

54. For hydrogen atom, the orbital/s with lowest energy is/are :

- (A) 4s
- (B) 3p_x
- (C) 3d_{x²-y²}
- (D) 3d_{z²}
- (E) 4p_z

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

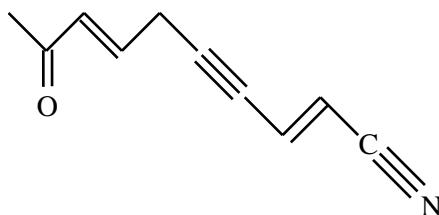
- (1) (A) and (E) only
- (2) (B) only
- (3) (A) only
- (4) (B), (C) and (D) only

Ans. (4)

Sol. In hydrogen atom the orbitals in a shell are degenerate means energy depends only on 'n'

$$\therefore E_{3p_x} = E_{3d_{x^2-y^2}} = E_{3d_{z^2}}$$

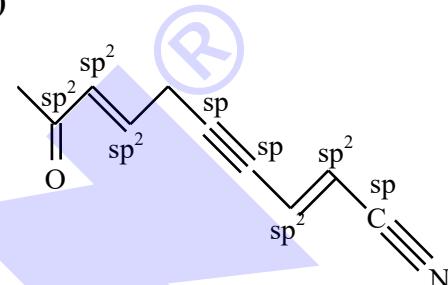
55. In the given structure, number of sp and sp² hybridized carbon atoms present respectively are :



- (1) 3 and 6
(2) 3 and 5
(3) 4 and 6
(4) 4 and 5

Ans. (2)

Sol.



Number of sp and sp² hybridised carbon atom are 3 and 5.

56. Which of the following mixing of 1M base and 1M acid leads to the largest increase in temperature?

- (1) 30 mL HCl and 30 mL NaOH
- (2) 30 mL CH₃COOH and 30 mL NaOH
- (3) 50 mL HCl and 20 mL NaOH
- (4) 45 mL CH₃COOH and 25 mL NaOH

Ans. (1)

Sol. Higher the number of milli moles of acid or base reacted higher will be temperature rise.

Option (4) n_{acid} or n_{base} reacted = 30 m mol

Option (2) n_{acid} or n_{base} reacted = 30 m mol

but less energy will be released by neutralisation reaction of weak acid hence option (2) can not be correct.

Option (3) ⇒ 20 m mol

Option (4) ⇒ 25 m mol

Hence Correct Option (1)



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57. Given below are two statements :

Statement(I) : Experimentally determined oxygen-oxygen bond lengths in the O_3 are found to be same and the bond length is greater than that of a $O = O$ (double bond) but less than that of a single ($O - O$) bond.

Statement (II) : The strong lone pair-lone pair repulsion between oxygen atoms is solely responsible for the fact that the bond length in ozone is smaller than that of a double bond ($O=O$) but more than that of a single bond ($O - O$).

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

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

Ans. (1)

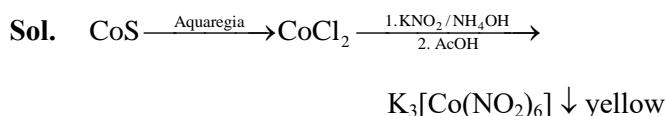
Sol. Due to resonance bond length is identical in ozone. Therefore statement I is true and statement II is false

58. Find the compound 'A' from the following reaction sequences.

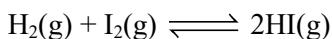


- (1) ZnS
- (2) CoS
- (3) MnS
- (4) NiS

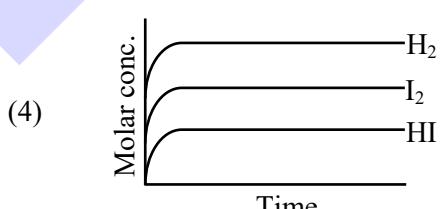
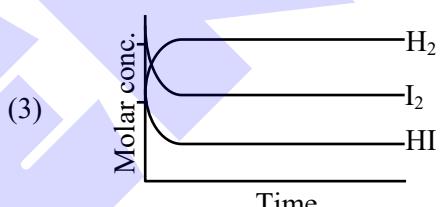
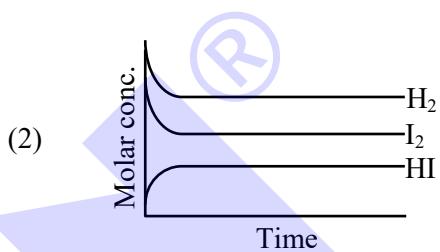
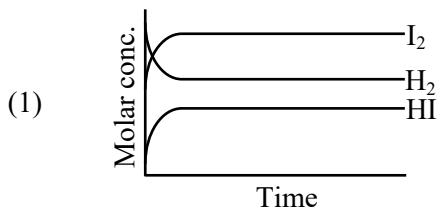
Ans. (2)



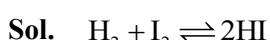
59. For the reaction,



Attainment of equilibrium is predicted correctly by:



Ans. (2)



Concentration of H_2 and I_2 decreases until equilibrium condition and concentration of HI increases till equilibrium condition and after equilibrium concentration of all the reactant and products remain constant.

