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केन्द्रीय माध्यमिक शिक्षा बोर्ड, दिल्ली
सीनियर स्कूल सर्टिफिकेट परीक्षा (कक्षा बारहवं
परीक्षार्थी प्रवेश–पत्र के अनुसार भरे

विषय Subject : CHEMISTRY

विषय कोड Subject Code : 043

परीक्षा का दिन एवं तिथि
Day & Date of the Examination : SATURDAY, 25th MARCH 2017

उत्तर देने का माध्यम
Medium of answering the paper : ENGLISH

प्रश्न पत्र के ऊपर लिखे कोड को दर्शाए : Write code No. as written on the top of the question paper :	Code Number	Set Number
	56/2	① ● ③ ④

अतिरिक्त उत्तर–पुस्तिका (ओं) की संख्या
No . of supplementary answer -book(s) used : —

विकलांग व्यक्ति : हाँ / नहीं
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किसी शारीरिक अक्षमता से प्रभावित हो तो संबंधित वर्ग में ✓ का निशान लगाऐं।
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B	D	H	S	C	A

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यदि दृष्टिहीन हैं तो उपयोग में लाए गये सॉफ्टवेयर का नाम :
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Each letter be written in one box and one box be left blank between each part of the name. In case Candidate's Name exceeds 24 letters, write first 24 letters.

कार्यालय उपयोग के लिए
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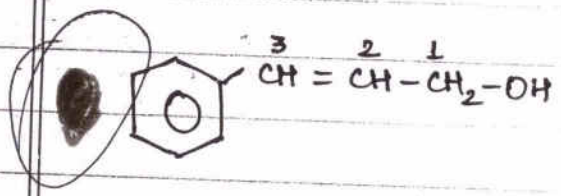
Ans. (1) (a) On adding a catalyst, activation energy decreases.

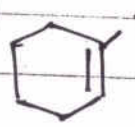
(b) Gibb's energy (ΔG) of the reaction remains the same, on adding a catalyst.

Ans. (2) A sol is formed when a solid is dispersed in a liquid.
Example – Cell fluids, paints, Gold sol, etc.

Ans. (3) 

IUPAC Name :- 3-Phenyl prop-2-en-1-ol

Ans. (4) H_2SO_4 is obtained when conc. HNO_3 oxidises S_8.

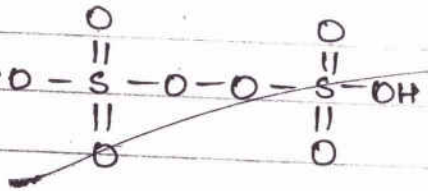
Ans. (5) 

is an example of vinylic halide.

Ans. (6.) (a) The formula of the given compound is → $[Cr(en)_3]Cl_3$

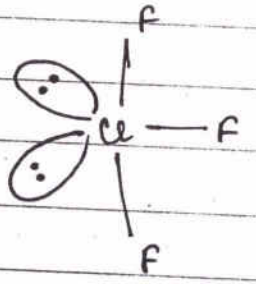
(b) The formula of the given compound is → $K_2[Zn(OH)_4]$

Ans. (7.) (a)



$H_2S_2O_8$ (Peroxodisulphuric acid),

(b)



Bent-T-shape.

Ans. (8.) (a) Lead storage battery is generally used in inverters.

(b) Reaction taking Place at →

(i) Anode

$$SO_4^{2-} + Pb \longrightarrow PbSO_4 + 2e^-$$

(ii) Cathode

$$PbO_2 + SO_4^{2-} + 4H^+ + 2e^- \longrightarrow PbSO_4 + 2H_2O$$

Ans. (9.) Aluminium crystallises in f.c.c. structure

∴ no. of atoms in 1 unit cell, $Z = 4$

given mass of Al = 8.1 g

Molar mass of Al = 27 g mol^{-1}

$$\therefore \text{no. of moles} = \frac{\text{Given mass}}{\text{Molar mass}} = \frac{8.1}{27} \times \frac{1}{10}$$

$$= \frac{81}{27 \times 10} = 0.3 \text{ mol}$$

∴ no. of atoms of Al = no. of moles × Avogadro's no.

