KCET 2020 Paper

Topic covered:

- **KCET-2020 (Session - 1)**

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1. Aqueous solution of a salt (A) forms a dense white precipitate with $BaCl_2$ solution. The precipitate dissolves in dilute HCl to produce a gas (B) which decolourises acidified $KMnO_4$ solution. A and B respectively are:
   a. $BaSO_3, H_2S$
   b. $BaSO_4, SO_2$
   c. $BaSO_3, SO_2$
   d. $BaSO_4, H_2S$

2. Bond angle in PH_4^+ is more than that of PH_3. This is because:
   a. PH_3has planar trigonal structure
   b. Hybridisation of P changes when PH_3 is converted to PH_4^+
   c. Lone pair-bond pair repulsion exists in PH_3
   d. PH_4^+ has a square planar structure

3. Incorrectly matched pair is:
   a. XeF_6 – distorted octahedral
   b. $XeOF_4$ – square pyramidal
   c. XeO_3 – pyramidal
   d. XeF_4 – tetrahedral

4. Phosphorous pentachloride
   a. Has all the five equivalent bonds
   b. Exist as an ionic solid in which the cation has an octahedral structure and the anion has a tetrahedral structure
   c. On hydrolysis gives an oxo acid of phosphorous which is tribasic
   d. On hydrolysis gives an oxo acid of phosphorous which is a good reducing agent

5. Identify the set of paramagnetic ions among the following:
   a. $Ti^{3+}, Cu^{2+}, Mn^{3+}$
   b. Sc^{3+}, Ti^{3+}, V^{3+}
   c. V^{2+}, Co^{2+}, Zn^{2+}
   d. $Ni^{2+}, Cu^{2+}, Zn^{2+}$

6. How many moles of $K_2Cr_2O_7$ is required to liberate 6 moles of I_2 from an aqueous solution of I^-?
   a. 0.25
   b. 0.5
   c. 2
   d. 1

7. Cu_2Cl_2 and $CuCl_2$ in aqueous medium
   a. Both are unstable
   b. $Cu_2Cl_2$is more stable than $CuCl_2$
   c. $CuCl_2$is more stable than Cu_2Cl_2
   d. Stability of Cu_2Cl_2 is equal to the stability of $CuCl_2$

8. The co-ordination number of Fe and Co in the complex ions $[Fe(C_2O_4)_3]^{3-}$ and $[Co(SCN)_4]^{2-}$ are respectively:
   a. 4 and 6
   b. 6 and 4
   c. 3 and 4
   d. 6 and 8

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9. Number of stereoisomers exhibited by $[Co(en)_2Cl_2]^+$ is
   a. 5
   b. 3
   c. 4
   d. 2

10. The IUPAC name of $[Pt(NH_3)_4][PtCl_4]$ is:
   a. Tetra ammine palatinate (0) tetra chloride platinum (IV)
   b. Tetra ammine platinum (II) tetra chloride palatinate (II)
   c. Tetra ammine platinum (0) tetra chloride platinum (IV)
   d. Tetra ammine palatinate (II) tetra chloride platinum (II)

11. Prolonged exposure of chloroform in humans may cause damage to liver. It is due to the formation of the following compound:
   a. CH_2Cl_2
   b. Cl_2
   c. CCl_4
   d. $COCl_2$

12. Which of the following halides show the highest reactivity towards S_N1 reactions?
   a. $CH_3 - CH_2 - CH_2 - CH_2I$
   b. C_6H_5Cl
   c. $C_6H_5CH_2Cl$
   d. CH_3CH_2Cl

13. In the reaction:

   The number of possible isomers for the compound X is:
   a. 3
   b. 2
   c. 4
   d. 5

14. Which of the following on heating gives ether as the major product?
   P $C_6H_5CH_2Br + CH_3ONa$
   Q $C_6H_5ONa + CH_3Br$
   R $(CH_3)_3C - Cl + CH_3ONa$
   S $C_6H_5CH = CHCl + CH_3ONa$
   a. Both Q and S
   b. Both P and Q
   c. Both R and S
   d. Both P and R

15. The steps involved in the conversion of propan-2-ol to propan-1-ol are in the order:
   a. Heating with PCl_5, heating with $alc.KOH$, hydroboration-oxidation
   b. Dehydration, addition of HBr in the presence of a peroxide, heating with $alc.KOH$
   c. Dehydration, addition of HBr, heating with $alc.KOH$
   d. Heating with PCl_5, heating with $alc.KOH$, acid catalysed addition of water

16. Which of the following is the strongest base?
   a. OH^-
   b. CH_3O^-
   c. CH_3COO^-
   d. Cl^-

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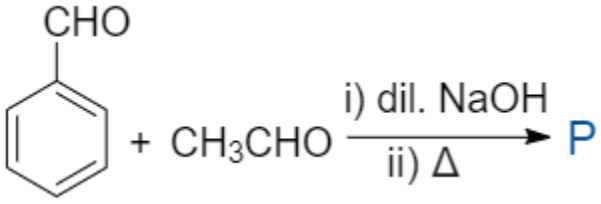
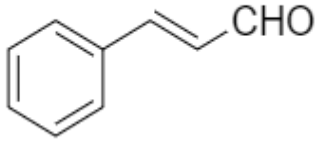
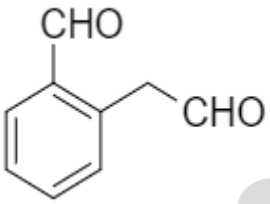
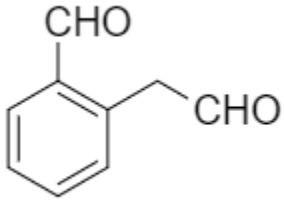
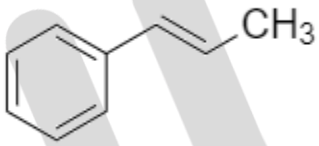
17. Product 'P' is:



a. 

b. 

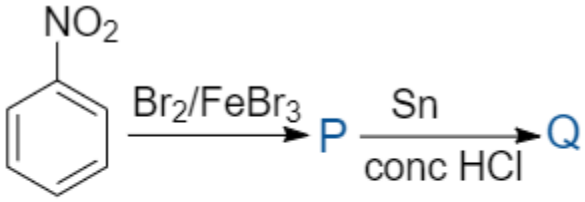
c. 

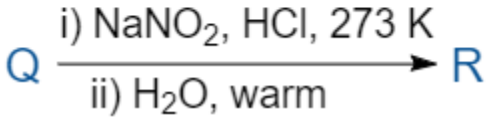
d. 

18. Which of the following has the lowest boiling point?
    a. $CH_3 - O - CH_3$
    b. $HCOOH$
    c. CH_3CH_2OH
    d. $CH_3CH_2NH_2$

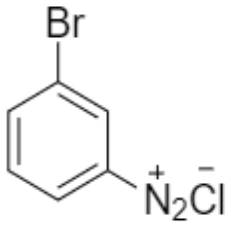
19. The carbonyl compound that does not undergo aldol condensation is:
    a. Trichloroacetaldehyde
    b. Acetaldehyde
    c. Acetone
    d. Dichloroacetaldehyde

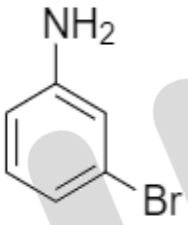
20.

