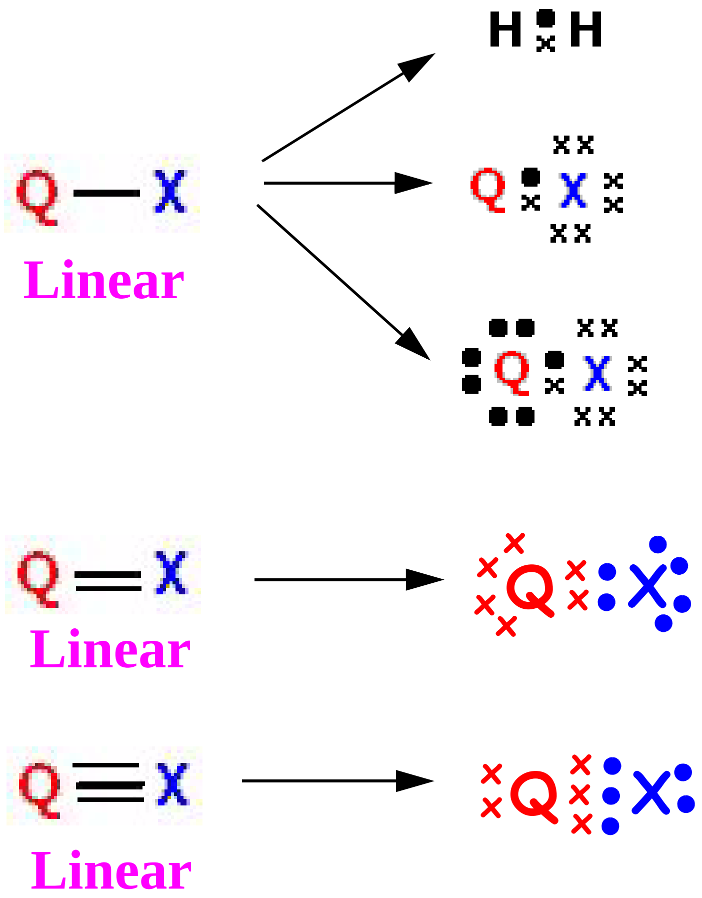
Valence electrons	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Missing electrons	**1**	**6**	**5**	**4**	**3**	**2**	**1**
Atoms	**H**	**Be**	**B**	**C , Si**	**N , P**	**O , S**	**Cl , F**
1 chargecenter	H– only $2e^-$						
2 chargecenters SP		–Be– only $4e^-$		=C= –C≡	:N≡	:C≡O: e^- moved from O to C	
3 chargecenters SP^2			–B– (with third bond below) only $6e^-$	–C= (with third bond below)	–N̈=	:Ö=	
4 chargecenters SP^3				–C– (with bonds above and below)	–N̈= (with bond below)	–Ö– (with two lone pairs)	:C̈l– (with three lone pairs)
5 chargecenters					P with five bonds $10e^-$	S̈ with four bonds $10e^-$	
6 chargecenters						S with six bonds $12e^-$	

