

## CHEMISTRY

46. 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  $\text{Cr}^{2+}$  ion ( $Z = 24$ ) is the same as that of a  $\text{Nd}^{3+}$  ion ( $Z = 60$ ).

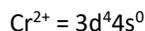
In the light of the above statements, choose the **correct** answer from the options given below :

- (1) Both Statement I and Statement II are 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

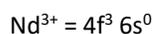
**Answer (2)**

**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.



Unpaired electrons = 4



Unpaired electrons = 3

Hence, Statement II is incorrect

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

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

$K_p$  for the reaction at 1000 K is

- (1)  $2.077 \times 10^5$
- (2) 0.033
- (3) 0.021
- (4) 83.1

**Answer (2)**

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

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

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

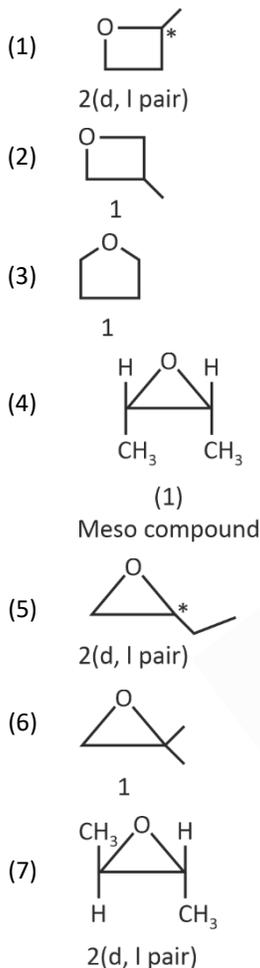
$$= 0.033$$

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

- (1) 8 (2) 10  
(3) 11 (4) 6

**Answer (2)**

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



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

49. 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 :

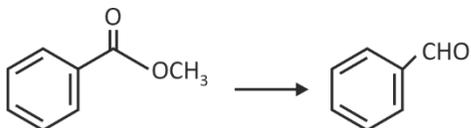
- (1) Both Statement I and Statement II are false (2) Statement I is true but Statement II is false  
(3) Statement I is false but Statement II is true (4) Both Statement I and Statement II are true

**Answer (1)**

**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.

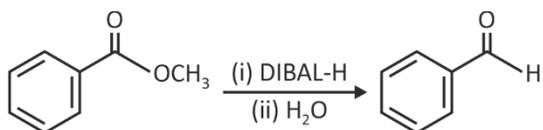
50. Identify the suitable reagent for the following conversion.



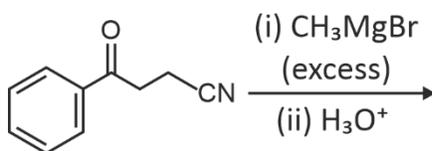
- (1) (i)  $\text{AlH}(\text{iBu})_2$ , (ii)  $\text{H}_2\text{O}$
- (2) (i)  $\text{NaBH}_4$ , (ii)  $\text{H}^+/\text{H}_2\text{O}$
- (3)  $\text{H}_2/\text{Pd}-\text{BaSO}_4$
- (4) (i)  $\text{LiAlH}_4$ , (ii)  $\text{H}^+/\text{H}_2\text{O}$

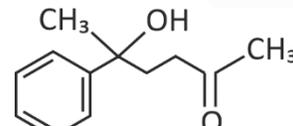
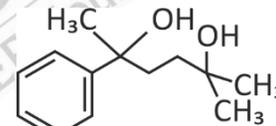
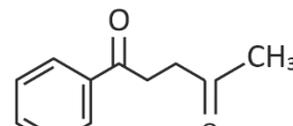
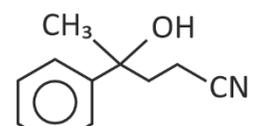
**Answer (1)**