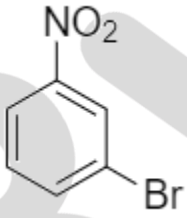


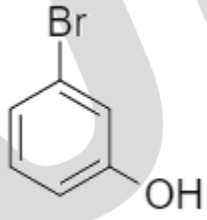


The final product R is:

a. 

b. 

c. 

d. 

21. Hinsberg's reagent is:
   a. $C_6H_5SO_2NH_2$
   b. $CH_3COCl/pyridine$
   c. $(CH_3CO)_2O/pyridine$
   d. $C_6H_5SO_2Cl$

22. Which of the following vitamins is not stored in the adipose tissue?
   a. D
   b. E
   c. A
   d. B_6

23. Hypothyroidism is caused by the deficiency of:
   a. Thyroxine
   b. Glucocorticoid
   c. Vitamin B-12
   d. Adrenalin

24. $C_1 - C_4$ glycosidic bond is NOT found in:
   a. Lactose
   b. Starch
   c. Maltose
   d. Sucrose

25. Which of the following polymers has the strongest intermolecular forces of attraction?
    a. Polythene
    b. Polystyrene
    c. Neoprene
    d. Terylene

26. Which of the following monomers can undergo condensation polymerisation?
    a. Isoprene
    b. Propene
    c. Styrene
    d. Glycine

27. A food additive that also acts as an anti-oxidant is:
    a. Sugar syrup
    b. Salt
    c. BHA
    d. Saccharin

28. Which of the following is not related to drug-enzyme interaction?
    a. Co-enzymes
    b. Enzyme inhibitor
    c. Allosteric site
    d. Antagonist

29. 0.4 g of dihydrogen is made to react with 7.1 g of dichloride to form hydrogen chloride. The volume of hydrogen chloride formed at 273 K and 1 bar pressure is:
    a. 90.8 L
    b. 45.4 L
    c. 9.08 L
    d. 4.54 L

30. With regard to photoelectric effect, identify the correct statement among the following:
    a. Number of electrons ejected increases with the increase in work function
    b. Number of electrons ejected increases with the increase in the intensity of incident light
    c. Energy of ejected electrons increases with the increase in the intensity of incident light
    d. Numbers of electrons ejected increases with the increase in the frequency of the incident light

31. The last element of the p-block in the 6th period is represented by the outer most electronic configuration:
    a. $4f^{14}5d^{10}6s^26p^4$
    b. $4f^{14}5d^{10}6s^26p^6$
    c. $7s^27p^6$
    d. $4f^{14}6d^{10}7s^27p^6$

32. The conjugate base of NH_3 is:
    a. NH_2OH
    b. NH_2^-
    c. NH_4^+
    d. NH_4OH

33. A gas mixture contains 25% He and 75% CH_4 by volume at a given temperature and pressure. The percentage by mass of methane in the mixture is approximately:
    a. 92%
    b. 8%
    c. 75%
    d. 25%

34. The percentage of s–character in the hybrid orbitals of nitrogen in NO_2^+, NO_3^- and NH_4^+ respectively are:
    a. 50%, 33.3%, 25%
    b. 25%, 50%, 33.3%
    c. 33.3%, 50%, 25%
    d. 33.3%, 25%, 50%

35. The formal charge on the central oxygen atom in ozone is:
    a. $+2$ b. $+1$
    c. -1 d. 0

36. When the same quantity of heat is absorbed by a system at two different temperatures T_1 and T_2, such that $T_1 > T_2$, change in entropies are ΔS_1 and ΔS_2 respectively. Then:
    a. $S_2 > S_1$ b. $\Delta S_2 < \Delta S_1$
    c. $\Delta S_1 < \Delta S_2$ d. $\Delta S_2 = \Delta S_1$

37. The oxidation number of nitrogen atoms in NH_4NO_3 are:
    a. $+3, -5$ b. $-3, -3$
    c. $+5, -5$ d. $-3, +5$

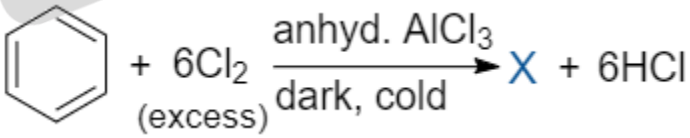
38. A Lewis acid `X' reacts with $LiAlH_4$ in ether medium to give a highly toxic gas. This gas when heated with NH_3 gives a compound commonly know as inorganic benzene. The gas is:
    a. $B_3N_3H_6$ b. BF_3
    c. B_2O_3 d. B_2H_6

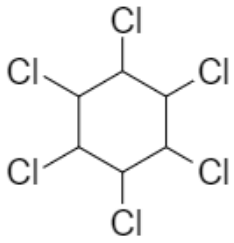
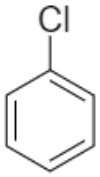
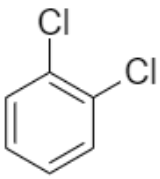
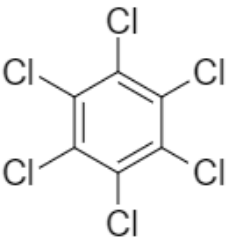
39. The oxide of potassium that does NOT exist is:
    a. K_2O_2 b. K_2O_3
    c. K_2O d. KO_2

40. The metal that produces H_2 with both dil. HCl and NaOH (aq) is:
    a. Ca b. Fe
    c. Zn d. Mg

41. Which of the following is not a pair of functional isomers?
    a. $CH_3CH_2NO_2$ and H_2NCH_2COOH
    b. CH_3COOH and $HCOOCH_3$
    c. $C_2H_5OC_2H_5$ and $C_3H_7OCH_3$
    d. CH_3CH_2OH and CH_3OCH_3

42. Identify 'X' in the following reaction:



a. 
b. 
c. 
d. 

