Electronics Devices (19EC31)

Class 3

Dr. Shilpa K.C
Assistant Professor
Dept. of Electronics and Communication Engineering
Dr.AIT

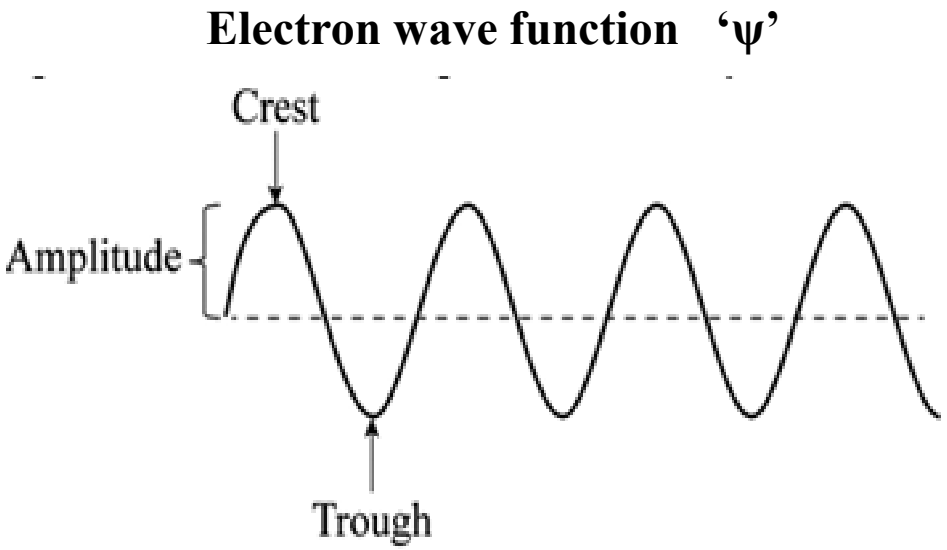
Electron Wave Function

Electrons in atoms

1) Wave (Electron wave)
2) Particle

Electron wave function ‘ψ’