**Sol.** Esters are reduced to aldehydes with DIBAL-H

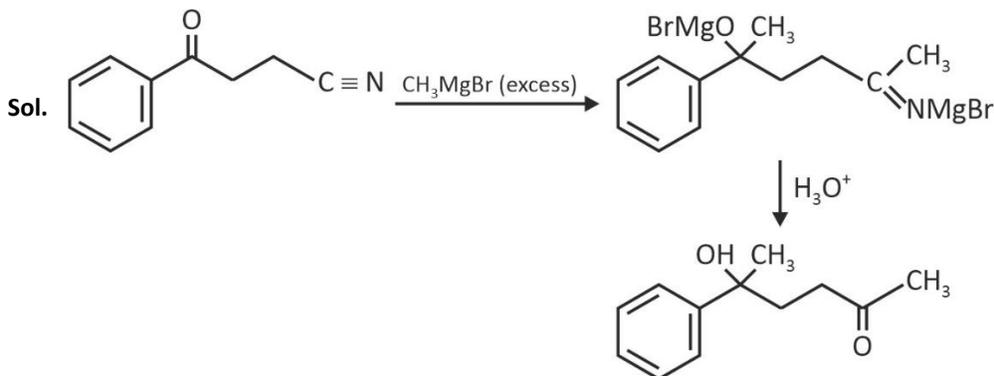


51. The major product of the following reaction is



- (1) 
- (2) 
- (3) 
- (4) 

**Answer (1)**



52. If the molar conductivity ( $\Lambda_m$ ) of a 0.050 mol L<sup>-1</sup> solution of a monobasic weak acid is 90 S cm<sup>2</sup> mol<sup>-1</sup>, its extent (degree) of dissociation will be

[Assume  $\Lambda_+^\circ = 349.6$  S cm<sup>2</sup> mol<sup>-1</sup> and  $\Lambda_-^\circ = 50.4$  S cm<sup>2</sup> mol<sup>-1</sup>.]

- (1) 0.125 (2) 0.225  
(3) 0.215 (4) 0.115

**Answer (2)**

**Sol.** Degree of dissociation ( $\alpha$ ) is given as

$$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$$

$$\Lambda_m^\circ = \Lambda_+^\circ + \Lambda_-^\circ$$

$$= 349.6 + 50.4$$

$$= 400 \text{ S cm}^2 \text{ mol}^{-1}$$

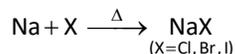
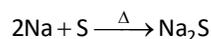
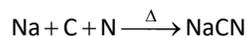
$$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ} = \frac{90}{400} = 0.225$$

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

- (1)  $2\text{Na} + \text{S} \xrightarrow{\Delta} \text{Na}_2\text{S}$   
(2)  $\text{Na} + \text{X} \xrightarrow{\Delta} \text{NaX}$   
(3)  $2\text{CuO} + \text{C} \xrightarrow{\Delta} 2\text{Cu} + \text{CO}_2$   
(4)  $\text{Na} + \text{C} + \text{N} \xrightarrow{\Delta} \text{NaCN}$

**Answer (3)**

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



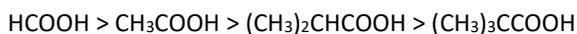
54. The correct order of decreasing acidity of the following aliphatic acids is

- (1)  $\text{CH}_3\text{COOH} > (\text{CH}_3)_2\text{CHCOOH} > (\text{CH}_3)_3\text{CCOOH} > \text{HCOOH}$   
(2)  $\text{HCOOH} > \text{CH}_3\text{COOH} > (\text{CH}_3)_2\text{CHCOOH} > (\text{CH}_3)_3\text{CCOOH}$   
(3)  $\text{HCOOH} > (\text{CH}_3)_3\text{CCOOH} > (\text{CH}_3)_2\text{CHCOOH} > \text{CH}_3\text{COOH}$   
(4)  $(\text{CH}_3)_3\text{CCOOH} > (\text{CH}_3)_2\text{CHCOOH} > \text{CH}_3\text{COOH} > \text{HCOOH}$

**Answer (2)**

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

So correct order is



55. Match List-I with List-II.

	List-I (Name of Vitamin)		List-II (Deficiency disease)
A.	Vitamin B <sub>12</sub>	I.	Cheilosis
B.	Vitamin D	II.	Convulsions
C.	Vitamin B <sub>2</sub>	III.	Rickets
D.	Vitamin B <sub>6</sub>	IV.	Pernicious anaemia

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

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

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

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

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

**Answer (1)****Sol.**

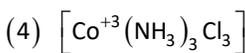
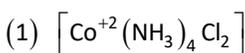
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B.	Vitamin D	Rickets
C.	Vitamin B <sub>2</sub>	Cheilosis
D.	Vitamin B <sub>6</sub>	Convulsions

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

(1) [Co(NH<sub>3</sub>)<sub>4</sub>Cl<sub>2</sub>](2) [Co(NH<sub>3</sub>)<sub>6</sub>]Cl<sub>3</sub>(3) [Co(NH<sub>3</sub>)<sub>5</sub>Cl]Cl(4) [Co(NH<sub>3</sub>)<sub>3</sub>Cl<sub>3</sub>]**Answer (1, 4)****Sol.** Conductance of any complex depends on the following factor.

