11.BLOCH'S THEOREM(Qualitative)

Introduction:

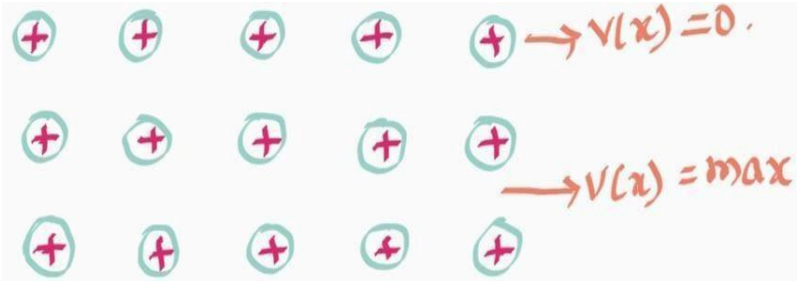
In 1928, Felix Bloch introduced a fundamental concept in condensed matter physics.

Statement:

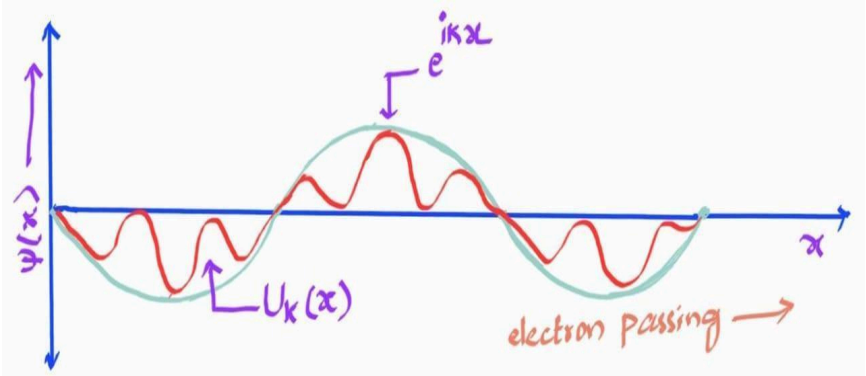
Bloch stated that "the free electrons move in a periodic potential rather than constant potential in between the ion cores in the crystal lattice."

Explanation:

- When an electron moves through the +ve ion cores, it experiences periodic potential.
- The potential is minimum [V(x)=0] at the +ve ion cores and maximum in between two +ve ion cores.



- The solution to the Schrodinger wave equation in a periodic potential can be expressed as plane waves modulated by periodic functions.
- Suppose an electron passes along x-direction in 1-D crystal as shown in figure.



- The periodic potential of moving electron along x-direction is **V(x) = V(x+a)**
- By using bloch solution **[$\psi(x) = e^{ikx} U_k(x)$]** for Schrodinger time independent ewave equation **{$\nabla^2\psi + (2m/\hbar^2)(E - V)\psi = 0$}** we get a Bloch condition**.**
- The Bloch's condition is **$\psi(x+a) = Q\,\psi(x)$**