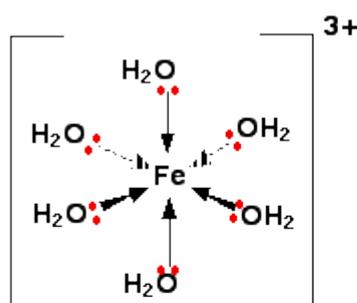


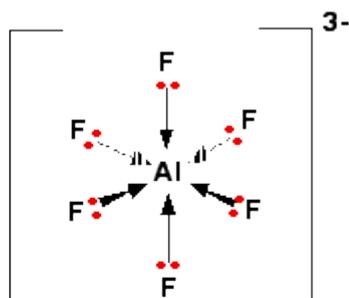
Thursday 5/1/2012

6-coordinated complex ions

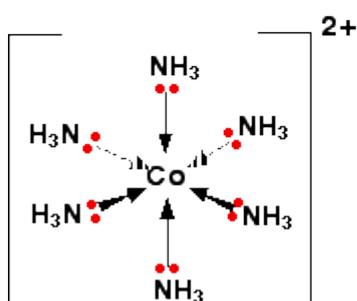
These are complex ions in which the central metal ion is forming six bonds. In the simple cases we are talking about, that means that it will be attached to six ligands. These ions have an *octahedral* shape. Four of the ligands are in one plane, with the fifth one above the plane, and the sixth one below the plane. The diagram shows four fairly random examples of octahedral ions.



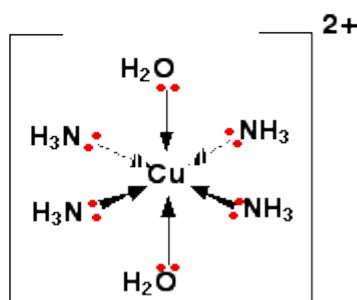
$[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$



$[\text{AlF}_6]^{3-}$



$[\text{Co}(\text{NH}_3)_6]^{2+}$



$[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$

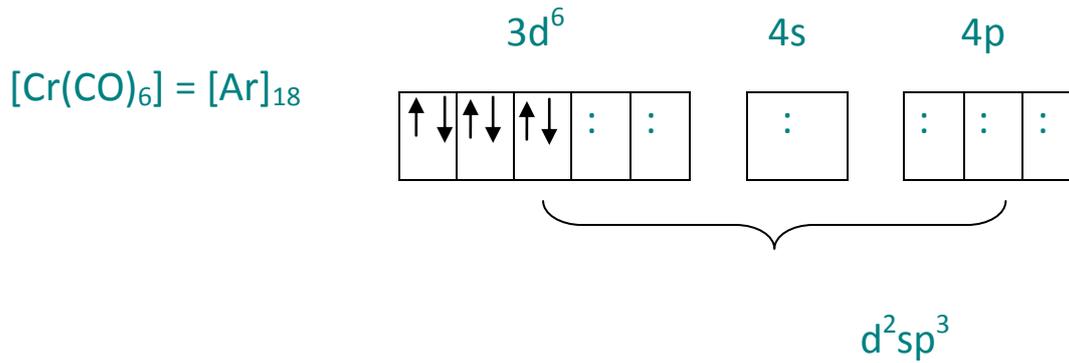
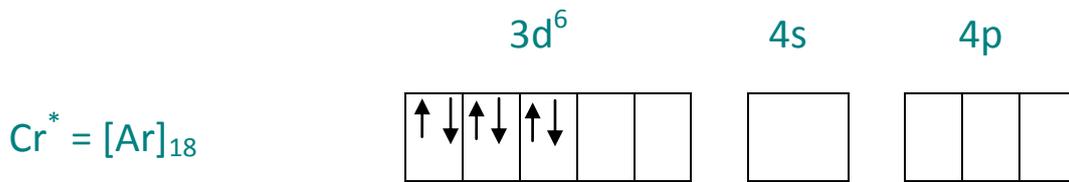
It doesn't matter what the ligands are. If you have six of them, this is the shape they will take up. Easy!

