic acids respectively.</p> <p>Organic compounds can also be classified on the basis of Homologous series. The successive members or series of organic compounds with a characteristic functional group having the same general molecular formulae and differ by <math>-\text{CH}_2</math> unit are called homologous series. The successive members of a homologous series are called homologues</p> <p>Ex: Homologous series of Alkanes are Methane, Ethane, Propane, Butane...etc</p>	
4-c	<p><b><u>Physical properties:</u></b></p> <p><b>Boiling point of alcohols:</b> Alcohols generally have higher boiling points in comparison to other hydrocarbons having equal molecular masses. This is due to the presence of intermolecular hydrogen bonding between hydroxyl groups of alcohol molecules. In general, the boiling point of alcohols increases with increase in number of carbon atoms in the aliphatic carbon chain. On the other hand, the boiling point decreases with increase in branching in aliphatic carbon chains as the Van der Waals forces decrease with decrease in surface area. Thus primary alcohols have higher boiling point.</p> <p><b>Solubility of alcohols:</b> Solubility of alcohol in water is governed by the hydroxyl group present. The <u>hydroxyl group in alcohol</u> is involved in the formation of intermolecular hydrogen bonding. Thus, hydrogen bonds are formed between water and alcohol molecules which make alcohol soluble in</p>	1 mark each for any 2



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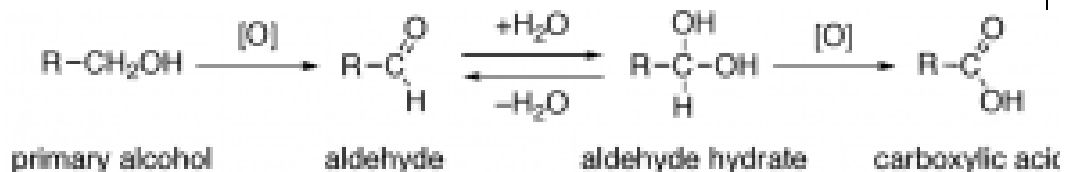
water. However the alkyl group attached to the hydroxyl group is hydrophobic in nature. Thus, the solubility of alcohol decreases with the increase in size of alkyl group.

**Acidity of alcohols:** Alcohols react with active metals such as sodium, potassium etc. to form the corresponding alkoxide. These reactions of alcohols indicate their acidic nature. The acidic nature of alcohol is due to the polarity of -OH bond. The acidity of alcohols decreases when an electron donating group is attached to the hydroxyl group as it increases the electron density on oxygen atom. Thus, primary alcohols are generally more acidic than secondary and tertiary alcohols. Due to the presence of unshared electrons on oxygen atom, alcohols act as Bronsted bases too.

**Chemical properties of alcohols:**

Alcohols exhibit wide range of spontaneous chemical reactions due to the cleavage of C-O bond and O-H bond. Some prominent chemical reactions of alcohols are:

**1. Oxidation of alcohol:** Alcohols undergo oxidation in the presence of an oxidizing agent to produce aldehydes and ketones which upon further oxidation give carboxylic acids.



Alcohols: Physical and Chemical Properties

**2. Dehydration of alcohol:** Upon treatment with protic acids, alcohols undergo dehydration (removal of a molecule of water) to form alkenes.

1 mark  
each for  
any 2







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	$\text{CH}_3\text{CH}_2\text{OH} + \text{PCl}_3 \xrightarrow{\Delta} \text{CH}_3\text{CH}_2\text{Cl} + \text{P(OH)}_3 + \text{HCl}$ $\text{CH}_3\text{CH}_2\text{OH} + \text{PCl}_5 \xrightarrow{\Delta} \text{CH}_3\text{CH}_2\text{Cl} + \text{POCl}_3 + \text{HCl}$ $\text{CH}_3\text{CH}_2\text{OH} + \text{PBr}_3 \xrightarrow{\Delta} \text{CH}_3\text{CH}_2\text{Br} + \text{P(OH)}_3 + \text{HBr}$	
4-e	<p><b>Alkenes</b> can be used to make polymers. Polymers are very large molecules made when many smaller molecules join together, end-to-end. The smaller molecules are called monomers.</p> <p>Alkenes can act as monomers because they are <b>unsaturated</b> (they have a double bond):</p> <p>ethene can polymerise to form poly(ethene), also called polythene propene can polymerise to form poly(propene), also called polypropylene.</p> <p>Polymer molecules are very large compared with most other molecules, so the idea of a repeating unit is used when drawing a displayed formula. When drawing one, starting with the monomer:</p> <p>change the double bond in the monomer to a single bond in the repeating unit add a bond to each end of the repeating unit.</p>	4



