

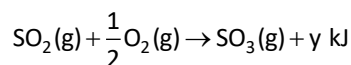
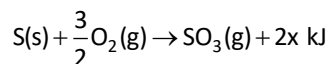
CHEMISTRY

SECTION - A

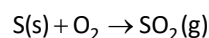
Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

1. Consider the following reactions



Calculate ΔH_r for following reaction based on above information



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

Answer (4)

Sol. $\Delta H_1 = -2x \text{ kJ}$

$$\Delta H_2 = -y \text{ kJ}$$

$$\Delta H_r = \Delta H_1 - \Delta H_2$$

$$\Delta H_r = -2x + y$$

2. The conditions and consequences that favour the $t_{2g}^3 e_g^1$ configuration in a metal complex are
- (1) Strong field ligand; High spin complex
 - (2) Weak field ligand; High spin complex
 - (3) Strong field ligand; Low spin complex
 - (4) Weak field ligand; Low spin complex

Answer (2)

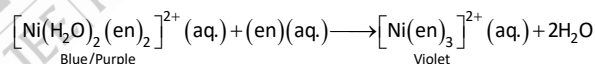
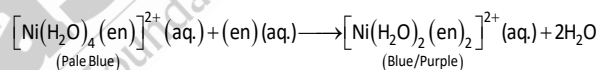
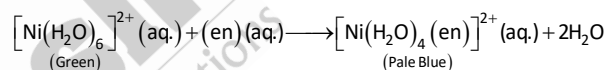
Sol. The electronic configuration of $t_{2g}^3 e_g^1$ for central metal ion in a complex implies $\Delta_0 < P$ i.e., weak field ligand and High spin complex.

3. When ethane-1, 2-diammine is progressively added to aqueous solution of Nickel (II) chloride, the sequence of colour change observed will be:

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

Answer (4)

Sol. If the bidentate ligand, ethane-1, 2-diammine(en) is progressively added in the molar ratio en: Ni 1 : 1, 2 : 1, 3 : 1, the following series of reactions and their associated colour changes occur:-



4. S-I :- The first ionisation energy of Pb is greater than that of Sn.

S-II:- The first ionisation energy of Ge is greater than that of Si.

- (1) S-I and S-II both are correct
- (2) S-I is correct and S-II incorrect
- (3) S-I is incorrect and S-II correct
- (4) S-I and S-II both are incorrect

Answer (2)

Sol. IE_1 of Pb = 715 kJ/mol

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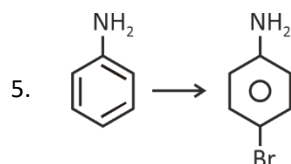
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IE_1 of Sn = 708 kJ/mol

 IE_1 of Si = 786 kJ/mol

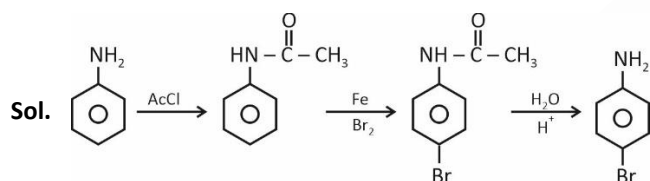
 IE_1 of Ge = 761 kJ/mol

SI is correct and S-II is incorrect



Above conversion can be done by using which reagents among the following.

- (1) $Fe/Br_2, H_2O(\Delta), H_2SO_4$
- (2) $AcOH, H_2SO_4, Br_2, NaOH$
- (3) $AcCl, Fe/Br_2, H_2O/H^+$
- (4) $AcOH, Br_2/Fe, NaOH$

Answer (3)


6. Match Column-I with the Column-II and select the correct option.

Column-I
(Ionic species)

Column-II
(Spin only magnetic moment (BM))

- | | |
|--------------|----------|
| A. Sc^{3+} | (P) 2.84 |
| B. Ti^{2+} | (Q) 0 |
| C. V^{2+} | (R) 5.92 |
| D. Mn^{2+} | (S) 3.87 |
- (1) $A \rightarrow (P), B \rightarrow (Q), C \rightarrow (R), D \rightarrow (S)$
 - (2) $A \rightarrow (R), B \rightarrow (S), C \rightarrow (P), D \rightarrow (Q)$
 - (3) $A \rightarrow (Q), B \rightarrow (P), C \rightarrow (S), D \rightarrow (R)$
 - (4) $A \rightarrow (Q), B \rightarrow (P), C \rightarrow (R), D \rightarrow (S)$

Answer (3)
Sol. $Sc^{3+} \rightarrow 0 \text{ BM}$
 $Ti^{2+} \rightarrow 2.84 \text{ BM}$
 $V^{2+} \rightarrow 3.87 \text{ BM}$
 $Mn^{2+} \rightarrow 5.92 \text{ BM}$

7. If a compound contains 54.2% carbon, 9.2% hydrogen and the rest is oxygen. What is molecular formula of the compound, if molecular mass is 132 g/mol?

