JEE Main Online Exam 2019

Questions & Solutions

8th April 2019 | Shift - II

Chemistry

Q.1 0.27 g of a long chain fatty acid was dissolved in 100 cm^3 of hexane, 10 mL of this solution was added dropwise to the surface of water in a round watch glass. Hexane evaportates and a monolayer is formed. The distance from edge to centre of the watch glassf is 10 cm. What is the height of the monolayer ? [Density of fatty acid = 0.9 g cm^{-3}, $\pi = 3$]

(1) 10^{-2} m (2) 10^{-4} m (3) 10^{-8} m (4) 10^{-6} m

Ans. **[4]**

Sol. In 100ml gm of fatty acid = 0.27 gm

1 ml gm ..... = $\frac{0.27}{100}$

10 ml gm ..... = $\frac{0.27}{100} \times 10 = 0.027$

$d = \frac{m}{v}$

$d \times v = m$

$0.9\left(\frac{gm}{cm^3}\right) \times$ area $\times$ height = 0.027 gm

$0.9 \times (3) \times (10)^2 \times h = 0.027$

$h = 10^{-4}$ cm

$h = 10^{-6}$ m

Q.2 5 moles of and ideal gas at 100 K are allowed to undergo reversible compresion till its temperature becomes 200 K. If $C_V = 28J\ K^{-1}\ mol^{-1}$, calculate ΔU and ΔpV

(1) $\Delta U = 14J$; $\Delta(pV) = 0.8J$ (2) $\Delta U = 14kJ$; $\Delta(pV) = 4kJ$

(3) $\Delta U = 14kJ$; $\Delta(pV) = 18J$ (4) $\Delta U = 2.8$ kJ; $\Delta(pV) = 0.8kJ$

Ans. **[2]**

Sol. $\Delta U = {}^nC_V\ \Delta T$,

$= 5(28)\ (100)$ J

$= 14000$ J $= 14$ kj

$\Delta PV = P_2V_2 - P_1V_1$

$nRT_2 - nRT_1$

$= nR\ (T_2 - T_1)$

$= 5(8)\ (100) = 4000$ J $= 4$ kJ

Q.3 The calculated spin-only magnetic moments (BM) of the anionic and cationic species of $[Fe(H_2O)_6]_2$ and $[Fe(CN)_6]$, respectively, are

(1) 2.84 and 5.92 (2) 0 amd 5.92 (3) 0 and 4.9 (4) 4.9 and 0

Ans. **[4]**

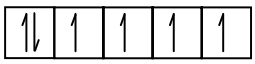
Sol. Compound is $[Fe(H_2O)_6]_2\ [Fe(CN)_6]$

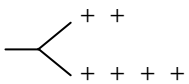
Cation is $[Fe(H_2O)_6]^{+2}$

Anion is $[Fe(CN)_6]^{-4}$

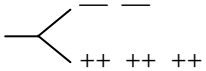
Configuration of Fe^{+2} = (Ar) $3d^6$

3d

= (Ar) 

For H_2O W.F. ligand 

4 umpaired e^-, $\therefore\ \mu = \sqrt{4(4+2)} = 4.9$ = 4.9 B.M.

For CN^- & F. ligand 

No unpaired e^-

$\mu = 0$

Q.4 The compound that inhibits the growth of tumors is -

(1) cis-$[Pd(Cl)_2(NH_3)_2]$ (2) trans-$[Pd(Cl)_2(NH_3)_2]$

(3) cis-$[Pt(Cl)_2(NH_3)_2]$ (4) trans-$[Pt(Cl)_2(NH_3)_2]$

Ans. **[3]**

Sol. cis platin is used to inhibit growth of tumor

Q.5 Which of the following comlpounds will show the maximum 'enol' content ?

