

केन्द्रीय माध्यमिक शिक्षा बोर्ड, दिल्ली  
सीनियर स्कूल सर्टिफिकेट परीक्षा (कक्षा बारहवं  
परीक्षार्थी प्रवेश—पत्र के अनुसार भरें)

प्रिय Subject : **CHEMISTRY**

प्रिय कोड Subject Code : **043**

परीक्षा का दिन एवं तिथि

Day & Date of the Examination : **SATURDAY, 25 MARCH**  
<sup>th</sup>  
उत्तर देने का माध्यम

Medium of answering the paper : **ENGLISH**

प्रश्न पत्र के ऊपर लिखे

कोड को दर्शाएँ :

Write code No. as written on  
the top of the question paper :

Code Number
<b>5612</b>

Set Number
<b>②</b> <b>③</b> <b>④</b>

आतिरिक्त उत्तर—पुस्तिकाग (ओं) की संख्या

No. of supplementary answer -book(s) used

—

विकलांग व्यक्ति :

हैं / नहीं

Person with Disabilities :

Yes / No

**No**

किसी शारीरिक अक्षमता से प्रभावित हो तो संबंधित वर्ग में **✓** का निशान लगाएं।  
If physically challenged, tick the category

<b>B</b>	<b>D</b>	<b>H</b>	<b>S</b>	<b>C</b>	<b>A</b>
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B = दृष्टिहीन, D = मूँफ व बधिर, H = शारीरिक रूप से विकलांग, S = स्पास्टिक  
C = डिस्लोविसक, A = ऑटिस्टिक

B = Visually Impaired, D = Hearing Impaired, H = Physically Challenged  
S = Spastic, C = Dyslexic, A = Autistic

यथा लेखन — लिपिक उपलब्ध करवाया गया : हैं / नहीं

Whether writer provided : Yes / No **No**

यदि दृष्टिहीन हैं तो उपयोग में लाए गये

सोफ्टवेयर का नाम :

If Visually challenged, name of software used :

\*एक खाने में एक अक्षर लिखें। नाम के प्रत्येक भाग के बीच एक खाना रिक्त छोड़ दें। यदि परीक्षार्थी का नाम 24 अक्षरों से अधिक है, तो केवल नाम के प्रथम 24 अक्षर ही लिखें।

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.

**3992634**  
043/01218

कार्यालय उपयोग के लिए  
Space for office use

2

Ans. ①

(a) On adding a catalyst, activation energy decreases

(b) Gibb's energy ( $\Delta G$ ) of the reaction remains the same, on adding a catalyst.

Ans. ⑥

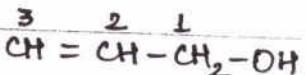
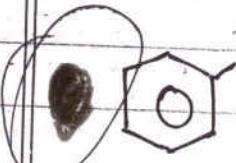
Ans. ②

A sol is formed when a solid is dispersed in a liquid.

Example - Cell fluids, paints, Gold sol, etc.

Ans. ④

Ans. ③

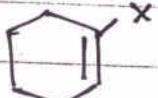


IUPAC Name :- 3-Phenylprop-2-en-1-ol

Ans. ④

$\text{H}_2\text{SD}_4$  is obtained when conc.  $\text{HNO}_3$  oxidises  $\text{S}_8$ .

Ans. ⑤



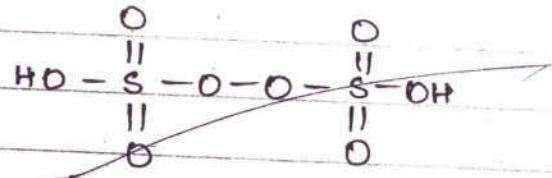
is an example of vinylic halide.

Ans. 6. (a)

The formula of the given compound is  $\rightarrow [\text{Cr}(\text{en})_3]\text{Cl}_3$

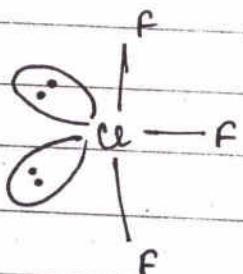
(b) The formula of the given compound is  $\rightarrow \text{K}_2[\text{Zn}(\text{OH})_4]$

Ans. 7. (a)



$\text{H}_2\text{S}_2\text{O}_8$  (Peroxodisulphuric acid),

(b)



Bent-T-shape.