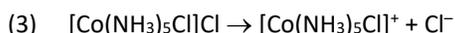
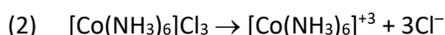
(1) Number of ions produced by complex.

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



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

conductance.



57. Sugar 'X'

A. is found in honey

B. is a keto sugar

C. exists in  $\alpha$  and  $\beta$  – anomeric forms.

D. Is laevorotatory.

'X' is :

(1) D-Fructose

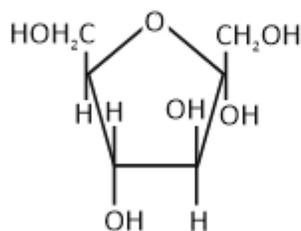
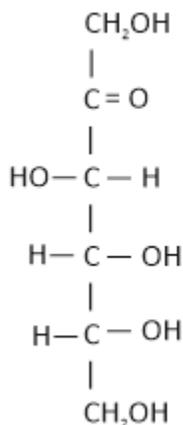
(2) Maltose

(3) Sucrose

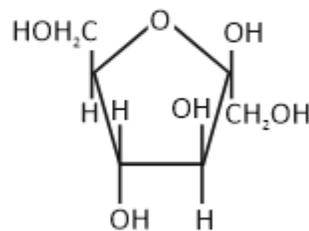
(4) D-Glucose

**Answer (1)**

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



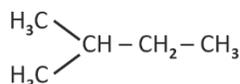
$\alpha$ -D-(-)-Fructofuranose



$\beta$ -D-(-)-Fructofuranose

D-(-) - Fructose

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



(1) 3

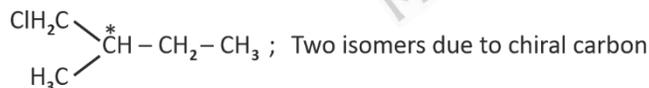
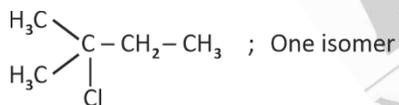
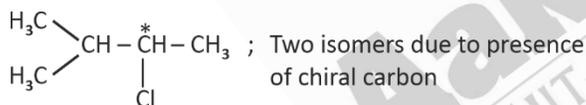
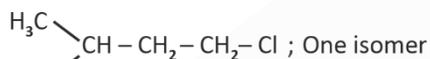
(2) 5

(3) 6

(4) 2

**Answer (3)**

**Sol.** Possible monochlorination products :



Total 6 isomers

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

(1) 2-Methylhex-2-ene

(2) 1, 1-Dimethylcyclopropane

(3) 1, 2-Dimethylcyclohexane

(4) Pent-1-ene

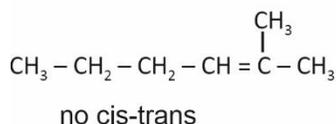
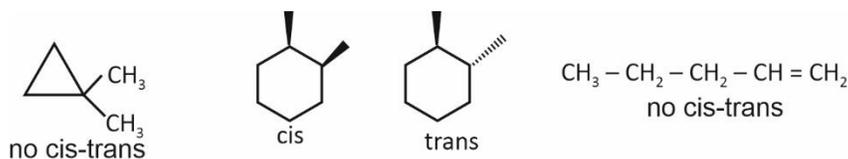
**Answer (3)**

**Sol.** Cis-trans isomers shown by :

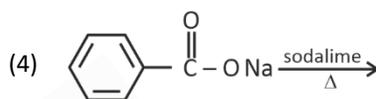
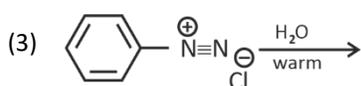
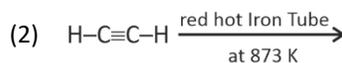
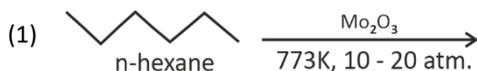
Condition: Restricted rotation around double bond

