

PART II

Useful data:Gas Constant, $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ $1 F = 96500 \text{ C}$

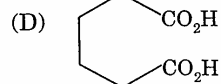
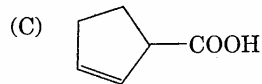
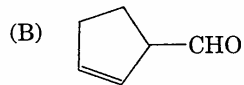
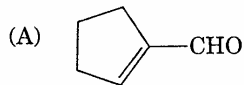
Atomic Numbers: $H = 1, Li = 3, B = 5, C = 6, N = 7, O = 8, F = 9, Na = 11, P = 15,$
 $S = 16, Cl = 17, Ar = 18, K = 19, V = 23, Cr = 24, Mn = 25,$
 $Fe = 26, Co = 27, Ni = 28, Cu = 29, Zn = 30, Ge = 32, Br = 35,$
 $Ag = 47, I = 53, Xe = 54, Pt = 78, Hg = 80, Pb = 82.$

SECTION - I

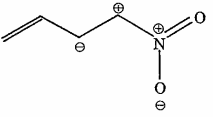
Straight Objective Type

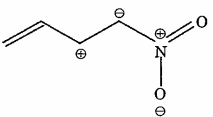
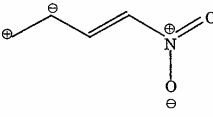
This section contains 9 multiple choice questions numbered 23 to 31. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

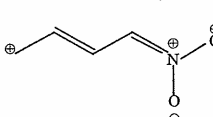
23. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is
 (A) 3 (B) 4 (C) 5 (D) 6
24. Among the following metal carbonyls, the C-O bond order is lowest in
 (A) $[\text{Mn}(\text{CO})_6]^+$ (B) $[\text{Fe}(\text{CO})_5]$ (C) $[\text{Cr}(\text{CO})_6]$ (D) $[\text{V}(\text{CO})_6]^-$
25. A solution of a metal ion when treated with KI gives a red precipitate which dissolves in excess KI to give a colourless solution. Moreover, the solution of metal ion on treatment with a solution of cobalt(II) thiocyanate gives rise to a deep blue crystalline precipitate. The metal ion is
 (A) Pb^{2+} (B) Hg^{2+} (C) Cu^{2+} (D) Co^{2+}
26. Cyclohexene on ozonolysis followed by reaction with zinc dust and water gives compound E. Compound E on further treatment with aqueous KOH yields compound F. Compound F is



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27. The number of stereoisomers obtained by bromination of *trans*-2-butene is
 (A) 1 (B) 2 (C) 3 (D) 4
28. Among the following, the least stable resonance structure is
- (A) 

(B) 
- (C) 

(D) 
29. A positron is emitted from $^{23}_{11}\text{Na}$. The ratio of the atomic mass and atomic number of the resulting nuclide is
 (A) 22/10 (B) 22/11
 (C) 23/10 (D) 23/12
30. For the process $\text{H}_2\text{O}(l)$ (1 bar, 373 K) \rightarrow $\text{H}_2\text{O}(g)$ (1 bar, 373 K), the correct set of thermodynamic parameters is
 (A) $\Delta G = 0, \Delta S = +ve$ (B) $\Delta G = 0, \Delta S = -ve$
 (C) $\Delta G = +ve, \Delta S = 0$ (D) $\Delta G = -ve, \Delta S = +ve$
31. Consider a reaction $aG + bH \rightarrow \text{Products}$. When concentration of both the reactants G and H is doubled, the rate increases by eight times. However, when concentration of G is doubled keeping the concentration of H fixed, the rate is doubled. The overall order of the reaction is
 (A) 0 (B) 1 (C) 2 (D) 3

SECTION - II

Assertion - Reason Type

This section contains 4 questions numbered 32 to 35. Each question contains STATEMENT-1 (Assertion) and STATEMENT-2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

