

CBSE Board Pattern 2015

CHEMISTRY

- Q.1** Write the formulae of any two oxoacids of phosphorus. [1]
- Q.2** Which would undergo SN^2 reaction faster in the following pair [1]
 $C_6H_5-CH_2-CH_2-Br$ and $C_6H_5-\underset{\text{Br}}{\text{CH}}-CH_3$
- Q.3** Out of $AlCl_3$ and $NaCl$, which is more effective in causing coagulation of a negative sol and why? [1]
- Q.4** Write the formula of a compound in which the element Y forms ccp lattice and atoms of X occupy $1/3^{\text{rd}}$ of tetrahedral voids [1]
- Q.5** Write the IUPAC name of the given compound : $CH_3-\underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{C}}}-CH_2-OH$ [1]
- Q.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? [2]
- Q.7** (i) Write down the IUPAC name of the following complex : [2]
 $[Pt(NH_3)(H_2O)Cl_2]$
(ii) Write the formula for the following complex :
tris(ethane-1,2-diamine)chromium(III) chloride
- Q.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 $Ag = 108 \text{ g mol}^{-1}$, $1 F = 96500 \text{ C mol}^{-1}$) [2]
- Q.9** Write the reagents used in the following reactions [2]
(i) $C_6H_5-CO-CH_3 \xrightarrow{?} C_6H_5-CH_2-CH_3$
(ii) $CH_3-COOH \xrightarrow{?} CH_3-COCl$
or
Arrange the following compounds in increasing order of their property as indicated
(i) CH_3CHO , C_6H_5CHO , $HCHO$
(reactivity towards nucleophilic addition reaction)
(ii) 2,4-dinitrobenzoic acid, 4-methoxybenzoic acid, 4-nitrobenzoic acid (acidic character)
- Q.10** (i) Why are aquatic species more comfortable in cold water than in warm water? [2]
(ii) What happens when we place the blood cell in saline water solution (hypertonic solution)? Give reason.
- Q.11** (i) Name the method used for the refining of titanium [3]
(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
- Q.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? [3]

(ii) Transition metals form coloured compounds. Why ?

(iii) Complete the following equation :



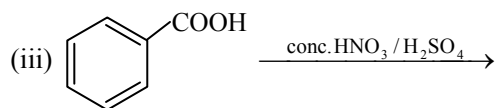
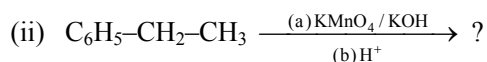
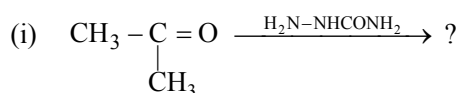
Q.13 (i) What type of isomerism is shown by $[\text{CO}(\text{NH}_3)_5\text{ONO}]\text{Cl}_2$? [3]

(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 $[\text{Fe}(\text{CN})_6]^{3-}$

(Atomic number of Fe = 26)

Q.14 Predict the products of the following reactions : [3]



Q.15 Write the names and structures of the monomers of the following polymers : [3]

(i) Nylon-6,6

(ii) Bakelite

(iii) Polystyrene

Q.16 (i) Which one of the following is a disaccharide : [3]

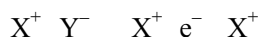
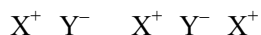
Starch, maltose, fructose, glucose

(ii) What is the difference between acidic amino acid and basic amino acid?

(iii) Write the name of the linkage joining two nucleotides.

Q.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. [3]

Q.18 Examine the given defective crystal : [3]



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.

Q.19 How do you convert the following : [3]

(i) Prop-1-ene to Propan-2-ol

(ii) Bromobenzene to 2-bromoacetophenone

(iii) 2-bromobutane to But-2-ene

OR

What happens when

- (i) Ethyl chloride is treated with NaI in the presence of acetone,
- (ii) Chlorobenzene is treated with Na metal in the presence of dry ether,
- (iii) Methyl chloride is treated with KNO_2 ?

Write chemical equations in support of your answer.

Q.20 Give reasons for the following : [3]

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

Q.21 Calculate E_{cell}^0 and $\Delta_r G^0$ for the following reaction at 25°C : [3]



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

Q.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. [3]

Q.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. [4]

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.

Q.24 For the hydrolysis of methyl acetate in aqueous solution, the following results were obtained : [5]

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

(a) 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?
- (b) A first order reaction takes 23.1 minutes for 50% completion. Calculate the time required for 75% completion of this reaction.