Or

Different group around double bond

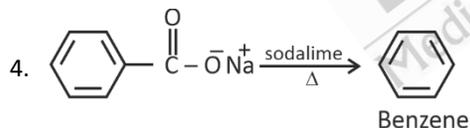
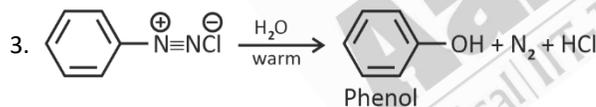
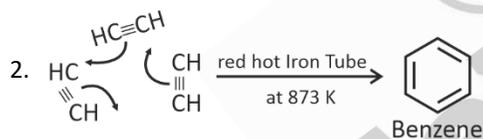
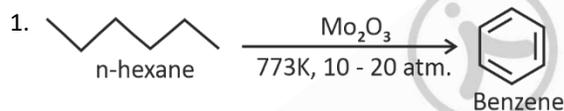


60. Which one of the following reactions does **NOT** give benzene as the product?



**Answer (3)**

**Sol.**



61. 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.  $\text{H}_3\text{PO}_4$  is a stronger acid than  $\text{H}_2\text{PO}_4^-$  and  $\text{HPO}_4^{2-}$

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 C only

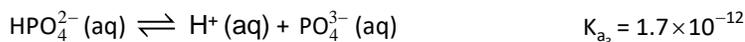
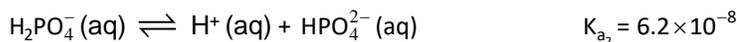
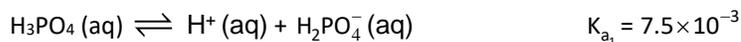
(2) B, C and D only

(3) A, B and C only

(4) A and B only

**Answer (3)**

**Sol.**  $\text{H}_3\text{PO}_4$  is a stronger acid than  $\text{H}_2\text{PO}_4^-$  and  $\text{HPO}_4^{2-}$



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

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

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

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

A. 212 g of  $\text{Na}_2\text{CO}_3(\text{s})$  [molar mass = 106 g]

B. 248 g of  $\text{Na}_2\text{O}(\text{s})$  [molar mass = 62 g]

C. 240 g of  $\text{NaOH}(\text{s})$  [molar mass = 40 g]

D. 12 g of  $\text{H}_2(\text{g})$  [molar mass = 2 g]

E. 220 g of  $\text{CO}_2(\text{g})$  [molar mass = 44 g]

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

(1) A, B, and D only

(2) B, C, and D only

(3) B, D, and E only

(4) A, B, and C only

**Answer (1)**

**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

63. 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 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

**Answer (2)**

**Sol.** All the elements of group 15 form hydrides of  $\text{EH}_3$  type. Nitrogen forms ammonia ( $\text{NH}_3$ ) while Arsenic forms Arsine ( $\text{AsH}_3$ )

All the elements of group 15 form two types of oxides :  $\text{E}_2\text{O}_3$  and  $\text{E}_2\text{O}_5$

Antimony forms antimony pentoxide  $\text{Sb}_2\text{O}_5$

Hence, statement I is correct and statement II is incorrect

64. Dalton's Atomic theory could not explain which of the following?
- (1) Law of constant proportion (2) Law of multiple proportion  
 (3) Law of gaseous volume (4) Law of conservation of mass

**Answer (3)**

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

65. The correct order of decreasing basic strength of the given amines is:
- (1) N-ethylethanamine > ethanamine > benzenamine > N-methylaniline  
 (2) N-ethylethanamine > ethanamine > N-methylaniline > benzenamine  
 (3) benzenamine > ethanamine > N-methylaniline > N-ethylethanamine  
 (4) N-methylaniline > benzenamine > ethanamine > N-ethylethanamine

**Answer (2)**

**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

66. 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) C and E only (2) C and D only  
 (3) A, C, and E only (4) A, B, and E only

**Answer (1)**

**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  $Si > Mg > Al > Na$

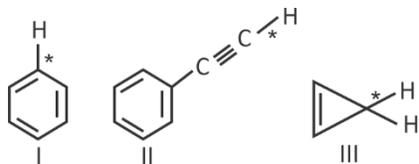
First ionisation enthalpy of Mg is higher than Al because the penetration of a 3s-electron to the nucleus is more than that of a 2p-electron.