LCAO – Linear Combinations of the individual atomic orbital

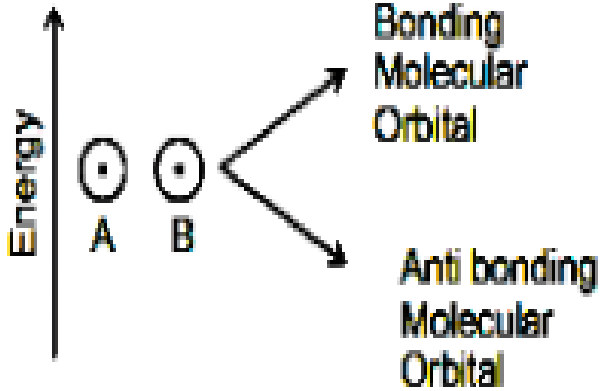


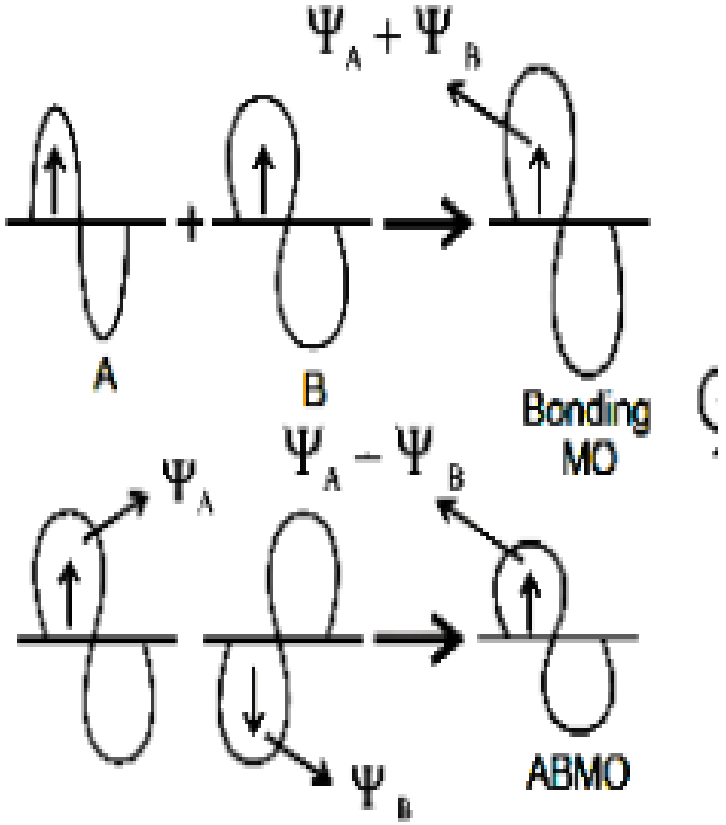
Molecular Orbits

Molecular Orbits

1. **Bonding Molecular Orbit (BMO)**
2. **Antibonding Molecular Orbit (AMBO)**

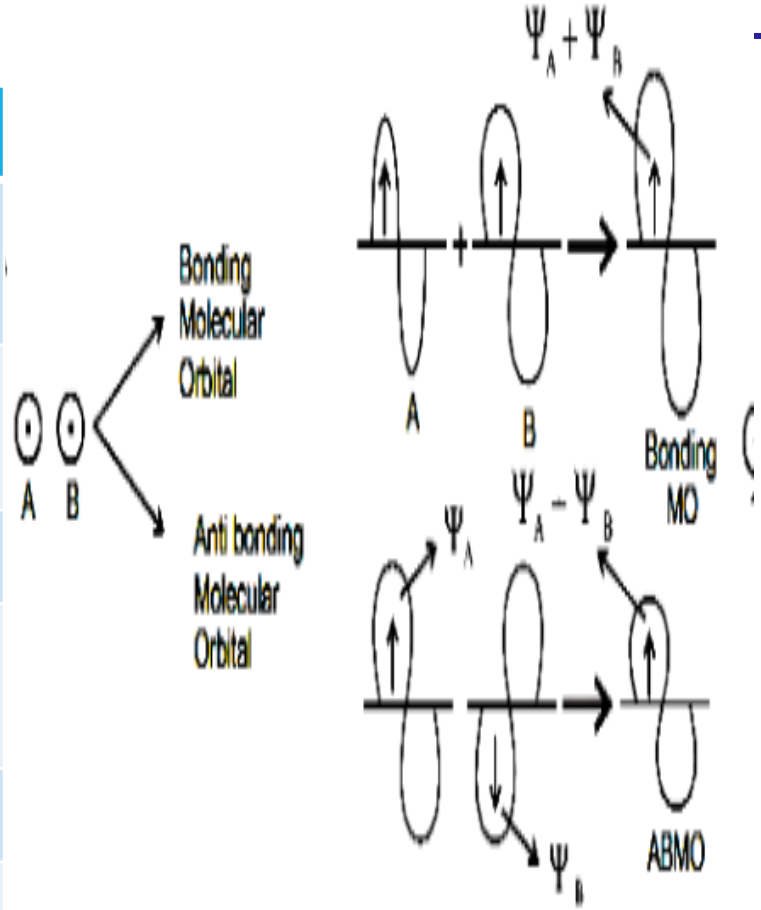
'ψ_A', 'ψ_B' ---- two electron wave function





Molecular Orbits

Bonding Molecular Orbit	Antibonding Molecular Orbit
1. $\psi_{BMO} = \psi_A + \psi_B$	$\psi_{ABMO} = \psi_A - \psi_B$
2. Waves are In-Phase Combination	Waves are Out of Phase Combination.
3. Stable Bonding	Unstable Bonding
4. Electron density is more (additive)	Electron density is less (destructive)
5. Constructive Interference	Destructive Interference
6. Occupies Lower energy level because of electron attraction is less	Occupies Higher energy level because of electron attraction is more



