

## Answers to RCH/Set-3

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1. (d)  $\text{CH}_3-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_2-\text{OH} \therefore$  it is primary alcohol.
2. (b)  $\frac{\Delta[\text{HI}]}{\Delta t} = 2 \times 10^{-4} \text{ moles L}^{-1} \text{ min}^{-1}$   
 Average rate =  $\frac{1}{2} \frac{\Delta[\text{HI}]}{\Delta t} = \frac{1}{2} \times 2 \times 10^{-4} = 10^{-4} \text{ mol L}^{-1} \text{ min}^{-1}$
3. (b) Ketones do not react with Tollen's reagent.
4. (d)  $\therefore$  All have primary amino group.
5. (d)  $K_{\text{dissociation}} = \frac{1}{\beta_4} = \frac{1}{2 \times 10^{13}} = 0.5 \times 10^{-13} = 5 \times 10^{-14}$
6. (a) Sc (3.43) has lowest density, copper (8.92) has highest density. Zn (7.1) has lower than Fe (7.8) and Cu (8.92).
7. (b) Cellulose is polysaccharide, linear polymer of  $\beta$ -glucose.
8. (a) Activation energy of forward reaction is  $E_1 + E_2$  and product is less stable than reactant due to higher energy.
9. (b) Because same substance is getting oxidised as well as reduced.
10. (d) In  $(\text{CH}_3)_3\text{N}$ , there is steric hindrance. It is less basic than primary and secondary amine.
11. (c)  $\text{CH}_3-\text{CH} \begin{matrix} \nearrow \text{OCH}_3 \\ \searrow \text{OCH}_3 \end{matrix}$  (1, 1-dimethoxy ethane)
12. (a)  $-\text{NHCOCH}_3$  is activating, hence, *o* and *p*-directing.
13. (d) A is false but R is true. Order of elementary reactions are equal to molecularity.
14. (b)      15. (d)      16. (c)
17. A. **Henry's law:** It states 'the partial pressure of a gas in vapour phase is proportional to the mole fraction of the gas in solution.  
 It is done to avoid bends (pain) and the toxic high concentration of  $\text{N}_2$  in blood at high pressure of water over divers body.

**OR**

B.

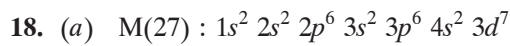
$$p_{\text{gas}} = K_{\text{H}} \times x$$

$$6 \text{ bar} = 40 \times 10^3 \text{ bar} \times x$$

$$x = \frac{6}{40} \times 10^{-3} = 1.5 \times 10^{-4}$$

$$x = \frac{n}{1000/18}$$

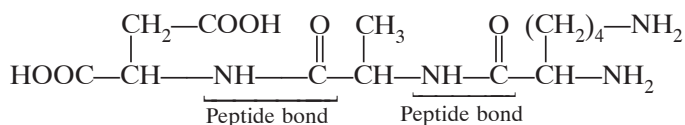
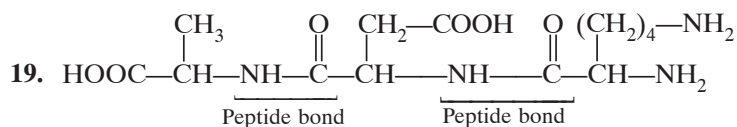
$$n = 1.5 \times 10^{-4} \times 55.5 = 8.305 \times 10^{-3} \text{ moles} = 8.305 \text{ millimoles}$$



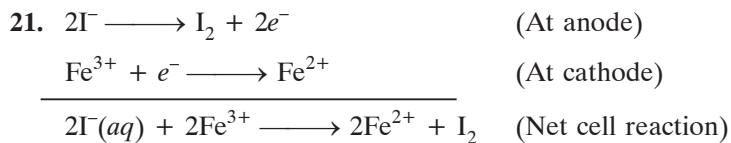
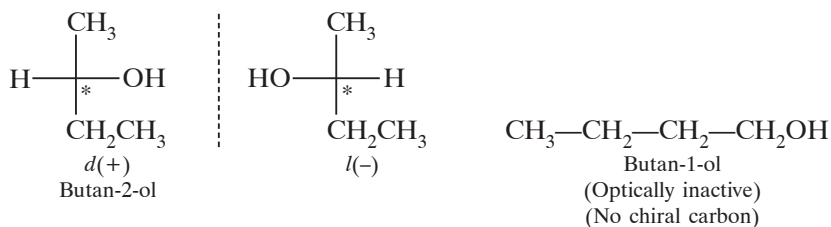
$$\mu = \sqrt{n(n+2)}$$

$$\mu = \sqrt{3 \times 5} = \sqrt{15} = 3.87 \text{ BM.}$$

- (b) Cr is typically hard metal due to presence of large number of unpaired electrons, metal-metal interaction is strong whereas mercury does not have unpaired electrons and has large size, therefore, forms weak metallic bond.