4-coordinated complex ions

These are far less common, and they can take up one of two different shapes.

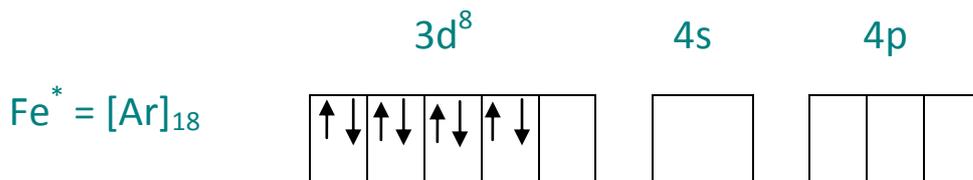
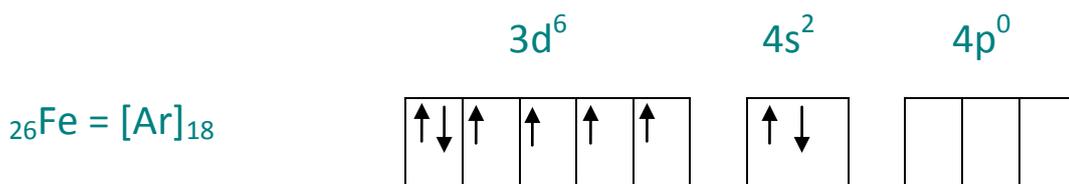
Tetrahedral ions

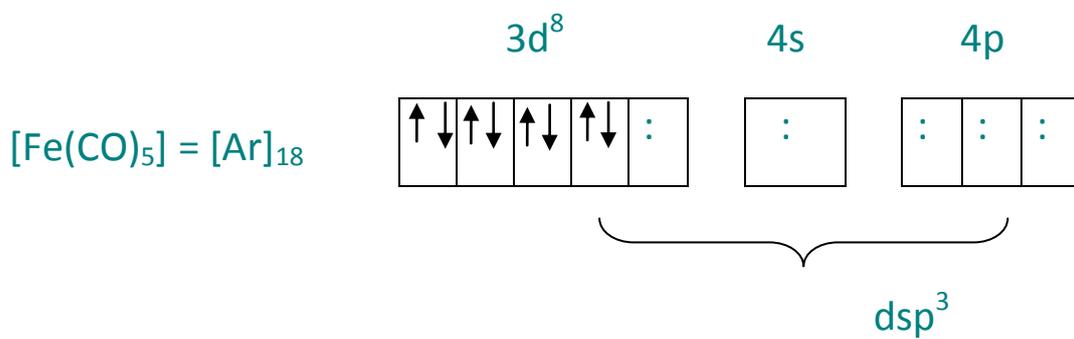
These are the ones you are most likely to need for A' level purposes in the UK. There are two very similar ions which crop up commonly at this level: $[\text{CuCl}_4]^{2-}$ and $[\text{CoCl}_4]^{2-}$. The copper(II) and cobalt(II) ions have *four* chloride ions bonded to them rather than six, because the chloride ions are too big to fit any more around the central metal ion



d^2sp^3
 (Octahedral)
 (Dimagnetic)

