



WINTER-17 EXAMINATION
Model Answer

Subject title: Industrial Chemistry

Subject code : 17312

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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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Q No.	Answer	marks
1	Any 10	20
1-a	Homologous series: Compounds within a homologous series typically have a fixed set of functional groups that gives them similar chemical and physical properties. (For example, the series of primary straight-chained alcohols has an hydroxyl at the end of the carbon chain.) These properties typically change gradually along the series, and the changes can often be explained by mere differences in molecular size and mass.	2
1-b	i) neo pentane, 2 dimethyl propane ii) butyric acid, butanoic acid	1 1
1-c	Physical properties of Alkane:(any 2) 1) First four members(C1 to C4) of alkane are gases,next thirteen members (C5 to C17) are colourless liquids and higher alkanes are solids. 2) Liquid alkanes are lighter than water. 3) Alkanes are insoluble in water but freely soluble in organic solvent. 4) Boiling point and specific gravity increases with increase in molecular weight.	1 mark each
1-d	Nitration: Nitration is a general class of chemical process for the introduction of a nitro group into an organic chemical compound. Reduction: A chemical reaction in which hydrogen is added to, or oxygen is removed from,	1 1



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	a compound. Opposite of oxidation.											
1-e	Differences between alkanes & alkenes(any two) <table border="1"><thead><tr><th>alkanes</th><th>alkenes</th></tr></thead><tbody><tr><td>The general formulae alkanes C_nH_{2n+2}.</td><td>The general formulae C_nH_{2n} for alkenes .</td></tr><tr><td>uses:1.Alkanes are used in domestic fuel (natural gas) 2. Methane is used in manufacturing of carbon black.</td><td>uses: 1.As an antiseptic 2. Manufacturing of drugs like aspirin</td></tr><tr><td>these are saturated hydrocarbons with single carbon –carbon bonds</td><td>these are unsaturated hydrocarbons with double carbon –carbon bonds</td></tr><tr><td>ex. methane,ethane.etc</td><td>ex. ethane,propene etc</td></tr></tbody></table>	alkanes	alkenes	The general formulae alkanes C_nH_{2n+2} .	The general formulae C_nH_{2n} for alkenes .	uses:1.Alkanes are used in domestic fuel (natural gas) 2. Methane is used in manufacturing of carbon black.	uses: 1.As an antiseptic 2. Manufacturing of drugs like aspirin	these are saturated hydrocarbons with single carbon –carbon bonds	these are unsaturated hydrocarbons with double carbon –carbon bonds	ex. methane,ethane.etc	ex. ethane,propene etc	1 mark each
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ex. methane,ethane.etc	ex. ethane,propene etc											
1-f	Preparation of benzene From phenol Phenol when heated with zinc dust gives benzene. $C_6H_5OH + Zn \rightarrow C_6H_6 + ZnO$	2										
1-g	Uses of aromatic compounds: (Any 2) <ol style="list-style-type: none">1. Aromatic compounds are used to produce a range of important chemicals and polymers, including styrene, phenol, aniline, polyester and nylon2. Other aromatic compounds play key roles in the biochemistry of all living things3. A common solvent, able to dissolve paints, paint thinners, silicone sealants, many chemical reactants, rubber, printing ink, adhesives (glues), lacquers, leather tanners, and disinfectants.	1 mark each										



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	<p>4. It can also be used as a fullerene indicator, and is a raw material for toluene diisocyanate (used in the manufacture of polyurethane foam) and TNT..</p> <p>5. Toluene can be used as an octane booster in gasoline fuels used in internal combustion engines</p>	
1-h	<p>The difference between aliphatic and aromatic compound : (any 2)</p> <ol style="list-style-type: none">1. Aromatic compounds are ring or close chain compounds, whereas aliphatic compounds are open chain compounds.2. Aromatic compounds gives nitro-derivative with conc. HNO_3, aliphatic compounds does not give nitro-derivative easily.3. Aromatic compounds have larger % of carbon than aliphatic compounds.4. Aromatic radicals are acidic in nature whereas aliphatic radicals are basic.5. Aromatic compounds shows name reactions like Friedel-craft's reaction, perkin reaction. Aliphatic compounds does not show this reactions.6. Aromatic halogen compounds are less active than aliphatic compounds.	1 mark each
1-i	<p>Sulphonation:</p> <p>When Benzene is treated with hot conc. Sulphuric acid then formation of Benzene Sulphonic acid takes place</p>  <p><chem>c1ccccc1.O=S(=O)(O)O>>c1ccc(cc1)S(=O)(=O)O.O</chem></p>	2
1-j	<p>Grignard reagent :</p> <p>A Grignard reagent has a formula RMgX where X is a halogen, and R is an</p>	