$= n \times N_A = 0.3 \times 6.022 \times 10^{23}$ atoms.

∴ no. of unit cells = $\frac{\text{No. of atoms of Al}}{\text{No. of atoms in 1 unit cell}}$

$= \frac{0.3 \times 6.022 \times 10^{23}}{4}$

$= 0.4516 \times 10^{23}$

no. of unit cells = 4.516×10^{22} unit cells

Ans

Ans (10.) (a) $CH_3-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow{CrO_3} CH_3-CH_2-\underset{\underset{O}{||}}{C}-CH_3$

Butan-2-ol → Butan-2-one

(b) $CH_3-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow{SOCl_2} CH_3-CH_2-\underset{\underset{Cl}{|}}{CH}-CH_3$

2-Chlorobutane.

Ans. (11.)

(a) **Principle Of Vapour Phase Refining:—**

Vapour phase refining is based on the principle that the impure metal is converted into a volatile compound which can be collected elsewhere. It is then decomposed to give back the pure metal.

Eg.

$$Zr + 2I_2 \xrightarrow{\Delta} ZrI_4$$

(impure) (volatile)

$$ZrI_4 \xrightarrow{\Delta} Zr + 2I_2$$

(pure)

(b) dilute NaCN is used as a reagent in leaching of silver (cyanide process)

$$2Ag + 4CN^- + H_2O + \frac{1}{2}O_2 \longrightarrow 2[Ag(CN)_2]^- + 2OH^-$$

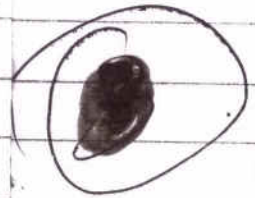
(soluble complex)

NaCN reacts with Ag to form complex $Na[Ag(CN)_2]$, which on reduction with zinc, gives Ag back.

$$2[Ag(CN)_2]^- + Zn \longrightarrow [Zn(CN)_4]^{2-} + 2Ag$$

(c) Collectors enhance the non-wettability of the mineral particles.
Example → Pine oil, ~~fatty~~ acids, xanthates

Ans. (12) (a).



$$CH_3-COOH \xrightarrow[\Delta]{NH_3} CH_3-\overset{\overset{O}{\|}}{C}-NH_2 \xrightarrow[KOH(aq)]{Br_2} CH_3-NH_2 \xrightarrow[+alc.\ KOH]{CHCl_3} CH_3NC$$

(A) (B) (C)

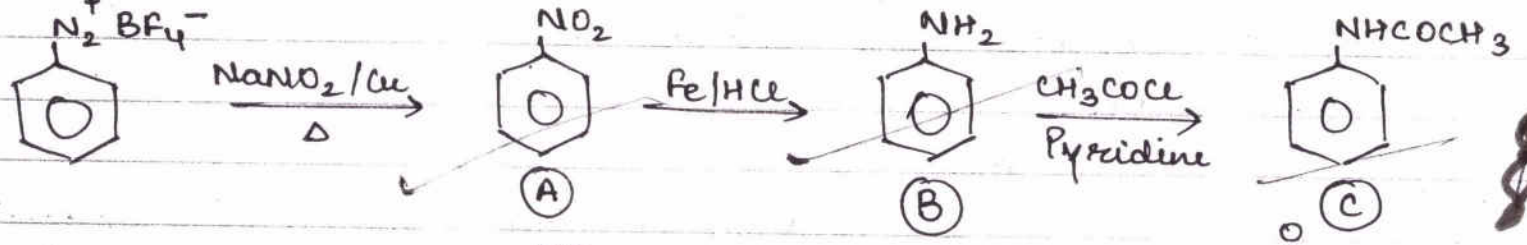
∴ Structure of

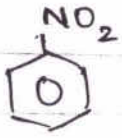
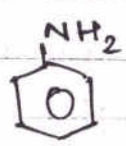
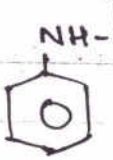
A is $CH_3-\overset{\overset{O}{\|}}{C}-NH_2$

B is CH_3-NH_2

C is CH_3-NC

(b)