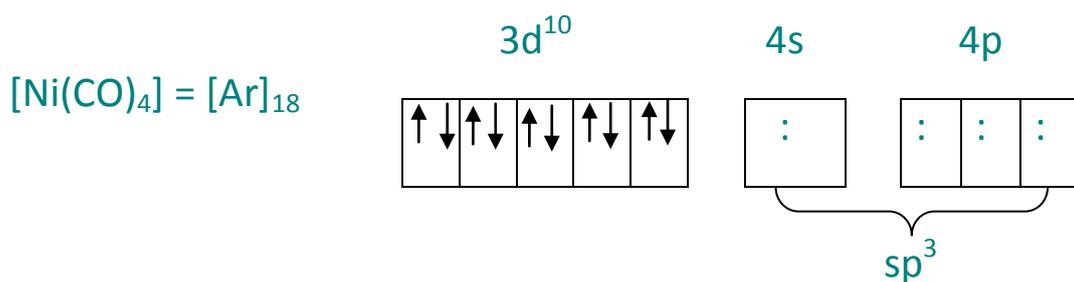
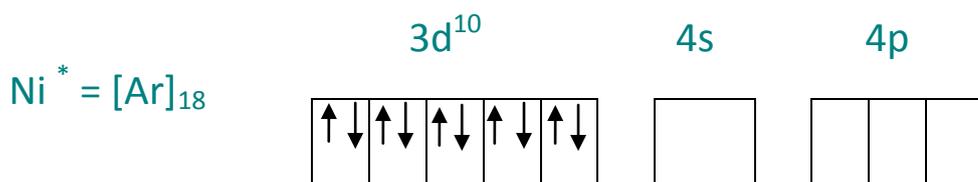
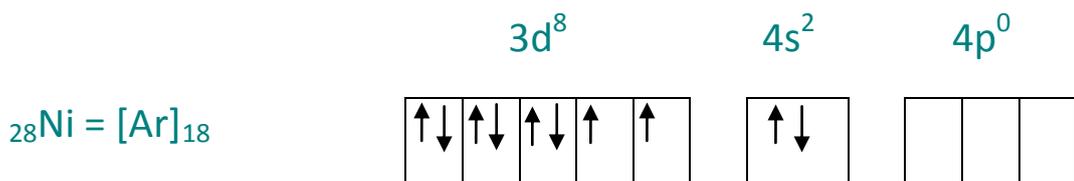
2- $\text{Fe}(\text{CO})_5$





dsp³
 (Trigonal Bipyramed)
 (Dimagnetic)

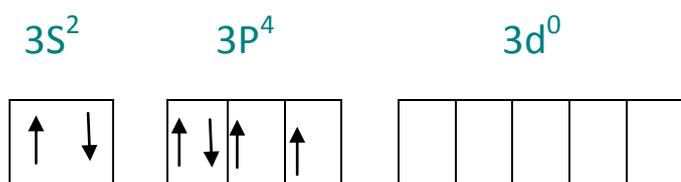
3- Ni(CO)₄



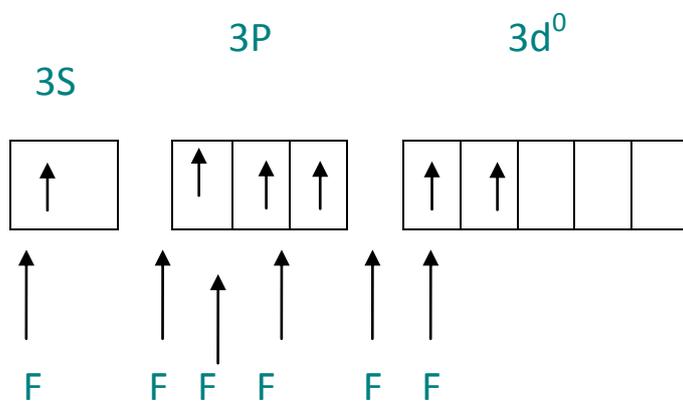
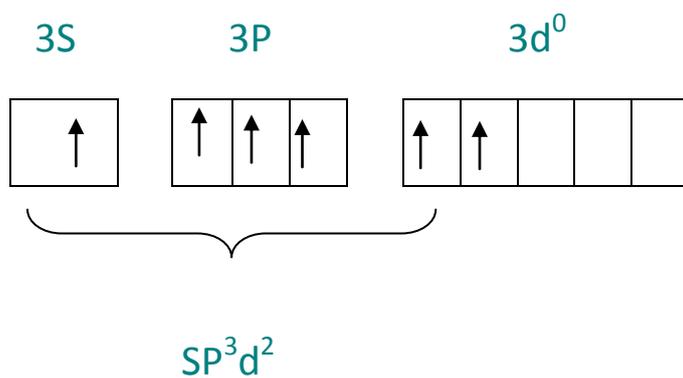
sp^3
(Tetrahedral)
(Dimagnetic)

