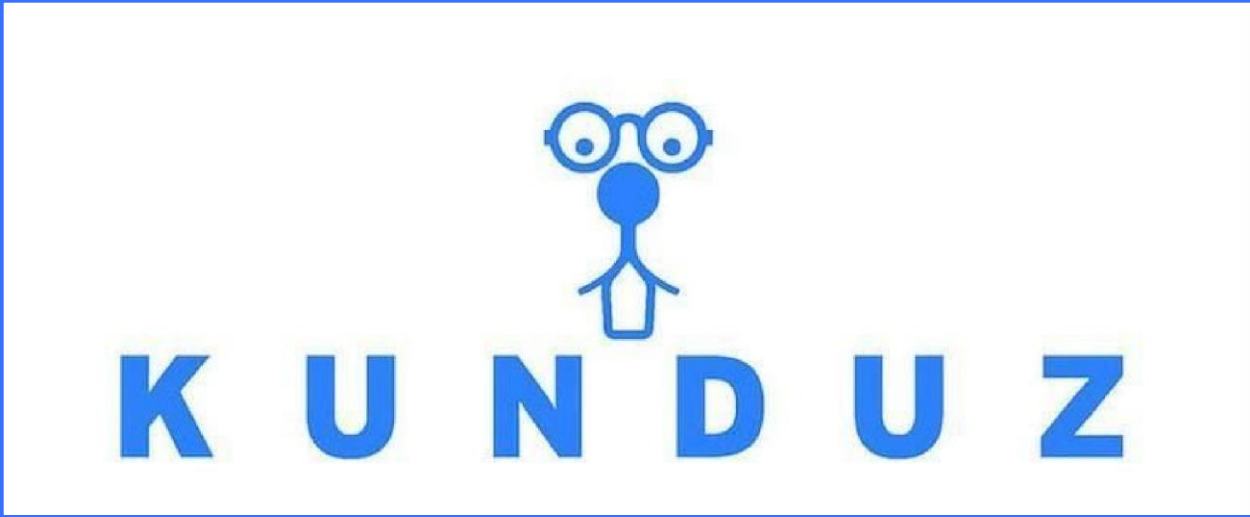

JEE Mains 6th September 2020 shift 1 Chemistry solutions prepared by KUNDUZ tutors

