

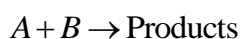
IIT-JEE-2004

Chemistry

[Time allowed: 2 hours]

Note: Question number 1 to 10 carries **2 marks** each and 11 to 20 carries **4 marks** each.

1. For the given reaction

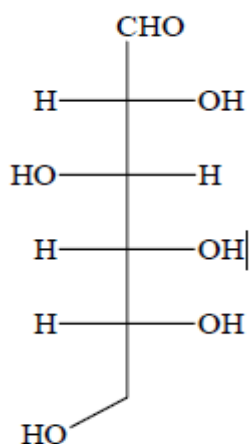


Following data were given

Initial conc.(m/L). [A]	Initial conc.(m/L) [B]	Initial rate [mL ⁻¹ S ⁻¹]
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 isolated 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 & 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 structure of *L* – Glucose.

b) Give the reaction of *L* – Glucose with Tollens reagent.

5. a) Draw New mann's projection for the less stable staggered form of butane.

b) Relatively less stability of the staggered form is due to

i) Torsional strain.

ii) Vander 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

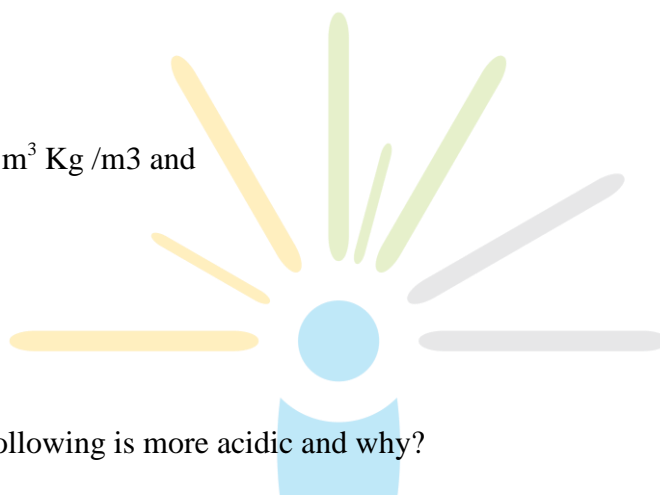
addition of BF_3 , AlF_3 is precipitated. Write the balanced chemical equations.

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 & anion is $y^{1/3}$ nm and the observed density is 20 Kg/m^3 .

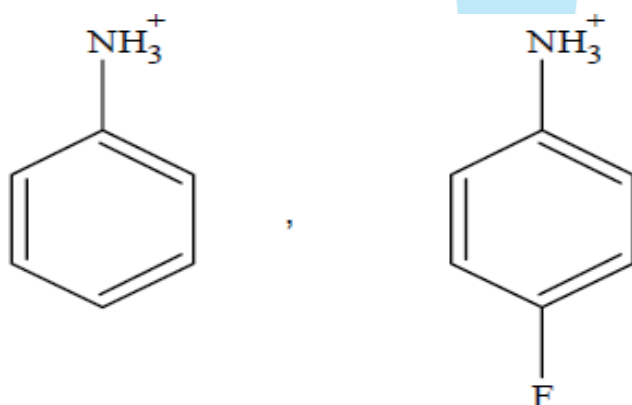
Find the

a) density in Kg/m^3 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 ionise even in presence of Ag^+ (aq), Explain.

11. a) The schrodinger wave equation for hydrogen atoms is

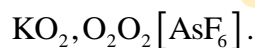
$$\Psi_{2s} = \frac{1}{4(2\pi)^{1/2}} \left(\frac{1}{a_0} \right)^{3/2} \left(2 - \frac{r}{a_0} \right) e^{-r/a_0}$$

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

b) A base ball having mass 100 g moves with velocity 100 m/sec. Find out the value of wave length of base ball.

c) ${}_{92}X^{234} \xrightarrow[-6\beta]{-7\alpha} Y$ 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

$$\Delta G_f^0(N_2O_4) = 100KJ$$

$$\Delta G_f^0(NO_2) = 50KJ$$

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 Vander Waal's equation with PV_m taken on Y -axis & P on X -axis. Find the intercept of the line where V_m is molar volume

14. a) 1.22 g C_6H_5COOH is added into two solvent and data of ΔT_b and K_b are given as:

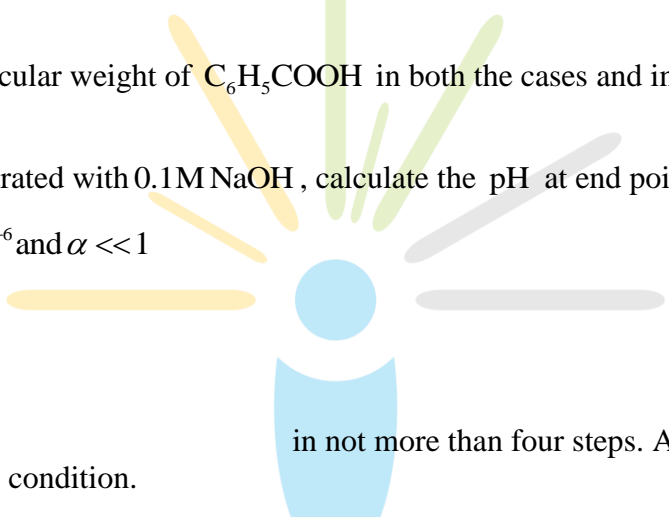
i) In 100g CH_3COOH , $\Delta T_b = 0.17$
 $K_b = 1.7 K \text{ kg Kelvin/mol}$

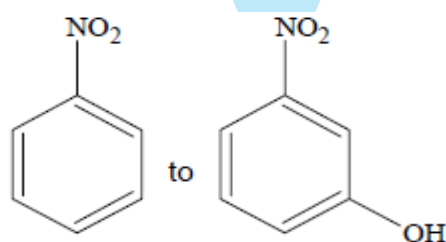
i) In 100g benzene, $\Delta T_b = 0.13$ and $K_b = 2.6 K \text{ kg Kelvin/mol}$

Find out the molecular weight of C_6H_5COOH in both the cases and interpret the result.

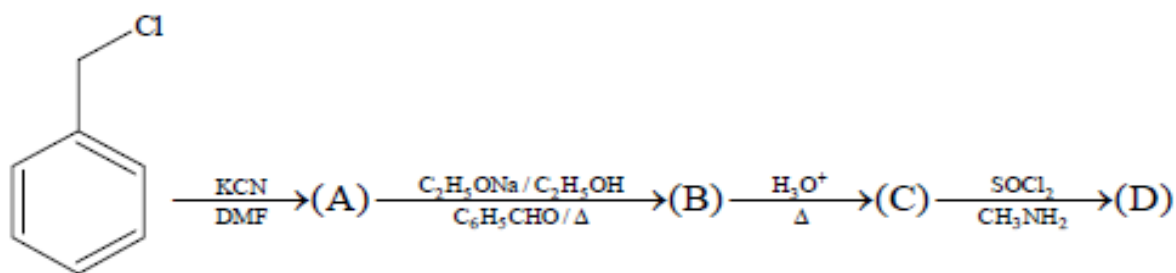
b) 0.1M of HA is titrated with 0.1M NaOH, calculate the pH at end point. Given

$K_a(HA) = 5 \times 10^{-6}$ and $\alpha \ll 1$

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

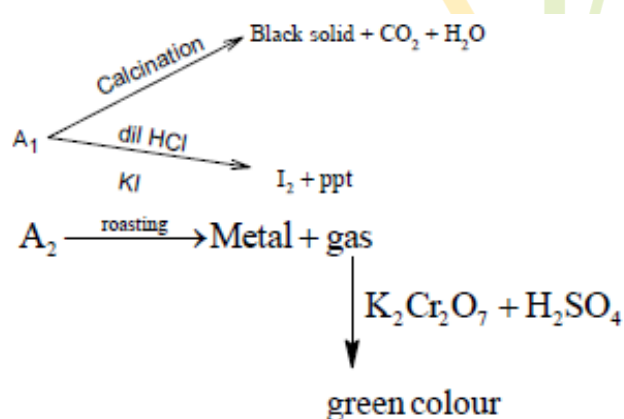


16.



Identify A to D.

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



18. NiCl_2 in the presence of dimethyl glyoxime (DMG) gives a complex which precipitates in the presence of

NH_4OH , giving a bright red colour.

- Draw its structure & show H-bonding
- Give oxidation state of Ni & its hybridisation.
- Predict whether it is paramagnetic or diamagnetic.

19. Find the equilibrium constant for the reaction



Given that

$$E^{\circ}_{\text{Cu}^{+2}/\text{Cu}^{+}} = 0.15\text{V}$$

$$E^{\circ}_{\text{In}^{+2}/\text{In}^{+}} = -0.4\text{V}$$

$$E^{\circ}_{\text{In}^{+3}/\text{In}^{+}} = -0.42\text{V}$$

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 & 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 & R. Give the reason for the extra stability of P.