4-SF₆

${}_{16}S = [Ne]_{10} 3S^2 3P^4 3d^0$

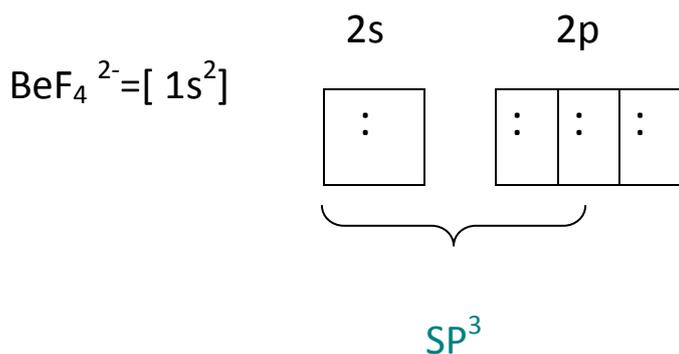
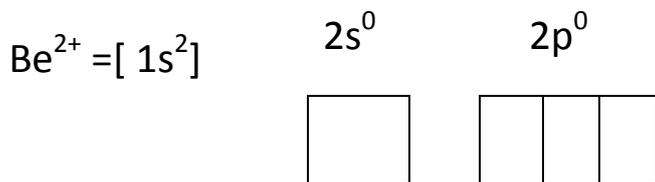


$S^* = [Ne]_{10}$



5- BeF_4^{2-}

${}_{4}\text{Be} \quad 1s^2 2s^2$

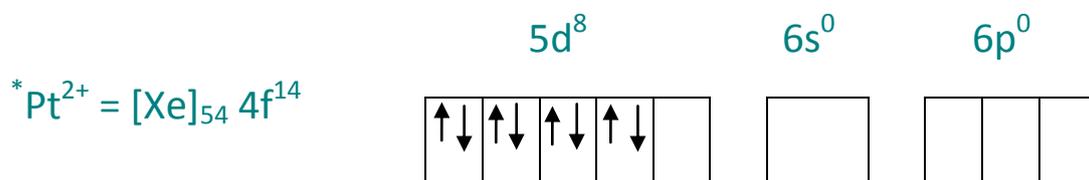
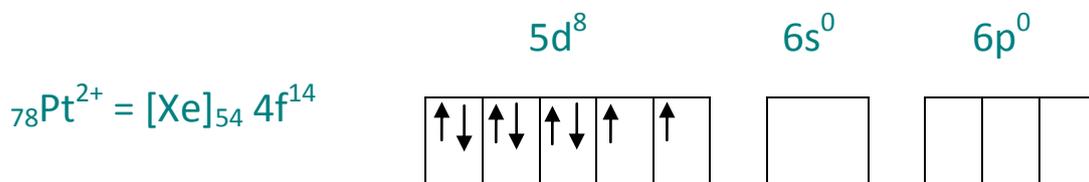
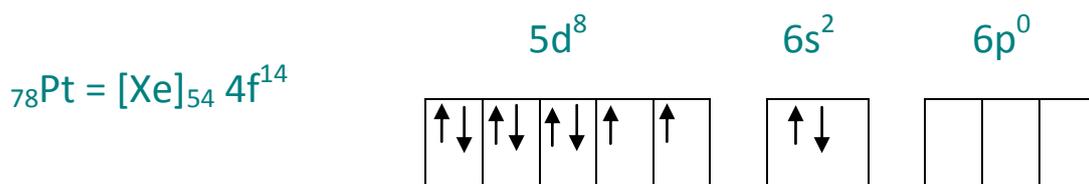