Correct option (2)



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60. Match List-I with List-II.

List-I (Transition metal ion)	List-II (Spin only magnetic moment (B.M.))
(A) Ti ³⁺	(I) 3.87
(B) V ²⁺	(II) 0.00
(C) Ni ²⁺	(III) 1.73
(D) Sc ³⁺	(IV) 2.84

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

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

Ans. (2)

Sol. $\text{Sc}^{3+} = 3d^0 \quad \therefore \mu_{\text{spin}} = 0$
 $\text{V}^{2+} = 3d^3 \quad \therefore \mu_{\text{spin}} = 3.87 \text{ B.M.}$
 $\text{Ni}^{2+} = 3d^8 \quad \therefore \mu_{\text{spin}} = 2.84 \text{ B.M.}$
 $\text{Ti}^{3+} = 3d^1 \quad \therefore \mu_{\text{spin}} = 1.73 \text{ B.M.}$

61. The elemental composition of a compound is 54.2% C, 9.2% H and 36.6% O. If the molar mass of the compound is 132 g mol⁻¹, the molecular formula of the compound is :

[Given : The relative atomic mass of C : H : O = 12 : 1 : 16]

- (1) C₄H₉O₃
- (2) C₆H₁₂O₆
- (3) C₆H₁₂O₃
- (4) C₄H₈O₂

Ans. (3)

Sol. C : H : O

54.2	: 9.2	: 36.6
12		16

4.516	: 9.2	● : 2.287
4.516	9.2	2.287
2.287	2.287	2.287

1.97	: 4.02	: 1
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C₂H₄O \Rightarrow Empirical formula

E.F. mass = 24 + 4 + 16 = 44

and molar mass = 132

Hence molecular formula = (C₂H₄O)₃
= C₆H₁₂O₃

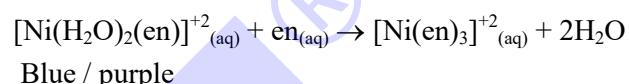
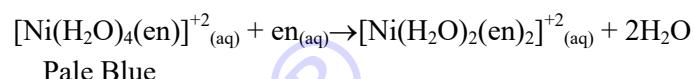
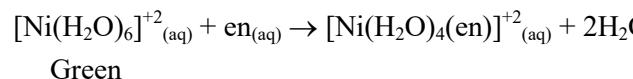
Correct Option (3)

62. When Ethane-1,2-diamine is added progressively to an aqueous solution of Nickel (II) chloride, the sequence of colour change observed will be :

- (1) Pale Blue \rightarrow Blue \rightarrow Green \rightarrow Violet
- (2) Pale Blue \rightarrow Blue \rightarrow Violet \rightarrow Green
- (3) Green \rightarrow Pale Blue \rightarrow Blue \rightarrow Violet
- (4) Violet \rightarrow Blue \rightarrow Pale Blue \rightarrow Green

Ans. (3)

Sol.



63. The conditions and consequence that favours the t_{2g}³, e_g¹ configuration in a metal complex are :

- (1) weak field ligand, high spin complex
- (2) strong field ligand, high spin complex
- (3) strong field ligand, low spin complex
- (4) weak field ligand, low spin complex

Ans. (1)

Sol. For 3d⁴

If ligand is SFL : t_{2g}⁴ e_g⁰ (Low spin)

If ligand is WFL : t_{2g}³ e_g¹ (High spin)

64. Identify correct statement/s :

- (A) —OCH₃ and —NHCOCH₃ are activating group
- (B) —CN and —OH are meta directing group
- (C) —CN and —SO₃H are meta directing group
- (D) Activating groups act as ortho – and para directing groups
- (E) Halides are activating groups

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

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

Ans. (1)

Sol. (B) —CN is meta directing But —OH is ortho / para directing.
(E) Halides are deactivating groups.



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65. Given below are two statements :

Statement (I) : The first ionization energy of Pb is greater than that of Sn

Statement(II) : The first ionization energy of Ge is greater than that of Si.

