

CHEMISTRY

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

[Assume $\Lambda_+^\circ = 349.6 \text{ S cm}^2 \text{ mol}^{-1}$ and $\Lambda_-^\circ = 50.4 \text{ S cm}^2 \text{ mol}^{-1}$.]

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

Answer (4)

Sol. Degree of dissociation (α) is given as

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

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

$$= 349.6 + 50.4$$

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

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

47. 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) Statement I is false but Statement II is true
 (2) Both Statement I and Statement II are true
 (3) Both Statement I and Statement II are false
 (4) Statement I is true but Statement II is false

Answer (3)

- 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.

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

- (1) $\frac{1}{4}$ (2) $\frac{1}{36}$
 (3) $\frac{1}{16}$ (4) $\frac{1}{9}$

Answer (1)

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

50. 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) 21.0 s (2) 69.3 s
 (3) 23.1 s (4) 210 s

Answer (2)

Sol. $k = 0.03 \text{ s}^{-1}$

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

51. Match List I with List II

| | List-I (Mixture) | | List-II (Method of separation) |
|----|---|-------|-------------------------------------|
| A. | $\text{CHCl}_3 + \text{C}_6\text{H}_5\text{NH}_2$ | (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:

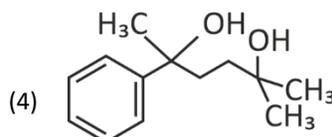
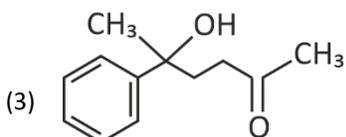
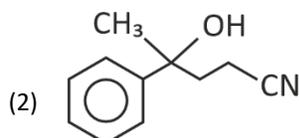
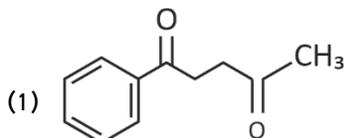
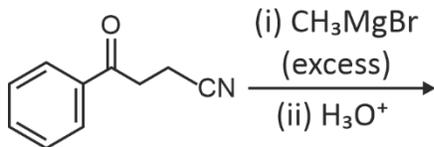
- (1) A-III, B-IV, C-II, D-I (2) A-IV, B-III, C-I, D-II
 (3) A-IV, B-III, C-II, D-I (4) A-III, B-IV, C-I, D-II

Answer (2)

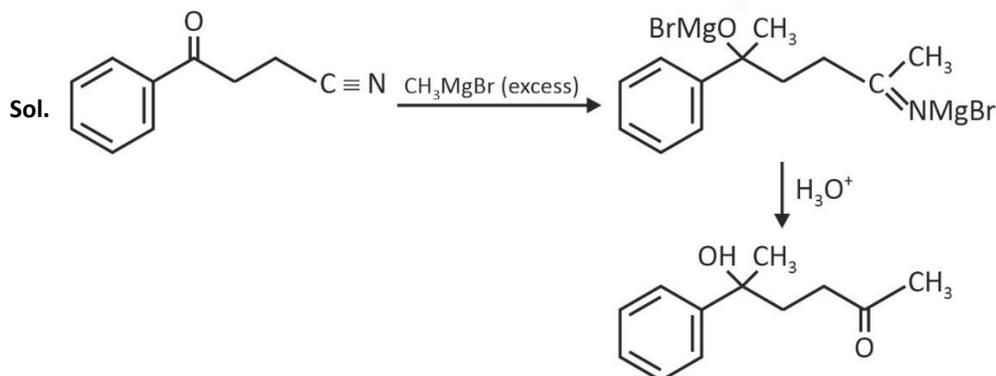
Sol.

| | | (Method of separation) |
|-----|---|-------------------------------------|
| (A) | $\text{CHCl}_3 + \text{C}_6\text{H}_5\text{NH}_2$ | Simple distillation |
| (B) | Crude oil in petroleum industry | Fractional distillation |
| (C) | Glycerol from spent-lye | Distillation under reduced pressure |
| (D) | Aniline - water | Steam Distillation |