Ans. 8. (a)

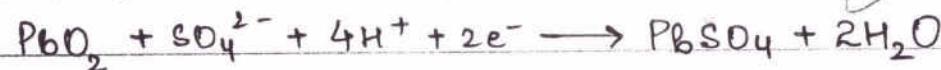
lead storage battery is generally used in inverters.

(b) Reaction taking Place at →

(i) Anode



(ii) Cathode



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<sup>-1</sup>

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

$$= \frac{8.1 \times 10^{-3}}{27 \times 10} = 0.3 \text{ mol.}$$

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

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

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

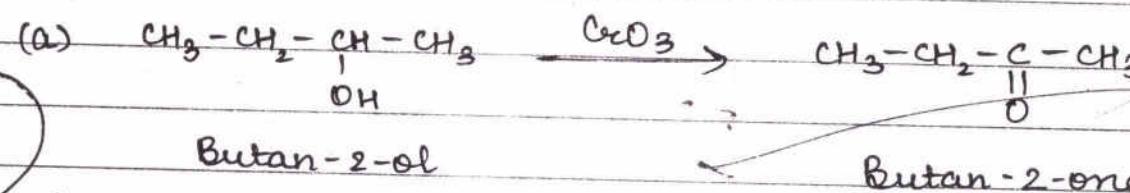
$$= \frac{0.3 \times 6.022 \times 10^{23}}{4}$$

$$= 0.4516 \times 10^{23}$$

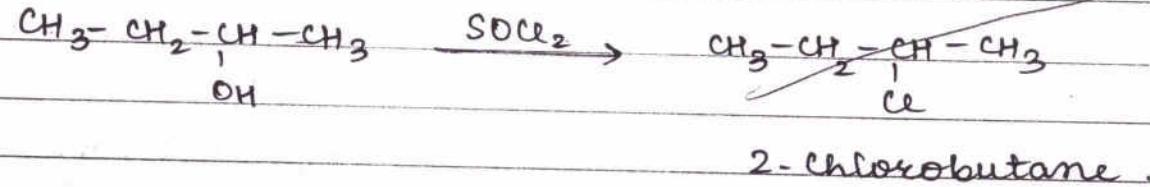
no. of unit cells =  $4.516 \times 10^{22}$  unit cells

Ans

Ans 10.



(b)

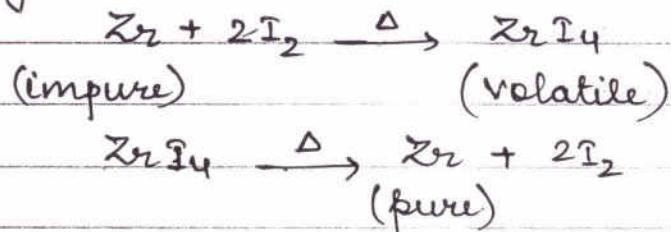


Ans. (ii)

## (a) Principle Of Vapour Phase Refining:-

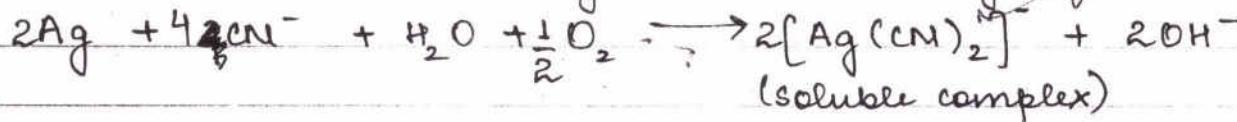
Vapour phase refining is based on the principle that the impure metal is converted into a volatile compound which can be collected elsewhere. It is then decomposed to give back the pure metal.

Eg.



Ans.

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

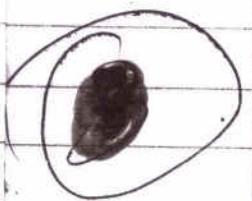


NaCN reacts with Ag to form complex  $\text{Na}[\text{Ag}(\text{CN})_2]$ , which on reduction with zinc, gives Ag back.