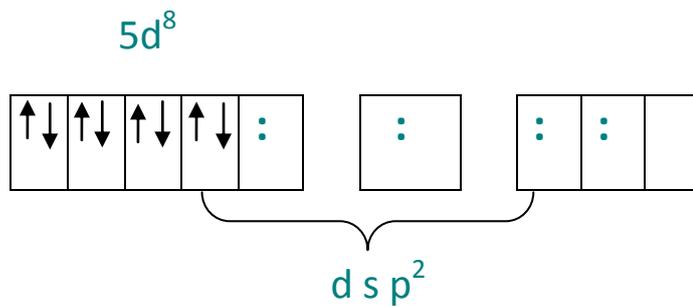
sp^3

Tetrahedral

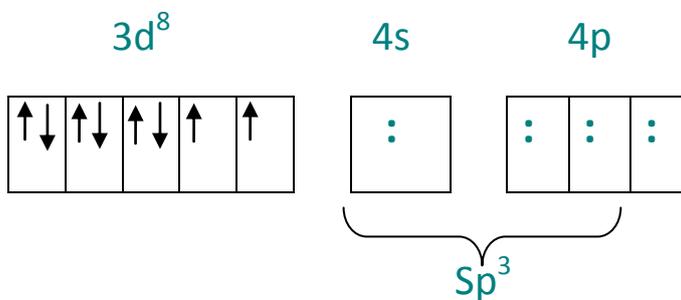
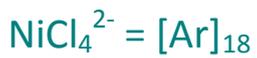
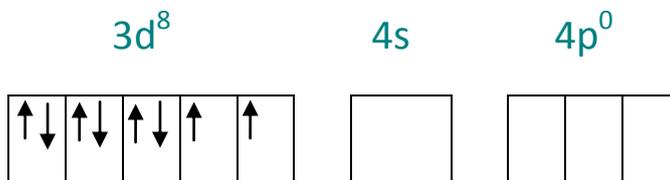
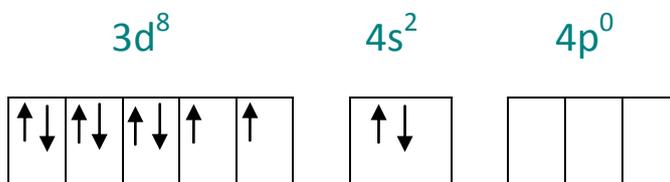
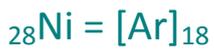
Diamagnetic