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	<p>1. Obey Raoult's law at every range of concentration.</p> <p>2. $\Delta H_{mix} = 0$; neither heat is evolved nor absorbed during dissolution.</p> <p>3. $\Delta V_{mix} = 0$; total volume of solution is equal to sum of volumes of the components.</p> <p>4. $P = p_A + p_B = p_A^0 X_A + p_B^0 X_B$ i.e., $p_A = p_A^0 X_A$; $p_B = p_B^0 X_B$</p> <p>5. $A-A, A-B, B-B$ interactions should be same, i.e., 'A' and 'B' are identical in shape, size and character.</p>									
2	Any 4	16								
2-a	<p>Differences between organic & inorganic compounds: (any 4)</p> <table><thead><tr><th><u>Organic Compounds</u></th><th><u>Inorganic Compounds</u></th></tr></thead><tbody><tr><td>1) Usually always contain carbon, especially carbon-hydrogen bonds</td><td>1) May contain carbon. Contain metal and other elements. Does not contain carbon-hydrogen bonds.</td></tr><tr><td>2) Generally found in living matter, i.e., animals and plants.</td><td>2) Generally obtained from non-living matter, i.e., minerals.</td></tr><tr><td>3) Lower melting and boiling points</td><td>3) Higher melting and boiling points</td></tr></tbody></table>	<u>Organic Compounds</u>	<u>Inorganic Compounds</u>	1) Usually always contain carbon, especially carbon-hydrogen bonds	1) May contain carbon. Contain metal and other elements. Does not contain carbon-hydrogen bonds.	2) Generally found in living matter, i.e., animals and plants.	2) Generally obtained from non-living matter, i.e., minerals.	3) Lower melting and boiling points	3) Higher melting and boiling points	1 mark each
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	<p>4) Insoluble in water, soluble in organic solvents</p> <p>5) Highly inflammable and volatile</p> <p>6) Poorer conductors of heat and electricity in aqueous solutions</p> <p>7) Produces more complex set of products during reaction</p> <p>8) Classified into many classes on the basis of functional groups, known as homologous series. Each class is represented by a general formula and the members show similar properties.</p> <p>9) Examples: methane, ethane, acetylene, alcohols, carbon tetrachloride (CCl₄), urea</p>	<p>4) Readily soluble in water, insoluble in organic solvents</p> <p>5) Not inflammable and non-volatile</p> <p>6) Better conductors of heat and electricity in aqueous solutions</p> <p>7) Produces less complex set of products during reaction</p> <p>8) Classified as acids, bases and salts. No homologous series found</p> <p>9) Examples: carbon dioxide, sulphuric acid, NaCl, diamond (pure carbon)</p>	
2-b	<p>Nomenclature of organic compounds: (any 4)</p> <p>1. Select the longest continuous chain of carbon atoms, it is known as main or parent chain & other chains attached to it are known as side chains. The no. of</p>		1 mark each



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carbon atoms present in main chain determines the parent name of hydrocarbon.

C

1

C-C-C-C-C-C-C

2. Number the c atoms of parent chain from the end which gives smallest possible no the carbon carrying the branches.

C

1

C-C-C-C-C-C-C

1 2 3 4 5 6 7

3. Prefix the name of substituent to the name of parent hydrocarbon & indicate its position on parent chain.

CH₃

1

CH₃-CH₂-CH-CH₂-CH₂-CH₂-CH₃

3-methyl heptane

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.

CH₃ C₂H₅

1 1

H₃C-CH-CH-CH₂-CH₂-CH₂-CH₃

3-ethyl-2-methyl heptane

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.

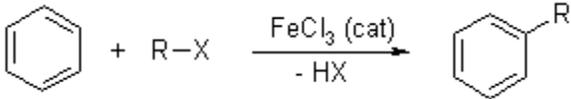
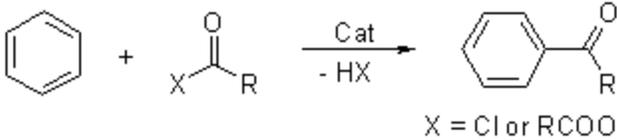