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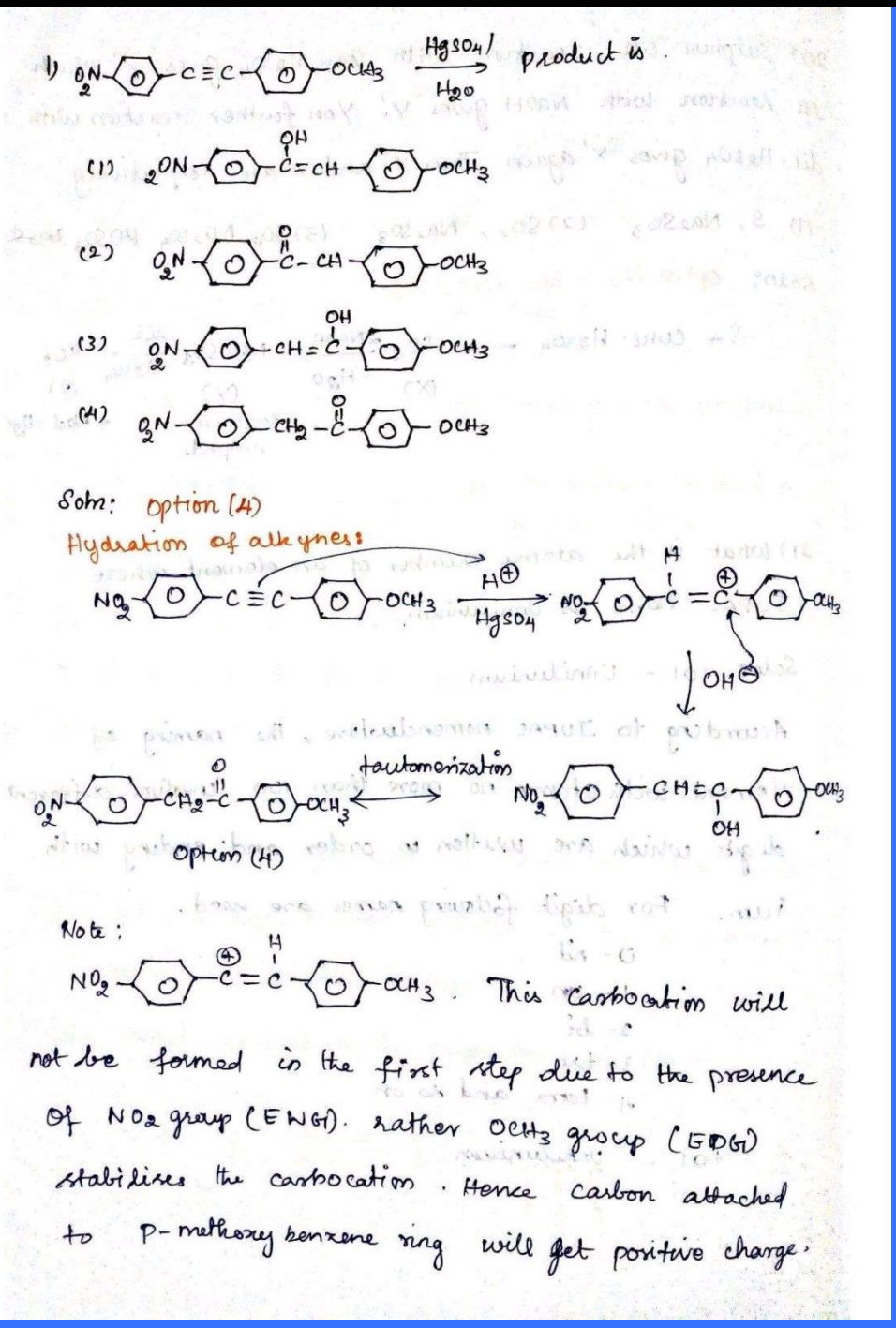
Question number

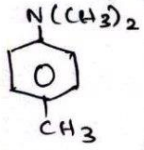
Question and Answers

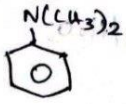
1

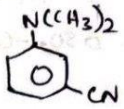


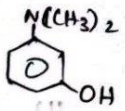
2

2) Write down increasing order of pK_b of the following?

(I) 

(II) 

(III) 

(IV) 

Soln: (1) IV < III < II < I (2) I < II < III < IV (3) I < II < IV < III (4) I < III < IV < II

Basic strength $(K_b) \propto \frac{1}{pK_b}$.

$K_b \propto +I$, +M effect.

$K_b \propto \frac{1}{-I, -M \text{ effect}}$.

+I effect of groups at ortho position and para position will be more than meta position.

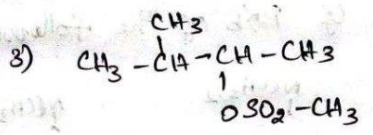
Given: CH_3 – +I effet ; CN → -I effelt ; OH – +I effect.

Order of Basicity (K_b) = 1 > 2 > 4 > 3

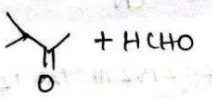
Order of pK_b value : 3 > 4 > 2 > 1

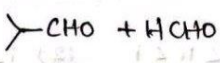
Ans: option (3) (I < II < IV < III)

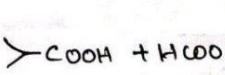
3

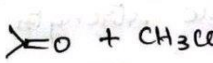
3) 

final product is.

