R5

NEET 2024

Chemistry

Section – A (Compulsory)

51. Match List I with List II.

	List I (Process)		List II (Conditions)
A.	Isothermal process	I.	No heat exchange
B.	Isochoric process	II.	Carried out at constant temperature
C.	Isobaric process	III.	Carried out at constant volume
D.	Adiabatic process	IV.	Carried out at constant pressure

Choose the correct answer from the options given below:

(1) A-IV, B-II, C-III, D-I

(2) A-I, B-II, C-III, D-IV

(3) A-II, B-III, C-IV, D-I

(4) A-IV, B-III, C-II, D-I

Solution :

Isothermal Process → Carried out of constant temp.

Isochoric Process → Carried out at constant volume

Isobaric process → Carried out at constant Pressure

Adiabatic Process → No heat exchange

52. Arrange the following elements in increasing order of first ionization enthalpy:

Li, Be, B, C, N

Choose the correct answer from the options give below:

(1) Li < B < Be < C < N

(2) Li < Be < C < B < N

(3) Li < Be < N < B < C

(4) Li < Be < B < C < N

Solution :

Li = $1s^2\ 2s^1$

Be = $1s^2\ 2s^2$ → Full filled

B = $1s^2\ 2s^2\ 2p^1$

C = $1s^2\ 2s^2\ 2p^2$

N = $1s^2\ 2s^2\ 2p^3$ → Half filled

∴ Li < B < Be < C < N

53. Match List I with List II.

	List I (Molecule)		List II (Number and types of bond/s between two carbon atoms)
A.	ethane	I.	one σ-bond and two π-bonds
B.	ethene	II.	two π-bonds
C.	carbon molecule, C_2	III.	one σ-bond
D.	ethyne	IV.	one σ-bond and one π-bond

Choose the correct answer from the options given below:

(1) A-IV, B-III, C-II, D-I

(2) A-III, B-IV, C-II, D-I

(3) A-III, B-IV, C-I, D-II

(4) A-I, B-IV, C-II, D-III

Solution :

- Ethane $CH_3 - CH_3$
  one σ bond
- Ethane $CH_2 = CH_2$
  one σ bond and one π bond
- Carbon $C_2 \Rightarrow$ Two π bond
- Ethyne $\Rightarrow HC \equiv CH$ two π bond and one σ bond

54. The Henry's law constant (K_H) values of three gases (A, B, C) in water are 145, 2×10^{-5} and 35 kbar, respectively. The solubility of these gases in water follow the order:

(1) B > C > A

(2) A > C > B

(3) A > B > C

(4) B > A > C

Solution :

Greater the value of K_H (Henry low constant) lesser is the solubility.

Henry law constant is indirectly proportional to the Solubility.

$K_H \propto \frac{1}{S}$

$\therefore$ B > C > A

55. Arrange the following elements in increasing order of electronegativity:
N, O, F, C, Si
Choose the correct answer from the options given below:

(1) Si < C < O < N < F

(2) O < F < N < C < Si

(3) F < O < N < C < Si

(4) Si < C < N < O < F

Solution :

Electronegativity series.

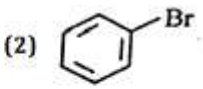
Trends:. Electronegativity increases across the period and decreases down the group

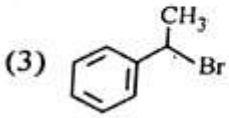
F > O > Cl > N

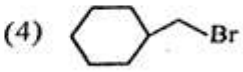
$\therefore$ Si < C < N < O < F

56. The compound that will undergo S_N1 reaction with the fastest rate is

(1) 

(2) 

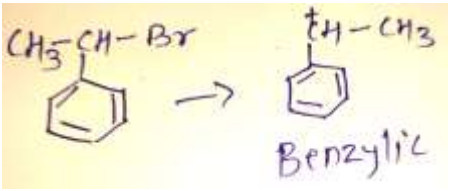
(3) 

(4) 

Ans: (3)

Solution :

Greater the stability of carbocation greater is the tendency for SN^1 reaction. Because in SN1 reaction carbocation is formed as intermediate.



Carbocation stability order

Benzyl > Allyl > 3^o > 2^o > 1^o > Phenyl > vinyl

57. In which of the following processes entropy increases?

A. A liquid evaporates to vapour.

B. Temperature of a crystalline solid lowered from 130 K to 0 K

C. $2\ NaHCO_{3(s)} \rightarrow Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$

D. $Cl_{2(g)} \rightarrow 2\ Cl_{(g)}$

Choose the correct answer from the options given below:

(1) A, B and D

(2) A, C and D

(3) C and D

(4) A and C

Solution :

As phase changes from Solid to liquid or phase entropy will increase because randomness is also increases when phase change from Solid to liq., solid to gas, and liq. to gas.

$\therefore$ Liquid $\rightarrow$ vapour

$$2NaHCO_{3_{(s)}} \rightarrow Na_2CO_{3_{(s)}} + CO_{2_{(g)}} + H_2O_{(s)}$$

$$Cl_{2_{(g)}} \rightarrow 2Cl_{(g)}$$

Here one mole of Cl_2 gas changes to two mole of Cl gas therefore entropy will increase.

$\therefore$ A, C, D

58. Given below are two statements:

Statement I: Aniline does not undergo Friedel- Crafts alkylation reaction.

Statement II: Aniline cannot be prepared through Gabriel synthesis.

In the light of the above statements, choose the correct answer from the options given below:

(1) Both Statement I and-Statement II are false.

(2) Statement I is correct but Statement II is false.

(3) Statement I is incorrect but Statement II is true.

(4) Both Statement I and Statement II are true.