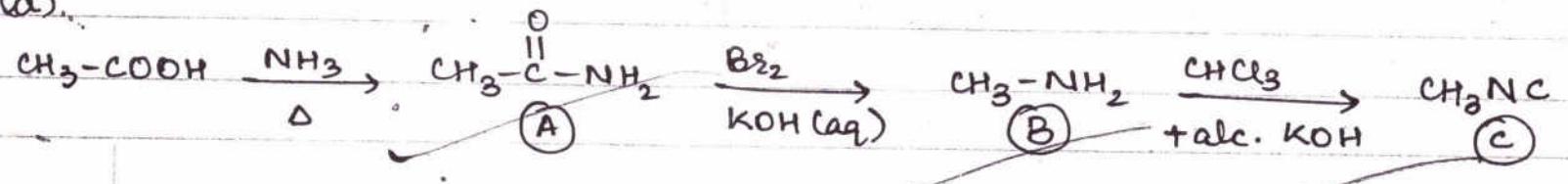


(c) Collectors enhance the non-wettability of the mineral particles.  
 Example → Pine oil, fatty acids, xanthates.

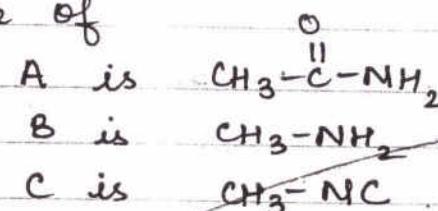
Ans. (12)



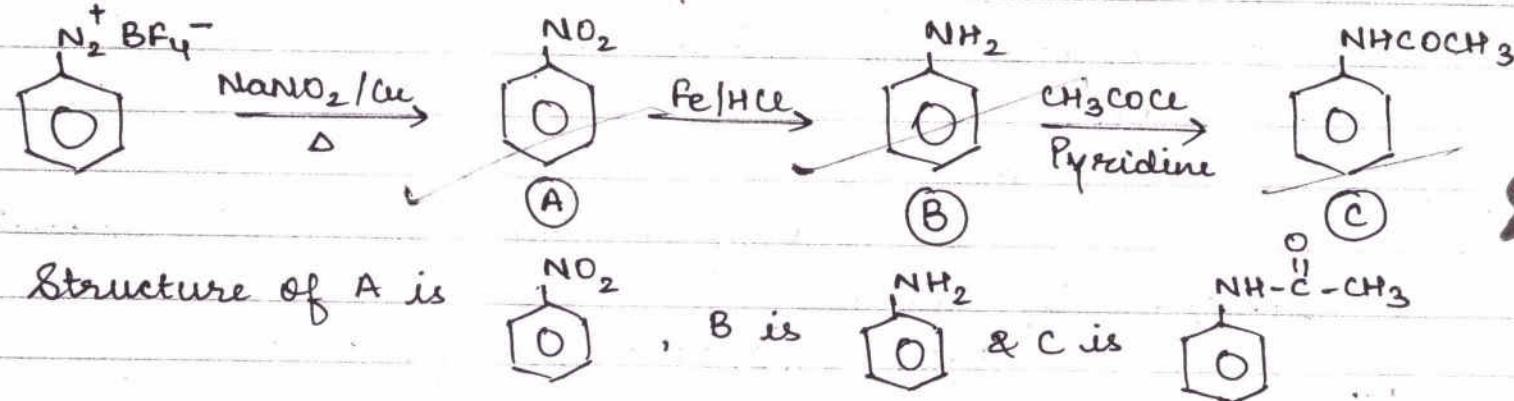
(a).



∴ Structure of



(b)



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



∴ n-factor,  $n = 2$

$$E_{\text{cell}}^\circ = 0.236 \text{ V} \quad (\text{given})$$

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

We know,

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

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

$$\boxed{\Delta G^\circ = -45.548 \text{ kJ mol}^{-1}}$$

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

Let 'n' electrons pass through it.