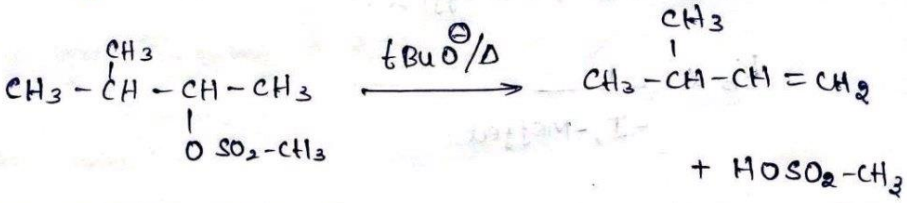
(1) 

(2) 

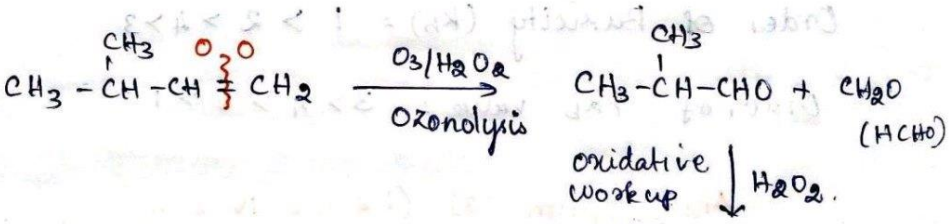
(3) 

(4) 

Soln: option (3)



Due to the presence of Bulky base at higher Temperature, E_2 reaction takes place giving hoffmann alkene (least substituted).



Ozonolysis of alkenes gives ketones or aldehydes which upon oxidative work up with H_2O_2 gives corresponding acid.

4

4) which can show geometrical isomer?

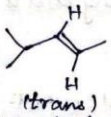
(1) 4-methylpent-1-ene 

(2) 4-methylpent-2-ene 

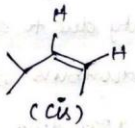
(3) 3-Methylpent-1-ene 

(4) 2-methylpent-1-ene 

Soln: option (2)



(trans)



(cis)

(4-methyl pent-2-ene) can show geometrical isomerism.

Double bonded carbon with two different groups can show geometrical isomerism.

Note: option 1, 3, and 4 have two H groups on one double bonded carbon. so it won't exhibit geometrical isomerism.

5

5) Statement-1: High density polythene (HDP) is form when addition polymerisation of ethene takes place in a hydrocarbon solvent in the presence of a catalyst ziegler-Natta catalyst at a temperature of 333K to 343K and under a pressure of 6-7 atm.

Statement-2: High density polythene (HDP) consists of linear molecules and has a high density due to closed packing and it is used for manufacturing buckets, dustbins, bottles.

Select correct option regarding these statements.

(1) Both statements are correct, and the statement-2 is the correct explanation for the statement-1.

(2) Both statements are correct, and the statement-2 is NOT correct explanation for the statement-1.

(3) The statement-1 is incorrect, but the statement-2 is correct.

(4) Both statements are incorrect.

Soln: option (1) - Both statements are correct, and the statement-2 is the correct explanation for the statement-1.

High density polythene - It is formed when addition polymerisation of ethene takes place in a hydrocarbon solvent in the presence of a catalyst such as triethylaluminium and titanium tetrachloride (ziegler-Natta catalyst) at a temperature of 333K to 343K and under a pressure of 6-7 atm. High density polythene (HDP) thus produced, consists of linear molecules and has a high density due to close packing. It is also chemically inert and more tougher and harder. It is used for manufacturing buckets, dustbins, bottles, pipes etc.

6

6) If the concentration of fluoride ion is upto 1 ppm, then which of the following options may be correct:

(1) good for teeth

(2) Harmful for teeth and cause brown mottling of teeth

(3) Harmful for bones and teeth

(4) Harmful for growth of children.

Soln: option (1)

Soluble fluorides are added to drinking water to make concentration upto 1 ppm because F^- ions make the enamel on teeth much harder. But above 2 ppm causes brown mottling of teeth and cause harmful effect on bones and teeth.