43. Which of the following is NOT a greenhouse gas?
    a. O_2
    b. NO_2
    c. CFC
    d. CO_2

44. A metal exists as an oxide with the formula $M_{0.96}O$. Metal M can exist as M^{2+} and M^{3+} in its oxide $M_{0.96}O$. The percentage of M^{3+} in the oxide is nearly:
    a. 5%
    b. 9.6%
    c. 8.3%
    d. 4.6%

45. A metal crystallizes in a face centred cubic structure having a metallic radius of $\sqrt{2}A^o$. The volume of the unit cell (in m^3) is:
    a. 4×10^{-9}
    b. 6.4×10^{-30}
    c. 4×10^{-10}
    d. 6.4×10^{-29}

46. Silicon doped with gallium forms:
    a. An intrinsic semiconductor
    b. p-type semiconductor
    c. n-type semiconductor
    d. Both n and p type semiconductor

47. The pair of electrolytes that possess the same value for the constant (A) in the Debye – Huckel – Onsager equation, $\lambda_m = \lambda_m^o - A\sqrt{C}$
    a. $NaBr, MgSO_4$
    b. $NaCl, CaCl_2$
    c. $MgSO_4, Na_2SO_4$
    d. $NH_4Cl, NaBr$

48. Which of the following pairs of solutions are isotonic?
    a. 0.001 M $CaCl_2$ and 0.001 M $Al_2(SO_4)_3$
    b. 0.01 M $BaCl_2$ and 0.001 M $CaCl_2$
    c. 0.01 M $BaCl_2$ and 0.015 M $NaCl$
    d. 0.001 M $Al_2(SO_4)_3$ and 0.01 M $BaCl_2$

49. Solute `X' dimerises in water to an extent of 80%. 2.5 $g$ of `X' in 100 g of water increases the boiling point by 0.3 °C. The molar mass of X is: [$K_b = 0.52\ Kkgmol^{-1}$]
    a. 65
    b. 26
    c. 13
    d. 52

50. Given, $E^o_{\frac{Fe^{+3}}{Fe^{+2}}} = +0.76\ V$ and $E^o_{\frac{I_2}{I^-}} = +0.55\ V$. The equilibrium constant for the reaction taking place in the galvanic cell consisting of the above two electrodes is: [$\frac{2.303RT}{F} = 0.06$]
    a. 3×10^8
    b. 5×10^{12}
    c. 1×10^7
    d. 1×10^9

51. If an aqueous solution of NaF is electrolyzed between inert electrodes, the product obtained at the anode is:
    a. Na
    b. O_2
    c. F_2
    d. H_2

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52. In which of the following cases a chemical reaction is possible:
    a. Conc. HNO_3 is stored in a platinum vessel
    b. Gold ornaments are washed with dil. HCl
    c. $ZnSO_4$ is placed in a copper vessel
    d. $AgNO_3$ solution is stirred with a copper spoon

53. The time required for 60% completion of a first order reaction is 50 min. The time required for 93.6% completion of the same reaction will be
    a. 50 min
    b. 150 min
    c. 100 min
    d. 83.8 min

54. For an elementary reaction, $2A + 3B \rightarrow 4C + D$, the rate of appearance of C at time `t' is $2.8 \times 10^{-3}\ molL^{-1}S^{-1}$ . Rate of disappearance of $B$ at `t' will be:
    a. $2(2.8 \times 10^{-3})\ molL^{-1}S^{-1}$
    b. $\frac{1}{4}(2.8 \times 10^{-3})\ molL^{-1}S^{-1}$
    c. $\frac{4}{3}(2.8 \times 10^{-3})\ mol\ L^{-1}S^{-1}$
    d. $\frac{3}{4}(2.8 \times 10^{-3})\ molL^{-1}S^{-1}$

55. The rate constant of a reaction is given by $k = PZe^{-\frac{E_a}{RT}}$ under standard notation. In order to speed up the reaction, which of the following factors has to be decreased?
    a. E_a
    b. T
    c. Z
    d. Both Z and T

56. A sol of AgI is prepared by mixing equal volumes of 0.1 M $AgNO_3$ and 0.2 M KI, which of the following statement is correct?
    a. Sol obtained is a positive sol with K^+ adsorbed on AgI
    b. Sol obtained is a negative sol with I^- adsorbed on AgI
    c. Sol obtained is a negative sol with NO_3^- adsorbed on AgI
    d. Sol obtained is a positive sol with Ag^+ adsorbed on AgI

57. During adsorption of a gas on a solid:
    a. $\Delta G < 0, \Delta H < 0, \Delta S > 0$
    b. $\Delta G < 0, \Delta H > 0, \Delta S > 0$
    c. $\Delta G < 0, \Delta H < 0, \Delta S < 0$
    d. $\Delta G > 0, \Delta H > 0, \Delta S > 0$

58. Copper is extracted from copper pyrites by:
    a. Electrometallurgy
    b. Auto reduction
    c. Thermal decomposition
    d. Reduction by coke

59. Function of potassium ethylxanthate in froth floatation process is to make ore:
    a. Hydrophilic
    b. Heavier
    c. Lighter
    d. hydrophobic

60. Sulphide ore on roasting gives a gas X. X reacts with Cl_2 in the presence of activated charcoal to give Y. Y is:
    a. SCl_6
    b. $SOCl_2$
    c. SO_2Cl_2
    d. S_2Cl_2

Answers Keys

1	2	3	4	5	6	7	8	9	10
c	c	d	c	a	c	c	b	b	d
11	12	13	14	15	16	17	18	19	20
d	c	b	b	a	a	a	a	a	d
21	22	23	24	25	26	27	28	29	30
d	d	a	d	d	d	c	d	d	b
31	32	33	34	35	36	37	38	39	40
b	b	a	a	b	c	d	d	b	c
41	42	43	44	45	46	47	48	49	50
c	d	a	c	d	b	d	c	b	c
51	52	53	54	55	56	57	58	59	60
b	d	b	d	a	b	c	b	d	c

Solutions

1. Sol : (c)

The corresponding reactions are

$$BaCl_2 + Na_2SO_3 \rightarrow BaSO_3 + 2NaCl$$
$$BaSO_3 + 2HCl \rightarrow BaCl_2 + SO_2 + H_2O$$

Salt A is Na_2SO_3 and the dense white precipitate is $BaSO_3$ (Barium sulfite).
Gas B is SO_2. It decolourises acidified $KMnO_4$ solution because of its reducing nature. The corresponding reaction is:

$$2KMnO_4 + 5SO_2 + 2H_2O \rightarrow K_2SO_4 + 2MnSO_4 + 2H_2SO_4$$

2. Sol : (c)

The hydrides of group 15, 16 below the 3rd period, follows Drago's rule. The rule states that due to a large energy difference between the atomic orbitals, these compounds do not exhibit hybridization. Thus, PH_3 will not exhibit hybridization and here the bond formation takes place due to the overlap of pure p-orbitals and s-orbitals. PH_3 has a lone pair on the central P atom, which is absent in PH_4^+. Thus in PH_3, there will be bond pair – lone pair repulsion and this is the reason why the bond angle in PH_3 is less than that of PH_4^+.

3. Sol : (d)

In XeF_6 there are 6 bond pairs and one lone pair. Thus the shape of XeF_6 is distorted octahedral.
In $XeOF_4$, Xe is sp^3d hybridized and the shape is square pyramidal.
In XeO_3, Xe is sp^3 hybridized and the shape is trigonal pyramidal.
In XeF_4, Xe is sp^3d^2 hybridized. It has 4 bond pairs and two lone pairs. Thus, the shape is square planar.

