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1. Singlet carbenes is more stable for CCl_2 .

Carbenes

Any electron-deficient neutral molecules that are formed as an intermediate is known as carbenes.

This carbene (CH_2) exists in two forms;

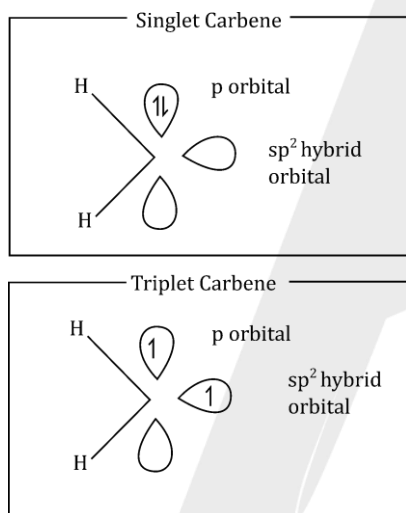
1. Triplet carbene

2. Singlet carbene

In triplet carbene, p orbitals are singlet occupied.

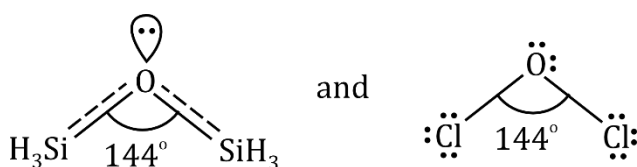
In the case of singlet carbene, p orbital is doubly occupied.

The structure of the triplet and singlet carbene are:



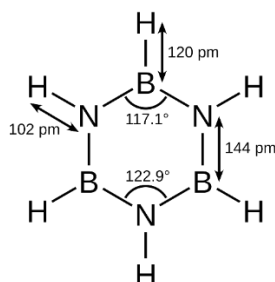
The bond angle in case of triplet carbene is 125-140 degree and the bond angle in case of singlet carbene is 102 degree.

2. OCl_2 molecule has a trigonal planar geometry with a bond angle of 120° .
The bond angle in SCl_2 is approximately 103 degrees.



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3.



4. Boraxine can show back bonding. Due to the significant difference in electronegativity between the boron and nitrogen atoms, borazine is a strongly polar compound.

Borazine contains $p\pi - d\pi$ back bond.

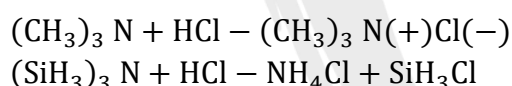
Due to its similarities to benzene, there have been a number of computational and experimental analyses of borazine's aromaticity. The number of pi electrons in borazine obeys the $4n + 2$ rule, and the B-N bond lengths are equal

In $B_3 N_3 H_6$ compound, the correct option is '3' $p\pi - p\pi$ bond is present. It can show back bonding.

Due to the significant difference in electronegativity between the boron and nitrogen atoms, borazine is a strongly polar compound. $B_3 N_3 H_6$ is non-polar with polar bonds. It has lumpy modes at nitrogen atom.

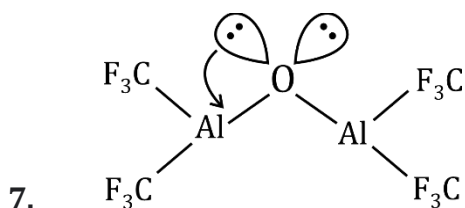
Here, first two statements are correct while other two are incorrect. Hence, option A is correct.

5. As the hybridisation of $(CH_3)_3 N$ is sp^3 , the l.p of the N atom exist in sp^3 hybrid orbital. So the l.p is more reactive... So in reaction with HCl it can form adduct, by donating its l.p. But for $(SiH_3)_3 N$ the hybridisation is sp^2 . And the l.p situates in p orbital... And in reaction with HCl it produces NH_4Cl and SiH_3Cl .