(1) CH_3COCH_3 (2) $CH_3COCH_2COOC_2H_5$

(3) $CH_3COCH_2COCH_3$ (4) $CH_3COCH_2CONH_2$

Ans. **[3]**

Sol. β-Dicarbonyl compound

β-Diketone

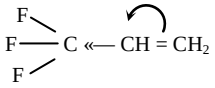
Extended conjugation and Intramolecular H-bonding in enolic form

Q.6 Which one of the following alkenes when treated with HCl yields majorly an anti Markovnikov product ?

(1) $CH_3O–CH=CH_2$ (2) $H_2N–CH=CH_2$

(3) $F_3C–CH=CH_2$ (4) $Cl–CH=CH_2$

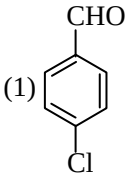
Ans. **[3]**

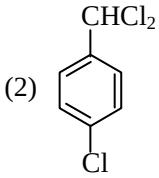
Sol. 

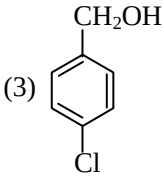
$-CF_3 \rightarrow -H$ effect

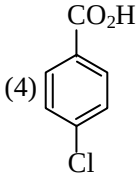
Most e^- withdrawing group

Q.7 The major product of the following reaction is –

(1) 

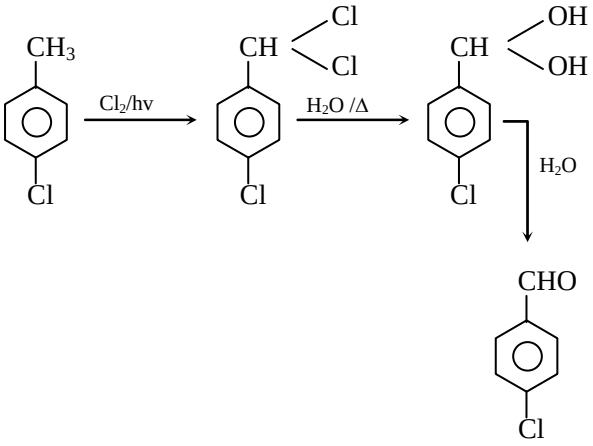
(2) 

(3) 

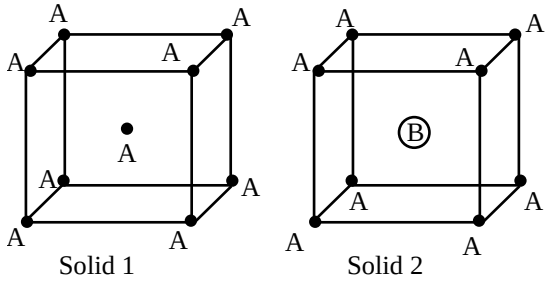
(4) 

Ans. **[1]**

Sol.



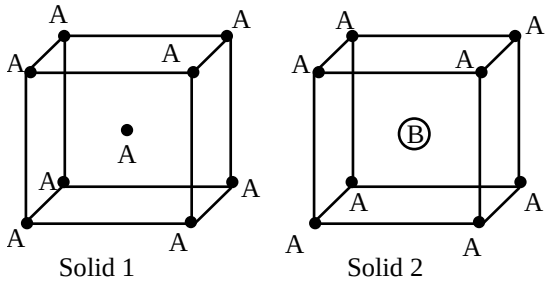
Q.8 Consider the bcc unit cells of the solids 1 and 2 with the position of atoms as shown below. The radius of atom B is twice that of atom A. The unit cell edge length is 50% more in solid 2 than in 1. What is the approximate packing efficency in solid 2 ?



(1) 75% (2) 90% (3) 45% (4) 65%

Ans. **[2]**

Sol.