4. Sol : (c)

a. Phosphorous pentachloride (PCl_5) has a trigonal bipyramidal structure. Here, the five bonds are not of equal lengths as the axial bonds are slightly longer than the equatorial bonds.
b. PCl_5 solid exists as $[PCl_4]^+$ and $[PCl_6]^-$ and they have tetrahedral and octahedral structures respectively.
c. On hydrolysis, PCl_5 gives H_3PO_4which is tribasic.

$$PCl_5 + 4H_2O \rightarrow H_3PO_4 + 5HCl$$

d. In H_3PO_4, P is in its +5 oxidation state. So it is in its highest oxidation state and hence is not a good reducing agent.

5. Sol : (a)

The ions which contain unpaired electrons exhibit paramagnetic behavior.
The electronic configuration of the ions are given below:

$$Ti^{3+} = 1s^2 2s^2 2p^6 3s^2 3p^5$$
$$Cu^{2+} = 1s^2 2s^2 2p^6 3s^2 3p^5 3d^9$$
$$Mn^{3+} = 1s^2 2s^2 2p^6 3s^2 3p^5 3d^4$$

Thus, all of them have unpaired electrons. Hence, they will show paramagnetic behavior.
In option (B) V^{3+} does not possess any unpaired electrons.
In option (C) Zn^{2+} does not possess any unpaired electrons.
Similarly in option (D) Zn^{2+} does not possess any unpaired electrons.

6. Sol : (c)

The balanced redox reaction will be:

$$K_2Cr_2O_7 + 6KI + 7H_2SO_4 \rightarrow 4K_2SO_4 + 3I_2 + Cr_2(SO_4)_3 + 7H_2O$$

3 moles of I_2 requires 1 mole of $K_2Cr_2O_7$
Hence, 6 moles of I_2 will require 2 moles of $K_2Cr_2O_7$

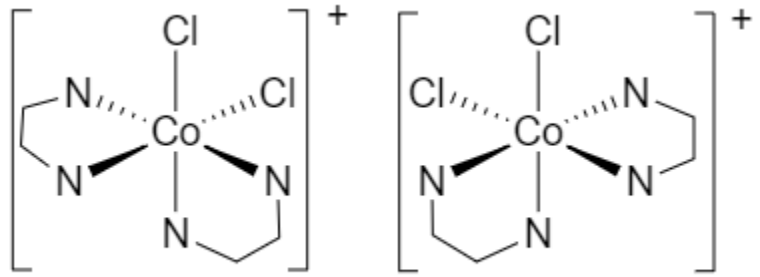
7. Sol : (c)

$CuCl_2$ is more stable than Cu_2Cl_2 . The size of Cu^{2+} is smaller than Cu^+. The hydration enthalpy depends on the size of the cation. Smaller the size of the cation, more will be the hydration enthalpy. Hence, more will be the stability.

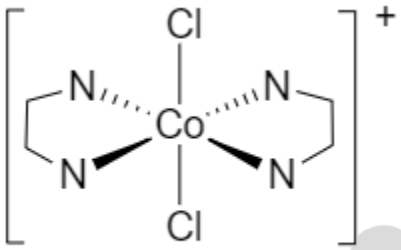
8. Sol : (b)

$C_2O_4^{2-}$ is the oxalate ligand. It binds through two oxygen atoms and thus, is a bidentate ligand. Hence the co-ordination number of Fe in $[Fe(C_2O_4)_3]^{3-}$ is 6.
SCN^- is the thiocyanate ligand. It is a monodentate ligand. Hence the co-ordination number of Co in the complex ion $[Co(SCN)_4]^{2-}$ is 4.

9. Sol : (b)



(Cis)



(Trans)

10. Sol : (d)

The coordination complex must be neutral. Here in all the options, the oxidation states of Pt are given such that we get an overall neutral complex. Again, while naming a complex, the cationic part should be named first followed by the anionic part. While naming the anionic part, the name of the metal should end with the suffix –ate. From this, we can conclude that the IUPAC name of $[Pt(NH_3)_4][PtCl_4]$ can be either (A) or (D). But the most common oxidation state of Pt is $+2$ and $+4$ and in both the parts of the complex, Pt has the same coordination number, and so, the correct option will be (D).

11. Sol : (d)

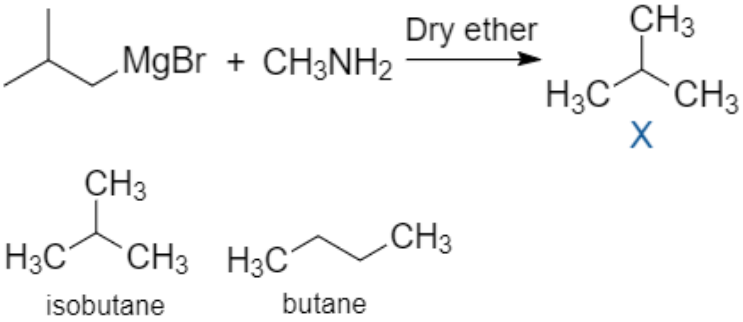
When chloroform is oxidised, it forms phosgene which is poisonous.

$$CHCl_3 \xrightarrow{[O]} COCl_2 + HCl$$

12. Sol : (c)

The rate of a S_N1 reaction is determined by the stability of the intermediate formed. In this case, the most stable intermediate formed would be for $C_6H_5CH_2Cl$ and the intermediate formed would be $C_6H_5CH_2^+$. This intermediate is stabilised via resonance.

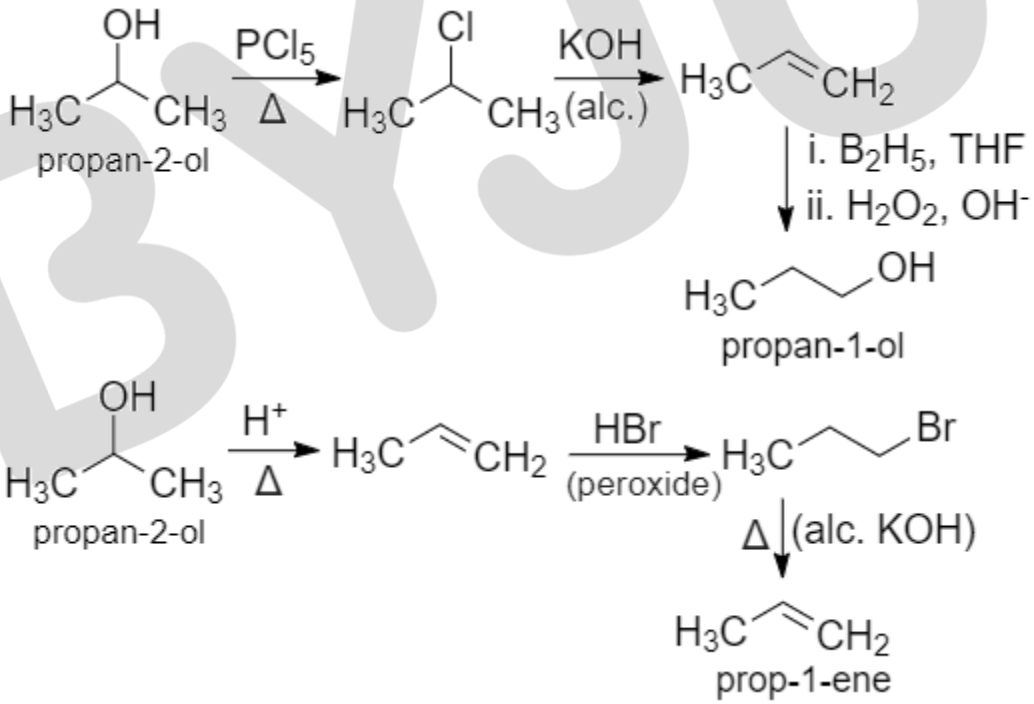
13. Sol : (b)

