

CBSE Class 12 Chemistry
Question Paper Ajmer 2015 set 2

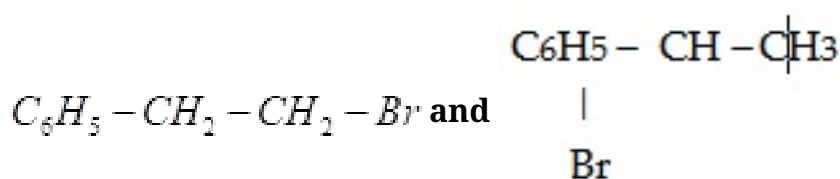
General Instructions :

- All the questions are compulsory.
- Question numbers 1 to 5 are very short answer questions carrying 1 mark each.
- Question numbers 6 to 10 are short answer question carrying 2 marks each.
- Question numbers 11 to 22 are also short answer questions carrying 3 marks each
- Question number 23 is a value based questions carrying 4 marks.
- Question numbers 24 to 26 are long answer questions carrying 5 m

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

Ans. H_3PO_2 , H_3PO_3 , $\text{H}_4\text{P}_2\text{O}_5$, $\text{H}_4\text{P}_2\text{O}_6$, H_3PO_4 , $\text{H}_4\text{P}_2\text{O}_7$, H_3PO_5 , $\text{H}_4\text{P}_2\text{O}_8$, $(\text{HPO}_3)_3$, $(\text{HPO}_3)_n$

2. Which would undergo $\text{S}_{\text{N}}2$ reaction faster in the following pair:



Ans. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{Br}$

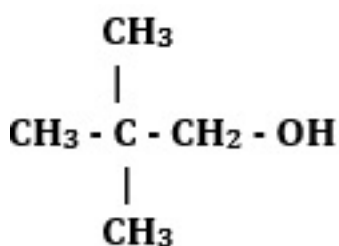
3. Out of AlCl_3 and NaCl , which is more effective in causing coagulation of a negative sol and why?

Ans. AlCl_3 , due to greater charge on Al^{3+} .

4. Write the formula of a compound in which the element Y forms ccp lattice and atoms of X occupy 1/3rd of tetrahedral voids.

Ans. X_2Y_3

5. Write the IUPAC name of the given compound:



Ans. 2,2-Dimethylpropan-1-ol

6. **Why do transition elements show variable oxidation states ? How is the variability in oxidation states of d-block different from that of the p-block elements?**

Ans. Due to comparable energies of ns & (n-1)d orbitals / due to presence of unpaired electrons in (n-1)d orbitals. In transition elements, oxidation states differ from each other by unity whereas in case of p-block elements, the oxidation states differ by units of two
Or In transition elements, the higher oxidation states are more stable for heavier elements in a group. In p-block elements, the lower oxidation states are more stable for heavier members due to inert pair effect.

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



ii. **Write the formula for the following complex:**

tris(ethane-1,2-diamine)chromium(III) chloride.

Ans.

i. Ammineaquadichloridoplatinum(II)

ii. $[\text{Cr}(\text{en})_3]\text{Cl}_3$

8. **Calculate the time to deposit 1.5 g of silver at cathode when a current of 1.5 A was passed through the solution of AgNO_3 . (Molar mass of Ag = 108 g mol^{-1} , $1 \text{ F} = 96500 \text{ C mol}^{-1}$)**

