CHEMISTRY

46. The ratio of the wavelengths of the light absorbed by a Hydrogen atom when it undergoes n = 2 → n = 3 and n = 4 → n = 6 transitions, respectively, is

(1) $\frac{1}{36}$ (2) $\frac{1}{16}$

(3) $\frac{1}{9}$ (4) $\frac{1}{4}$

Answer (4)

Sol. $\Delta E = \frac{hc}{\lambda} = E_{final} - E_{initial} \quad \left(E_n = \frac{-R_H}{n^2}\right)$

$$\Delta E_{2\to3} = \frac{hc}{\lambda_{2\to3}} = E_3 - E_2 = \frac{-R_H}{3^2} - \left(\frac{-R_H}{2^2}\right)$$

$$= R_H\left(\frac{1}{4} - \frac{1}{9}\right)$$

$$= R_H \times \frac{5}{36}$$

$$\therefore \lambda_{2\to3} = \frac{hc \cdot 36}{R_H \cdot 5}$$

$$\Delta E_{4\to6} = E_6 - E_4 = \frac{-R_H}{36} + \frac{R_H}{16} = \frac{R_H \times 20}{36 \times 16}$$

$$\frac{hc}{\lambda_{4\to6}} = \frac{R_H \times 20}{36 \times 16}$$

$$\lambda_{4\to6} = \frac{hc \times 36 \times 16}{R_H \cdot 20}$$

$$\frac{\lambda_{2\to3}}{\lambda_{4\to6}} = \frac{\frac{hc \cdot 36}{R_H \cdot 5}}{\frac{hc \times 36 \times 16}{R_H \cdot 20}}$$

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

47. Which of the following statements are true?

A. Unlike Ga that has a very high melting point, Cs has a very low melting point.

B. On Pauling scale, the electronegativity values of N and Cl are not the same.

C. Ar, K^+, Cl^-, Ca^{2+}, and S^{2-} are all isoelectronic species.

D. The correct order of the first ionization enthalpies of Na, Mg, Al, and Si is Si >Al > Mg > Na.

E. The atomic radius of Cs is greater than that of Li and Rb.

Choose the **correct** answer from the options given below :

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

(3) C and D only (4) A, C, and E only

Answer (2)

Sol. Both Ga and Cs have low melting points.

Element	Melting point/K
Ga	303
Cs	302

- On Pauling scale, the electronegativity value of N and Cl have same (3.0).
- Ar, K^+, Cl^-, Ca^{2+} and S^{2-} have 18 electrons. So these are isoelectronic species.
- The correct order of first ionization enthalpy is Si > Mg > Al > Na
  First ionisation enthalpy of Mg is higher than Al because the penetration of a 3s-electron to the nucleus is more than that of a 2p-electron.
- Generally down the group atomic radii increases

Atom	Atomic radius/pm
Li	152
Rb	244
CS	262

48. Match **List I** with **List II**

	List-I (Ion)		List-II (Group Number in Cation Analysis)
A.	Co^{2+}	I.	Group-I
B.	Mg^{2+}	II.	Group-III
C.	Pb^{2+}	III.	Group-IV
D.	Al^{3+}	IV.	Group-VI

Choose the **correct** answer from the options given below :

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

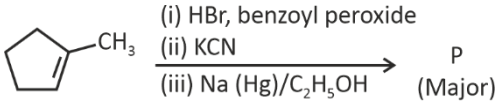
(3) A-III, B-II, C-IV, D-I (4) A-III, B-II, C-I, D-IV

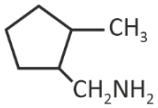
Answer (2)

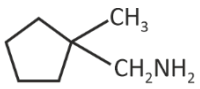
Sol.

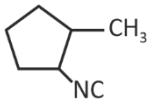
	Ion	Group number in Cation Analysis
A.	Co^{2+}	Group-IV
B.	Mg^{2+}	Group-VI
C.	Pb^{2+}	Group-I
D.	Al^{3+}	Group-III

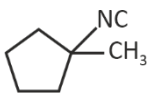
49. Predict the major product 'P' in the following sequence of reactions-



(1) 

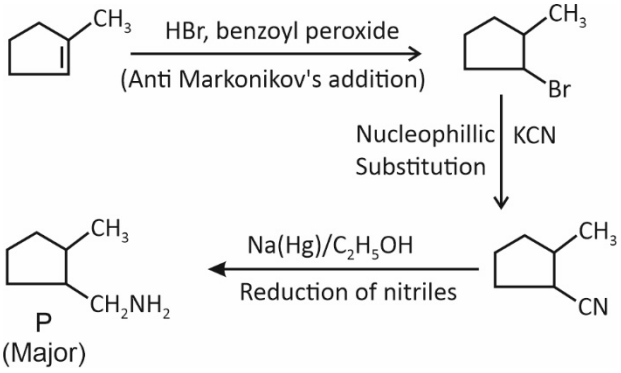
(2) 

(3) 

(4) 

Answer (1)

Sol.



