MISCELLANEOUS EXERCISE

Chemical Bonding - I

1.(D) $I^+ < I < I^-$ ∵ cation is always smaller and anion is always greater than the corresponding neutral atom.

2.(B) Refer to theory (Dobereiner's triads)

3.(D) Octet of each of the species Cl, Br, I and O is complete and duplet of H is complete in the given options. Thus, none of them would like to take up another electron.

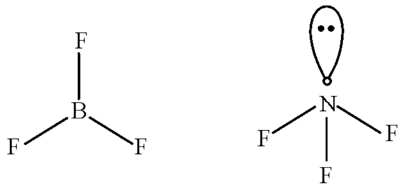
4.(C) Covalent character increases as size of anion increases.

5.(D) Size of Te^{2-} anion will be greatest, hence is more prone to be distorted by a cation.

6.(CD) Oxygen and phosphorous both are non metals.

7.(ACD) All are facts (refer to theory)

8.(D) BF_3 and NF_3 have different structures as there is no lone pair present in BF_3, which is there is NF_3.

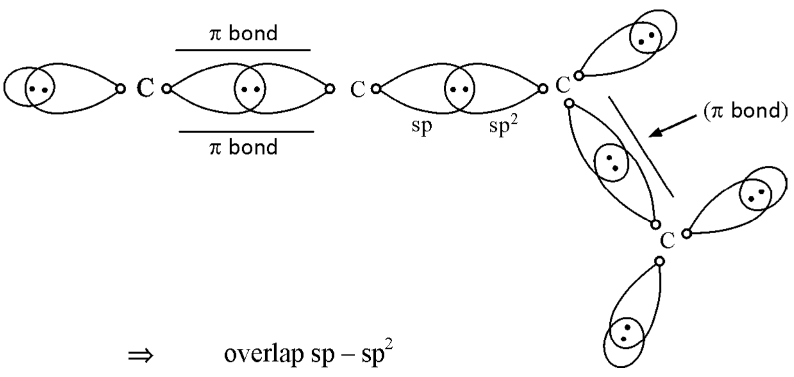


Trigonal planar geometry

Tetrahedral geometry (pyramidal shape)

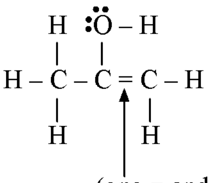
9.(A) (fact) Octahedral arrangement is the most stable configuration if 6 electron pairs are to be arranged. **10.(D)**

11.(B)



⇒ overlap sp – sp^2

12.(C)



$$H-\overset{\displaystyle H}{\underset{\displaystyle H}{C}}-\overset{:\ddot{O}-H}{C}=\underset{\displaystyle H}{C}-H$$

(one π and one σ bond)

9σ, 1π and 2 lone pair **13.(BCD)**

14.(D) Polarising power of a cation increases as charge increases and size decreases.

15.(ABC) "D" is not correct as polar nature of halogen acid is due to the electronegativity difference b/w the bonding atoms.

16.(D) **17.(C)** Ionic character will be maximum (and covalent character is minimum) if cation is large and anion is small.

18.(C) Cl – Cl bond will be non polar ;

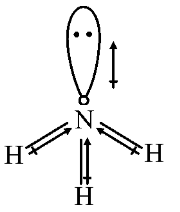
now $\xleftarrow[\text{polarity}]{C-F > N-F > O-F}$ as $\xrightarrow[\text{electronegativity}]{C < N < O < F}$ **19.(A)**

20.(C) Triple bond is the shortest.

21.(B) As $\xleftarrow[\text{electronegativity}]{F > O > N > S}$

23.(D) **22.(D)** (9σ and 9π)

24.(D) NH_3 has highest diplole moment as its electronegativity is highest



25.(D) (H — F··· H — F ··· H — F)

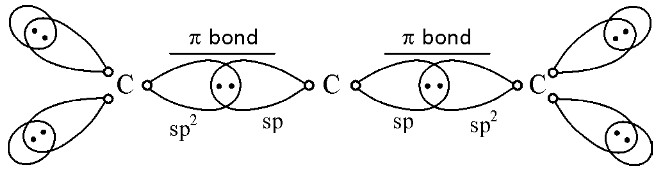
NH_3 and H_2O will form a 3- dimentional polymeric structure and H – bonds in H – Cl are not very strong (as in H – F), so formation of polymeric structure is difficult.