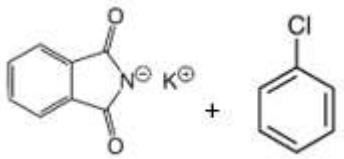
Solution :

Aniline has a lone pair of electron which interacts with $AlCl_3$ & hence it does not undergo friedel craft reaction.

Aniline $\rightarrow$ Lewis base

$AlCl_3 \rightarrow$ Lewis Acid

Aromatic halide does not undergo NSR & hence aniline cannot be prepared using Gabriel synthesis.



$\rightarrow$ No reaction. (due to resonance)

$\therefore$ Both Start I and II are correct.

59. Match List I with List II.

	List I (Conversion)		**List II (Number of Faraday required)**
A.	1 mol of H_2O to O_2	I.	3F
B.	1 mol of MnO_4^- to Mn^{2+}	II.	2F
C.	1.5 mol of Ca from molten $CaCl_2$	III.	1F
D.	1 mol of FeO to Fe_2O_3	IV.	5F

Choose the correct answer from the options given below:

(1) A-III, B-IV, C-I, D-II

(2) A-II, B-III, C-I, D-IV

(3) A-III, B-IV, C-II, D-I

(4) A-II, B-IV, C-I, D-III

Solution :

$$\underset{(-2)}{H_2O} \rightarrow \underset{(0)}{O_2}$$

$\therefore$ for one mole of H_2O

2F of electricity is required because it lost 2 electrons

$$\underset{(+7)}{MnO_4} \rightarrow \underset{(+2)}{Mn^{+2}}$$

$\therefore$ 5 F of electricity is required for 1 mole of MnO^-_4 Because it gained 5 electron

$Ca^{+2} + 2e^- \rightarrow Ca_{(s)}$

$\therefore$ For 1 mole $\rightarrow$ 2F

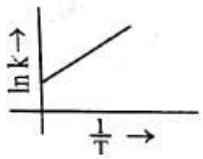
$\therefore$ 1.5 mole $\rightarrow$ n F

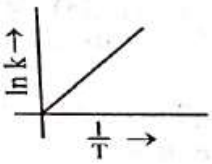
n = 2 × 1.5 = 3 F

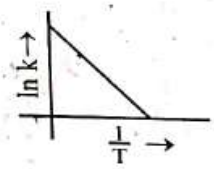
$Fe^{+2} \rightarrow Fe^{+3} + e^-$

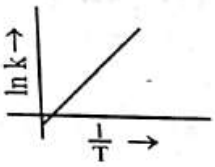
∴ 1 F of electricity will be required for 1 mole of FeO

60. Which plot of In k vs $\frac{1}{T}$ is consistent with Arrhenius equation?

(1) 

(2) 

(3) 

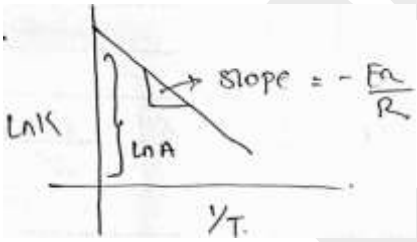
(4) 

Ans: (3)

Solution :

$$LnK = \frac{-Ea}{R} \times \frac{1}{T} + LnA$$

$$\overset{\uparrow}{y} = -\overset{\uparrow}{m}\,\overset{\uparrow}{x} + \overset{\uparrow}{C}$$



61. Given below are two statements:

Statement I: The boiling point of three isomeric pentanes follows the order n-pentane > isopentane > neopentane

Statement II: When branching increases, the molecule attains a shape of sphere. This results in smaller surface area for contact, due to which the intermolecular forces between the spherical molecules are weak, thereby lowering the boiling point.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both Statement I and Statement II are incorrect.

(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct.

(4) Both Statement I and Statement II are correct.

Solution :

Branching increases then boiling point is also increases in isomeric hydrocarbon.

Both statement I & II are correct.

62. Match List I with List II.

	List I (Complexes)		**List II (Type of isomerism)**
A.	$[Co(NH_3)_5(NO_2)]Cl_2$	I.	Solvate isomerism
B.	$[Co(NH_3)_5(SO_4)]Br$	II.	Linkage isomerism
C.	$[Co(NH_3)_6]$ $[Cr(CN)_6]$	III.	Ionization isomerism
D.	$[Co(H_2O)_6]Cl_3$	IV.	Coordination isomerism

Choose the correct answer from the options given below:

(1) A - I, B - III, C - IV, D - II

(2) A - I, B - IV, C - III, D - II

(3) A - II, B - IV, C - III, D - I

(4) A - II, B - III, C - IV, D – I

Solution :

- Linkage isomer

$[Co(NH_3)_5(NO_2)]Cl_2 \leftrightarrow [Co(NH_3)_5(ONO)]Cl_2$

- Ionization isomer

$[Co(NH_3)_5(SO_4)]Br \leftrightarrow [Co(NH_3)_5Br]SO_4$

- Coordination isomer

$[Co(NH_3)_6][Cr(CN)_6] \leftrightarrow [Co(CN)_6][Cr(NH_3)_6$.