(Given : $\log 2 = 0.301$, $\log 3 = 0.4771$, $\log 4 = 0.6021$)

Q.25 (a) Account for the following :

[5]

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

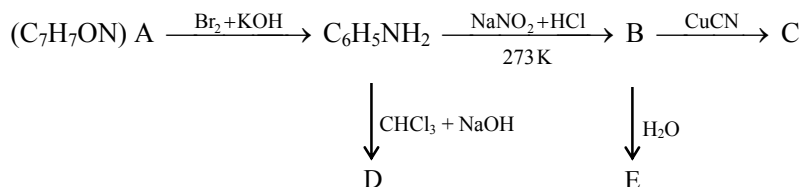
(b) Draw the structures of the following :

- (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 :
 $\text{CaF}_2 + \text{H}_2\text{SO}_4 \rightarrow$

Q.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 : [5]

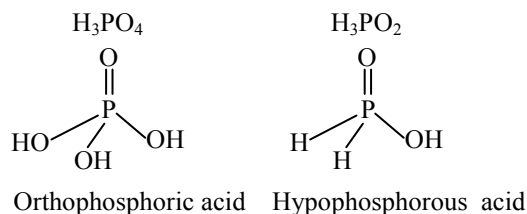


OR

- (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 $(\text{CH}_3)_3\text{N}$

Solution

1.



2. $\text{C}_6\text{H}_5\text{CH}_2\text{-CH}_2\text{-Br}$ 1° , Because

$\text{Rate of SN}^2 \propto \text{stability of T.S.} \propto \frac{1}{\text{steric hinderance}}$

3. AlCl_3 , because the greater the valence of the flocculating ion added, the greater is its power to cause precipitation
 $\text{Al}^{3+} > \text{Na}^+$

4. Y is present in ccp

$$\therefore \text{effective ions} = \frac{1}{8} \times 8 + \frac{1}{2} \times 6 = 4$$

$$\text{X is present at } \frac{1}{3} \text{ of T.V.} \quad \therefore \text{X} = \frac{1}{3} \times 8$$

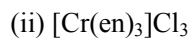
$$\therefore \text{Formula is X : Y or X}_2\text{Y}_3 \\ 4 : 8/3$$

5. 2, 2-Dimethyl propan-1-ol

6. Transition elements show variable oxidation states because electrons in ns and (n-1)d-orbitals are available for bond formation

The oxidation states of d-block differ from each other by unity (due to incomplete filling of d-orbitals) where as oxidation states of p-block elements normally differ by two units.

7. (i) Ammineaquadichloridoplatinum(II)



8. $\text{Ag}^+ + \text{e}^- \longrightarrow \text{Ag}$

108 g of Ag are deposited by 96500 C

$$\therefore 1.5\text{g of Ag will be deposited by } \frac{96500}{100} \times 1.5 = 1340.27\text{C}$$

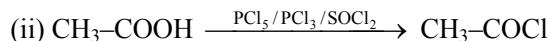
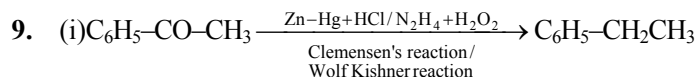
$$t = \frac{Q}{I} = \frac{1340.27}{1.5} = 893.5 \text{ s}$$

OR

$$W = \frac{E}{F} It$$

$$1.5 = \frac{108}{96500} \times 1.5 \times t$$

$$t = 893.5 \text{ s}$$



OR

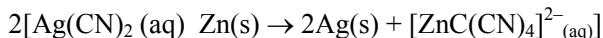


10. (i) Solubility of gases in liquid decreased with rise in temp. So aquatic species are more comfortable in cold water due to availability of more oxygen than hot water

(ii) The blood cell shrinks due to loss of water by osmosis because osmosis takes place from low conc. to high conc.

11. (i) Van-Arkel method, In this method Ti is converted into volatile iodide.

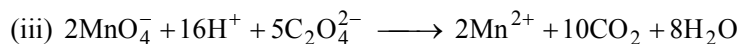
(ii) Zn act as a reducing agent in the extraction of Ag



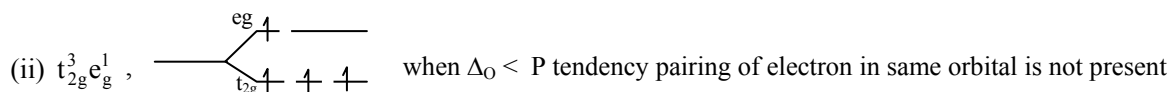
(iii) The entropy is higher in liquid state of metal & the value of entropy change (ΔS) of reduction process is more on the product side. So the value of ΔG become more negative on right side and reduction becomes easier.