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

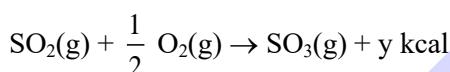
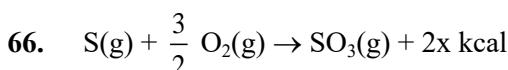
- (1) **Statement I** is true but **Statement II** is false
- (2) Both **Statement I** and **Statement II** are false
- (3) **Statement I** is false but **Statement II** is true
- (4) Both **Statement I** and **Statement II** are true

Ans. (1)

Sol. Order of I.E. (in KJ/mol) :



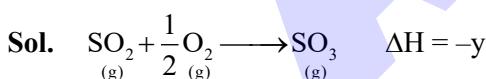
1086 786 761 708 715



The heat of formation of $\text{SO}_2(\text{g})$ is given by :

- (1) $\frac{2x}{y} \text{ kcal}$
- (2) $y - 2x \text{ kcal}$
- (3) $2x + y \text{ kcal}$
- (4) $x + y \text{ kcal}$

Ans. (2)



$$\Delta H_r = (\Delta H_f)_{\text{SO}_3} - (\Delta H_f)_{\text{SO}_2}$$

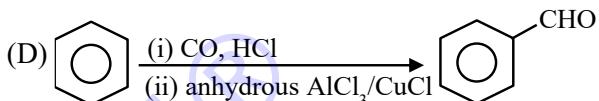
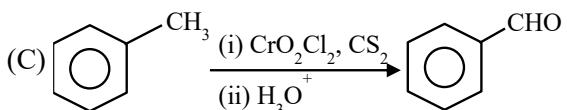
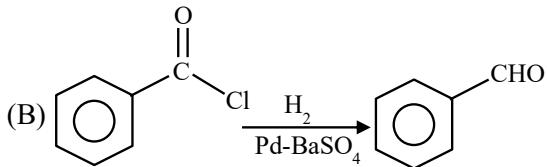
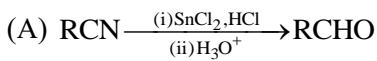
$$-y = -2x - (\Delta H_f)_{\text{SO}_2}$$

$$(\Delta H_f)_{\text{SO}_2} = y - 2x$$

Option (2)

67. Match List-I with List-II

List-I



List-II

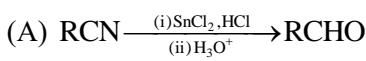
- (I) Etard reaction
- (II) Gatterman –Koch reaction
- (III) Rosenmund reduction
- (IV) Stephen reaction

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

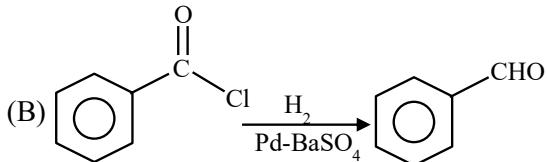
- (1) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)
- (2) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)
- (3) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
- (4) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

Ans. (1)

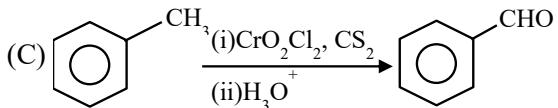
Sol. List-I



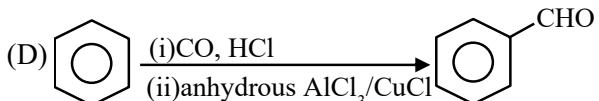
Stephen reaction



Rosenmund reduction



Etard reaction



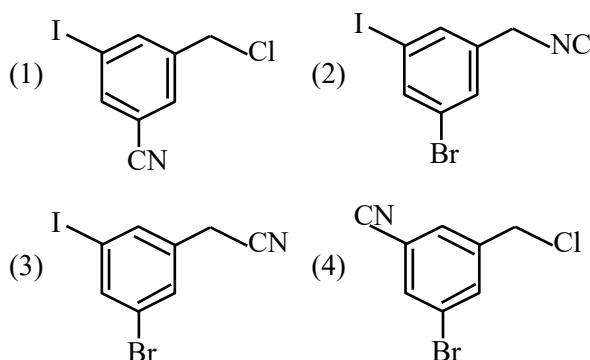
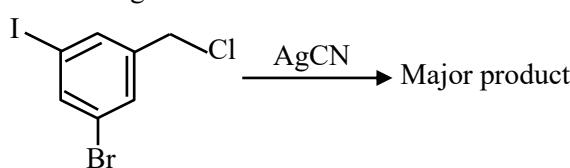
Gatterman –Koch reaction



