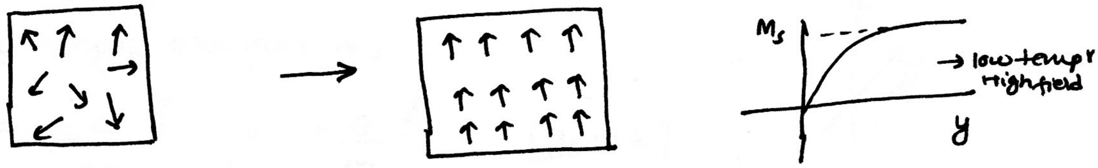


<u>Ferromagnetic ordering</u>:

Weiss proposed that inaddition to external magnetic field, there is an internal field called the molecular field or weiss field.

For paramagnet, $y = g_J \mu_B \dfrac{BJ}{K_B T}$ B = ext. field,

In the presence of molecular field,

B = ~~B_ext + B_molecularfield~~

$$y = g_J \mu_B \frac{(B + \lambda M) J}{K_B T}$$

Even for External field $B = 0$, there is spontaneous magnetization due to λM.

$$y = g_J \mu_B \frac{\lambda M J}{K_B T}$$

So, the

$$\frac{M}{M_s} = B_J(y) = B_J\left(\frac{g_J \mu_B \lambda M J}{K_B T}\right) \quad \text{— (1)}$$

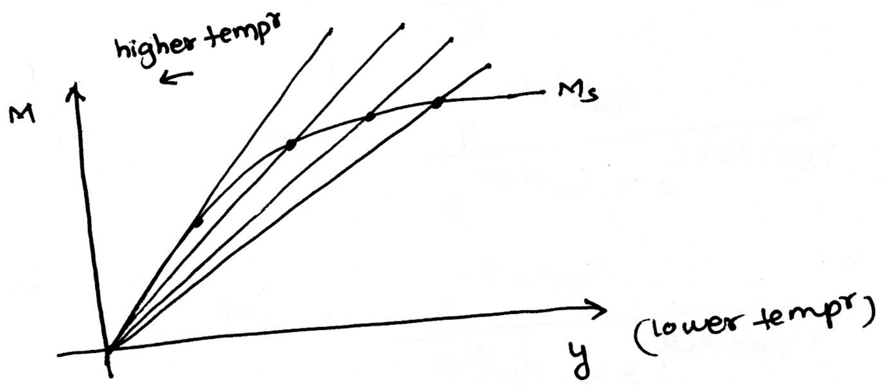
$$y = \frac{g_J \mu_B \lambda M J}{K_B T}$$

or $$M = \frac{y K_B T}{g_J \mu_B \lambda J} \quad \text{— (2)}$$

linear dependence with y, with slope $= \dfrac{K_B}{g_J \mu_B \lambda J} T$ — (3)

$\propto T$

higher the tempr, higher or steeper will be the slope



From graph we see that point of intersection is the solution to both eqn (1) & (2), i.e it gives the Magnetization for certain value of y.

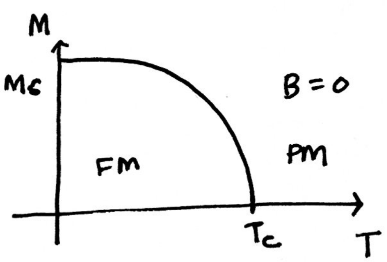
we also see that higher the temperature larger will be the slope.

And for certain critical temperature, slope of the line is equal to the slope of the Brioullin function. and $y=0$ is the only soln)

This critical temperature at which the magnetization is zero is called the curie Temperature T_c.

For Temperature $T > T_c$ (, only soln is $M=0$ at $y=0$)

For temperature $T < T_c$ (spontaneous magnetization is found).



To find T_c, we find slope of Brioullin function at $y \to 0$

we know, At $y \to 0$ (small y) $\quad B_J(y) \approx y\left(\frac{J+1}{3J}\right)$

so slope of $B_J(y)$ $\quad \frac{dM}{dy} = M_s\left(\frac{J+1}{3J}\right)$

At critical temperature, slope of Brioullin fn = slope of line from (3)

$$\frac{k_B T_c}{g_J \mu_B \lambda J} = M_s\left(\frac{J+1}{3J}\right)$$

$$\Rightarrow \quad T_c = \frac{(g_J \mu_B J)\,\lambda M_s}{k_B}\left(\frac{J+1}{3J}\right)$$