- Generally down the group atomic radii increases

Atom	Atomic radius/pm
Li	152
Rb	244
CS	262



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



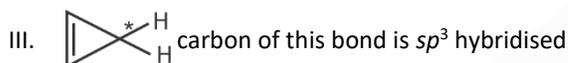
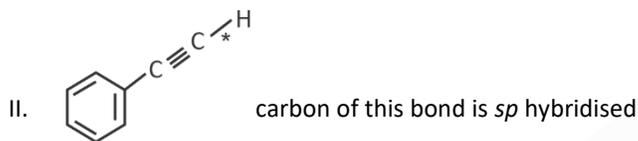
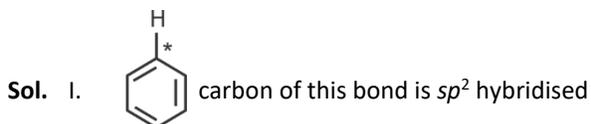
(1) I > II > III

(2) III > II > I

(3) II > III > I

(4) II > I > III

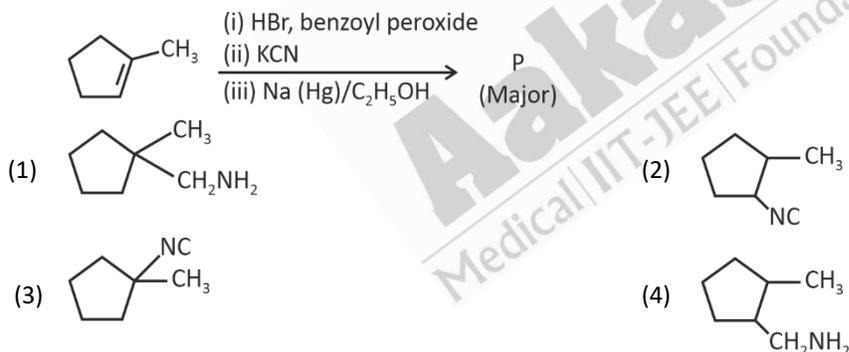
**Answer (4)**



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

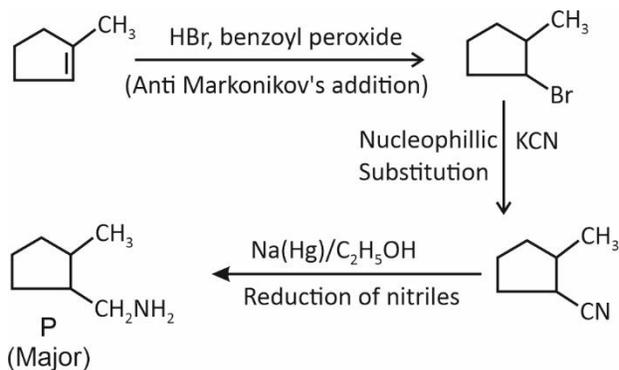
II > I > III

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



**Answer (4)**

**Sol.**





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

For  $\text{He}^+$

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

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

For  $\text{Li}^{2+}$

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

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

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

**Assertion (A)** :  I undergoes  $\text{S}_{\text{N}}2$  reaction faster than  Cl.

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

**Answer (4)**

**Sol.** Rate of  $\text{S}_{\text{N}}2$  reaction of  I is faster than  Cl.

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

74. 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) 4 minutes
- (2) 5 minutes
- (3) 10 minutes
- (4) 2 minutes

**Answer (3)**

**Sol.** For 1<sup>st</sup> order reaction

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

$A_t$  = Final concentration

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

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

75. Which of the following aqueous solution will exhibit highest boiling point?
- (1) 0.01M  $\text{KNO}_3$  (2) 0.01M  $\text{Na}_2\text{SO}_4$   
 (3) 0.015M  $\text{C}_6\text{H}_{12}\text{O}_6$  (4) 0.01M Urea

