



**SUMMER-16 EXAMINATION**  
**Model Answer**

Subject code :(17312)

Page 1 of 26

**Important Instructions to examiners:**

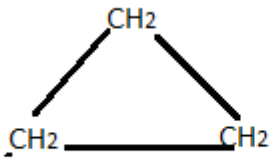

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling 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.



SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 2 of 26

Q No.	Answer	marks	Total marks
1	Any 10		20
1-a	<b>Functional group</b> – It is a group of atoms bonded together in a unique fashion which is present in the molecule & it is responsible for its characteristics chemical properties. e.g. –OH, –COOH are the functional groups of alcohol & acid respectively	1          1	2
1-b	<b>Secondary carbon:</b> A carbon atom attached to two other carbon atom is called a secondary carbon( $2^0$ ) <b>tertiary carbon:</b> A carbon atom attached to three other carbon atom is called a tertiary carbon( $3^0$ )	1          1	2
1-c	<b>Uses of Alkane: (any 2)</b> 1. Alkanes are used in domestic fuel (natural gas) 2. Methane is used in manufacturing of carbon black. 3. Used as refrigerent and solvent. 4. Used in rubber compounding, packing tc. 5. Used in lubricant, paper, plasticizers	1 mark          each	2
1-d	a)  OR  cyclopropane	1	2



SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 3 of 26

	<p>b)</p> <p style="text-align: center;">cyclopentane</p>	1	
1-e	<p><math>C_2H_4</math> or <math>CH_2=CH_2</math> ETHENE</p> <p><math>CH \equiv CH</math> ACETYLENE</p>	1	2
1-f	<p><b>Aromatic compounds:</b> These are cyclic compounds usually having six membered rings of carbon atoms with alternate single and double bonds and show typical characteristic properties.</p>	2	2
1-g	<p><b>Reduction reaction of benzene:</b></p> <p>On reduction with hydric acid at <math>250^{\circ}C</math> or hydrogen under pressure in presence of finely divided nickel at <math>200^{\circ}C</math> they form products like cyclohexane.</p> <p><math>C_6H_6 + 6(H) \longrightarrow C_6H_{12}</math></p> <p>BENEZENE                          CYCLOHEXANE</p>	2	2
1-h	<p><b>IUPAC NAMES OF:</b></p> <p>a) ethyl bromide: bromo ethane</p> <p>b) n-butyl chloride: 1, chlorobutane</p>	1	2
1-i	<p><b>Method of preparation of alcohol: (any 1)</b></p> <p>By the hydrolysis of an alkyl halide with aqueous alkali or silver oxide suspended in water, Monohydric alcohols are formed.</p> <p><math>C_2H_5I + KOH \longrightarrow C_2H_5OH + KI</math></p>	2	2



SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 4 of 26

	$\text{CH}_3 \text{ Br} + \text{Ag OH} \longrightarrow \text{CH}_3 \text{ OH} + \text{AgBr}$ <p><b>by olefins:</b></p> <p>olefins may be hydrated to alcohols by absorption in concentrated sulphuric acid followed by hydrolysis of alkyl hydrogen sulphate.</p> $\begin{array}{ccccc} \text{CH}_2 & \text{H}_2\text{SO}_4 & \text{CH}_3 & \text{H}_2\text{O} & \text{CH}_3 \\    & \longrightarrow &   & \longrightarrow &   \\ \text{CH}_2 & & \text{CH}_2\text{H}_2\text{SO}_4 & & \text{CH}_2\text{OH} \end{array}$ <p>This is one of the recent methods used for the industrial preparation of lower alcohols from olefins obtained from cracked petroleum.</p>														
1-j	<p><b>Vapor pressure</b> or <b>equilibrium vapor pressure</b> is defined as the pressure exerted by a vapor in thermodynamic equilibrium with its condensed phases (solid or liquid) at a given temperature in a closed system.</p>	2	2												
1-k	<p>ideal solution: Obey Raoult's law at every range of concentration.</p> <p>non ideal solution Do not obey Raoult's law.</p>	1 1	2												
2	<b>Any 4</b>		<b>16</b>												
2-a	<p><b>homologous series</b> is a series of compounds with the same general formula, usually varying by a single parameter—such as the length of a carbon chain.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;"><i>Functional Group</i></th> <th style="text-align: center;"><i>Name</i></th> <th style="text-align: center;"><i>Example</i></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"> <math display="block">\begin{array}{c}   \\ -\text{C}- \\   \end{array}</math> </td> <td style="text-align: center;">Alkane</td> <td style="text-align: center;">CH<sub>3</sub>CH<sub>2</sub>CH<sub>3</sub> (propane)</td> </tr> <tr> <td style="text-align: center;">C=C</td> <td style="text-align: center;">Alkene</td> <td style="text-align: center;">CH<sub>3</sub>CH=CH<sub>2</sub> (propene)</td> </tr> <tr> <td style="text-align: center;">C≡CH</td> <td style="text-align: center;">Alkyne</td> <td style="text-align: center;">CH<sub>3</sub>C≡CH (propyne)</td> </tr> </tbody> </table>	<i>Functional Group</i>	<i>Name</i>	<i>Example</i>	$\begin{array}{c}   \\ -\text{C}- \\   \end{array}$	Alkane	CH <sub>3</sub> CH <sub>2</sub> CH <sub>3</sub> (propane)	C=C	Alkene	CH <sub>3</sub> CH=CH <sub>2</sub> (propene)	C≡CH	Alkyne	CH <sub>3</sub> C≡CH (propyne)	4	4
<i>Functional Group</i>	<i>Name</i>	<i>Example</i>													
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SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 5 of 26