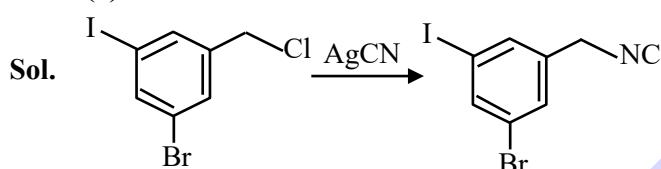
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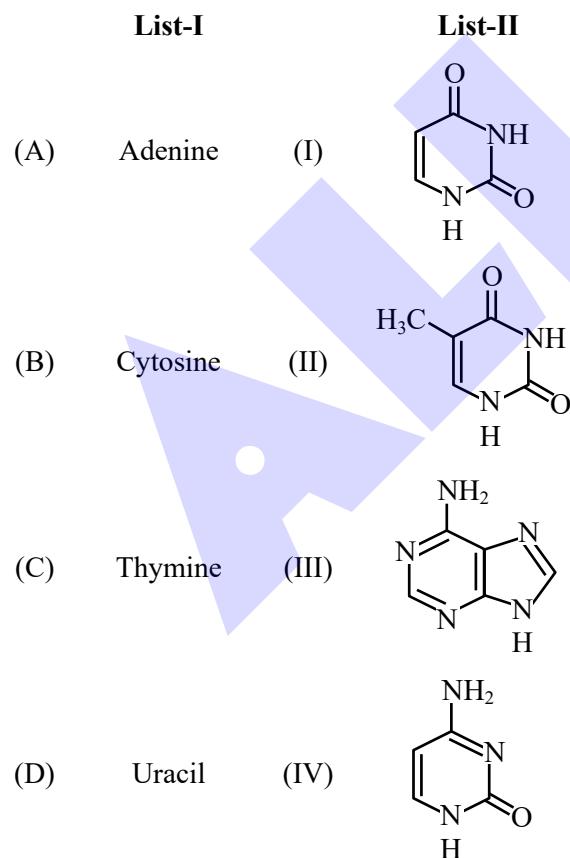
68. The structure of the major product formed in the following reaction is :



Ans. (2)



69. Match List-I with List-II.

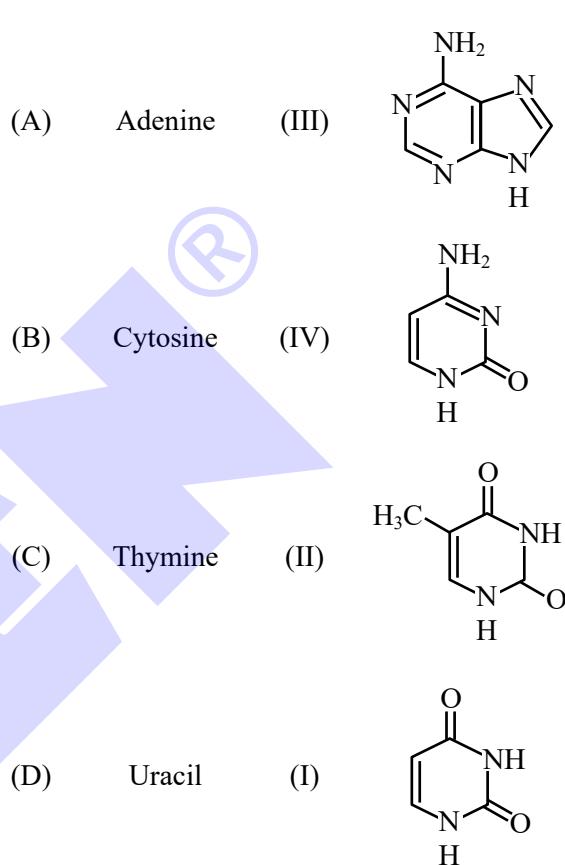


Choose the **correct** answer from the options given below :

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

Ans. (1)

Sol.



70. The successive 5 ionisation energies of an element are 800, 2427, 3658, 25024 and 32824 kJ/mol, respectively. By using the above values predict the group in which the above element is present :

- (1) Group 2
 (2) Group 13
 (3) Group 4
 (4) Group 14

Ans. (2)

Sol. The IE_4 is suddenly very high therefore element must have 3 valence e^- s and it belong to group 13



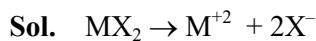
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SECTION-B

71. The observed and normal masses of compound MX_2 are 65.6 and 164 respectively. The percent degree of ionisation of MX_2 is _____.%.
(Nearest integer)

Ans. (75)



$$i = \frac{\text{normal molar mass}}{\text{observed molar mass}}$$

$$i = \frac{164}{65.6}$$

$$1 + (3 - 1)\alpha = \frac{164}{65.6}$$

$$2\alpha = \frac{98.4}{65.6}$$

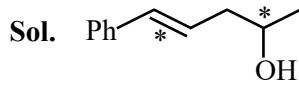
$$\alpha = 0.75$$

percent dissociation = 75%

Ans. 75

72. The possible number of stereoisomers for 5-phenylpent-4-en-2-ol is _____.

Ans. (4)



n (stereogenic unit) = 2, $2^2 = 4$ stereoisomers are possible.