We know,

$$\text{charge, } Q = It = ne$$

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

Substituting, we get,

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

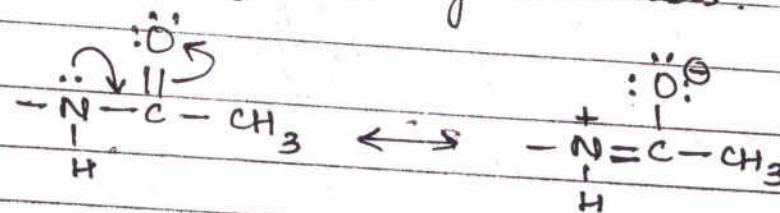
$$\pi = \frac{0.5 \times 2 \times 3600}{1.6 \times 10^{-19}}$$

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

Ans

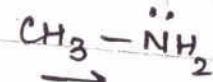
Ans (4)

(a) Acetylation of aniline reduces its activation effect, because, the lone pair of electron on nitrogen atom is involved in resonance with  $\text{-C}(=\text{O})\text{CH}_3$  (acetyl group). So, electron density on benzene ring decreases.

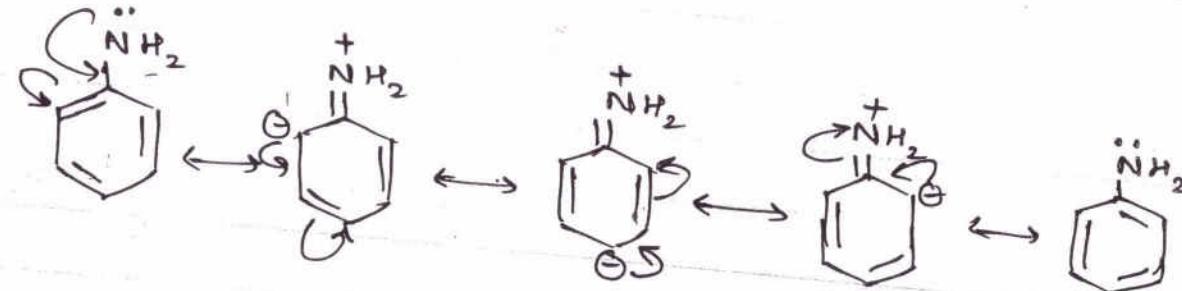


(b)  $\text{CH}_3\text{NH}_2$  is more basic than  $\text{C}_6\text{H}_5\text{NH}_2$ , as the lone pair of electron on nitrogen atom in  $\text{C}_6\text{H}_5\text{NH}_2$  is involved in resonance, whereas, in  $\text{CH}_3\text{NH}_2$ , electron density on N atom increases in  $\text{CH}_3\text{NH}_2$  due to  $+\text{i}$  effect of  $-\text{CH}_3$  group. Hence,

Affinity of  $\text{CH}_3\ddot{\text{N}}\text{H}_2$  towards proton ( $\text{H}^+$ ) is more than that of  $\text{C}_6\text{H}_5\text{NH}_2$ .



+I effect

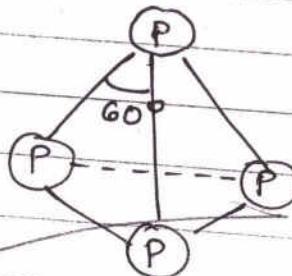
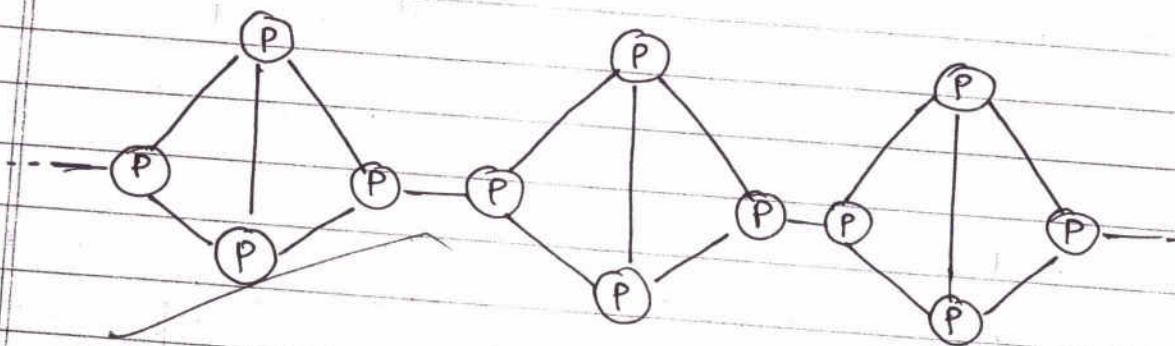


