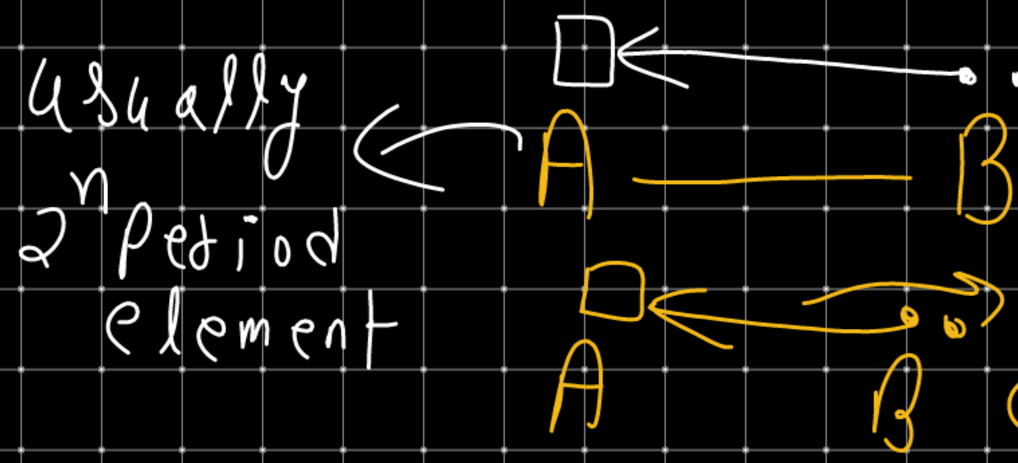
Chemical Bonding

Back bonding :-

(1) Out of two bonded atoms one atom have Vacant orbital and other is having L.P. (lone pair)



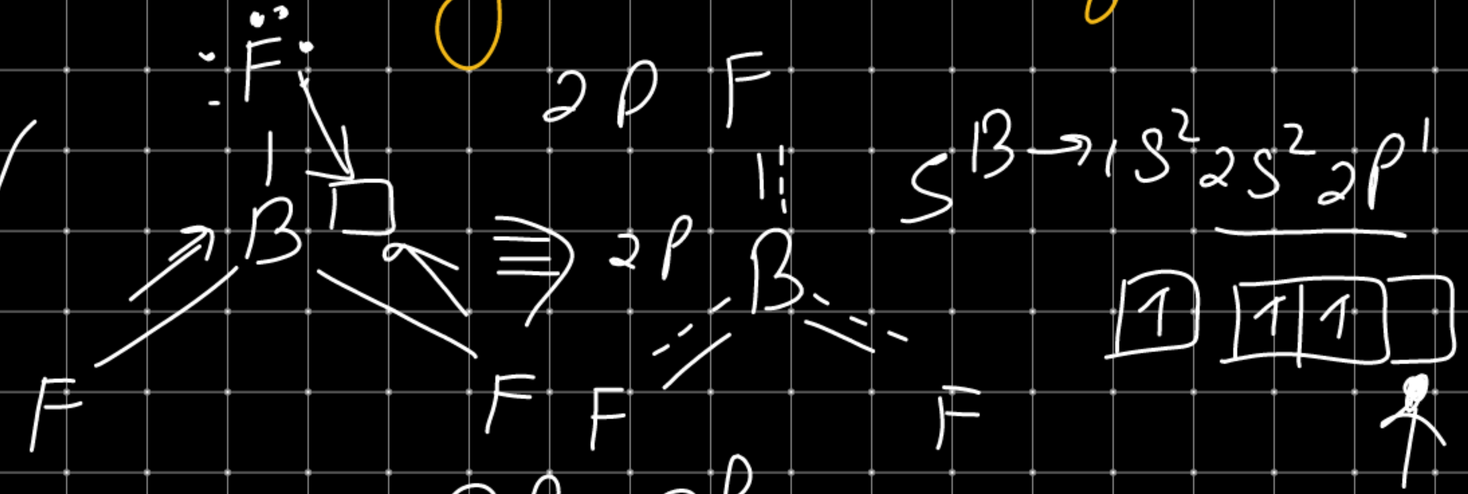
(2) Back Bonding increases bond strength and decreases bond length.

(3) Extent of back bonding is much larger if orbitals involve in bonding have similar size, for strength of back bonding atleast one of two bonded atoms should be 2^{nd} period.

ex: Identify back bonding in following.

