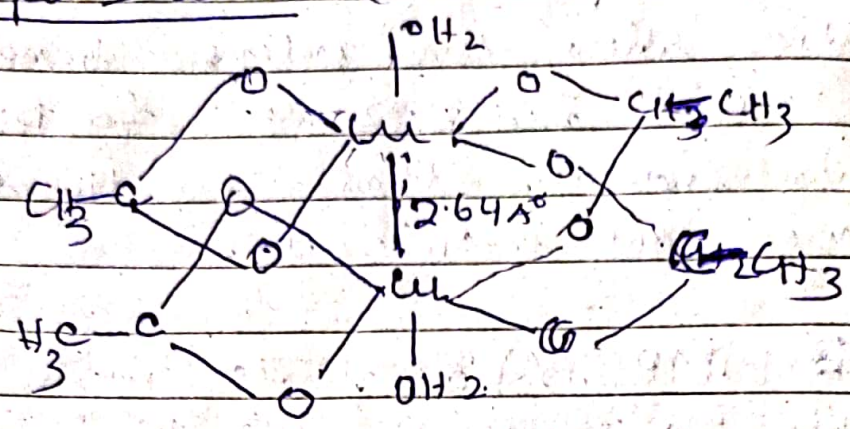


Copper(II) acetate ($\text{Cu}_2(\text{CH}_3\text{COO})_4 \cdot 2\text{H}_2\text{O}$)



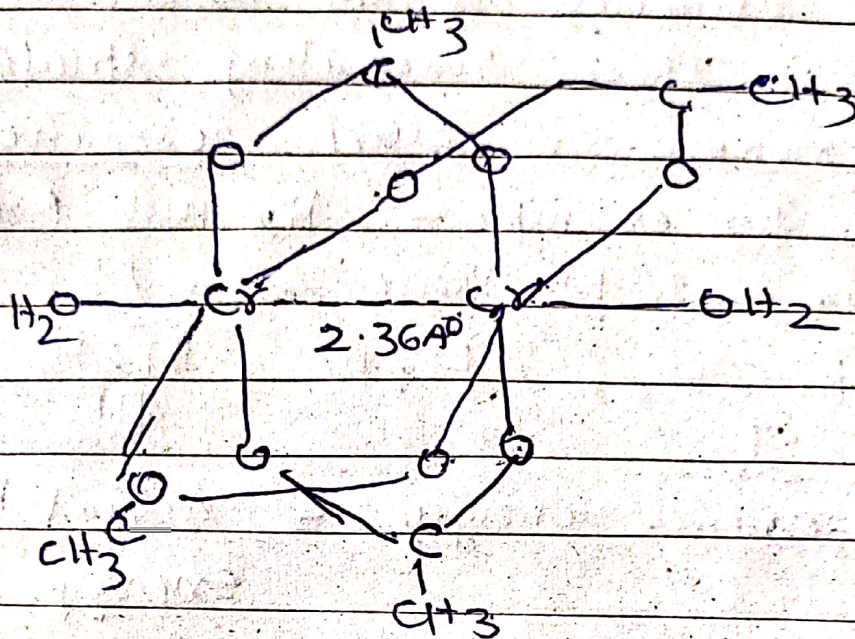
Cu(II) acetate is dimer and hydrated $\text{Cu}_2(\text{CH}_3\text{COO})_4 \cdot 2\text{H}_2\text{O}$. The structure consists of two Cu atoms each with a roughly octahedral structure. The four acetate groups act as bridging ligands. The two Cu atoms.

Cu - Cu - distance is 2.64 \AA .