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	<p>cracking</p> $\text{CH}_3\text{-CH}_3 \xrightarrow{500^\circ\text{C}} \text{CH}_2 = \text{CH}_2 + \text{CH}_4 + \text{H}_2$ <p>Ethane Ethylene methane</p>	2
2-e	<p>Friedel-Crafts Alkylation</p>  <p>This Lewis acid-catalyzed electrophilic aromatic substitution allows the synthesis of alkylated products via the reaction of arenes with alkyl halides or alkenes. Since alkyl substituents activate the arene substrate, polyalkylation may occur. A valuable, two-step alternative is Friedel-Crafts Acylation followed by a carbonyl reduction.</p> <p>Friedel-Crafts Acylation</p>  <p>X = Cl or RCOO</p> <p>This electrophilic aromatic substitution allows the synthesis of monoacylated products from the reaction between arenes and acyl chlorides or anhydrides. The products are deactivated, and do not undergo a second substitution. Normally, a stoichiometric amount of the Lewis acid catalyst is required, because both the substrate and the product form complexes.</p>	2



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2-f	<p>1) Redox, intermolecular forces, alcohols, ketones, aldehydes, carboxylic acids and chemical tests.</p> <p>We can use acidified potassium dichromate ($K_2Cr_2O_7$) solution to distinguish between primary, secondary and tertiary alcohols. Primary alcohols are oxidised to aldehydes and the carboxylic acids</p> <p>Secondary alcohols are oxidised to ketones.</p> <p>Tertiary alcohols cannot be oxidised by the dichromate ions.</p> <p>Dichromate ions ($Cr_2O_7^{2-}$) are orange. On reduction Cr^{3+} ions are formed which are green.</p> <p>the tertiary alcohol remaining an orange colour whilst the secondary and tertiary alcohols would be oxidised and in doing so, the dichromate ions would be reduced to give a green solution.</p> <p>2) To distinguish between primary and secondary alcohols you would use either Tollen's reagent or Fehlings solution.</p> <p>The unknown alcohol would first need to be oxidised to either the ketone or the aldehyde.</p> <p>Tollens or Fehlings would be added. Aldehydes will react. Ketones will not react.</p> <p>For Tollens reagent, a positive result produces a Silver mirror.</p> <p>3) Lucas test in alcohols is a test to differentiate between <u>primary, secondary, and tertiary alcohols</u>. It is based on the difference in reactivity of the three classes of alcohols with hydrogen <u>halides</u> via an <u>S_N1 reaction</u>.^[3]</p> $ROH + HCl \rightarrow RCl + H_2O$	4
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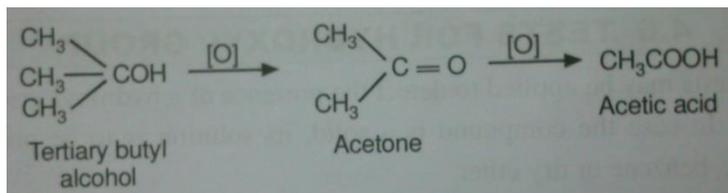
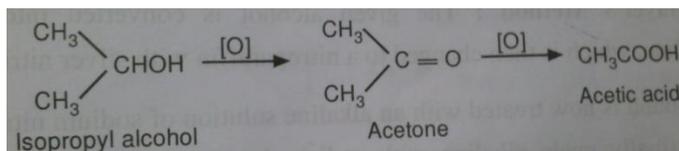
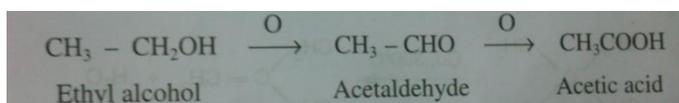
The differing reactivity reflects the differing ease of formation of the corresponding carbocations. Tertiary carbocations are far more stable than secondary carbocations, and primary carbocations are the least stable.

OR

A primary alcohol is easily oxidized to an aldehyde and then to an acid, both containing the same no. of carbon atoms, as the original alcohol for e.g. ethyl alcohol is oxidized to acetaldehyde which is further oxidized to acetic acid.

A secondary alcohol on oxidation gives first a ketone with the same no. of carbon atoms as original alcohol. Ketones are difficult to oxidized but on prolonged action of oxidizing agent, these are oxidized to an acid or a mixture of acids. e.g. Isopropyl alcohol gives first acetone & then acetic acid.

A tertiary alcohol is resistant to oxidation in neutral or alkaline solution but is readily oxidized by an acid oxidizing agent to give a mixture of ketone & acid each with fewer no. of carbon atoms than the original alcohol. The oxidizing agents usually used are acid dichromate, acid or alkaline potassium permanganate & dilute nitric acid. Thus oxidizing the alcohol & analyzing the products of oxidation will indicate whether it is primary, secondary or tertiary alcohol.