### Resonance in aniline.

(c) Although  $-\text{NH}_2$  group is o/p directing group, yet aniline on nitration gives a significant amount of m-nitroaniline, because, in highly acidic medium, aniline accepts  $\text{H}^+$  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  $n p^6$  configuration.

(c)  $\text{N}_2\text{O}_5$ 

Oxidation state of Nitrogen = +5.

 $\text{N}_2\text{O}_3$ 

Oxidation state of Nitrogen = +3.

greater the oxidation state of nitrogen, greater is the acidic character. Hence,  $\text{N}_2\text{O}_5$  is more acidic than  $\text{N}_2\text{O}_3$  as oxidation state of nitrogen in  $\text{N}_2\text{O}_5$  is greater than that in  $\text{N}_2\text{O}_3$ .

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.

(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)

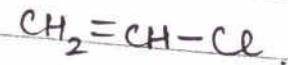
Antacids :-

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<sup>on</sup> the stomach wall, preventing the release of pepsin and HCl acid.

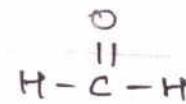
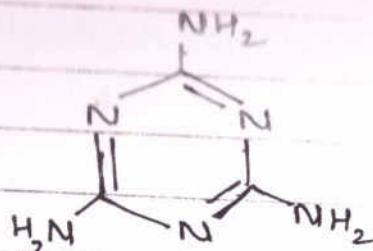
Example - Ranitidine & Cimetidine

Ans. (17.)

(a) Monomer of PVC is vinyl chloride.

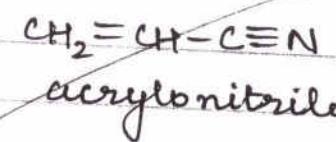
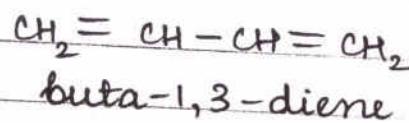


(b) Monomers of melamine-formaldehyde polymer are melamine and formaldehyde.



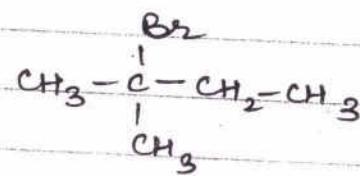
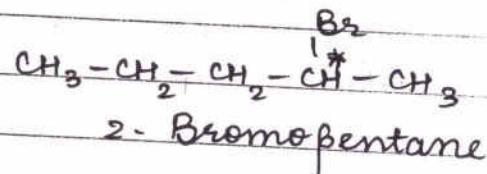
formaldehyde.

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

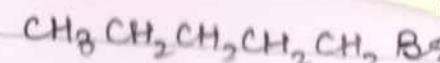


Ans. 18

Given compounds are -



2-bromo-2-methyl  
butane



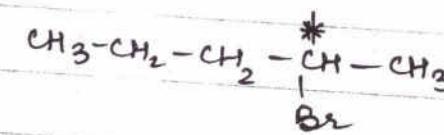
1-Bromopentane

(a)

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

(b)

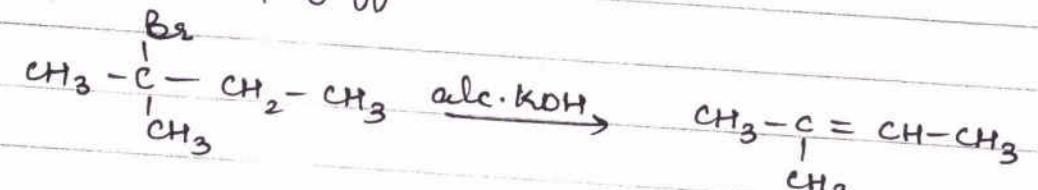
2-Bromopentane is optically active, due to presence of chiral carbon atom.



