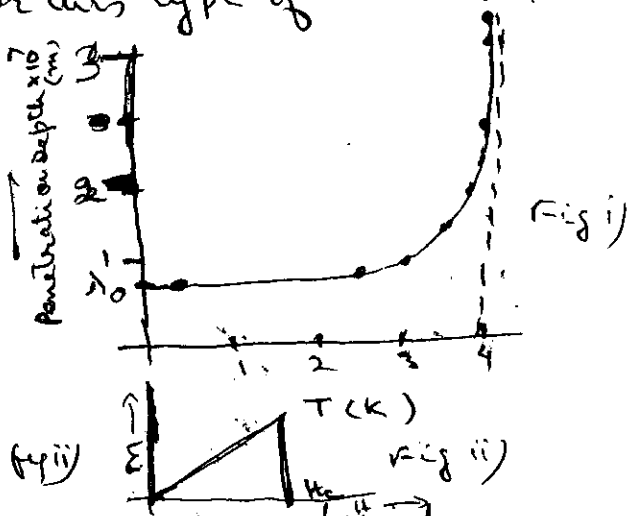
Type-I and Type-II Superconductors

Superconductors are classified into to catagories

i) Type-I superconductors, also called soft superconductors

ii) Type-II superconductors, also called as Hard superconductors

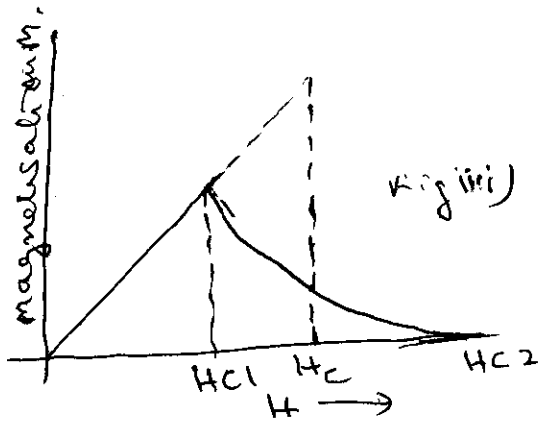
Soft or Type-I superconductor is that superconductor which excibits complete meissner effect i.e field exclusion. The magnetisation curve for this type of material is shown in figure



Critical fields* for superconductors are very low. It is because of this reason that superconducting wires can not be used to produce high magnetic fields.

Graph between H & M is shown in fig ii)

Hard or Type-II superconductors are those materials in which ideal behaviour of superconductors is seen upto a lower critical field H_{c1}. For $H > H_{c1}$ magnetisation gradually changes and attains zero at an upper critical field H_{c2}.



The region between H_{c1} & H_{c2} is known as **vortex region**. (Mixed region)

Normal behavior of type-II substances is observed after $H > H_{c2}$. The lines of induction penetrate gradually as field H is increased beyond H_{c1} & penetration completes at $H = H_{c2}$.

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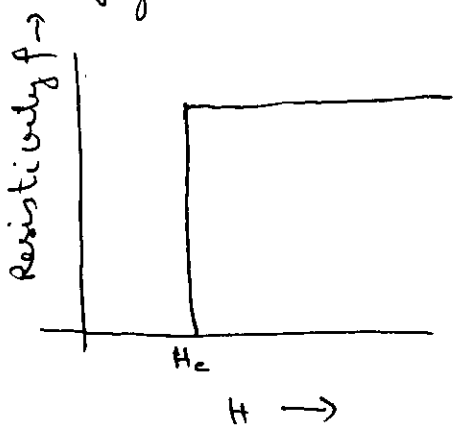
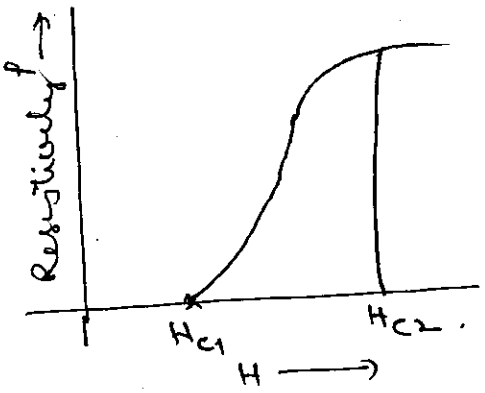
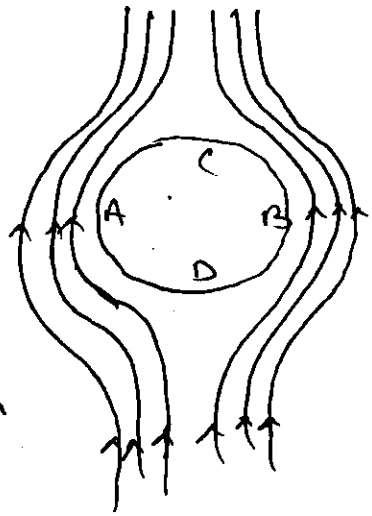
* Critical field is that minimum magnetic field at which superconducting materials loose their superconductivity even when they are cooled below critical temperature.

Resistivity graph against applied magnetic field is as shown in figure.





Adjoining figure shows that magnetic field is stronger near the sides of spherical conductor, than near top and bottom. (C & D)



On increasing the field the field becomes larger than H_c near A & B. and the material near the sides becomes normal i.e. looses superconductivity.

However at the same time the material near C and D still remains superconductor. This means, that the material is in mixed state (with some portion superconducting and some portion normal metal).

At $H \geq H_{c2}$ field near C & D also becomes > critical field and whole material becomes normal metal.

∴ The state between $H_{c1} \leq H < H_{c2}$ is called mixed state.