7

7. Which of the following lanthanides elements do not show +4 oxidation state?

(1) Eu (2) Dy (3) Tb (4) Ce.

Soln: option (1) - Eu

$Eu\ (z=63) = [Xe]\ 4f^7\ 6s^2$.

It can lose only 2 $e^\ominus$ since it has half-filled stable $4f^7$ configuration. So Eu exists as Eu^{2+} and rarely as Eu^{3+}. But Eu^{4+} does not exist.

$Dy\ (z=66) = [Xe]\ 4f^{10}\ 6s^2$; $Dy^{4+} = [Xe]\ 4f^8$

$Tb\ (z=65) = [Xe]\ 4f^9\ 6s^2$; $Tb^{4+} = [Xe]\ 4f^7$.

$Ce\ (z=58) = [Xe]\ 4f^1\ 5d^1\ 6s^2$; $Ce^{4+} = [Xe]^{54}$

8

8. Value of Equilibrium Constant at two different temperature is given as.

Temperature	Equilibrium constant
$T_1 = 50^\circ C$	$K_1 = 10$
$T_2 = 100^\circ C$	$K_2 = 100$.

Then the value of ΔH of reaction, ΔG_1 and ΔG_2 (in KJ) at T_1 and T_2 respectively are.

(1) 46.14, −6.2, −14.3 (2) −46.14, +6.2, +14.3.

(3) +46.14, 6.2, 14.3 (4) −46.14, −6.2, +14.3

Soln: option (1)

$$\log\left(\frac{K_2}{K_1}\right) = \frac{\Delta H}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

$$\log\left(\frac{100}{10}\right) = \frac{\Delta H}{2.303 \times 8.314}\left[\frac{1}{50^\circ C} - \frac{1}{100^\circ C}\right] \quad T_1 = 323K, \; T_2 = 373K$$

$$\Delta H = \frac{2.303 \times 8.314 \times 323 \times 373}{50} = 46.14 \text{ KJ}.$$

$$\Delta G_1 = -2.303 RT_1 \log K_1$$

$$= -2.303 \times 8.314 \times 323 \times \log(10)$$

$$= -6184.5 \text{ J} = -6.2 \text{ KJ}.$$

$$\Delta G_2 = -2.303 \log K_2 \times RT_2$$

$$= -2.303 \times 8.314 \times 373 \times \log(100)$$

$$= -14283.7 \text{ J}$$

$$= -14.3 \text{ KJ}.$$

$\Delta H = 46.14$ KJ

$\Delta G_1 = -6.2$ KJ

$\Delta G_2 = -14.3$ KJ

9

9. Identify the correct set of Atomic Number belongs to transition elements series.

(1) 98, 21, 25, 72 (2) 21, 25, 29, 57 (3) 21, 25, 30, 57

4) 29, 48, 57, 72

Soln: option (2)

A Transition element has incompletely filled d-orbitals in its ground state. Scandium (21), Manganese (25), Copper (29), Lanthanum (57) belongs to transition element Zn (30), Cadmium (48) have fully filled d-orbitals. So they are not transition elements.

Note: fluorine (9) belongs to halogen family.

10

10. Micelles formation takes place

(1) Below kraft Temperature (2) above kraft temperature.

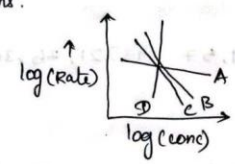
(3) below critical micelles concentration (CMC) (4) have no relation with kraft temperature.

Soln: option (2)

Micelles are aggregate of molecules in a colloidal suspension. Kraft temperature is defined as the temperature at which the solubility of a surfactant is equal to its critical micelle concentration at same temperature. Micelle formation takes place only above kraft temperature.

11

11) Following graph is obtained for four different reactions.