(1) BF_3

B.B.✓

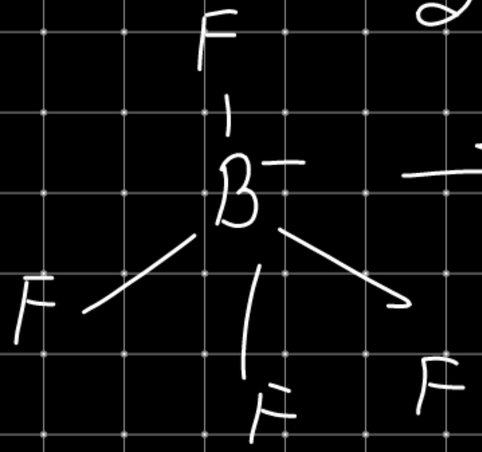


$5^{B} \rightarrow 1s^2 2s^2 2p^1$

$2p_x - 2p_x$

(2) BF_4^-

B.B.X

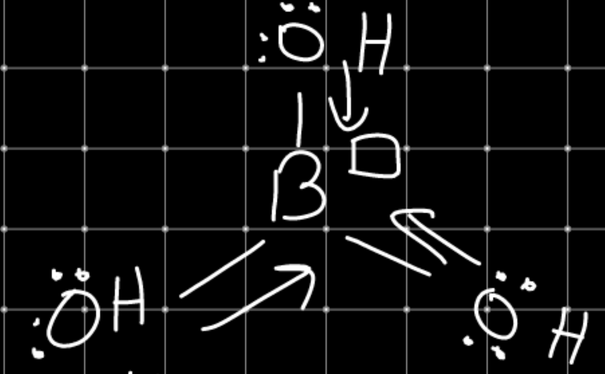


→ octet completed

Back bonding :-

Ex :- (i) H_3BO_3 or $B(OH)_3$

B.B. ✓

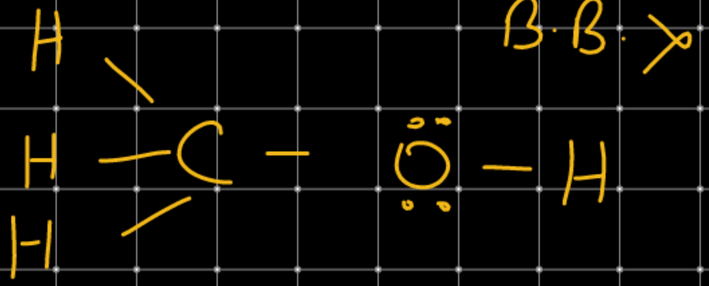


(ii) $N(CH_3)_3$ (Trimethyl amine)

No Vacant orbital B.B. ✗

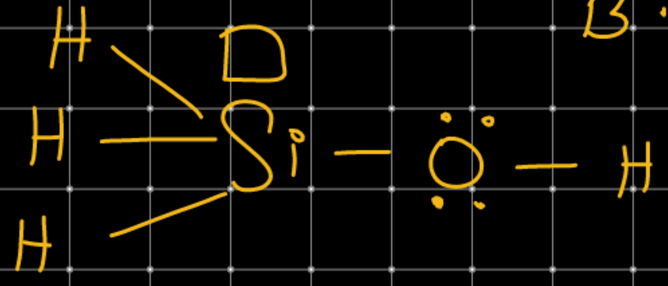
Present in C-atom.