∴ Structure of A is  , B is  & C is 

Ans. (13) (a) Given reaction is :-

$$2Fe^{3+}(aq) + 2I^{-}(aq) \longrightarrow 2Fe^{2+}(aq) + I_2(s)$$

∴ n-factor, $n = 2$

$E^{\circ}_{cell} = 0.236\ V$ (given)

$\Delta G^{\circ} = ?$

We know,

$$\Delta G^{\circ} = -nFE^{\circ}_{cell}$$

$$= -(2)(96500)(0.236) = -45548\ J\,mol^{-1}$$

$$\boxed{\Delta G^{\circ} = -45.548\ KJ\,mol^{-1}}$$

(b) Given:- Current, $I = 0.5\ A$ & time, $t = 2\ hrs$.

Let 'n' electrons pass through it.

We know.

charge, $Q = It = ne$

'e' is charge on one electron. $(e = 1.6 \times 10^{-19}\ C)$

Substituting, we get,

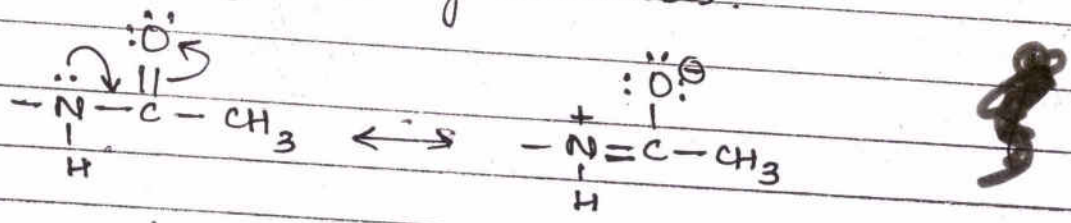
$$0.5 \times 2 \times 3600 = x \times 1.6 \times 10^{-19}$$

$$\therefore x = \frac{0.5 \times 2 \times 3600}{1.6 \times 10^{-19}}$$

$$x = 2.25 \times 10^{22} \text{ electrons.}$$

Ans

Ans (14) (a) Acetylation of aniline reduces its activation effect, because, the lone pair of electron on nitrogen atom is involved in resonance with $-\overset{\overset{O}{\|}}{C}-CH_3$ (acetyl group). So, electron density on benzene ring decreases.



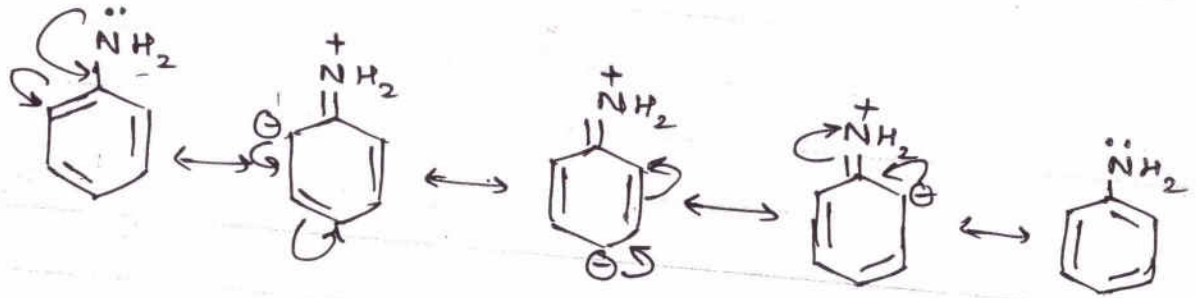
(b) CH_3NH_2 is more basic than $C_6H_5NH_2$, as the lone pair of electron on nitrogen atom in $C_6H_5NH_2$ is involved in resonance, whereas, in CH_3NH_2, electron density on N atom increases ~~in CH_3NH_2~~ due to +I effect of $-CH_3$ group. Hence,

affinity of $CH_3\ddot{N}H_2$ towards proton (H^+) is more than that of $C_6H_5NH_2$.

