

Latest Examination Papers, 2015

[All India Set-I, II, III]

General Instructions: As given in Examination Paper, Delhi 2015.

Set-I (All questions in 3 sets were same)

1. Write the formulae of any two oxoacids of sulphur. 1

Ans. H_2SO_4 and H_2SO_3 .

2. Write the IUPAC name of the given compound:



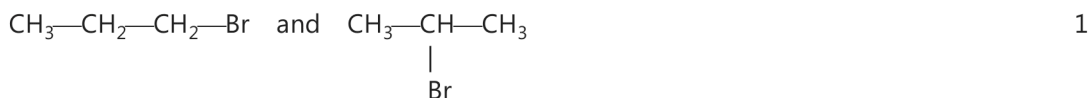
Ans. $\begin{array}{c} \text{CH}_3-\overset{3}{\text{C}}\text{H}-\overset{2}{\text{C}}\text{H}-\overset{1}{\text{C}}\text{H}_2-\text{OCH}_2\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$

1-Ethoxy-2-methyl propane.

3. A delta is formed at the meeting point of sea water and river water. Why? 1

Ans. Muddy river water is a colloidal solution, gets coagulated by electrolytes present in sea water.

4. Which would undergo $\text{S}_{\text{N}}1$ reaction faster in the following pair:



Ans. $\begin{array}{c} \text{CH}_3-\text{CH}-\text{CH}_3 \\ | \\ \text{Br} \end{array}$ will react faster.

5. What is the formula of a compound in which the element Y forms *ccp* lattice and atoms of X occupy $2/3^{\text{rd}}$ of tetrahedral voids? 1

Ans. Y forms *ccp*, therefore, $Y = 8 \times \frac{1}{8} = 1$

'X' occupies $2/3^{\text{rd}}$ of tetrahedral voids, therefore, No. of 'X' = $2 \times \frac{2}{3} = \frac{4}{3}$

\therefore Ratio = $X_{4/3} Y_1$

That is, X_4Y_3 is the formula of compound.

6. Write one similarity and one difference between the chemistry of lanthanoids and that of actinoids. 2

Ans. Similarity

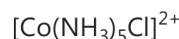
Lanthanoids show lanthanoid contraction like actinoids contraction.

Dissimilarity

Lanthanoids show mostly +3 oxidation state. Few show +2 and +4, whereas

Actinoids show +3, +4, +5, +6 and +7 oxidation state.

7. (i) Write down the IUPAC name of the following complex:



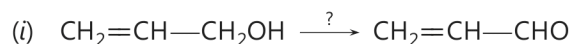
- (ii) Write the formula for the following complex:

Potassium tetrachloridonickelate (II) 2

- Ans.** (i) Pentaamminechlorido cobalt (III)

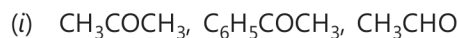


8. Write the reagents required in the following reactions:

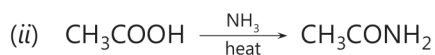
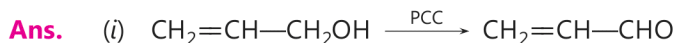


Or

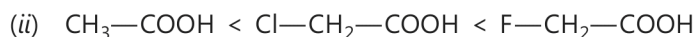
Arrange the following compounds in increasing order of their property as indicated:



(reactivity towards nucleophilic addition reaction)



Or



9. (i) On mixing liquid X and liquid Y, volume of the resulting solution decreases. What type of deviation from Raoult's law is shown by the resulting solution? What change in temperature would you observe after mixing liquids X and Y?

- (ii) What happens when we place the blood cell in water (hypotonic solution)? Give reason. 2

- Ans.** (i) The resulting solution will show negative deviation from Raoult's law.

The temperature of solution will increase.

- (ii) The cell will swell and even may burst due to inflow of solvent because of osmosis.