Diatomic molecules i.e. molecules with only two atoms



H-H

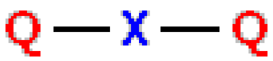
H-Cl H-F H-Br OH^-

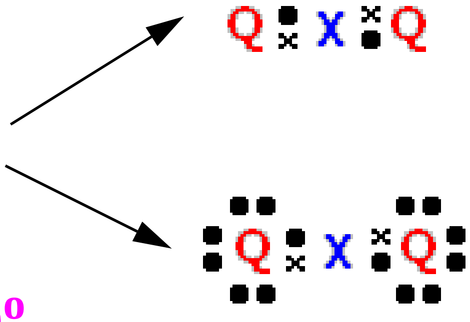
Cl-Cl I-I I-Cl

O=O

N≡N C≡O

Molecules with two charge centers around the central atom: SP



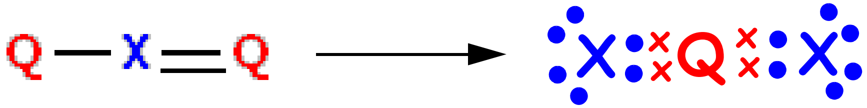


H-Be-H i.e. BeH_2

Cl-Be-Cl i.e. $BeCl_2$

Linear

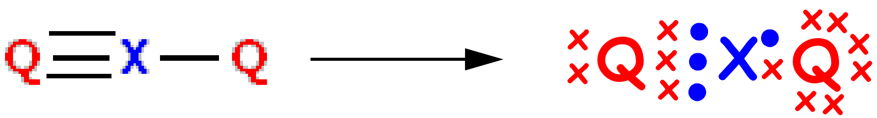
Angle = 180^o



O=C=O i.e. CO_2

Linear

Angle = 180^o



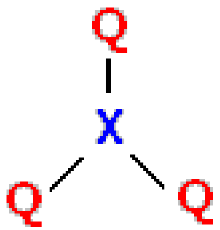
H-C≡N i.e. HCN

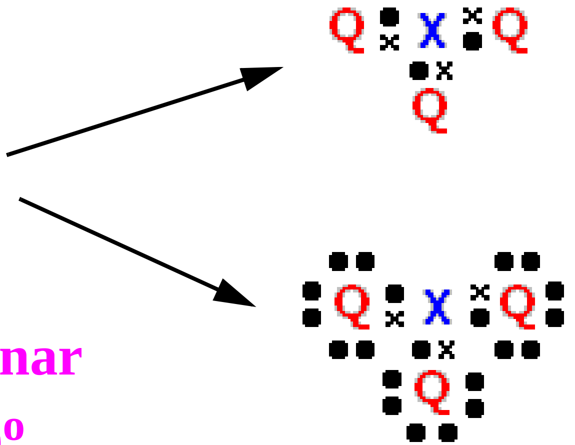
H-C≡C-H i.e. C_2H_2

Linear

Angle = 180^o

Molecules with three charge centers around the central atom: SP^2



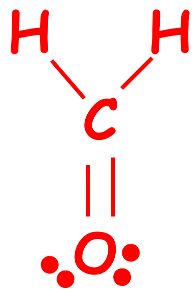


BH$_3$

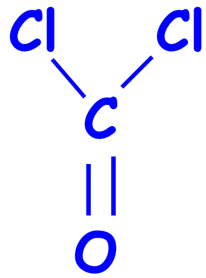
BF$_3$

Trigonal Planar

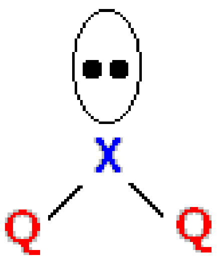
Angle = 120^o

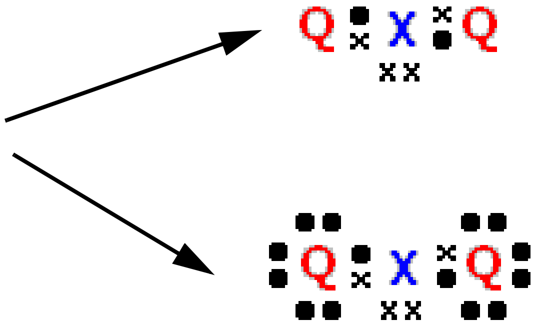