	<table border="1"><tbody><tr><td><math>\text{F, Cl, Br, or I}</math></td><td>Alkyl halide</td><td><math>\text{CH}_3\text{Br}</math> (methyl bromide)</td></tr><tr><td><math>\text{—OH}</math></td><td>Alcohol</td><td><math>\text{CH}_3\text{CH}_2\text{OH}</math> (ethanol)</td></tr><tr><td><math>\text{—O—}</math></td><td>Ether</td><td><math>\text{CH}_3\text{OCH}_3</math> (dimethyl ether)</td></tr><tr><td><math>\text{—NH}_2</math></td><td>Amine</td><td><math>\text{CH}_3\text{NH}_2</math> (methyl amine)</td></tr></tbody></table>	$\text{F, Cl, Br, or I}$	Alkyl halide	$\text{CH}_3\text{Br}$ (methyl bromide)	$\text{—OH}$	Alcohol	$\text{CH}_3\text{CH}_2\text{OH}$ (ethanol)	$\text{—O—}$	Ether	$\text{CH}_3\text{OCH}_3$ (dimethyl ether)	$\text{—NH}_2$	Amine	$\text{CH}_3\text{NH}_2$ (methyl amine)								
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2-b	<p>1. Select the longest continuous chain of carbon atoms, it is known as main or parent chain &amp; other chains attached to it are known as side chains. The no. of carbon atoms present in main chain determines the parent name of hydrocarbon.</p> <p>C</p>	4	4																		



SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 6 of 26

<p>1</p> <p>C-C-C-C-C-C-C</p> <p>2. Number the c atoms of parent chain from the end which gives smallest possible no the carbon carrying the branches.</p> <p>C</p> <p>1</p> <p>C-C-C-C-C-C-C</p> <p>1 2 3 4 5 6 7</p> <p>3. Prifix the name of substituent to the name of parent hydrocarbon &amp; indicate its position on parent chain.</p> <p>CH<sub>3</sub></p> <p>1</p> <p>CH<sub>3</sub>-CH<sub>2</sub>-CH-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>3</sub></p> <p>3-methyl heptane</p> <p>4. When more than one substituent's are present on the main chain their names are given as per alphabetical order, inserting hyphen (-) in between the names of substituents.</p> <p>CH<sub>3</sub> C<sub>2</sub>H<sub>5</sub></p> <p>1 1</p> <p>H<sub>3</sub>C-CH-CH-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>3</sub></p> <p>3-ethyl-2-methyl heptane</p> <p>5. When the same substituent is present two or more times in the molecule then it is indicated by di, tri, tetra etc to the substituent name.</p> <p>CH<sub>3</sub>CH<sub>3</sub></p> <p>1 1</p> <p>H<sub>3</sub>C-CH-CH-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>3</sub></p>		
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SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 7 of 26

	<p>2,3-dimethyl heptane</p> <p>6. The position of double bond or triple bond is indicated by prefixing the no. of carbon preceding such bonds.</p> <p><math>\text{H}_3\text{C}-\text{CH}_2-\text{CH}=\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_3</math>      3-heptene</p>		
2-c	<p><b>Sache-Mohr theory:</b></p> <p>In 1890 Sche suggested that the ring compounds with 6 or more 'C' atoms could exist without (-) strain .</p> <p>According to Bayer's strain theory</p> <p>If the 'c' atoms forming the ring didn't lie in the same plane but took up multiplanesfokled conformations retaining the normal valency angle and there by producing strainless ring containing 6 or more 'c' atoms may become strainless by assuming a folded form. By folded form or conformation the angle between two valency bond is <math>109^0 28'</math>.</p> <p>According to Bayer strain theory put forward the valency angle can be altered from the normal value(<math>109^0 28'</math>) by bending of the valency bonds. But due to bending of valency bond a strain is set in molecule. Greater the deviation from the normal angle, greater the strain and greater the instability of organic compounds. According to Bayers Cyclohexane being more stable due to multiplaner structure and retaining normal valency angle. This can be conform by heating Cyclohexane and Cyclopentane separately at <math>300^0\text{C}</math>, it is observed that cyclopentane ring gets opened but Cyclohexane ring do not get opened.</p>	4	4



SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 8 of 26

2-d	<p><b>1) Reaction of calcium carbide with H<sub>2</sub>O</b></p> $\text{CaC}_2 + \text{H}_2\text{O} \longrightarrow \text{H} - \text{C} \equiv \text{C} - \text{H} + \text{Ca}(\text{OH})_2$ <p>Calcium carbide                      Acetylene</p> <p><b>2) Dehalogenation of Tetrahalides :</b></p> <p>When 1, 1, 2, 2 - tetrahalides are heated with Zn dust in alcohol, they produces alkynes.</p> $\begin{array}{c} \text{X} \quad \text{X} \\   \quad   \\ \text{R} - \text{C} - \text{C} - \text{R} \\   \quad   \\ \text{X} \quad \text{X} \end{array} + 2\text{Zn} \xrightarrow[\Delta]{\text{alcohol}} \text{R} - \text{C} \equiv \text{C} - \text{R} + 2\text{ZnX}_2$ <p style="margin-left: 50px;">Tetrahalide                      Alkynes</p>	2	4
2-e	<p><b>Oxidation reaction of phenol:</b></p>	2	4