50. Energy and radius of first Bohr orbit of He^+ and Li^{2+} are

[Given $R_H = 2.18 \times 10^{-18}$ J, $a_0 = 52.9$ pm]

(1) $E_n(Li^{2+}) = -19.62 \times 10^{-18}$ J;

$r_n(Li^{2+}) = 17.6$ pm

$E_n(He^+) = -8.72 \times 10^{-18}$ J;

$r_n(He^+) = 26.4$ pm

(2) $E_n(Li^{2+}) = -8.72 \times 10^{-18}$ J;

$r_n(Li^{2+}) = 26.4$ pm

$E_n(He^+) = -19.62 \times 10^{-18}$ J;

$r_n(He^+) = 17.6$ pm

(3) $E_n(Li^{2+}) = -19.62 \times 10^{-16}$ J;

$r_n(Li^{2+}) = 17.6$ pm

$E_n(He^+) = -8.72 \times 10^{-16}$ J;

$r_n(He^+) = 26.4$ pm

(4) $E_n(Li^{2+}) = -8.72 \times 10^{-16}$ J;

$r_n(Li^{2+}) = 17.6$ pm

$E_n(He^+) = -19.62 \times 10^{-16}$ J;

$r_n(He^+) = 17.6$ pm

Answer (1)

Sol. $E_n = \frac{-2.18 \times 10^{-18} \times z^2}{n^2}$ J; $r_n = \frac{52.9 \times n^2}{z}$ pm

For He^+

$E_{He^+} = -2.18 \times 10^{-18} \times 4 = -8.72 \times 10^{-18}$ J

$r_{He^+} = \frac{52.9 \times 1}{2} = 26.45$ pm

For Li^{2+}

$E_{Li^{2+}} = -2.18 \times 10^{-18} \times 9 = 19.62 \times 10^{-18}$ J

$r_{Li^{2+}} = \frac{52.9 \times 1}{3} = 17.63$ pm

51. Which of the following are paramagnetic?

A. $[NiCl_4]^{2-}$

B. $Ni(CO)_4$

C. $[Ni(CN)_4]^{2-}$

D. $[Ni(H_2O)_6]^{2+}$

E. $Ni(PPh_3)_4$

Choose the **correct** answer from the options given below :

(1) A and C only

(2) B and E only

(3) A and D only

(4) A, D and E only

Answer (3)

Sol.

A. $[NiCl_4]^{2-}$; Ni^{+2}; $3d^8$; sp^3 hybridisation; 2 unpaired electrons; paramagnetic

B. $Ni(CO)_4$; Ni; $3d^8\ 4s^2$; sp^3 hybridisation; Zero unpaired electron; diamagnetic

C. $[Ni(CN)_4]^{2-}$; Ni^{+2}; $3d^8$; dsp^2 hybridisation; Zero unpaired electron; diamagnetic

D. $[Ni(H_2O)_6]^{2+}$; Ni^{2+}, $3d^8$; sp^3d^2 hybridisation; Two unpaired electron; paramagnetic

E. $Ni(PPh_3)_4$; Ni; $3d^8\ 4s^2$, sp^3 hybridisation; zero unpaired electron; Diamagnetic

52. Given below are two statements :

Statement I : Like nitrogen that can form ammonia, arsenic can form arsine.

Statement II : Antimony cannot form antimony pentoxide.

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 correct

(2) Both Statement I and Statement II are incorrect

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

(4) Statement I is incorrect but Statement II is correct

Answer (3)

Sol. All the elements of group 15 form hydrides of EH_3 type. Nitrogen forms ammonia (NH_3) while Arsenic forms Arsine (AsH_3)

All the elements of group 15 form two types of oxides : E_2O_3 and E_2O_5

Antimony forms antimony pentoxide Sb_2O_5

Hence, statement I is correct and statement II is incorrect

53. Which among the following electronic configurations belong to main group elements?

A. $[Ne]3s^1$

B. $[Ar]3d^34s^2$

C. $[Kr]4d^{10}\ 5s^25p^5$

D. $[Ar]3d^{10}4s^1$

E. $[Rn]5f^06d^27s^2$

Choose the correct answer from the option given below :

(1) B and E only

(2) A and C only

(3) D and E only

(4) A, C and D only

Answer (2)

Sol. (A) $[Ne]3s^1$; Na (s-block)

(B) $[Ar]3d^34s^2$; V (d-block)

(C) $[Kr]4d^{10}5s^25p^5$; I (p-block)

(D) $[Ar]3d^{10}4s^1$; Cu (d-block)

(E) $[Rn]5f^06d^27s^2$; Th (f-block)

Main group elements (A and C only)

54. Dalton's Atomic theory could not explain which of the following?

(1) Law of conservation of mass (2) Law of constant proportion

(3) Law of multiple proportion (4) Law of gaseous volume

Answer (4)

Sol. Dalton's theory could explain the laws of chemical combination. However, it could not explain the laws of gaseous volumes.

55. Consider the following compounds :

$\underline{K}O_2$, $H_2\underline{O}_2$ and $H_2\underline{S}O_4$

The oxidation state of the underlined elements in them are, respectively,

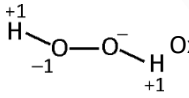
(1) +1, –1, and +6 (2) +2, –2, and +6

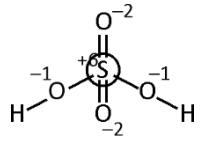
(3) +1, –2, and +4 (4) +4, –4, and +6

Answer (1)

Sol.

KO_2 → Alkali metal always shows +1 oxidation state. Therefore oxidation state of K is +1.

H_2O_2 →  Oxidation state of oxygen in H_2O_2 is –1.

H_2SO_4 →  Oxidation state of sulphur in H_2SO_4 is +6.

