

Marks
8

- Transition metals are often found in coordination complexes such as $[\text{NiCl}_4]^{2-}$. What is a complex?

How does the bonding in the complex $[\text{NiCl}_4]^{2-}$ differ from the bonding in CCl_4 ?

What is a chelate complex?

Why is a chelate complex generally more stable than a comparable complex without chelate ligands?

Marks
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- An aqueous solution of iron(III) nitrate is pale yellow/brown. Upon addition of three mole equivalents of potassium thiocyanate (KSCN) a bright red colour develops. Draw the metal complex responsible for the red colour, including any stereoisomers.

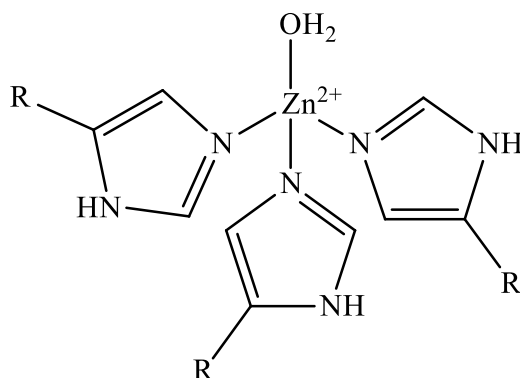


Marks
2

- Compounds of *d*-block elements are frequently paramagnetic. Using the box notation to represent atomic orbitals, account for this property in compounds of Co^{2+} .

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- The structure below represents the active site in carbonic anhydrase, which features a Zn^{2+} ion bonded to three histidine residues and a water molecule.



The $\text{p}K_a$ of uncoordinated water is 15.7 but the $\text{p}K_a$ of the water in carbonic anhydrase is around 7. Suggest an explanation for this large change.

When studying zinc-containing metalloenzymes such as this, chemists often replace Zn^{2+} with Co^{2+} because of their different magnetic properties. Predict which of these species, if either, is attracted by a magnetic field. Explain your reasoning.

- The nickel(II) ion exists as the $[\text{Ni}(\text{OH}_2)_6]^{2+}$ complex ion in aqueous solution. Define the term complex.

Marks
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What is the name of this complex ion?

Why is such a solution acidic?

Write a balanced equation for the corresponding reaction.

- The K_{sp} of $\text{Fe}(\text{OH})_3$ is $2.0 \times 10^{-39} \text{ M}^4$. What is the solubility of $\text{Fe}(\text{OH})_3$ in g L^{-1} ?

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Answer:

What effect does lowering the pH have on the solubility of $\text{Fe}(\text{OH})_3$? Explain your answer.