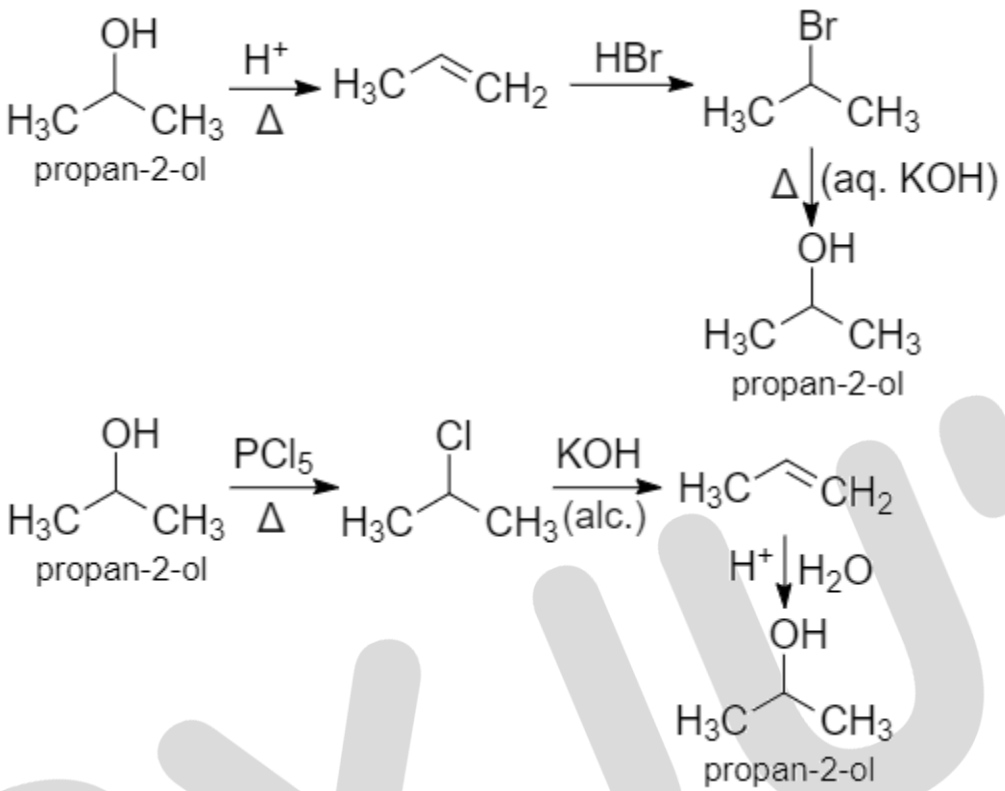


14. Sol : (b)

Primary alkyl halides/ benzyl halides reacts with alkoxide/phenoxide to give ethers via S_N2 mechanism. This reaction is known as Williamson's ether synthesis. Aryl halides are the least reactive as the $C - X$ bond has a partial double bond characteristic and hence, does not cleave easily. 3^o halides do not give ethers as they undergo elimination in the presence of a strong base like alkoxides.

15. Sol : (a)



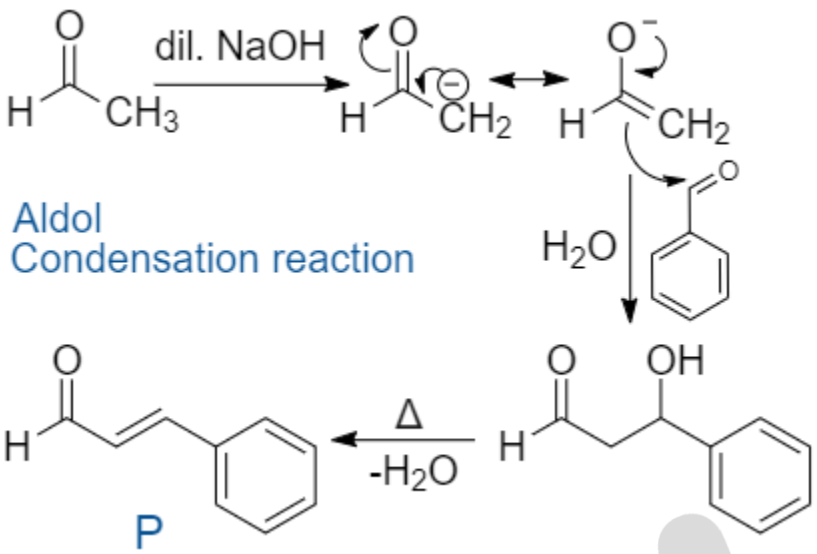


16. Sol : (a)

To check the basicity of an ion, the conjugate acid must be weak. The conjugate acids are given below: H_2O, CH_3OH, CH_3COOH and HCl.

We know that methanol is a stronger acid than water. Weaker the acid, stronger is the conjugate base, by that logic, OH^- is the strongest base among the given options.

17. Sol : (a)



18. Sol : (a)

Ethers cannot form strong hydrogen bonds and hence they have the lowest boiling point among the given options.

19. Sol : (a)

At least one α-hydrogen should be present for an aldehyde or a ketone to undergo aldol reaction. The only compound that does not have even one α-hydrogen is trichloroacetaldehyde, and hence, it does not undergo aldol reaction.

20. Sol : (d)

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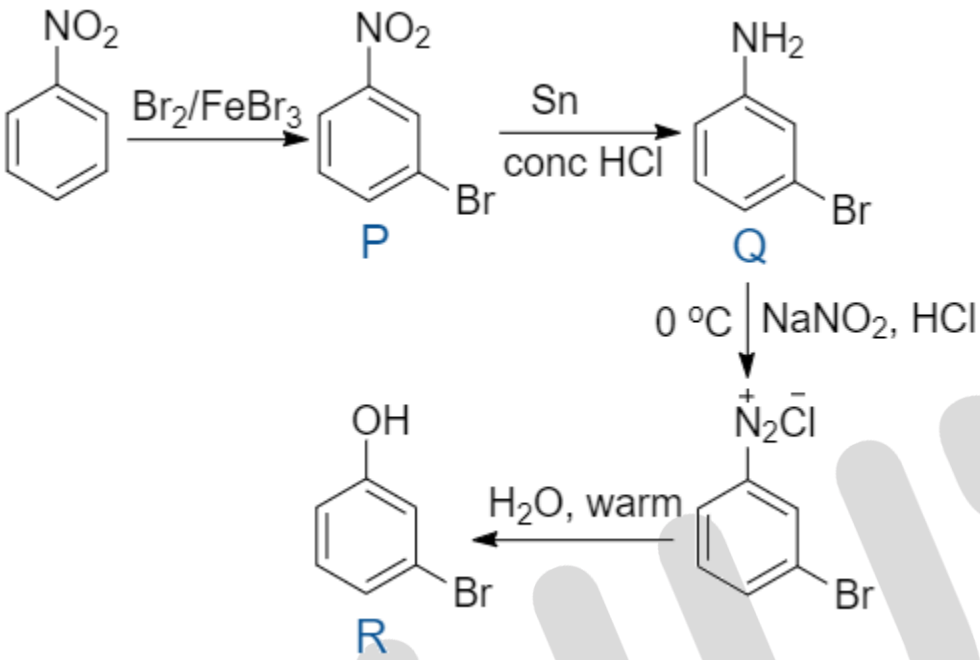