Molecular Orbits

Molecular Orbits

1. **Bonding Molecular Orbit**
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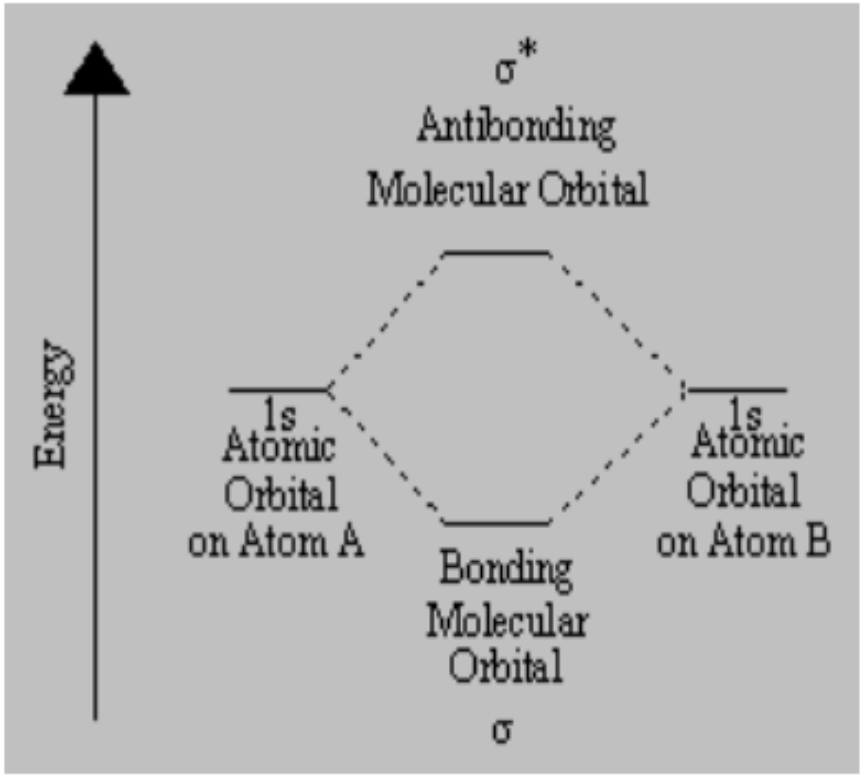