56. If the half-life ($t_{1/2}$) for a first order reaction is 1 minute, then the time required for 99.9% completion of the reaction is closest to :

(1) 2 minutes (2) 4 minutes

(3) 5 minutes (4) 10 minutes

Answer (4)

Sol. For 1st order reaction

$kt = 2.303 \log \frac{A_0}{A_t}$ A_0 = initial concentration

A_t = Final concentration

$t_{99.9\%} = 10\ t_{1/2}$

$t_{99.9\%} = 10 \times 1$ minute = 10 minutes

57. The correct order of the wavelength of light absorbed by the following complexes is,

A. $[Co(NH_3)_6]^{3+}$ B. $[Co(CN)_6]^{3-}$

C. $[Cu(H_2O)_4]^{2+}$ D. $[Ti(H_2O)_6]^{3+}$

Choose the **correct** answer from the options given below:

(1) B < D < A < C (2) B < A < D < C

(3) C < D < A < B (4) C < A < D < B

Answer (2)

Sol. $\lambda \propto \frac{1}{\text{strength of ligand}}$

$\lambda \propto \frac{1}{\text{splitting}}$

A. $[Co(NH_3)_6]^{3+}$; 475 nm

B. $[Co(CN)_6]^{3-}$; 310 nm

C. $[Cu(H_2O)_4]^{2+}$; 600 nm

D. $[Ti(H_2O)_6]^{3+}$; 498 nm

Order of λ = C > D > A > B

58. Which one of the following compounds can exist as cis-trans isomers?

(1) Pent-1-ene

(2) 2-Methylhex-2-ene

(3) 1, 1-Dimethylcyclopropane

(4) 1, 2-Dimethylcyclohexane

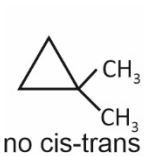
Answer (4)

Sol. Cis-trans isomers shown by :

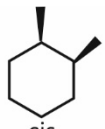
Condition: Restricted rotation around double bond

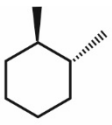
Or

Different group around double bond



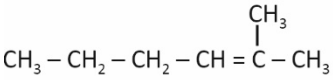
no cis-trans


cis


trans

$CH_3 - CH_2 - CH_2 - CH = CH_2$

no cis-trans



no cis-trans

59. Phosphoric acid ionizes in three steps with their ionization constant values K_{a_1}, K_{a_2} and K_{a_3}, respectively, while K is the overall ionization constant. Which of the following statements are true?

A. $\log K = \log K_{a_1} + \log K_{a_2} + \log K_{a_3}$

B. H_3PO_4 is a stronger acid than $H_2PO_4^-$ and HPO_4^{2-}

C. $K_{a_1} > K_{a_2} > K_{a_3}$

D. $K_{a_1} = \frac{K_{a_3} + K_{a_2}}{2}$

Choose the **correct** answer from the options given below :

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

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

Answer (4)

Sol. H_3PO_4 is a stronger acid than $H_2PO_4^-$ and HPO_4^{2-}

$H_3PO_4(aq) \rightleftharpoons H^+(aq) + H_2PO_4^-(aq)$ $\quad K_{a_1} = 7.5\times10^{-3}$

$H_2PO_4^-(aq) \rightleftharpoons H^+(aq) + HPO_4^{2-}(aq)$ $\quad K_{a_2} = 6.2\times10^{-8}$

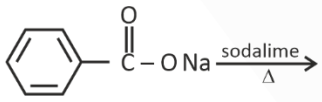
$HPO_4^{2-}(aq) \rightleftharpoons H^+(aq) + PO_4^{3-}(aq)$ $\quad K_{a_3} = 1.7\times10^{-12}$

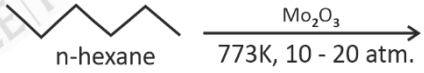
$K_{a_1} > K_{a_2} > K_{a_3}$

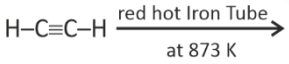
$\log K = \log K_{a_1} + \log K_{a_2} + \log K_{a_3}$

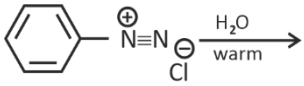
Ans. (A), (B) and (C) only

60. Which one of the following reactions does **NOT** give benzene as the product?

(1) 

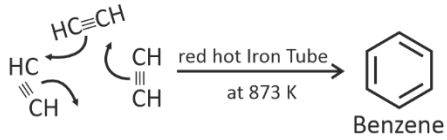
(2) 

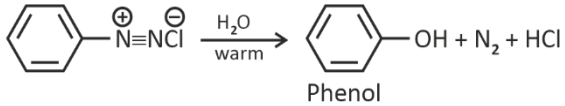
(3) 

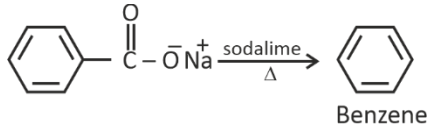
(4) 

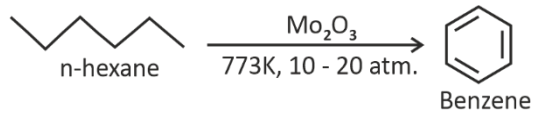
Answer (4)

Sol.

1. 

2. 

3. 

4. 

61. If the molar conductivity (Λ_m) of a 0.050 mol L^{-1} solution of a monobasic weak acid is 90 S cm^2 mol^{-1}, its extent (degree) of dissociation will be

[Assume Λ°_+ = 349.6 S cm^2 mol^{-1} and Λ°_- = 50.4 S cm^2 mol^{-1}.]

(1) 0.115 (2) 0.125

(3) 0.225 (4) 0.215

Answer (3)

Sol. Degree of dissociation (α) is given as

$$\alpha = \frac{\Lambda_m}{\Lambda^\circ_m}$$

$$\Lambda^\circ_m = \Lambda^\circ_+ + \Lambda^\circ_-$$

= 349.6 + 50.4

= 400 S cm^2 mol^{-1}

$$\alpha = \frac{\Lambda_m}{\Lambda^\circ_m} = \frac{90}{400} = 0.225$$

62. Given below are two statements :

Statement I : A hypothetical diatomic molecule with bond order zero is quite stable.