21. Sol : (d)

Hinsberg's reagent is benzene sulphonyl chloride ($C_6H_5SO_2Cl$).

It is used to test for and distinguish between primary, secondary and tertiary amines.

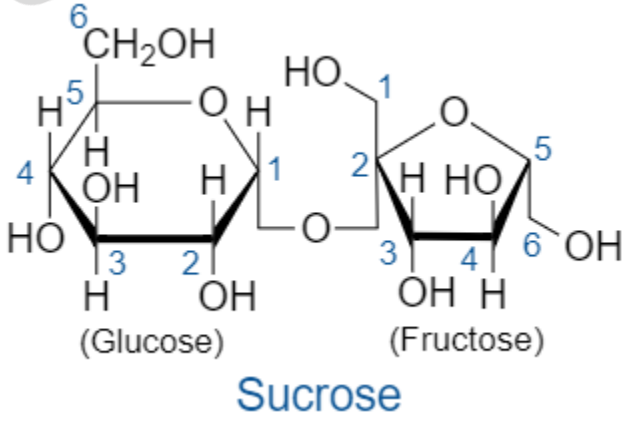
22. Sol : (d)

Adipose tissue stores those vitamins which are fat soluble. Among the given vitamins, only A, D and E are fat soluble. Vitamin B_6 is water soluble and hence, is not stored in adipose tissue.

23. Sol : (a)

Hypothyroidism is caused by the deficiency of the hormone thyroxine which is produced by thyroid gland.

24. Sol : (d)



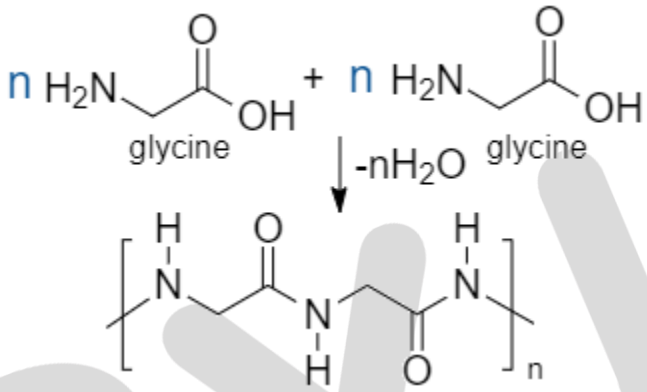
Sucrose has $C_1 - C_2$ glycosidic bond and not$C_1 - C_4$ glycosidic bond.

25. Sol : (d)

The monomer of polythene is ethane (C_2H_4)
The monomer of polystyrene is styrene $(C_6H_5CHCH_2)$
The monomer of neoprene is chloroprene $(CH_2 = C(Cl) - CH = CH_2)$
The monomer of Terylene is 1,4 –benzene dicarboxylic acid and 1,2-ethane diol. Thus, it possesses intermolecular hydrogen bonding and has the strongest intermolecular forces among the given options.

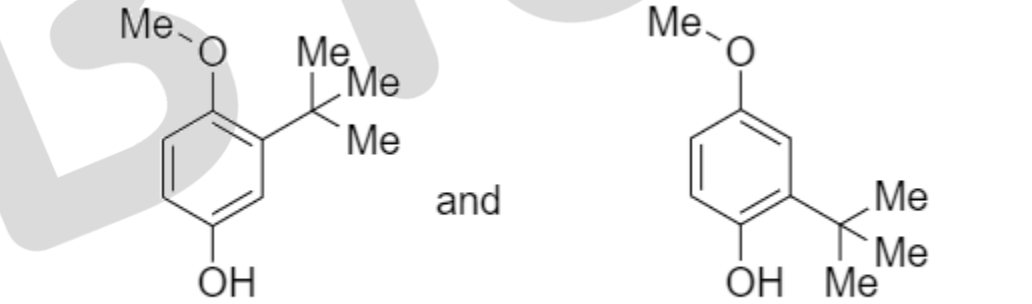
26. Sol : (d)

Glycine can undergo condensation polymerisation. Given below is an example:



27. Sol : (c)

BHA (Butylated hydroxyl anisole) is widely used as an anti-oxidant in foods like vegetable oils to stop them from getting oxidised and thereby, preventing them from going rancid.



2-tert-butyl-4-hydroxyanisole 3-tert-butyl-4-hydroxyanisole

28. Sol : (d)

Antagonists impede the action of drugs by occupying the enzyme sites themselves, and hence is the odd one out.

29. Sol : (d)

The corresponding balanced reaction is:

$$H_2 + Cl_2 \rightarrow 2HCl$$

Again, 0.4 g $H_2 = \frac{0.4}{2} mol = 0.2\ mol$

7.1 g $Cl_2 = \frac{7.1}{71} mol = 0.1\ mol$
So, Cl_2 is the limiting reagent here.
Hence 0.2 moles of HCl will be formed.
Again, we need to find out the volume of HCl formed in the STP condition.
1 mol of a gas in STP occupies 22.7 L
Thus, 0.2 mol of HCl will occupy = 4.54 L

30. Sol : (b)
Photoelectric effect is the emission of electrons from a certain metal surface when it is irradiated with photons or light. The minimum frequency required to eject an electron from a metal surface is called threshold frequency. (υ_o)
The equation for photoelectric effect is:
$h\upsilon = h\upsilon_o + KE$, where υ = frequency of the incident radiation
Here $h\upsilon_o$ is the work function. The number of electrons ejected does not depend on work function.
The number of electrons ejected increases with the increase in the intensity of incident light, an increase in the intensity of incident light means that the number of photons incident per unit surface area of the metal increases. (Provided the incident photons has its frequency more than the threshold frequency)
Energy of the ejected electrons increases with an increase in the frequency of incident light.