- (1) $C_6H_{12}O_3$
- (2) $C_4H_{12}O_3$
- (3) $C_4H_{12}O_6$
- (4) $C_6H_{13}O_6$

Answer (1)
Sol. Let mass of compound be 100 g

	Mass (g)	Mole	Molar ratio
C	54.2	$\frac{54.2}{12} = 4.52$	2
H	9.2	$\frac{9.2}{1} = 9.2$	4
O	36.6	$\frac{36.6}{16} = 2.3$	1

 Empirical formula = C_2H_4O

$$\Rightarrow MF = n(EF)$$

$$n = \frac{MF \text{ mass}}{EF \text{ mass}}$$

$$\frac{132}{44} = 3$$

$$MF = 3(C_2H_4O)$$

$$= C_6H_{12}O_3$$



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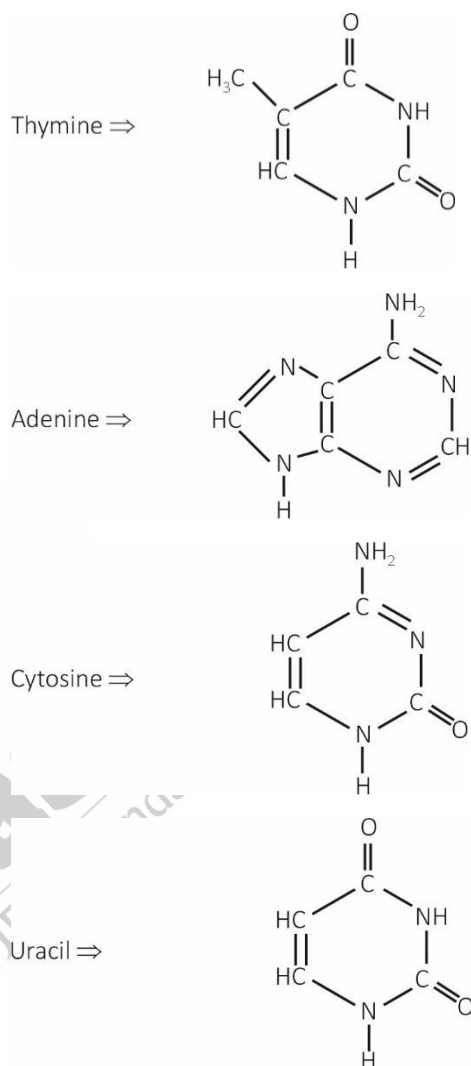
8. Match the following nitrogenous bases present in List-I with their structures present in List-II.

List-I	List-II
A. Thymine	(i)
B. Adenine	(ii)
C. Cytosine	(iii)
D. Uracil	(iv)

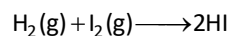
- (1) A-(i), B-(ii), C-(iii), D-(iv)
 (2) A-(ii), B-(i), C-(iv), D-(iii)
 (3) A-(ii), B-(i), C-(iii), D-(iv)
 (4) A-(iii), B-(iv), C-(i), D-(ii)

Answer (2)

Sol. Correct structure of



9. Consider the following gaseous reaction

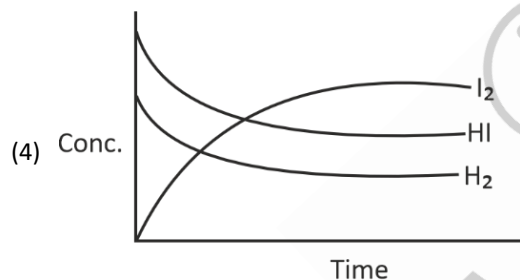
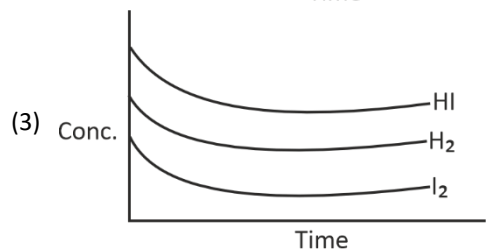
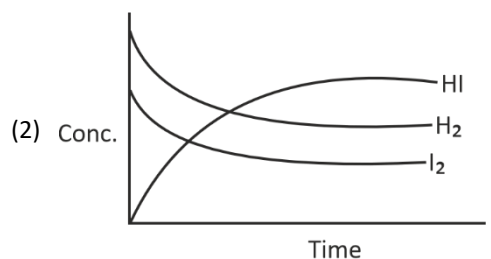
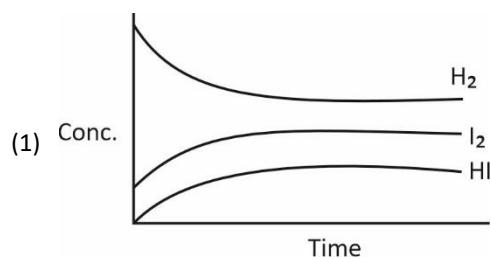


The above reaction is started with 'a' moles of H_2 and 'b' moles of I_2 in a closed container at a certain temperature T(K) till the equilibrium is established. Which one of the following plots correctly describes the progress of reaction?