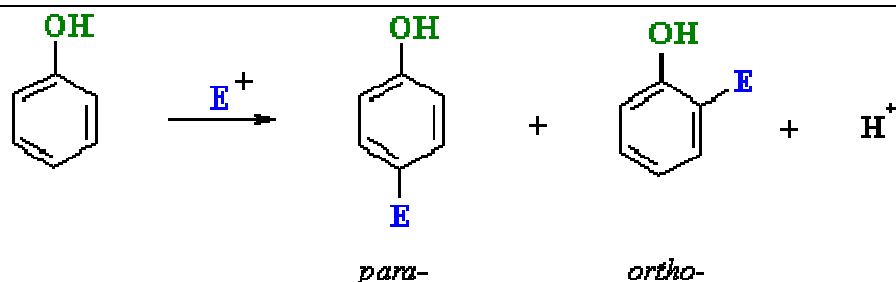




SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

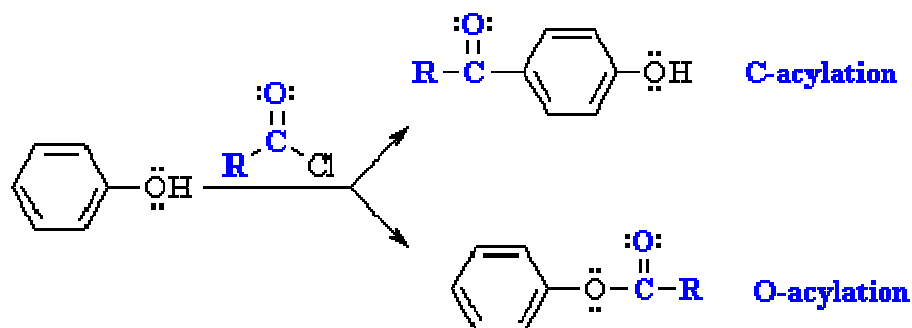
Page 9 of 26



Phenols are potentially very reactive towards electrophilic aromatic substitution. This is because the hydroxy group,  $-\text{OH}$ , is a strongly activating, *ortho-* / *para-* directing substituent. Substitution typically occurs *para* to the hydroxyl group unless the *para* position is blocked, then *ortho* substitution occurs. The strong activation often means that milder reaction conditions than those used for benzene itself can be used (see table below for a comparison) Phenols are so activated that polysubstitution can be a problem.

(any one example)

Acylation:



Esterification:

2



SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 10 of 26

	<p>aryl ester</p> <p>Kolbe's reaction:</p>		
2-f	i) $\text{CH}_3\text{COCl} + \text{C}_2\text{H}_5\text{OH} \longrightarrow \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$ ii) $\text{C}_2\text{H}_5\text{OH} + \text{PCl}_5 \longrightarrow \text{C}_2\text{H}_5\text{Cl} + \text{POCl}_3 + \text{HCl}$	2 2	4
3	<b>Any 4</b>		<b>16</b>
3-a	i) Amide ii) Hydroxyl (Alcohol) iii) Carboxylic Acid iv) Amine	1 mark each	4
3-b	<b>Formation of ethane</b>  In ethane both the carbon atoms assume $\text{sp}^3$ hybrid state. One of the hybrid orbitals of carbon atom overlaps axially with similar orbital of the other carbon atoms to form $\text{sp}^3\text{-sp}^3$ sigma bond. The other three hybrid orbitals of each carbon atom are used in forming $\text{sp}^3\text{-s}$ sigma bonds with hydrogen atoms as	2	4

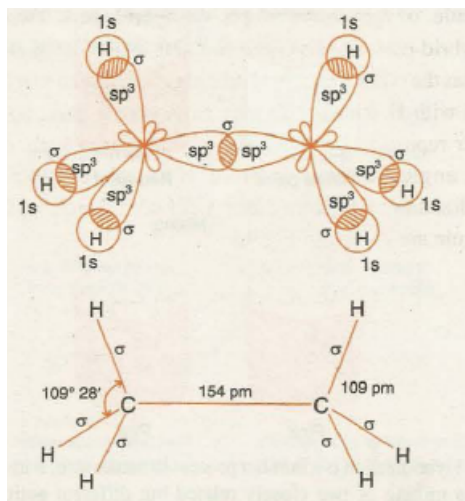


SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 11 of 26

described in



**Orbital picture of ethane.**

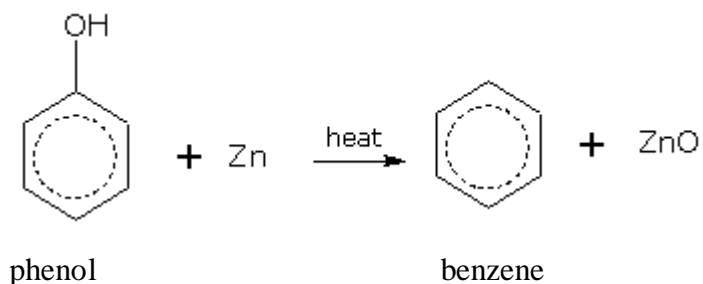
Each C-H bond in ethane is  $sp^3$ -s sigma bond with bond length 109 pm. The C-C bond is  $sp^3$ - $sp^3$  sigma bond with bond length 154 pm.