(\* = chiral carbon)

(c)

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



(stable alkene  
with 9  $\alpha$ -H atoms)

Ans. 19.

Given Order of reaction = 1.

X time = 20 min

for 20% decomposition

~~at last~~  
~~solved wrong.~~

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

Solution Required time when 75% of reaction is completed.  
 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,

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

$$C' = 0.25 C_0$$

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

X

$$\therefore t = \frac{2.303}{k} \log \frac{t_0 \times 100}{t_0 + 0.25\%}$$

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

Putting the value of  $k$  from equation ①  
we get,

$$t = \frac{2.303}{2.303 \cdot \frac{\log(10)}{20}} \log 4$$

$$= \frac{2.303}{2.303} \times \frac{20}{(\log 10 - \log 8)} \times \log 4$$

$$= \frac{20 \times 2 \log 2}{(\log 10 - 3 \log 2)}$$

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

$$\left[ \because \log \frac{a}{b} = \log a - \log b \right]$$

$$\left\{ \begin{array}{l} \because \log a^n = n \log a \\ \text{&} 4 = 2^2 \\ 8 = 2^3 \end{array} \right\}$$

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

$$\begin{aligned}
 \times \therefore t &= \frac{40 \times 0.301}{1 - 0.903} = \frac{40 \times 0.301}{0.097} \\
 &= \frac{40 \times 301}{97} \\
 &= \frac{12040}{97} \text{ min} \\
 t &= 124.04 \text{ min}
 \end{aligned}$$

space for rough

work

$$\begin{array}{r}
 1.000 \\
 0.903 \\
 \hline
 0.097
 \end{array}$$

$$\begin{array}{r}
 301 \\
 4 \\
 \hline
 1204
 \end{array}
 \cdot \begin{array}{r}
 124.04 \\
 3 \\
 \hline
 97
 \end{array}
 \begin{array}{r}
 120 \\
 120 \\
 \hline
 040
 \end{array}
 \begin{array}{r}
 97 \\
 \downarrow \\
 234
 \end{array}
 \begin{array}{r}
 194 \\
 \downarrow \\
 400
 \end{array}
 \begin{array}{r}
 396 \\
 \hline
 400
 \end{array}$$

Ans

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

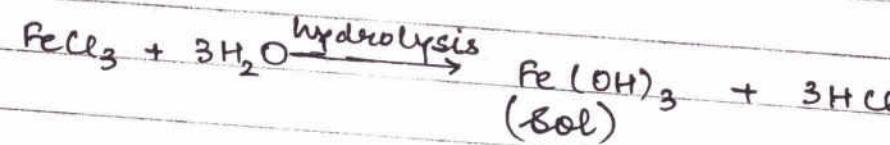
(b) • Both physisorption and chemisorption increase with the increase in surface area per unit mass of the adsorbing substance.

• Both physisorption and chemisorption depend upon

the nature of the substance adsorbed. Physisorption is possible 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)

$\text{Fe(OH)}_3$  is prepared from  $\text{FeCl}_3$  by the process of hydrolysis of  $\text{FeCl}_3$ .



Ans. 21.

- a. linkage isomerism is shown by the complex  $[\text{Co}(\text{NH}_3)_5(\text{SCN})]^{2+}$  due to presence of ambidentate ligand.
- b.  $[\text{NiCl}_4]^{2-}$  is paramagnetic, but  $[\text{Ni}(\text{CN})_4]^{2-}$  is  $\pm$  diamagnetic, because  $\text{Cl}^-$  is a weak field ligand, so the electrons in d subshell do not get paired up, but  $\text{CN}^-$  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  $\text{Ni}^{2+}$  =  $[\text{Ar}]^{18} 3\text{d}^8 4\text{s}^0$

Orbitals of  $\text{Ni}^{2+}$

$1\downarrow$	$1\downarrow$	$1\downarrow$	$1\downarrow$	$1\downarrow$				

$3\text{d}^8$

$4\text{s}$

$4\text{p}$

- $\text{Cl}^-$  is a weak ligand.

so,

$\text{sp}^3$  hybrid

orbitals

$1\downarrow$	$1\downarrow$	$1\downarrow$	$1\downarrow$	$1\downarrow$				
					$1\downarrow$			

$3\text{d}^8$

$\text{sp}^3$  hybrid

$\text{Co}(\text{Ni}(\text{Cl})_6)^{2-}$

high spin  
complex

$1\downarrow$	$1\downarrow$	$1\downarrow$	$1\downarrow$	$1\downarrow$				
					$x\downarrow$	$x\downarrow$	$x\downarrow$	$x\downarrow$

Ans.