$r_B = 2r_A$ $\quad a_2 = 1.5a_1$

$4r_A = \sqrt{3}a_1$, $\quad a_1 = \dfrac{4r_A}{\sqrt{3}}$

$a_2 = 1.5\ a_1$

$= \dfrac{3}{2}\ \dfrac{4r_A}{\sqrt{3}}$

$a_2 = 2\sqrt{3}r_A$

$$PE_2 = \frac{\left(\frac{4}{3}\pi r_A^3 \times 1\right) + \left(\frac{4}{3}\pi r_B^3 \times 1\right)}{a_2^3}$$

$$= \frac{\frac{4}{3}\pi r_A^3 + \frac{4}{3}\pi(2r_A)^3}{(2\sqrt{3}r_A)^3}$$

$$= \frac{\frac{4}{3}\pi r_A^3 \times 9}{8 \times 3\sqrt{3}\, r_A^3} = \frac{\pi}{2\sqrt{3}} = 90.64\%$$

$= 90\%$

Q.9 If p is the momentum of the fastest electron ejected from a metal surface after the irradiation of light having wavelength λ, then for 1.5 p momentum of the photoelectron, the wavelength of the light should be (Assume kinetic energy of ejected photoelectron to be very high in comparison to work function)

(1) $\frac{4}{9}\lambda$ (2) $\frac{2}{3}\lambda$ (3) $\frac{3}{4}\lambda$ (4) $\frac{1}{2}\lambda$

Ans. **[1]**

Sol. $E = \phi + KE$

$E = KE$

$$\frac{h_c}{\lambda} = \frac{1}{2}mv^2\left(\frac{m}{m}\right) = \frac{P^2}{2m}$$

$$p^2 \propto \frac{1}{\lambda}$$

$$\left(\frac{P_2}{P_1}\right)^2 = \frac{\lambda_1}{\lambda_2}$$

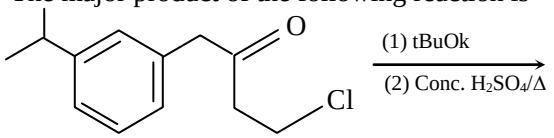
$$\left(\frac{1.5P_1}{P_1}\right)^2 = \frac{\lambda_1}{\lambda_2}$$

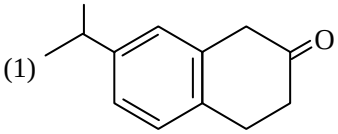
$$\left(\frac{3}{2}\right)^2 = \frac{\lambda_1}{\lambda_2}$$

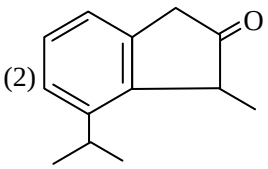
$$\frac{9}{4} = \frac{\lambda_1}{\lambda_2}$$

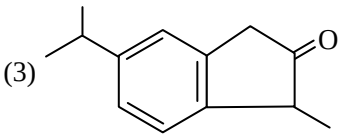
$$\lambda_2 = \frac{4}{9}\lambda_1$$

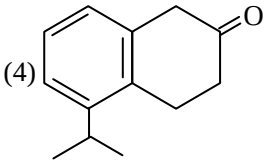
Q.10 The major product of the following reaction is –



(1) 

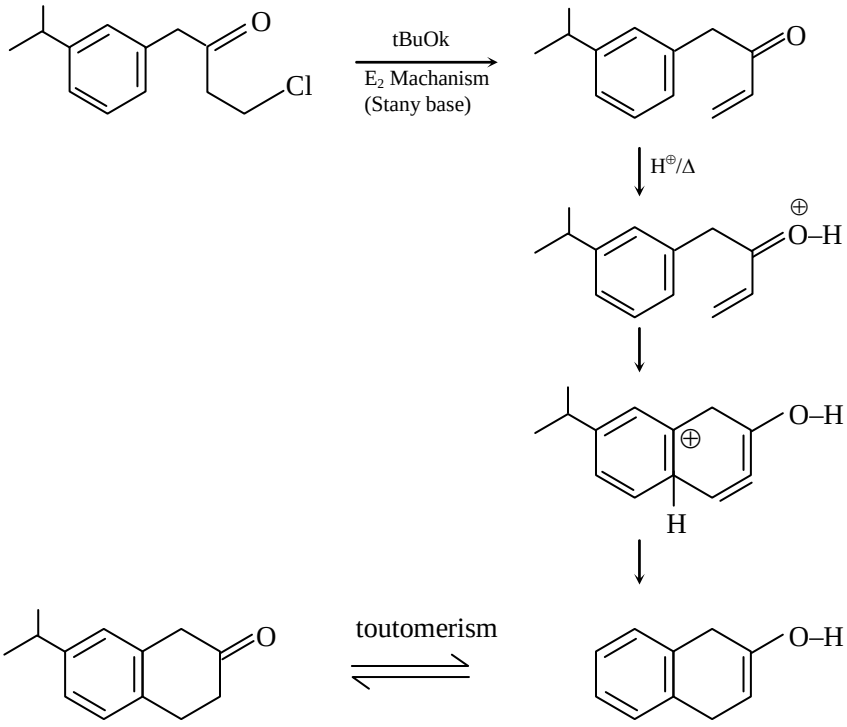
(2) 