52. The major product of the following reaction is



Answer (3)



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

(1) 1, 2-Dimethylcyclohexane

(2) Pent-1-ene

(3) 2-Methylhex-2-ene

(4) 1, 1-Dimethylcyclopropane

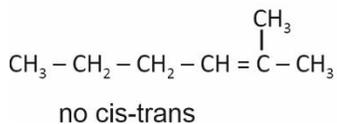
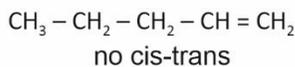
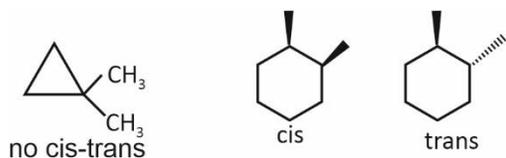
Answer (1)

Sol. Cis-trans isomers shown by :

Condition: Restricted rotation around double bond

Or

Different group around double bond



56. 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 $\text{BaSO}_4(\text{s}) = -4.5$ kcal/mol, standard heat of formation of $\text{BaSO}_4(\text{s}) = -349$ kcal/mol]

- (1) + 220.5 (2) - 128.5
(3) - 133.0 (4) + 133.0

Answer (2)



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

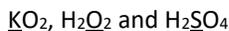
So, $-349 - (-4.5) - (-216)$

$\text{So } -349 + 4.5 + 216$

$= -349 + 220.5$

$= -128.5 \text{ kcal/mol}$

57. Consider the following compounds :



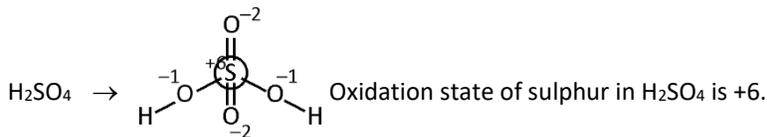
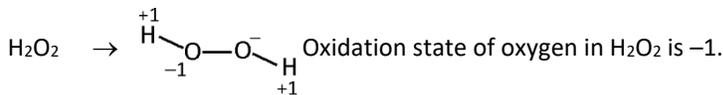
The oxidation state of the underlined elements in them are, respectively,

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

Answer (2)

Sol.

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



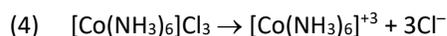
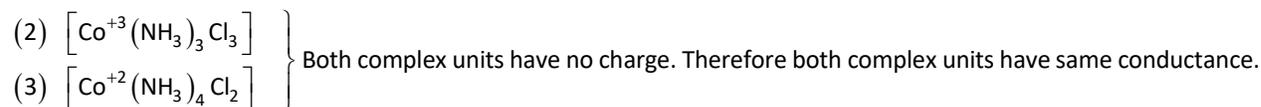
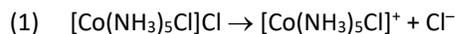
58. Out of the following complex compounds, which of the compound will be having the minimum conductance in solution?

- (1) $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}$ (2) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$
(3) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]$ (4) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$

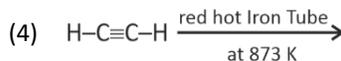
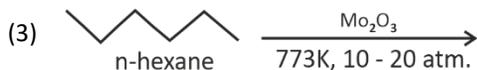
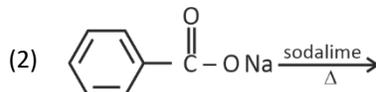
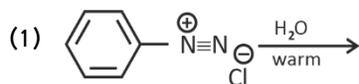
Answer (2, 3)

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.