10. Calculate the time to deposit 1.27 g of copper at cathode when a current of 2 A was passed through the solution of CuSO_4 . 2

(Molar mass of Cu = 63.5 g mol^{-1} , $1 \text{ F} = 96500 \text{ C mol}^{-1}$)

Ans.

$$t = ?, \quad m = 1.27 \text{ g}, \quad I = 2 \text{ A}$$

$$m = Z \times I \times t$$

$$\Rightarrow 1.27 = \frac{\text{Eq. Wt}}{96500} \times 2 \times t.$$

$$\Rightarrow 1.27 \times 96500 = \frac{\text{Atomic Wt}}{\text{Valency}} \times 2 \times t.$$

$$\Rightarrow 1.27 \times 96500 = \frac{63.5}{2} \times 2 \times t$$

$$\Rightarrow t = \frac{1.27 \times 96500}{63.5} = \frac{127 \times 10 \times 96500}{100 \times 635}$$

$$\therefore t = 2 \times 965 = 1930 \text{ seconds.}$$

11. A solution is prepared by dissolving 10 g of non-volatile solute in 200 g of water. It has a vapour pressure of 31.84 mm Hg at 308 K. Calculate the molar mass of the solute. 3

(Vapour pressure of pure water at 308 K = 32 mm Hg)

Ans. Given:

$$W_B = 10 \text{ g}, \quad W_A = 200 \text{ g}, \quad P_A^0 = 32 \text{ mm}, \quad P_A = 31.84 \text{ mm.}$$

$$M_B = ?, \quad M_A = 18 \text{ g mol}^{-1}$$

$$\text{Now, } \frac{P_A^0 - P_A}{P_A^0} = x_B = \frac{\frac{W_B}{M_B}}{\frac{W_B}{M_B} + \frac{W_A}{M_A}}$$

$$\therefore \frac{W_B}{M_B} \ll \ll \frac{W_A}{M_A}$$

$$\therefore \frac{P_A^0 - P_A}{P_A^0} = \frac{W_B}{M_B} \times \frac{M_A}{W_A}$$

$$\Rightarrow \frac{32.00 - 31.84}{32} = \frac{10}{M_B} \times \frac{18}{200}$$

$$\Rightarrow M_B = \frac{180}{200} \times \frac{32}{0.16} = \frac{9}{10} \times \frac{32}{16} \times 100 = 180 \text{ g mol}^{-1}$$

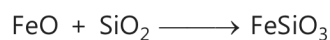
$$\therefore M_B = 180 \text{ g mol}^{-1}$$

12. (i) Name the method of refining to obtain silicon of high purity.
 (ii) What is the role of SiO_2 in the extraction of copper?
 (iii) What is the role of depressants in froth floatation process? 3

Ans.

(i) Zone refining

(ii) SiO_2 acts as a flux. It reacts with gangue (FeO) to form slag (iron silicate)



(iii) Depressants help separate two sulphide ores by froth floatation process, e.g. NaCN does not allow ZnS to enter froth but allows PbS.

13. (i) Which one of the following is a polysaccharide:

starch, maltose, fructose, glucose

(ii) Write one difference between α -helix and β -pleated sheet structures of protein.

(iii) Write the name of the disease caused by the deficiency of vitamin B₁₂. 3

Ans. (i) Starch

(ii) α -helix structure has intra-molecular H-bonding in polypeptide chains of globular proteins.

β -pleated structure has inter-molecular H-bonding between polypeptide chains of fibrous proteins.

(iii) Pernicious Anaemia.

14. (i) What type of isomerism is shown by the complex $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$?

(ii) On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_0 > P$.

(iii) Write the hybridization and shape of $[\text{CoF}_6]^{3-}$.

(Atomic number of Co = 27)

3

Ans. (i) Hydrate Isomerism.