(3) 

(4) 

Ans. **[1]**

Sol.



Q.11 The Mond process is used for the-

(1) purification of Ni
(2) extraction of Zn
(3) extraction of Mo
(4) purification of Zr and Ti

Ans. **[1]**

Sol. Mond process is used for Ni

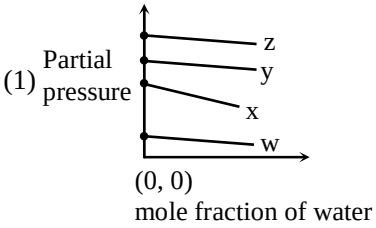
$$\underset{\text{impure}}{Ni} + 4CO \xrightarrow{330-350K} Ni(CO)_4$$

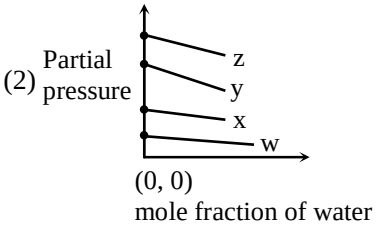
$$\underset{\text{impure}}{Ni} + 4CO \xrightarrow{330-350K} Ni(CO)_4$$

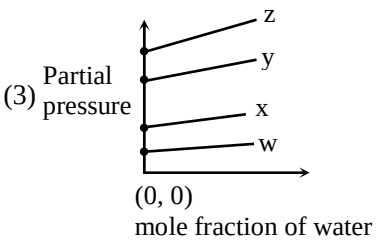
$$\downarrow 450 - 470\ K$$

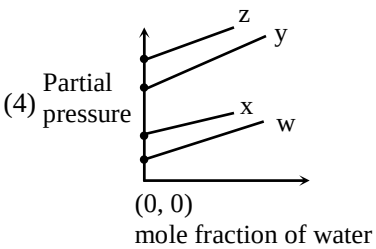
$$Ni + 4CO$$
Pure

Q.12 For the solution of the gases w, x, y and z in water at 298 K, the Henry law constants (K_H) are 0.5, 2, 35 and 40 kbar, respectively. The correct plot for the given data is -

(1) 

(2) 

(3) 

(4) 

Ans. **[2]**

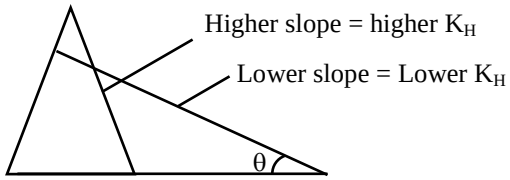
Sol. $k_H = \frac{p_g}{x_g} = \text{bar}$

$p_g = k_H x_g = k_H(1 - x_w)$

$= k_H - k_H x_w$

$= -k_H x_w + k_H$

$y = -mx + c$



$k_H{}_z > k_H{}_y > k_H{}_x > k_H{}_w$

Q.13 The IUPAC symbol for the element with atomic number 119 would be -

(1) uue (2) une (3) uun (4) unh

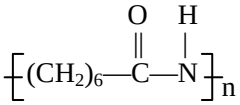
Ans. **[1]**

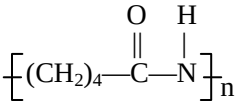
Sol. z = 119 is

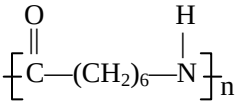
ununennium

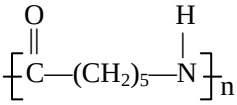
$\therefore$ uue

Q.14 The structure of Nylon-6 is ?