Ans. Wt. of Ag = 1.5g , Current = i = 1.5amp

Molecular mass = 108g/mol , F = 96500C/mol n = number of electron transferred

$$W = \frac{M \times I \times t}{n \times F}$$

$$\therefore t = \frac{W \times n \times F}{M \times I} = \frac{1.5 \times 1 \times 96500}{108 \times 1.5}$$

$$= 893.51 \text{ s or } 14.89 \text{ min}$$

OR

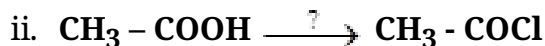
At cathode: $\text{Ag}^+ + \text{e}^- \longrightarrow \text{Ag(s)}$ 108g of Ag require 1F

$$\therefore 1.5\text{g of Ag require } \frac{1.5}{108} \text{ F} = \frac{1.5 \times 96500}{108} = 1340.27 \text{ C}$$

$$t = \frac{Q}{i} = \frac{1340.27}{1.5}$$

=893.51s or 14.89 min

9. Write the reagents used in the following reactions :



OR

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

- CH_3CHO , $\text{C}_6\text{H}_5\text{CHO}$, HCHO (reactivity towards nucleophilic addition reaction)
- 2,4-dinitrobenzoic acid, 4-methoxybenzoic acid, 4-nitrobenzoic acid (acidic character)

Ans.

- Zn-Hg, HCl or $\text{H}_2\text{N}-\text{NH}_2$ & KOH/Glycol, Δ
- PCl_5 / PCl_3 / SOCl_2

OR

- $\text{C}_6\text{H}_5\text{CHO} < \text{CH}_3\text{CHO} < \text{HCHO}$
- 4 - Methoxybenzoic acid < 4 - Nitrobenzoic acid < 2,4 - Dinitrobenzoic acid

10. i. Why are aquatic species more comfortable in cold water than in warm water?
ii. What happens when we place the blood cell in saline water solution (hypertonic solution)? Give reason.

Ans.

- As solubility of gases decreases with increase of temperature, less oxygen is available in summer in the lakes / as cold water contains more oxygen dissolved.
- They will shrink, due to osmosis.

11. i. Name the method used for the refining of titanium.
ii. What is the role of Zn in the extraction of silver?

iii. Reduction of metal oxide to metal becomes easier if the metal obtained is in liquid state. Why?

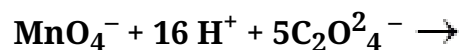
Ans.

- i. Van Arkel Method / vapour phase refining
- ii. Zn acts as a reducing agent
- iii. As ΔS is positive / ΔG is more negative

12. i. E^0 value for the Mn^{3+}/Mn^{2+} couple is positive (+ 1.5 V) whereas that of Cr^{3+}/Cr^{2+} is negative (- 0.4 V). Why?

ii. Transition metals form coloured compounds. Why?

iii. Complete the following equation:



Ans.

- i. The large positive E^0 value for Mn^{3+} / Mn^{2+} shows that Mn^{2+} ($3d^5$ / half filled d orbital) is much more stable than Mn^{3+} Whereas Cr^{3+} (t_{2g}^3) is more stable than Cr^{2+}
- ii. Due to d – d transition / due to presence of unpaired electrons in d – orbitals which absorb light in visible region
- iii. $2MnO_4^- + 16H^+ + 5C_2O_4^{2-} \rightarrow 2Mn^{2+} + 8H_2O + 10CO_2$

13. i. What type of isomerism is shown by $[Co(NH_3)_5ONO]Cl_2$?

ii. On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_o < P$.

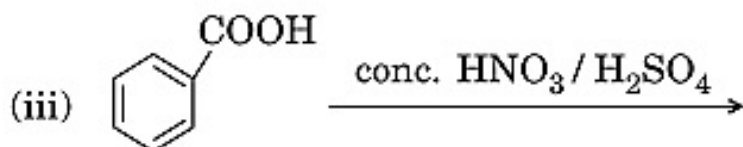
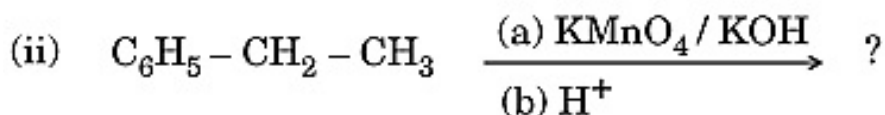
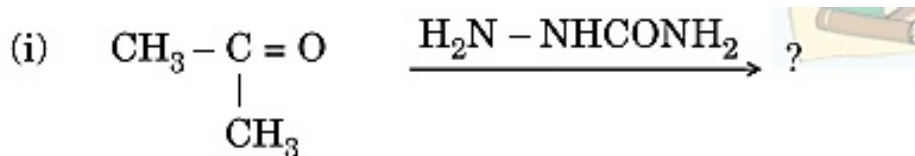
iii. Write the hybridization and shape of $[Fe(CN)_6]^{3-}$.