On basis of above graph, correct increasing order of reaction is

(1) A < B < C < D (2) D < C < B < A (3) A < B < D < C (4) D < C < A < B

Soln: option (1)

$$Rate = k[conc]^{order}$$

$$\log Rate = \log k + order \log [conc]$$

This is of the form $y = mx + c$.

slope = m = order.

⇒ Greater the slope higher the order.

Order of reaction = A < B < C < D

12

12. Which of the following complex show magnetic moment (spin only) = 5.91 BM.

(1) $[Ni(CO)_4]$ (2) $[FeF_6]^{3-}$ (3) $[Fe(CN)_6]^{3-}$ (4) $[Cr(H_2O)_6]^{3+}$

Soln: option (2)

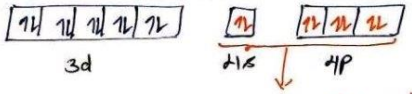
$$\mu = \sqrt{n(n+2)}\ BM = 5.91\ BM.$$

where n = no. of unpaired electrons.

If $\mu = 5.91$ BM, then n should be 5

(1) $[Ni(CO)_4]$ ⇒ Oxidation state of Ni = 0

$Ni^{28} - 3d^8 4s^2$

$[Ni(CO)_4]$ - 

CO ligands

$n = 0$

(2) $[FeF_6]^{3-}$ O.S of Fe = +3 ; $Fe^{26} - 3d^6 4s^2$.

$Fe^{+3} = 3d^5$

$[FeF_6]$ - 

F^- → weak ligand

$n = 5$ ⇒ $\mu = 5.91$ BM.

3) $[Fe(CN)_6]^{3-}$ $Fe^{3+} = 3d^5$

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

$n = 1$

(4) $[Cr(H_2O)_6]^{3+}$ - $Cr^{3+} = 3d^3$.

$[Cr(H_2O)_6]^{3+}$ = 

$n = 3$

13

13. Which of the following is not correct for alloys.

(1) German silver — Cu, Zn, Ni

(2) Brass — Cu, Zn, Ni

(3) Bronze — Cu, Sn

(4) Bell Metal — Cu, Sn

Soln: option (2)

Alloy	composition
Bronze	Cu(75-90%) + Sn(10,25%)
Bell Metal	Cu(80%) + Sn(20%)
German Silver	Cu(50-62%) + Zn(17-19%) + Ni(13-14)
Brass	Cu(60-80%) + Zn(20-40%)

Brass does not contain Nickel.

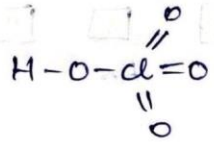
14

14. How many total no. of 'Cl=O' bond are present in structure of perchloric acid.

Soln: 3

$HClO_4$ - perchloric acid

Structure:



No. of 'Cl=O' bonds = 3.

15

15) Arrange the following solutions in the decreasing order of pOH.

(A) 0·01M HCl (B) 0·01M NaOH (C) 0·01M CH_3COONa

(D) 0·01M NaCl.

1) B>C>D>A. (2) A>C>D>B.

(3) B>D>C>A (4) A>D>C>B.

Soln: option (4) – A>D>C>B.

NaOH and CH_3COONa are bases, so they have lowest pOH values. NaOH is the strongest base which have higher PH and lowest pOH value. Hcl and Nacl are salt and acid. which have higher pOH value. Since Hcl has highest pOH (strongest) acid. it will have low pH value.

pOH order: Hcl > Nacl > CH_3COONa > NaOH (A>D>C>B)

pH order: NaOH> CH_3COONa > Nacl > Hcl.