2

3-c

**i) By heating phenol with zinc**

When phenol vapours are passed over heated zinc dust, benzene is formed.



**ii) By the hydrolysis of benzene sulphonic acid**

2

2

4



SUMMER-16 EXAMINATION  
Model Answer

	<p>Benzene sulphonic acid on hydrolysis with superheated steam gives benzene.</p> $\text{C}_6\text{H}_5\cdot\text{SO}_3\text{H} + \text{H}_2\text{O} \longrightarrow \text{C}_6\text{H}_6 + \text{H}_2\text{SO}_4$ <p>benzene sulphonic acid                  benzene</p>		
3-d	<p><b>Wurtz-Fittig Reaction</b></p> <p>The <b>Wurtz-Fittig reaction</b> is the <u>chemical reaction</u> of <u>aryl halides</u> with <u>alkyl halides</u> and <u>sodium</u> metal to give substituted aromatic compounds.</p> $\text{C}_6\text{H}_5\text{Br} + \text{CH}_3\text{I} + 2 \text{Na} \longrightarrow \text{C}_6\text{H}_5\text{CH}_3 + 2 \text{NaX}$ <p>This reaction allows the alkylation of aryl halides. The more reactive alkyl halide forms an organosodium first, and this reacts as a nucleophile with an aryl halide as the electrophile. Excess alkyl halide and sodium may be used if the symmetric coupled alkanes formed as a side product may be separated readily.</p> <p>The reaction works best for forming asymmetrical products if the halide reactants are somehow separate in their relative <u>chemical reactivities</u>. One way to accomplish this is to form the reactants with halogens of different <u>periods</u></p>	2	4
3-e	<p><b>Isomerism of alcohols</b></p> <p>Alcohols exhibit following types of isomerism:</p> <p><b>1. Chain isomerism</b></p> <p>Alcohols with four or more carbon atoms exhibit this type of isomerism in which the carbon skeleton is different.</p>	1	4



SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 13 of 26

<p><math>\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2\text{OH}</math> Butan -1- ol</p> <p><math>\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3 - \text{CH} - \text{CH}_2\text{OH} \end{array}</math> 2 - Methylbutan -1-ol</p> <p><b>2. Position isomerism</b></p> <p>Alcohols with three or more carbon atoms can exhibit position isomerism. In this type of isomerism the position of the functional group i.e., the -OH group varies. In other words the carbon atoms to which the -OH group is attached is different.</p> <p><math>\text{CH}_3 - \text{CH}_2 - \text{CH}_2\text{OH}</math> Propan -1- ol</p> <p><math>\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_3 \\   \\ \text{OH} \end{array}</math> Propan -2- ol</p> <p><b>3. Functional isomerism</b></p> <p>Alcohols with two or more carbon atoms can exhibit functional isomerism with ethers. Thus ethers and alcohols have the same molecular formula but have different functional groups, hence they are called functional isomers.</p> <p><math>\text{CH}_3 \text{ CH}_2 \text{ CH}_2 \text{ CH}_2\text{OH}</math> Butan -1- ol</p> <p><math>\text{CH}_3 - \text{CH}_2 - \text{O} - \text{CH}_2 \text{CH}_3</math> Ethoxyethane</p> <p><b>4. Optical isomerism</b></p> <p>Alcohols containing chiral centres exhibit enantiomerism or optical isomerism. The optical isomers can rotate the plane of plane polarized angles in</p>	<p>1</p> <p>1</p> <p>1</p>	
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SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 14 of 26

	<p>different directions.</p> $\begin{array}{c} \text{CH}_3 - \overset{*}{\text{CH}} - \text{CH}_2 - \text{CH}_3 \\   \\ \text{OH} \\ \text{Butan-2-ol} \end{array}$ $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \overset{*}{\text{CH}} - \text{CH}_3 \\   \\ \text{OH} \\ \text{Pent-2-ol}$ $\begin{array}{c} \text{CH}_3 - \text{CH} - \overset{*}{\text{CH}} - \text{CH}_3 \\   \quad   \\ \text{CH}_3 \quad \text{OH} \\ \text{3-Methylbutan-2-ol} \end{array}$		
3-f	<p><b>Examples of azeotropic mixture(any 4)</b></p> <ul style="list-style-type: none"><li>• <u>nitric acid</u> (68%) / <u>water</u>, boils at 120.2 °C at 1 atm (negative azeotrope)</li><li>• <u>perchloric acid</u> (71.6%) / <u>water</u>, boils at 203 °C (negative azeotrope)</li><li>• <u>hydrofluoric acid</u> (35.6%) / <u>water</u>, boils at 111.35 °C (negative azeotrope)</li><li>• <u>ethanol</u> (96%) / <u>water</u>, boils at 78.1 °C</li><li>• <u>sulfuric acid</u> (98.3%) / <u>water</u>, boils at 338 °C</li><li>• <u>acetone</u> / <u>methanol</u> / <u>chloroform</u> form an intermediate boiling (saddle) azeotrope</li><li>• <u>diethyl ether</u> (33%) / <u>halothane</u> (66%) a mixture once commonly used in <u>anaesthesia</u>.</li><li>• <u>benzene</u> / <u>hexafluorobenzene</u> forms a double binary azeotrope.</li></ul>	1 mark each	4
4	<b>Any 4</b>		<b>16</b>