31. Sol : (b)
The last element of the p-block in 6th period is Radon (Rn)
The electronic configuration of Rn is $[Xe]4f^{14}5d^{10}6s^26p^6$

32. Sol : (b)
A conjugate base has one proton less from the acid. If we remove one proton from NH_3, we get NH_2^-.
$NH_3 \rightarrow NH_2^- + H^+$

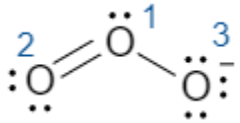
33. Sol : (a)
Since temperature and pressure is constant, we can assume it to be in STP condition.
Now, let the total volume be 100 L
Moles of He present $= \frac{25}{22.4} = 1.12\ mol$
Mass of He present $= 1.12 \times 4 = 4.48\ g$
Moles of CH_4 present $= \frac{75}{22.4} = 3.35\ mol$
Mass of CH_4 present $= 3.35 \times 16 = 53.60\ g$
Hence, the mass percentage of $CH_4 = \frac{53.60}{58.08} \times 100 = 92.28\%$

34. Sol : (a)
In NO_2^+, the steric number of N is two (two sigma bonds). Thus, it is sp hybridized. Hence, the percentage s-character is $= \frac{1}{2} \times 100 = 50\%$
In O_3^-, the steric number of N is three (three sigma bonds). Thus, it is sp^2 hybridized. Hence the

percentage s-character is $= \frac{1}{3} \times 100 = 33.33\%$

In NH_4^+, steric number of N is four (four sigma bonds). Thus, it is sp^3 hybridized. Hence, the percentage s-character is $= \frac{1}{4} \times 100 = 25\%$

35. Sol : (b)



(number of valence electron(s) in the neutral atom) - $\frac{1}{2}$ (number of valence electron(s) in the covalent bond)-(number of electrons in lone pair)

$6 - \frac{1}{2} \times 6 - 2 = +1$

Formal charge on the central oxygen i.e. oxygen (1) is +1.

36. Sol : (c)

In thermodynamics we are concerned about entropy change due to the transfer of heat.

Which we can write in the form, $\Delta S = \frac{q}{T}$, here q is constant.

So, $\Delta S \propto \frac{1}{T}$

We are given, $T_1 > T_2$, so the actual relation between the entropies will be $\Delta S_1 < \Delta S_2$.

37. Sol : (d)

NH_4NO_3 is a salt. The cationic part is NH_4^+ and the anionic part is NO_3^-.

In NH_4^+, let the oxidation number be x. So,

$x + 4 = 1$

$\Rightarrow x = -3$

In NO_3^-, let the oxidation number be y. So,

$y - 6 = -1$

$\Rightarrow y = +5$

38. Sol : (d)

The corresponding reactions are

$$4BF_3 + 3LiAlH_4 \rightarrow 2B_2H_6 + 3LiF + 3AlF_3$$

$$3B_2H_6 + 6NH_3 \rightarrow 3[BH_2(NH_3)_2]^+[BH_4]^-$$

$$3[BH_2(NH_3)_2]^+[BH_4]^- + heat \rightarrow 2B_3N_3H_6 + 12H_2$$

So here the Lewis acid `X' is BF_3 , inorganic benzene is $B_3N_3H_6$ which is also know as Borazine.

So the toxic gas is B_2H_6

39. Sol : (b)

Potassium generally forms three oxides: K_2O, K_2O_2 and KO_2.

K_2O_3 is not formed in normal conditions and hence, is the answer.

40. Sol : (c)

Zn produces H_2 with both dil. HCl and NaOH (aq). The corresponding reactions are:

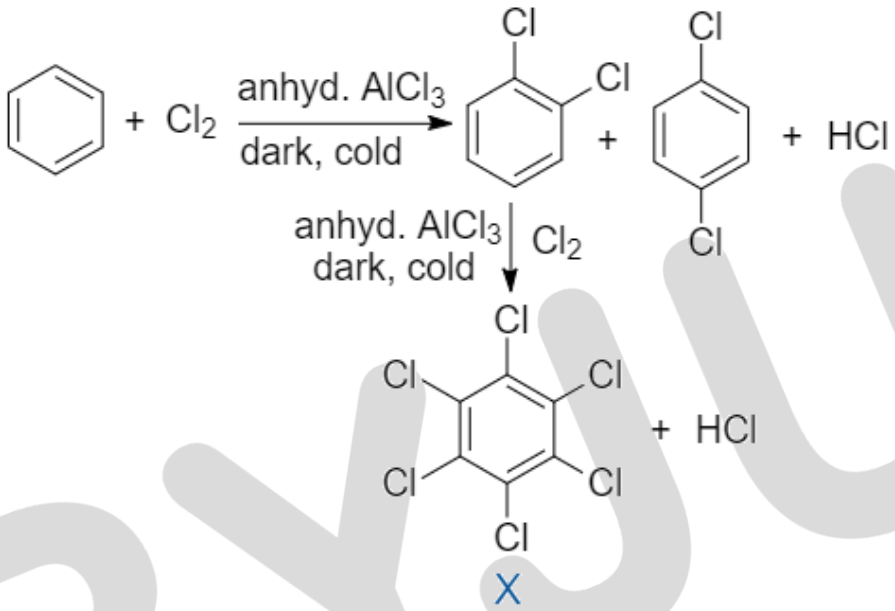
$$Zn + 2HCl \rightarrow ZnCl_2 + H_2 \uparrow$$

$$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2 \uparrow$$

41. Sol : (c)

Functional isomers are compounds having the same molecular formula but different functional groups. Both the compounds given in option c are ethers. $C_2H_5OC_2H_5$ and $C_3H_7OCH_3$ are metamers, while the rest of the options are examples of functional isomers.

42. Sol : (d)



43. Sol : (a)

Greenhouse gases are those compounds which increase the temperature of the atmosphere by absorbing the IR rays of the sun. They include compounds like water vapour, CO_2, NO_2, O_3, CFCs etc. O_2 is not a greenhouse gas.

44. Sol : (c)

Let, the number of M^{2+} ions $= x$

Then, the number of M^{3+} ions will be $0.96 - x$

We know, the overall charge in the metal oxide is zero.

So, $x(2) + (0.96 - x)(3) + 1(-2) = 0$

$\Rightarrow 2x + 2.88 - 3x = 2$

$\Rightarrow -x = -0.88$

$\Rightarrow x = 0.88$

$\therefore$Number of M^{3+} ions $= 0.96 - 0.88 = 0.08$

$\therefore$ Percentage of M^{3+} ions $= \frac{0.08}{0.96} \times 100 = 8.33\%$

45. Sol : (d)

For FCC,

Atomic radius (r) $= \frac{\sqrt{2}a}{4}$

$\Rightarrow \sqrt{2} \times 10^{-10} = \frac{\sqrt{2}a}{4}$

$\Rightarrow a = \frac{4 \times \sqrt{2} \times 10^{-10}}{\sqrt{2}} = 4 \times 10^{-10}\ m$

Volume of unit cell = $a^3 = (4 \times 10^{-10})^3 = 64 \times 10^{-30} m^3 = 6.4 \times 10^{-29}\ m^3$

46. Sol : (b)

An intrinsic semiconductor is a semiconductor where we do not use any dopant, i.e. it is an undoped semiconductor.