$CH_3 - \ddot{N}H_2$

$\rightarrow$

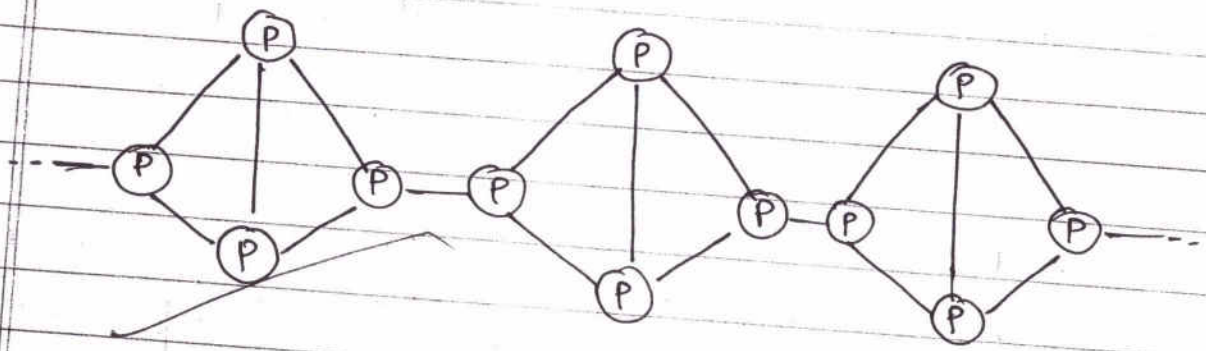
+I effect



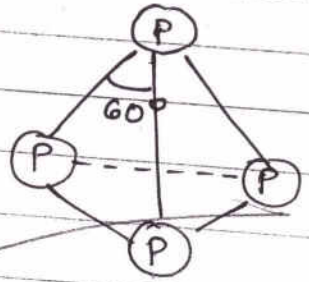
Resonance in aniline.

(vi) Although $-NH_2$ group is o/p directing group, yet aniline on nitration gives a significant amount of m-nitroaniline, because, in highly acidic medium, aniline accepts H^+ ion and form anilinium ion, which is a highly deactivating group. Thus, the electrophilic substitution takes place at meta position, leading to formation of meta nitroaniline.

Ans 15. (a) Red phosphorus is less reactive than white phosphorus, because, it exists as a linear polymer of tetrahedral units linked together, but, white phosphorus exists as discrete tetrahedral units, with large angle strain, making it highly reactive.



Structure of Red Phosphorus



Structure of White Phosphorus.

(b) Electron gain enthalpies of halogens are largely negative, because, they require only one electron to acquire the nearest noble gas configuration and hence, achieve stable np^6 configuration.

(c) N_2O_5

Oxidation state of Nitrogen = +5

N_2O_3

Oxidation state of Nitrogen = +3

Greater the oxidation state of nitrogen, greater is the acidic character. Hence, N_2O_5 is more acidic than N_2O_3 as oxidation state of nitrogen in N_2O_5 is greater than that in N_2O_3.

Ans. (16)

(a) Anionic Detergents

The detergents which are sodium salts of long chain sulphonate hydrocarbons are called anionic detergents. In such detergents, the micelles are formed by the long chain hydrocarbon (hydrophobic) and sulphate ion (hydrophilic and negatively charged).

Example.

Sodium-n-dodecyl benzene sulphonate.

Ans. (1

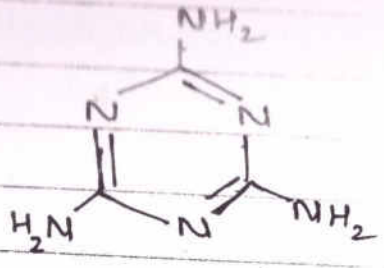
(b) **Narrow Spectrum Antibiotics** :-
The antibiotics which are effective against either gram positive or Gram negative bacteria are called narrow spectrum antibiotics. Penicillin-G has a narrow spectrum.

(c) **Antacids** :-
Antacids are the drugs or chemicals that are used to treat the problem of acidity. They help to cure the root cause of this disorder by inhibiting the binding of histamine on the stomach wall, preventing the release of pepsin and HCl acid.
Example - Ranitidine & Cimetidine.