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	Methyl bromide ethane <i>Any other method should be given marks</i>	
3-c	Preparation of benzene : 1) By heating an aromatic acid or its sodium salt with sodalime (Removal of COOH group) $C_6H_5COONa + NaOH \rightarrow C_6H_6 + Na_2CO_3$ Sodium benzoate benzene 2) By the hydrolysis of sulphonic acid with superheated steam $C_6H_5SO_3H + H_2O \rightarrow C_6H_6 + H_2SO_4$ Benzene sulphonic acid benzene	2 2
3-d	Preparation of monohydric phenol: 1) By fusing sodium sulphonate with sodium hydroxide- $C_6H_5SO_3Na + NaOH \rightarrow C_6H_5OH + Na_2SO_3$ 2) By heating chlorobenzene with sodium hydroxide at about 300 ^o c in the presence of copper salts . $C_6H_5Cl + NaOH \rightarrow C_6H_5OH + NaCl$ <i>Any other method should be given marks</i>	2 marks each for any 2
3-e	Action of alcohol i) With PCl_3 The hydroxyl group is replaced by the corresponding halogen atom & an alkyl halide is formed. $3C_2H_5OH + PCl_3 \rightarrow 3 C_2H_5Cl + H_3PO_3$ ii) When ethanol reacted with PCl_5 alkyl halide is formed. $C_2H_5OH + PCl_5 \rightarrow C_2H_5Cl + POCl_3 + HCl$	2 2
3-f	Quinonoid theory: This theory explains the color changes in titrations on the	4

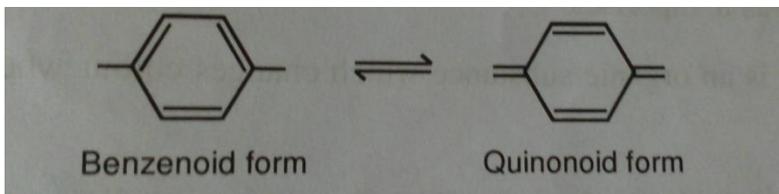


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	<p>basis of intramolecular changes.</p> <p>This theory believes that-</p> <ol style="list-style-type: none">1. An acid base indicator is either a weak acid or a weak base.2. An indicator consists of an equilibrium mixture of at least two tautomeric forms one is benzenoid while the other is Quinonoid form.3. The two forms possess different colors.4. Out of these forms, one exists in an acid solution & the other form exists in an alkaline solution.5. The Quinonoid form is generally deeper in colour than benzenoid form.6. As the PH of the solution containing an indicator changes one form of the indicator changes to the other & as a result of this the solution shows a change of colour <p>There are two tautomeric forms of methyl orange .The Quinonoid form (red form)exists in an acidic solution & 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 theQuinonoid form & imparts pink color to the solution.</p>  <p>Benzenoid form Quinonoid form</p>	
4	Any 4	16
4-a	<p>i) Closed chain compound: These compounds contain closed chains of carbon atoms joined together in the molecule .They are also called as cyclic compounds or ring compounds. e.g. benzene, thiophene</p> <p>They are further classified as homocyclic & heterocyclic compounds.</p>	2



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	<p>Homocyclic compounds are further classified as alicyclic compounds e.g. cyclopropane & aromatic compounds e.g. benzene</p> <p>(ii) Melting point –It is the temperature at which it changes state from solid to liquid at atmospheric pressure .Organic compounds usually have low melting points because of their covalent nature.</p> <p>M.P. of benzoic acid-122⁰c,naphthalene-80⁰c</p>	2
4-b	<p>Preparation of alkyne by dehydrohalogenation of vicinal dihalide .</p> <p>: Acetylene can be prepared by the elimination of two molecules of hydrogen halide(HX) from a vicinal 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> $\begin{array}{c} \text{H}_2\text{C}-\text{Br} \\ \\ \text{H}_2\text{C}-\text{Br} \end{array} \xrightarrow[\text{-HX}]{\text{KOH (alcoholic)}} \begin{array}{c} \text{CH}_2 \\ \\ \text{HC}-\text{Br} \end{array} \xrightarrow{\text{NaNH}_2} \begin{array}{c} \text{CH} \\ \\ \text{CH} \end{array}$ <p>1,2-dibromoethane ethyne (acetylene)</p>	4
4-c	<p>Nitration of benzene: Substitution of a nitro group (-NO₂) for a hydrogen atom of benzene nucleus is known as nitration. It is usually carried out with a nitrating mixture (sulfuric acid + nitric acid) at about 323 K.</p> $\text{C}_6\text{H}_6 + \text{HNO}_3 \rightarrow \text{C}_6\text{H}_5\text{NO}_2 + \text{H}_2\text{O}$ <p>Benzene nitrobenzene</p>	2 2
4-d	<p>Classification of alcohols:</p> <p>Alcohols are classified according to the no.of hydroxyl group present .e.g. alcohol containing one hydroxyl group are called monohydric while others</p>	4