(1) 

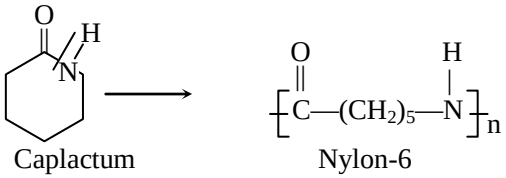
(2) 

(3) 

(4) 

Ans. **[4]**

Sol.



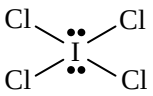
Caplactum Nylon-6

Q.15 The ion that has sp^3d^2 ha hybridazation for the central atom is -

(1) $[ICl_4]^-$ (2) $[ICl_2]^-$ (3) $[BrF_2]^-$ (4) $[IF_6]-$

Ans. **[1]**

Sol.



sp^3d^2

square planar geo

Q.16 For a reaction scheme $A \xrightarrow{k_1} B \xrightarrow{k_2} C$, if the rate of formation of B is set to be zero then the concentration of B is given by -

(1) $(k_1 - k_2)$ [A] (2) k_1k_2[A] (3) $(k_1 + k_2)$ [A] (4) $\left(\frac{k_1}{k_2}\right)$[A]

Ans. **[4]**

Sol. $\frac{dB}{dt} = K_1[A] - K_2[B] = 0$

$K_1[A] = K_2[B]$

$[B] = \frac{K_1}{K_2}[A]$

$\frac{d_A}{dt} = K_1[A]$

$\frac{d_C}{dt} = K_2[B]$

Q.17 For the following reactions, equilibrium constants are given -

$S(s) + O_2(g) \rightleftharpoons SO_2(g)$; $K_1 = 10^{52}$

$2S(s) + 3O_2(g) \rightleftharpoons 2SO_3(g)$; $K_2 = 10^{129}$

The equilibrium constant for the reaction,

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ is

(1) 10^{154} (2) 10^{181} (3) 10^{25} (4) 10^{77}

Ans. **[3]**

Sol. $S + O_2 \rightleftharpoons SO_2$; $K_1 = 10^{52}$

$2S + 3O_2 \rightleftharpoons 2SO_3$; $K_2 = 10^{129}$

$2SO_2 + O_2 \rightleftharpoons 2SO_3$; $K_3 = ?$

$K_3 = K_1^{-2} \cdot K_2 = \frac{K_2}{K_1^2} = \frac{10^{129}}{10^{104}} = 1$

Q.18 The statement that is incorrect about the intertitial compounds is -

(1) they are very hard (2) they have metallica conductivity

(3) they have high melting points (4) they are chemically reactive

Ans. **[4]**

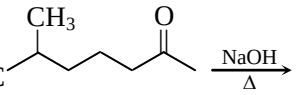
Sol. Intustitial compound are –

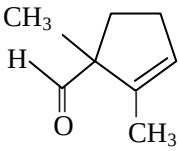
(i) hard

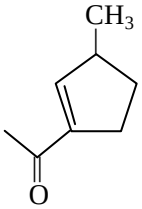
(ii) chemically inert

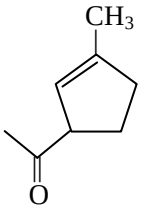
(iv) high m.p.