6- PtCl_4^{2-}



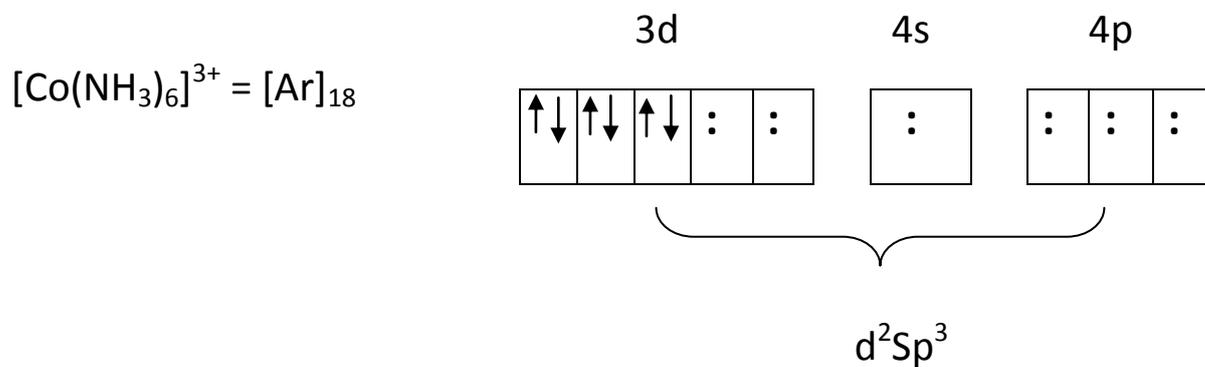
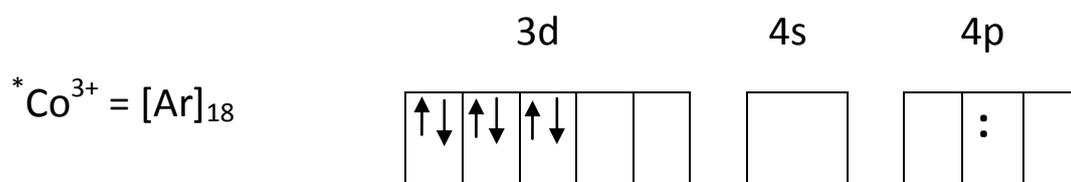
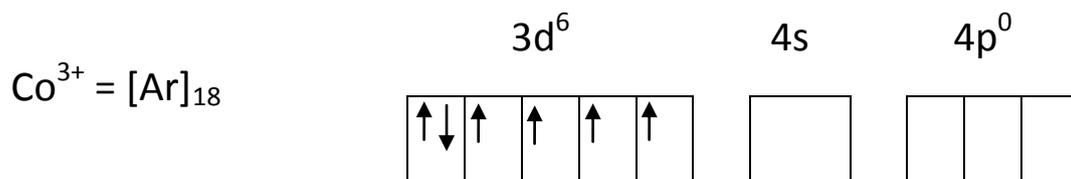
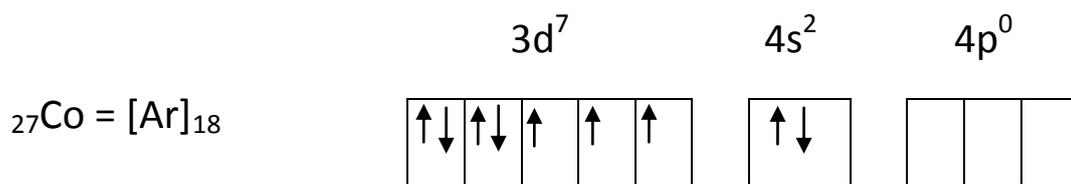


$d s p^2$
Square Planer
Diamagnetic



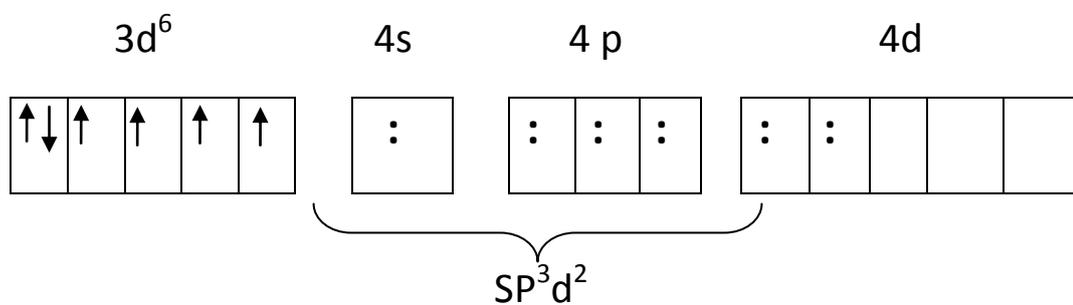
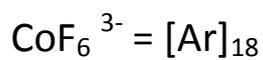
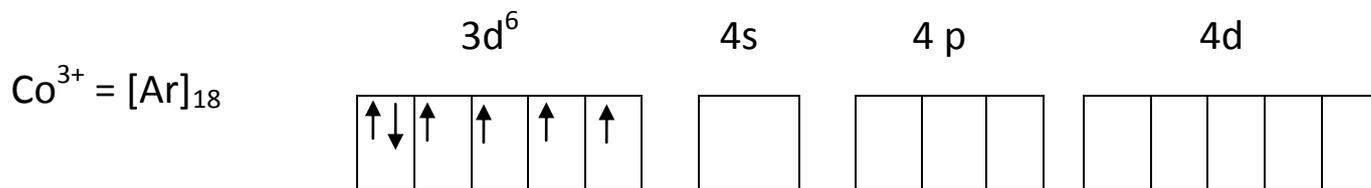
$s p^3$
Tetrahedral