(v) CH_3OH



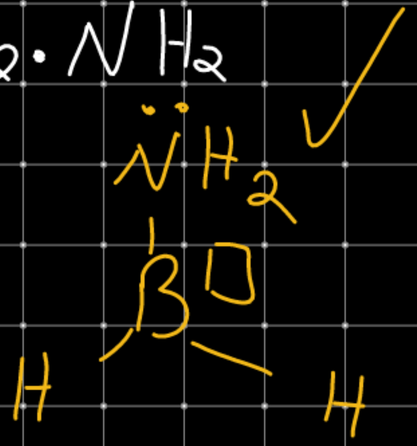
B.B. ✗

(vi) SiH_3OH



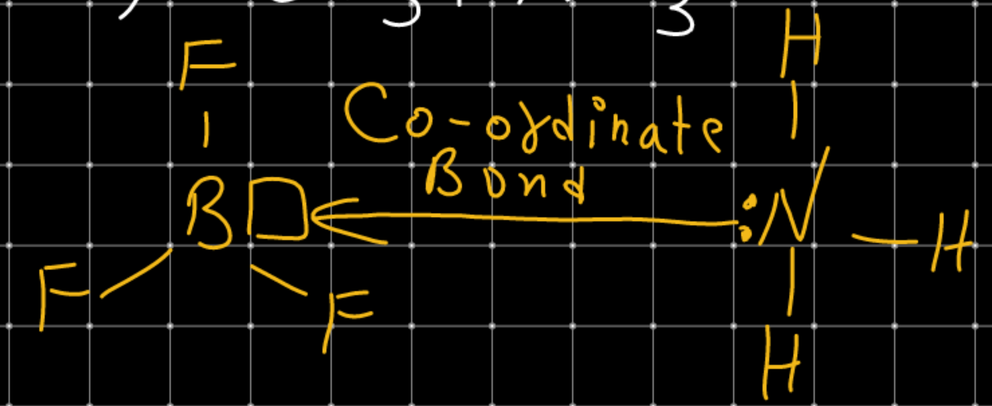
B.B. ✓

(vii) $BH_2 \cdot NH_2$



✓

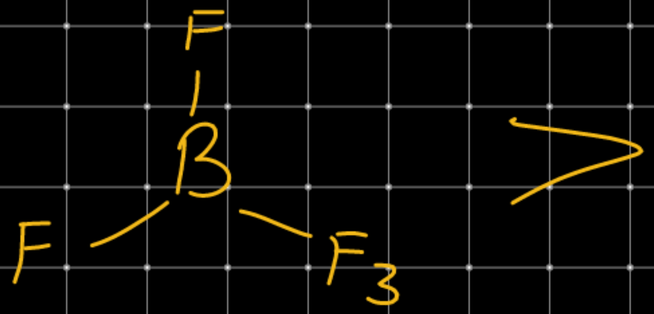
(viii) $BF_3 + NH_3$



B.B. ✗

8. Compare the properties which are written.

(1) BF_3 & BF_4^- (Bond angle)



