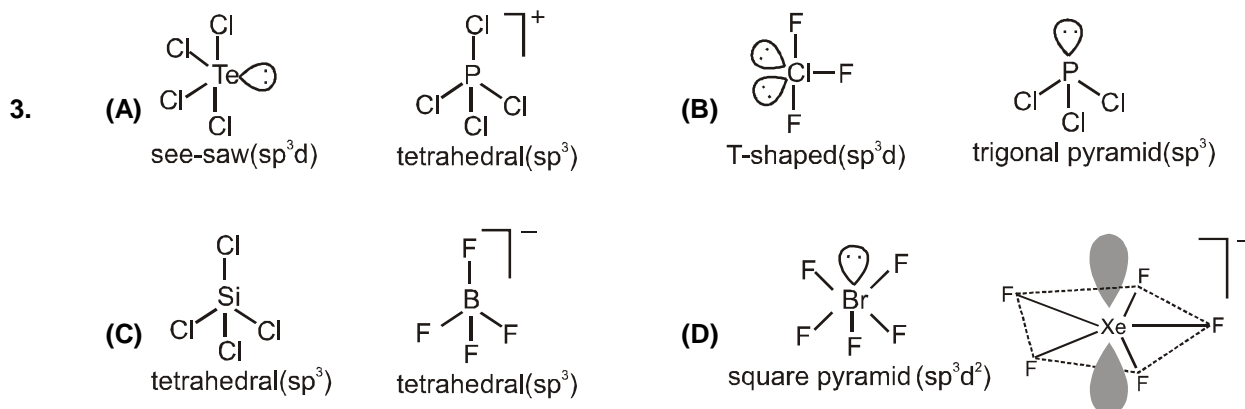


**CHEMISTRY**

- $\text{C}_2\text{H}_4 + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$   
 $\text{sp}^2 \qquad \qquad \qquad \text{sp}$
- Each of given species except  $\text{CH}_3\text{CH}_2\text{CH}_3$  contain either H bonded to EN atom or lone pair containing EN atom.



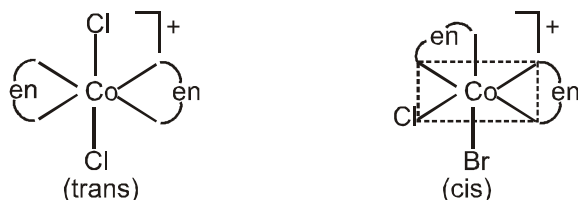
- In triple bond,  $\pi$  bond is formed by  $p_x-p_x$  and  $p_y-p_y$ . Hence perpendicular to each other. In consecutive double bond, if  $p_x-p_x$  overlap form one  $\pi$  bond, then  $p_y-p_y$  form other  $\pi$  bond. Hence perpendicular to each other. (Here Z axis is taken as internuclear axis).
- As it has 4 properly oriented N atoms.
- For Name, check rules from notes.



5 planes of symmetry

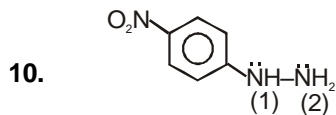
2-planes of symmetry

- (A)  $[\text{Co}(\text{NH}_3)_5\text{Br}] \text{SO}_4$  can show ionization isomerism only But  $[\text{Ni}(\text{dmg})_2]$  can't  
 (B)  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$  is square planar and hence can show cis-trans isomerism.  
 $[\text{Co}(\text{en})_2\text{ClBr}]\text{Cl}$  can show ionisation isomerism as well as cis-trans isomerism in octahedral complexes.



- (C)  $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$  can show coordination isomerism where as  $\text{K}[\text{PtCl}_3(\text{C}_2\text{H}_4)]$  can't show any isomerism.  
 (D)  $[\text{Ni}(\text{en})_3]^{2+}$  is optically active and  $[\text{Pt}(\text{en})_2]^{2+}$  is square planar and hence optically inactive.

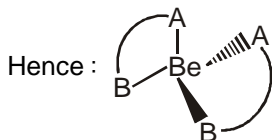
- As octahedral field is present so their will be octahedral splitting.  
 Further,  $\text{F}^-$  is a weak field ligand. so pairing will not take place unless all orbital are half filled.



Either nitrogen (1) or nitrogen (2) can donate lone pair

12.  $\text{Cr}^{+3}$  and  $2\text{Br}^-$  in the bracket, so one  $\text{Br}^-$  will remain outside the bracket to balance total positive charge.

13. Benzoylacetato is non-symmetrical didentate ligand and beryllium can only use  $\text{sp}^3$  orbitals (as it has no d-orbital). So Be forms tetrahedral complex with it.



Where A B is a representation of non-symmetrical didentate ligand. This structure has no plane of symmetry. so it is optically active.

