

**IIT-JEE-2009**

**PAPER – II**

**CHEMISTRY**

**[Time allowed: 3 hours] [Maximum Marks: 240]**

**General Instruction:**

**A. Question paper format:**

1. **Section I** contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.
2. **Section II** contains **5 multiple choice questions**. Each question has four choice (A), (B), (C) and (D) out of which **ONE or MORE are correct**.
3. **Section III** contains **2 questions**. Each question has four statements (A, B, C and D) given in column I and five statements (p, q, r, s and t) in Column II. Any given statement in column I can have correct matching with one or more statements(s) given in column II. For example, if for a given question, statement B matches with the statements given in q and r, then for that particular question, against statement B, darken the bubbles corresponding to q and r in the ORS.
4. **Section IV** contains **8 questions**. The answer to each question is a **single digit integer**, ranging from 0 to 9. The answer will have to be appropriately bubbled in the ORS as per the instructions given at the beginning of the section.

**B. Marking scheme:**

5. For each question in **Section I**, you will be **awarded 3 marks** if you darken only the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. In all other cases, **minus one (-1) mark** will be awarded.
6. For each question in **Section II**, you will be **awarded 4 marks** if you darken only the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. In all other cases, **minus one (-1) mark** will be awarded.

13. For each question in **Section III**, you will be **awarded 2 marks** if you darken only the bubble corresponding to the correct answer. Thus, each question in this section carries a maximum of 8 marks. There is **no negative marking** for incorrect answer(s) for this section.
14. For each question in **Section IV**, you will be **awarded 4 marks** if you darken only the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. In all other cases, **minus one (-1) mark** will be awarded.

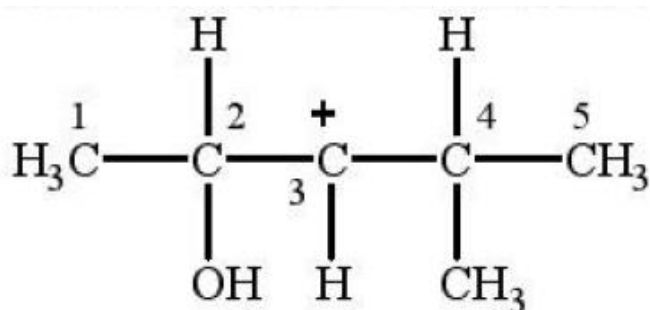


## SECTION – I

### Single Correct Choice Type

This section contains 8 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct.

1. In the following carbocation. H/CH<sub>3</sub> that is most likely to migrate to the positively charged carbon is



- (A) CH<sub>3</sub> at C-4  
 (B) H at C-4  
 (C) CH<sub>3</sub> at C-2  
 (D) H at C-2
2. The correct stability order of the following resonance structures is

- (I)  $\text{H}_2\text{C}=\overset{+}{\text{N}}=\overset{-}{\text{N}}$   
 (II)  $\text{H}_2\overset{+}{\text{C}}-\text{N}=\overset{-}{\text{N}}$   
 (III)  $\text{H}_2\overset{-}{\text{C}}-\overset{+}{\text{N}}=\text{N}$   
 (IV)  $\text{H}_2\overset{-}{\text{C}}-\text{N}=\overset{+}{\text{N}}$

(A) (I) > (II) > (IV) > (III)

(B) (I) > (III) > (II) > (IV)

(C) (II) > (I) > (III) > (IV)

(D) (III) > (I) > (IV) > (II)

3. The spin only magnetic moment value (in Bohr magneton units) of  $\text{Cr}(\text{CO})_6$  is

(A) 0

(B) 2.84

(C) 4.90

(D) 5.92

4. For a first order reaction  $A \rightarrow P$ , the temperature ( $T$ ) dependent rate constant ( $k$ ) was

found to follow the equation  $\log k = -(2000)\frac{1}{T} + 6.0$ . The pre-exponential factor  $A$  and the activation energy  $E_a$ , respectively, are

(A)  $1.0 \times 10^6 \text{ s}^{-1}$  and  $9.2 \text{ kJ mol}^{-1}$

(B)  $6.0 \text{ s}^{-1}$  and  $16.6 \text{ kJ mol}^{-1}$

(C)  $1.0 \times 10^6 \text{ s}^{-1}$  and  $16.6 \text{ kJ mol}^{-1}$

(D)  $1.0 \times 10^6 \text{ s}^{-1}$  and  $38.3 \text{ kJ mol}^{-1}$

## SECTION-II Multiple Correct Choice Type

This section contains 5 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, **out** which **ONE OR MORE** is/are correct.