(Atomic number of Fe = 26)

Ans

- i. Linkage isomerism
- ii. $t_2g^3 eg^1$ / Diagrammatic representation
- iii. d^2sp^3 , Octahedral.

14. Predict the products of the following reactions:

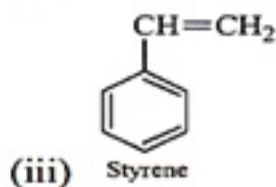
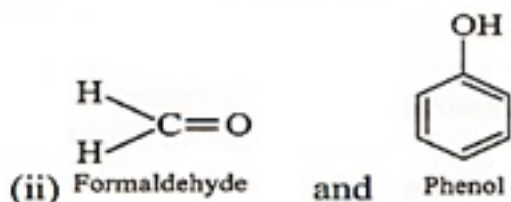
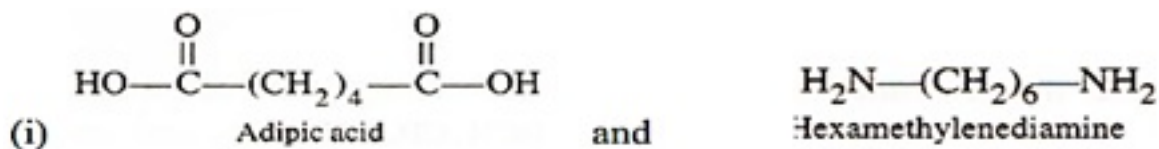


Ans. (ii) $\text{C}_6\text{H}_5 - \text{COOH}$

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

- i. Nylon-6,6
- ii. Bakelite
- iii. Polystyrene

Ans.



- i. Which one of the following is a disaccharide : starch, maltose, fructose, glucose
- ii. What is the difference between acidic amino acid and basic amino acid?
- iii. Write the name of the linkage joining two nucleotides.

Ans.

- i. Maltose

- ii. In acidic amino acid more carboxyl groups as compared to amino groups are present & In basic amino acid more number of amino than carboxyl groups are present
- iii. Phosphodiester linkage

17. Vapour pressure of water at 20°C is 17.5 mm Hg. Calculate the vapour pressure of water at 20°C when 15 g of glucose (Molar mass = 180 g mol⁻¹) is dissolved in 150 g of water.

Ans. $P_A^0 = 17.5 \text{ mm of Hg}$ $W_B = 15 \text{ g}$ $M_B = 180 \text{ g/mol}$

$W_A = 150 \text{ g}$ $P_s = ?$

$$\frac{P_A^0 - P_s}{P_A^0} = \frac{W_B \times M_A}{M_B \times W_A} \therefore \frac{P_A^0 - P_s}{P_A^0} = \frac{15 \times 18}{180 \times 150} = 0.01$$

$$\frac{P_A^0 - P_s}{P_A^0} = \frac{17.5 - P_s}{17.5} = 0.01 \therefore$$

$p_s = 17.325 \text{ mm of Hg}$

18. Examine the given defective crystal:

Answer the following questions:

- i. Is the above defect stoichiometric or non-stoichiometric?
- ii. Write the term used for the electron occupied site.
- iii. Give an example of the compound which shows this type of defect.

Ans.