(ii) $\Delta_0 > P$

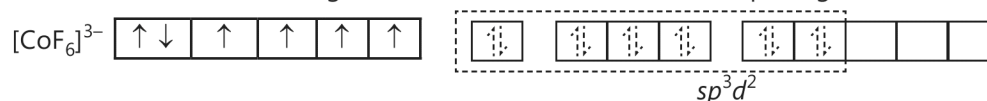
$t_{2g}^4 e_g^0$

(iii) $[\text{CoF}_6]^{3-}$

Co(27) : $[\text{Ar}] 4s^2 3d^7$

Co^{3+} : $[\text{Ar}] 4s^0 3d^6$

F^- is a weak field ligand, therefore, it does not cause pairing.



It has sp^3d^2 hybridization and octahedral shape.

15. How can the following conversions be carried out:

(i) Aniline to bromobenzene

(ii) Chlorobenzene to 2-chloroacetophenone

(iii) Chloroethane to butane

3

Or

What happens when

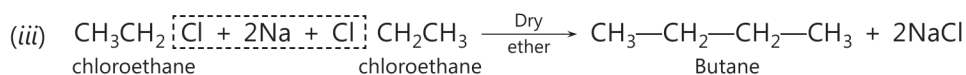
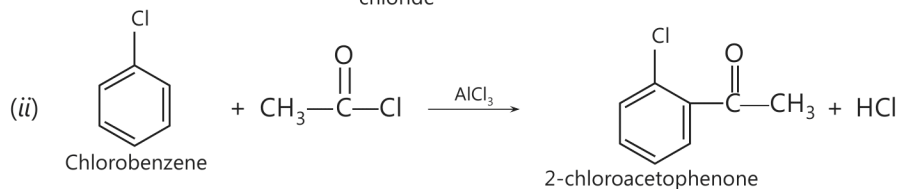
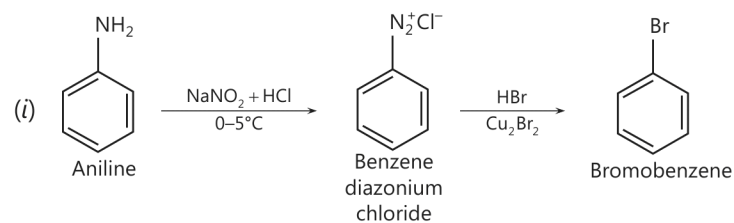
(i) Chlorobenzene is treated with $\text{Cl}_2/\text{FeCl}_3$,

(ii) ethyl chloride is treated with AgNO_2 ,

(iii) 2-bromopentane is treated with alcoholic KOH?

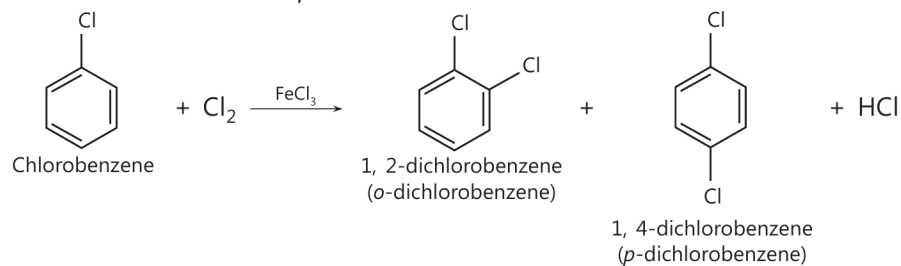
Write the chemical equations in support of your answer.

Ans.

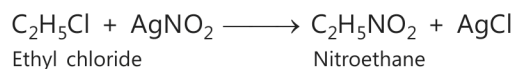


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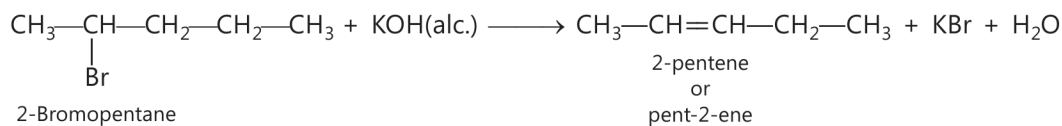
(i) *o*-dichlorobenzene and *p*-dichlorobenzene are formed.