12. (i) Because Mn^{2+} is more stable as it has half filled configuration $3d^5 4s^0$, where as comparatively negative value of Cr show the extra stability of Cr^{3+}

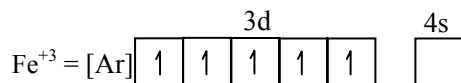
(ii) Due to d-d transition, when visible light falls on a transition metal compound, they absorb certain radiation of visible light and when energy is emitted definite colour is observed.



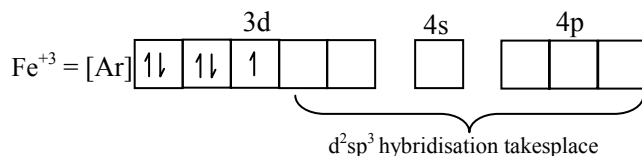
13. (i) Linkage isomerism, when ever ambidentate ligand is present coordination compound shows linkage isomerism.



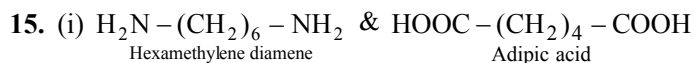
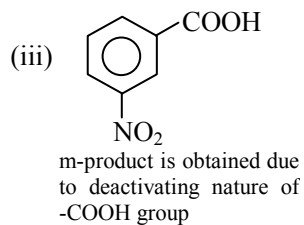
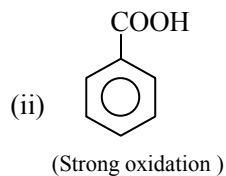
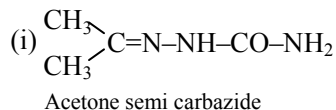
(iii) d^2sp^3 , octahedral, ${}_{26}\text{Fe} = [\text{Ar}] 3d^6 4s^2$



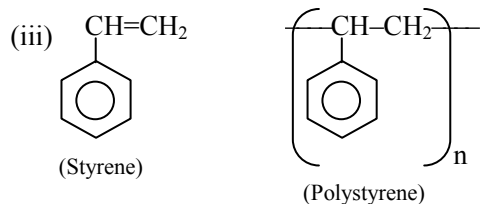
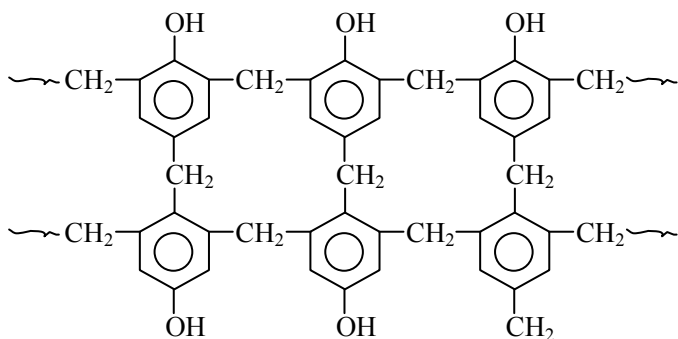
In the presence of S.F. ligand CN^-



14.



(ii) Phenol + formaldehyde



16. (i) Maltose

(ii) Acidic amino acids (contain one $-\text{NH}_2$ group & two $-\text{COOH}$ groups eg. glutamic)

Basic amino acids contain two $-\text{NH}_2$ group & one $-\text{COOH}$ groups eg lysine.

(iii) Phosphodiester linkage

$$17. \frac{P^{\circ} - P}{P^{\circ}} = \frac{w_B \times M_A}{M_B \times w_A}$$

Here $w_B = 15$ g (glucose)

$M_A = 180$ (water)

$M_B = 180$ (glucose)

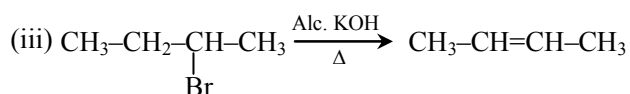
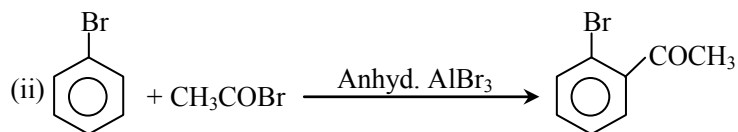
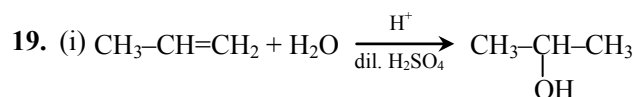
$w_A = 150$ (water)

