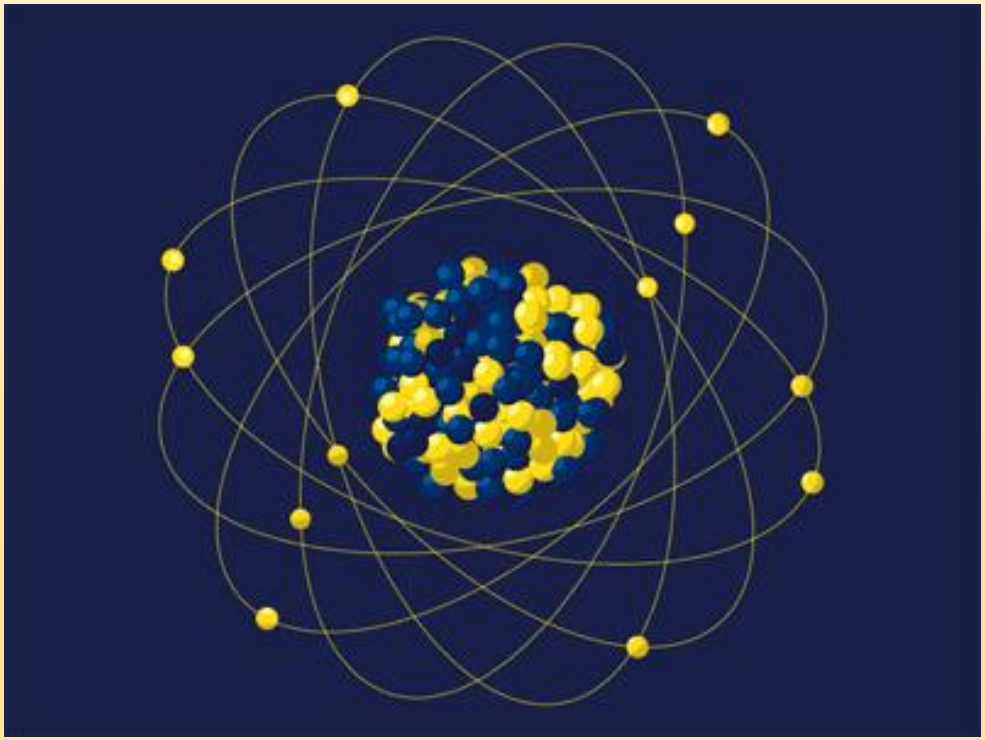
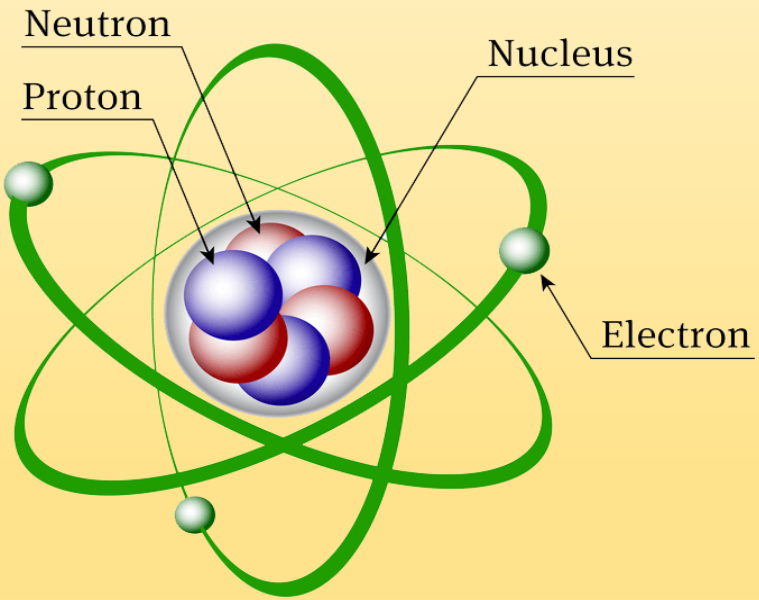
# INTERACTION OF LIGHT

Materials are made up of _____ ???