Statement II : As bond order increases, the bond length increases.

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 true (2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false (4) Statement I is false but Statement II is true

Answer (2)

Sol.
- A positive bond order means a stable molecule while a negative or zero bond order means an unstable molecule.
- When bond order increases, the bond length decreases.

63. Out of the following complex compounds, which of the compound will be having the minimum conductance in solution?

(1) $[Co(NH_3)_3Cl_3]$ (2) $[Co(NH_3)_4Cl_2]$

(3) $[Co(NH_3)_6]Cl_3$ (4) $[Co(NH_3)_5Cl]Cl$

Answer (1, 2)

Sol. Conductance of any complex depends on the following factor.

(1) Number of ions produced by complex.

(2) If number of ions are same then we will check charge on complex unit.

(1) $\left[Co^{+3}(NH_3)_3Cl_3\right]$

(2) $\left[Co^{+2}(NH_3)_4Cl_2\right]$

} Both complex units have no charge. Therefore both complex units have same conductance.

(3) $[Co(NH_3)_6]Cl_3 \rightarrow [Co(NH_3)_6]^{+3} + 3Cl^-$

(4) $[Co(NH_3)_5Cl]Cl \rightarrow [Co(NH_3)_5Cl]^+ + Cl^-$

64. Match **List-I** with **List-II**

	List-I		List-II
A.	XeO_3	(I)	sp^3d; linear
B.	XeF_2	(II)	sp^3; pyramidal
C.	$XeOF_4$	(III)	sp^3d^3; distorted octahedral
D.	XeF_6	(IV)	sp^3d^2; square pyramidal

Choose the **correct** answer from the options given below :

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

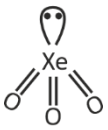
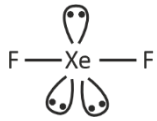
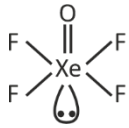
(2) A-II, B-I, C-III, D-IV

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

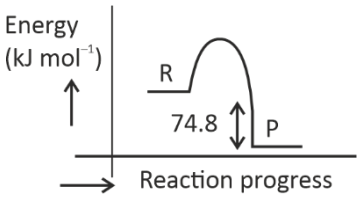
(4) A-IV, B-II, C-I, D-III

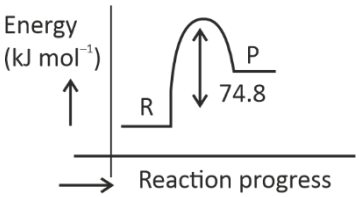
Answer (1)

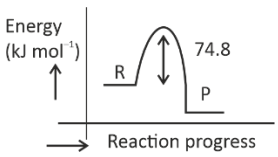
Sol.

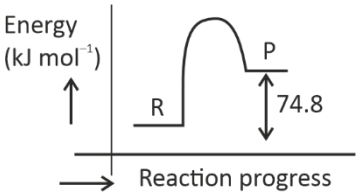
Molecule	Hybridisation	Shape
	sp^3	Pyramidal
	sp^3d	Linear
	sp^3d^2	Square Pyramidal
	sp^3d^3	Distorted Octahedral

65. $C(s) + 2H_2(g) \rightarrow CH_4(g)$; $\Delta H = -74.8$ kJ mol^{-1}. Which of the following diagrams gives an accurate representation of the above reaction? [R $\rightarrow$ reactants; P $\rightarrow$ products]

(1) 

(2) 

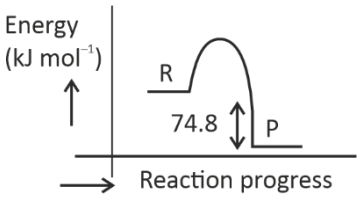
(3) 

(4) 

Answer (1)

Sol. $\Delta H = -74.8$ k J mol^{-1}, it is an exothermic reaction.

So, accurate representation is



66. Match List-I with List-II

	List-I (Example)		**List-II (Type of Solution)**
A.	Humidity	I.	Solid in solid
B.	Alloys	II.	Liquid in gas
C.	Amalgams	III.	Solid in gas
D.	Smoke	IV.	Liquid in solid

Choose the **correct** answer from the options given below:

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

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

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

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

Answer (2)

Sol.

- Humidity is a solution of liquid in gas
- Alloy is a solution of solid in solid
- Amalgam is a solution of liquid in solid
- Smoke is a solution of solid in gas

67. The correct order of decreasing basic strength of the given amines is:

(1) N-methylaniline > benzenamine > ethanamine > N-ethylethanamine

(2) N-ethylethanamine > ethanamine > benzenamine > N-methylaniline

(3) N-ethylethanamine > ethanamine > N-methylaniline > benzenamine

(4) benzenamine > ethanamine > N-methylaniline > N-ethylethanamine

Answer (3)

Sol. Lower is the value of pK_b, higher is the basicity

Also aliphatic amines are stronger bases than aromatic amines.

pK_b : Benzenamine > N-Methylaniline > Ethanamine > N-Ethylethanamine

Basic strength : N-Ethylethanamine > Ethanamine > N-Methylaniline > Benzenamine

68. Among the following, choose the ones with equal number of atoms.

A. 212 g of $Na_2CO_3(s)$ [molar mass = 106 g]

B. 248 g of $Na_2O(s)$ [molar mass = 62 g]

C. 240 g of NaOH(s) [molar mass = 40 g]

D. 12 g of $H_2(g)$ [molar mass = 2 g]

E. 220 g of $CO_2(g)$ [molar mass = 44 g]

Choose the **correct** answer from the options given below :