- Solvate/Hydrate isomer

$[Co(H_2O)_6]\ Cl_3 \leftrightarrow [Co(H_2O)_5Cl]Cl_2\ H_2O$

63. 1 gram of sodium hydroxide was treated with 25 ml. of 0.75 M HCl solution, the mass of sodium hydroxide left unreacted is equal to

(1) 250 mg (3) 200 mg

(2) Zero mg (4) 750 mg

Solution :

$n_{NaOH} = \frac{1}{40} = 0.025$ moles

$n_{HCl} = \frac{M \times V}{1000} = \frac{0.75 \times 25}{1000} = 0.01875$

$\therefore$ n_{NaOH} consumed = 0.01875 moles

n_{NaOH} left = 0.025 – 0.01875 = 0.00625

$\therefore$ Wt. of NaOH left = 0.00625×40

= 0.25 g

= 250 mg

64. Which one of the following alcohols reacts instantaneously with Lucas reagent?

(1) $CH_3-CH_2-\underset{\displaystyle CH_3}{\overset{|}{CH}}-OH$

(2) $CH_3-\underset{\displaystyle CH_3}{\overset{|}{CH}}-CH_2OH$

(3) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-OH$

(4) $CH_3-CH_2-CH_2-CH_2OH$

Ans: (3)

Solution :

Lucas test

3° alcohol → immediately give turbid

2° alcohol → after 5 mins give turbid

1° alcohol → on heating give turbid

65. The E° value for the Mn^{3+}/Mn^{2+} couple is more positive than that of Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+} due to change of

(1) d^5 to d^2 configuration

(2) d^4 to d^5 configuration

(3) d^3 to d^5 configuration

(4) d^5 to d^4 configuration

Solution :

$Mn^{+3} \rightarrow d^4$

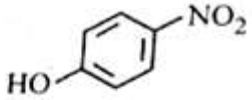
$Mn = 25 \rightarrow [Ar]4s^2 3d^5$

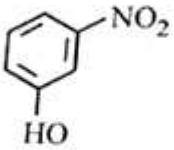
$Mn^{+3} \rightarrow [Ar]45° \ 3d^4$

$Mn^{+2} \rightarrow [Ar]45° \ 3d^5 \rightarrow d^5$

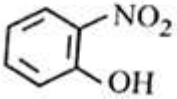
Mn^{3+}/Mn^{2+} it is more positive Because it achieve half filled stability.

66. Intramolecular hydrogen bonding is present in

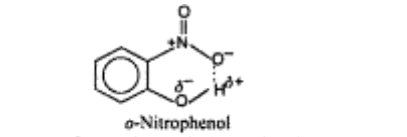
(1) 

(2) 

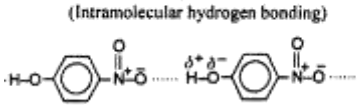
(3) HF

(4) 

Ans: (4)



o-Nitrophenol
(Intramolecular hydrogen bonding)



p-Nitrophenol
(Intermolecular hydrogen bonding)

67. Match List I with List II.

	List I (Compound)		List II (Shape/ geometry)
A.	NH_3	I.	Trigonal Pyramidal
B.	BrF_5	II.	Square Planar
C.	XeF_4	III.	Octahedral
D.	SF_6	IV.	Square Pyramidal

Choose the correct answer from the options given below:

(1) A-II, B-IV, C-III, D-I

(2) A-III, B-IV, C-I, D-II

(3) A-II, B-III, C-IV, D-I

(4) A-I, B-IV, C-II, D-III

Ans :

No. of electron pair= $\frac{1}{2}[V+M-C+a]$

$NH_3 \rightarrow \frac{1}{2}[5+3]$

$= \frac{1}{2}[8]=4$ (Trigonal pyramidal)

$BrF_5 \rightarrow \frac{1}{2}[7+5]= \frac{1}{2}\times 12 =6$ (Square pyramidal)

$XeF_4 = \frac{1}{2}[8+4]=\frac{1}{2}\times 12=6$ (Square planar)

$SF_6 = \frac{1}{2}[6+6]=\frac{12}{2}=6$ (Octahedral)

68. Among Group 16 elements, which one does NOT show - 2 oxidation state?

(1) Se (2) Te

(3) Po (4) O

Solution :

Polonium Shows metallic character and hence will show (+2) oxidation state not -2

69. Given below are two statements:

Statement I: The boiling point of hydrides of Group 16 elements follow the order $H_2O > H_2Te > H_2Se > H_2S$.

Statement II: On the basis of molecular mass, H_2O is expected to have lower boiling point than the other members of the group but due to the presence of extensive H-bonding in H_2O, it has higher boiling point.

In the light of the above statements, choose the correct answer from the options given below:

(1) Both Statement I and Statement II are false.

(2) Statement I is true but Statement II is false.

(3) Statement I is false but Statement II is true.

(4) Both Statement I and Statement II are true.

Solution :

Both statements are correct

70. 'Spin only' magnetic moment is same for which of the following ions?

A. Ti^{3+} B. Cr^{2+}

C. Mn^{2+} D. Fe^{2+}

E. Sc^{3+}

Choose the most appropriate answer from the options given below:

(1) A and E only (2) B and C only

(3) A and D only (4) B and D only

Solution :

Ions having same nes of unpaired e^- will have same spin only magnetic moment

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

Ti = 22 = [Ar] $4s^2\ 3d^2$

(A) Ti^{+3} = [Ar] $45°\ 3d^1 \rightarrow d^1$ (One unpaired)

(B) Cr^{+2} = 24 = [Ar] $4s°\ 3d^4 \rightarrow d^4$ (4 unpaired)

Mn = 25 $\rightarrow$ [ar] $45^2\ 3d^5$

(C) Mn^{+2} = [Ar]$4s°\ 3d^5 \rightarrow d^5$ (5 unpaired)

Fe = 26 → [Ar] 45^2 $3d^6$

(D) Fe^{+2} = [Ar]4S° $3d^6$ → d^6 (4 unpaired)

Sc = 21 = [Ar] $4s^2$ $3d^1$

(E) Sc^{+3} = [Ar] 45° 3d° (zero unpaired)

∴ B and D only

71. The reagents with which glucose does not react to give the corresponding tests/products are

A. Tollen's reagent
B. Schiff's reagent
C. HCN
D. NH_2OH
E. $NaHSO_3$

Choose the correct options from the given below:

(1) A and D (2) B and E
(3) E and D (4) B and C

Solution :

- Glucose gives positive Tollens reagent test because presence of aldehydic group.
- Glucose+ HCN gives cynohydrine.
- Glucose + NH_2OH gives Hydroxylamine.
- Glucose does not result with schiff's reagent & $NaHSO_3$.