6. Back bonding is a type of weaker π bond which is formed by sideways overlapping of filled orbital with empty orbital present on adjacent bonded atoms in a molecule. It is also considered as intermolecular Lewis acid-base interaction as it is a π bond.
- In case of back bonding which normally involves donation of excess electrons on transition metal ions (mainly from its $d\pi(yz \& xz)$ orbitals) to vacant π orbitals of ligands (again $p\pi/d\pi$ type) to have sideways overlap forming π bonds.
- When the back bonding is effective, the lack of electrons is balanced and the Lewis acid character decreases. Due to this, acid strength decreases down the halogen group. Back bonding is effective only when the size of the valence shell matches.

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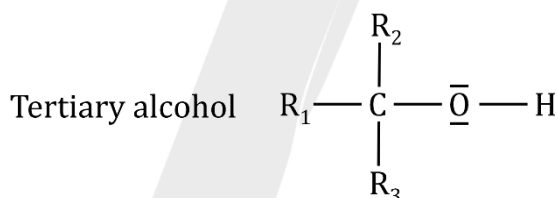
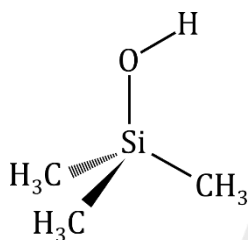


Vacant p - orbital is present in Al \therefore lone pair of oxygen participates in back - bonding, resulting in sp^2 hybridisation of O. Hence bond angle is nearly 120° .

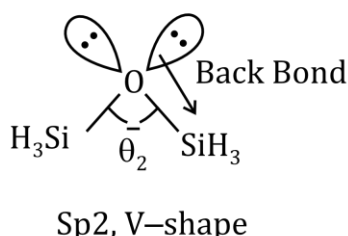
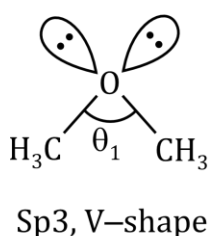
8. in Silyl isocyanate, the lone pair of N is forming back bond with the vacant d orbital of Si i.e. $d\pi - p\pi$ back bonding and its shape becomes linear.

$N(SiH_3)_3$ and $(GeH_3)_3N$ is planar because in $N(SiH_3)_3$ lone-pair on N-atom is transferred to the empty d - orbitals of silicon ($p\pi - d\pi$ overlapping)

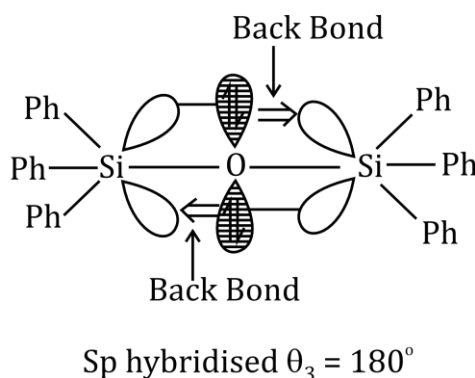
As from structure it can be seen that $\angle CNC$ and $\angle HNN$ in $\angle CH_3NCS_N$ and HN_3 respectively are greater than 120° and less than 120°




9. In $(Ph)_3Si-O-Si(Ph)_3$ compounds Si - O - Si bond angle is Approx 180° due to back bonding and hybridisation is sp .



$$\theta_1 < \theta_2 < \theta_3$$



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10. Back bonding in OCl_2 occurs from the centre atom to the surrounding atom. The fact that chlorine already contains a lone pair of electrons prevents the p pi-d pi back bonding from being possible in the OCl_2 molecule.

Back bonding in NCl_3

However, the free orbital of chlorine is not empty, but it is occupied by an electron pair donated by nitrogen. Thus, the free orbital of chlorine cannot participate in back bonding. Therefore, back bonding is not present in NCl_3 .

Yes back bonding occurs in PF_3 , (it is one of the most common examples) as Phosphorus has vacant d-orbitals and each fluorine has 3 lone-pairs of electron.

In CO it is $p\pi - p\pi$.