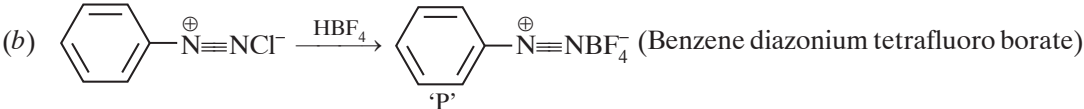
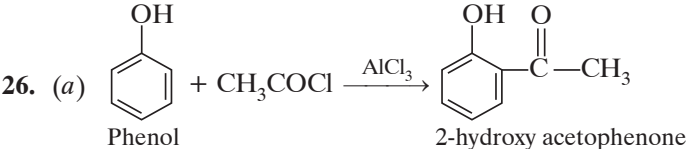
20. (a) Alkyl halides are insoluble in water because they can neither form H-bonds with water nor they can break H-bonds between water molecules.  
 (b) Butan-1-ol is achiral, i.e. does not have chiral 'C' atom which is attached to four different groups, therefore, it is optically inactive.  
 Butan-2-ol is chiral, i.e. has chiral 'C' atom, attached to four different groups.



$$E_{\text{cell}} = E_{\text{Fe}^{3+}/\text{Fe}^{2+}}^\circ - E_{\text{I}_2/\text{I}^-}^\circ$$

$$= 0.77 \text{ V} - 0.54 \text{ V} = 0.23 \text{ V}$$

22. (a) Lanthanoids, mostly show +3 oxidation state but some of them show +2 and +4 oxidation states also due to the stability of electronic configuration ( $4f^0$ ,  $4f^7$  and  $4f^{14}$ ), e.g. Eu shows +2, whereas Ce shows +4 oxidation state.

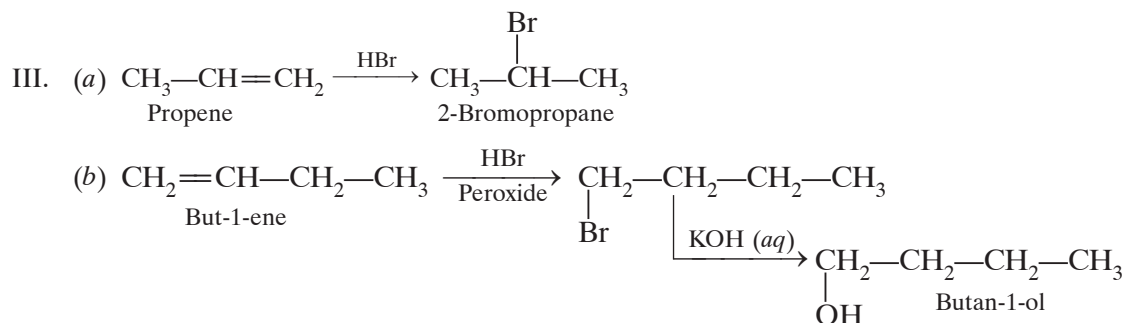
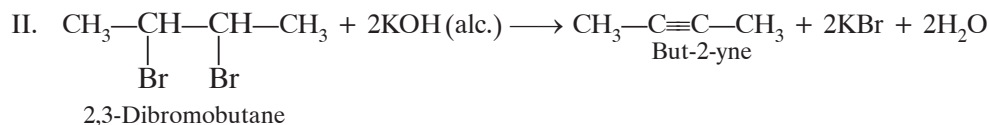
- (b) (i) They show variable oxidation states (+ 3 to +7).  
(ii) They usually form coloured compounds and ions in aqueous solution.
- (c) Hg may not be regarded as transition metal because neither 'Hg' nor  $\text{Hg}^{2+}$  ions have incompletely filled *d*-orbital.
23. (a)  $\text{PbBr}_2 \xrightarrow{\text{Electrolysis}} \text{Pb}^{2+} + 2\text{Br}^-$   
(Molten)  
At Cathode:  $\text{Pb}^{2+} + 2e^- \longrightarrow \text{Pb}(s)$   
At Anode:  $2\text{Br}^- \longrightarrow \text{Br}_2(g) + 2e^-$
- (b) It is because number of ions increases on dilution as degree of ionisation increases and mobility of ions increases.
- (c) At cathode, gain of electrons, i.e. reduction takes place, whereas at anode, loss of electrons, i.e. oxidation takes place.
24. (a) (i) I.  $\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- \xrightarrow{\text{Cu/HCl}} \text{C}_6\text{H}_5\text{Cl} + \text{N}_2$  [Gattermann synthesis]  
II.  $\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- \xrightarrow[\text{HCl}]{\text{Cu}_2\text{Cl}_2} \text{C}_6\text{H}_5\text{Cl} + \text{N}_2$  [Sandmeyer's reaction]
- (ii) II. method uses Cu(I) ( $3d^{10}$ ), it favours equilibrium in forward reaction and yield is more.
- (b) 
25. Nucleotides are made up of a heterocyclic base containing nitrogen, a five carbon sugar and a phosphate group, e.g. AMP (adenosine monophosphate), ADP (adenosine diphosphate) and ATP (adenosine triphosphate).
- Functions:**
- (i) They act as energy carriers.  
(ii) They are monomers of nucleic acid, i.e. DNA and RNA.  
(iii) They store and pass on heredity characteristics.  
(iv) They synthesise proteins.
26. (a) 