14.  $\text{Al} = 1.61$  Due to d-contraction  
 $\text{Ga} = 1.81$

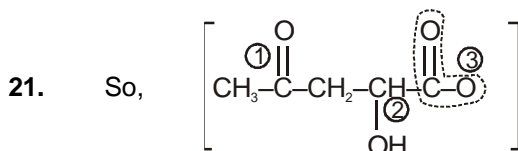
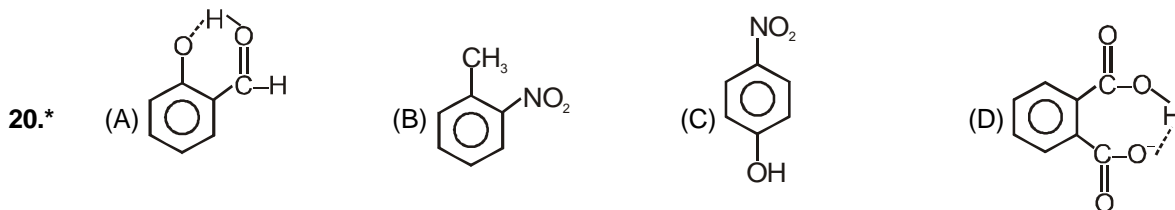
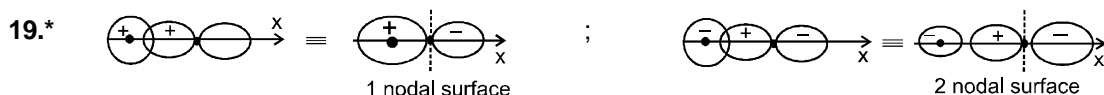
15.  $\begin{array}{c} -1 \quad +1 \quad -1 \\ \vdots \quad \vdots \quad \vdots \\ \text{N}=\text{N}=\text{N} \end{array}$  The two nitrogen atoms are equivalent

16.\* In  $\text{HN}(\text{SiH}_3)_2$ , lone pair of N is delocalized by back bonding in d-orbitals of 2 silicons. So it is very poor base.

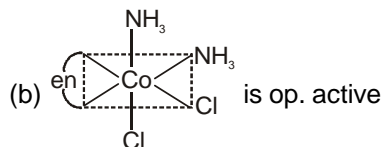
$\text{NH}_3$ ,  $\text{NH}_2(\text{CH}_3)$ ,  $\text{:NH}$  and  $\text{H}_2\text{N}(\text{SiH}_3)_2$  are hence better bases than  $\text{HN}(\text{SiH}_3)_2$ .



18.\* Refer notes



22. (a) cis-isomer is op. active.



(c) op. inactive

(e) always optically active.

(g) EDTA complexes are optically active

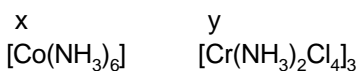
(i) same as (h)

(d) op. inactive

(f) square planar, optically inactive

(h) 3 didentate ligands are always optically active

23.



$$x + 3y - 4 \times 3 = 0 \Rightarrow x + 3y = 12$$

common oxidation states of Co are +2 and +3 & same for chromium.

only  $\text{Co}^{+3}$ ,  $\text{Cr}^{+3}$ , satisfy the above equation

$$\text{Hence } x + y = 6$$

24.

(a)  $d_{x^2-y^2}$  ( $d\text{-}sp^2$ ) (b)  $sp^3$

(c)  $\text{NH}_4^+ = sp^3$

(d)  $sp^3d^2$  (SN=6)  $d_{z^2}$  and  $d_{x^2-y^2}$

(e)  $d^2sp^3$  ( $d_{z^2}$  and  $d_{x^2-y^2}$ )

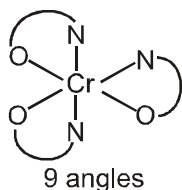
(f)  $dsp^2$  ( $d_{x^2-y^2}$ )

(g)  $sp^3d^2$  ( $d_{z^2}$  and  $d_{x^2-y^2}$ )

(h)  $\text{I}_3^-$  ( $d_{z^2}$ )

Hence, ans is 4

25.



26.

For  $\text{H}_x \text{Fe}(\text{CO})_4$ ,  $18e^-$  rule for Fe =  $8 - (-x) + 4 \times 2 = 18$

$$\Rightarrow x + 8 = 10 \Rightarrow x = 2$$

Similarly, Re belongs to 7<sup>th</sup> group

;

So,  $18e^-$  rule for Re =  $7 - (-y) + 10 = 18$

$$\Rightarrow 7 + y = 8$$

$$\Rightarrow y = 1$$

$$\Rightarrow x + y = 3$$

27.

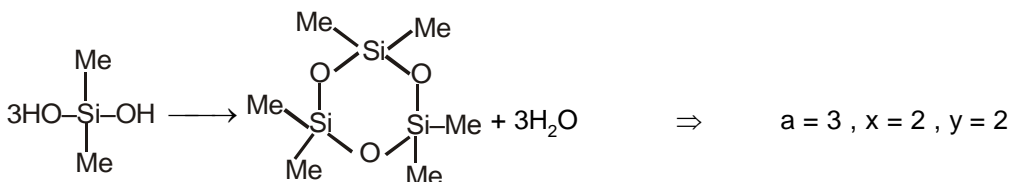
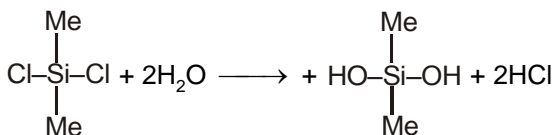
(a), (c), (f), (i) are correct

28.