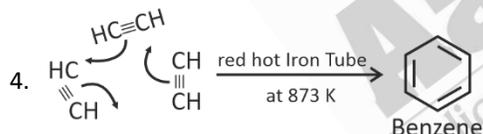
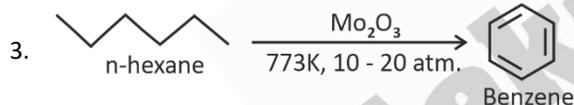
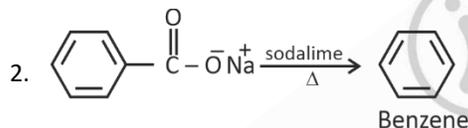
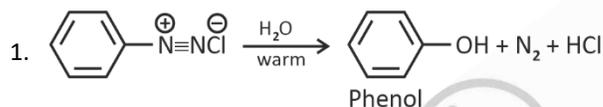


59. Which one of the following reactions does **NOT** give benzene as the product?



Answer (1)

Sol.



60. 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 :

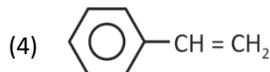
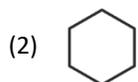
- | | |
|---------------------|------------------|
| (1) A, D and E only | (2) A and C only |
| (3) B and E only | (4) A and D only |

Answer (4)

Sol.

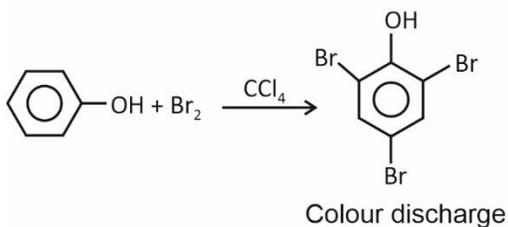
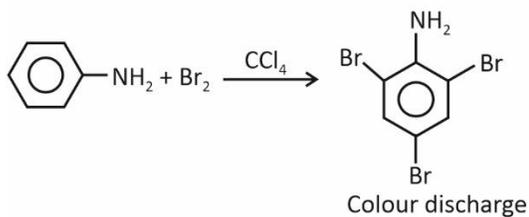
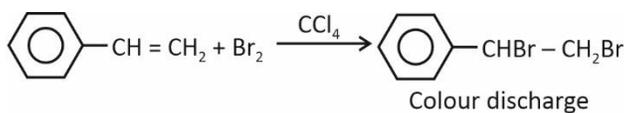
- A. $[\text{NiCl}_4]^{2-}$; Ni^{+2} ; $3d^8$; sp^3 hybridisation; 2 unpaired electrons; paramagnetic
- B. $\text{Ni}(\text{CO})_4$; Ni; $3d^8 4s^2$; sp^3 hybridisation; Zero unpaired electron; diamagnetic
- C. $[\text{Ni}(\text{CN})_4]^{2-}$; Ni^{+2} ; $3d^8$; dsp^2 hybridisation; Zero unpaired electron;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

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



Answer (2)

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.



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

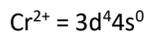
| | List-I | | List-II |
|----|--------------------|------|---|
| A. | Haber process | I. | Fe catalyst |
| B. | Wacker oxidation | II. | PdCl_2 |
| C. | Wilkinson catalyst | III. | $[(\text{PPh}_3)_3\text{RhCl}]$ |
| D. | Ziegler catalyst | IV. | TiCl_4 with $\text{Al}(\text{CH}_3)_3$ |

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

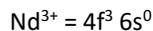
- (1) A-I, B-IV, C-III, D-II
- (2) A-I, B-II, C-IV, D-III
- (3) A-II, B-III, C-I, D-IV
- (4) A-I, B-II, C-III, D-IV

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

65. 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) 10 minutes (2) 2 minutes
(3) 4 minutes (4) 5 minutes

Answer (1)

Sol. For 1st order reaction

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

A_t = Final concentration

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

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

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

- (1) benzenamine > ethanamine > N-methylaniline > N-ethylethanamine
(2) N-methylaniline > benzenamine > ethanamine > N-ethylethanamine
(3) N-ethylethanamine > ethanamine > benzenamine > N-methylaniline
(4) N-ethylethanamine > ethanamine > N-methylaniline > benzenamine

Answer (4)

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

67. 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-II, C-I, D-IV

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

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

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

Answer (3)**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 |

68. 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?