30. I. Pent-2-ene (81%) will be major product.

OR

2-methyl propene will be formed by nucleophilic elimination reaction.



31. A. I. (a) **Polydentate ligand:** The ligand which can form two or more  $\sigma$  bond with central metal atom or ion, e.g.,  $\begin{array}{c} \text{COO}^- \\ | \\ \text{COO}^- \end{array}$

(b) **Homoleptic complex:** In these complexes a metal is bound to only one type of donor groups, e.g.,  $[\text{Co}(\text{NH}_3)_6]^{3+}$ .

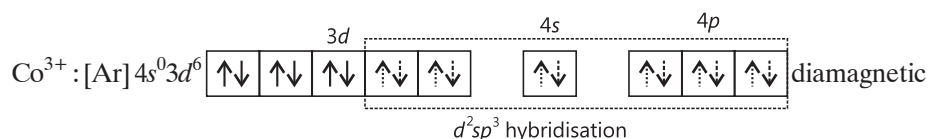
II. (a) Transition metals have vacant  $d$ -orbitals which accept lone pair from ligands to form  $\sigma$  bond and give pair of electron to molecular orbital of ligand forming  $\pi$ -bond.

(b)  $\text{Ni}^{2+}$  has unpaired electrons, therefore, forms high spin complex as pairing of electrons does not take place because after pairing only one  $d$ -orbital will be left which cannot be used in octahedral complex, ( $sp^3d^2$  hybridisation), outer orbital complex.

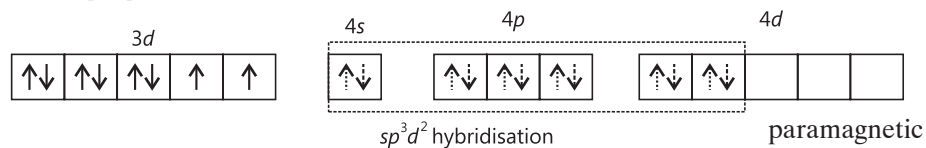
(c) They absorb different wavelengths from visible light, undergo  $d-d$  transitions and radiate complementary colour.  $\text{CN}^-$  is stronger ligand than  $\text{H}_2\text{O}$ , so  $\Delta_0$  is higher, ' $\lambda$ ' lower.