72. Given below are two statements:

Statement I: Both $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ complexes are octahedral but differ in their magnetic behaviour.

Statement II: $[Co(NH_3)_6]^{3+}$ is diamagnetic whereas $[CoF_6]^{3-}$ is paramagnetic.

In the light of the above statements, choose the correct answer from the options given below:

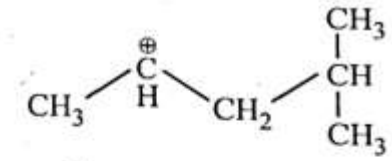
(1) Both Statement I and Statement II are false.
(2) Statement I is true' but Statement II is false.
(3) Statement I is false but Statement II is truè.
(4) Both Statement I and statement II are true.

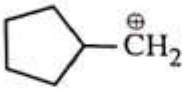
Solution :

In $[Co(NH_3)_6]^3$ due to presence of S.F.L it prefer pairing instead of splitting therefore all paired electron results into diamagnetic. . Whereas in $[CoF_6]^{3-}$ kkk Due to presence of W.F.L. it prefer splitting instead of pairing this result into unpaired electron therefore it will show paramagnetic.

Both Statement I and Statement II are correct.

73. The most stable carboçation among the following is

(1) 

(2) 

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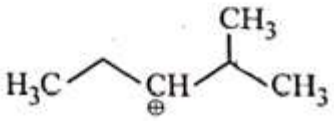
(4) 

Ans: (3)

Solution :

Stability of carbocation

Benzyl > Allyl > 3° > 2° > 1° > Phenyl > vinyl.

74. Fehling's solution 'A' is

(1) alkaline copper sulphate
(2) alkaline solution, of sodium potassium tartrate (Rochelle's salt)
(3) aqueous sodium citrate
(4) aqueous copper sulphate

Solution :

Fehling's Solution

A → Aq. Copper Sulphate [$CuSO_4$]

B → Rochelle's salt [Alkaline solution of sodium potassium tartrate]

75. In which of the following equilibria, K_p and K_c are NOT equal?

(1) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2\,HI_{(g)}$

(2) $CO_{(g)} + H_2O_{(g)} \rightleftharpoons CO_{2(g)} + H_{2(g)}$

(3) $2\,BrCl_{(g)} \rightleftharpoons Br_{2(g)} + Cl_{2(g)}$

(4) $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$

Solution :

Identity Equilibria

With $k_p \neq k_c$

1) $H_2(g) + I_{2(g)} \rightleftharpoons 2HI_{(g)}$

$\Delta n = 2 - 2 = 0$

$k_p = k_c\,(RT)^{\Delta n}$

$k_p = k_c\,(RT)^{\circ}$

$\therefore \quad k_p = k_c$

2) $CO_{(g)} + H_2O_{(g)} \rightleftharpoons CO_{2(g)} + H_{2(g)}$

$\Delta n = 2 - 2 = 0$

$\therefore \quad k_p = k_c(RT)^{\Delta n}$

$K_p = k_c(RT)^{\circ}$

$\therefore \quad k_p = k_c$

3) $2Br\,Cl_{(g)} \rightleftharpoons Br_{2(g)} + Cl_{2(g)}$

$\Delta n = 2 - 2 = 0$

$k_p = k_c\,(RT)^{\Delta n}$

$k_p = k_c(RT)^{\circ}$

$\therefore \quad j_p = k_c$

4) $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$

$\Delta n = 2 - 1 = 1$

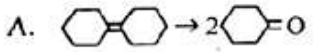
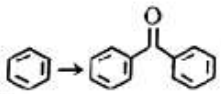
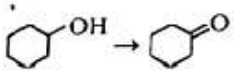
$k_p = k_c(RT)^{\Delta n}$

$k_p = k_c(RT)^{1}$

$\therefore \quad k_p \neq k_c$

76.

Match List I with List II.

List I (Reaction)	List II (Reagents/ Condition)
A. 	I.  Anhyd. $AlCl_3$
B. 	II. CrO_3
C. 	III. $KMnO_4$/ KOH, Δ
D. 	IV. (i) O_3 (ii) Zn-H_2O

Choose the correct answer from the options given below

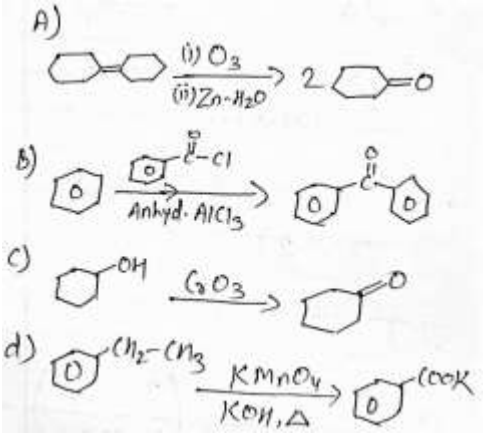
(1) A-III, B-I, C-II, D-IV

(2) A-IV, B-I, C-II, D-III

(3) A-I, B-IV, C-II, D-III

(4) A-IV, B-I, C-III, D-II

Solution :



77. A compound with a molecular formula of C_6H_{14} has two tertiary carbons. Its IUPAC name is:

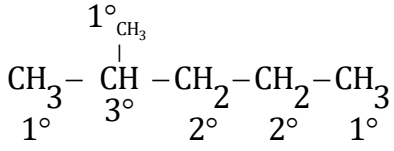
(1) 2-methylpentane

(2) 2,3-dimethylbutane

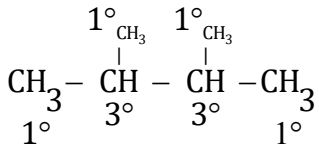
(3) 2,2-dimethylbutane

(4) n-hexane

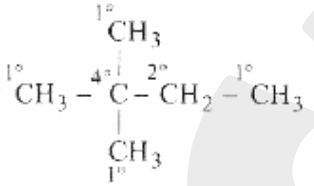
Solution :

1. 