$3+0=3\,(SP^2)$

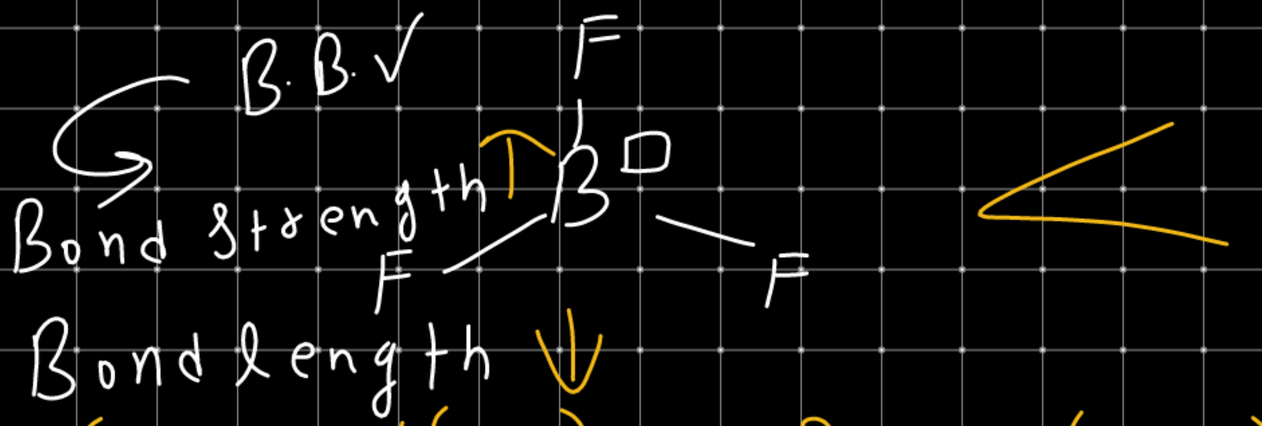
120°

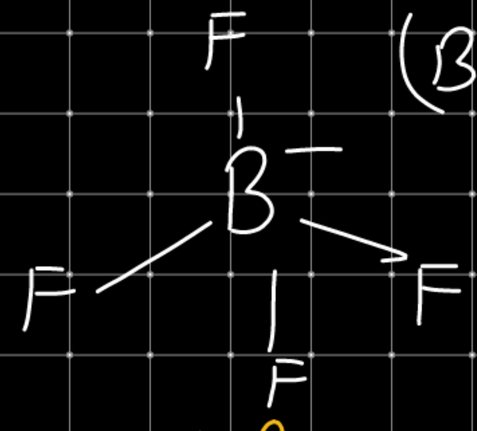
$>$

$4+0=4\,(SP^3)$

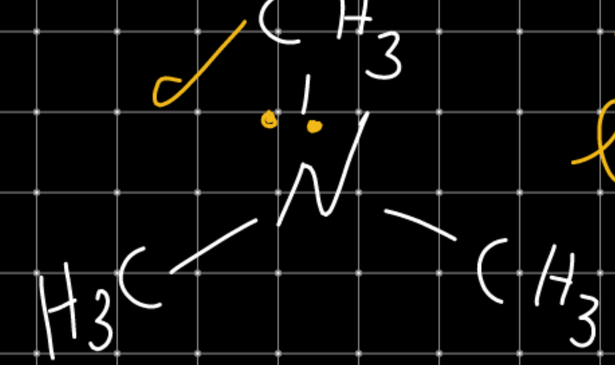
$(109^\circ 28')$

(2) BF_3 & BF_4^- (Bond length)

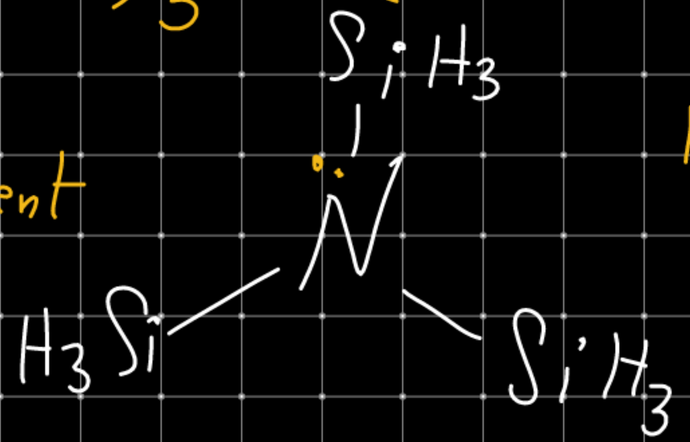




(3) $N(CH_3)_3$ & $N(SiH_3)_3$ (Lewis base strength)



B.B ✗
l.p → present



B.B ✓
l.p → not present

(4) BF_3 BCl_3 BBr_3 BI_3 (Lewis acid Strength)

$2p_\pi$ $2p_\pi$ $2p_\pi$ $2p_\pi$ $4p_\pi$ $2p_\pi - 5p_\pi$

3p

Extent of B.B is very less, so B-orbital are Vacant.

$BF_3 < BCl_3 < BBr_3 < BI_3$

Electron deficient Compound :-

(1) There are many Compounds in which some e^-- deficient bonds are present apart from normal Covalent and Co-ordinate bond $(2C-2e^-)$

