

IIT-JEE-Chemistry-Mains-2004

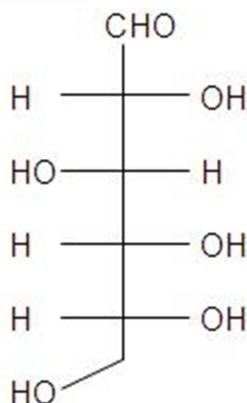
1. For the given reaction



Following data were given

Initial conc. (m/L)	Initial conc. (m/L)	Initial rate (mL ⁻¹ s ⁻¹)
[A] ₀	[B] ₀	
0.1	0.1	0.05
0.2	0.1	0.1
0.1	0.2	0.05

- (a) Write the rate equation.
 (b) Calculate the rate constant.
2. 100 mL of a liquid contained in an insulated container at a pressure of 1 bar. The pressure is steeply increased to 100 bar. The volume of the liquid is decreased by 1 mL at this constant pressure. Find the ΔH and ΔU .
3. Draw the shape of XeF_4 and OSF_4 according to VSEPR theory. Show the lone pair of electrons on the central atom.
4. The structure of D-Glucose is as follows :



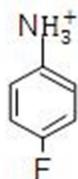
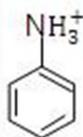
- (a) Draw the structures of L-Glucose.
(b) Give the reaction of L-Glucose with Tollen's reagent.
5. (a) Draw Newmann's projection the less stable staggered form of butane.
(b) Relatively less stability of the staggered form is due to :
- (i) Torsional strain
(ii) Van der Waal's strain
(iii) Combination of the above two

6. Arrange the following oxides in the increasing order of Bronsted basicity.



7. AlF_3 is insoluble in anhydrous HF but when little KF is added to the compound it becomes soluble. On addition of BF_3 , AlF_3 is precipitated. Write the balanced chemical equations.
8. The crystal AB (rock salt structure) has molecular weight $6.023 y$ amu. Where y is an arbitrary number in amu. If the minimum distance between cation and anion is $y^{1/3}$ nm and the observed density is 20 kg/m^3 . Find the:
- (a) density in kg/m^3 and
(b) type of defect

9. Which of the following is more acidic and why?

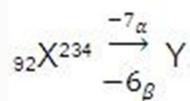


10. 7-bromo-1, 3, 5-cycloheptatriene exists as ionic species in aqueous solution while 5-bromo-1, 3 cyclopentadiene doesn't ionize even in presence of Ag^+ (aq). Explain.
11. (a) The Schrodinger wave equation for hydrogen atom is :

$$\Psi_{2s} = \frac{1}{4(2\pi)^{3/2}} \left(\frac{1}{a_0}\right)^{3/2} \left(2 - \frac{r}{a_0}\right) e^{-r/a_0}$$

Where a_0 is Bohr's radius. Let the radial node is 2s be at r_0 . Then find r_0 in terms of a_0

- (b) A base ball having mass 100 g moves with velocity 100 m/sec. Find out the value of wavelength of base ball.
- (c) Find out atomic number, mass number of Y and identify it.



12. On the basis of ground state electronic configuration arrange the following molecules in increasing O-O bond length order.



13. (a) In the following equilibrium



When 5 moles of each are taken, the temperature is kept at 298 K the total pressure was found to be 20 bar. Given that

$$\Delta G_f^0(\text{N}_2\text{O}_4) = 100 \text{ kJ}$$

$$\Delta G_f^0(\text{NO}_2) = 50 \text{ kJ}$$

- (i) Find ΔG of the reaction
- (ii) The direction of the reaction in which the equilibrium shifts

- (b) A graph is plotted for a real gas which follows van der Waal's equation with PV_m taken on Y-axis and P on X-axis. Find the intercept of the line where V_m is molar volume.

14. (a) 1.22 g $\text{C}_6\text{H}_5\text{COOH}$ is added into two solvent and data of DTb and Kb are given as:

- (i) In 100 g CH_3COCH_3 $\Delta T_b = 0.172, K_b = 1.7 \text{ kg Kelvin/mol}$
 (ii) In 100 benzene, $\Delta T_b = 0.13, K_b = 2.6 \text{ kg Kelvin/mol}$

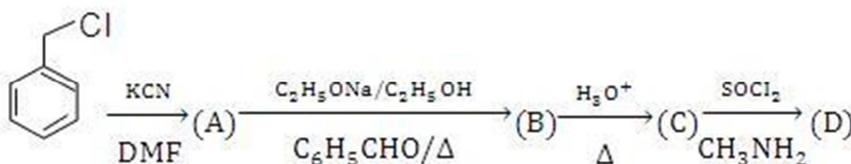
- (b) 0.1 M of HA is titrated with 0.1 M NaOH, calculate the pH at end point.
 Given $K_a(\text{HA}) = 5.6 \times 10^{-6}$ and $a \ll 1$.

15.



Convert in not more than four steps. Also mention the temperature and reaction condition.

16. Identify A to D.



17. A_1 and A_2 are two ores of metal M. A_1 on calcinations gives black precipitate, CO_2 and water.

18. NiCl_2 in the presence of dimethyl glyoxime (DMG) gives a complex which precipitates in the presence of NH_2OH , giving a bright red colour.

- (a) Draw its structure and show H-bonding
 (b) Give oxidation state of Ni and its hybridization
 (c) Predict whether it is paramagnetic or diamagnetic

19. Find the equilibrium constant for the reaction



Given that

$$E_{\text{Cu}^{+2}/\text{Cu}^+}^{\circ} = 0.15\text{V}, E_{\text{In}^{+2}/\text{In}^+}^{\circ} = 0.4\text{V}, E_{\text{In}^{+3}/\text{In}^+}^{\circ} = 0.42\text{V}$$

- 20.** An organic compound 'P' having the molecular formula $\text{C}_5\text{H}_{10}\text{O}$ treated with dil H_2SO_4 gives two compounds, Q and R both gives positive iodoform test. The reaction of $\text{C}_5\text{H}_{10}\text{O}$ with dil H_2SO_4 gives reaction 10^{15} times faster than ethylene. Identify organic compound of Q and R. Give the reason for the extra stability of P.