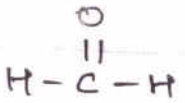
Ans. (17.) (a) Monomer of PVC is vinyl chloride.

$$CH_2=CH-Cl$$

(b) Monomers of melamine - formaldehyde polymer are melamine and formaldehyde.



melamine.



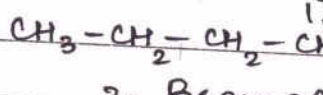
formaldehyde.

(c) The monomers of Buna-N are buta-1,3-diene and acrylonitrile.

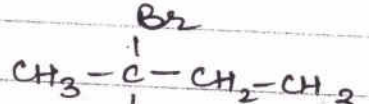
$CH_2 = CH - CH = CH_2$
buta-1,3-diene

$CH_2 = CH - C \equiv N$
acrylonitrile

Ans. (18) Given compounds are –



2-Bromopentane



2-bromo-2-methyl butane

$CH_3CH_2CH_2CH_2CH_2Br$

1-Bromopentane

(a) 1-Bromopentane is most reactive towards S_N2 reaction, as it is a primary alkyl halide, so has least steric hindrance.

(b) 2-Bromopentane is optically active, due to presence of chiral carbon atom.

$$CH_3-CH_2-CH_2-\overset{*}{C}H(Br)-CH_3$$

(* = chiral carbon)

(c) 2-Bromo-2-methyl butane is most reactive towards β-elimination, due to formation of most stable alkene (highly substituted) according to "Saytzeff Rule"

$$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{Br}{|}}{C}}-CH_2-CH_3 \xrightarrow{\text{alc. KOH}} CH_3-\underset{\underset{CH_3}{|}}{C}=CH-CH_3$$

(stable alkene with 9 α-H atoms)

Ans. (19.) Given Order of reaction = 1.

time = 20 min.

for 20% decomposition

$$C = C_0 - \frac{20}{100} C_0 = 0.8 C_0$$

at last ⇒ applied wrong.

Required time when 75% of reaction is completed.

Solution Let 'k' be the rate constant of the reaction.

We know, for a first order reaction,

$$k = \frac{2.303}{t} \log \frac{C_0}{C}$$

$$\Rightarrow k = \frac{2.303}{20} \log \frac{C_0}{0.8 C_0} = \frac{2.303}{20} \log \frac{10}{8} \quad \text{---(1)}$$

now,

for 75% reaction to be completed,

$$C' = C_0 - \frac{75}{100} C_0 = C_0 - 0.75 C_0$$

$$C' = 0.25 C_0$$

Hence, $t = \frac{2.303}{k} \log \frac{C_0}{C'}$

$\therefore t = \frac{2.303}{k} \log \frac{100}{25} 4$

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

Putting the value of k from equation (1) we get,

$t = \frac{2.303}{\frac{2.303}{20} \log\left(\frac{10}{8}\right)} \log 4$

$= \frac{2.303}{2.303} \times \frac{20}{(\log 10 - \log 8)} \times \log 4$ $\quad [\because \log \frac{a}{b} = \log a - \log b]$

$= \frac{20 \times 2 \log 2}{(\log 10 - 3 \log 2)}$ $\quad \left\{\because \log a^n = n \log a \text{ \& } 4 = 2^2,\ 8 = 2^3.\right\}$

$t = \frac{40 \times \log 2}{1 - 3 \log 2}$

Putting, $\log 2 = 0.301$, we get, $t = \frac{40 \times 0.301}{1 - 3(0.301)}$

$$\therefore t = \frac{40 \times 0.301}{1 - 0.903} = \frac{40 \times 0.301}{0.097}$$

$$= \frac{40 \times 301}{97}$$

$$= \frac{12040}{97} \text{ min}$$

$$\boxed{t = 124.04 \text{ min}}$$

Ans

Space for Rough Works

1.000
0.903
0.097

301
4
1204

124.04
97) 12040
97
234
194
400
396
400

Ans. (20.) (a) Milk is an oil in water type emulsion (O/W)

∴ Therefore,

the dispersed phase in milk is oil and the dispersion medium of milk is water.

Ans

(b) • Both physisorption and chemisorption increase with the increase in surface area per unit mass of the adsorbing substance.