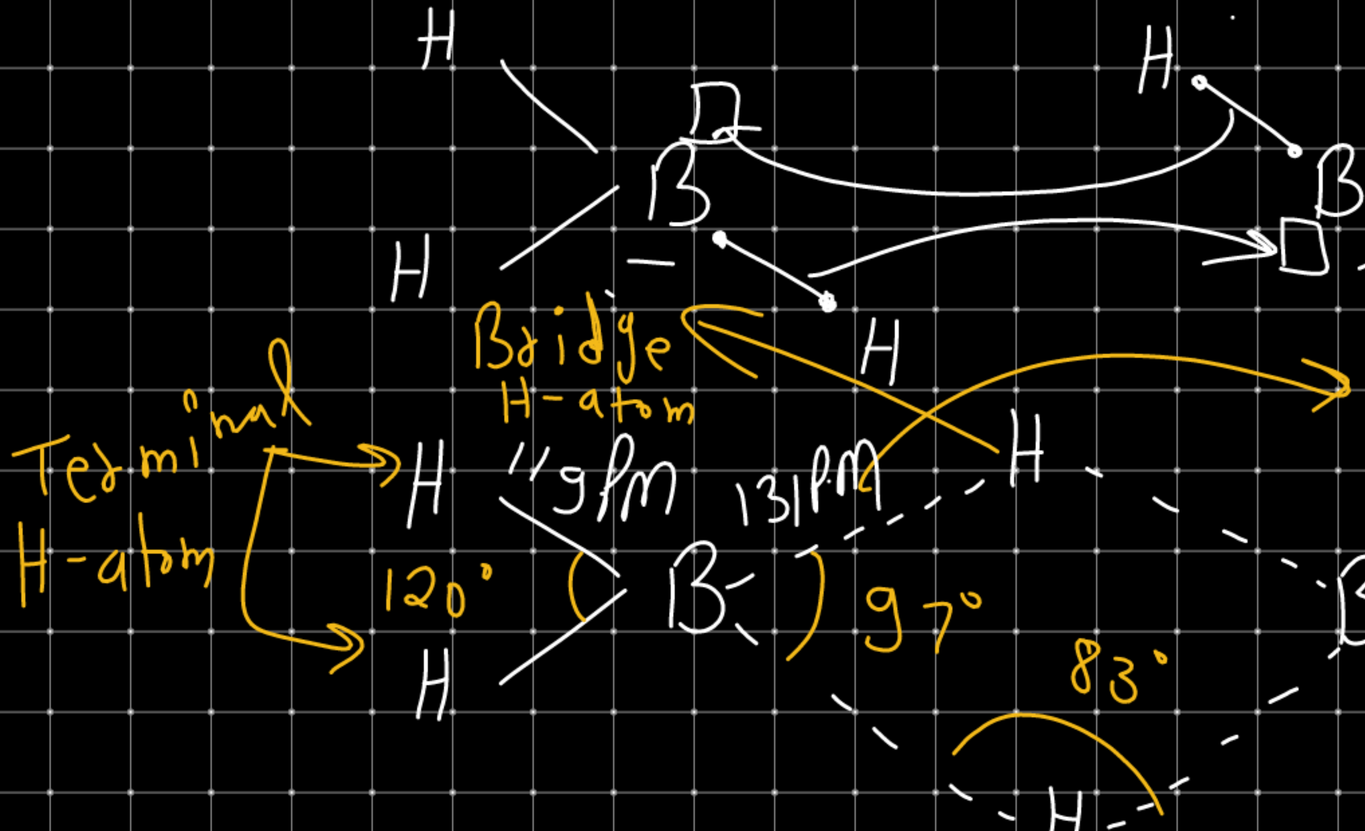
2 Centre - 2 - electron Bond

(2) These electron deficient (3C-2e) (3 centre-2 electron bonds) have less no. of electrons then expected, just like in B_2H_6, $(BeH_2)_n$, $Al_2(CH_3)_6$ etc.

(3) These 3C-2e$^-$ bonds are called Banana Bond.