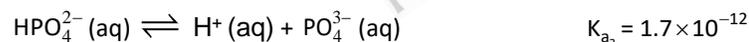
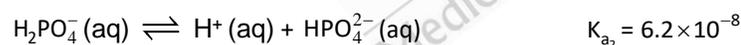
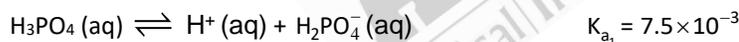
A. $\log K = \log K_{a_1} + \log K_{a_2} + \log K_{a_3}$ B. H_3PO_4 is a stronger acid than $H_2PO_4^-$ and HPO_4^{2-} C. $K_{a_1} > K_{a_2} > K_{a_3}$ D. $K_{a_1} = \frac{K_{a_2} + K_{a_3}}{2}$ Choose the **correct** answer from the options given below :

(1) A, B and C only

(2) A and B only

(3) A and C only

(4) B, C and D only

Answer (1)**Sol.** H_3PO_4 is a stronger acid than $H_2PO_4^-$ and 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

69. 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⁻, Ca²⁺, and S²⁻ 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, C, and E only

(2) A, B, and E only

(3) C and E only

(4) C and D only

Answer (3)

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⁻, Ca²⁺ and S²⁻ 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 |

70. 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) Statement I is incorrect but Statement II is correct
- (2) Both Statement I and Statement II are correct
- (3) Both Statement I and Statement II are incorrect
- (4) Statement I is correct but Statement II is incorrect

Answer (4)

Sol. All the elements of group 15 form hydrides of EH₃ type. Nitrogen forms ammonia (NH₃) while Arsenic forms Arsine (AsH₃)

All the elements of group 15 form two types of oxides : E₂O₃ and E₂O₅

Antimony forms antimony pentoxide Sb₂O₅

Hence, statement I is correct and statement II is incorrect

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

- (1) 0.015M C₆H₁₂O₆
- (2) 0.01M Urea
- (3) 0.01M KNO₃
- (4) 0.01M Na₂SO₄

Answer (4)

Sol.

$$\Delta T_b = iK_b \times m$$

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

By considering molarity same as molality

$$(1) \quad 0.015 \text{ M C}_6\text{H}_{12}\text{O}_6 \quad i \times m = 1 \times 0.015 = 0.015$$

$$(2) \quad 0.01 \text{ M Urea} \quad i \times m = 1 \times 0.01 = 0.01$$

$$(3) \quad 0.01 \text{ M KNO}_3 \quad i \times m = 2 \times 0.01 = 0.02$$

$$(4) \quad 0.01 \text{ M Na}_2\text{SO}_4 \quad i \times m = 3 \times 0.01 = 0.03$$

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

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

72. 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) Statement I is incorrect but Statement II is correct

(2) Both Statement I and Statement II are correct

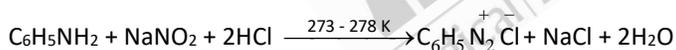
(3) Both Statement I and Statement II are incorrect

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

Answer (2)

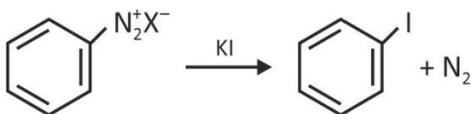
Sol. Benzene diazonium chloride is prepared by the reaction of aniline with nitrous acid at 273-278 K.

Nitrous acid is produced in the reaction mixture by reaction of NaNO_2 with HCl.