16

18. Consider the following reactions :

$$\underset{(C_7H_{14})}{A} \xrightarrow{\text{Ozonolysis}} B + C.$$

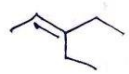
$$B \xrightarrow[\Delta]{I_2 + NaOH} \text{Yellow ppt.}$$

$$B \xrightarrow[\Delta]{Ag_2O} \text{Silver mirror.}$$

$$C \xrightarrow[\Delta]{I_2 + NaOH} \text{no yellow ppt}$$

$$C \xrightarrow{LiAlH_4} D \xrightarrow[\text{Con. HCl}]{\text{Anhyd } ZnCl_2} \text{gives white turbidity within 5 mins.}$$

A is

① 

② 

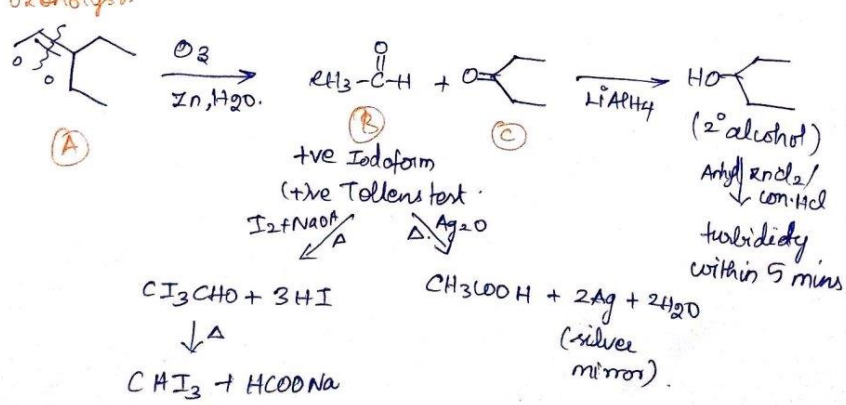
③ 

④ 

Soln: Option (1)

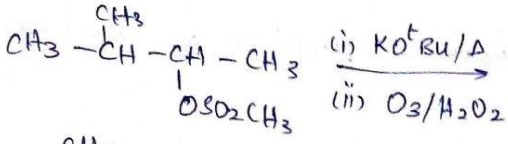
Note: Acetaldehyde and terminal ketones (methyl ketones) only give (+)ve Iodoform test (I_2/NaOH). 2° alcohol gives white turbidity within 5-10mins when treated with Lucas Reagent. (anhyd. $ZnCl_2$ + con. HCl).

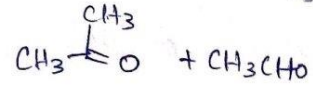
Ozonolysis

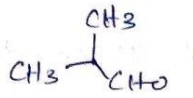


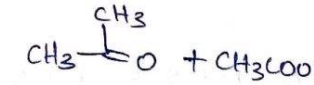
17

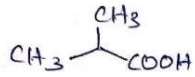
The major products of the following reaction are:



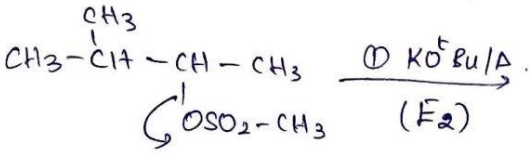
(1)  + CH_3CHO

(2)  + HCHO.

(3)  + CH_3COOH

(4)  + HCOOH.

Soln: Option (4)

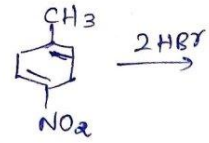


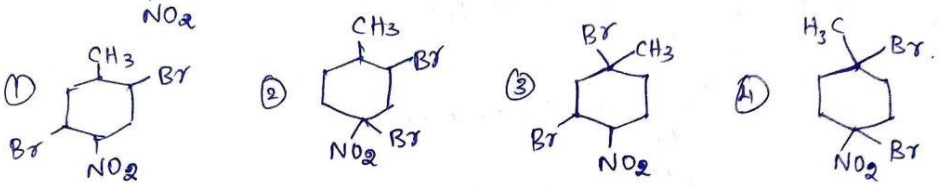
(1) Due to presence of Bulky Base KO^{t}Bu, the reactant undergoes E2 reaction and gives hoffman alkene.