**SUMMER-16 EXAMINATION**  
**Model Answer**

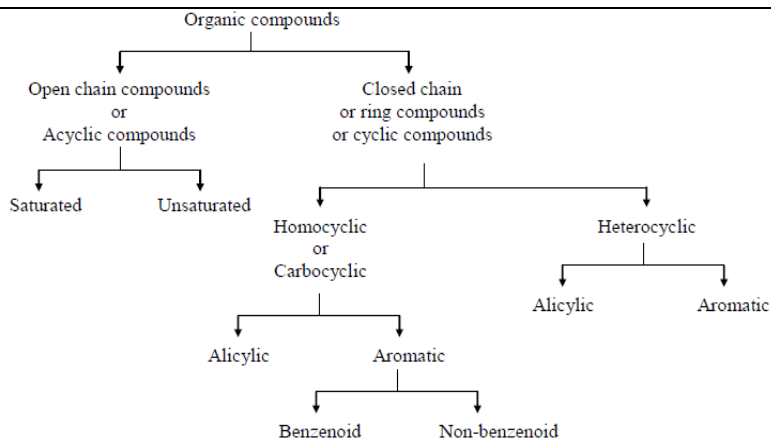
Subject code :(17312)

Page 15 of 26

4-a

4

4



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.

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.

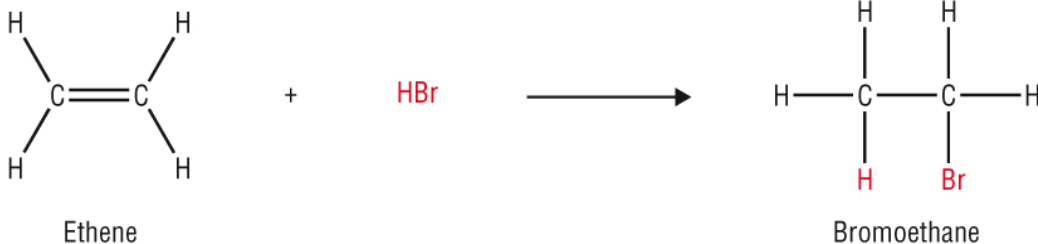
Heterocyclic compounds are those in which the ring consists of carbon atoms, as well the other atoms like sulphur, oxygen or nitrogen...etc



**SUMMER-16 EXAMINATION**  
**Model Answer**

Subject code :(17312)

Page 16 of 26

	<p>Ex: cyclopropane, cyclobutane and cyclohexane...etc</p> <p>Aromatic compounds are benzene and compounds those resemble benzene in theirbehaviour.</p> <p>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. Thiophene and Furan are heterocyclic compounds containing hetero atoms Sulphur and Oxygen. Another classification of organic compounds is based on Functionalgroups.</p> <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-b	<p>i)</p>  <p>Ethene</p> <p>Bromoethane</p> <p>ii)</p>	2	4





SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 17 of 26

	$\text{CH}_2=\text{CH}_2 + \text{HO}-\overset{\text{O}}{\parallel}{\text{S}}-\text{OH} \longrightarrow \text{CH}_3\text{CH}_2\text{O}-\overset{\text{O}}{\parallel}{\text{S}}-\text{OH}$ <p style="text-align: center;">ethene                      sulfuric acid                      ethyl hydrogen sulfate</p>	2	
4-c	<p>Step 1 <math>\text{H}-\text{O}-\text{NO}_2 + \text{H}_2\text{SO}_4 \rightleftharpoons \text{H}-\overset{\text{H}}{\underset{\text{H}}{\text{O}^+}}-\text{NO}_2 + \text{HSO}_4^-</math></p> <p>Step 2 <math>\text{H}-\overset{\text{H}}{\underset{\text{H}}{\text{O}^+}}-\text{NO}_2 + \text{H}_2\text{SO}_4 \rightleftharpoons \text{NO}_2^+ + \text{H}_3\text{O}^+ + \text{HSO}_4^-</math></p> <p>Step 3 </p>	4	4
4-d	<p><b>Industrial Uses of Alcohol:</b></p> <p>i) Ethanol is usually sold as industrial methylated spirits which is ethanol with a small quantity of methanol added and possibly some colour. Methanol is poisonous, and so the industrial methylated spirits is unfit to drink. This avoids the high taxes which are levied on alcoholic drinks (certainly in the UK!).</p> <p><b>ii) As a fuel</b></p> <p>Ethanol burns to give carbon dioxide and water and can be used as a fuel in its own right, or in mixtures with petrol (gasoline). "Gasohol" is a petrol / ethanol mixture containing about 10 - 20% ethanol.</p> <p>Because ethanol can be produced by fermentation, this is a useful way for</p>	1 mark each	4