(1) A, B, and C only (2) A, B, and D only

(3) B, C, and D only (4) B, D, and E only

Answer (2)

Sol. Number of atoms = $\frac{\text{given mass}}{\text{molar mass}} \times \text{atomicity} \times N_A$

A. $\frac{212}{106} \times 6 \times N_A = 12\ N_A$

B. $\frac{248}{62} \times 3 \times N_A = 12\ N_A$

C. $\frac{240}{40} \times 3 \times N_A = 18\ N_A$

D. $\frac{12}{2} \times N_A \times 2 = 12\ N_A$

E. $\frac{220}{44} \times N_A \times 3 = 15\ N_A$

A, B and D have same number of atoms

69. Match **List-I** with **List-II.**

	List-I (Name of Vitamin)		**List-II (Deficiency disease)**
A.	Vitamin B_{12}	I.	Cheilosis
B.	Vitamin D	II.	Convulsions
C.	Vitamin B_2	III.	Rickets
D.	Vitamin B_6	IV.	Pernicious anaemia

Choose the **correct** answer from the options given below:

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

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

Answer (2)

Sol.

	List-I (Name of Vitamin)	**List-II (Deficiency disease)**
A.	Vitamin B_{12}	Pernicious anaemia
B.	Vitamin D	Rickets
C.	Vitamin B_2	Cheilosis
D.	Vitamin B_6	Convulsions

70. The correct order of decreasing acidity of the following aliphatic acids is

(1) $(CH_3)_3CCOOH > (CH_3)_2CHCOOH > CH_3COOH > HCOOH$

(2) $CH_3COOH > (CH_3)_2CHCOOH > (CH_3)_3CCOOH > HCOOH$

(3) $HCOOH > CH_3COOH > (CH_3)_2CHCOOH > (CH_3)_3CCOOH$

(4) $HCOOH > (CH_3)_3CCOOH > (CH_3)_2CHCOOH > CH_3COOH$

Answer (3)

Sol. Electron donating group decreases the acidity of carboxylic acids.

So correct order is

$HCOOH > CH_3COOH > (CH_3)_2CHCOOH > (CH_3)_3CCOOH$

71. Given below are two statements :

Statement I : Ferromagnetism is considered as an extreme form of paramagnetism.

Statement II : The number of unpaired electrons in a Cr^{2+} ion (Z = 24) is the same as that of a Nd^{3+} ion (Z = 60).

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

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false

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

(4) Statement I is false but Statement II is true

Answer (3)

Sol. Substances which are attracted very strongly in applied magnetic field are termed as ferromagnetic. Infact, ferromagnetism is an extreme form of paramagnetism.

Hence statement I is correct.

$Cr^{2+} = 3d^4 4s^0$

Unpaired electrons = 4

$Nd^{3+} = 4f^3\ 6s^0$

Unpaired electrons = 3

Hence, Statement II is incorrect

72. Match **List I** with **List II**

	List-I (Mixture)		**List-II (Method of separation)**
A.	$CHCl_3 + C_6H_5NH_2$	(I)	Distillation under reduced pressure
B.	Crude oil in petroleum industry	(II)	Steam distillation
C.	Glycerol from spent-lye	(III)	Fractional distillation
D.	Aniline - water	(IV)	Simple distillation

Choose the **correct** answer from the options given below:

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

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

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

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

Answer (1)

Sol.

		(Method of separation)
(A)	$CHCl_3 + C_6H_5NH_2$	Simple distillation
(B)	Crude oil in petroleum industry	Fractional distillation
(C)	Glycerol from spent-lye	Distillation under reduced pressure
(D)	Aniline - water	Steam Distillation

73. For the reaction $A(g) \rightleftharpoons 2B(g)$, the backward reaction rate constant is higher than the forward reaction rate constant by a factor of 2500, at 1000 K.

[Given : R = 0.0831 L atm mol^{-1} K^{-1}]

K_P for the reaction at 1000 K is

(1) 83.1 (2) 2.077×10^5

(3) 0.033 (4) 0.021

Answer (3)

Sol. $K_C = \frac{k_f}{k_b} = \frac{1}{2500}$

$K_P = K_C(RT)^{\Delta n_g}$ $(\Delta n_g = 2 - 1 = 1)$

$= \frac{1}{2500} \times 0.0831 \times 1000$

$= 0.033$

74. Given below are two statements :

Statement-I : Benzenediazonium salt is prepared by the reaction of aniline with nitrous acid at 273 – 278 K. It decomposes easily in the dry state.

Statement-II : Insertion of iodine into the benzene ring is difficult and hence iodobenzene is prepared through the reaction of benzenediazonium salt with KI.

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 correct (2) Both Statement I and Statement II are incorrect

(3) Statement I is correct but Statement II is incorrect (4) Statement I is incorrect but Statement II is correct

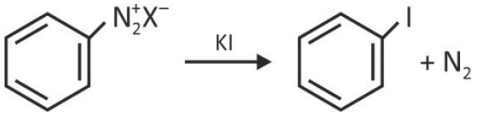
Answer (1)

Sol. Benzene diazonium chloride is prepared by the reaction of aniline with nitrous acid at 273-278 K.
Nitrous acid is produced in the reaction mixture by reaction of $NaNO_2$ with HCl.