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	<p>by the vapour of both the solute & the solvent. A straight line is obtained when p is plotted again X_A or X_B. The broken lines give partial pressures versus composition. The solid line gives the variation of total vapour pressure with the mole fraction.</p> <p>Liquid pairs that obey the Raoult's law are called ideal solutions, some such typical liquid pairs, which obeys the Raoult's law are, benzene + toluene, benzene+ ether.</p>	
4-f	<p>Ostwald's theory for indicator: This theory is based on the phenomenon of ionization. According to this theory an acid-base indicator is a weak organic acid or a weak organic base. These acid-base indicators ionize to liberate a small no. of H^+ ions or OH^- ions. The indicators have different colours in the undissociated & dissociated form. The colour imparted to the solution by the indicator depends upon the relative proportions of the dissociated molecule & the ions provided by the indicator, on dissociation in the solution.</p> <p>Consider that the indicator to be used be an acid of chemical formula HIn. It dissolves in water & dissociate to some extent. The ionization of HIn in solution can be represented as</p> <div data-bbox="289 1402 1024 1667" data-label="Chemical-Block">$\begin{array}{ccccc} HIn & \rightleftharpoons & H^+ & + & In^- \\ \text{(colour P)} & & \text{(colourless)} & & \text{(colour R)} \end{array}$<p>above equilibrium, we can write</p>$K_{In} = \frac{[H^+][In^-]}{[HIn]}$</div>	4
	<p>Where K_{In} is indicator dissociation constant. The undissociated molecule HIn has one color say colour p & the In^- has another colour R. The actual colour imparted by the indicator will depend upon the hydrogen ion conc. of the</p>	



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	<p>solution to which it is added. If the solution is acidic, the equilibrium in the above reaction will shift towards the left. The dissociation of HIn will be suppressed, there will be large conc. Of H⁺ & so indicator shows the colour P.(acidic colour) If the solution is alkaline ,the equilibrium shift towards the right. There will be large conc. Of In⁻ ions & the indicator will show the colourR(basic colour)Thus the above dissociation reaction explains the change of colours of an indicator when the solution changes from acidic to alkaline condition.</p>																						
5	Any 4	16																					
5-a	<p>An organic compound is any member of a large class of gaseous, liquid, or solid chemical compounds whose molecules contain carbon.</p> <p><i>Functional Group Name</i> <i>Example (any 2)</i></p> <table><tr><td>$\begin{array}{c} \\ -C- \\ \end{array}$</td><td>Alkane</td><td>CH₃CH₂CH₃ (propane)</td></tr><tr><td>C=C</td><td>Alkene</td><td>CH₃CH=CH₂ (propene)</td></tr><tr><td>C≡CH</td><td>Alkyne</td><td>CH₃C≡CH (propyne)</td></tr><tr><td>F, Cl, Br, or I</td><td>Alkyl halide</td><td>CH₃Br (methyl bromide)</td></tr><tr><td>—OH</td><td>Alcohol</td><td>CH₃CH₂OH (ethanol)</td></tr><tr><td>—O—</td><td>Ether</td><td>CH₃OCH₃ (dimethyl ether)</td></tr><tr><td>—NH₂</td><td>Amine</td><td>CH₃NH₂ (methyl amine)</td></tr></table>	$\begin{array}{c} \\ -C- \\ \end{array}$	Alkane	CH ₃ CH ₂ CH ₃ (propane)	C=C	Alkene	CH ₃ CH=CH ₂ (propene)	C≡CH	Alkyne	CH ₃ C≡CH (propyne)	F, Cl, Br, or I	Alkyl halide	CH ₃ Br (methyl bromide)	—OH	Alcohol	CH ₃ CH ₂ OH (ethanol)	—O—	Ether	CH ₃ OCH ₃ (dimethyl ether)	—NH ₂	Amine	CH ₃ NH ₂ (methyl amine)	2 1 mark each
$\begin{array}{c} \\ -C- \\ \end{array}$	Alkane	CH ₃ CH ₂ CH ₃ (propane)																					
C=C	Alkene	CH ₃ CH=CH ₂ (propene)																					
C≡CH	Alkyne	CH ₃ C≡CH (propyne)																					
F, Cl, Br, or I	Alkyl halide	CH ₃ Br (methyl bromide)																					
—OH	Alcohol	CH ₃ CH ₂ OH (ethanol)																					
—O—	Ether	CH ₃ OCH ₃ (dimethyl ether)																					
—NH ₂	Amine	CH ₃ NH ₂ (methyl amine)																					