higher,
less stable

↑

potential
energy

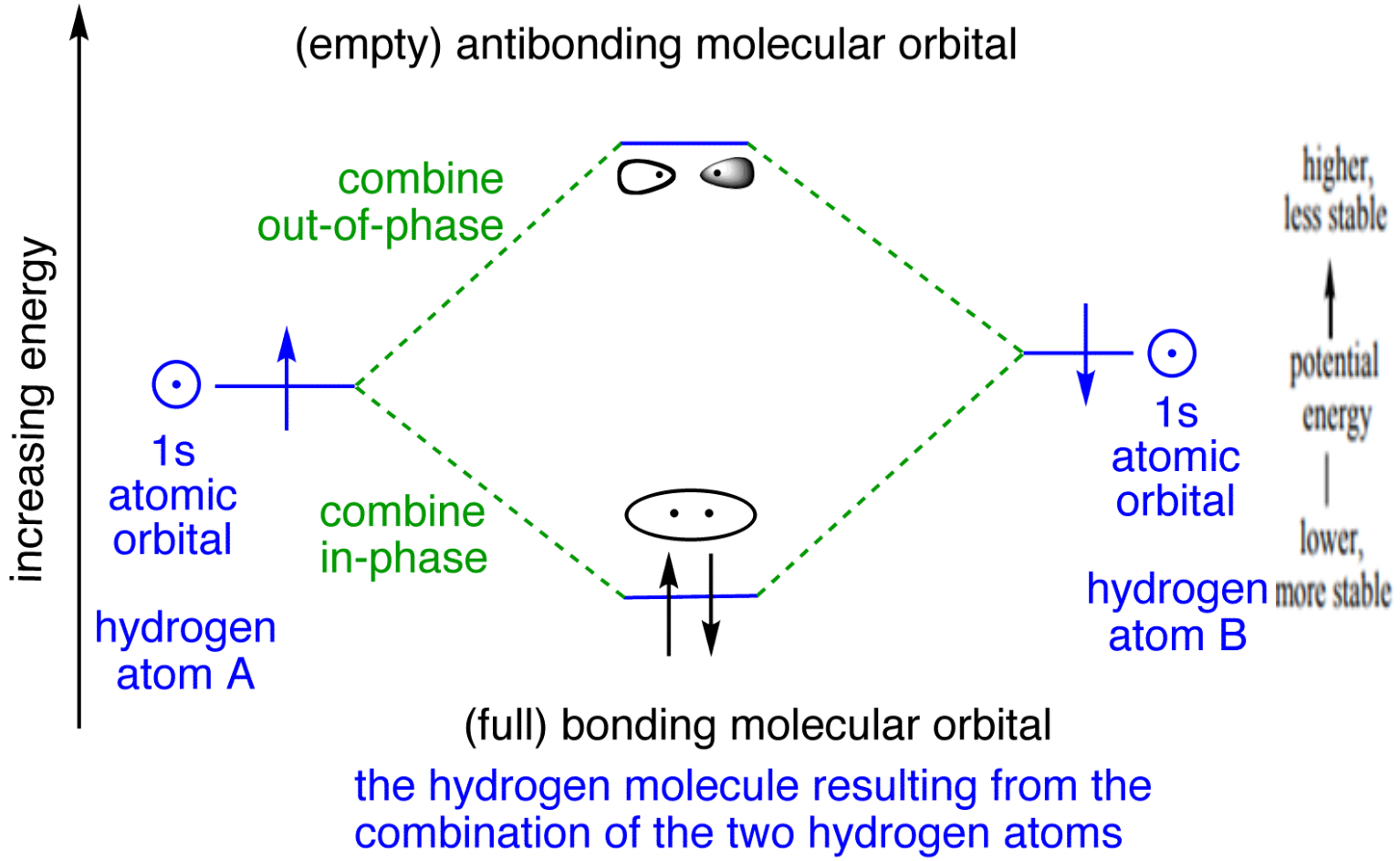
|

lower,
more stable

Molecular Orbits

Molecular Orbits

1. **Bonding Molecular Orbit**
2. **Antibonding Molecular Orbit**

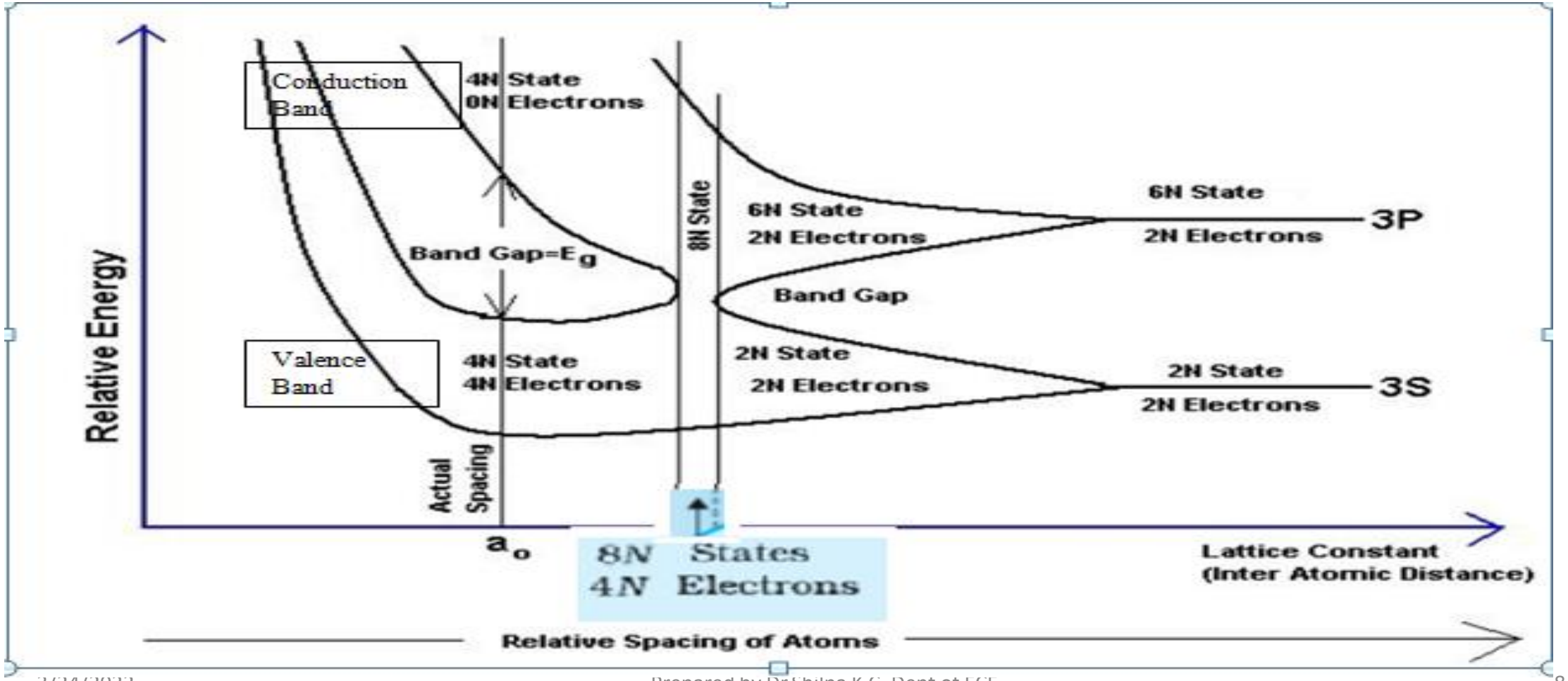


the hydrogen molecule resulting from the combination of the two hydrogen atoms