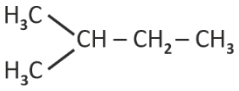
$C_6H_5NH_2 + NaNO_2 + 2HCl \xrightarrow{273 - 278\ K} C_6H_5\overset{+}{N_2}\overset{-}{Cl} + NaCl + 2H_2O$

Benzene diazonium chloride decomposes easily in the dry state

Iodobenzene is prepared by shaking benzene diazonium salt with KI because direct insertion of iodine into benzene ring is difficult



75. How many products (including stereoisomers) are expected from monochlorination of the following compound?

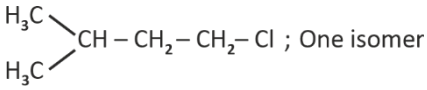


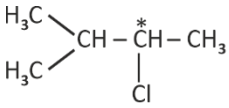
(1) 2 (2) 3

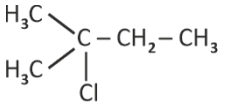
(3) 5 (4) 6

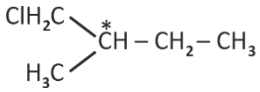
Answer (4)

Sol. Possible monochlorination products :


; One isomer

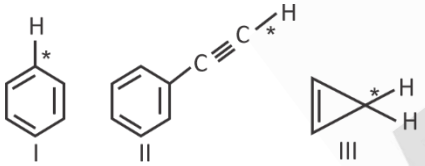

; Two isomers due to presence of chiral carbon


; One isomer


; Two isomers due to chiral carbon

Total 6 isomers

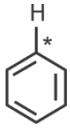
76. Among the given compounds I-III, the correct order of bond dissociation energy of C–H bond marked with * is :

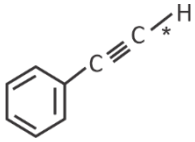


(1) II > I > III (2) I > II > III

(3) III > II > I (4) II > III > I

Answer (1)

Sol. I.  carbon of this bond is sp^2 hybridised

II.  carbon of this bond is *sp* hybridised

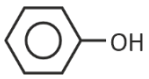
III.  carbon of this bond is sp^3 hybridised

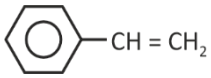
Higher the percentage s character, stronger is C–H bond. Correct order of bond dissociation energy of C–H bond:

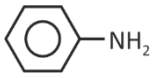
II > I > III

77. Which one of the following compounds **does not** decolourize bromine water?

(1) 

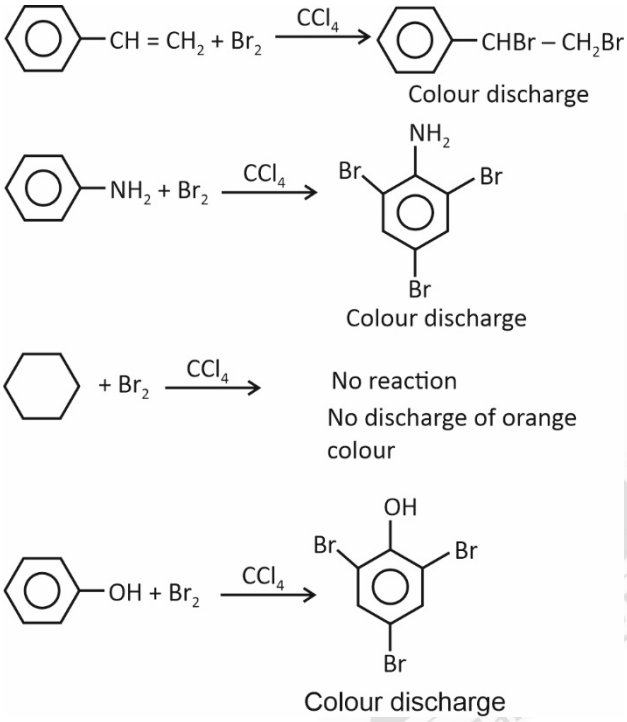
(2) 

(3) 

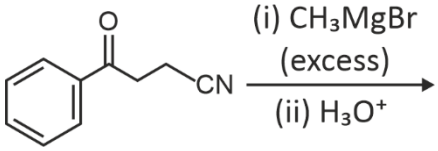
(4) 

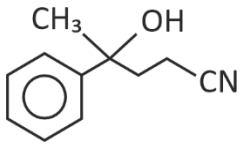
Answer (1)

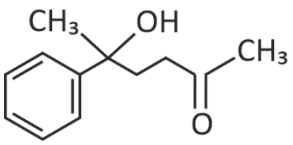
Sol. Test for unsaturation i.e. Bromine water Reddish orange colour of bromine solution in CCl_4 will discharge when bromine adds to an unsaturation site.

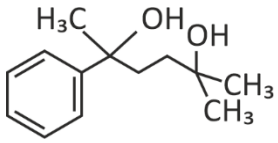


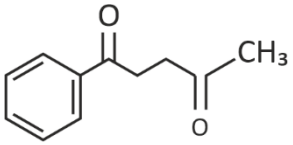
78. The major product of the following reaction is



(1) 

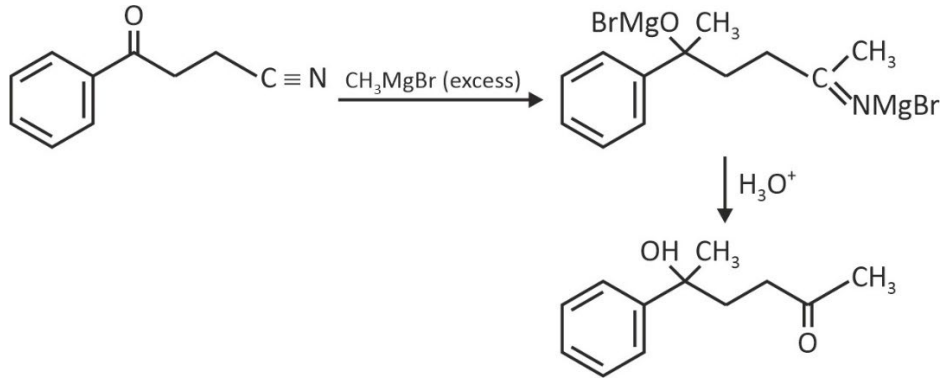
(2) 

(3) 

(4) 

Answer (2)

Sol.