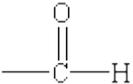
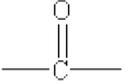
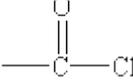
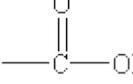
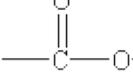
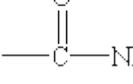


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	 <p>Aldehyde CH_3CHO (acetaldehyde)</p>  <p>Ketone CH_3COCH_3 (acetone)</p>  <p>Acyl chloride CH_3COCl (acetyl chloride)</p>  <p>Carboxylic acid $\text{CH}_3\text{CO}_2\text{H}$ (acetic acid)</p>  <p>Ester $\text{CH}_3\text{CO}_2\text{CH}_3$ (methyl acetate)</p>  <p>Amide CH_3NH_2 (acetamide)</p>	
5-b	<p>Uses of aromatic compounds: (any 2)</p> <ol style="list-style-type: none">1. Aromatic compounds are used to produce a range of important chemicals and polymers, including styrene, phenol, aniline, polyester and nylon2. Other aromatic compounds play key roles in the biochemistry of all living things3. A common solvent, able to dissolve paints, paint thinners, siliconesealants, many chemical reactants, rubber, printing ink, adhesives (glues), lacquers, leather tanners, and disinfectants.4. It can also be used as a fullerene indicator, and is a raw material for toluene diisocyanate (used in the manufacture of polyurethane foam) and TNT..5. Toluene can be used as an octane booster in gasoline fuels used in internal	1 mark each



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	<p>combustion engines</p> <p>Uses of phenol : (any 2)</p> <ol style="list-style-type: none"> 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. <p>Phenol is active against a wide range of microorganisms, and there are some medical and pharmaceutical applications including topical anaesthetic</p>	<p>1 mark each</p>
<p>5-c</p>	<p>(i) Primary alcohols are obtained with dry oxygen or formaldehyde.</p> $\text{RMgBr} + \frac{1}{2} \text{O}_2 \longrightarrow \begin{array}{c} \text{H} \\ \\ \text{RO} \end{array} \begin{array}{c} \text{OH} \\ \\ \text{MgBr} \end{array} \xrightarrow{\text{H}_2\text{O}} \text{ROH} + \text{Mg} \begin{array}{c} \text{OH} \\ \\ \text{Br} \end{array} \quad (\text{v.g.})$ $\text{H}_2\text{C}=\text{O} + \text{RMgI} \longrightarrow \text{RCH}_2-\begin{array}{c} \text{H} \\ \\ \text{O} \end{array} \begin{array}{c} \text{OH} \\ \\ \text{MgI} \end{array} \xrightarrow{\text{H}_2\text{O}} \text{RCH}_2\text{OH} \quad (\text{g.})$ <p style="text-align: center;"> Formaldehyde Grignard's reagent Addition product Alcohol (Primary) </p> <p>(ii) Secondary alcohols are prepared with aldehydes other than formaldehyde.</p> $\text{RCH}=\text{O} + \text{R}'\text{MgI} \longrightarrow \begin{array}{c} \text{R} \\ \diagdown \\ \text{CH} \\ \diagup \\ \text{R}' \end{array} \begin{array}{c} \text{H} \\ \\ \text{O} \end{array} \begin{array}{c} \text{OH} \\ \\ \text{MgI} \end{array} \xrightarrow{\text{H}_2\text{O}} \begin{array}{c} \text{R} \\ \diagdown \\ \text{CHOH} \\ \diagup \\ \text{R}' \end{array} \quad (\text{f.g.g.})$ <p style="text-align: center;"> Aldehyde Grignard's reagent Addition product Alcohol (Secondary) </p>	<p>4</p>