- $\text{CN}^-$  is a strong ligand.

$\text{sp}^2$  hybrid

orbitals

$1\downarrow$	$1\downarrow$	$1\downarrow$	$1\downarrow$					
					$1\downarrow$	$1\downarrow$	$1\downarrow$	$1\downarrow$

$\text{sp}^2$  hybrid

$\text{dsp}^2$  hybrid

$\text{Ni}(\text{CN})_4^{2-}$

low spin  
complex

$1\downarrow$	$1\downarrow$	$1\downarrow$	$1\downarrow$					
				$x\downarrow$	$x\downarrow$	$x\downarrow$	$x\downarrow$	

$\text{dsp}^2$  hybrid

(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,  $\Delta_t$  = crystal field splitting energy in Tetrahedral complex  
 $\Delta_o$  = crystal field splitting energy in Octahedral complex.  
Hence,

the  $\Delta_t$  rarely exceeds the pairing energy, so, mainly low 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  $\text{Ag}^+$  is too small as compared to  $\text{Cl}^-$ , it shows Frenkel defect, while, size  $\text{Na}^+$  and  $\text{Cl}^-$  are almost similar, so, it does not show Frenkel defect.

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

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 carbohydrates that is commonly present in bread.

c) The two types of secondary structures of proteins are  $\alpha$ -Helix and  $\beta$ -pleated.

d) Vitamin B<sub>1</sub> and Vitamin C are water soluble vitamins.

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

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

mass of solvent ( $w_1$ ) = 846 g.

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

at 298 K,

Vapour pressure of pure solvent ( $P_1^{\circ}$ ) = 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,  $n_2 = \frac{30}{60} = 0.5 \text{ mol}$

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

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

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

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

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

$$23.8 - p_1 = 0.2505$$

$$\Rightarrow p_1 = 23.8 - 0.2505 \\ = 23.5495 \text{ mmHg}$$

$$\therefore p_1 \approx 23.55 \text{ mmHg}$$

Exa

Ans

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

(b)

Ideal Solution

(i) The solution which follows

Raoult's law strictly over  
of Temperature & concentration  
the entire range is called  
ideal solution.

(ii) The change in enthalpy  
of mixture,  $\Delta H_{\text{mix}} = 0$ , and

Non-Ideal Solution

(i) The solution which does not  
follow Raoult's Law is  
called non-ideal  
solution.

(ii) The change in enthalpy of  
mixture,  $\Delta H_{\text{mix}} \neq 0$  and

### Ideal Solution

the change in volume of mixture,  $\Delta V_{\text{mix}} = 0$ .

- (iii) The interaction between A---B is the same as those between A---A and B---B.

Example - Solution of n-hexane and n-heptane.

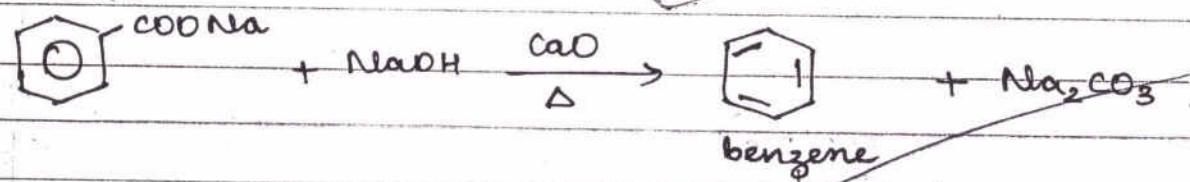
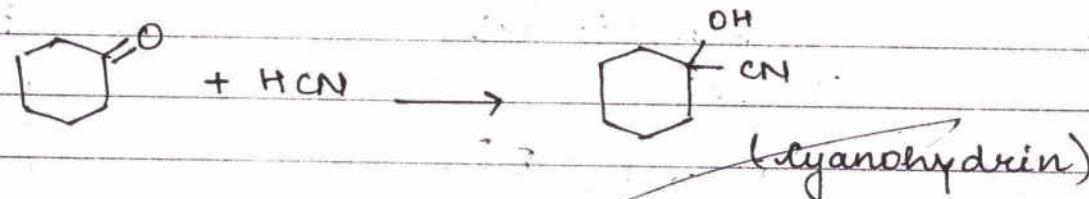
### Non-Ideal Solution