- i. Non – Stoichiometric defect
- ii. F – Centre or Farbe Centre
- iii. NaCl is heated in an atmosphere of Na vapour / LiCl is heated in an atmosphere of Li vapour / KCl is heated in an atmosphere of K vapour

19. How do you convert the following:

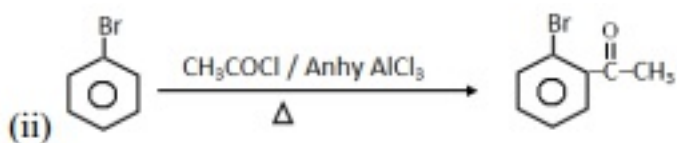
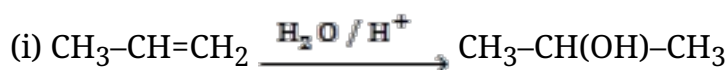
- i. Prop-1-ene to Propan-2-ol
- ii. Bromobenzene to 2-bromoacetophenone
- iii. 2-bromobutane to But-2-ene

OR

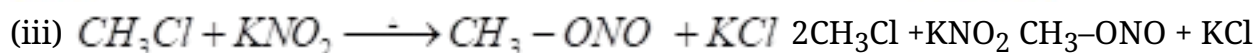
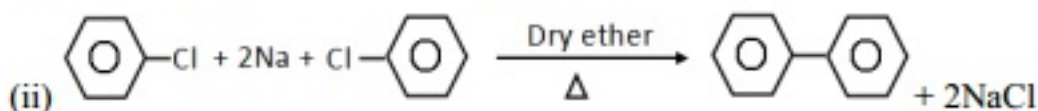
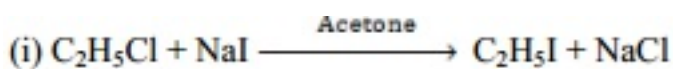
What happens when

- ethyl chloride is treated with NaI in the presence of acetone,
- chlorobenzene is treated with Na metal in the presence of dry ether,
- methyl chloride is treated with KNO_2 ? Write chemical equations in support of your answer.

Ans.



OR



20. Give reasons for the following:

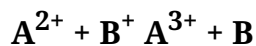
- p-nitrophenol is more acidic than p-methylphenol.
- Bond length of C – O bond in phenol is shorter than that in methanol.
- $(\text{CH}_3)_3\text{C - Br}$ on reaction with sodium methoxide ($\text{Na}^+ \text{ } ^-\text{OCH}_3$) gives alkene as the main product and not an ether.

Ans.

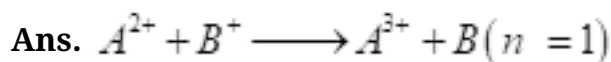
- Due to -I / -R effect of $-\text{NO}_2$ group & +I / +R effect of $-\text{CH}_3$ group or 4-nitrophenoxide ion is more stable than 4-methylphenoxide ion
- Due to +R effect of $-\text{OH}$ group in phenol / due to sp^2 hybridization of C-atom in C-OH group in phenol whereas sp^3 hybridization of C-atom in C-OH group in methanol.

iii. $(\text{CH}_3)_3\text{C}-\text{Br}$ being a 3° halide prefers to undergo β – elimination on reacting with strong base like NaOCH_3 .

21. Calculate E^0_{cell} and $\Delta_r G^0$ for the following reaction at 25°C :



Given : $K_c = 10^{10}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$



$$\Delta G^0 = -2.303RT \log K_c$$

$$\Delta G^0 = -2.303 \times 8.314 \text{ J/K/mol} \times 298\text{K} \times \log 10^{10}$$

$$\therefore \Delta G^0 = -57058.4 \text{ J/mol or } -57.0584 \text{ kJ/mol}$$

$$\Delta G^0 = -57058.4 \text{ J/mol} = -nFE^0 = -1 \times 96500$$

$$\therefore E_0 = \frac{-57058.4}{-96500} = 0.591\text{V}$$

22. Define adsorption with an example. Why is adsorption exothermic in nature ? Write the types of adsorption based on the nature of forces between adsorbate and adsorbent.

