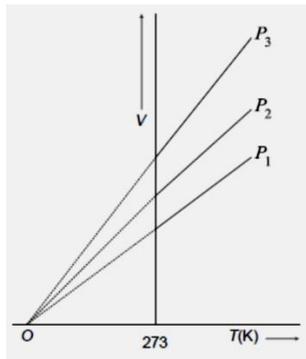


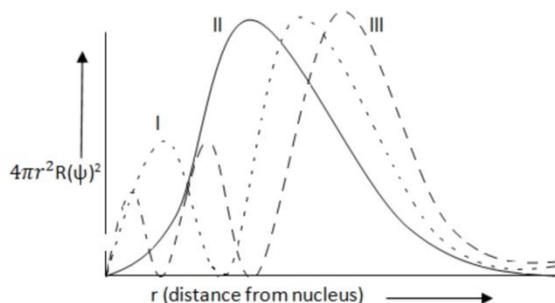
CHEMSITRY

- The bond angles in NH_3 , NF_3 and NCl_3 are in the order:
 A) $\text{NCl}_3 > \text{NH}_3 > \text{NF}_3$ B) $\text{NH}_3 > \text{NCl}_3 > \text{NF}_3$
 C) $\text{NF}_3 > \text{NH}_3 > \text{NCl}_3$ D) $\text{NF}_3 > \text{NCl}_3 > \text{NH}_3$
- For which of the following van't Hoff factor cannot be greater than unity?
 A) $\text{K}_4[\text{Fe}(\text{CN})_6]$ B) AlCl_3 C) NH_2CONH_2 D) KNO_3
- The number of isomers (including stereoisomers) of C_5H_{10} are
 A) 10 B) 11 C) 12 D) 13
- The volume-temperature graphs of a given mass of an ideal gas at constant pressures are shown below. What is the correct order of pressures?



- $p_1 > p_3 > p_2$
 - $p_1 > p_2 > p_3$
 - $p_2 > p_3 > p_1$
 - $p_2 > p_1 > p_3$
- SO_2 turns into which acid when mixed with water
 A) H_2SO_2 B) H_2SO_3 C) H_2SO_4 D) None of the above
- A reaction is 50% completed in 2 hours and 75% completed in 4 hours. The order of the reaction is
 A) 0 B) 1 C) 2 D) 3
- Total number of geometrical isomers for the complex $[\text{RhCl}(\text{CO})(\text{PPh}_3)(\text{NH}_3)]$ is
 A) 1 B) 2 C) 3 D) 4
- In case of nitrogen, NCl_3 is possible but not NCl_5 while in case of phosphorous, PCl_3 as well as PCl_5 are possible. It is due to
 A) Availability of vacant d orbitals in P but not in N
 B) Lower electronegativity of P than N
 C) Lower tendency of H-bond formation in P than N
 D) Occurrence of P in solid while N in gaseous state at room temperature.
- The lattice energy of solid NaCl is 180 kcal/mol. The dissolution of the solid in water in the form of ions is endothermic to the extent of 1 kcal/mol. If the hydration energies of Na^+ and Cl^- are in the ratio 6 : 5, what is the enthalpy of hydration of Na^+ ion?
 A) $-8.5 \text{ kcal mol}^{-1}$ B) $-97.64 \text{ kcal mol}^{-1}$ C) $+82.6 \text{ kcal mol}^{-1}$ D) $+100 \text{ kcal mol}^{-1}$

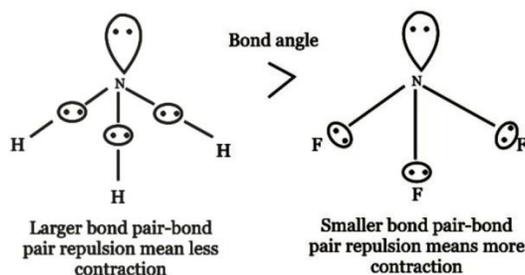
10. Which of the following explain the poling process?
 A) Reduction of metallic oxide impurities to metal by Al
 B) Reduction of metallic oxide impurities to metal by gaseous hydrocarbon
 C) Electrolytic reduction of metallic oxide to metal
 D) Removal of volatile oxides from the molten metal
11. Salicylic acid is produced when phenol in alcoholic KOH is treated with
 A) CH_3Cl B) CHCl_3 C) CH_2Cl_2 D) CCl_4
12. Consider the following radial distribution function diagrams. Which of the following has the correct matching of curve and orbital?



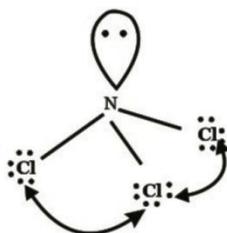
- A) I(3s), II(3p), III(3d) B) I(3d), II(3p), III(3s)
 C) I(3s), II(3d), III(3p) D) I(3p), II(3d), III(3s)