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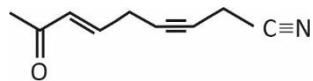
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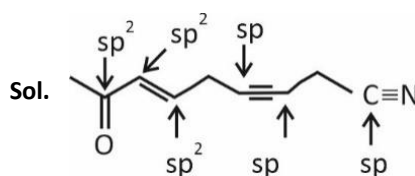
**Answer (2)**

Sol. The reaction is started with certain concentrations of H_2 and I_2 to form HI . The concentrations of H_2 and I_2 decrease with time while the concentration of HI increases with time till their concentrations become constant at equilibrium.

10. In the given compound no. of sp and sp^2 hybridised carbon are



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

Answer (4)

11. The successive ionisation energy (I.E.) of an element 'X' is given

	I.E ₁	I.E ₂	I.E ₃	I.E ₄	I.E ₅
X →	500	600	2000	2200	2600

Data given in KJ/mol.

Find out the group number of element X.

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

Answer (3)

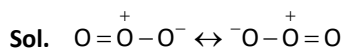
Sol. Since the ratio of $\frac{I.E_3}{I.E_2}$ is maximum, so the element X belongs to group 2.

12. Consider the following statements :

Statement-I : Oxygen-oxygen bond in O_3 is greater than O_2 .

Statement-II : O – O bond order in O_3 is 1.5 and O – O bond order in O_2 is 2.

- (1) Both Statement-I and Statement-II are correct
(2) Both Statement-I and Statement-II are incorrect
(3) Statement-I is correct, Statement-II is incorrect
(4) Statement-I is incorrect, Statement-II is correct

Answer (1)

$$\text{Bond order} = \frac{3}{2} = 1.5$$



$$\text{Bond order} = 2$$



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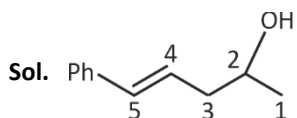
13.
14.
15.
16.
17.
18.
19.
20.

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. How many stereoisomers are possible for 5-Phenylpent-4-en-2-ol.

Answer (4)



There are two centre which can show stereoisomers, one chiral centre and one geometrical centre.

For unsymmetrical compound

Total isomers = 2^n

$$n = 2$$

$$= 2^2$$

$$= 4$$

22. A hydrocarbon X which has molar mass 80 g contains 90% carbon by mass. Find degree of unsaturation in X

Answer (3)

Sol. Mass of C-atom = $\frac{90}{100} \times 80$ g
= 72 g

$$\text{Moles of C-atom} = \frac{72}{12} = 6 \text{ mol C}$$

$$\text{Mass of H-atom} = \frac{10}{100} \times 80 = 8 \text{ g}$$

$$\text{Moles of H-atom} = \frac{8}{1} = 8 \text{ mol H}$$

$\therefore$ Molecular formula of X $\rightarrow$ C_6H_8

$$\text{D.U} = \text{C} + 1 - \frac{\text{H}}{2}$$

$$= 6 + 1 - \frac{8}{2}$$

$$= 7 - 4 = 3$$

Degree of unsaturation $\rightarrow$ 3

23. In Carius method of estimation of halogen, 0.25 g of an organic compound gave 0.16 g of AgBr. What is the percentage of bromine in the organic compound (Given molar mass of Ag = 108, Br = 80)

Answer (27)

Sol. Moles of AgBr = $\frac{0.16}{188}$ moles

$$\text{Mass of Br} = \frac{0.16}{188} \times 80 \text{ g}$$

$$= 0.068 \text{ g}$$

$$\% \text{ of Br} = \frac{0.068}{0.25} \times 100$$

$$= 27\%$$

24. Let k_1 , k_2 and k_3 be the rate constant of reaction and

$$k = \sqrt{\frac{k_1 k_3}{k_2}}. \text{ Then find activation energy of overall}$$

reaction. (Given : $E_{a_1} = 10 \text{ kJ/mol}$, $E_{a_2} = 30 \text{ kJ/mol}$, $E_{a_3} = 60 \text{ kJ/mol}$)

Answer (20)

Sol. $(E_a)_{\text{overall}} = \frac{1}{2} [E_{a_1} + E_{a_3} - E_{a_2}]$

$$= \frac{1}{2} [10 + 60 - 30]$$

$$= 20 \text{ kJ/mole}$$

25.



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