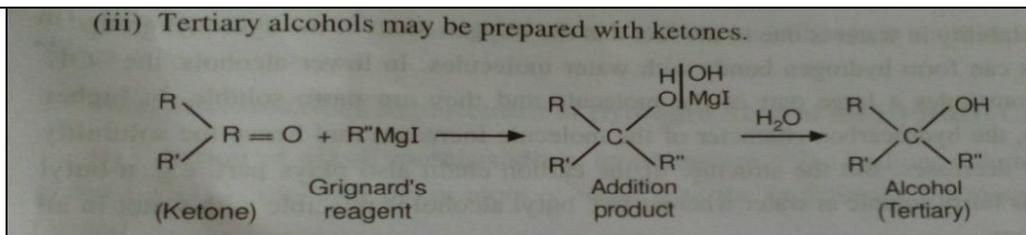


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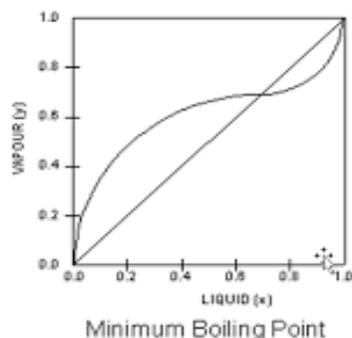
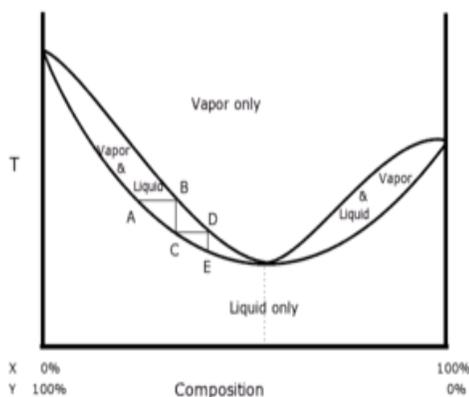


5-d

Minimum boiling azeotrope :

Minimum boiling azeotrope is mixture of some definite composition which boils at a definite temperatures which is lower than the boiling point of both the component of the solution.

Example : Water ethanol system boils at a temperature 78.1°C , which is lower than the boiling point of both components. Water (100°C), & ethanol (78.3°C)



2

2marks
for any
one
diagram

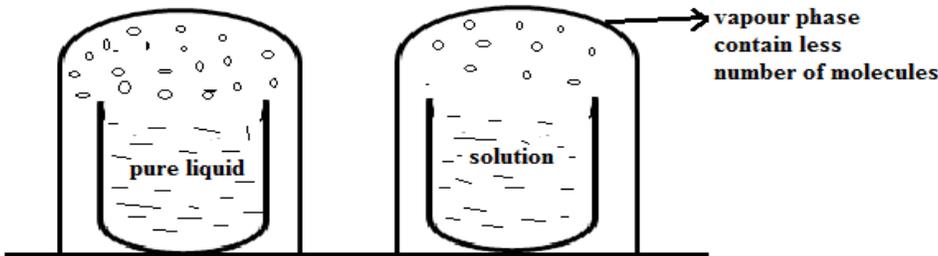


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5-e	<p>Vapour pressure of solvent is lowered by addition of non-volatile solute :</p> <p>If a non-volatile solute is added to a volatile liquid, the vapour pressure of the solution is lower than the vapour pressure of pure solvent.</p>  <p>In pure liquid, the whole, surface of the liquid is occupied by the molecules of the liquid. In case of solution , a part of surface of the solution is occupied by the solute particles. This decreases number of molecules of liquid at the surface of the solution. This reduces escaping tendency of solvent molecules, thereby lowering vapour pressure of the liquid (solvent)</p>	4
5-f	<p>Action of water on acetylene: one molecule o water gets added to acetylene.when passed through a dilute solution of sulphuric acid containing small amount of mercury sulphate it produces aldehyde.</p> $\text{H-C}\equiv\text{C-H} + \text{H}_2\text{O} \longrightarrow \text{H}_2\text{C=CHOH} \longrightarrow \begin{array}{c} \text{CH}_3\text{-C=O} \\ \\ \text{H} \end{array}$ <p>ACETYLENE Vinyl alcohol Acetaldehyde</p> <p>Action of sulphuric acid on acetylene: sulphuric acid absorbs acetylene to give ethylidene hydrogen sulphate.</p> <p style="text-align: right;">H</p>	2