the change in volume of mixture,  $\Delta V_{\text{mix}} \neq 0$ .

- (iii) The interaction between A---B is not the same as in A---A and B---B.

Example - Solution of phenol and aniline.

Ans. 25. (a). (ii)

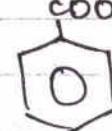
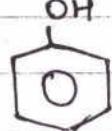


(iii)



(b) H<sub>2</sub>O

But-2-en-1-al  
(aldehyde)

<p>(i) Test</p> <p>Iodoform Test:</p>	<p>Butanal</p> $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CHO}$ $\downarrow \text{NaOH} + \text{I}_2$ <p>X</p> <p>no yellow crystalline product obtained.</p>	<p>Butan-2-one</p> $\text{CH}_3-\text{CH}_2-\overset{\underset{\text{O}}{\parallel}}{\text{C}}-\text{CH}_3$ $\downarrow \text{NaOH} + \text{I}_2$ $\text{CH}_3-\text{CH}_2-\overset{\underset{\text{O}}{\parallel}}{\text{C}}-\text{O}^-\text{Na}^+$ $+ \text{CHI}_3$ <p>Yellow crystalline iodoform</p>
<p>(ii) Test</p> <p>Sodium bicarbonate test</p>	<p>Benzoic acid</p> $\text{COOH}$  $+ \text{NaHCO}_3$ $\downarrow$ $\text{COO}^-\text{Na}^+$  $+ \text{H}_2\text{O} + \text{CO}_2 \uparrow$ <p>Brisk effervescence of <math>\text{CO}_2</math>.</p>	<p>Phenol</p> $\text{OH}$  $+ \text{NaHCO}_3$ $\downarrow$ <p>X</p> <p>no brisk effervescence of <math>\text{CO}_2</math> observed.</p>

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)  $E^\circ$  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  $Cr^{3+} + e^- \rightarrow Cr^{2+}$ ,

the chromium ion becomes unstable as, the  $3d^3$  electronic configuration (exactly half-filled  $t_{2g}$  level), is quite stable, is converted to  $3d^4$  configuration. Hence,  $E^\circ$  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 :-

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

Ans. (

Difference between chemistry of Lanthanoid and Actinoid Elements :-

- ① Lanthanoids Lanthanoids have less tendency for complex formation and do not form oxocations.
- ② Magnetic properties of lanthanoids can be easily interpreted.

Actinoids

- ① Actinoids have more tendency for complex formation and form oxocations like  $\text{UO}_2^{2+}$ ,  $\text{PuO}_2^{2+}$ , etc.
- ② Magnetic properties of Actinoids are very difficult to explain.

Ans. 19.

Given time  $t_1 = 20 \text{ min}$ 

for 25% decomposition

Required time  $t_2$ 

for 75% decomposition

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

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

We know, for a first order reaction,

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

$$\Rightarrow 20 = \frac{2.303}{k} \log \frac{C_0}{0.75 C_0} = \frac{2.303}{k} \log \frac{100 C_0}{75 C_0} \quad \text{--- (1)}$$

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

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 eqn. ①

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

$$\frac{2.303}{20} \log \frac{4}{3}$$

$$= \frac{20 \log 4}{\log \frac{4}{3}}$$

$$= \frac{20 \log 4}{\log 4 - \log 3}$$

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

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

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

$$1250$$

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

Ans

$$[\because \log \frac{a}{b} = \log a - \log b]$$