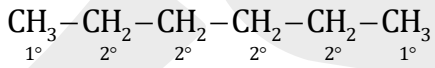
Only one tertiary carbon

2. 

It has two 3° carbon.

3. 

It does not have any 3° carbon.

4. 

It does not have any 3° carbon

Ans: 2, 3 dimethyl butane (2)

78. Activation energy of any chemical reaction can be calculated if one knows the value of

(1) probability of collision.

(2) orientation of reactant molecules during collision.

(3) rate constant at two different temperatures.

(4) rate constant at standard temperature.

Solution:

$$\log\left(\frac{K_2}{K_1}\right)=\frac{E_a}{2.303K}\left(\frac{T_2-T_1}{T_1\times T_2}\right)$$

Value of K_1 and K_2 should be known.

79. On heating, some solid substances change from solid to vapour state without passing through liquid state. The technique used for purification of such solid substances based on above principle is known as

(1) Sublimation

(2) Distillation

(3) Chromatography

(4) Crystallization

Solution :

On heating, Some Solid Substances change from Solid to vapour state without passing through liquid state.

This technique used for the purification of such solid substances this principle is Known as Sublimation.

80. The energy of an electron in the ground state (n = 1) for He^+ ion is – x J , then that for an electrons in n = 2 state for Be^{3+} ion in J is:

(1) $-\frac{x}{9}$ (2) $-4x$

(3) $-\frac{4}{9}x$ (4) $-x$

Solution:

$$\text{Energy} = \frac{-13.6Z^2}{n^2}$$

$$\frac{E_2}{E_1}=\left(\frac{Z_2}{Z_1}\right)^2\times\left(\frac{n_1}{n_2}\right)^2$$

$$=\left(\frac{4}{2}\right)^2\times\left(\frac{1}{2}\right)^2$$

$$\frac{E_2}{E_1}=4\times\frac{1}{4}=1$$

$$\frac{E_2}{-x}=1$$

$\therefore$ $E_2 = 1 \times (-x) = -x$

81. Which reaction is NOT a redox reaction?

(1) $2\ KClO_3 + I_2 \rightarrow 2\ KIO_3 + Cl_2$

(2) $H_2 + Cl_2 \rightarrow 2\ HCl$

(3) $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2\ NaCl$

(4) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

Solution :

1. $2KClO_3 + I_2 \rightarrow 2KIO_3 + Cl_2$
   $+5 \quad 0 \quad +5 \quad 0$

   Cl – Reduced, I – oxidised

2. $H + Cl_2 \rightarrow 2HCl$
   $0 \quad 0 \quad +1 \quad -1$

   H – oxidized, Cl – Reduced

2. $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaCl$

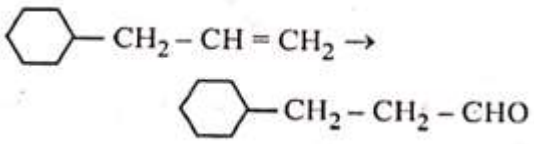
   Here no oxidation and reduction takes place.

   It is double displacement Reaction.

4. $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$
   $0 \quad +2 \quad +2 \quad 0$

   Zn-Oxidised, Cu → Reduced.

82. Identify the correct reagents that would bring about the following transformation.



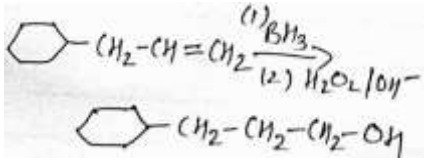
(1) (i) BH_3; (ii) $H_2O_2/\bar{O}H$; (iii) PCC

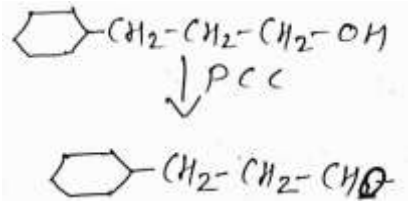
(2) (i) BH_3; (ii) $H_2O_2/\bar{O}H$; (iii) alk. $KMnO_4$; (iv) H_3O^+

(3) (i) H_2O/H^+; (ii) PCC

(4) H_2O/H^+; (ii) CrO_3

Solution :





83. Match List I with List II.

	List I Quantum Number		List II Information provided
A.	m_l	I.	shape of orbital
B.	m_s	II.	size of orbital
C.	l	III.	orientation of orbital
D.	n	IV.	orientation of spin of electron

Choose the correct answer from the options given below:

(1) A-III, B-IV, C-I, D-II

(2) A-III, B-IV, C-II, D-I

(3) A-II, B-I, C-IV, D-III

(4) A-I, B-III, C-II, D-IV

84. For the reaction $2A \rightleftharpoons B + C$, $K_c = 4 \times 10^{-3}$. At a given time, the composition of reaction mixture is: [A] = [B] = [C] = 2×10^{-3}M.

Then, which of the following is correct?

(1) Reaction has a tendency to go in forward direction.

(2) Reaction has a tendency to go in backward direction.