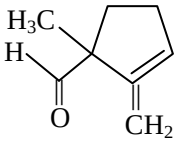
As interstitial compounds are chamically inert

Q.19 The major product obtained in the following reaction is 

(1) 

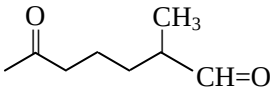
(2) 

(3) 

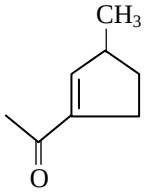
(4) 

Ans. **[2]**

Sol.



Inter molecular aldol condensation



α, β –unsaturated carbonyl compound

Q.20 The percentage composition of carbon by mole in methane is -

(1) 75% (2) 80% (3) 20% (4) 25%

Ans. **[3]**

Sol. % composition of C by mole in CH_4

$$\% \text{ C} = \frac{1}{5} \times 100$$

$$= 20\%$$

Q.21 Among the following molecules /ions, C_2^{2-}, N_2^{2-}, O_2^{2-}, O_2 which one is diamagnetic and has the shortest bond length

(1) N_2^{2-} (2) O_2 (3) C_2^{2-} (4) O_2^{2-}

Ans. **[3]**

Sol. O_2, N_2^{-2} = paramagnetic

C_2^{-2} and O_2^{-2} = diamagnetic

C_2^{-2} has B.O. = 3

$\therefore$ diamagnetic & shortest B.L.

Q.22 Polysubstition is a major drawback in -

(1) Reimer Tiemann reaction (2) Friedel Craft's acylation

(3) Friedel Craft's alkylation (4) Acetylation of aniline

Ans. **[3]**

Sol. Polysubstitution is a major drawback of Friedal –Craft alkylation

$-CH_3$ gp in highly activating group

due to +H effect of its

Q.23 Calculate the standard cell potential (in V) of the cell in which following reaction takes place –

$Fe^{2+}(aq) + Ag^{+}(aq) \rightarrow Fe^{3+}(aq) + Ag(s)$

Given that

$E°_{Ag^+/Ag} = xV$

$E°_{Fe^{2+}/Fe} = yV$

$E°_{Fe^{3+}/Fe} = zV$

(1) x + 2y – 3z (2) x + y – z (3) x – y (4) x – z

Ans. **[1]**

Sol. $E°_{Ag^+/Ag} = x$

$E°_{Fe^{2+}/Fe} = z$

$E°_{Fe^{3+}/Fe} = y$

$Fe^{2+} + Ag^{+} \rightarrow Fe^{+3} + Ag$

$$E^{\circ}_{cell} = \frac{E^{\circ}_C}{R.P.} - \frac{E^{\circ}_A}{R.P.}$$

$= E^{\circ}_{Ag^+/Ag} = E^{\circ}_{Fe^{+3}/Fe^{+2}}$

$= x - (3z - 2y)$

$= x + 2y - 3z$

$$E_3 = \frac{\pm n_1, E_1 \pm n_2 E_2}{n_3}$$

$$= \frac{3z - 2y}{1} = 3z - 2y$$

Q.24 The covalent alkaline earth metal halide (X = Cl, Br, I) is

(1) BeX_2 (2) SrX_2 (3) MgX_2 (4) CaX_2

Ans. **[1]**

Sol. Halides of Be are covalent

Q.25 The correct statement about ICl_5 and ICl_4^-

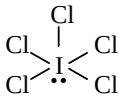
(1) both are isostructural

(2) ICl_5 is square pyramidal and ICl_4^- is square planner

(3) ICl_5 is trigonal bipyramidal and ICl_4^- is tetrahedral

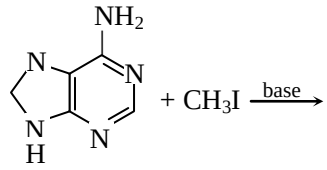
(4) ICl_5 is square pyramidal and ICl_4^- is tetrahedral

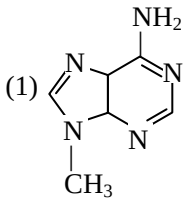
Ans. **[2]**

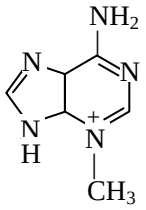
Sol. ICl_5 is  sp^3d^2 square pyramidal

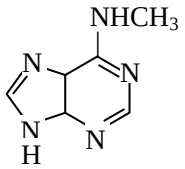
ICl_4^- square planar sp^3d^2

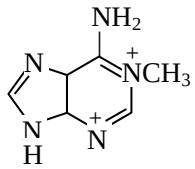
Q.26 The major product in the following reaction is ?