**Answer (2)**

**Sol.**  $\Delta T_b = iK_b \times m$

$$\Delta T_b \propto i \times m$$

By considering molarity same as molality

- (1) 0.01 M  $\text{KNO}_3$   $i \times m = 2 \times 0.01 = 0.02$   
 (2) 0.01M  $\text{Na}_2\text{SO}_4$   $i \times m = 3 \times 0.01 = 0.03$   
 (3) 0.015M  $\text{C}_6\text{H}_{12}\text{O}_6$   $i \times m = 1 \times 0.015 = 0.015$   
 (4) 0.01M Urea  $i \times m = 1 \times 0.01 = 0.01$

$$T'_b = T_b^* + \Delta T_b$$

Higher the value of  $(i \times m)$  more will be the boiling point.

76. Higher yield of NO in  $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$  can be obtained at

$[\Delta H \text{ of the reaction} = +180.7 \text{ kJ mol}^{-1}]$

- A. Higher temperature  
 B. Lower temperature  
 C. Higher concentration of  $\text{N}_2$   
 D. Higher concentration of  $\text{O}_2$

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

- (1) B, C only (2) B, C, D only  
 (3) A, C, D only (4) A, D only

**Answer (3)**

**Sol.** Yield of the product generally depends on

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

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

Increase in concentration of reactants ( $\text{N}_2$  and  $\text{O}_2$ ) also shifts the equilibrium in forward direction and increase the yield of NO.

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



$$\frac{hc}{\lambda_{4 \rightarrow 6}} = \frac{R_H \times 20}{36 \times 16}$$

$$\lambda_{4 \rightarrow 6} = \frac{hc \times 36 \times 16}{R_H \cdot 20}$$

$$\frac{\lambda_{2 \rightarrow 3}}{\lambda_{4 \rightarrow 6}} = \frac{\frac{hc \cdot 36}{R_H \cdot 5}}{\frac{hc \times 36 \times 16}{R_H \cdot 20}}$$

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

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

- A.  $[\text{Co}(\text{NH}_3)_6]^{3+}$
- B.  $[\text{Co}(\text{CN})_6]^{3-}$
- C.  $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$
- D.  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$

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

- (1)  $B < A < D < C$
- (2)  $C < D < A < B$
- (3)  $C < A < D < B$
- (4)  $B < D < A < C$

**Answer (1)**

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

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

- A.  $[\text{Co}(\text{NH}_3)_6]^{3+}$  ; 475 nm
- B.  $[\text{Co}(\text{CN})_6]^{3-}$  ; 310 nm
- C.  $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$  ; 600 nm
- D.  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  ; 498 nm

Order of  $\lambda = C > D > A > B$

80. Identify the correct orders against the property mentioned

- A.  $\text{H}_2\text{O} > \text{NH}_3 > \text{CHCl}_3$  – dipole moment
- B.  $\text{XeF}_4 > \text{XeO}_3 > \text{XeF}_2$  – number of lone pairs on central atom
- C.  $\text{O-H} > \text{C-H} > \text{N-O}$  – bond length
- D.  $\text{N}_2 > \text{O}_2 > \text{H}_2$  – bond enthalpy

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

- (1) B, D only
- (2) A, C only
- (3) B, C only
- (4) A, D only

**Answer (4)**



$$\begin{aligned}
 t &= \frac{2.303}{k} \log \frac{a}{a-x} \\
 &= \frac{2.303}{0.03} \log \frac{7.2}{0.9} \\
 &= \frac{2.303}{0.03} \log 8 \\
 &= \frac{2.303}{0.03} \times 3 \times \log 2 \\
 &= \frac{2.303}{0.03} \times 3 \times 0.301 \\
 &= 69.3 \text{ s}
 \end{aligned}$$

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

- |   |   |
|---|---|
| A. [Ne]3s <sup>1</sup>                                  | B. [Ar]3d <sup>3</sup> 4s <sup>2</sup>  |
| C. [Kr]4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>5</sup> | D. [Ar]3d <sup>10</sup> 4s <sup>1</sup> |
| E. [Rn]5f <sup>9</sup> 6d <sup>2</sup> 7s <sup>2</sup>  |   |

Choose the correct answer from the option given below :