Ans. The accumulation of molecular species at the surface rather than in the bulk of a solid or liquid is termed adsorption.

eg: gas like O_2 , H_2 , CO , Cl_2 , NH_3 or SO_2 is taken in a closed vessel containing powdered charcoal

Due to bond formation / interaction between adsorbent and adsorbate Physical (van der Waal's adsorption) & Chemical (Langmuir adsorption)

23. Seeing the growing cases of diabetes and depression among young children, Mr. Lugani, 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. Lugani 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. Lugani?
- ii. As a student, how can you spread awareness about this issue?
- iii. What are antidepressant drugs? Give an example.
- iv. Name the sweetening agent used in the preparation of sweets for a diabetic patient.

Ans.

- i. Caring nature / Generous / Sensible human approach / empathy/ concern
- ii. By making posters & displaying them in school premises / by doing role play
- iii. Drugs which are used for the treatment of /counteract depression. eg: Rauwolfia serpentina / Barbituric acid / Equanil / Valium (Diazepam) / Chlordiazepoxide / meprobamate / iproniazid / phenelzine
- iv. Saccharin / Aspartame / Alitame / Sucrolose / Cyclamate / L-Glucose

24. For the hydrolysis of methyl acetate in aqueous solution, the following:

t/s	0	30	60
$[\text{CH}_3\text{COOCH}_3]/\text{mol L}^{-1}$	0.60	0.30	0.15

- i. Show that it follows pseudo first order reaction, as the concentration of water remains constant.
- ii. Calculate the average rate of reaction between the time interval 30 to 60 seconds.

OR

For a reaction $\text{A} + \text{B} \rightarrow \text{P}$, the rate is given by $\text{Rate} = k [\text{A}]^2[\text{B}]$

- i. How is the rate of reaction affected if the concentration of A is doubled?
- ii. What is the overall order of reaction if B is present in large excess?

A first order reaction takes 23.1 minutes for 50% completion. Calculate the time required for 75% completion of this reaction. (Given : $\log 2 = 0.301$, $\log 3 = 0.4771$, $\log 4 = 0.6021$)

Ans.

$$(i) A_0 = 0.60 \quad \quad \quad A = 0.30 \quad \text{when} \quad t = 30\text{s}$$

$$k = \frac{2.303}{t} \log \frac{[A_0]}{[A]}$$

$$k = \frac{2.303}{30} \log \frac{0.60}{0.30}$$

$$k = \frac{2.303}{30} \log 2 = \frac{2.303}{30} \times 0.3010$$

$$k = \frac{0.693}{30} = 0.0231 \text{ s}^{-1}$$

$$\text{When } A_0 = 0.60 \quad \quad \quad A = 0.15 \quad \text{when} \quad t = 60\text{s}$$

$$k = \frac{2.303}{t} \log \frac{0.60}{0.15}$$

$$k = \frac{2.303}{60} \log \frac{0.60}{0.15}$$

$$k = \frac{2.303}{60} \log 4 = \frac{2.303}{60} \times 0.6021$$

$$k = \frac{1.3866}{60} = 0.0231 \text{ s}^{-1}$$

As for both cases k is approximately same reaction is of pseudo first order

$$(ii) \text{ Average rate during the interval 30 - 60 sec} = - \frac{\text{Change in concentration}}{\text{Change in time}}$$

$$= - \frac{0.15 - 0.30}{60 - 30}$$

$$= - \frac{-0.15}{30} = 0.005 \text{ mol L}^{-1} \text{ S}^{-1}.$$

OR

a. For a reaction $A + B \rightarrow P$, the rate is given by Rate = $k [A]^2[B]$

i. How is the rate of reaction affected if the concentration of A is doubled?

ii. What is the overall order of reaction if B is present in large excess?

b. A first order reaction takes 23.1 minutes for 50% completion. Calculate the time required for 75% completion of this reaction. (Given : $\log 2 = 0.301$, $\log 3 = 0.4771$, $\log 4 = 0.6021$)