32. STATEMENT-1 : Alkali metals dissolve in liquid ammonia to give blue solutions.
because
STATEMENT-2 : Alkali metals in liquid ammonia give solvated species of the type $[\text{M}(\text{NH}_3)_n]^+$ (M = alkali metals).
- (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
- (B) Statement-1 is True; Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
- (C) Statement-1 is True, Statement-2 is False
- (D) Statement-1 is False, Statement-2 is True
33. STATEMENT-1 : Glucose gives a reddish-brown precipitate with Fehling's solution.
because
STATEMENT-2 : Reaction of glucose with Fehling's solution gives CuO and gluconic acid.
- (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
- (B) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
- (C) Statement-1 is True, Statement-2 is False
- (D) Statement-1 is False, Statement-2 is True

34. STATEMENT-1 : Molecules that are not superimposable on their mirror images are chiral.

because

STATEMENT-2 : All chiral molecules have chiral centres.

- (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
- (B) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
- (C) Statement-1 is True, Statement-2 is False
- (D) Statement-1 is False, Statement-2 is True

35. STATEMENT-1 : Band gap in germanium is small.

because

STATEMENT-2 : The energy spread of each germanium atomic energy level is infinitesimally small.

- (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
- (B) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
- (C) Statement-1 is True, Statement-2 is False
- (D) Statement-1 is False, Statement-2 is True

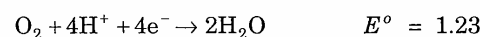
SECTION - III

Linked Comprehension Type

This section contains 2 paragraphs C36-38 and C39-41. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

C36-38 : Paragraph for Question Nos. 36 to 38

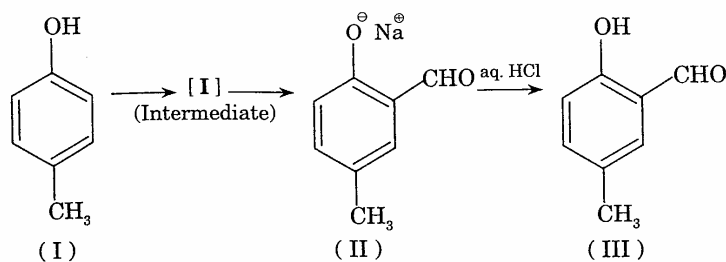
Redox reactions play a pivotal role in chemistry and biology. The values of standard redox potential (E°) of two half-cell reactions decide which way the reaction is expected to proceed. A simple example is a Daniel cell in which zinc goes into solution and copper gets deposited. Given below are a set of half-cell reactions (acidic medium) along with their E° (V with respect to normal hydrogen electrode) values. Using this data obtain the correct explanations to Questions 36-38.



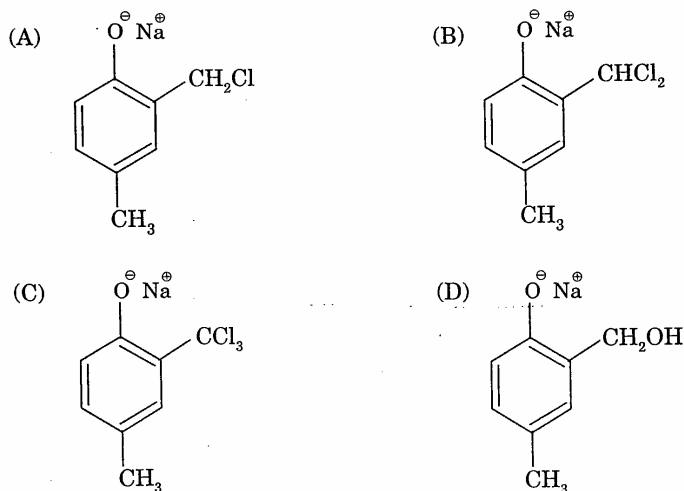
36. Among the following, identify the correct statement.
 (A) Chloride ion is oxidised by O_2 (B) Fe^{2+} is oxidised by iodine
 (C) Iodide ion is oxidised by chlorine (D) Mn^{2+} is oxidised by chlorine
37. While Fe^{3+} is stable, Mn^{3+} is not stable in acid solution because
 (A) O_2 oxidises Mn^{2+} to Mn^{3+}
 (B) O_2 oxidises both Mn^{2+} to Mn^{3+} and Fe^{2+} to Fe^{3+}
 (C) Fe^{3+} oxidises H_2O to O_2
 (D) Mn^{3+} oxidises H_2O to O_2
38. Sodium fusion extract, obtained from aniline, on treatment with iron(II) sulphate and H_2SO_4 in presence of air gives a Prussian blue precipitate. The blue colour is due to the formation of
 (A) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ (B) $\text{Fe}_3[\text{Fe}(\text{CN})_6]_2$
 (C) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_2$ (D) $\text{Fe}_3[\text{Fe}(\text{CN})_6]_3$