(2) Ozonolysis of the alkene will give 2 aldehydes, which upon oxidative workup (H_2O_2) gives acids.

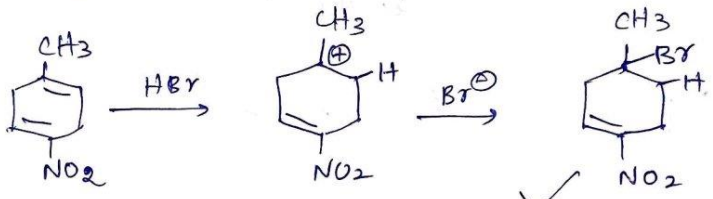
18

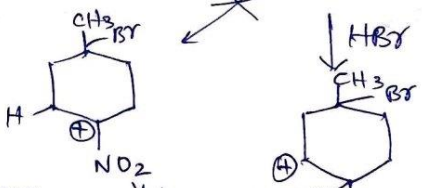
(Q) The major product of the following reaction is :



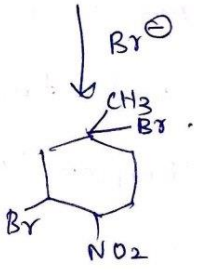


Soln : option (3)





This structure won't be formed because EWG (NO2) destabilises the carbocation.



19

(9) Kraft temperature is the temperature:

(1) above which the aqueous solution of detergent starts boiling.

(2) below which the aqueous solution of detergents starts freezing.

(3) above which the formation of micelles takes place.

(4) below which the formation of micelles takes place.

Soln: option (3)

Micelles are aggregate of molecules in a colloidal suspension. Kraft temperature is defined as the temperature at which the solubility of a surfactant is equal to its critical micelle concentration at same temperature. Micelle formation takes place only

20

20) Among the sulphates of alkaline earth metals, the solubilities of $BeSO_4$ and $MgSO_4$ in water respectively are.

① poor and poor ② poor and high ③ high and poor.

④ high and high.

Soln: option (4)

On moving down the group, solubility of sulphates decreases.

Solubility order: $BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$

So $BeSO_4$ and $MgSO_4$ have high solubility in water.

21

20) A solution of two components containing n_1 Moles of the 1st component and n_2 moles of the 2nd component is prepared M_1 and M_2 are the molecular weights of component 1 and 2 respectively. If d is the density of the solution in $g\,ml^{-1}$, C_2 is the molarity and x_2 is the mole fraction of the 2nd component, then C_2 can be expressed as:

① $C_2 = \dfrac{d x_1}{M_2 + x_2(M_2 - M_1)}$

② $C_2 = \dfrac{1000 x_2}{M_1 + x_2(M_2 - M_1)}$

③ $C_2 = \dfrac{1000 d x_2}{M_1 + x_2(M_2 - M_1)}$

④ $C_2 = \dfrac{d x_2}{M_2 + x_2(M_2 - M_1)}$

Soln: Option (3)

$$\text{Molarity} = \frac{\text{No. of moles of solute} \times 1000}{\text{Mass of solvent in Kg.}}$$

$$\text{Molarity} = \frac{n_2 \times 1000}{\frac{n_2 M_2 + n_1 M_1}{d}} = \frac{n_2 d \times 1000}{n_1 M_1 + n_2 M_2}$$

$$= \frac{\frac{n_2}{n_1 + n_2} d \times 1000}{\frac{n_1 M_1}{n_1 + n_2} + \frac{n_2}{n_1 + n_2} M_2} = \frac{x_2 d \times 1000}{x_1 M_1 + x_2 M_2}$$

$$C_2 = \frac{1000 \times d x_2}{M_1 + x_2(M_2 - M_1)}$$

22

22) potassium chlorate is prepared by the electrolysis of KCl in basic solution $6OH^- + Cl^- \rightarrow ClO_3^- + 3H_2O + 6e^-$

If only 60% of the current is utilized in the reaction, the time (rounded to the nearest hour) required to produce 10 kg of $KClO_3$ using a current of 2A is.