Cu does not form a M - M (metal-metal) bond. The Cu(II) ion in complex have a d_9 configuration with one unpaired electron. If the two Cu ions form a metal - metal bond these electron will be paired and the complex will be diamagnetic. The magnetic moment measured at 25°C is 1.4 B.M. per Cu atom rather than spin only value of 1.73 B.M. This suggests that there is ~~no~~ weak coupling of unpaired

~~orbital~~ spin on the two Cu-atom in the complex. This involves lateral overlap of the dx^2-y^2 orbitals on the Cu-atom which is known as δ bonding.

chromium acetate



The structure is almost like $Cr(II)$ acetate. The one big difference is Cr forms M-M bond between two Cr ion because bond length is 2.36 Å which is shorter and can form M-M bond and thus diamagnetic.

Four acetate group bridge in chromium acetate ligands using one S, 3P and dx^2-y^2 and d_{z^2} orbitals. d_{z^2} form σ bond to another Cr. dx^2 and dy^2 form π bonding between two Cr atoms. dx^2 form δ bond.

Resonance

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There are large no. of molecules and ions such as CO_2 , NO_2 , SO_4^{2-} etc. in which basic mode of bond formation can not explain by single structure. We explain it by saying that the structure of the substance is hybrid of these resonating structures. This phenomenon is called resonance.

For example - H_2 mol. (in formation of H_2 mol. we have seen)

$\text{H}-\text{H}$, $\text{H}^+ \text{H}^-$, $\text{H}^- \text{H}^+$

I , II , III

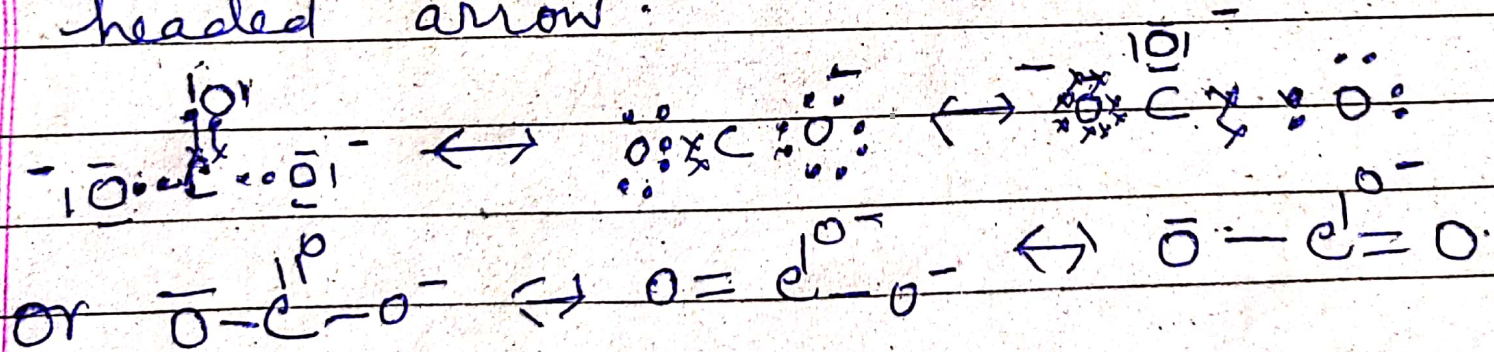
Resonance energy = Actual bond energy - energy for

Example : - CO_2

If we consider the bonding of CO_2 as follow $\text{O}=\text{C}=\text{O}$, molecule is linear one because sp hybridization. In CO_2 the bond distance is 1.15 \AA . This is intermediate between 1.21 \AA in ketone ($\text{C}=\text{O}$) and in $\text{CO} = 1.13 \text{ \AA}$ which is generally supposed to contain a triple bond ($\text{C}\equiv\text{O}$). Hence we conclude that Carbon-oxygen is stronger than a double bond. This increase in strength is due to resonance.

According to Resonance, whenever a single Lewis structure cannot describe a molecule accurately, a number of structures with similar energy (position of nuclei bonding and non-bonding pairs of electron lone pair) taken as the canonical structures of the hybrid which describe the molecule accurately.

Resonance is represented by a double headed arrow.



According to the experimental finding, all carbon to oxygen bonds in CO_3^{2-} are equivalent i.e. π electrons are delocalised.