Ans.

a. i. rate increases by 4 times

ii. 2nd order

b. Reaction is 50% completed in 23.1 min i.e. Half-life is 23.1 min

$$\therefore k = \frac{0.693}{t_{1/2}}$$

$$= \frac{0.693}{23.1} = 0.03 \text{ min}^{-1}$$

$$k = \frac{2.303}{t} \log \frac{[A_0]}{[A]}$$

$$0.03 \text{ min}^{-1} = \frac{2.303}{t} \log \frac{100}{25}$$

$$0.03 = \frac{2.303}{t} \log 4$$

$$t = \frac{2.303}{0.03} \times 0.6021 = \frac{1.3866}{0.03} :$$

$$= 46.221 \text{ min}$$

25. a. Account for the following:

- i. Bond angle in NH_3 greater than that in NH_4^+ .
- ii. Reducing character decreases from SO_2 to TeO_2 .
- iii. HClO_4 is a stronger acid than HClO .

b. Draw the structures of the following:

- i. $\text{H}_2\text{S}_2\text{O}_8$
- ii. XeOF_4

OR

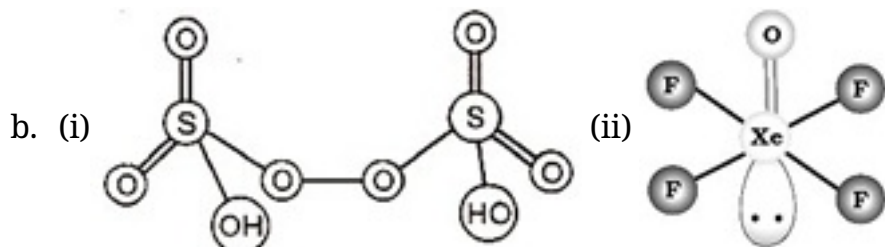
- a. Which poisonous gas is evolved when white phosphorus is heated with conc. NaOH solution? Write the chemical equation
- b. Write the formula of first noble gas compound prepared by N. Bartlett. What inspired N. Bartlett to prepare this compound?
- c. Fluorine is a stronger oxidizing agent than chlorine. Why?
- d. Write one use of chlorine gas.
- e. Complete the following equation:
 $\text{CaF}_2 + \text{H}_2\text{SO}_4 \rightarrow$

Ans.

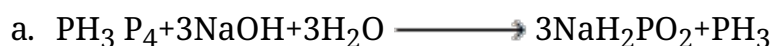
- a. i. Due to lone pair of electron on nitrogen in NH_3

ii. Due to inert pair effect / Stability of higher oxidation state decreases down the group from S to Te / Stability of lower oxidation state increases down the group

iii. ClO^- is more stable than ClO^- / ClO_4^- is weak conjugate base than ClO^-



OR



b. $\text{Xe} + [\text{PtF}_6]^-$, Approximately same molecular size of Xe & O_2 / Comparable ionisation energies of Xe & O_2

c. It is due to (i) low enthalpy of dissociation of F-F bond (ii) high hydration enthalpy of F^- .

d. i. for bleaching wood pulp (required for manufacture of paper and rayon), cotton and textiles.

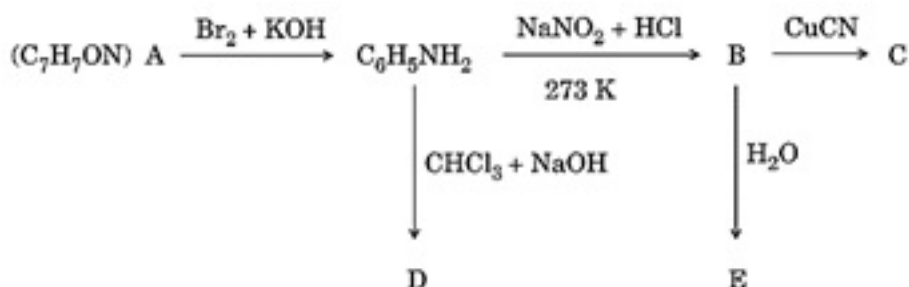
ii. In the metallurgy (extraction) of gold and platinum.