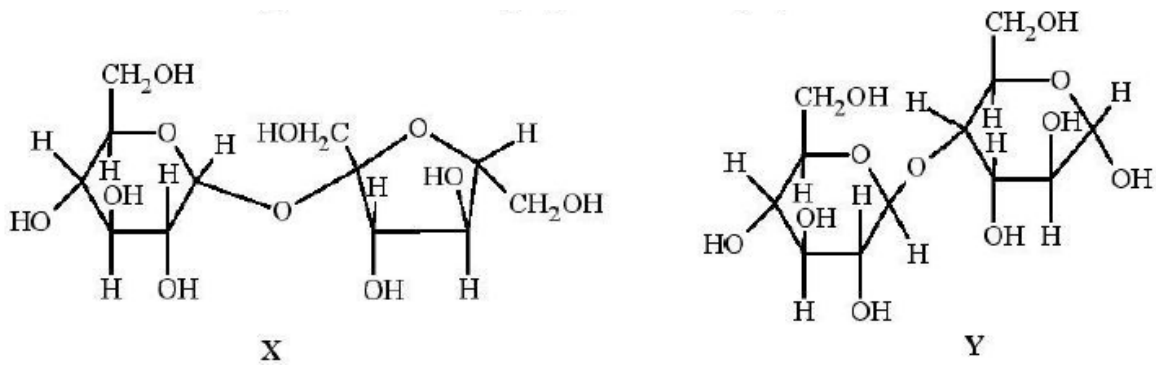
5. The nitrogen oxide(s) that contain(s) N–N bond(s) is(are)



6. In the reaction  $2\text{X} + \text{B}_2\text{H}_6 \rightarrow [\text{BH}_2(\text{X})_2]^+ [\text{BH}_4]^-$  the amine(s) X is(are)



7. The correct statement(s) about the following sugars  $X$  and  $Y$  is(are)

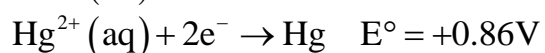
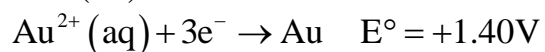
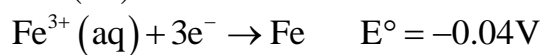


- (A)  $X$  is a reducing sugar and  $Y$  is a non-reducing sugar
- (B)  $X$  is a non-reducing sugar and  $Y$  is a reducing sugar
- (C) The glucosidic linkages in  $X$  and  $Y$  are  $\alpha$  and  $\beta$ , respectively
- (D) The glucosidic linkages in  $X$  and  $Y$  are  $\beta$  and  $\alpha$ , respectively

8. Among the following, the state function(s) is(are)

- (A) Internal energy
- (B) Irreversible expansion work
- (C) Reversible expansion work
- (D) Molar enthalpy

9. For the reduction of  $\text{NO}_3^-$  ion in an aqueous solution,  $E^\circ$  is  $+0.96\text{V}$ . Values of  $E^\circ$  for some metal ions are given below



The pair(s) of metals that is(are) oxidized by  $\text{NO}_3^-$  in aqueous solution is(are)

- (A) V and Hg
- (B) Hg and Fe
- (C) Fe and Au
- (D) Fe and V



**SECTION – III**

**Matrix - Match Type**

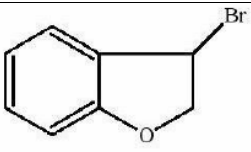
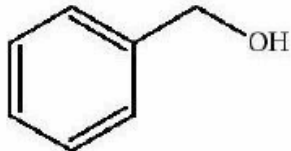
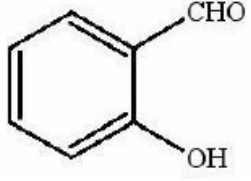
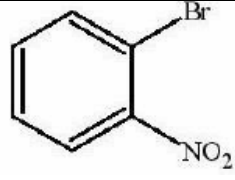
This section contains 2 questions. Each question contains statements given in two columns, which have to be matched. The statements in Column I are labelled A, B, C and D, while the statements in Column II are labelled p, q, r, s and t. Any given statement in Column I can have correct matching with ONE OR MORE statements) in Column II. The appropriate bubbles corresponding to the answers to these questions have to be darkened as illustrated in the following example:

If the correct matches are A - p, s and t; B - q and r; C - p and q; and D - s and t then the correct darkening of bubbles will look like the following:

	p	q	r	s	t
A	<input checked="" type="checkbox"/> p	<input type="checkbox"/> q	<input type="checkbox"/> r	<input checked="" type="checkbox"/> s	<input checked="" type="checkbox"/> t
B	<input type="checkbox"/> p	<input checked="" type="checkbox"/> q	<input checked="" type="checkbox"/> r	<input type="checkbox"/> s	<input type="checkbox"/> t
C	<input checked="" type="checkbox"/> p	<input checked="" type="checkbox"/> q	<input type="checkbox"/> r	<input type="checkbox"/> s	<input type="checkbox"/> t
D	<input type="checkbox"/> p	<input type="checkbox"/> q	<input type="checkbox"/> r	<input checked="" type="checkbox"/> s	<input checked="" type="checkbox"/> t



10. Match each of the compounds given in Column I with the reaction(s), that they can undergo given in Column II.

Column-I	Column-II
(A) 	(p) Nucleophilic substitution
(B) 	(q) Elimination
(C) 	(r) Nucleophilic addition
(D) 	(s) Esterification with acetic anhydride
	(t) Dehydrogenation

11. Match each of the reactions given in Column I with the corresponding produces) given in Column II.

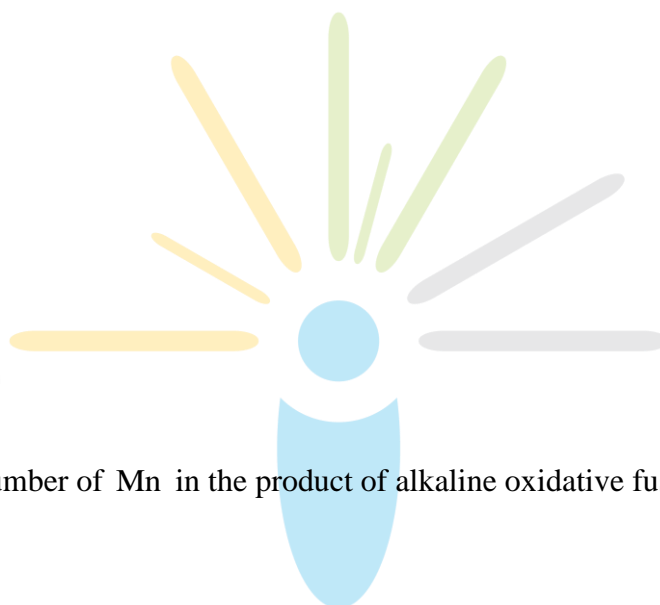
Column-I	Column-II
(A) $\text{Cu} + \text{dil HNO}_3$	(p) NO
(B) $\text{Cu} + \text{conc HNO}_3$	(q) $\text{NO}_2$
(C) $\text{Zn} + \text{dil HNO}_3$	(r) $\text{N}_2\text{O}$
(D) $\text{Zn} + \text{conc HNO}_3$	(s) $\text{Cu}(\text{NO}_3)_2$
	(t) $\text{Zn}(\text{NO}_3)_2$

## SECTION-IV

### Integer Answer Type

This section contains 8 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9. The appropriate bubbles below the respective question numbers in the ORS have to be darkened. For example, if the correct answers to question numbers X, Y, Z and W (say) are 6, 0, 9 and 2, respectively, then the correct darkening of bubbles will look like the following:

X	Y	Z	W
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9



12. The oxidation number of Mn in the product of alkaline oxidative fusion of  $\text{MnO}_2$  is
13. The number of water molecule(s) directly bonded to the metal centre in  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  is
14. The coordination number of Al in the crystalline state of  $\text{AlCl}_3$  is
15. In a constant volume calorimeter, 3.5 g of a gas with molecular weight 28 was burnt in excess oxygen at 298.0 K. The temperature of the calorimeter was found to increase from 298.0 K to 298.45 K due to the combustion process. Given that the heat capacity of the calorimeter is  $2.5 \text{ kJ}^{-1}$ , the numerical value for the enthalpy of combustion of the gas in  $\text{kJmol}^{-1}$  is

16. The dissociation constant of a substituted benzoic acid at  $25^{\circ}\text{C}$  is  $1.0 \times 10^{-4}$ . The pH of 0.01M solution of its sodium salt is
17. The total number of cyclic structural as well as stereo isomers possible for a compound with the molecular formula  $\text{C}_5\text{H}_{10}$  is
18. The total number of  $\alpha$  and  $\beta$  particles emitted in the nuclear reaction  ${}_{92}^{238}\text{U} \rightarrow {}_{82}^{214}\text{Pb}$  is
19. At 400 K, the root mean square (rms) speed of a gas X (molecular weight = 40) is equal to the most probable speed of gas Y at 60 K. The molecular weight of the gas Y is