$$\frac{17.5 - P}{17.5} = \frac{15 \times 18}{180 \times 150}$$

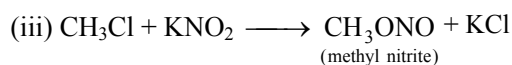
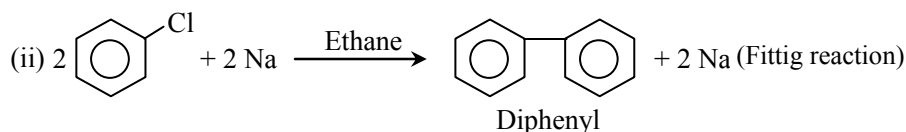
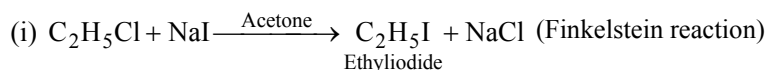
$$17.5 P = 17.5 \times 0.01$$

$$P = 17.325 \text{ mmHg}$$

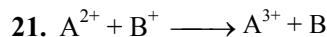
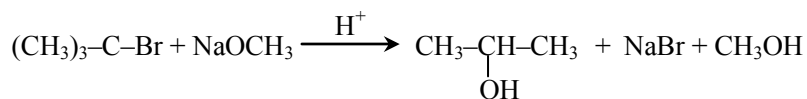
18. (i) Non-stoichiometric defect, because ratio of cation and anion changes after the formation of defect.
(ii) F-centre, The site at which e^- is present is called as F-centre or Farbe centre, which means colour because free e^- absorb energy and transit to higher energy state that makes compound coloured.
(iii) NaCl, when NaCl is heated in the presence of Na vapour this defect is formed



OR



20. (i) NO_2 group is electron withdrawing group & methyl group is electron releasing group. Withdrawing group help in increasing acidic nature, where as electron releasing group decreases acidic nature of phenol.
(ii) Due to sp^2 hybridised C and resonance in phenol to which $-\text{OH}$ group attached, where as in CH_3OH , C is sp^3 hybridised bond length in $sp^3 > sp^2$
(iii) Because alkoxides are not only nucleophile but strong bases as well. They react with 3° alkyl halides leading to elimination reaction.



$$K_c = 10^{10}; E_{\text{cell}}^{\circ} = ?$$

$$n = 1, \Delta G^{\circ} = ?$$

$$E_{\text{cell}}^{\circ} = \frac{0.059}{1} \log K_c \quad [\log 10^{10} = 10]$$

$$E_{\text{cell}}^{\circ} = 0.059 \times 10 = 0.59 \text{ V}$$

$$\Delta G^{\circ} = -nFE_{\text{cell}}^{\circ}$$

$$= -1 \times 96500 \times 0.59$$

$$= -56935 \text{ J/mol} \quad \text{or} \quad -56.935 \text{ kJ/mol}$$

22. Adsorption : "The accumulation of molecular species at the surface rather than in the bulk of a solid is termed as adsorption. eg the air becomes dry in the presence of silica gel because the water molecules get adsorption on the surface of the gel.

During adsorption, there is always bond formation between adsorbate and adsorbent and it results in release of energy.

There are two types of adsorption on the basis of nature of forces –

(i) Physisorption which occur due to Vander Waal's force of attraction

(ii) Chemisorption which occur due to chemical bond

23. (i) Mr. Lugani is well aware of harmful effects of junk food & diseases related to it, he is caring and concerning person for others

(ii) As a student we can make poster and plays to aware people about adverse effects of junk foods

(iii) Antidepressant drugs help in treatment of stress, relieve anxiety & induce a sense of well being by inhibiting the enzyme which catalysis degradation of noradrenaline

(iv) Aspartame

24. (i) For pseudo first order reaction, the reaction should be first order with respect to ester when H₂O is excess.
for first order reaction

$$K = \frac{2.303}{t} \log \frac{[R]_0}{[R]} \text{ where } K = K'[\text{H}_2\text{O}], [R]_0 = 0.60 \text{ M}$$

t/s	[R]	K/s ⁻¹	
0	0.60	-	-
30	0.30	$= \frac{2.303}{30} \log \frac{0.60}{0.30}$	$= 1.91 \times 10^{-2}$
60	0.15	$= \frac{2.303}{60} \log \frac{0.30}{0.15}$	$= 1.96 \times 10^{-2}$

It can be seen that K'[H₂O] is constant & equal to $1.91 \times 10^{-2} \text{ s}^{-1}$

$$(ii) = - \frac{C_2 - C_1}{t_2 - t_1} = - \frac{0.15 - 0.30}{60 - 30} = \frac{0.15}{30} = 5 \times 10^3 \text{ mol L}^{-1} \text{ sec}^{-1}$$

OR

a(i) Rate (r) = K[A]²[B]

$$r_1 = K[2A]^2[B]$$

$$\frac{r_1}{r} = 2^2 \text{ or } r_1 = 4r$$

The rate will increase 4 times

- (ii) It has overall order as 2 because concentration of B does not get altered during the course of reaction.