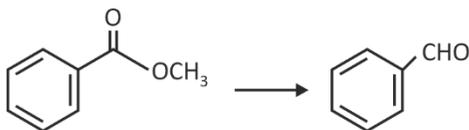


Benzene diazonium chloride decomposes easily in the dry state

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



73. Identify the suitable reagent for the following conversion.



(1) $\text{H}_2/\text{Pd}-\text{BaSO}_4$

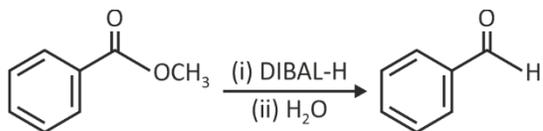
(2) (i) LiAlH_4 , (ii) $\text{H}^+/\text{H}_2\text{O}$

(3) (i) $\text{AlH}(\text{iBu})_2$, (ii) H_2O

(4) (i) NaBH_4 , (ii) $\text{H}^+/\text{H}_2\text{O}$

Answer (3)

Sol. Esters are reduced to aldehydes with DIBAL-H



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

Answer (2)

Sol. Rate of S_N2 reaction of I is faster than Cl.

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

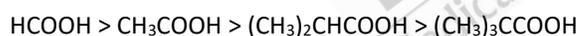
75. The correct order of decreasing acidity of the following aliphatic acids is

- (1) HCOOH > (CH₃)₃CCOOH > (CH₃)₂CHCOOH > CH₃COOH
- (2) (CH₃)₃CCOOH > (CH₃)₂CHCOOH > CH₃COOH > HCOOH
- (3) CH₃COOH > (CH₃)₂CHCOOH > (CH₃)₃CCOOH > HCOOH
- (4) HCOOH > CH₃COOH > (CH₃)₂CHCOOH > (CH₃)₃CCOOH

Answer (4)

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

So correct order is

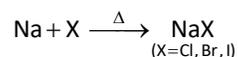
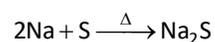
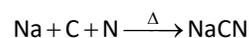


76. Which one of the following reactions does **NOT** belong to "Lassaigne's test"?

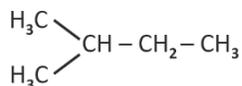
- (1) $2\text{CuO} + \text{C} \xrightarrow{\Delta} 2\text{Cu} + \text{CO}_2$
- (2) $\text{Na} + \text{C} + \text{N} \xrightarrow{\Delta} \text{NaCN}$
- (3) $2\text{Na} + \text{S} \xrightarrow{\Delta} \text{Na}_2\text{S}$
- (4) $\text{Na} + \text{X} \xrightarrow{\Delta} \text{NaX}$

Answer (1)

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



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

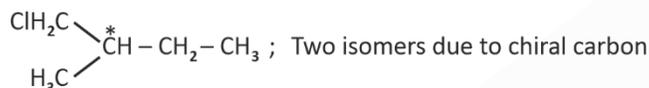
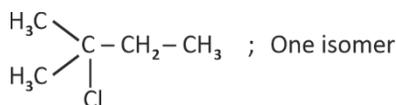
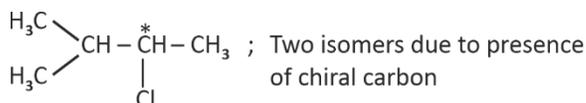
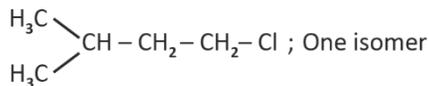


(1) 6 (2) 2

(3) 3 (4) 5

Answer (1)

Sol. Possible monochlorination products :



Total 6 isomers

78. Sugar 'X'

- A. is found in honey
- B. is a keto sugar
- C. exists in α and β – anomeric forms.
- D. Is laevorotatory.