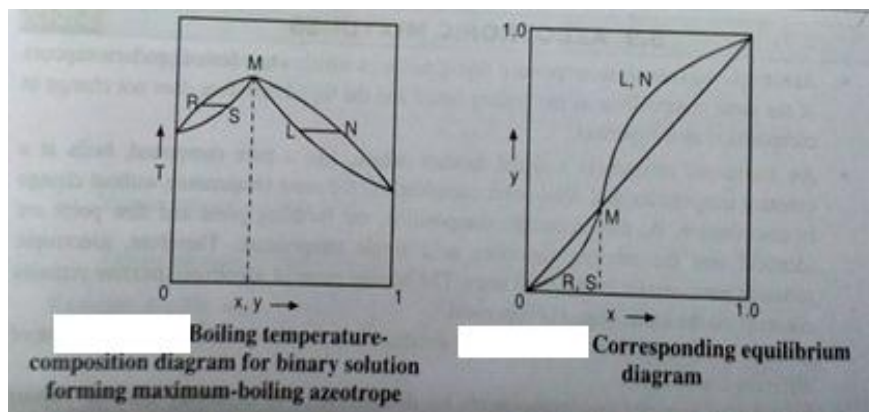
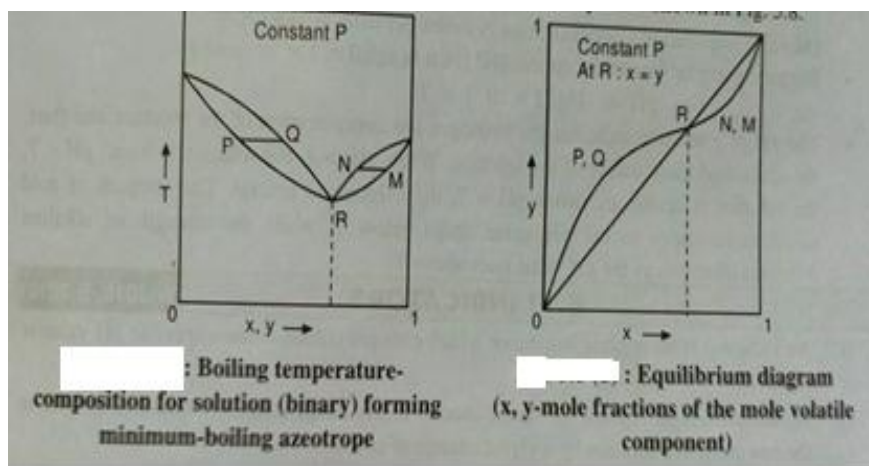


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Maximum boiling azeotropes show negative deviation from Raoult's law.  
Examples of minimum boiling azeotrope / azeotropic mixture-ethanol-water, chloroform-methanol etc.  
Examples of maximum boiling azeotrope-HCl-water, water-nitric acid etc.



1

1

5-b

**Chemical properties of phenol:**

1. Nitration: o,p nitrophenol
2. By sulphonation o-phenol sulphonic acid is formed.
3. By halogenation 2,4,6-Tribromophenol is formed.
4. By Kolbe reaction salicylic acid is formed.
5. By hydrogenation cyclohexanol is formed.

Any  
2with  
chemical  
reaction  
should be  
considered



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	<p>6. Friedal-Craft reaction o-cresol is formed.</p> <p>7. By Reimer-tiemann reaction salicyladehyde is formed.</p> <p>8. By condensation reaction phenolphthalein is formed.</p> <p>9. Akylation,acetylation,reaction with phosphorous halide,oxidation,with ammonia.</p>	d
5-c	<p>Acetylene can be prepared by the elimination of two molecules of hydrogen halide(HX) from a vicinal dihalide or a germinal dihalide.</p> <p>Removal of HX can be generally carried out in two stages. The first stage involves removal of one molecule of hydrogen halide by boiling with alcoholic KOH, to form a vinyl halide. The vinyl halides are very unreactive. So under mild conditions the dehydrohalogenation stops at this stage. Under more vigorous condition i.e.by using a strong base such as sodamide second stage can be accomplished to give an acetylene.</p> <p>The geminaldihalides can also give alkyne on boiling with alcoholic KOH.Soethylidene bromide on dehydrohalogenation gives acetylene.</p> $\begin{array}{c} \text{H}_2\text{C}-\text{Br} \\   \\ \text{H}_2\text{C}-\text{Br} \end{array} \xrightarrow[\text{-HX}]{\text{KOH (alcoholic)}} \begin{array}{c} \text{CH}_2 \\    \\ \text{HC}-\text{Br} \end{array} \xrightarrow{\text{NaNH}_2} \begin{array}{c} \text{CH} \\     \\ \text{CH} \end{array}$ <p>1,2-dibromoethane <span style="margin-left: 200px;">ethyne (acetylene)</span></p> <p style="text-align: center;"><math display="block">\begin{array}{c} \boxed{\text{H}} \quad \boxed{\text{Br}} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{H} \\   \quad   \\ \boxed{\text{H}} \quad \boxed{\text{Br}} \end{array} \xrightarrow[\text{(alcoholic)}]{\Delta, 2 \text{ KOH}} \text{H}-\text{C}\equiv\text{C}-\text{H} + 2\text{KBr} + 2\text{H}_2\text{O}</math></p>	2
5-d	1) By fusing sodium sulphonate with sodium hydroxide-	2marks



