

H: CHEMISTRY (COMPULSORY)

Q. 1 – Q. 5 carry one mark each.

Q.1 The molecule having net 'non-zero dipole moment' is

- (A) CCl_4 (B) NF_3 (C) CO_2 (D) BCl_3

Q.2 The Diels-Alder adduct from the reaction between cyclopentadiene and benzyne is

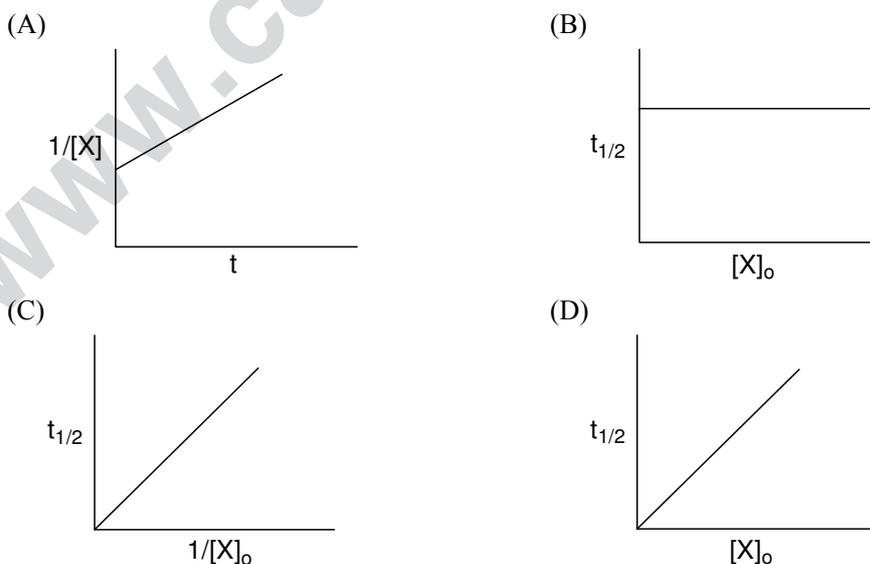


Q.3 The number of possible enantiomeric pair(s) in $\text{HOOC}-\text{CH}(\text{OH})-\text{CH}(\text{OH})-\text{COOH}$ is _____

Q.4 For the electrochemical reaction, $\text{Cu}^{2+}(\text{aq}) + \text{Zn}(\text{s}) \rightleftharpoons \text{Cu}(\text{s}) + \text{Zn}^{2+}(\text{aq})$
 the equilibrium constant at 25°C is 1.7×10^{37} . The change in standard Gibbs free energy (ΔG°) for this reaction at that temperature will be _____ kJ mol^{-1} (up to one decimal place).
 (Given: $R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$)

Q.5 Among the following diagrams, the one that correctly describes a zero order reaction ($\text{X} \rightarrow \text{product}$) is

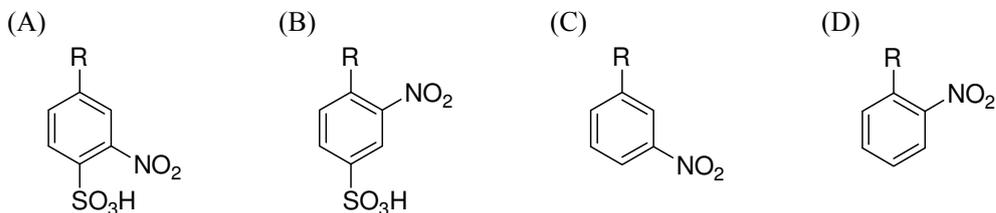
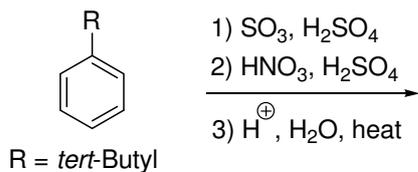
(Given: $[\text{X}]_0$ = initial concentration of reactant X; $[\text{X}]$ = concentration of reactant X at time t and $t_{1/2}$ = half-life period of reactant X)



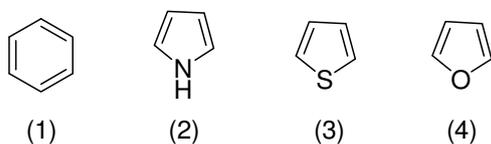
Q. 6 – Q. 15 carry two marks each.

- Q.6 If the radius of first Bohr orbit is 0.53 \AA , then the radius of the third Bohr orbit is
 (A) 2.12 \AA (B) 4.77 \AA (C) 1.59 \AA (D) 3.18 \AA
- Q.7 If 50 mL of 0.02 M HCl is added to 950 mL of H_2O , then the pH of the final solution will be _____
- Q.8 Stability of $[\text{CrCl}_6]^{3-}$ (X), $[\text{MnCl}_6]^{3-}$ (Y) and $[\text{FeCl}_6]^{3-}$ (Z) follows the order
 (Given: Atomic numbers of Cr = 24, Mn = 25 and Fe = 26)
 (A) $X > Y > Z$ (B) $X < Y < Z$ (C) $Y < X < Z$ (D) $X < Y = Z$
- Q.9 Among the following pairs, the paramagnetic and diamagnetic species, respectively, are
 (A) CO and O_2^- (B) NO and CO (C) O_2^{2-} and CO (D) NO^+ and O_2^-
- Q.10 In compounds $\text{K}_4[\text{Fe}(\text{CN})_6]$ (P) and $\text{Fe}(\text{CO})_5$ (Q), the iron metal centre is bonded to
 (A) C of CN^- in P and C of CO in Q
 (B) N of CN^- in P and C of CO in Q
 (C) C of CN^- in P and O of CO in Q
 (D) N of CN^- in P and O of CO in Q
- Q.11 Among the following reactions, the one that produces achiral alcohol (after hydrolysis) is
- (A) $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H} + \text{CH}_3\text{CH}_2\text{MgBr} \longrightarrow$
- (B) $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{Ph} + \text{CH}_3\text{CH}_2\text{MgBr} \longrightarrow$
- (C) $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OEt} + \text{CH}_3\text{CH}_2\text{MgBr} \longrightarrow$
- (D) $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2\text{CH}_2\text{CH}_3 + \text{CH}_3\text{CH}_2\text{MgBr} \longrightarrow$

Q.12 The major product from the following reaction is



Q.13 The order of resonance energy for the following molecules is



- (A) (1) > (3) > (2) > (4) (B) (1) > (3) > (4) > (2)
- (C) (1) > (4) > (2) > (3) (D) (1) > (4) > (3) > (2)

Q.14 The molar enthalpy of vaporization for a liquid (normal boiling point = 78.3 °C) is 39 kJ mol⁻¹. If the liquid has to boil at 25 °C, the pressure must be reduced to _____ Torr (up to one decimal place).

(Given: R = 8.314 JK⁻¹mol⁻¹; 1 atm = 760 Torr)

Q.15 For the process, H₂O(l) ⇌ H₂O(s) at 0 °C and 1 atm, the correct statement is

- (A) $\Delta S_{\text{system}} = 0$ (B) $\Delta S_{\text{total}} > 0$ (C) $\Delta S_{\text{total}} = 0$ (D) $\Delta S_{\text{total}} < 0$

END OF THE QUESTION PAPER