Ex:-

(i) Diborane (B_2H_6) → dimer



(1) Total 3C-2e⁻ Bonds = 2

(2) Total 2c-2e⁻ bonds = 4

(3) Hybridisation of BH_3 = sp^2

(4) Hybridisation of B_2H_6 = sp^3

Poor overlapping due to partial bond

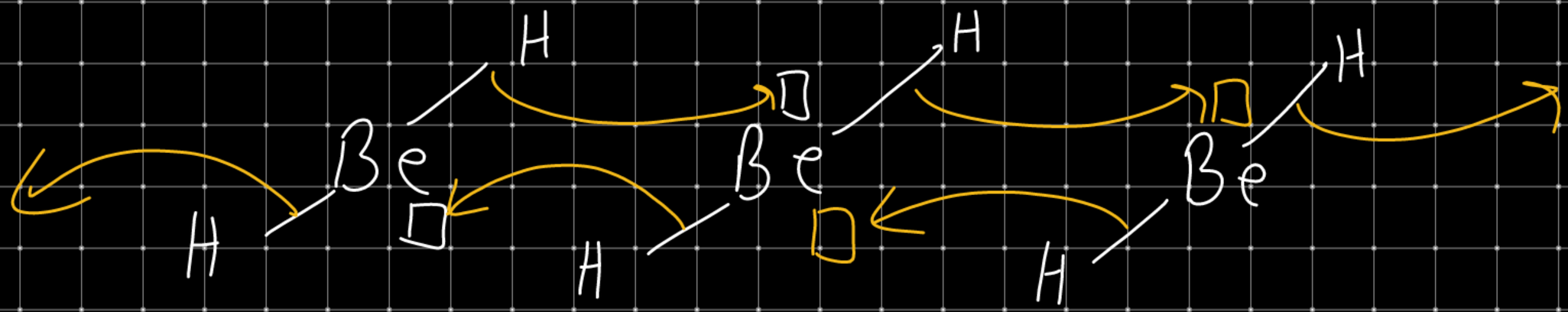
(4) no. of terminal H-atom = 4

(5) -11- Bridge H-atom = 2

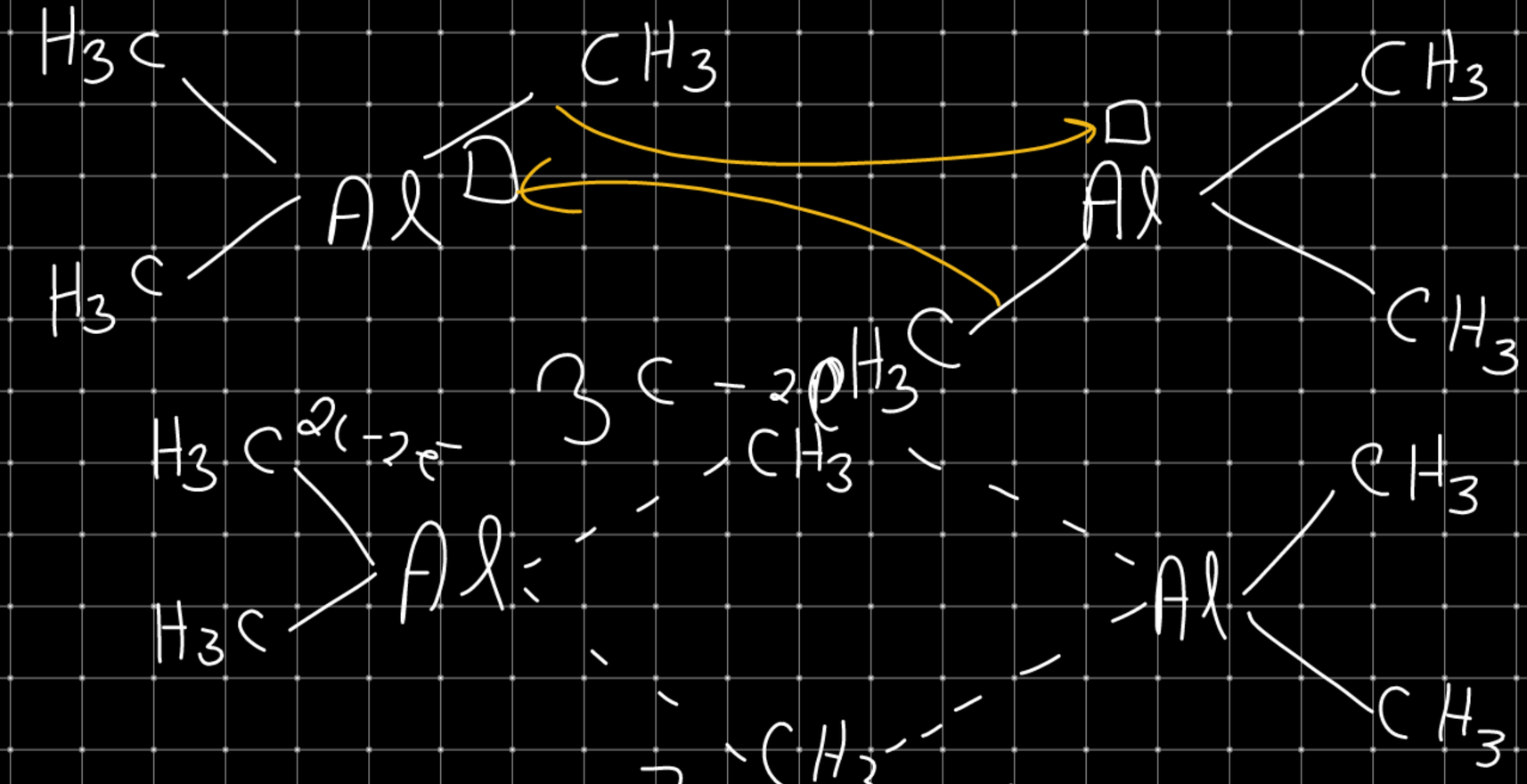
Overlapping of 3c-2e⁻ bond ⇒ $Sp^3 - S - Sp^3$