Energy Band Diagram Formation of Silicon Semiconductor

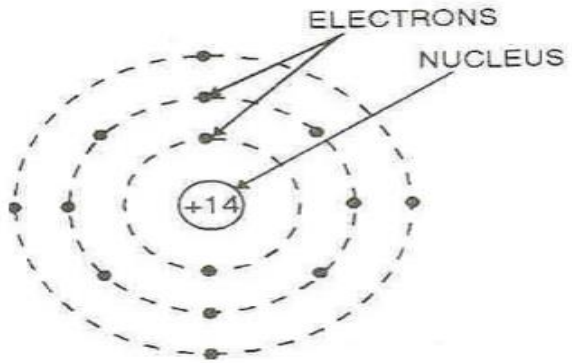
Isolated Silicon Atom -- It means atom which exist separately without any bonding with other atoms.

Energy Band Diagram Formation



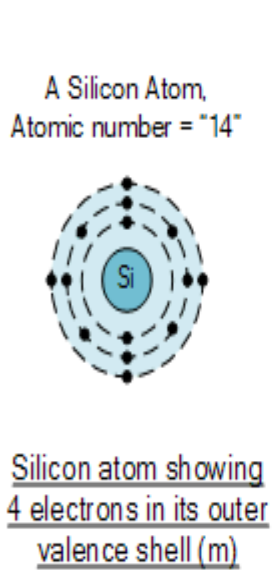
Energy Band Diagram Formation of Silicon Semiconductor