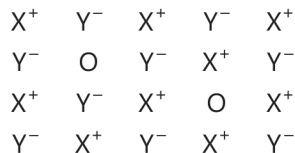
(ii) Nitroethane will be formed.



(iii) 2-pentene will be formed as major product.



16. Examine the given defective crystal:



Answer the following questions:

- Is the above defect stoichiometric or non-stoichiometric?
- Write the term used for this type of defect. Give an example of the compound which shows this type of defect.
- How does this defect affect the density of the crystal?

3

- Ans.** (i) It is stoichiometric defect.
(ii) Schottky defect. NaCl shows this type of defect.
(iii) Density of crystal decreases.

17. Conductivity of 2.5×10^{-4} M methanoic acid is 5.25×10^{-5} S cm^{-1} . Calculate its molar conductivity and degree of dissociation.

Given: $\lambda^0(\text{H}^+) = 349.5$ S $\text{cm}^2 \text{mol}^{-1}$ and $\lambda^0(\text{HCOO}^-) = 50.5$ S $\text{cm}^2 \text{mol}^{-1}$. 3

Ans.

$$\kappa = 5.25 \times 10^{-5} \text{ S cm}^{-1}, M = 2.5 \times 10^{-4} \text{ M.}$$

$$\lambda_{\text{HCOOH}}^0 = \lambda_{(\text{HCOO}^-)}^0 + \lambda_{\text{H}^+}^0$$

$$= 349.5 + 50.5 = 400 \text{ S cm}^2 \text{mol}^{-1}.$$

$$\therefore \Lambda_m = \frac{1000 \kappa}{M} = \frac{1000 \times 5.25 \times 10^{-5}}{2.5 \times 10^{-4}} = \frac{1000 \times 525}{10 \times 2.5 \times 100}$$

$$\Rightarrow \Lambda_m = \frac{525}{2.5} = \frac{5250}{25} = 210 \text{ S cm}^2 \text{mol}^{-1}$$

$$\lambda \quad \alpha = \frac{\Lambda_m}{\Lambda_m^0} = \frac{210}{400} = \frac{21}{40} = 0.525$$

$$\Rightarrow \alpha = 0.525 \times 100\% = 52.5\%$$

18. Write any three differences between Physisorption and Chemisorption. 3

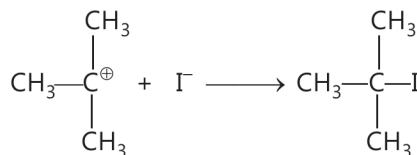
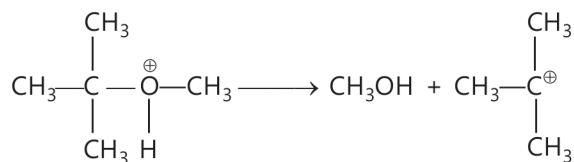
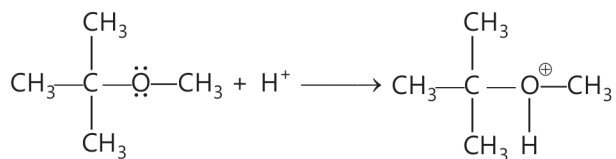
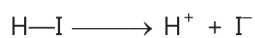
Physisorption	Chemisorption
(i) It is reversible. (ii) It has low heat of adsorption. (iii) It occurs at low temperature and decreases with increase in temperature.	(i) It is irreversible. (ii) It has high heat of adsorption. (iii) It occurs at moderate temperature. It first increases and then decreases with increase in temperature.