8- $[\text{Co}(\text{NH}_3)_6]^{3+}$



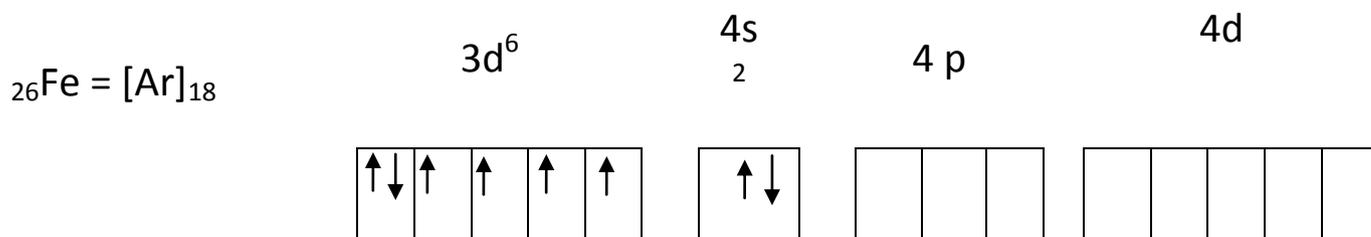
d^2sp^3
Octahedral

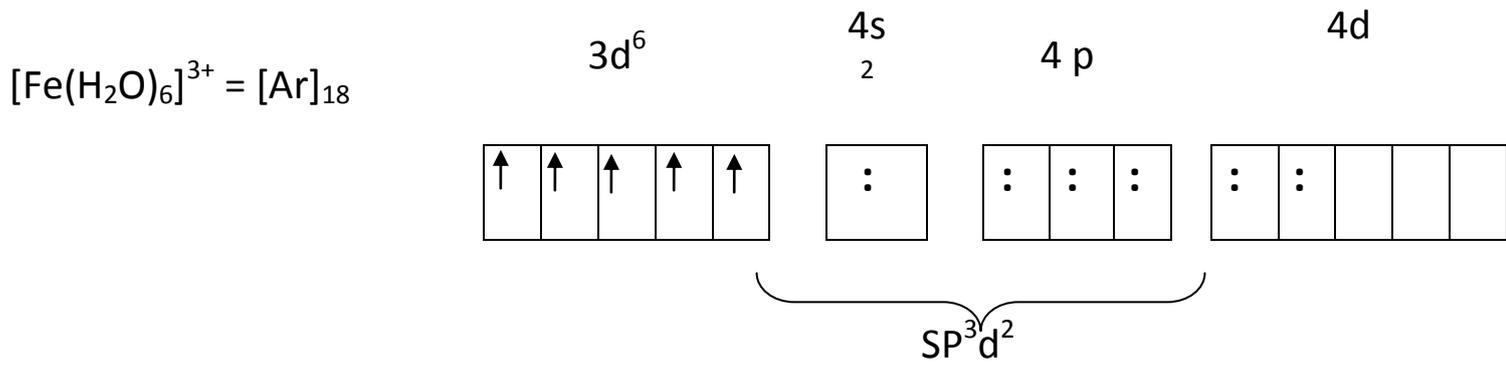
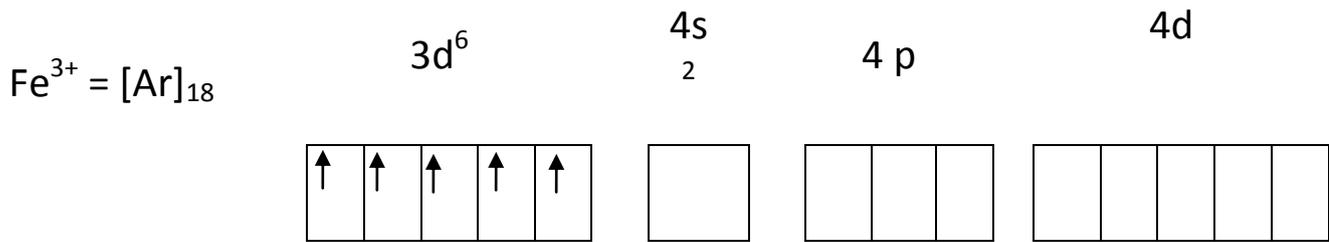
9- CoF_6^{3-}