- Silicon Atom - 14
- Si – $1s^2$ $2s^2 2p^6$ $3s^2$ $3p^2$

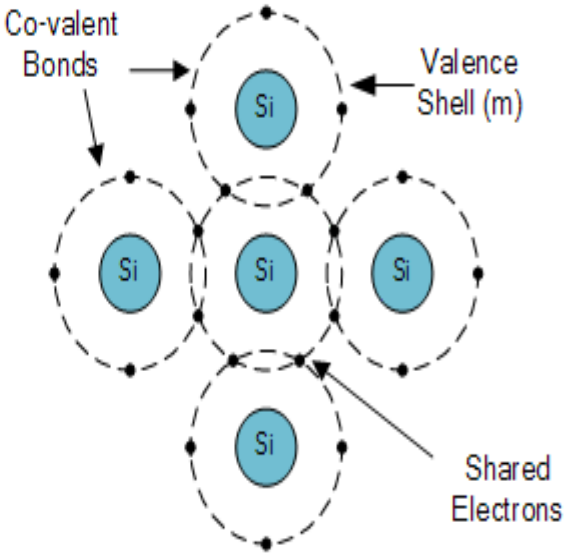


Atomic structure of Silicon

Valence band of Si is $3s^2$ $3p^2$
Valence electrons of Si = 4

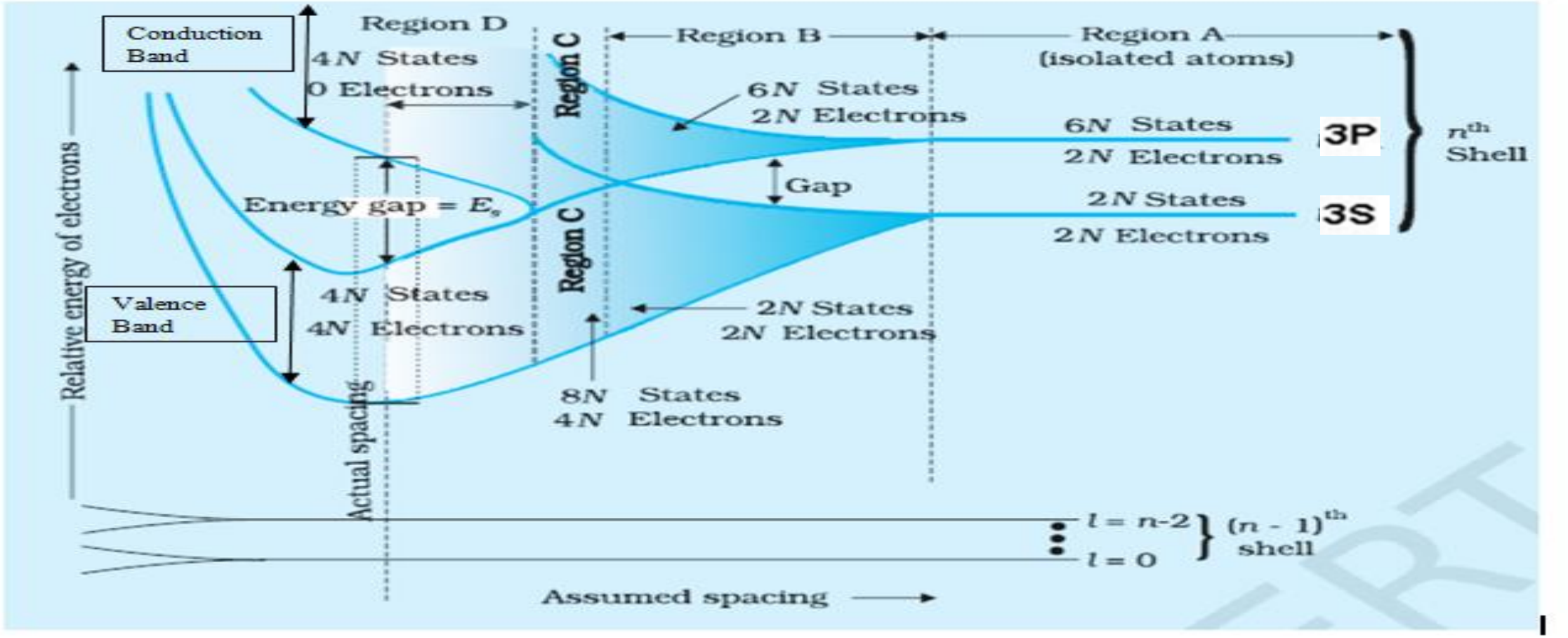


Silicon atom showing 4 electrons in its outer valence shell (m)