19. Give reasons for the following:

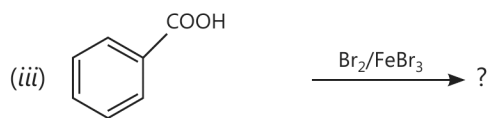
- (i) Phenol is more acidic than methanol.
(ii) The C—O—H bond angle in alcohols is slightly less than the tetrahedral angle ($109^\circ 28'$).
(iii) $(\text{CH}_3)_3\text{C—O—CH}_3$ on reaction with HI gives $(\text{CH}_3)_3\text{C—I}$ and $\text{CH}_3\text{—OH}$ as the main products and not $(\text{CH}_3)_3\text{C—OH}$ and $\text{CH}_3\text{—I}$. 3

- Ans.** (i) It is because phenoxide ions are stabilized by resonance, whereas methoxide ions are not.
(ii) It is due to repulsion between lone pair of electrons with bonded pair of electrons.

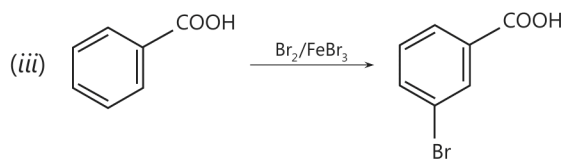
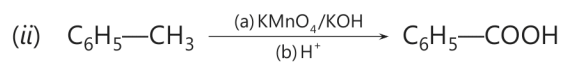
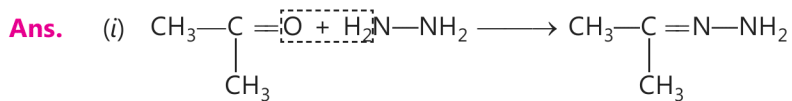
- (iii) It is because tert. carbocation is more stable which combines with I^- to form Tert. butyl iodide and methanol.



20. Predict the products of the following reactions:



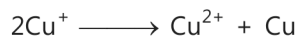
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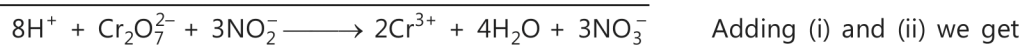
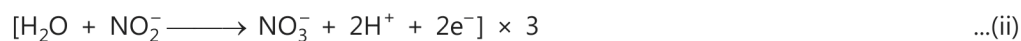
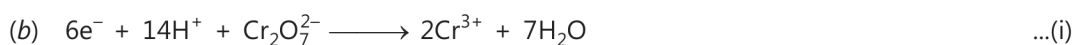
21. (a) Account for the following:
 (i) Cu^+ is unstable in an aqueous solution.
 (ii) Transition metals form complex compounds.
 (b) Complete the following equation:



- Ans. (a) (i) It is because hydration energy of Cu^{2+} overcomes 2nd ionisation enthalpy that is why Cu^+ changes to Cu^{2+} and Cu.



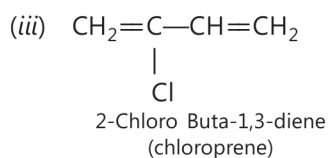
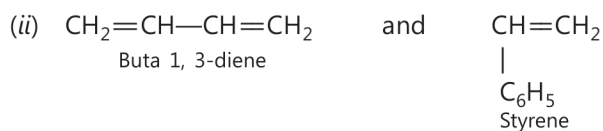
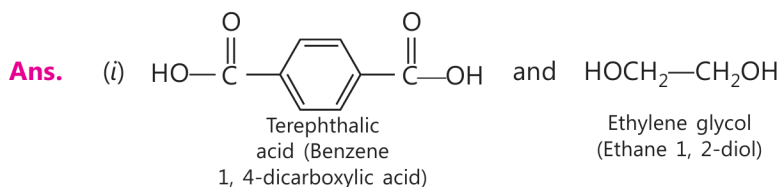
- (ii) It is due to small size, high charge and availability of vacant *d*-orbitals.