H_2CO



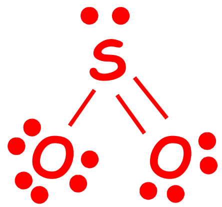
$COCl_2$



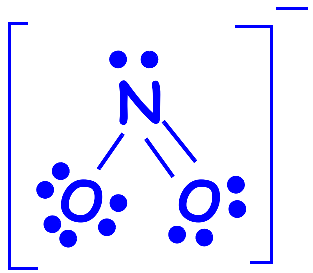


Bent V-shape

Angle almost 120^o

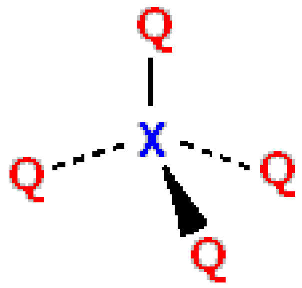


SO_2



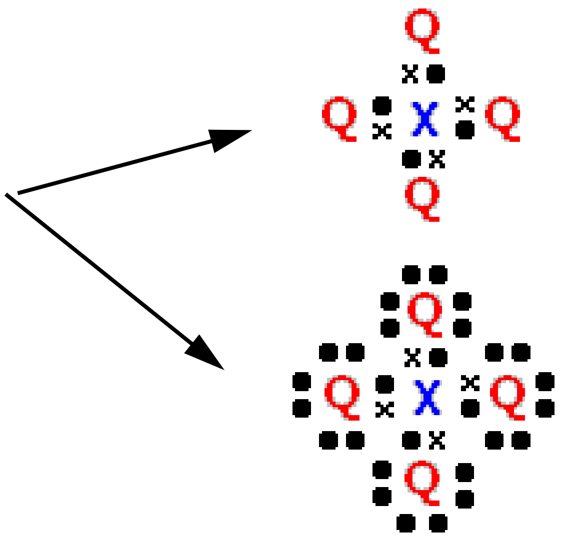
NO_2^-

Molecules with four charge centers around the central atom: SP^3



Tetrahedral

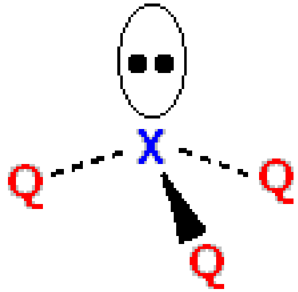
Angle = 109^o



CH_4 SiH_4 NH_4^+

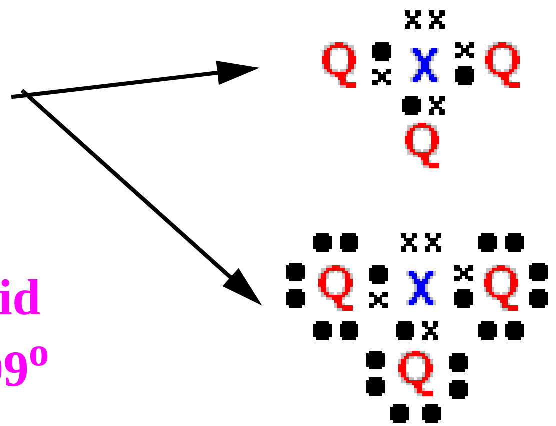
CCl_4 $[PCl_4]^+$ SO_4^{2-} $[BF_4]^-$

$POCl_3$



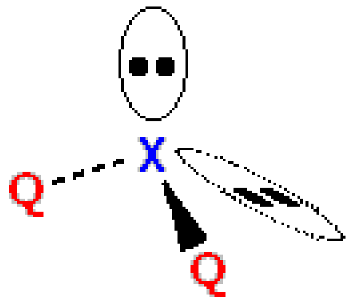
Trigonal Pyramid

Angle almost 109^o



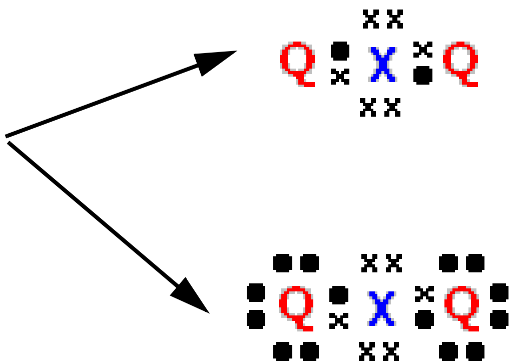
NH_3 H_3O^+

NCl_3 PF_3 PCl_3



Bent V-shape

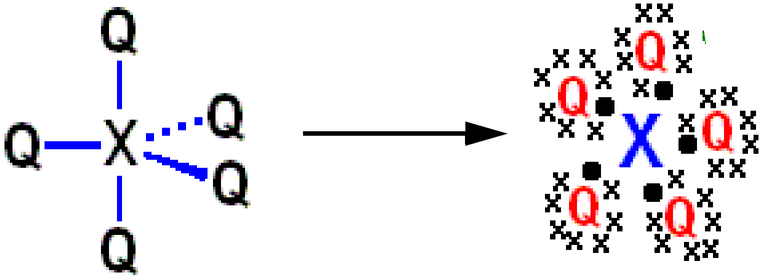
Angle almost 109^o



H_2O

OF_2 SCl_2

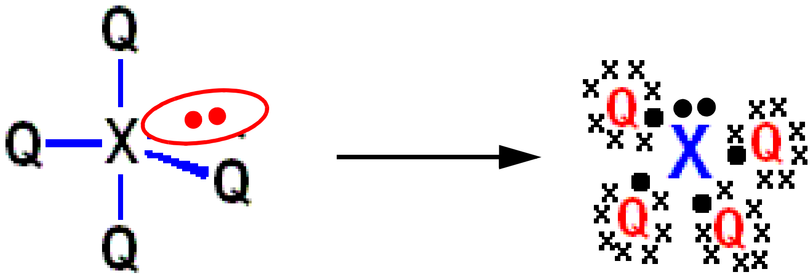
Molecules with five charge centers around the central atom