SUMMER-16 EXAMINATION  
Model Answer

	<p>type of solutions are called minimum boiling azeotrope. e.g.,</p> <p style="text-align: center;"><math>H_2O + C_2H_5OH, H_2O + C_2H_5CH_2OH</math></p> <p style="text-align: center;"><math>CHCl_3 + C_2H_5OH, (CH_3)_2CO + CS_2</math></p> <p>(2) <b>Maximum boiling azeotrope</b> : For the solutions with negative deviations there is an intermediate composition for which the vapour pressure of the solution is minimum and hence, boiling point is maximum. At this composition the solution distill's at constant temperature without the change in composition. This type of solutions are called maximum boiling azeotrope. e.g.,</p> <p style="text-align: center;"><math>H_2O + HCl, H_2O + HNO_3, H_2O + HClO_4</math></p>	<p>1/2</p> <p>1</p> <p>1/2</p>	
4-f	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Ideal solution</p> <p><math>X_A = 1</math> Mole fraction <math>X_A = 0</math> <math>X_B = 0</math> <math>X_B = 1</math></p> </div> <div style="text-align: center;"> <p>Positive deviation</p> <p><math>X_A = 1</math> Mole fraction <math>X_B = 1</math> <math>X_B = 0</math> <math>X_A = 0</math></p> </div> <div style="text-align: center;"> <p>Negative deviation</p> <p><math>X_A = 1</math> Mole fraction <math>X_A = 0</math> <math>X_B = 0</math> <math>X_B = 1</math></p> </div> </div>	4	4
5	<b>Any 4</b>		<b>16</b>
5-a	<p>i) Ketone: <math>(C_nH_{2n+1})_2CO</math> <math>R_2CO</math></p> <p>ii) Ethers: <math>(C_nH_{2n+1})_2O</math> <math>R-O-R'</math></p>	1 mark each	4



SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 20 of 26

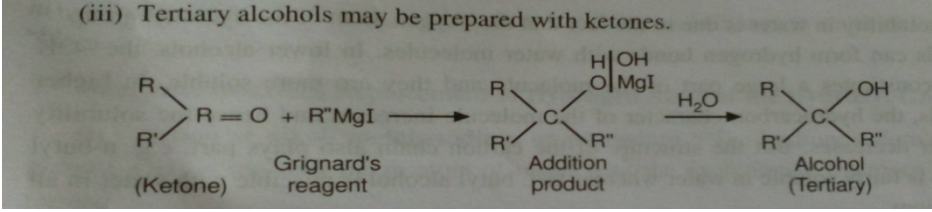
	iii) Anhydride: $(C_nH_{2n+1}CO)_2O$ iv) Organo metallic compounds: $RMgX$		
5-b	<p>i)By fusing sodium benzene sulphonate with caustic soda</p> $C_6H_5SO_3Na \xrightarrow{NaOH} C_6H_5ONa \xrightarrow{NaOH} C_6H_5OH$ <p>ii)By heating chlorobenzene under pressure with 10% solution of sodium carbonate or sodium hydroxide at about <math>300^{\circ}C</math> in the presence of copper salts as a catalyst</p> $C_6H_5Cl + NaOH \rightarrow C_6H_5OH + NaCl$	2 marks each	4
5-c	<p>With the help of Grignard reagent, primary, secondary &amp; tertiary alcohols may be prepared by means of a Grignard's reagent &amp; an appropriate carbonyl compound(an aldehyde or ketone) The addition products first formed is decomposed with water to give alcohol.</p> <p>(i) Primary alcohols are obtained with dry oxygen or formaldehyde.</p> $RMgBr + \frac{1}{2} O_2 \longrightarrow \begin{array}{c} H \\   \\ RO \\   \\ MgBr \end{array} \xrightarrow{H_2O} ROH + \begin{array}{c} OH \\   \\ Mg \\   \\ Br \end{array} \quad (\text{v.g.})$ $H_2C=O + RMgI \longrightarrow \begin{array}{c} H \\   \\ RCH_2-O \\   \\ MgI \end{array} \xrightarrow{H_2O} RCH_2OH \quad (\text{g.})$ <p>Formaldehyde      Grignard's reagent      Addition product      Alcohol (Primary)</p> <p>(ii) Secondary alcohols are prepared with aldehydes other than formaldehyde.</p> $RCH=O + R'MgI \longrightarrow \begin{array}{c} R \\ \diagdown \\ CH \\ \diagup \\ R' \end{array} \begin{array}{c} H \\   \\ O \\   \\ MgI \end{array} \xrightarrow{H_2O} \begin{array}{c} R \\ \diagdown \\ CHOH \\ \diagup \\ R' \end{array} \quad (\text{f.g.g.})$ <p>Aldehyde      Grignard's reagent      Addition product      Alcohol (Secondary)</p>	4	4



SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 21 of 26

	<p>(iii) Tertiary alcohols may be prepared with ketones.</p>  <p><math display="block">\begin{array}{c} \text{R} \\ \diagdown \\ \text{C}=\text{O} \\ \diagup \\ \text{R}' \end{array} + \text{R}''\text{MgI} \longrightarrow \begin{array}{c} \text{R} \\ \diagdown \\ \text{C} \\ \diagup \\ \text{R}' \end{array} \begin{array}{c} \text{H} \\   \\ \text{OH} \\   \\ \text{O} \\   \\ \text{MgI} \end{array} \xrightarrow{\text{H}_2\text{O}} \begin{array}{c} \text{R} \\ \diagdown \\ \text{C} \\ \diagup \\ \text{R}' \end{array} \begin{array}{c} \text{OH} \\   \\ \text{R}'' \end{array}</math></p> <p>(Ketone) Grignard's reagent Addition product Alcohol (Tertiary)</p>		
5-d	<p><b>Quinonoid theory of indication:</b> This theory 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>	4	4

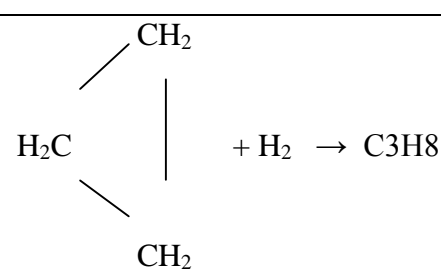
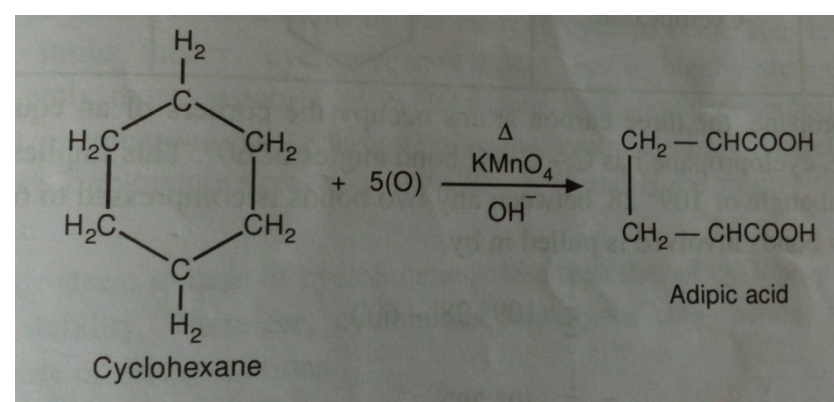
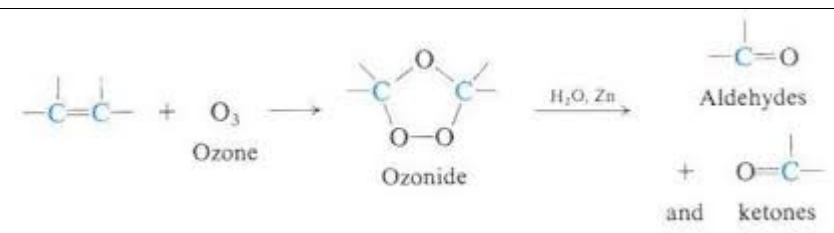




SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 23 of 26

	and (3) <u>chloroform</u> and <u>ethanol</u> .		
5-f	 <p>Cyclopropane reacts with hydrogen in the presence of Ni catalyst to give propane.</p>  <p>Cycloalkanes undergo oxidation with hot alkaline KMnO<sub>4</sub> to form dicarboxylic acids</p>	2	4
6	<b>Any 4</b>		16
6-a	 <p>When ozone is passed through an alkene in an inert solvent like CCl<sub>4</sub>, it adds across the double bonds to form an ozonide. On warming with zinc &amp; water, the</p>	4	4

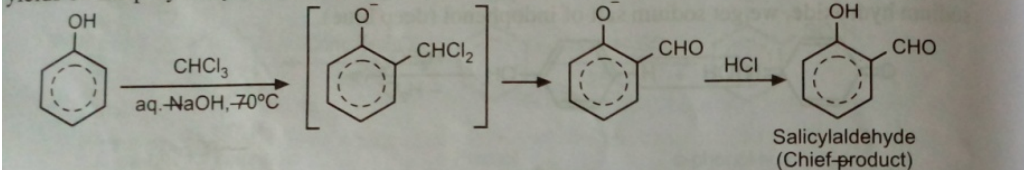
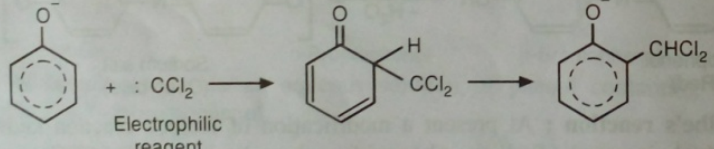
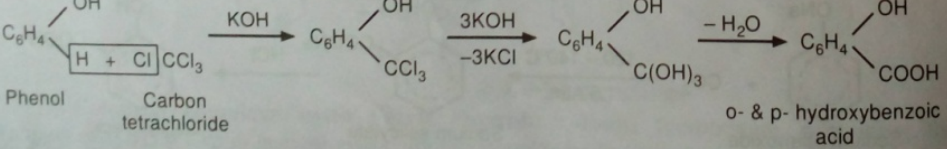




SUMMER-16 EXAMINATION  
Model Answer

Subject code :(17312)