22. Write the names and structures of the monomers of the following polymers:

- (i) Terylene
 (ii) Buna-S
 (iii) Neoprene

3



23. Seeing the growing cases of diabetes and depression among young children, Mr. Chopra, the principal of one reputed school organized a seminar in which he invited parents and principals. They all resolved this issue by strictly banning junk food in schools and introducing healthy snacks and drinks like soup, lassi, milk, etc. in school canteens. They also decided to make compulsory half an hour of daily physical activities for the students in the morning assembly. After six months, Mr. Chopra conducted the health survey in most

of the schools and discovered a tremendous improvement in the health of the students.

After reading the above passage, answer the following questions:

- (i) What are the values (at least two) displayed by Mr. Chopra?
- (ii) As a student, how can you spread awareness about this issue?
- (iii) Why should antidepressant drugs not be taken without consulting a doctor?
- (iv) Give two examples of artificial sweeteners. 4

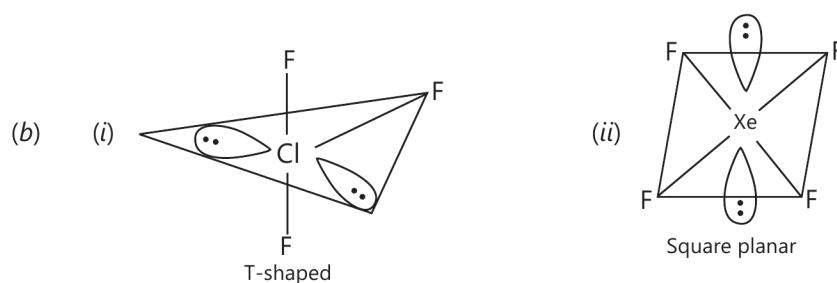
- Ans.**
- (i)
 - Mr. Chopra is genuinely concerned about the health of students and other people.
 - He has done positive efforts to improve the health of people. He is focused person to achieve his goals.
 - (ii)
 - By putting posters on school notice boards.
 - By discussing in meetings of parents as well as in resident welfare associations in various localities.
 - (iii) It is because these are habit forming (cause addiction) and their proper dose, duration must be decided by doctor as these can be fatal if taken in excess.
 - (iv) Alitame, Aspartame and Sucralose (Any two)

- 24.**
- (a) Account for the following:
 - (i) Acidic character increases from HF to HI.
 - (ii) There is a large difference between the melting and boiling points of oxygen and sulphur.
 - (iii) Nitrogen does not form pentahalide.
 - (b) Draw the structures of the following:
 - (i) ClF_3
 - (ii) XeF_4 5

Or

- (i) Which allotrope of phosphorus is reactive and why?
- (ii) How are the supersonic jet aeroplanes responsible for the depletion of ozone layer?
- (iii) F_2 has lower bond dissociation enthalpy than Cl_2 . Why?
- (iv) Which noble gas is used in filling balloons for meteorological observations?
- (v) Complete the following equation:
 $\text{XeF}_2 + \text{PF}_5 \longrightarrow$

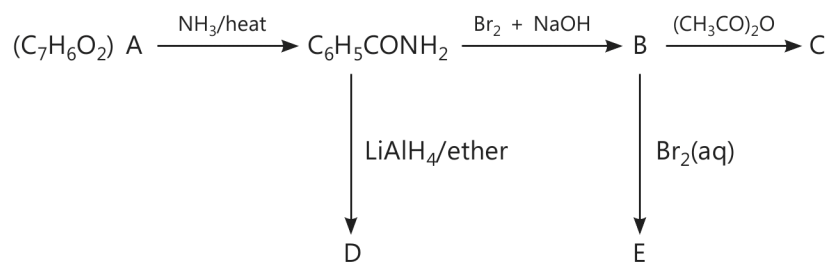
- Ans.**
- (a)
 - (i) It is because bond dissociation energy decreases due to increase in bond length as atomic size of halogen increases.
 - (ii) Oxygen is diatomic gas having weak van der Waals' forces, whereas sulphur is octatomic (S_8) solid, therefore, it has more van der Waals' forces of attraction. Hence sulphur has higher melting and boiling point than oxygen.
 - (iii) It is because nitrogen does not have *d*-orbitals.



