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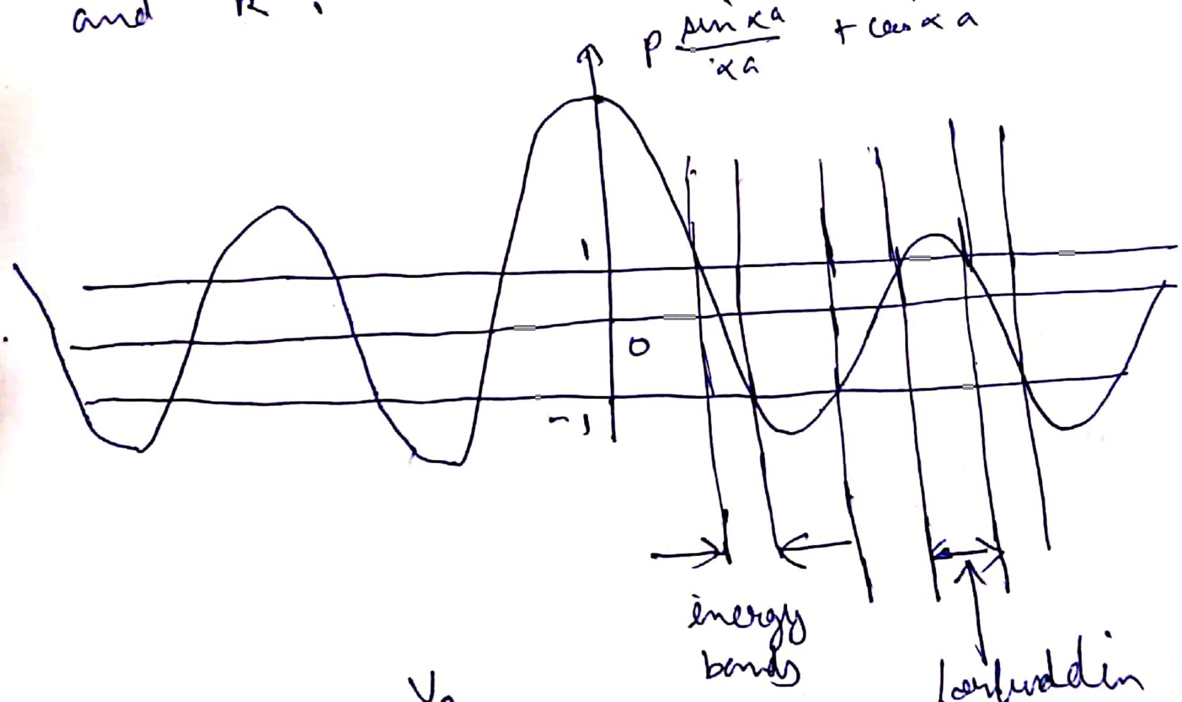
Q5) The solution of shroedinger eq^n in Kronig-Penny model comes out to be

$$P \frac{\sin \alpha a}{\alpha a} + \cos \alpha a = \cos ka$$

where $P = \frac{m V_0 b a}{h^2}$

now since $\cos(ka)$ can take values only between +1 to −1 only certain values of k are allowed.

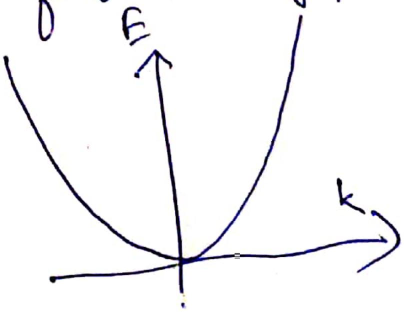
This also gives the relation between E (through α) and k.



b) Case 1 → when $V_0 \longrightarrow 0$, $P \longrightarrow 0$

$\cos \alpha a = \cos ka$ $\quad E = \frac{\hbar^2 k^2}{2m}$

$\alpha = k$



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Case 2)

When $V_0 \to \infty$, $P \to \infty$

Left hand side still has to stay within ± 1.

therefore $\frac{\sin \alpha a}{\alpha a} \to 0 \implies \alpha a = n\pi$

$\therefore \alpha^2 = \frac{n^2 \pi^2}{a^2}$ $n = 1, 2, 3 \ldots$

$\alpha^2 = \frac{2mE}{\hbar^2} \implies E = \frac{\pi^2 \hbar^2 n^2}{2ma^2}$

Energy has only discrete values

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