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TOPIC - MAGNETIC PROPERTIES
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When a substance is placed in a magnetic field of strength H, the intensity of the magnetic field in the substance may be greater than or less than H. If the field in the substance is greater than H, the substance is paramagnetic. It is easier for magnetic lines of force to travel through a paramagnetic material than through a vacuum. Thus paramagnetic materials attract lines of force, and, if it is free to move, a paramagnetic material will move from a weaker to a stronger part of the field paramagnetic arises as a result of unpaired electron spins in the atom.

If the field in the substance is less than H, the substance is diamagnetic. Diamagnetic materials tend to repel line of force. It is harder for magnetic lines of force to travel through diamagnetic materials than through a vacuum, and such materials tend to move from a stronger to a weaker part of a magnetic field. In diamagnetic compounds all the electron spins are paired. The paramagnetic effect is much larger than the diamagnetic effect.

It should be noted that Fe, Co and Ni are ferromagnetic. Ferromagnetic materials may be regarded as a special case of paramagnetism in which the moments on individual atoms become aligned and all point in the same direction.

When this happens the magnetic Susceptibility is greatly enhanced Compared with what it would be if all the moments behaved independently. Alignment occurs when materials are magnetized, and Fe, Co and Ni can form permanent magnets. ferromagnetism is found in Several of the transition metals and their Compounds. It is also possible to get antiferromagnetism by pairing the moments on adjacent atoms which point in opposite directions. This gives a magnetic moment less than would be expected for an array of independent ions It occurs in Several Simple Salts of Fe^{3+}, Mn^{2+} and Gd^{3+}. Since ferromagnetism and antiferromagnetism depend on orientation they disappear in Solution.

Many Compounds of the transition elements are paramagnetic, because they Contain partially filled electron Shells. If the magnetic moment is measured, the number of unpaired electrons Can be Calculated. the magnetochemistry of the transition elements Shows whether the d electrons are paired This is of great importance in distinguishing between high-Spin and low-Spin octahedral Complexes.

The magnetic moment μ of a transition metal Can give important information about the number of unpaired electrons present in the atom and the orbitals that are occupied. and Some times indicates the structure of the molecule or Complex. If the magnetic moment is due entirely to the spin of unpaired electrons μ_s then

$$\mu_s = \sqrt{4S(S+1)} \cdot \mu_B$$