79. Which of the following aqueous solution will exhibit highest boiling point?

(1) 0.01M Urea (2) 0.01M KNO_3

(3) 0.01M Na_2SO_4 (4) 0.015M $C_6H_{12}O_6$

Answer (3)

Sol.

$\Delta T_b = iK_b \times m$

$\Delta T_b \propto i \times m$

By considering molarity same as molality

(1) 0.01M Urea $i \times m = 1 \times 0.01 = 0.01$

(2) 0.01 M KNO_3 $i \times m = 2 \times 0.01 = 0.02$

(3) 0.01M Na_2SO_4 $i \times m = 3 \times 0.01 = 0.03$

(4) 0.015M $C_6H_{12}O_6$ $i \times m = 1 \times 0.015 = 0.015$

$T_b' = T_b^* + \Delta T_b$

Higher the value of (i × m) more will be the boiling point.

80. Match **List-I** with **List-II**.

	List-I		**List-II**
A.	Haber process	I.	Fe catalyst
B.	Wacker oxidation	II.	$PdCl_2$
C.	Wilkinson catalyst	III.	$[(PPh_3)_3RhCl]$
D	Ziegler catalyst	IV.	$TiCl_4$ with $Al(CH_3)_3$

Choose the **correct** answer from the options given below :

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

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

Answer (3)

Sol.

	Process		Catalyst used
A.	Haber process	I.	Fe catalyst
B.	Wacker oxidation	II.	$PdCl_2$
C.	Wilkinson catalyst	III.	$[(PPh_3)_3RhCl]$
D	Ziegler catalyst	IV.	$TiCl_4$ with $Al(CH_3)_3$

81. 5 moles of liquid X and 10 moles of liquid Y make a solution having a vapour pressure of 70 torr. The vapour pressures of pure X and Y are 63 torr and 78 torr respectively. Which of the following is true regarding the described solution?

(1) The solution shows positive deviation.

(2) The solution shows negative deviation.

(3) The solution is ideal.

(4) The solution has volume greater than the sum of individual volumes.

Answer (2)

Sol. $P_{total} = X_x P_x^\circ + X_y P_y^\circ$

$= \frac{5}{15} \times 63 + \frac{10}{15} \times 78$

= 21 + 52

= 73 torr

Observed total pressure of solution is 70 torr.

It is less than calculated total pressure.

Hence, it shows negative deviation.

82. Sugar 'X'

A. is found in honey

B. is a keto sugar

C. exists in α and β – anomeric forms.

D. Is laevorotatory.

'X' is :

(1) D-Glucose

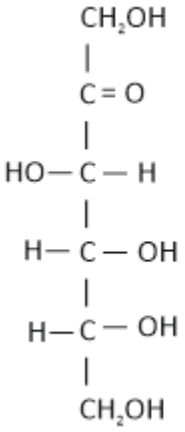
(2) D-Fructose

(3) Maltose

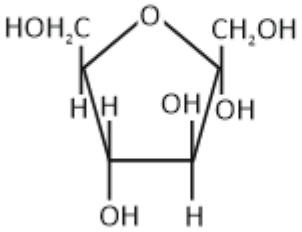
(4) Sucrose

Answer (2)

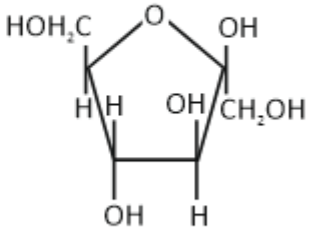
Sol. D-Fructose is found in honey and is a keto sugar.



D—(—) — Fructose

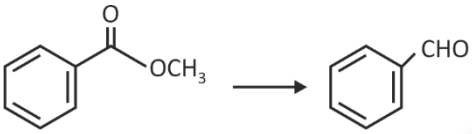


α–D–(–)–Fructofuranose



β–D–(–)–Fructofuranose

83. Identify the suitable reagent for the following conversion.



(1) (i) $LiAlH_4$, (ii) H^+/H_2O

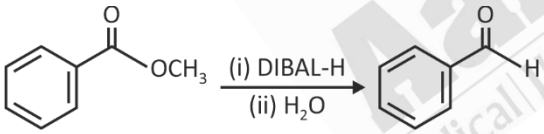
(2) (i) $AlH(iBu)_2$, (ii) H_2O

(3) (i) $NaBH_4$, (ii) H^+/H_2O

(4) $H_2/Pd\text{-}BaSO_4$

Answer (2)

Sol. Esters are reduced to aldehydes with DIBAL-H



84. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) :  undergoes S_N2 reaction faster than  .

Reason (R) : Iodine is a better leaving group because of its large size.

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

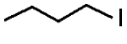
(1) Both **A** and **R** are true and **R** is the correct explanation of **A**

(2) Both **A** and **R** are true but **R** is **not** the correct explanation of **A**

(3) **A** is true but **R** is false

(4) **A** is false but **R** is true

Answer (1)

Sol. Rate of S_N2 reaction of  is faster than  .