iii. In the manufacture of dyes, drugs and organic compounds such as CHCl_3 , CCl_4 , DDT, refrigerants (CCl_2F_2 , freon), and bleaching powder. In the preparation of poisonous gases such as phosgene (COCl_2), tear gas (CCl_3NO_2), mu tear gas ($\text{ClCH}_2\text{CH}_2\text{SCH}_2\text{CH}_2\text{Cl}$), etc. Mustard gas was used by many in World War I.

iv. In sterilizing drinking water.



26. An aromatic compound 'A' of molecular formula $\text{C}_7\text{H}_7\text{ON}$ undergoes a series of reactions as shown below. Write the structures of A, B, C, D and E in the following reactions:



OR

a. Write the structures of the main products when aniline reacts with the following reagents:

i. Br_2 water

ii. HCl

iii. $(\text{CH}_3\text{CO})_2\text{O}$ / pyridine

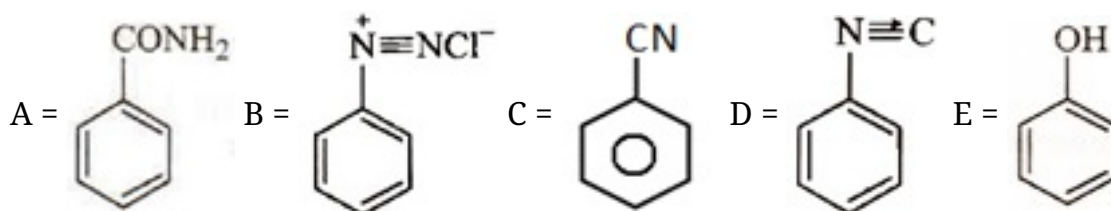
b. Arrange the following in the increasing order of their boiling point:

$\text{C}_2\text{H}_5\text{NH}_2, \text{C}_2\text{H}_5\text{OH}, (\text{CH}_3)_3\text{N}$

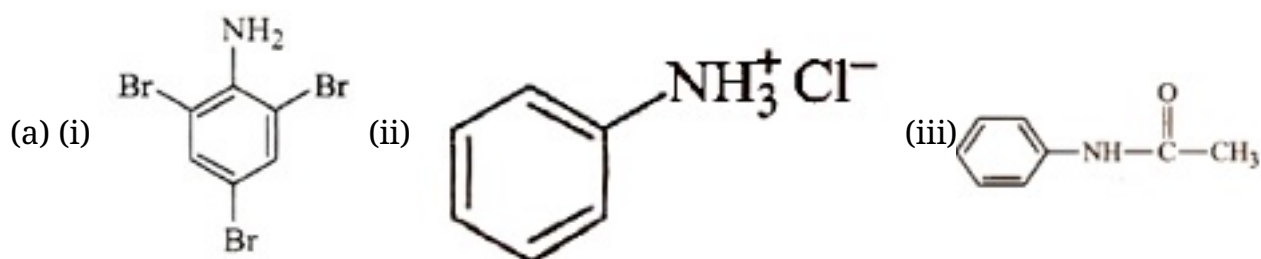
c. Give a simple chemical test to distinguish between the following pair of compounds:

$(\text{CH}_3)_2\text{-NH}$ and $(\text{CH}_3)_3\text{N}$

Ans.



OR



(b) $(\text{CH}_3)_3\text{N} < \text{C}_2\text{H}_5\text{NH}_2 < \text{C}_2\text{H}_5\text{OH}$

(c) By Hinsberg test - Add Hinsberg reagent (Benzene sulphonyl chloride) in both compounds $(\text{CH}_3)_2\text{-NH}$ forms ppt insoluble in KOH while $(\text{CH}_3)_3\text{-N}$ does not react