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	$C_6H_5SO_3Na + NaOH \rightarrow C_6H_5OH + Na_2SO_3$ 2) By heating chlorobenzene with sodium hydroxide at about $300^{\circ}C$ in the presence of copper salts . $C_6H_5Cl + NaOH \rightarrow C_6H_5OH + NaCl$ { 3) by oxidation with cumene followed by treatment with acid 4) from benzene and air oxidation method }	each for any 2
5-e	1) By reduction of alkyl halides- Alkyl halides when reduced with nascent hydrogen, give alkanes. Common reducing agents used are zinc-copper couple & alcohol. $CH_3I + 2[H] \rightarrow CH_4 + HI$ $C_2H_5I + 2[H] \rightarrow C_2H_6 + HI$ 2) By catalytic hydrogenation of unsaturated hydrocarbons- A mixture of an unsaturated hydrocarbon & hydrogen is passed over a catalyst (Pt, Ni) at 523 to 573 K to get an alkane. $CH_2=CH_2 + H_2 \rightarrow CH_3-CH_3$ { 3. hydrolysis of Grignard's reagent 4. wurtz's synthesis 5. kolbe 's synthesis }	2marks each for any 2
5-f	Methane contains only one carbon & four hydrogen atoms in its molecule. The carbon atom is joined by four single covalent bonds to four hydrogen atoms, each covalent bond being represented by a dash. Tetravalency of carbon & monovalency of hydrogen is satisfied. Molecular formula of methane $CH_4$ .	4





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6-c	<p><b>Quinonoid theory</b> explains the color changes in titrations on the basis of intramolecular changes.</p> <p>This theory believes that-</p> <ol style="list-style-type: none"><li>1. An acid base indicator is either a weak acid or a weak base.</li><li>2. An indicator consists of an equilibrium mixture of at least two tautomeric forms one is benzenoid while the other is Quinonoid form.</li><li>3. The two forms possess different colors.</li><li>4. Out of these forms, one exists in an acid solution &amp; the other form exists in an alkaline solution.</li><li>5. The Quinonoid form is generally deeper in colour than benzenoid form.</li><li>6. As the PH of the solution containing an indicator changes one form of the indicator changes to the other &amp; as a result of this the solution shows a change of colour</li></ol> <p>There are two tautomeric forms of methyl orange. The Quinonoid form (red form) exists in an acidic solution &amp; it passes to the Benzenoid form (yellow) as the PH changes to the alkaline side.</p> <p>Phenolphthalein is colorless in an acidic solution where it exists in the Benzenoid form. If an alkali is added, it changes to the Quinonoid form &amp; imparts pink color to the solution.</p> <div data-bbox="285 1516 1065 1709" style="text-align: center;"><p>Benzenoid form                      Quinonoid form</p></div>	4
6-d	<p><b>Homologous series-</b></p> <p>It is a series of class of organic compounds in which each member differs from</p>	4



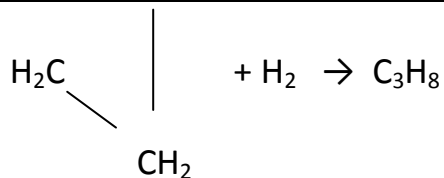




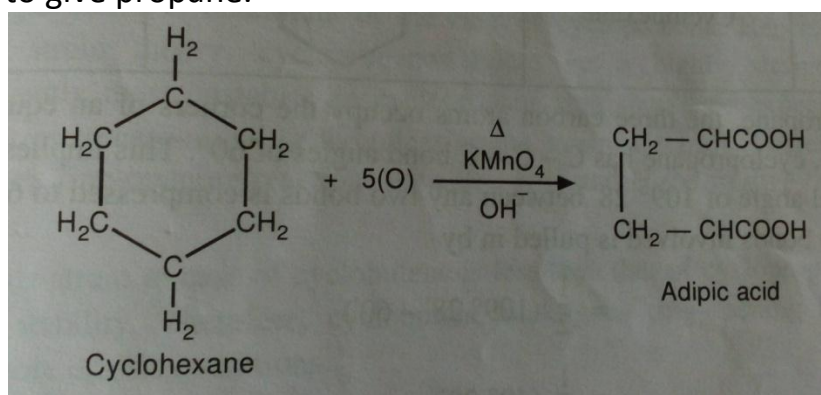
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Cyclopropane reacts with hydrogen in the presence of Ni catalyst to give propane.



Cycloalkanes undergo oxidation with hot alkaline  $\text{KMnO}_4$  to form dicarboxylic acids

2