Or

- (i) White phosphorus because it is monomeric and has low bond dissociation enthalpy.
- (ii) Supersonic jet aeroplanes release NO, which is responsible for the depletion of ozone layer.
- (iii) It is due to inter electronic repulsion between lone pair of electrons on smaller 'F' atoms in F_2 than Cl_2 .
- (iv) Helium.
- (v) $XeF_2 + PF_5 \longrightarrow [XeF]^+ [PF_6]^-$

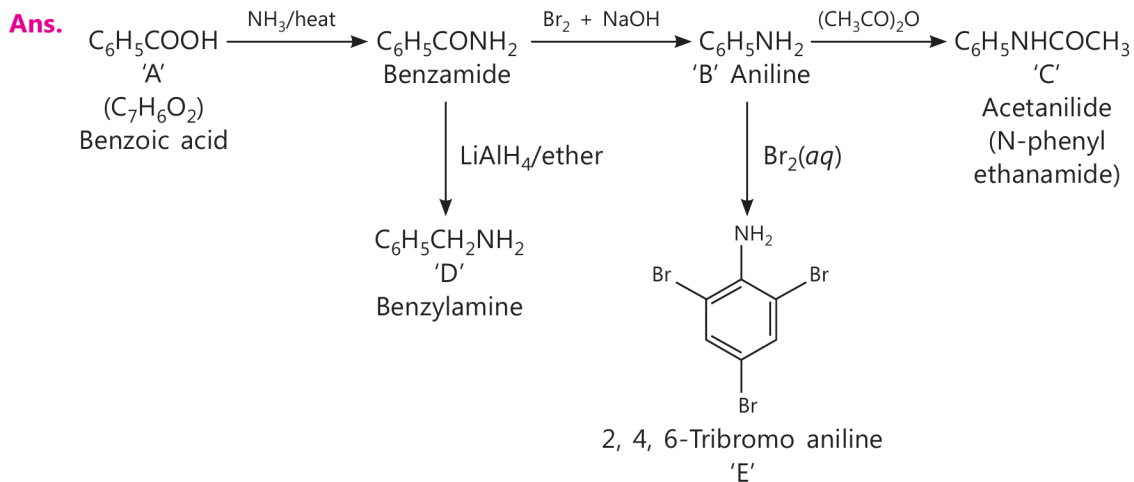
25. An aromatic compound 'A' of molecular formula $C_7H_6O_2$ undergoes a series of reactions as shown below. Write the structures of A, B, C, D and E in the following reactions:



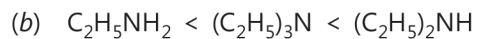
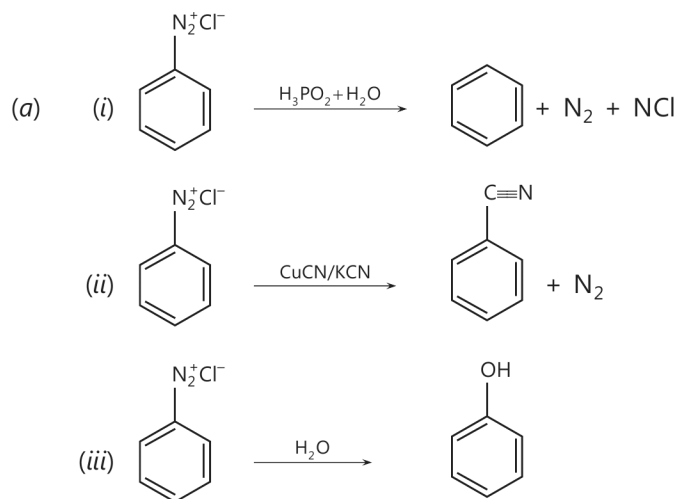
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Or