C₃₉₋₄₁ : Paragraph for Question Nos. 39 to 41

Riemer-Tiemann reaction introduces an aldehyde group, on to the aromatic ring of phenol, *ortho* to the hydroxyl group. This reaction involves electrophilic aromatic substitution. This is a general method for the synthesis of substituted salicylaldehydes as depicted below.



39. Which one of the following reagents is used in the above reaction?
 (A) aq. NaOH + CH₃Cl (B) aq. NaOH + CH₂Cl₂
 (C) aq. NaOH + CHCl₃ (D) aq. NaOH + CCl₄
40. The electrophile in this reaction is
 (A) :CHCl (B) ⁺CHCl₂ (C) :CCl₂ (D) ·CCl₃
41. The structure of the intermediate I is



SECTION - IV

Matrix-Match Type

This section contains 3 questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column I** have to be matched with statements (p, q, r, s) in **Column II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.

If the correct matches are A-p, A-s, B-q, B-r, C-p, C-q and D-s, then the correctly bubbled 4×4 matrix should be as follows :

	p	q	r	s
A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
B	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

42. Match the reactions in **Column I** with nature of the reactions/type of the products in **Column II**. Indicate your answer by darkening the appropriate bubbles of the 4×4 matrix given in the ORS.

Column I

Column II

- | | |
|--|--|
| (A) $O_2^- \rightarrow O_2 + O_2^{2-}$ | (p) redox reaction |
| (B) $CrO_4^{2-} + H^+ \rightarrow$ | (q) one of the products has trigonal planar structure. |
| (C) $MnO_4^- + NO_2^- + H^+ \rightarrow$ | (r) dimeric bridged tetrahedral metal ion |
| (D) $NO_3^- + H_2SO_4 + Fe^{2+} \rightarrow$ | (s) disproportionation |

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43. Match the compounds/ions in **Column I** with their properties/reactions in **Column II**. Indicate your answer by darkening the appropriate bubbles of the 4×4 matrix given in the ORS.

Column I**Column II**

- | | |
|-----------------------|---|
| (A) C_6H_5CHO | (p) gives precipitate with 2,4-dinitrophenylhydrazine |
| (B) $CH_3C \equiv CH$ | (q) gives precipitate with $AgNO_3$ |
| (C) CN^- | (r) is a nucleophile |
| (D) I^- | (s) is involved in cyanohydrin formation |

44. Match the crystal system/unit cells mentioned in **Column I** with their characteristic features mentioned in **Column II**. Indicate your answer by darkening the appropriate bubbles of the 4×4 matrix given in the ORS.

Column I**Column II**

- | | |
|---|--|
| (A) simple cubic and face-centred cubic | (p) have these cell parameters $a = b = c$ and $\alpha = \beta = \gamma$ |
| (B) cubic and rhombohedral | (q) are two crystal systems |
| (C) cubic and tetragonal | (r) have only two crystallographic angles of 90° |
| (D) hexagonal and monoclinic | (s) belong to same crystal system |