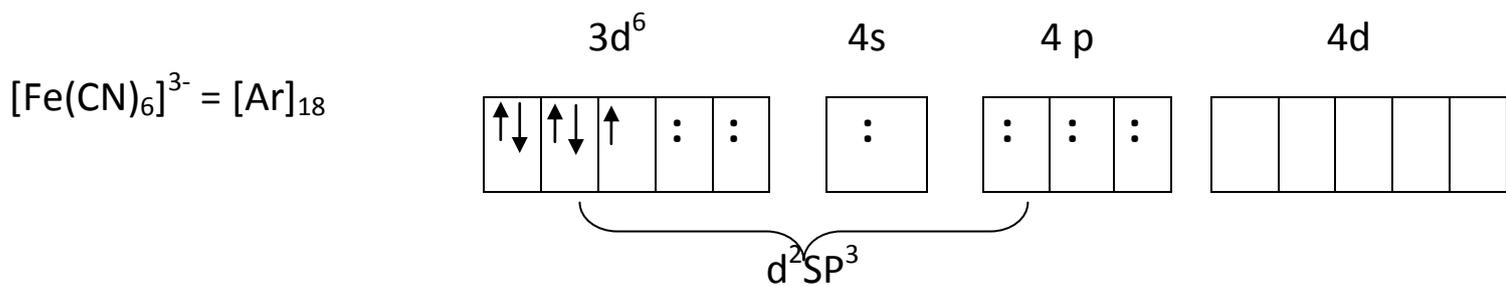
(outer complex) SP^3d^2
Octahedral

10- $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$



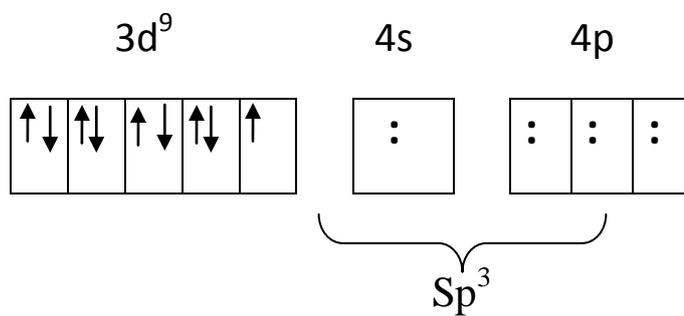
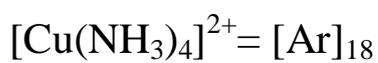
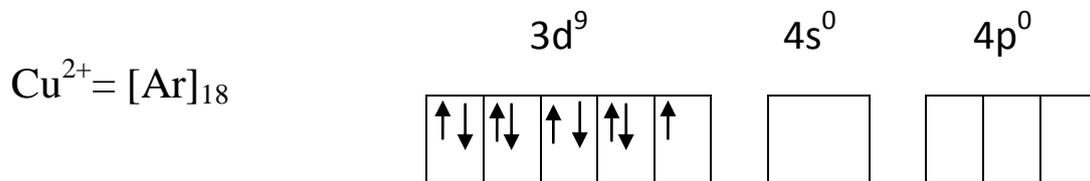
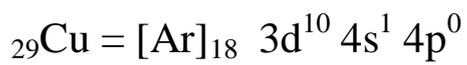


(Outer Orbital Complex) SP^3d^2
Octahedral



(Inner Orbital Complex) SP^3d^2
Octahedral

13- $[\text{Cu}(\text{NH}_3)_4]^{2+}$



14- $[\text{Cu}(\text{NH}_3)_4]^{2+}$