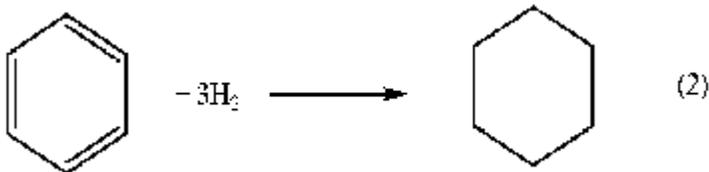
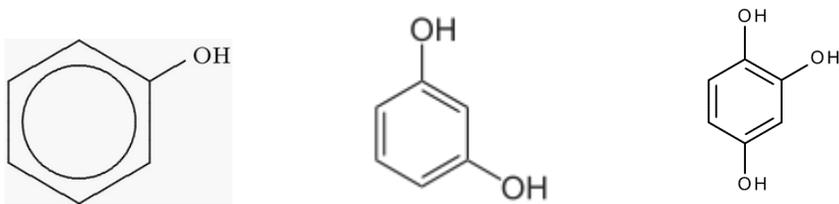


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	$\text{H}-\text{C}\equiv\text{C}-\text{H} + \text{H}_2\text{SO}_4 \longrightarrow \text{H}_2\text{C}=\text{CHOSO}_3\text{H} \longrightarrow \begin{array}{c} \text{H}_3\text{C}-\text{C}-\text{OSO}_3\text{H} \\ \text{OSO}_3\text{H} \end{array}$ <p>Acetylene ethylidene hydrogen sulphate</p>	2
6	Any four	16
6-a	preparation of cyclohexane from benzene: six membered cycloalkanes can be prepared by the catalytic reduction of benzene and its derivatives.	2
		2
6-b	Aromatic Hydroxy compound: 1) Depends on number of hydroxy group attached to benzene ring aromatic hydroxy compounds are classified as monohydric, dihydric and trihydric as they contain one, two and three hydroxyl group	2
		
	2) Those containing the hydroxyl group in the side chain are term as aromatic alcohols. These may be regarded as aryl derivatives of the aliphatic alcohols.	2

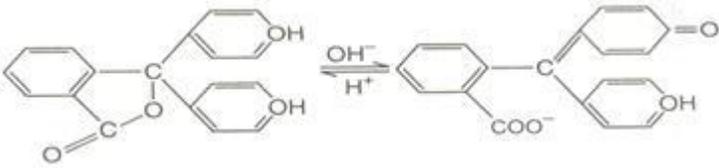


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	<p>Example :- Phenolphthalein (Hph) is a colourless weak acid. Methyl orange is a weak base.</p> <p>(ii) The acid-base indicators exist in two tautomeric forms having different structures. Two forms are in equilibrium. One form is termed benzenoid form and the other quinonoid form.</p> <p>The two forms have different colors. The color change is due to the interconversion of one tautomeric form into other.</p> <p>(c) One form mainly exists in acidic medium and the other in alkaline medium.</p> <p>Thus, during titration the medium changes from acidic to alkaline or vice-versa. The change in pH converts one tautomeric form into other and thus, the colour change occurs.</p> <p>Phenolphthalein has benzenoid form in acidic medium and thus, it is colourless while it has quinonoid form in alkaline medium which has pink colour.</p> 	2
6-e	<p>Ostwald's theory:</p> <p>Ostwald's theory considers indicator to be a weak acid or base whose unionised forms differently coloured. In presence of acid or base, i.e. pH change, there is ionization of indicator and hence the colour change appears.</p> <p>For example</p>	4



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	<p>phenolphthalein</p> <p>phenolphthalein is a weak acid (PhH)</p> $\text{PhH} \rightleftharpoons \text{Ph}^- + \text{H}^+ \dots\dots\dots(1)$ <p>(colourless (Pink in base) in acid)</p> $\text{H}^+ + \text{OH}^- \rightleftharpoons \text{H}_2\text{O}$ <p>In presence of an acid (H⁺) 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⁻ that can react with H⁺ of the phenolphthalein and can impart pink colour only after excess of weak base is added.</p>	
6-f	<p>Ethyl bromide and ethyl iodide with benzene:</p> <p>Friedel-Crafts Alkylation</p> $\text{C}_6\text{H}_6 + \text{R-X} \xrightarrow[\text{-HX}]{\text{FeCl}_3 \text{ (cat)}} \text{C}_6\text{H}_5\text{R}$ <p>This Lewis acid-catalyzed electrophilic aromatic substitution allows the synthesis of alkylated products via the reaction of arenes with alkyl halides or alkenes. Since alkyl substituents activate the arene substrate, polyalkylation may occur. Thus the higher aromatic compounds like toluene & xylene are formed.(R-X is ethyl bromide/ethyl iodide)</p>	4