Given (F = 96500 C mol^{-1} ; molar mass of $KClO_3$ = 122 g mol^{-1})

Soln:

$$\text{weight} = \frac{\text{Eq.Wt} \times I \times t}{96500F}$$

$$\text{Eq.Wt of } KClO_3 = \frac{122.5}{\text{no. of electrons involved}}$$

$$= \frac{122.5}{6} = 20.42.$$

$$\text{weight} = 10 = \frac{20.42 \times 0.60 \times 2 \times t}{96500.}$$

$$t = \frac{965000}{24.51}$$

$$t = 39381 \text{ secs.}$$

$$t = \frac{39381}{60 \times 60} = 10.98 \text{ hrs}$$

23

23) A spherical ballon of radius 3cm containing helium gas has a pressure of 48×10^{-3} bar. At the same temperature, the pressure of a spherical balloon of radius 12 cm containing the same amount of gas will be ____ $\times 10^{-6}$ bar.

Let V be the volume of the balloon of r = 3cm.

then volume of 12cm radius balloon = 64 V

we know, $P \propto \frac{1}{V}$.

So pressure of balloon of radius 12cm will be $\frac{1}{64}$ times of pressure of balloon of radius 3cm.

$$P = \frac{1}{64} \times 48 \times 10^{-3} = 750 \times 10^{-3} \text{ bar}.$$

$P = 750 \times 10^{-3}$ bar

24

24) In an estimation of bromine by Carius method, 1.6 g of an organic compound gave 1.88 g of AgBr. The mass percentage of Bromine in the compound is.

Soln:

Mass of organic compound = 1.6 g.

Mass of AgBr = 1.88 g.

Molecular mass of AgBr = 188 g/mol.

188 g AgBr contains 80 g Bromine.

1.88 g of AgBr contains x g of Bromine.

$$x = \frac{80 \times 1.88}{188} = 0.8 \text{ of bromine.}$$

$$\% \text{ of Bromine} = \frac{0.8}{1.6} \times 100 = \boxed{50\%}$$

25

25) The correct statement with respect to dinitrogen is.

(1) Liquid dinitrogen is not used in cryosurgery.

(2) N_2 is paramagnetic in nature.

(3) It can combine with dioxygen at 25°C.

(4) It can be used as an inert diluent for reactive chemicals.

Soln: Option (4)

N_2 is diamagnetic in nature and it cannot combine with dioxygen at 25°C. It can combine only at high temperature so the reaction of $N_2 + O_2$ is an endothermic process. Liquid dinitrogen is used in cryosurgery. It can be used as an inert diluent for reactive chemicals. So 4th statement is correct.

26

26) The elevation of boiling point of 0.1 m aqueous $CrCl_3 \cdot XNH_3$ solution is two times that of 0.05 m aqueous $CaCl_2$ solution. The value of x is ——.

[Assume 100% ionisation of the complex and $CaCl_2$, co-ordination number of Cr as 6, and that all NH_3 molecules are present inside the co-ordination sphere].

Soln:

ΔT_b for $(CrCl_3 \cdot XNH_3)$ = ΔT_b for $CaCl_2 \times 2$.

i for non-electrolyte = 1.

0.05m $CaCl_2$ solution = 0.15 molal soln of non electrolyte.

$$[CrCl \cdot x\,NH_3]Cl_2 \longrightarrow \underbrace{[CrCl \cdot x\,NH_3]^{2+} + 2\,Cl^-}_{3 \text{ ions}}$$

Co-ordination no. of Cr^{2+} is 6.

So no. of ligands bounded to Chromium is 6.

Cr has one Cl ligand and x NH_3 ligand.

no. of ligands = 6.

$1(Cl) + x(NH_3) = 6$

$\boxed{x = 5}$

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