— " — 2c-2e⁻ bond ⇒ $Sp^3 - S$

(2) $(BeH_2)_n$



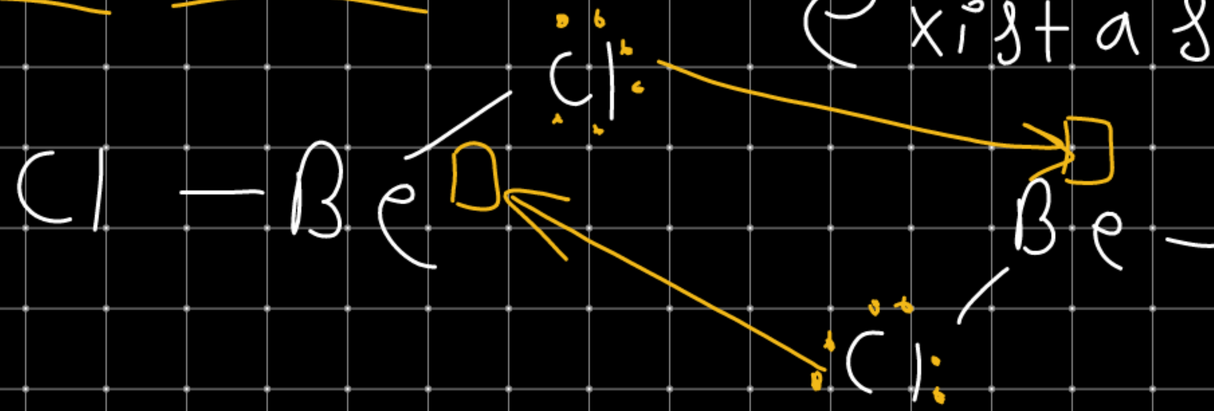
(3) $Al_2(me)_6$ $\quad me \Rightarrow CH_3-$