Because iodine is a good leaving group due to large size of iodine. Which stabilises the I^- ion.

85. The standard heat of formation, in kcal/mol of Ba^{2+} is :
[Given : standard heat of formation of SO_4^{2-} ion (aq) = –216 kcal/mol, standard heat of crystallisation of $BaSO_4(s)$ = –4.5 kcal/mol, standard heat of formation of $BaSO_4(s)$ = – 349 kcal/mol]

(1) – 128.5 (2) – 133.0

(3) + 133.0 (4) + 220.5

Answer (1)

Sol. $S + 2O_2 + 2e^- \longrightarrow SO_4^{2-}$ $\Delta H_f = -216$ kcal/mol …(1)

$Ba^{2+}(g) + SO_4^{2-}(g) \longrightarrow BaSO_4(s)$ $\Delta H_{crystallisation} = -4.5$ kcal/mol …(2)

$Ba + S + 2O_2 \longrightarrow BaSO_4(s)$ $\Delta H_{f(BaSO_4)} = -349$ kcal/mol …(3)

$Ba(s) \longrightarrow Ba^{2+}(g) + 2e^-$ …(4)

From equation (1),(2) and (3) we get equation (4). Applying equation (3) – (1) – (2)

So, –349 – (–4.5) – (–216)

So – 349 + 4.5 + 216

= –349 + 220.5

= – 128.5 kcal/mol

86. Total number of possible isomers (both structural as well as stereoisomers) of cyclic ethers of molecular formula C_4H_8O is :

(1) 6 (2) 8

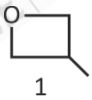
(3) 10 (4) 11

Answer (3)

Sol. For cyclic ethers O should be in ring * carbon here is chiral

(1) 

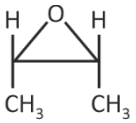
2(d, l pair)

(2) 

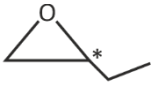
1

(3) 

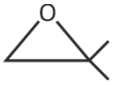
1

(4) 

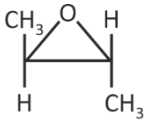
(1)
Meso compound

(5) 

2(d, l pair)

(6) 

1

(7) 

2(d, l pair)

Total number of isomers = 2 + 1 + 1 + 1 + 2 + 1 + 2 = 10

87. Identify the correct orders against the property mentioned

A. $H_2O > NH_3 > CHCl_3$ – dipole moment

B. $XeF_4 > XeO_3 > XeF_2$ – number of lone pairs on central atom

C. O–H > C–H > N–O – bond length

D. $N_2 > O_2 > H_2$ – bond enthalpy

Choose the **correct** answer from the options given below:

(1) A, D only (2) B, D only

(3) A, C only (4) B, C only

Answer (1)

Sol.

		μ(D)
A.	H_2O	1.85
	NH_3	1.47
	$CHCl_3$	1.04

B. XeF_4 : 2 lone pairs of electron

XeO_3 : 1 lone pair of electron

XeF_2 : 3 lone pairs of electron

C. Order of Bond length :- N–O > C–H > O–H

D. N_2 Bond order is 3

H_2 Bond order is 1

O_2 Bond order is 2

88. Higher yield of NO in $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ can be obtained at

[ΔH of the reaction = +180.7 kJ mol^{-1}]

A. Higher temperature

B. Lower temperature

C. Higher concentration of N_2

D. Higher concentration of O_2

Choose the **correct** answer from the options given below :

(1) A, D only (2) B, C only

(3) B, C, D only (4) A, C, D only

Answer (4)

Sol. Yield of the product generally depends on

- Temperature
- Concentration of reactant(s) and product(s)
- Pressure

As this is an endothermic reaction (ΔH = +180.7 kJ mol^{-1}), so, increase in temperature will shift equilibrium in forward direction to increase yield of NO.

Increase in concentration of reactants (N_2 and O_2) also shifts the equilibrium in forward direction and increase the yield of NO.

Hence, (A), (C) and (D) only will increase yield of NO.

89. If the rate constant of a reaction is 0.03 s^{-1}, how much time does it take for 7.2 mol L^{-1} concentration of the reactant to get reduced to 0.9 mol L^{-1}?

(Given: log 2 = 0.301)

(1) 69.3 s (2) 23.1 s

(3) 210 s (4) 21.0 s

Answer (1)

Sol. k = 0.03 s^{-1}

$$t = \frac{2.303}{k}\log\frac{a}{a-x}$$

$$= \frac{2.303}{0.03}\log\frac{7.2}{0.9}$$

$$= \frac{2.303}{0.03}\log 8$$

$$= \frac{2.303}{0.03}\times 3\times\log 2$$

$$= \frac{2.303}{0.03}\times 3\times 0.301$$

= 69.3 s

90. Which one of the following reactions does **NOT** belong to "Lassaigne's test"?

(1) $Na + C + N \xrightarrow[\Delta]{} NaCN$ (2) $2Na + S \xrightarrow[\Delta]{} Na_2S$

(3) $Na + X \xrightarrow[\Delta]{} + NaX$ (4) $2CuO + C \xrightarrow[\Delta]{} 2Cu + CO_2$

Answer (4)

Sol. Nitrogen, sulphur, halogens and phosphorus present in an organic compound are detected by "Lassaigne's test".

$$Na + C + N \xrightarrow{\Delta} NaCN$$

$$2Na + S \xrightarrow{\Delta} Na_2S$$

$$Na + X \xrightarrow{\Delta} \underset{(X=Cl, Br, I)}{NaX}$$