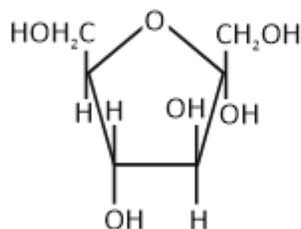
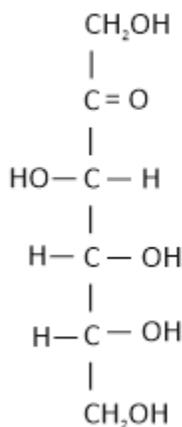
'X' is :

(1) Sucrose (2) D-Glucose

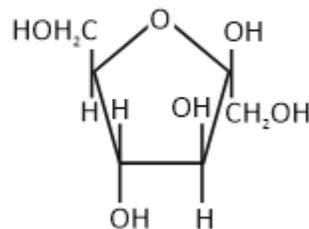
(3) D-Fructose (4) Maltose

Answer (3)

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



α -D-(-)-Fructofuranose



β -D-(-)-Fructofuranose

D-(-) — Fructose

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

- (1) Law of gaseous volume (2) Law of conservation of mass
(3) Law of constant proportion (4) Law of multiple proportion

Answer (1)

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

80. Higher yield of NO in $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ 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 N_2
D. Higher concentration of O_2

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

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

Answer (1)

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 (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.

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

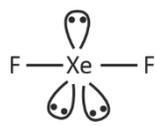
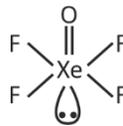
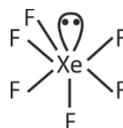
| | List-I | | List-II |
|----|---------------|-------|----------------------------------|
| A. | XeO_3 | (I) | sp^3d ; linear |
| B. | XeF_2 | (II) | sp^3 ; pyramidal |
| C. | $XeOF_4$ | (III) | sp^3d^3 ; distorted octahedral |
| D. | XeF_6 | (IV) | sp^3d^2 ; square pyramidal |

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

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

Answer (2)

Sol.

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

82. Match List-I with List-II

List-I

(Example)

- A. Humidity
- B. Alloys
- C. Amalgams
- D. Smoke

List-II

(Type of Solution)

- I. Solid in solid
- II. Liquid in gas
- III. Solid in gas
- IV. Liquid in solid

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

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

Answer (3)

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

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

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

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

$r_n(\text{He}^+) = 17.6$ pm

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

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

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

$r_n(\text{He}^+) = 26.4$ pm

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

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

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

$r_n(\text{He}^+) = 17.6$ pm

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

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

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

$r_n(\text{He}^+) = 26.4$ pm

Answer (2)

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^+

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

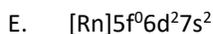
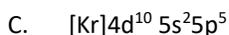
$r_{\text{He}^+} = \frac{52.9 \times 1}{2} = 26.45$ pm

For Li^{2+}

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

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

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



Choose the correct answer from the option given below :

(1) A, C and D only

(2) B and E only

(3) A and C only

(4) D and E only

Answer (3)

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

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

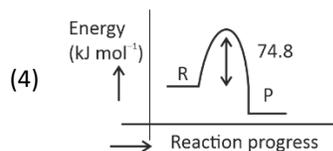
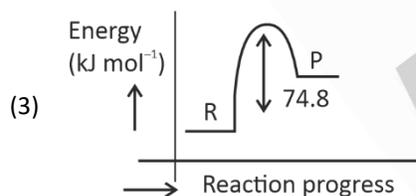
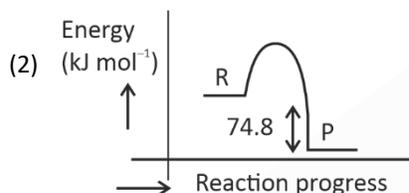
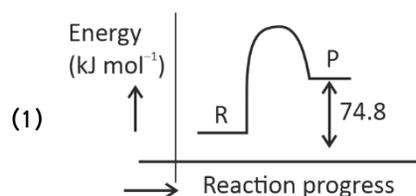
(C) $[\text{Kr}]4d^{10}5s^25p^5$; I (p-block)