• Both physisorption and chemisorption depend upon

the nature of the substance adsorbed. Physisorption is easier for gases with high critical temperature (T_c) while Chemisorption takes place only if there is possibility of formation of covalent bond between the two substances.

(c) $Fe(OH)_3$ is prepared from $FeCl_3$ by the process of hydrolysis of $FeCl_3$.

$$FeCl_3 + 3H_2O \xrightarrow{\text{Hydrolysis}} \underset{(Sol)}{Fe(OH)_3} + 3HCl$$

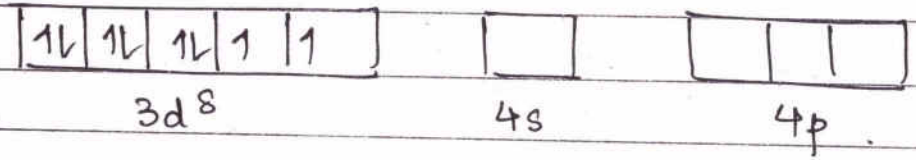
Ans. (21.) (a) Linkage isomerism is shown by the complex $[Co(NH_3)_5(SCN)]^{2+}$ due to presence of ambidentate ligand.

(b) $[NiCl_4]^{2-}$ is paramagnetic, but $[Ni(CN)_4]^{2-}$ is diamagnetic. because Cl^- is a weak field ligand, so the electrons in d subshell do not get paired up, but CN^- is a strong field ligand, so the electrons get paired up.

Atomic no. of Ni = 28 ; Oxidation state of Ni = +2 in both.

electronic configuration of Ni^{2+} = $[Ar]^{18}\ 3d^8\ 4s^0$

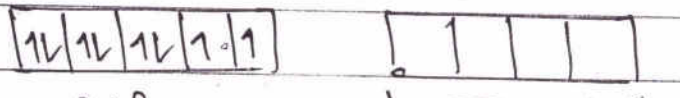
Orbitals of Ni^{2+}



- Cl^- is a weak ligand.

So,

sp^3 hybrid orbitals

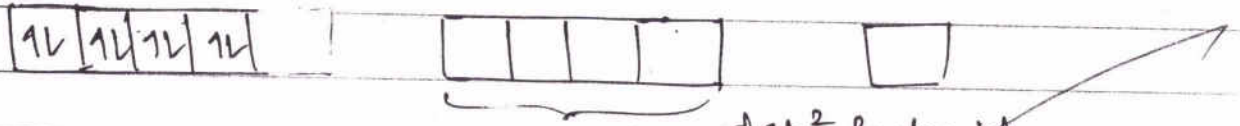


$[NiCl_4]^{2-}$ high spin complex

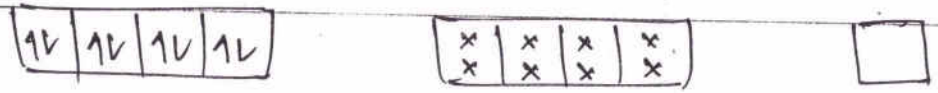
Ans.

- CN^- is a strong ligand.

sp^2 hybrid orbitals



$[Ni(CN)_4]^{2-}$ low spin complex



(c) Low spin tetrahedral complexes are rarely observed, because for the same metal and same ligand, it is observed that

$$\Delta_t = \frac{4}{9}\Delta_o$$

where, Δ_t = Crystal field Splitting energy in Tetrahedral complex
Δ_o = Crystal field splitting energy in Octahedral complex.

Hence, the Δ_t rarely exceeds the pairing energy, so, mainly ~~low~~ high spin tetrahedral complexes are formed.

Ans. (22) (a) Benzene is a molecular solid.
Silver is a metallic solid.

(b) Frenkel defect is shown by those compounds in which the sizes of anion and cation differ greatly. Since, size of Ag^+ is too small as compared to Cl^-, it shows Frenkel defect, while, size Na^+ and Cl^- are almost similar, so, it doesnot show Frenkel defect.