(3) Reaction has gone to completion in forward direction.

(4) Reaction is at equilibrium.

Solution :

$2A \rightleftharpoons B + C$

$K_C = 4 \times 10^3$

now, If $Q_c > K_c$ Reaction goes back ward

$K_c > Q_c$ Reaction goes forward

$Q_c = K_c$ Equilibrium achieved

$$Q_c = \frac{[B][C]}{[A]^2} = \frac{2\times10^{-3}\times2\times10^{-3}}{4\times10^{-6}}$$

$Q_c = 1$

$\therefore$ $Q_c >> K_c$

$\therefore$ Reaction will proceed in backward direction.

85. The highest number of helium atoms is in

(1) 4 u of helium

(2) 4 g of helium

(3) 2.271098 L of helium at STP

(4) 4 mol of helium

Solution:

Number of moles will decides the number of helium atoms

Number of moles increases

Number of atoms also increases

For 4 u of helium

$n = \frac{4}{4} = 1$ n = 1

In one mole 6.022×10^{23} atoms

For 4 g of He

$n = \frac{4}{4} = 1$

In one mole 6.022×10^{23} atoms

For 2.271098 L of helium at STP

1 mole $\rightarrow$ 22.7L

x ? $\rightarrow$ 2.27L

$x = \frac{2.27}{22.7} = \frac{1}{10}$ = 0.1 mole

In 0.1 mole 6.022×10^{22} atoms

For, 4 mole of helium

1 mole $\rightarrow$ 6.022×10^{23} atoms

4 $\rightarrow$ x

$x = 2.4 \times 10^{24}$ atoms

Therefore, 4 mole of helium contains highest number of helium atoms

Section – B (Attempt Any 10)

86. The pair of lanthanoid ions which are diamagnetic is

(1) Ce^{3+} and Eu^{2+}

(2) Gd^{3+} and Eu^{3+}

(3) Pm^{3+} and Sm^{3+}

(4) Ce^{4+} and Yb^{2+}

Solution :

1. Ce^{+3} and Eu^{2+}

Ce = $6s^2\ 4f^1\ 5d^1$

In Ce^{+3} = $4f^1$

Ce^{+3} contain one unpaired electron, hence it can't be diamagnetic

2. For Gd^{3+} and Eu^{3+}

Gd = $6s^2\ 47^7\ 5d^1$

In Gd^{3+} = $4f^7$

Gd^{+3} contains 7 unpaired electron, hence can't be diametric.

Eu^{+3} contains 6 unpaired electron,

Therefore it can't be diamagnetic

3.For, Pm^{3+} and Sm^{3+}

Pm = $6s^2\ 4f^5$

Pm^{+3} = $4f^4$

Pm^{+3} contains 4 unpaired electron, therefore it can't be diamagnetic

Sm = $6s^2\ 4f^6$

Sm^{+3} = $4f^5$

Sm^{+3} contains 5 unpaired electron therefore it can't be diamagnetic

4.For Ce^{4+} and yb^{2+}

Ce^{+4} does not have any unpaired electron, Hence it is diamagnetic

Yb^{2+}

Yb = $6s^2\ 4f^{14}$

Yb^{2+} = $4f^{14}$

Yb^{+2} does not have any unpaired electron.

Therefore it can be diamagnetic

Ans : Ce^{+4} and Yb^{2+}

87. The products A and B obtained in the following reactions, respectively, are

$3ROH + PCl_3 \rightarrow 3RCl + A$

$ROH + PCl_5 \rightarrow RCl + HCl + B$

(1) $POCl_3$ and H_3PO_4

(2) H_3PO_4 and $POCl_3$

(3) H_3PO_3 and $POCl_3$

(4) $POCl_3$ and H_3PO_3

Solution :

$$3ROH + PCl_3 \rightarrow 3RCl + \underset{A}{H_3PO_3}$$

$$ROH + PCl_5 \rightarrow R\text{–}Cl + HCl + \underset{B}{POCl_3}$$

Ans: A–H_3PO_3, B–$POCl_3$

88. Given below are two statements:

Statement I: $[Co(NH_3)_6]^{3+}$ is a homoleptic complex whereas $[Co(NH_3)_4Cl_2]^{+}$ is a heteroleptic complex.

Statement II: Complex $[Co(NH_3)_6]^{3+}$ has only one kind of ligands but $[Co(NH_3)_4Cl_2]^{+}$ more than one kind of ligands.

In the light of the above statements, choose the correct answer from the options given below:

(1) Both Statement I and Statement II are false.

(2) Statement I is true but Statement II is false.

(3) Statement I is false but Statement II is true.

(4) Both Statement I and Statement II are true.

Solution :

Ans : Both statement – I and statement – II are true

89. Identify the major product C formed in the following reaction sequence :

$CH_3 - CH_2 - CH_2 - I$

$$\xrightarrow{NaCN} A \xrightarrow[\text{Partial hydrolysis}]{OH^-} B \xrightarrow[Br_2]{NaOH} \underset{\text{(major)}}{C}$$

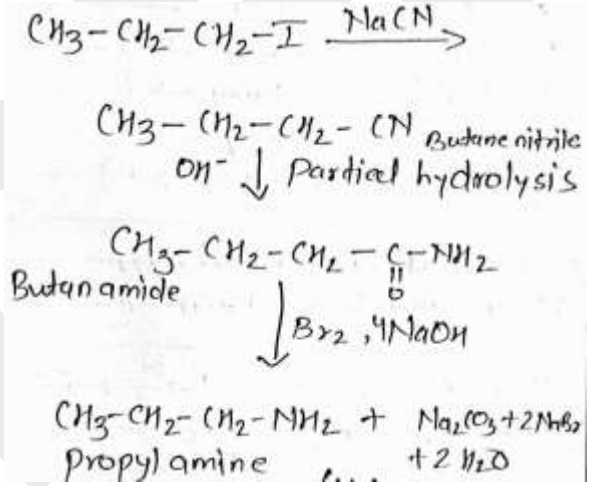
(1) butylamine

(2) butanamide

(3) α-bromobutanoic acid

(4) propylamine

Solution :



