

KATHMANDU UNIVERSITY
End Semester Examination
March, 2025

Marks Scored:

Level : B.E.

Course : CHEM 101

Year : I

Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date 24 MAR 2025

SECTION "A"

[10Q. × 1 = 10 marks]

Choose and Mark [X] the most appropriate answer from the given ones.

- The conjugate base of NH_3 is
 $\cdot\text{NH}_2$ NH_2^- NH_4^+ $\cdot\text{NH}_3^+$
- For a reaction, $\text{A} + \text{B} \longrightarrow \text{C}$, the rate law equation is $\frac{d[\text{C}]}{dt} = k[\text{A}]^{\frac{3}{2}}[\text{B}]^0$. On increasing the concentration of A and B by four times, the rate of reaction is increased by _____ times.
 4 6 8 16
- If the equilibrium constants for $\text{H}_2\text{O}_{(g)} = \text{H}_{2(g)} + \frac{1}{2}\text{O}_{2(g)}$ and $2\text{H}_{2(g)} + \text{O}_{2(g)} = 2\text{H}_2\text{O}_{(g)}$ are K_1 and K_2 respectively, which one of the following relations is correct?
 $K_2 = \frac{1}{K_1}$ $K_2 = \left(\frac{1}{K_1}\right)^{\frac{1}{2}}$ $K_2 = 2\left(\frac{1}{K_1}\right)$ $K_2 = \left(\frac{1}{K_1}\right)^2$
- If both ΔH and ΔS are positive, the process will be spontaneous at _____.
 high temperature low temperature high pressure low pressure
- For a reaction, $2\text{NO}_2(g) \rightleftharpoons \text{N}_2\text{O}_4(g)$, at equilibrium, $K = \frac{[\text{N}_2\text{O}_4]}{[\text{NO}_2]^2}$
 When the volume is increased, the relation between equilibrium constant (K) and concentration quotient (Q) becomes
 $K = Q$ $K > Q$ $K < Q$ $K \geq Q$
- The unit of rate constant for first order reaction is
 sec^{-1} M sec^{-1} $\text{M}^{-1} \text{sec}^{-1}$ $\text{M}^{-2} \text{sec}^{-1}$
- The indicator *phenol red* is
 weak acid weak base acidic buffer basic buffer
- The Nernst equation is used to calculate
 Standard cell potential Concentration of electrolyte solution
 Standard electrode potential Cell potential under non-standard condition
- Which one of the following salts has higher solubility in water at 25°C ?
 CaF_2 with $K_{sp} = 1.7 \times 10^{-10}$ CaSO_4 with $K_{sp} = 2.4 \times 10^{-5}$
 BaSO_4 with $K_{sp} = 1.1 \times 10^{-10}$ BaF_2 with $K_{sp} = 1.7 \times 10^{-6}$

10. The standard electrode potential of two half cells are,
 $\text{Zn}^{2+} + 2\text{e}^- = \text{Zn} \quad E^\circ = -0.76 \text{ V}$
 $\text{Fe}^{2+} + 2\text{e}^- = \text{Fe} \quad E^\circ = -0.44 \text{ V}$
 Which one of following is the strongest reducing agent?

Fe Zn Fe²⁺ Zn²⁺

SECTION "B"

[10Q. × 1 = 10 marks]

Fill in the blanks with appropriate words and values.

11. For a reaction, $2\text{MnO}_4^- + 5\text{C}_2\text{O}_4^{2-} + 16\text{H}^+ \longrightarrow 2\text{Mn}^{2+} + 10\text{CO}_2 + 8\text{H}_2\text{O}$, the required volume of 1M KMnO_4 to react completely with 0.35 mole of oxalate ion ($\text{C}_2\text{O}_4^{2-}$) is _____.
12. Liquids with low boiling point have _____ vapour pressure than liquids having high boiling point.
13. In concentration cell, the electrode immersed in more dilute solution is _____.
14. If $\Delta H_{\text{vap}} = 6.5 \text{ kcal/mol}$ for one mole of diethyl ether, the molar entropy change (ΔS_{vap}) for vaporization at 35°C is _____.
15. A substance has melting point (T_f) less than 35°C and molar heat capacities of solid (C_p) and liquid (C'_p). According to third law of thermodynamics, the standard absolute entropy (S_{298}°) of that substance at 298K is _____.
16. If the enthalpy change (ΔH_{sol}) for solution formation is positive, then the solubility of the solute _____ as temperature increases.
17. In 0.1 M NH_4Cl solution, the concentration of H^+ in the solution is _____. ($K_h = 5.6 \times 10^{-10}$)
18. If the heat is absorbed by the system during the reaction, the products have _____ internal energy than the reactants.
19. For a certain first order reaction, half life time ($t_{1/2}$) is 100 seconds. The time required for the 75% completion of this reaction is _____.
20. The value of ΔH° for the reaction, $\frac{1}{2}\text{N}_{2(\text{g})} + \frac{3}{2}\text{H}_{2(\text{g})} = \text{NH}_{3(\text{g})}$, in the temperature range between 673 K and 773 K is _____.
 (Given, $K = 1.3 \times 10^{-2}$ at 673 K and $K = 3.8 \times 10^{-3}$ at 773 K)