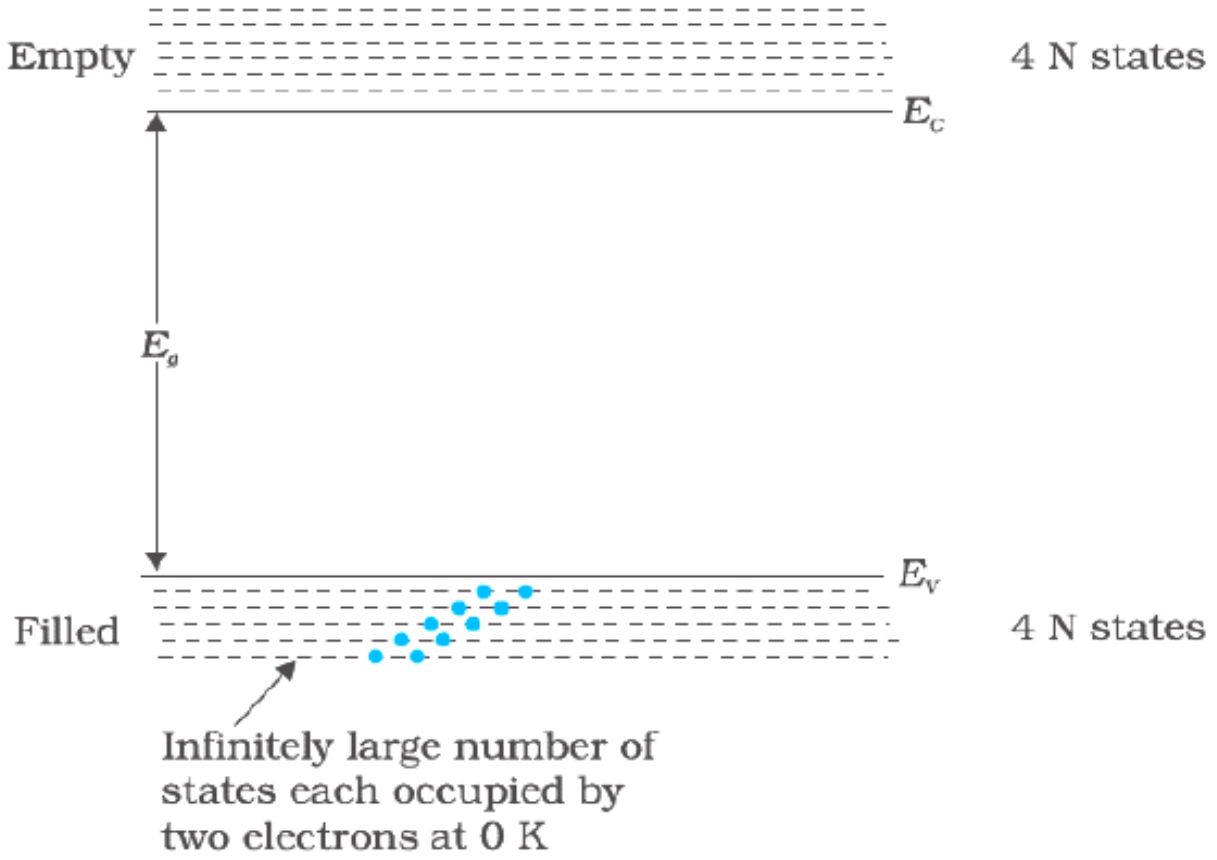


Silicon Crystal Lattice

Energy Band Diagram Formation



Energy Band Diagram Formation



- **At 0 K,** The lower band , called the valence band, having 4N energy states, completely filled with **4N electrons**
- The upper band , called the Conduction band having 4N energy states with completely **ZERO electrons**

- **<u>At absolute zero (0K), Silicon acts like a perfect Insulator</u>**

Thank You

HAVE A NICE DAY