(c) When Ge is doped with Al, p-type semiconductor is formed, as Al is a trivalent impurity. A

Ans. (23)

(a) Through this act, Rupali displays the values like –
(i) Concern for others' well-being
(ii) Scientific knowledge of harmful effects of carcinogens.
(iii) Knows the importance of healthy and balanced diet. R So

(b) Starch is a polysaccharide component of carbohydrate that is commonly present in bread.

(c) The two types of secondary structures of proteins are α-Helix and β-pleated.

(d) Vitamin B_1 and Vitamin C are water soluble vitamins.

Ans. (24.) (a) Given mass of solute (w_2) = 30 g.

molar mass of solute, $M_2 = 60\ g\ mol^{-1}$.

mass of solvent (w_1) = 846 g.

molar mass of solvent, $M_1 = 18\ g\ mol^{-1}$.

at 298 K,

Vapour pressure of pure solvent (p_1°) = 23.8 mm Hg.

Required Solution

Vapour pressure of solution, p_1 (let).

Since,

relative lowering in vapour pressure is a colligative property.

$$\frac{p_1^\circ - p_1}{p_1^\circ} = x_2 \quad [x_2 \rightarrow \text{mole fraction of solute}]$$

$$x_2 = \frac{n_2}{n_1 + n_2}$$

now, no. of moles of solute, $n_2 = \frac{30}{60} = 0.5\ mol$

& no. of moles of solvent, $n_1 = \frac{846}{18} = 47\ mol$

$$\therefore x_2 = \frac{0.5}{47 + 0.5} = \frac{0.5}{47.5} = \frac{5}{475} = \frac{1}{95}$$

$$\therefore \frac{p_1^\circ - p_1}{p_1^\circ} = \frac{1}{95}$$

$$\Rightarrow \frac{23.8 - p_1}{23.8} = \frac{1}{95}$$

$$\Rightarrow 23.8 - p_1 = \frac{23.8}{95}$$

$$23.8 - p_1 = 0.2505$$

$$\Rightarrow p_1 = 23.8 - 0.2505$$

$$= 23.5495 \text{ mm Hg}$$

$$\therefore \boxed{p_1 \approx 23.55 \text{ mm Hg}}$$

Exa

Ans

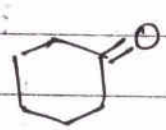
Ans. Vapour pressure of given solution at 298 K is 23.55 mm Hg.

(b.)

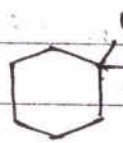
Ideal Solution	Non-Ideal Solution
(i) The solution which follows Raoult's Law strictly over the entire range of temperature & concentration, is called ideal solution.	(i) The solution which doesnot follow Raoult's Law is called non-ideal solution.
(ii) The change in enthalpy of mixture, $\Delta H_{mix} = 0$, and	(ii) The change in enthalpy of mixture, $\Delta H_{mix} \neq 0$ and

Ideal Solution	Non-Ideal Solution
the change in volume of mixtures, $\Delta V_{mix} = 0$.	the change in volume of mixtures, $\Delta V_{mix} \neq 0$.
(iii) The interaction between A---B is the same as those between A---A and B---B.	(iii) The interaction between A---B is not the same as in A---A and B---B.
Example – Solution of n-hexane and n-heptane.	Example – Solution of phenol and aniline.

Ans. (25). (a). (i)



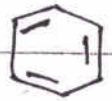
+ HCN ⟶



(cyanohydrin)

(ii)

+ NaOH $\xrightarrow[\Delta]{CaO}$



+ Na_2CO_3.

benzene

(iii)

$CH_3-CH=CH-CN \xrightarrow[(b)\ H_2O]{(a)\ DIBAL-H}$ $CH_3-CH=CH-CHO + NH_3$.