73. Consider a complex reaction taking place in three steps with rate constants k_1 , k_2 and k_3 respectively.

The overall rate constant k is given by the expression $k = \sqrt{\frac{k_1 k_3}{k_2}}$. If the activation energies of

the three steps are 60, 30 and 10 kJ mol^{-1} respectively, then the overall energy of activation in kJ mol^{-1} is _____. (Nearest integer)

Ans. (20)

Sol. $K = \sqrt{\frac{K_1 K_3}{K_2}}$

$$A.e^{-E_a/RT} = \sqrt{\frac{A_1 e^{-E_{a_1}/RT} \times A_3 e^{-E_{a_3}/RT}}{A_2 e^{-E_{a_2}/RT}}}$$

By comparing exponential term

$$\frac{E_a}{RT} = \frac{1}{2} \times \left(\frac{E_{a_1}}{RT} + \frac{E_{a_3}}{RT} - \frac{E_{a_2}}{RT} \right)$$

$$E_a = (E_{a_1} + E_{a_3} - E_{a_2}) / 2$$

$$E_a = (60 + 10 - 30) / 2 = 20 \text{ kJ mol}^{-1}$$

Ans. 20

74. The hydrocarbon (X) with molar mass 80 g mol^{-1} and 90% carbon has _____ degree of unsaturation.

Ans. (3)

Sol. Mass of carbon = $\frac{80 \times 90}{100} = 72 \text{ gm}$

$$\text{Number of C-atoms} = \frac{72}{12} = 6$$

$$\text{Mass of hydrogen} = \frac{80 \times 10}{800} = 8 \text{ gm}$$

$$\text{Number of H-atoms} = \frac{8}{1} = 8$$

So molecular formula C_6H_8

$$\text{D.U.} = 6 + 1 - 8/2 = 7 - 4 = 3$$

75. In Carius method of estimation of halogen, 0.25 g of an organic compound gave 0.15 g of silver bromide (AgBr). The percentage of Bromine in the organic compound is _____ $\times 10^{-1}\%$ (Nearest integer).

(Given : Molar mass of Ag is 108 and Br is 80 g mol^{-1})

Ans. (255)

Sol. % Bromine = $\frac{\text{Molar Mass of Bromine}}{\text{Molar Mass of Silver bromide}} \times \frac{\text{Weight of AgBr}}{\text{Weight of sample}} \times 100$

$$= \frac{80}{188} \times \frac{0.165}{0.25} \times 100$$

$$= \frac{4800}{188} = 25.53 = 255 \times 10^{-1}$$



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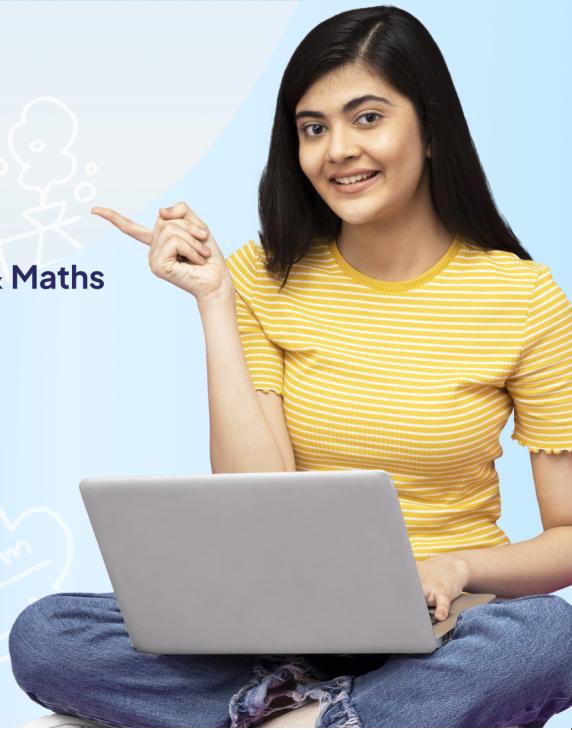


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