Trigonal bipyramid

Angles are 90^0 and 120^0 and 180^0

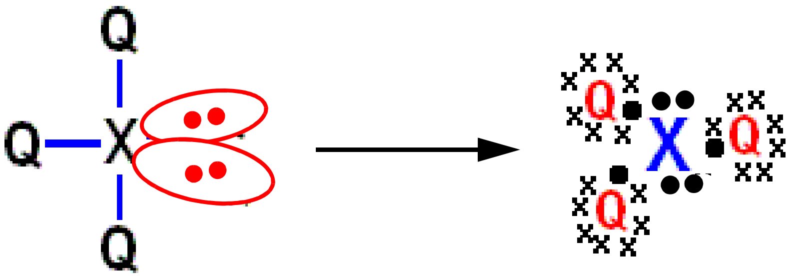
PCl_5 PF_5



See saw

Angles are 90^0 and almost 120^0 and 180^0

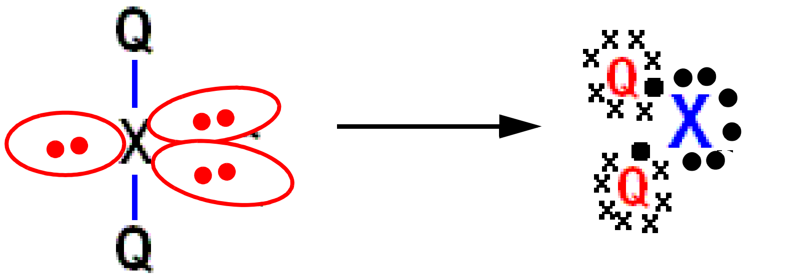
SF_4



T-shaped

Angles are 90^0 and 180^0

ClF_3

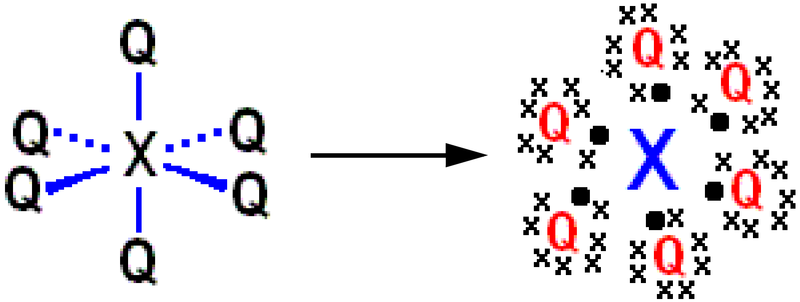


Linear

Angles is 180^0

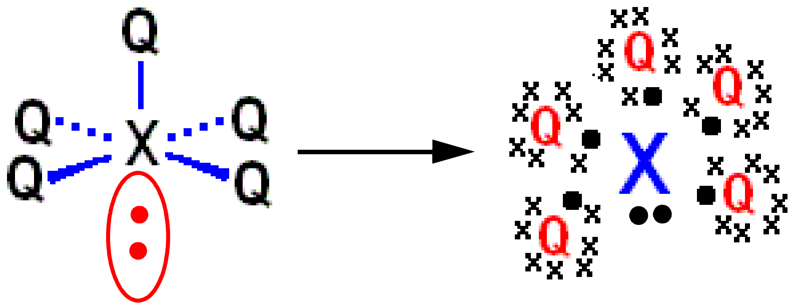
I_3^-

Molecules with six charge centers around the central atom



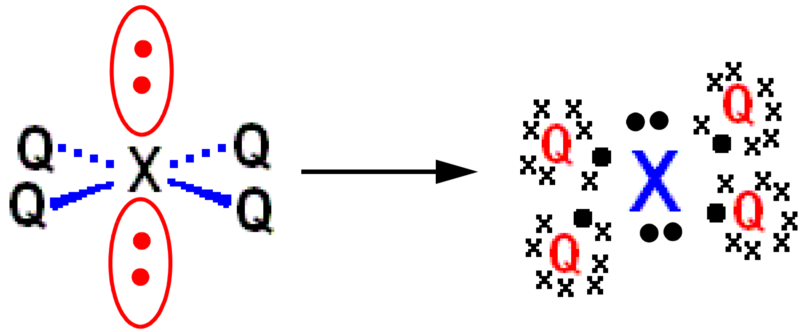
Octahedral shape
Angles are 90^0 and 180^0

SF_6 $[PCl_6]^-$



Square pyramid
Angles are 90^0

BrF_5 ICl_5



Square planar
Angles are 90^0

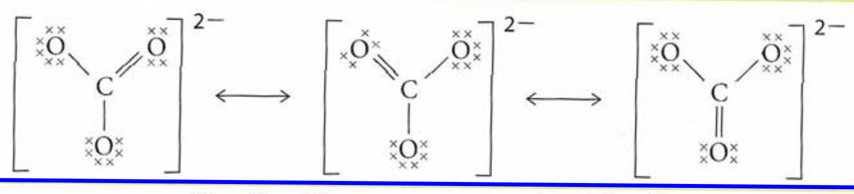
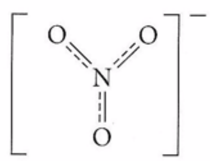
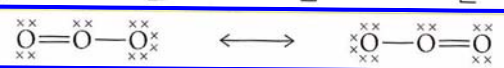
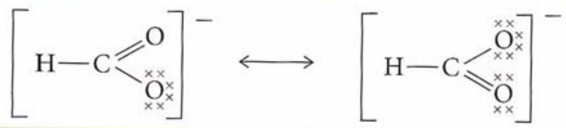
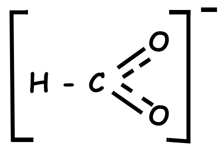
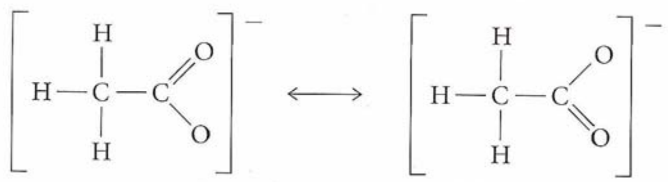
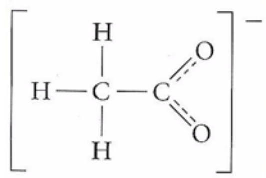
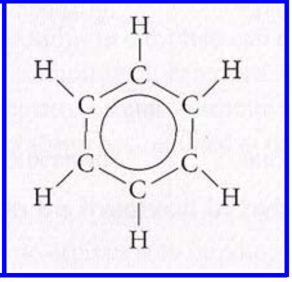
XeF_4 $[ICl_4]^-$

Delocalization of electrons

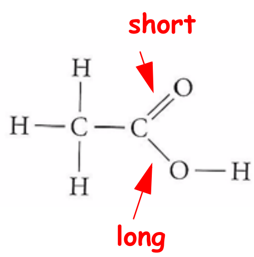
In some molecules for which the Lewis structure can be drawn in several way one has delocalization of electrons i.e. they are shared between different bonds. One call this a resonance structure.

1. Bonds with delocalized electrons all have the same length and strength.
2. Molecules with delocalized electrons are more stable.
3. Metals have delocalized electrons over their whole structure which gives good electrical conductivity.

Examples of molecules with delocalized electrons:

Ion name and formula	Number of valence electrons	Resonance structures	Resonance formula
carbonate CO_3^{2-}	24		
ozone O_3	18		
methanoate $HCOO^-$	18		
Ethanoic acid CH_3COO^-	24		
Benzene C_6H_6			

Examples of a molecule without delocalized electrons:



CH_3COOH

When the bonds are not delocalized the following rule apply:

Single Bond → Double bond → Triple bond

Weak → Strong

Long ← Short