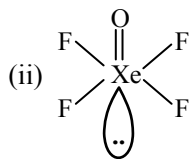
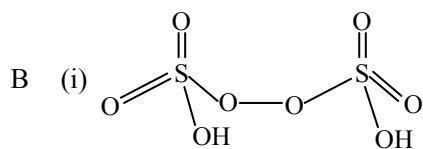
b(ii) $t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$

$$\frac{t_{75\%}}{t_{50\%}} = \frac{\frac{2.303}{k} \log \frac{[R]_0}{[R]_0 - 0.75[R]_0}}{\frac{2.303}{k} \log \frac{[R]_0}{[R]_0 - 0.20[R]_0}} = \frac{\log 4}{\log 2}$$

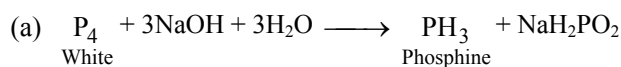
$$\frac{t_{75\%}}{23.1} = \frac{0.6021}{0.301}$$

$$t_{75\%} = \frac{0.6021 \times 23.1}{0.301} = 47.6 \text{ minute}$$

25. (A) (i) In NH₄⁺ all the four orbitals are bonded where as in NH₃, there is a lone pair of electron s on p, which is responsible for lone pair-bond pair repulsion in NH₃ & reduce the bond angle
- (ii) Acidic character increases due to decrease in bond enthalpy as we move down the group and due to increasing of size E-H bond breaks more easily.
- (iii) In case of HClO ; O-Cl bond order is 1 and in HClO₄ ; O-Cl bond order is 1.75, as B.O.↑ B.S.↑ and tendency to give oxygen ↓
∴ oxidising character ↓



OR



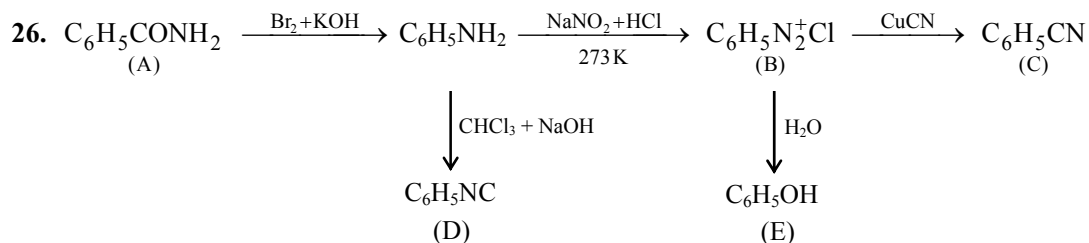
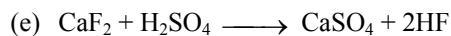
(b) N. Bartlett first prepared $\text{O}_2^+\text{PtF}_6^-$ & then he made effort to make first noble gas compound $\text{Xe}^+\text{PtF}_6^-$ because I.E. of xenon is almost same as oxygen.

(c)(i) The E_{cell}^0 value of F_2 is much higher than that of Cl_2

(ii) F_2 has low bond dissociation enthalpy than Cl_2

(iii) F_2 has more electronegativity than Cl_2

(d) Cl_2 is used in bleaching wood pulp



A → $\text{C}_6\text{H}_5\text{CONH}_2$

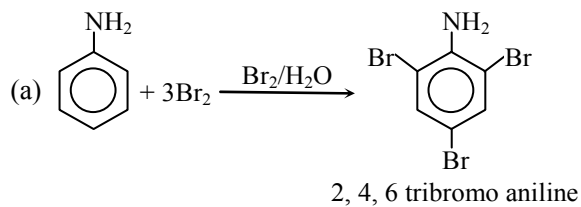
B → $\text{C}_6\text{H}_5\text{N}_2\text{Cl}$

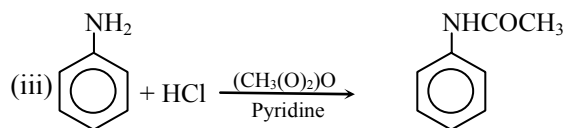
C → $\text{C}_6\text{H}_5\text{CN}$

D → $\text{C}_6\text{H}_5\text{NC}$

E → $\text{C}_6\text{H}_5\text{OH}$

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) 2° Amine give sulphonamide with Hinsberg's reagent ($\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$), where as 3° amine do not react with Hinsberg reagen