- |                     |                  |
|---------------------|------------------|
| (1) A and C only    | (2) D and E only |
| (3) A, C and D only | (4) B and E only |

**Answer (1)**

- Sol.** (A) [Ne]3s<sup>1</sup>; Na (s-block)  
 (B) [Ar]3d<sup>3</sup>4s<sup>2</sup>; V (d-block)  
 (C) [Kr]4d<sup>10</sup>5s<sup>2</sup>5p<sup>5</sup>; I (p-block)  
 (D) [Ar]3d<sup>10</sup>4s<sup>1</sup>; Cu (d-block)  
 (E) [Rn]5f<sup>9</sup>6d<sup>2</sup>7s<sup>2</sup>; Th (f-block)  
 Main group elements (A and C only)

84. Match List-I with List-II

- | List-I<br>(Example) | List-II<br>(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-I, C-IV, D-III | (2) A-III, B-I, C-IV, D-II |
| (3) A-III, B-II, C-I, D-IV | (4) A-II, B-IV, C-I, D-III |

**Answer (1)**

**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

85. 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 negative deviation.
  - (2) The solution is ideal.
  - (3) The solution has volume greater than the sum of individual volumes.
  - (4) The solution shows positive deviation.

**Answer (1)**

**Sol.**  $P_{\text{total}} = X_X P_X^\circ + X_Y P_Y^\circ$

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

$$= 21 + 52$$

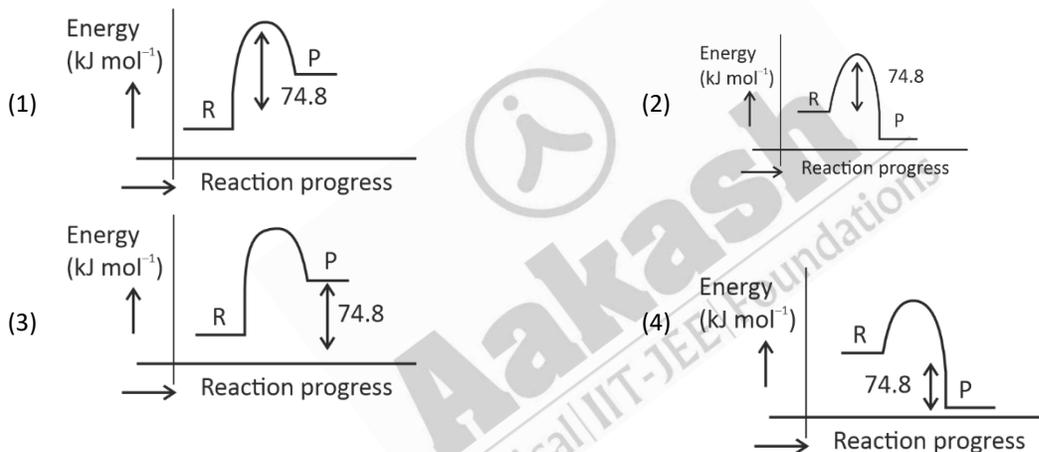
$$= 73 \text{ torr}$$

Observed total pressure of solution is 70 torr.

It is less than calculated total pressure.

Hence, it shows negative deviation.

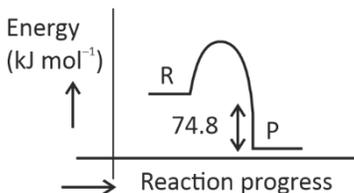
86.  $C(s) + 2H_2(g) \rightarrow CH_4(g)$ ;  $\Delta H = -74.8 \text{ kJ mol}^{-1}$ . Which of the following diagrams gives an accurate representation of the above reaction? [R  $\rightarrow$  reactants; P  $\rightarrow$  products]



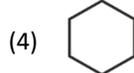
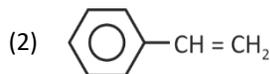
**Answer (4)**