OR

B. I. (a)  $[\text{CoNH}_3\text{Cl}(\text{en})_2]^{2+}$   
amine chloridobis (ethane-1,2-diamine) cobalt (III) ion



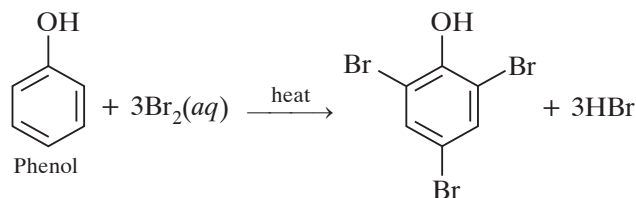
- (b)  $[\text{Ni}(\text{H}_2\text{O})_2(\text{ox})_2]^{2-}$   
diaqua dioxalato nickelate (II) ion



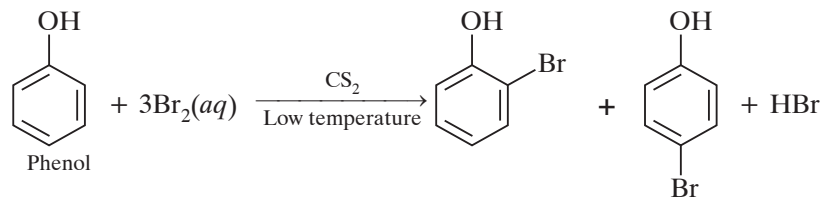
- II. (a) It has 5 unpaired electrons,  $\therefore \text{H}_2\text{O}$  is weak field ligand.  
 (b)  $[\text{Co}(\text{NH}_3)_6]_2(\text{SO}_4)_3$ , octahedral.  
 (c)  $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$  is formed which does not have free  $\text{Cu}^{2+}$  ions. It is central metal ion, not ionisable.

32. A. I. (a) Cumene (2-phenyl propane) is used in the industrial preparation phenol.

- (b) (i) **In aqueous medium**



- (ii) **In non-aqueous medium**



- (c) In the case of phenol, the polarisation of bromine molecule takes place even in the absence of Lewis acid. It is due to highly activating effect of  $-\text{OH}$  group attached to benzene ring.  $\text{Br}_2 + \text{H}_2\text{O} \longrightarrow \text{HOBr}$ . Secondly,  $\text{HOBr}$  breaks into  $\text{OH}^-$  and  $\text{Br}^+$ :  $\text{HOBr} \longrightarrow \overset{\ominus}{\text{O}}\text{H} + \text{Br}^+$ .
- II. (a) Add Tollen's reagent to each of them.  $\text{HCOOH}$  will form silver mirror whereas  $\text{CH}_3\text{COOH}$  will not react with Tollen's reagent.  
 (b) Add  $\text{NaHCO}_3$  to each, benzoic acid gives brisk effervescence due to release of  $\text{CO}_2$ . Methyl benzoate does not react.



$$\begin{aligned}\text{Boiling point of solution} &= \Delta T_b + T_b^\circ = 373.15 \text{ K} + 0.052 \text{ K} \\ &= 373.202 \text{ K}.\end{aligned}$$

**OR**

B. I.  $P_A^\circ = 450 \text{ mm}$ ,  $P_B^\circ = 700 \text{ mm}$ ,  $P_T = 600 \text{ mm}$

$$P_T = P_A^\circ x_A + P_B^\circ x_B$$

$$P_T = P_A^\circ(1 - x_B) + P_B^\circ x_B \quad [\because x_A + x_B = 1 \Rightarrow x_A = 1 - x_B]$$

$$600 = 450(1 - x_B) + 700 x_B$$

$$600 = 450 - 450 x_B + 700 x_B$$

$$250 x_B = 600 - 450 = 150$$

Mole fraction of 'B' in liquid phase

$$x_B = \frac{150}{250} = \frac{3}{5} = 0.6$$

Mole fraction of 'A' in liquid phase =  $x_A = 1 - x_B = 1 - 0.6 = 0.4$

II. Boiling point of benzene = 353.23 K,

$$W_B = 1.80 \text{ g}, W_A = 90 \text{ g},$$

Boiling point of solution = 354.11 K

$$\Delta T_b = T_b - T_b^\circ$$

$$= 354.11 \text{ K} - 353.23 \text{ K} = 0.88 \text{ K}$$

Also,

$$\Delta T_b = K_b \times m$$

$$\Rightarrow \Delta T_b = \frac{W_B}{M_B} \times \frac{1000}{W_A} \times K_b$$

$$\begin{aligned}\Rightarrow M_B &= \frac{1.80 \text{ g}}{0.88 \text{ K}} \times \frac{1000}{90 \text{ g}} \times 2.53 \text{ K kg mol}^{-1} \\ &= 57.5 \text{ g mol}^{-1}\end{aligned}$$

Therefore, molar mass of solute = 57.5 g mol<sup>-1</sup>.