SOLUTIONS CHEMISTRY

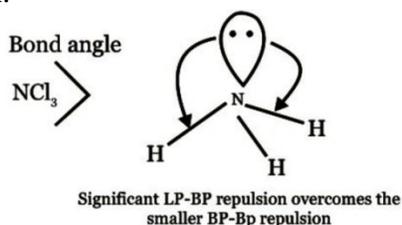
1. Comparison of NH_3 and NF_3 : Since N is more electronegative than hydrogen, shared pair of electrons of the N – H bond spent more time with nitrogen (closer to nitrogen) giving a greater bond pair repulsion. On the other hand fluorine is more electronegative than nitrogen, shared pair of electrons of N – F bond spent more times with fluorine (closer to fluorine) giving less bond pair repulsion as compared to N – H bond. Although bond pair bond pair repulsion in both cases are less than lone pair – bond repulsion, contraction in bond angle is more in NF_3 due to smaller bond pair repulsion in this case than in NH_3 . Hence bond angles are less than $109^\circ 28'$ in both cases but it is further less in NF_3



Comparison of NH_3 and NCl_3 : In NCl_3 , chlorine is much larger in size than hydrogen, they comes closer and their valence shell electrons start repelling one another. Therefore, in NCl_3 the bond expand to some extent to compensate this repulsion:



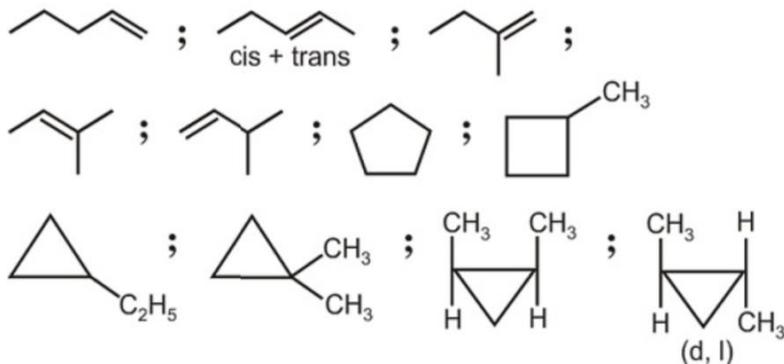
Significant repulsion between the valence electrons of chlorine atom overcomes the lone pair bond – pair repulsion.



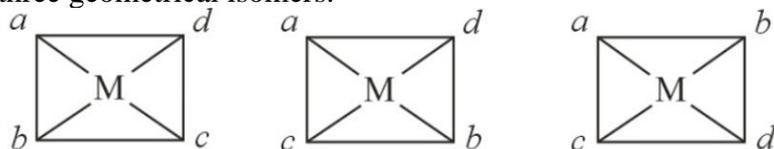
Hence, the overall order of bond angle is $\text{NCl}_3 = \text{NH}_3 > \text{NF}_3$

2. For urea (NH_2CONH_2) the van't Hoff factor can not be greater than unity because urea is non-ionisable while other are ionic compounds so will undergo dissociate in aqueous solution so van't Hoff factor will become more than unity.

3.



4. Drawing a constant temperature line parallel to 'Y' axis, the isobar at higher volumes will be at lower pressure as $P \propto \frac{1}{V}$ at constant temperature.
5. The reaction involved in this case is $\text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_3$
6. A reaction is 50% completed in 2 hours and 75% completed in 4 hours $t_{3/4} = 2t_{1/2}$ for first-order reaction
7. Rh^+ will form a square planar complex. $[\text{M}(\text{abcd})]$ complex is square planar, so it will have three geometrical isomers.



8. $7^{\text{N}} = 1s^2 2s^2 2p^3$; $15^{\text{P}} = 1s^2 2s^2 2p^6 3s^2 3p^3$

In phosphorous the 3d-orbitals are available. Hence phosphorus can form pentahalides also but nitrogen cannot form pentahalide due to absence of d-orbitals.

9. $\Delta H_{solu} = \Delta H_{hydration} + \Delta H_{Lattice}$

$$1 = \Delta H_{hydration} + 180$$

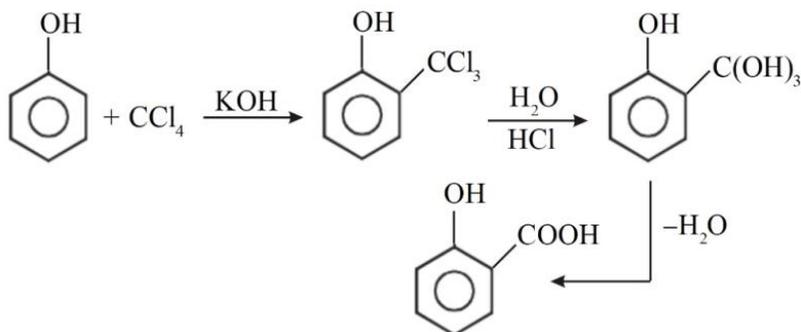
$$\Delta H_{hydration} = -179 \text{ kcal } m^{-1}$$

$$\Delta H_{hyd}(Na^+) + \Delta H_{hyd}(Cl^-) = -179 \text{ kcal } m^{-1}$$

$$\Delta H_{hyd}(Na^+) = -179 \times \frac{6}{11} = -97.64 \text{ kcal } m^{-1}$$

10. In poling process molten impure metal is stirred with green wood. Green wood releases hydrocarbon gases which reduced the impurities of metal oxides to metal.

11.



12. No of radial node = $n - \ell - 1$.

I(3p) ----- $n = 3$ and $\ell = 1$. One radial node

II(3d) ----- $n = 3$ and $\ell = 2$. No radial node

III(3s) ----- $n = 3$ and $\ell = 0$. Two radial nodes.

All the orbitals provided in choices belong to match. I(3p), II(3d), III(3s)