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

So, accurate representation is

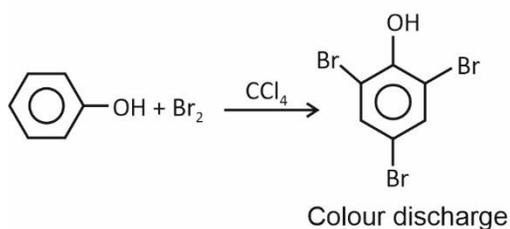
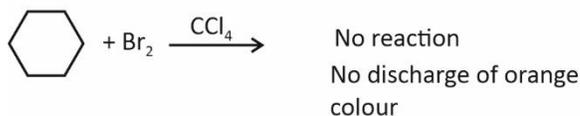
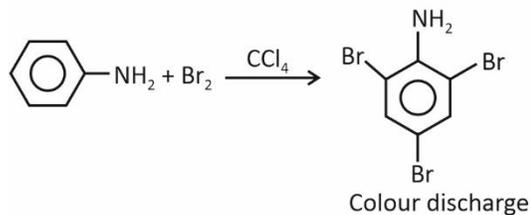
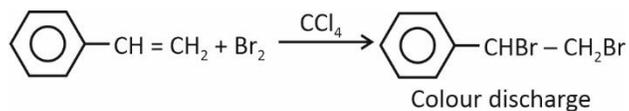


87. Which one of the following compounds **does not** decolourize bromine water?

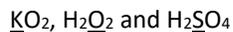


**Answer (4)**

**Sol.** Test for unsaturation i.e. Bromine water Reddish orange colour of bromine solution in  $\text{CCl}_4$  will discharge when bromine adds to an unsaturation site.



88. Consider the following compounds :

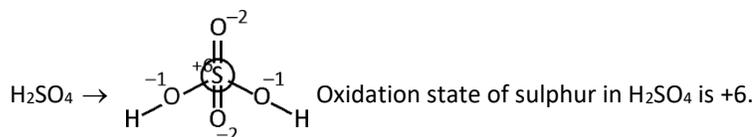
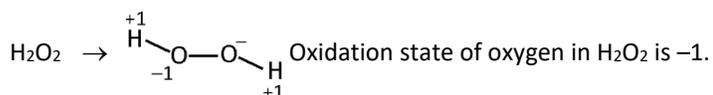


The oxidation state of the underlined elements in them are, respectively,

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

**Answer (4)**

**Sol.**  $\text{KO}_2 \rightarrow$  Alkali metal always shows +1 oxidation state. Therefore oxidation state of K is +1.



89. 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.

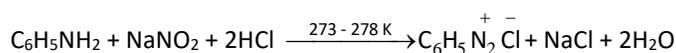
In the light of the above statements, choose the **most appropriate** answer from the options given below :

- (1) Both Statement I and Statement II are 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

**Answer (4)**

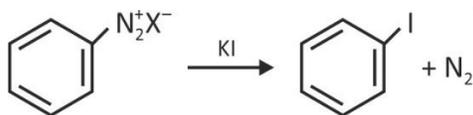
**Sol.** Benzene diazonium chloride is prepared by the reaction of aniline with nitrous acid at 273-278 K.

Nitrous acid is produced in the reaction mixture by reaction of  $\text{NaNO}_2$  with HCl.



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



90. Which of the following are paramagnetic?

- A.  $[\text{NiCl}_4]^{2-}$   
 B.  $\text{Ni}(\text{CO})_4$   
 C.  $[\text{Ni}(\text{CN})_4]^{2-}$   
 D.  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$   
 E.  $\text{Ni}(\text{PPh}_3)_4$

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

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

**Answer (2)**

**Sol.**

- A.  $[\text{NiCl}_4]^{2-}$ ;  $\text{Ni}^{+2}$ ;  $3d^8$ ;  $sp^3$  hybridisation; 2 unpaired electrons; paramagnetic  
 B.  $\text{Ni}(\text{CO})_4$ ; Ni;  $3d^8 4s^2$ ;  $sp^3$  hybridisation; Zero unpaired electron; diamagnetic  
 C.  $[\text{Ni}(\text{CN})_4]^{2-}$ ;  $\text{Ni}^{+2}$ ;  $3d^8$ ;  $dsp^2$  hybridisation; Zero unpaired electron; diamagnetic  
 D.  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ ;  $\text{Ni}^{2+}$ ;  $3d^8$ ;  $sp^3d^2$  hybridisation; Two unpaired electron; paramagnetic  
 E.  $\text{Ni}(\text{PPh}_3)_4$ ; Ni;  $3d^8 4s^2$ ;  $sp^3$  hybridisation; zero unpaired electron; Diamagnetic