(1) 

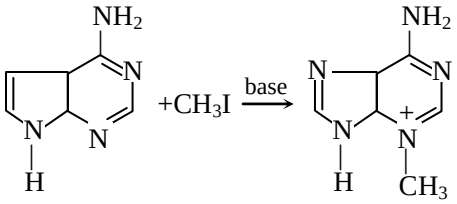
(2) 

(3) 

(4) 

Ans. **[1] Bonus**

Sol.



Official answer
according to
NTA → 1

Q.27 The maximum prescribed concntration of copper in dringking water is -

(1) 5 ppm (2) 0.5 ppm (3) 3 ppm (4) 0.05

Ans. **[3]**

Sol. The prescribed conc. of Cu in drinking water is 3ppm

Q.28 Fructose and glucose can be distinguished by -

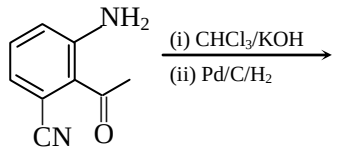
(1) Fehling's test (2) Seliwanoff's test

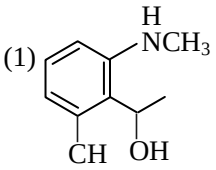
(3) Barfoed's test (4) Benedict's test

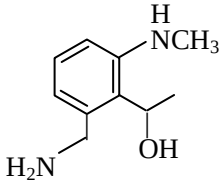
Ans. **[2]**

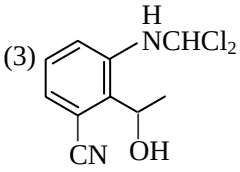
Sol. Glucose and fructose can be distinguised by seliwan eff's. It is used to distinguished aldose ketose group.

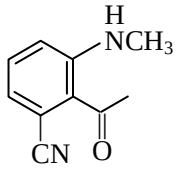
Q.29 The major product obtained in the following reaction is –



(1) 

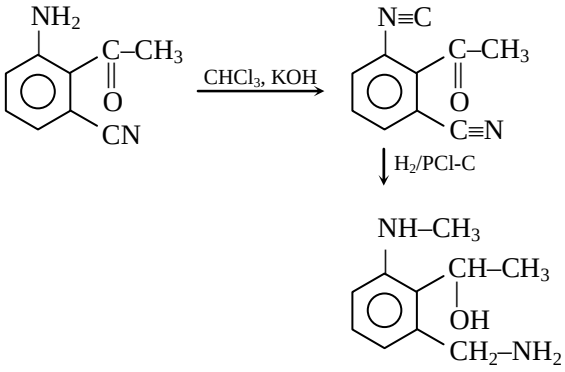
(2) 

(3) 

(4) 

Ans. **[2]**

Sol.



Q.30 The strength of 11.2 volume solution of H_2O_2 is : [Given that molar mass of H = 1g mol^{-1} and O = 16g mol^{-1}]

(1) 1.7% (2) 34% (3) 3.4% (4) 13.6%

Ans. **[3]**

Sol. 11.2 vol. H_2O_2

m = ?

Vol. strength = 11.2 M

11.2 = 11.2 m

m = 1

1 mole H_2O_2 prompt in IL solution

34 gm in 1000 gm solution

$$\%\frac{w}{w} = \frac{(g_m)\text{solute}}{(g_m)\text{solution}} \times 100$$

$$= \frac{34}{1000} \times 100 = 3.4\%$$