The lone pair on nitrogen of  $\text{NH}_2$  is in conjugation with the double bond of rings and hence is delocalized.

29.

The product is a silicone in which each Si is bonded to two O atom. This can be achieved by having two Cl atoms.



$$\text{So, } a + x + y = 7$$



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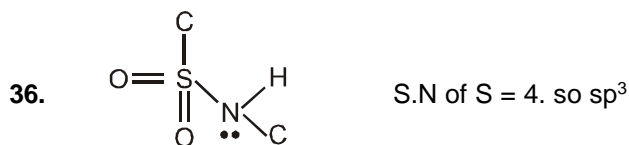
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31. Self explanatory 32. The valence shell of sodium as well as aluminium is 3.

33.  $X = [\text{Cu}(\text{NH}_3)_4]^{2+}$   
 $\text{Cu}^{2+} = d^9$ , one electron is excited so we get  $dsp^2$  hyb.

34. Y is  $\text{K}_2[\text{CuCl}_4]$  35.  $[\text{CuCl}_4]^{2-} + \text{CN}^- \rightarrow [\text{Cu}(\text{CN})_4]^{3-} + (\text{CN})_2 + \text{Cl}^-$



37. sulphamate  $\Rightarrow \text{NH}_2 - \text{SO}_3^-$   
Carbamate  $\Rightarrow \text{NH}_2 - \text{CO}_2^-$   
Pyrophosphate  $\Rightarrow (\text{P}_2\text{O}_7)^{4-}$   
Thiosulphate  $\Rightarrow \text{S}_2\text{O}_3^{2-}$

38. Refer class notes.

39. All C are equivalent in Cyclopropane

40. more is s-character in the hybridized orbital involved, stronger is the bond.

41.  $:\bar{\text{C}} \equiv \overset{+}{\text{O}}:$

Although Oxygen is highly electronegative in comparison of  $sp$  hybridized carbon, here the direction of dipole is decided by the above canonical structure which is stable due to complete octet of both atoms.

42. (A)  $\text{XeO}_2\text{F}_4 \rightarrow \text{SN} = 6$ ,  $sp^3d^2$  hybridization use  $d_{z^2}$  and  $d_{x^2-y^2}$ .

(B)  $\text{SO}_2\text{Cl}_2 \rightarrow \text{SN} = 4$ ,  $sp^3$  hybridized 'S' with no lone pair.

(C)  $\text{COCl}_2 \rightarrow \text{SN} = 3$ ,  $sp^2$  hybridized.

(D)  $\text{HClO}_3 \rightarrow$  Oxidation no. of Cl = +5 & highest is +7. It contains one lone pair.

43. (A) Oxidation number of Co = +3. It is  $d^6$ , and electrons are paired. It is diamagnetic. It is low spin complex. It produces four particles per formula.

(B) Oxidation number of Rh = +1. It is  $4d^8$  and coordination number is 4. It is square planar and diamagnetic. It shows geometrical isomerism.

(C)  $\text{K}[\text{Cr}(\text{NH}_3)_2(\text{CN})_4]$  has Cr in +3 oxidation state, It shows GI, Cr(+3) is  $d^3$  hence paramagnetic with 3 unpaired electrons. It produces 2 particles per formula and is electrically conducting.

(D) It contains  $\text{Co}^{2+}$  which is  $d^7$  and it is tetrahedral. It is paramagnetic with 3 unpaired electrons. It also has 2 particles per formula. It is electrically conducting.

44. (A)  $\text{MnO}_4^- \rightarrow$  Oxidation no. of Mn = +7, It is  $d^0$ . It is diamagnetic transfer spectrum. It is tetrahedral.

(B)  $\text{MnO}_4^{2-} \rightarrow$  Oxidation no. of Mn = +6, It is  $d^1$ . It is paramagnetic & also colored. It is tetrahedral.

(C)  $[\text{Cu}(\text{CN})_4]^{3-} \rightarrow$  Oxidation no. of Cu = +1, It is  $d^{10}$ . It is diamagnetic & colorless. It is tetrahedral.

(D)  $\text{Ni}(\text{dmg})_2 \rightarrow$  Oxidation no. of Ni = +2, It is  $d^8$ . It is square planar and diamagnetic but is colored.

45. (A) Electronegativity increases in going from left to right in period. I.E. of Be > I.E. of B.

Atomic radius decreases in going from left to right in period.

Metallic nature decreases in going from left to right in period.

Acidic nature of oxides increases in going from left to right.

(B) Down the group, electronegativity decreases, ionization energy decreases, Atomic radius increases, metallic nature increases and acidic nature of oxide decreases.

(C) Calcium & Zn belong same period but Zn is more electronegative has higher I.E. smaller radius, lesser metallic nature and has amphoteric oxide.

(D) EN, I.E and acidic nature of oxide of S is more than those of Se.