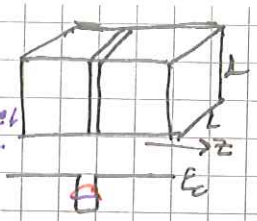
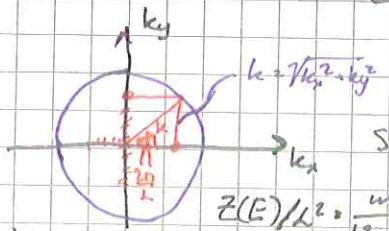
12. 2D-elektrongas

$\psi_n e^{ik_x x} \cdot e^{ik_y y} \cdot \phi(z)$ $\quad \frac{2\pi}{L} \cdot n$ $n = 0, \pm 1 \ldots$

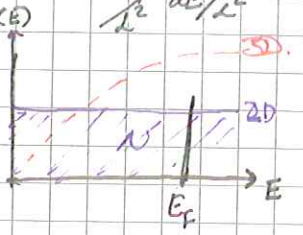
$E = \frac{\hbar^2}{2m}(k_x^2 + k_y^2) + E_z$





$S(k) = \frac{\pi k^2}{\left(\frac{2\pi}{L}\right)^2} \cdot 2$ $\quad E = \frac{\hbar^2 k^2}{2m}$

$S(E) = \ldots$ $\quad Z(E) = \frac{dS}{dE} / L^2$



$Z(E)/L^2 = \frac{m}{\hbar^2 \pi}$

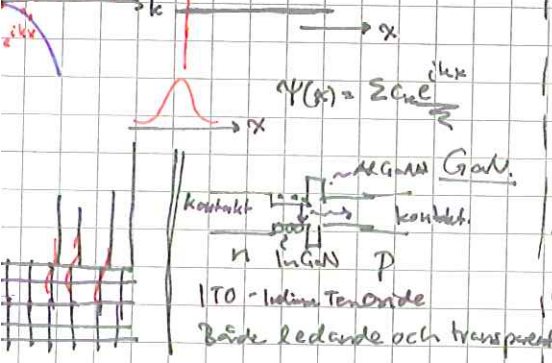
Fermienergin: E_F

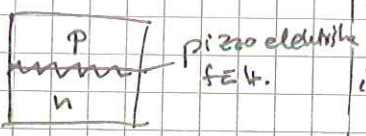
i) $N = n \cdot L^2 = \int_0^{E_F} Z(E) \cdot dE$ $\quad E_F = \frac{n\pi\hbar^2}{m}$

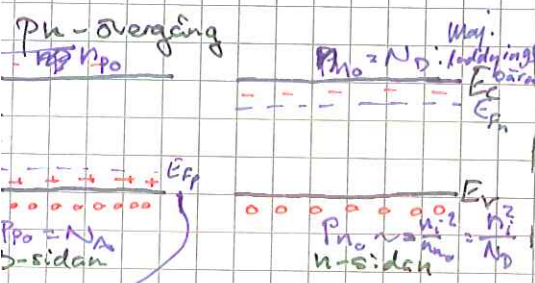
$n = \int_0^{E_F} Z(E)\, dE$ $\quad$ en ytenhet.

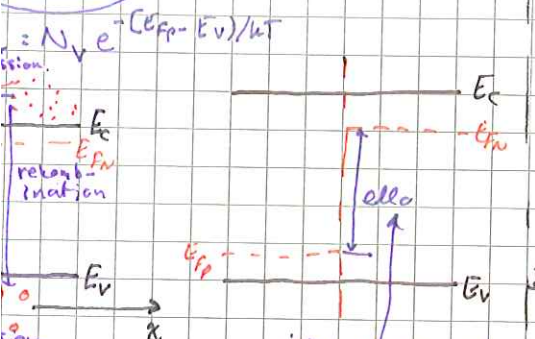
ii) $S(E) = \frac{2mE}{2n\hbar^2} L^2$. Om $E = E_F$, då är $S(E) = N$.

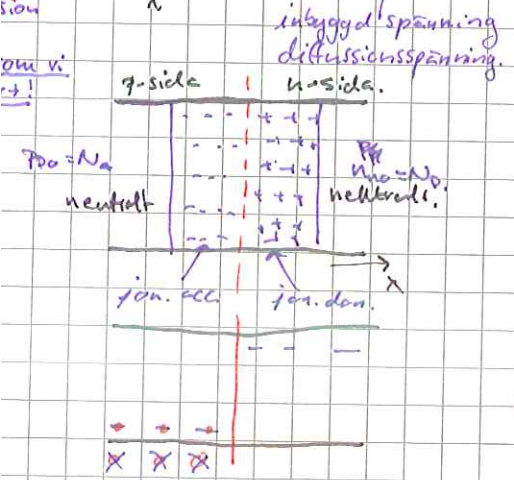
$\frac{2mE_F}{2n\hbar^2} L^2 = N = nL^2$

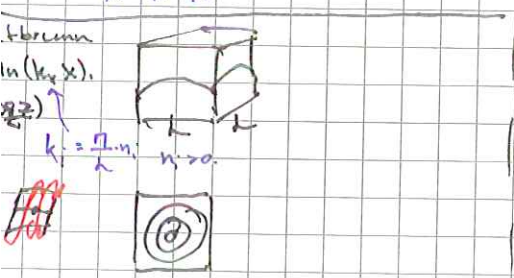




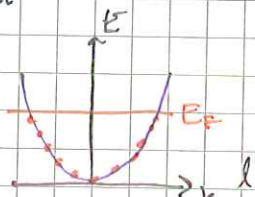








16.

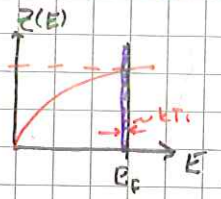


$C_v = \frac{dE}{dT}$ $\quad E(T) = E(0) + \int_0^\infty Z(E) F(E)\, dE$

I kompendiet: (uppr. 1) $\quad E(T) = E(0) + kT \cdot Z(E_F) \cdot kT = \frac{2}{2} kT \cdot \frac{N}{E_F} \cdot kT$

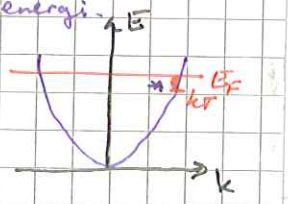
Antal e^- som kan ändra energi.

egentligen...



I uppgiften (uppr 2.). $\quad * \frac{kT}{E_F} \cdot N \cdot kT$

Antal som kan ändra energi.



17. atomära vibrationer

$E(T) = N_{atom} \cdot 3kT$ $\quad \cdot kT$

el. $\quad$ Klassiska $\quad E = N_{el} \cdot \frac{3}{2} kT$ $\quad C_v = \frac{3}{2} N_{el} \cdot k$

el. $\quad$ FEM: $\quad E = \frac{3}{2} N \frac{k^2 T^2}{E_F}$

$p = \hbar k = m v$ $\quad \frac{p^2}{2m} = \frac{m^2}{2} \omega^2 x^2$

$C_v = 3N \frac{kT}{E_F} \cdot k$