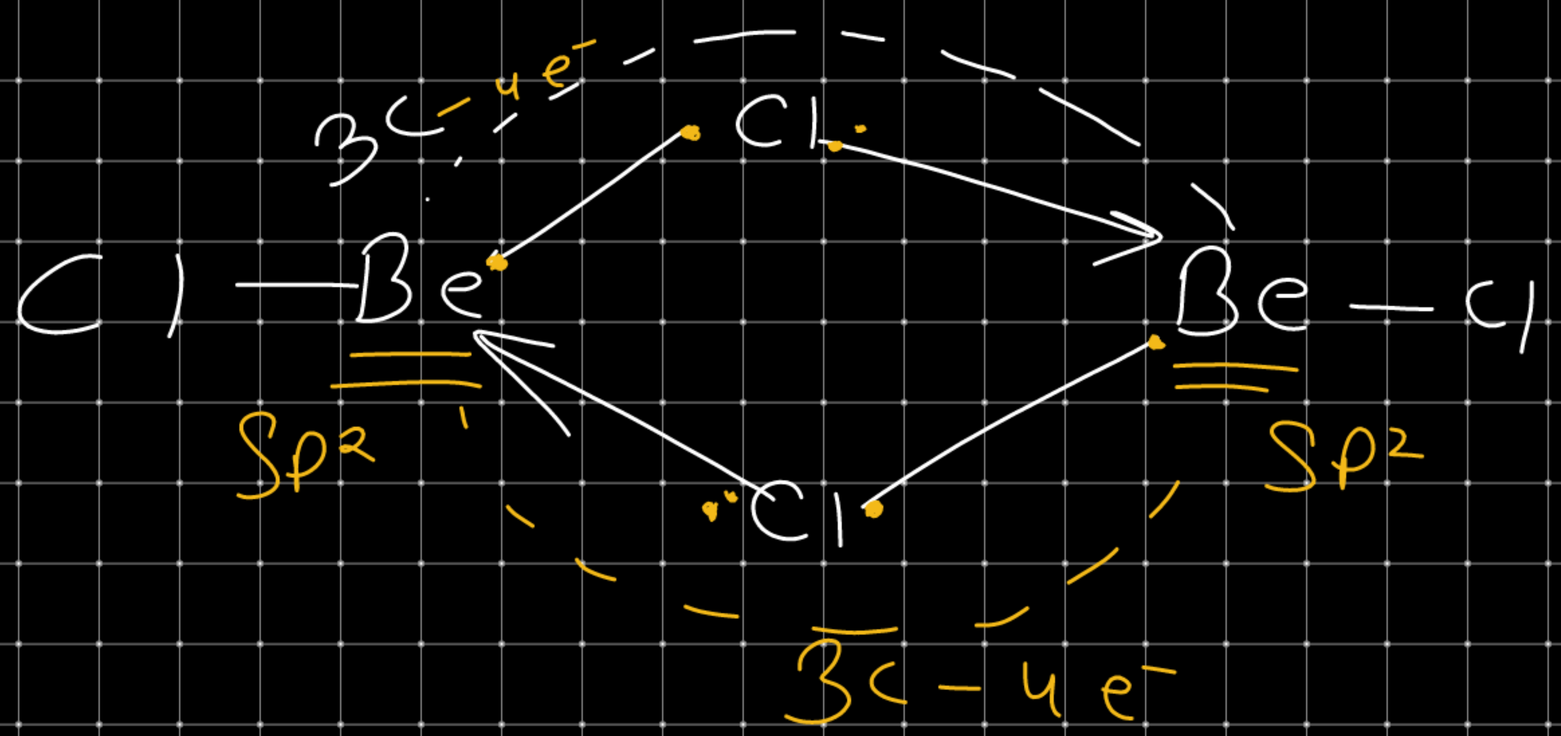


(8) In which of the following 3C-2e⁻ bond is not present.

(a) $(BeH_2)_n$ (b) B_2H_6 (c) Al_2Me_6 (d) C_2H_6

3C-4e⁻-bond :- (i) $BeCl_2$ in Vapour phase exists as dimer $(BeCl_2)_2$





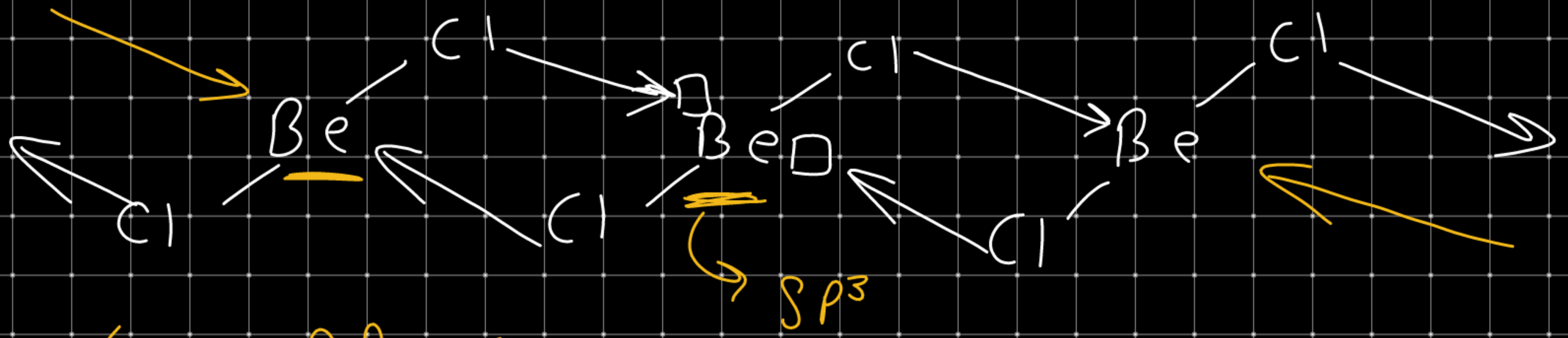
At 1200k $BeCl_2$ exist as monomer

Cl - Be - Cl

Sp

(2) $BeCl_2$ in solid phase exist as polymer.

$(BeCl_2)_n$



(3) Al_2Cl_6

Brahmagupta :-

3C - 2e⁻

Side atom H, CH_3-

$(BeH_2)_n$ Al_2Me_6

$(MgH_2)_n$ e.t.c.

3C - 4e⁻

Side atom halogen

(usually Cl-atom)

$(BeCl_2)_n$, $(BeCl_2)_2$

Al_2Cl_6, $(SnCl_2)_n$,

I_2Cl_6 - - - - - e.t.c