90. The work done during reversible isothermal expansion of one mole of hydrogen gas at 25°C from pressure of 20 atmosphere to 10 atmosphere is:

(Given R = 2.0 cal K^{-1} mol^{-1})

(1) – 413.14 calories

(2) 413.14 calories

(3) 100 calories

(4) 0 calorie

Solution :

$T = 250°C = 298\ K$

$P_1 = 20\ atm$

$P_2 = 10\ atm$

$R = 2.0\ cal\ K^{-1}\ mol^{-1}$

$$W = 2.303\ nRT \log \frac{P_1}{P_2}$$

$= -2.30 \times 1 \times 2 \times 298 \times \log \frac{20}{10}$

$= -2.303 \times 596 \times 0.3010$

$= -413.14 calories$

91. Identify the correct answer.

(1) BF_3 has non-zero dipole moment.

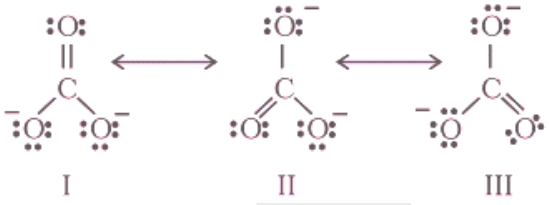
(2) Dipole moment of NF_3 is greater than that of NH_3.

(3) Three canonical forms can be drawn for CO_3^{2-} ion.

(4) Three resonance structures can be drawn for ozone.

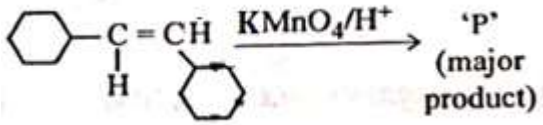
Solution :

- B F_3 has zero dipole moments due to trigonal planar geometry.
- Dipole moment of NF_3 is lower than that of NH_3. Because In NF_3 different direction leads to subtract the value of D.M where as in NH_3 Same direction of vector will leads to add the D.M
- Only two resonance structures can be drawn for ozone.
- Three canonical forms can be drawn for CO_3^{-2} ion.

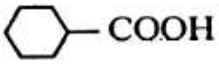


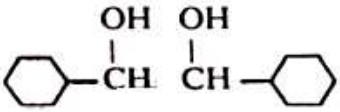
I II III

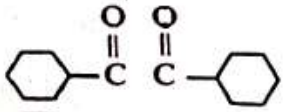
92. For the given reaction:

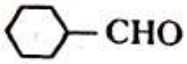


'P' is

(1) 

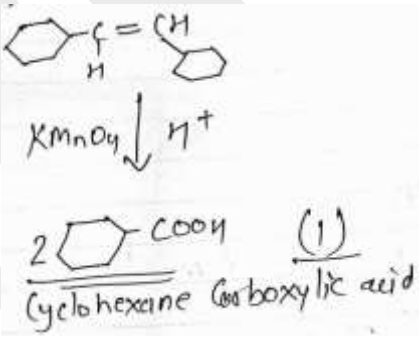
(2) 

(3) 

(4) 

Ans: (1)

Solution :



93. During the preparation of Mohr's salt solution (Ferrous ammonium sulphate), which of the following acid is added to prevent hydrolysis of Fe^{2+} ion?

(1) concentrated sulphuric acid

(2) dilute nitric acid

(3) dilute sulphuric acid

(4) dilute hydrochloric acid

Solution :

During the preparation of mohr's salt solution dilute sulphuric acid is added to prevent hydrolysis of Fe^{+2} ion.

If we add conc. H_2SO_4 it will convert Fe^{+2} ion into Fe^{3+}.

94. Given below are certain cations. Using inorganic qualitative analysis, arrange them in increasing group number from 0 to VI.

A. Al^{3+} B. Cu^{2+}
C. Ba^{2+} D. Co^{2+}
E. Mg^{2+}

Choose the correct answer from the options given below:

(1) B, C, A, D, E
(2) E, C, D ,B, A
(3) E, A, B, C, D
(4) B, A, D, C, E

Solution :

A. Al^{+3} (Group-III)
B. Cu^{2+} (Group-II)
C. Ba^{2+} (Group-V)
D. Co^{+2} (Group-IV)
E. Mg^{+2} (Group-VI)

Arranging in increasing group meter from 0 to VI

$Cu^{2+}, Al^{+3}, Co^{+3}, Ba^{2+}, Mg^{+2}$

$\therefore$ B, A, D, C, E

95. Consider the following reaction in a sealed vessel at equilibrium with concentrations of $N_2 = 3.0 \times 10^{-3}$ M, $O_2 = 4.2 \times 10^{-3}$ M and NO $= 2.8 \times 10^{-3}$M

$2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$

If 0.1 mol L^{-1} of $NO_{(g)}$ is taken in a closed vessel what will be degree of dissociation (α) of $NO_{(g)}$ at equilibrium?

