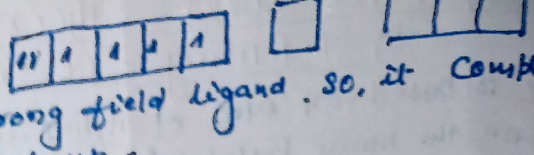
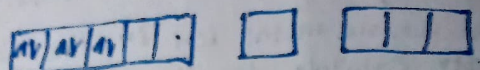
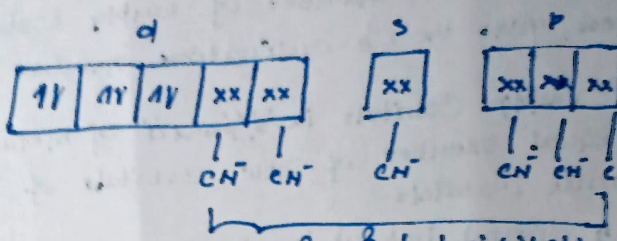
Fe^{2+} in $[Fe(CN)_6]^{4-}$ → 

We know CN^- is strong field ligand. So, it compels the d-electrons to pair up.

i.e. Fe^{2+} in $[Fe(CN)_6]^{4-}$ → 

d) $[Fe(CN)_6]^{4-}$ → 

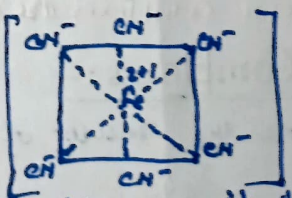
d^2sp^3 hybridisation

Valence bond diagram showing the formation of octahedral complex, $[Fe(CN)_6]^{4-}$ complex ion involving d^2sp^3 hybridisation.

As the six ligands approaches towards central metal ion Fe^{2+}, the energy thus made available forces for the pairing of unpaired electrons in 3d orbitals by rearranging them, it is shown in (c). Thus in 3d out of four unpaired electrons, two becomes paired (by spin pairing) and two 3d orbitals becomes vacant, which are used for hybridisation with one 4s orbital and three 4p orbitals to give six equivalent d^2sp^3 hybride orbitals. These hybride orbitals which are directed towards six (6) corners of a regular octahedron, accept six electron pairs donated by six CN^- ligands and thus form $[Fe(CN)_6]^{4-}$ as shown at diagram (d).

Since the complex is result of d^2sp^3 hybridisation. It has one octahedral shape as shown in fig.

Since there is no unpaired electron in the Complex so, the nature of the Complex is Diamagnetic.



From the valence bond diagram, it is evident that inner d-orbitals have been used in the hybridisation. So, complex is called inner orbital Complex. In General inner orbital Complexes use (n-1) d, ns and np orbitals in d^2sp^3 hybridisation Scheme.

These Complexes have been also called Low spin (L.S) Complex (Orgel) and spin paired (Nyholm) Complex.

In $[Fe(CN)_6]^{3-}$, five unpaired electrons in Fe^{3+} give a Calculated Value of magnetic moment is 5.91 magnetron. But experimental value of magnetic moment is 2.3. In order to explain the magnetic moment of $[Fe(CN)_6]^{3-}$, Pauling suggested that the unpaired 3d electrons in the Fe^{3+} undergo pairing to give the arrangement as shown in fig. The resulting Complex should have one unpaired electron and it has d^2sp^3 hybridization as given below. — (*)