Silicon has 4 valence electrons whereas gallium has only 3 valence electrons. Thus, the dopant has less number of valence electrons in this case. Hence, silicon doped with gallium forms a p-type semiconductor.

47. Sol : (d)

The value of the constant A in the Debye – Huckel –Onsager equation, $\lambda_m = \lambda_m^o - A\sqrt{C}$ depends on temperature, charges of the ions, dielectric constant of the solvent and also the viscosity of the solvent. Here, since we are not given the solvent, we will assume that the solvent is same for each case. Here, the deciding factor are the charges on the ions. Again, in NH_4Cl and $NaBr$ the charges on the ions are same. Hence the pair of electrolytes that will possess same value for the constant (A) will be $NH_4Cl, NaBr$.

48. Sol : (c)

Isotonic solutions are those which have same osmotic pressure ($\Pi = iCRT$). But here we have different concentration of the solutions and also they have different van't Hoff factors (i). So the solutions for which the product of i and c will be same, will be isotonic.

a. For, 0.001 M $CaCl_2$, $i = 3$. So $i \times C = 3 \times 0.001 = 0.003$
   For, 0.001 M $Al_2(SO_4)_3$, $i = 5$. So $i \times C = 5 \times 0.001 = 0.005$
b. For, 0.01 M $BaCl_2$, $i = 3$. So $i \times C = 3 \times 0.01 = 0.03$
   For, 0.001 M $CaCl_2$, $i = 3$. So $i \times C = 3 \times 0.001 = 0.003$
c. For, 0.01 M $BaCl_2$, $i = 3$. So $i \times C = 3 \times 0.01 = 0.03$
   For, 0.015 M $NaCl$, $i = 2$. So $i \times C = 2 \times 0.015 = 0.03$
   Thus 0.01 M $BaCl_2$ and 0.015 M $NaCl$ are isotonic in nature.
d. For, 0.001 M $Al_2(SO_4)_3$, $i = 5$. So $i \times C = 5 \times 0.001 = 0.005$
   For, 0.01 M aCl_2, $i = 3$. So $i \times C = 3 \times 0.01 = 0.03$

49. Sol : (b)

We are given,

$2X \rightarrow X_2$

Therefore, $i = 1 - \propto + \frac{\propto}{2} = 1 - 0.8 + 0.4 = 0.6$ (since $\propto = 0.8$, given)

We know, $\Delta T_b = iK_b \times \frac{W_B}{M} \times \frac{1000}{W_{A(g)}}$

Where, $W_B = Mass of solute, W_A = Mass of solvent$, M =Molar mass

Given, $\Delta T_b = 0.3$

Therefore, $0.3 = 0.6 \times 0.52 \times \frac{2.5}{M} \times \frac{1000}{100}$
$\Rightarrow M = 2 \times 0.52 \times 2.5 \times 10 = 26\ g$

50. Sol : (c)
Given,
$E^o_{Fe^{+3}/Fe^{+2}} = +0.76\ V$ (Cathode)
$E^o_{I_2/I^-} = +0.55\ V$ (Anode)
$\therefore E^o_{Cell} = E^o_C - E^o_A = 0.76 - 0.55 = 0.21$
The complete cell reaction is
$2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$
$\therefore E^o_{cell} = \frac{0.059}{2} logK_C$
$\Rightarrow logK_C \approx 7$
$\Rightarrow K_C = 10^7$

51. Sol : (b)
At the anode, oxidation takes place. Here water will be oxidized. The reaction at the anode will be:

$$2H_2O \rightarrow 4H^+ + O_2 + 4e^-$$

52. Sol : (d)
Platinum and gold lies at the bottom of the reactivity series. Thus it does not react with HNO_3 and HCl. Again, Zn is more reactive than copper. Thus, copper will be displaced by Zn, if $ZnSO_4$ is placed in a copper vessel. But Ag^+ is less reactive than copper. Thus, copper will displace silver. The corresponding reaction is: $2AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2Ag$

53. Sol : (b)
For a first order reaction the, the rate constant is given by
$k = \frac{2.303}{t} log \frac{[R_0]}{[R]}$
Given, at 50 min, 60% of the reaction is completed
$\therefore k = \frac{2.303}{t} log \frac{[R_0]}{[R]} = \frac{2.303}{50} log \frac{100}{40} = \frac{2.303}{50} \times 0.397$
So, when 93.6% of the reaction is completed,
$\Rightarrow \frac{2.303}{50} \times 0.397 = \frac{2.303}{t} log \frac{100}{6.4}$
$\Rightarrow \frac{2.303}{50} \times 0.397 = \frac{2.303}{t} \times 1.19$
$\Rightarrow t \approx 150\ min$

54. Sol : (d)
The given reaction is,
$2A + 3B \rightarrow 4C + D$
So, $-\frac{1}{3}\frac{d[B]}{dt} = \frac{1}{4}\frac{d[C]}{dt}$
$\Rightarrow -\frac{d[B]}{dt} = \frac{3}{4}\frac{d[C]}{dt} = \frac{3}{4}(2.8 \times 10^{-3})\ molL^{-1}S^{-1}$

55. Sol : (a)

The expression of rate constant given in the question ($k = PZe^{-\frac{E_a}{RT}}$) is according to Arrhenius theory.
To speed up the reaction, we will have to decrease the value of E_a i.e. activation energy and will have to increase the value of temperature (T) and the number of collisions (Z).

56. Sol : (b)
Given reaction is,

$$AgNO_3 + KI \rightarrow AgI(Sol) + KNO_3$$

Here, amount of $AgNO_3$ present is 0.1 M.
Amount of KI present is 0.2 M.
Since KI is excess here, thus, sol obtained is a negative sol with I^- adsorbed on AgI.

57. Sol : (c)
When a gas is adsorbed on a solid surface, its movement is restricted leading to a decrease in the entropy of the gas i.e. ΔS is negative. Now, we know that, for a process to be spontaneous, ΔG should be negative.
We know, $\Delta G = \Delta H - T\Delta S$
Since ΔS is negative, ΔH has to be negative so as to make ΔG negative. Hence adsorption is always an exothermic process. Hence the correct option is (C).

58. Sol : (b)
The formula of copper pyrites is $CuFeS_2$. In auto reduction, the sulphide ores of the metals which are less electropositive like Hg, Pb and Cu are heated in air so as to convert a part of it to its oxides.
These oxides then reacts with the remaining sulphide ore in the absence of air, to give the metal and sulphur dioxide. The corresponding reaction is:

$$Cu_2O + \frac{1}{2}Cu_2S \rightarrow 3Cu + \frac{1}{2}SO_2$$

59. Sol : (d)
The function of potassium ethylxanthate in froth floatation process is to make the ore water repellant, i.e. hydrophobic.

60. Sol : (c)
The corresponding reactions are
$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2(s)$ (Reaction involved in roasting)
$SO_2 + Cl_2 + activatedcharcoal \rightarrow SO_2Cl_2$
So here X is SO_2 (sulphur dioxide)
And Y is SO_2Cl_2 (Sulfuryl chloride)