26.(D) $F \leftrightarrows Be \rightleftarrows F$, Dipole moment cancel each other in BeF_2 because of its linear shape and thus it is non-polar, which is not in the case of H_2O.

27.(C) Single bond energies tend to increase as we proceed to right in a given period but still C – C bond is the greatest because electron-electron repulsion is very high in N – N, O – O and F – F due to small size of atoms weakening the respective bonds.

28.(B) All carbons are sp^3 hybridised.

29(C)

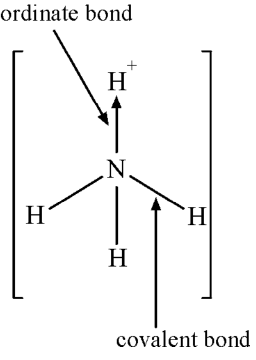


30.(D) $\underset{(1.91D)}{HF} > \underset{(1.84D)}{H_2O} > \underset{(0.90D)}{H_2S}$ ∵ $\xleftarrow[\text{electronegativity}]{F > O > S}$

31.(BD) $\mu_{CH_4} = \mu_{CCl_4} = 0$, as both CH_4 and CCl_4 are perfectly tetrahedral molecules.

32.(B) Bond $\text{length}_{H-Cl} = 1/2\,(\text{Bond length}_{H-H}) + 1/2\,(\text{Bond length}_{Cl-Cl})$
$= 1/2\,(74) + 1/2\,(198) = 136\text{ pm}$

33.(ABC) $\underset{\text{ionic bond}}{NH_4^+Cl}$ and $NH_4^+ =$



34.(ABD) HF is more polar than HBr as electronegativity of F is more than that of Br.
CuCl is more covalent than NaCl, as 18-electron shell of Cu^+([Ar] $3d^{10}$) is more electronegative because inner electrons have poor shielding effect on nucleus incresaing the polarising power of nucleus.

35.(A) For 100% ionic character (for 1 Å bond length)
1 electon (Charge = 1.6×10^{-19} C = 4.8×10^{-10} esu), should be separated by 1 Å
$\Rightarrow$ Dipole moment = 4×10^{-10} esu $\times$ 10^{-8} cm = 4.8×10^{-18} esu cm = 4.8 D
Now observed dipole moment = 1.2D = 1/4 (4.8 D)
$\Rightarrow$ fraction of electric charge = 1/4 = 0.25

36.(A) Fact (refer to theory)

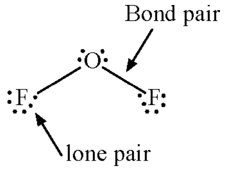
37.(C) Carbon in diamond is arranged in a tetrahedral structure $\Rightarrow$ sp^3 hybridised carbon.
In graphite it is arranged in trigonal planar geometry $\Rightarrow$ sp^2 hybridised carbon.
In acetylene ($CH \equiv CH$) the geometry is linear $\Rightarrow$ sp hybridised carbon

38.(B) BF_3 is a trigonal planar molecule.

39.(D) Polarising power of Mg^{2+} and Li^+ will be higher than that of Na^+ due do higher charge and smaller size respectively.
Now polarisability of F will be less than that of Cl due to smaller size.
$\Rightarrow$ NaF should be the most ionic

40.(AD) As we go down the group stability of lower oxidation states increases due to increasing inert pair effect.
$\Rightarrow$ $\xrightarrow[\text{increasing stability}]{Ge^{2+} < Sn^{2+} < Pb^{2+}}$, also Pb^{+2} is more stable than Pb^{+4} as inert pair effect is strong but Sn^{2+} is more stable than Sn^{4+} as inert pair effect is relatively weaker.

41.(B)



42.(A) $\xleftarrow[\text{increasing polarizability}]{I^- > Br^- > Cl^- > F^-}$ $\because$ larger the size of anion, higher will be its polarisability.