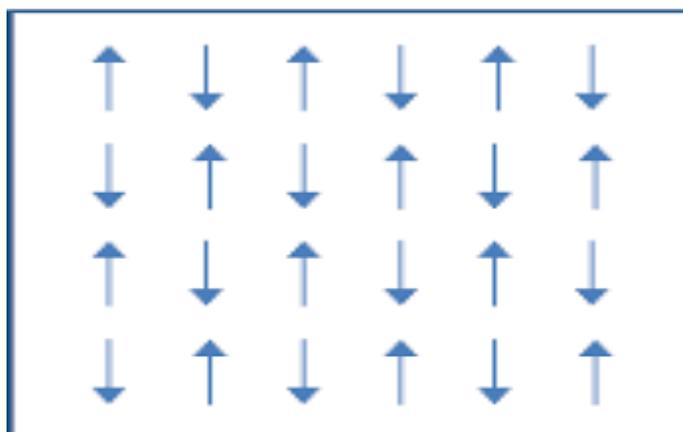




## ANTIFERROMAGNETIC MATERIALS

- The spin alignment is in antiparallel manner.
- Susceptibility is small and positive and it depends on temperature.
- Initially susceptibility increases with increase in temperature and beyond Neel temperature the susceptibility decreases with temperature.
- The antiparallel alignment exists in material below a critical temperature known as Neel temperature
- At Neel temperature susceptibility is maximum. Susceptibility,  $\chi = M / M + \theta$
- Examples: Mn, Cr, FeO, MnO, Cr<sub>2</sub>O<sub>3</sub> and salts of transition elements

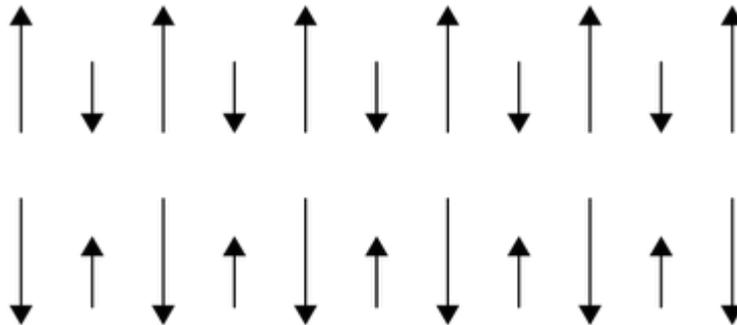


Antiferromagnetic ordering



## FERRI MAGNETIC MATERIALS

- The spin alignment is antiparallel but have different magnitude.
- So they possess net magnetic moment which produce a large magnetization even for a small applied external field.



- It is also called ferrites.
- Susceptibility is very large and positive.
- Examples: ferrous ferrite, nickel ferrite



**Comparison:**

<i>S. N</i>	<i>Properties</i>	<i>Diamagnetic</i>	<i>Paramagnetic</i>	<i>Ferromagnetic</i>
1	Definition	It is a material in which there is no permanent magnetic moment.	It has permanent magnetic moment.	It has enormous (more) permanent magnetic moment.
2	Spin or magnetic moment or dipole alignment.	No spin alignment.	Random alignment	Parallel and orderly alignment.
3	Behavior	Repulsion of magnetic lines of force from the centre of the material.	Attraction of magnetic lines towards the centre.	Heavy attraction of lines of force towards the centre.
4	Magnetized direction	Opposite to the External magnetic field.	Same direction as the External magnetic field.	Same direction as the External magnetic field.
5	Permeability	It is very less	It is high	It is very high
6	Relativity permeability	$\mu_r < 1$	$\mu_r > 1$	$\mu_r \gg 1$
7	Susceptibility	Negative	Low positive	High positive
8	Magnetic phase transition	At 0 K, diamagnetic material is Superconductor. When we increase its temperature it becomes a normal conductor.	When temperature is less than the curie temp, it is converted in to Diamagnetic.	When temperature of the material is greater than it Curie temperature it is converted into Paramagnet.