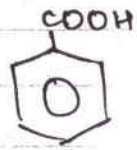
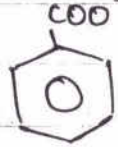
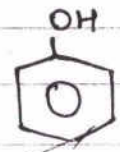
But-2-en-1-al

(aldehyde)

(b.) (i)

Test	Butanal	Butan-2-one
Iodoform Test.	$CH_3-CH_2-CH_2-CHO$ $\downarrow NaOH + I_2$ X no yellow crystalline product obtained.	$CH_3-CH_2-\overset{\overset{O}{\|\|}}{C}-CH_3$ $\downarrow NaOH + I_2$. $CH_3-CH_2-\overset{\overset{O}{\|\|}}{C}-O^-Na^+$ $+ CHI_3$ Yellow crystalline iodoform

(ii)

Test	Benzoic acid	Phenol
Sodium bicarbonate test	 $+ NaHCO_3$ $\downarrow$  $+ H_2O + CO_2\uparrow$ Brisk effervescence of CO_2.	 $+ NaHCO_3$ $\downarrow$ X no brisk effervescence of CO_2 observed.

Ans (26.) (a) (i) Transition metals show variable oxidation states, because of presence of incompletely filled d orbitals, their oxidation states differ from each other by unity.

Example → V^{2+}, V^{3+}, V^{4+}, V^{5+}

(ii) Zn, Cd and Hg have fully filled d-orbitals, so, their d electrons do not contribute in metallic bonding. Hence, due to weak interatomic interactions, contributed only by ns electrons, Zn, Cd and Hg are soft metals.

(iii) E^0 value of Mn^{3+}/Mn^{2+} couple is highly positive (+1.57 V), as, on gaining 1 electron, Mn attains very stable $3d^5$ electronic configuration (exactly half-filled). But for

$$Cr^{3+} + e^- \longrightarrow Cr^{2+},$$

the chromium ion becomes unstable as, the $3d^3$ electronic configuration (exactly half filled t_{2g} level), which is quite stable, is converted to $3d^4$ configuration. Hence, E^0 value of Cr^{3+}/Cr^{2+} is less than that of Mn^{3+}/Mn^{2+} couple.

(b) Similarity between chemistry of Lanthanoid and Actinoid Elements :—

Ans.(

Both Lanthanoid and actinoid elements are reactive and show +3 as the most common oxidation state in their respective series.

Difference between chemistry of Lanthanoid and Actinoid Elements :-

Lanthanoids	Actinoids
⊙ Lanthanoids have less tendency for complex formation and do not form oxocations.	⊙ Actinoids have more tendency for complex formation and form oxocations like UO_2^{2+}, PuO_2^{2+}, etc.
⊙ Magnetic properties of Lanthanoids can be easily interpreted.	⊙ Magnetic properties of Actinoids are very difficult to explain.

Ans. (19.) Given time $t_1 = 20$ min
for 25% decomposition

Required time t_2
for 75% decomposition

Solution Let 'k' be the rate constant of the reaction

Case-I $C = C_0 - \frac{25}{100} C_0 = 0.75 C_0$.

We know, for a first order reaction,

$$t = \frac{2.303}{k} \log \frac{C_0}{C}$$

$$\Rightarrow 20 = \frac{2.303}{k} \log \frac{C_0}{0.75 C_0} = \frac{2.303}{k} \log \frac{100 C_0}{75 C_0} \quad \frac{4}{3}$$

$$\Rightarrow k = \frac{2.303}{20} \log \left(\frac{4}{3}\right) \quad \text{---(1)}$$

Case-II

$$C' = C_0 - 0.75 C_0 = 0.25 C_0.$$

$$\therefore t_2 = \frac{2.303}{k} \log \frac{C_0}{C'} = \frac{2.303}{k} \log \frac{C_0 \times 100}{0.25 C_0}$$

$$t_2 = \frac{2.303}{k} \log 4.$$

Putting the value of k from equ: ①

$$t_2 = \frac{2.303}{\frac{2.303}{20}\log\frac{4}{3}} \times \log 4$$

$$= \frac{20\log 4}{\log\frac{4}{3}} = \frac{20\log 4}{\log 4 - \log 3} \quad \left[\because \log\frac{a}{b} = \log a - \log b\right]$$

$$= \frac{20 \times 0.6021}{0.6021 - 0.4771}$$

$$= \frac{20 \times 0.6021}{0.1250}$$

$$= \frac{20 \times 6021}{1250}$$

$$\boxed{t_2 = 96.336 \text{ min}}$$

Ans