(1) 0.0889 (2) 0.8889
(3) 0.717 (4) 0.00889

Solution :

$$K_c = \frac{[N_2][O_2]}{[NO]^2} \quad (1)$$

$$2NO \rightleftharpoons N_{2(g)} + O_{2(g)}$$

$2 - 2\alpha \quad \alpha \quad \alpha$

$$Ka = \frac{\alpha \, X \, \alpha}{[2\,(1-\alpha)]^2} \quad (2)$$

$$\frac{\propto^2}{4(1-\propto)^2} = \frac{[N_2][O_2]}{[NO]^2}$$

$$\frac{\propto^2}{4(1-\propto)^2} = \frac{3\times10^{-3}\times4.2\times10^{-3}}{(2.8\times10^{-3})^2}$$

$$\frac{\propto^2}{4(1-\propto)^2} = \frac{3\times4.2}{2.8\times2.8}$$

$$= \frac{3\times420}{28\times28} = \frac{1260}{28\times28}$$

Taking root

$$\frac{\propto}{2(1-\propto)} = \frac{\sqrt{1260}}{28} = \frac{35}{28}$$

$$\frac{\propto}{1-\propto} = 2.5 \qquad \therefore \propto = 2.5 - 2.5 \propto$$

$$\therefore \; 3.5 \propto = 2.5$$

$$\therefore \quad \propto = 0.71$$

96. Mass in grams of copper deposited by passing 9.6487 A current through a voltmeter containing copper sulphate solution for 100 seconds is:

(Given: Molar mass of Cu: 63 g mol^{-1} 1F = 96487 C)

(1) 0.315 g (2) 31.5 g
(3) 0.0315 g (4) 3.15 g

Solution :

I = 9.6487 A
t = 100 sec
M.M = 63
M.R = $\frac{1}{2}$, F = 96487C
Wt = ?

$$Wt = \frac{I\times t}{96487}\times M.R\times M.M$$

$$= \frac{9.6487\ X\ 100}{96487} \text{ x } \frac{1}{2} \text{ x } 63$$

$$= \frac{31.5}{100} = 0.315g$$

97. The plot of osmotic pressure (Π) vs concentration (mol L^{-1}) for a solution gives a straight line with slope 25.73 L bar mol^{-1}. The temperature at which the osmotic pressure measurement is done is: (Use R = 0.083 L bar mol^{-1} K^{-1})

(1) 310°C (2) 25.73°C

(3) 12.05°C (4) 37°C

Solution :

$\pi = C R T$

$y = x m$

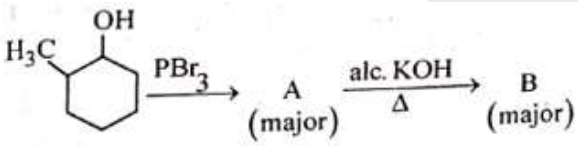
$\therefore$ Slope = m = RT = 25.73

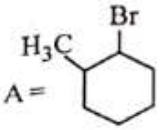
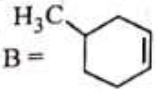
$\therefore$ $T = \frac{25.73}{R} = \frac{25.73}{0.083}$

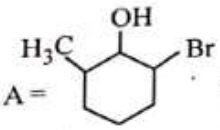
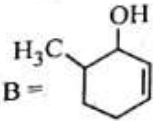
T = 315 K

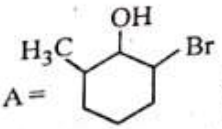
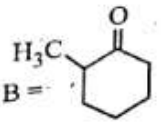
$\therefore$ T = 37°C

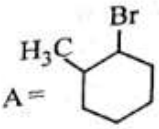
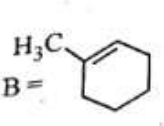
98. Major products A and B formed in the following reaction sequence, are



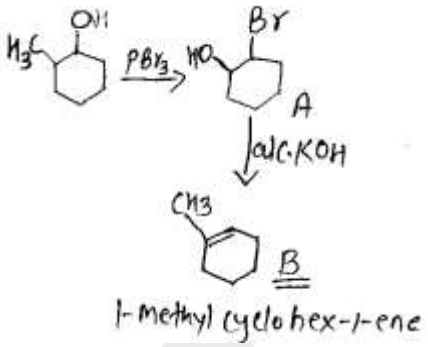
(1) A =  ; B = 

(2) A =  ; B = 

(3) A =  ; B = 

(4) A =  ; B = 

Ans: (4)



99. The rate of a reaction quadruples when temperature changes from 27°C to 57°C. Calculate the energy of activation.

Given R = 8.314 JK^{-1} mol^{-1}, log 4 = 0.6021

(1) 380.4 kJ/mol (2) 3.80 kJ/mol

(3) 3804 kJ/mol (4) 38.04 kJ/mol

Solution :

$T_1 = 27°C = 300 K$

$T_2 = 57°C = 330 K$

$R = 8.314 J K^{-1} mol^{-}$

Ea = ?

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

$$\log(4) = \frac{Ea}{2.303 \times 8.314}\left[\frac{330 - 300}{300 \times 330}\right]$$

$$0.6021 = \frac{Ea}{19.14}\left[\frac{30}{99000}\right]$$

$$Ea = \frac{0.6021 \times 19.14 \times 3300}{3}$$

Eu = 38029.84 J

$\therefore$ Ea = 38.029 KJ/mol

100. A compound X contains 32% of A, 20% of B and remaining percentage of C. Then, the empirical formula of X is:
(Given atomic masses of A = 64; B = 40; C = 32 u)

(1) ABC_3 (2) AB_2C_2

(3) ABC_4 (4) A_2BC_2

Solution :

Compound × contains

A = 32%, B = 20%

C = 48%

For A = $\frac{32}{64}=\frac{1}{2}$

For B = $\frac{20}{40}=\frac{1}{2}$

For C = $\frac{48}{32}=\frac{3}{2}$

A, B, C

$\frac{1}{2},\frac{1}{2},\frac{3}{2}$

Multiply by 2

1, 1, 3

$\therefore$ ABC_3