- (a) Write the structures of main products when benzene diazonium chloride reacts with the following reagents:
- (i) $H_3PO_2 + H_2O$
- (ii) $CuCN/KCN$
- (iii) H_2O
- (b) Arrange the following in the increasing order of their basic character in an aqueous solution:
- $C_2H_5NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$
- (c) Give a simple chemical test to distinguish between the following pair of compounds:
- $C_6H_5-NH_2$ and $C_6H_5-NH-CH_3$



Or



(c) Add CHCl_3 and KOH . $\text{C}_6\text{H}_5\text{NH}_2$ will give offensive smelling compound, whereas $\text{C}_6\text{H}_5\text{NHCH}_3$ will not.

Alternatively, add NaNO_2 and conc. HCl . Cool it to $0-5^\circ\text{C}$. Then add alkaline solution of phenol. Aniline will form orange azo dye, whereas $\text{C}_6\text{H}_5\text{NHCH}_3$ will not.

26. For the hydrolysis of methyl acetate in aqueous solution, the following results were obtained:

t/s	0	10	20
[CH ₃ COOCH ₃]/mol L ⁻¹	0.10	0.05	0.025

- (a) Show that it follows pseudo first order reaction, as the concentration of water remains constant.
- (b) Calculate the average rate of reaction between the time interval 10 to 20 seconds.
(Given: $\log 2 = 0.3010$, $\log 4 = 0.6021$) 5

Or

- (a) For a reaction $A + B \rightarrow P$, the rate is given by
Rate = $k [A] [B]^2$
- (i) How is the rate of reaction affected if the concentration of B is doubled?
- (ii) What is the overall order of reaction if A is present in large excess?
- (b) A first order reaction takes 30 minutes for 50% completion. Calculate the time required for 90% completion of this reaction.

Ans. (a)
$$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$$

$$= \frac{2.303}{10} \log \frac{0.10}{0.05} = \frac{2.303}{10} \log 2$$

$$= \frac{2.303}{10} \times 0.3010 = \frac{0.693}{10}$$

$$= 6.93 \times 10^{-2} \text{ s}^{-1}$$

Again,
$$k = \frac{2.303}{20} \log \frac{0.10}{0.025} = \frac{2.303}{20} \log 4$$

$$= \frac{2.303}{20} \times 0.6021 = 6.93 \times 10^{-2} \text{ s}^{-1}$$

Since 'k' is constant, it shows that it follows pseudo first order reaction.

(b) Average rate of reaction = $\frac{\text{Change in conc. of reactants}}{\text{time interval}}$

$$= \frac{0.05 - 0.025}{10} = \frac{0.025}{10} = 2.5 \times 10^{-3} \text{ s}^{-1}$$

Or

- (a) (i) If concentration of 'B' is doubled, the rate of reaction becomes four times.
(ii) If 'A' is present in large excess, overall order of reaction will be equal to 2.

$$(b) \quad k = \frac{2.303}{t_{1/2}} \log \frac{[R]_0}{[R]_0/2}$$
$$= \frac{2.303}{30 \text{ min}} \log 2 = \frac{2.303}{30} \times 0.3010 = \frac{0.693}{30} = \frac{6.93 \times 10^{-2}}{3}$$

$$\Rightarrow k = 2.31 \times 10^{-2} \text{ min}^{-1}$$

$$\text{Also, } t_{90\%} = \frac{2.303}{k} \log \frac{[R]_0}{\frac{10}{100} [R]_0}$$

$$\Rightarrow t_{90\%} = \frac{2.303}{k} \log 10 = \frac{2.303}{2.31 \times 10^{-2}} = 99.70 \text{ min.}$$