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

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

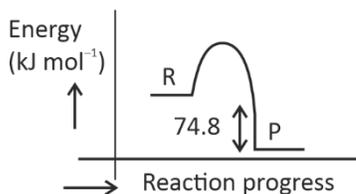
Main group elements (A and C only)

85. $\text{C(s)} + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g}); \Delta H = -74.8 \text{ kJ mol}^{-1}$. Which of the following diagrams gives an accurate representation of the above reaction? [R \rightarrow reactants; P \rightarrow products]

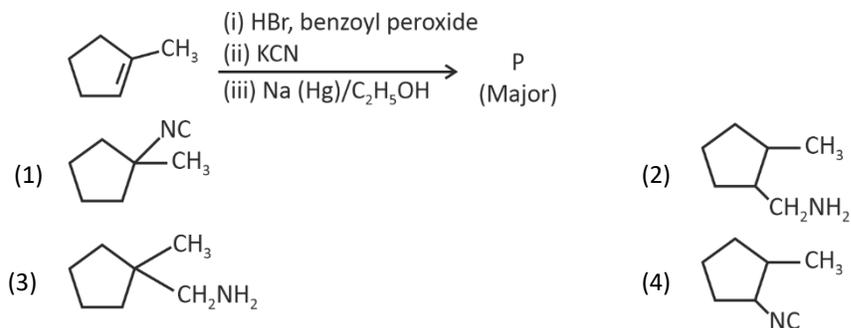
**Answer (2)**

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

So, accurate representation is

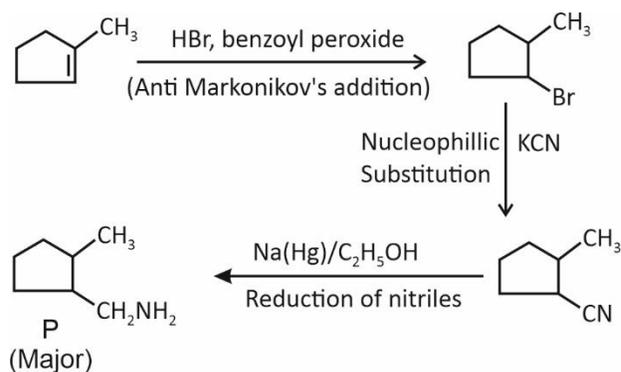


86. Predict the major product 'P' in the following sequence of reactions-



Answer (2)

Sol.



87. Identify the correct orders against the property mentioned

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

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

- B, C only
- A, D only
- B, D only
- A, C only

Answer (2)

Sol.

| | $\mu(\text{D})$ |
|--|-----------------|
| 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 | |

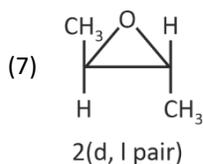
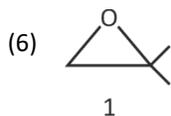
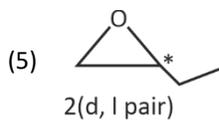
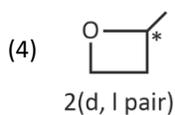
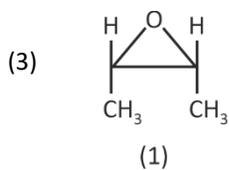
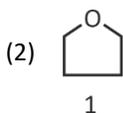
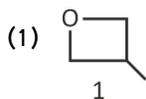
- C. Order of Bond length :- $N-O > C-H > O-H$
- D. N_2 Bond order is 3
 H_2 Bond order is 1
 O_2 Bond order is 2

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

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

Answer (4)

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



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

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

K_p for the reaction at 1000 K is

- (1) 0.021
- (2) 83.1
- (3) 2.077×10^5
- (4) 0.033

Answer (4)

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

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

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

$$= 0.033$$

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

Answer (3)

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.