Page 24 of 26

	<p>ozonides cleave at the double bond. The products are aldehydes ,ketones or an aldehyde &amp; a ketone depending on the structure of the alkene.</p> <p>The oxygenated carbons in carbonyl compound obtained by ozonolysis are that were joined by double bond in the original alkene. Suppose an alkenes on ozonolysis gives the carbonyl compounds.</p> $\begin{array}{ccc} \text{CH}_3 & & \text{H} \\   & &   \\ \text{I} & & \text{I} \\ \text{H}_3\text{C}-\text{C}=\text{O} & \quad \& \quad & \text{O}=\text{C}-\text{CH}_3 \end{array}$		
6-b	<p><b>Reimer Tiemann reaction-</b></p> <p><b>Reimer-Tiemann reaction :</b> When refluxed with chloroform and alkali, phenol yields o- and p-hydroxybenzaldehyde, the former predominating.</p>  <p>Reimer-Tiemann reaction involves electrophilic substitution on the highly reactive phenoxide ring. The electrophile is dichloromethylene, <math>\text{CCl}_2</math>, generated from chloroform by the action of base. Although electrically neutral, dichloromethylene contains a carbon atom with only a sextet of electrons and hence is strongly electrophilic.</p> $\text{OH}^- + \text{CHCl}_3 \rightleftharpoons \text{H}_2\text{O} + \text{:}\ddot{\text{C}}\text{Cl}_3 \longrightarrow \text{Cl}^- + \text{:}\text{CCl}_2$  <p>Similarly, with carbon tetrachloride and alkali, o- and p-hydroxybenzoic acid is obtained.</p> 	4	4
6-c	Gaseous chlorine or bromine adds to acetylene even in dark to form dihalides &	4	4

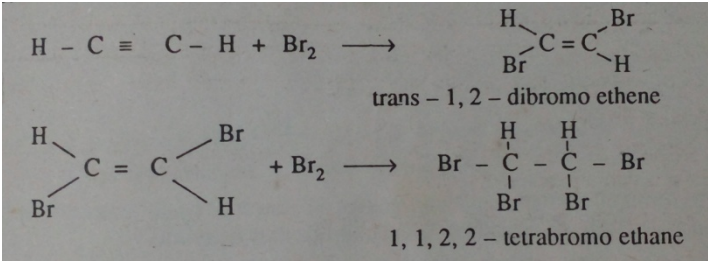




**SUMMER-16 EXAMINATION**  
**Model Answer**

Subject code :(17312)

Page 25 of 26

	<p>tetrahalides.</p> <p>Bromine adds to acetylene in two steps ,first to give trans-1,2-dibromo ethane(acetylene dibromide) &amp; finally to give 1,1,2,2-tetra bromo ethane(acetylene tetrabromide)</p>  <p><math display="block">\text{H} - \text{C} \equiv \text{C} - \text{H} + \text{Br}_2 \longrightarrow \begin{array}{c} \text{H} \quad \text{Br} \\ \diagdown \quad / \\ \text{C} = \text{C} \\ / \quad \diagdown \\ \text{Br} \quad \text{H} \end{array}</math><p style="text-align: center;">trans - 1, 2 - dibromo ethene</p><math display="block">\begin{array}{c} \text{H} \quad \text{Br} \\ \diagdown \quad / \\ \text{C} = \text{C} \\ / \quad \diagdown \\ \text{Br} \quad \text{H} \end{array} + \text{Br}_2 \longrightarrow \begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{Br} - \text{C} - \text{C} - \text{Br} \\   \quad   \\ \text{Br} \quad \text{Br} \end{array}</math><p style="text-align: center;">1, 1, 2, 2 - tetrabromo ethane</p></p>		
6-d	<p>Indicator-color in acidic solution</p> <ol style="list-style-type: none"><li>1. phenolphthalein- colorless</li><li>2. Methyl orange- red</li><li>3. Bromophenol blue- yellow</li><li>4. Methyl red- red</li></ol>	1 mark each	4
6-e	<p>vapor pressure of a solution containing non volatile solute</p> <p>if a non volatile solute is added to volatile solvent the vapour pressure of the solution is lower than the vapour pressure of pure component, glucose is non volatile and water is volatile.</p> <p>The surface of a pure solvent is populated only by solvent molecules therefore its easier for them to escape .</p> <p>but when glucose is present only solvent molecules volatile They alone can escape to build up the vapor pressure of the solution</p>	4	4
6-f	<p>1. aliphatic compounds are open chain compounds, whereas aromatic compounds are closed chain compounds</p>	1 mark for any1	4



**SUMMER-16 EXAMINATION**  
**Model Answer**

Subject code :(17312)

Page **26** of **26**

<p>2. aromatic hydroxy compounds (phenol) are acidic, whereas aliphatic hydroxyl compounds( alcohols) are neutral</p> <p>3. Aromatic compounds give nitro derivatives, when heated with Concentrated nitric acid.</p> <p>In case of aliphatic compounds, the nitro derivatives are not formed easily</p> <p>4. Aromatic halogen compounds are much less reactive than aliphatic halogen compounds</p> <p>5. Aromatic compounds- Benzene</p> <p>Aliphatic compounds- Alkanes, alkenes, alkynes</p>		
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