Atoms



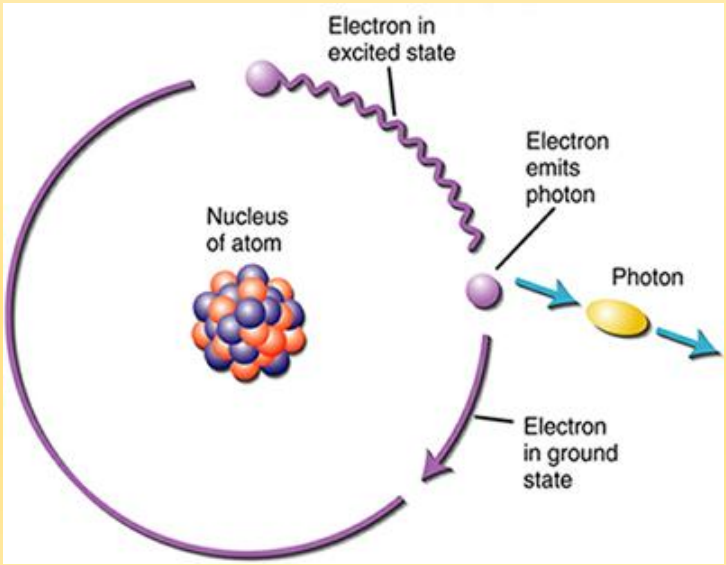



ATOMIC STRUCTURE

# *Interaction of Light with materials* *(Semiconductors)*

When Light (photons) interacts with atoms any one of these phenomenon occurs

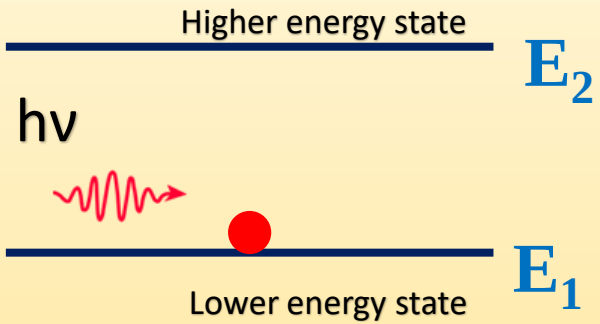
## Absorption

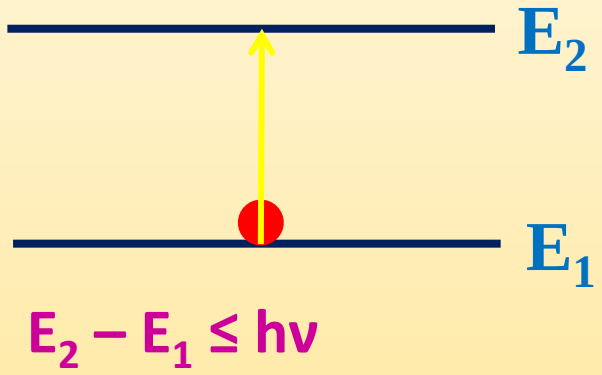



## Emission

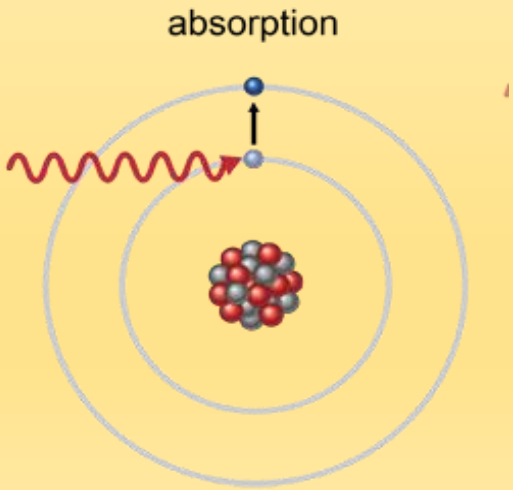
Spontaneous Emission
Stimulated Emission

## Absorption



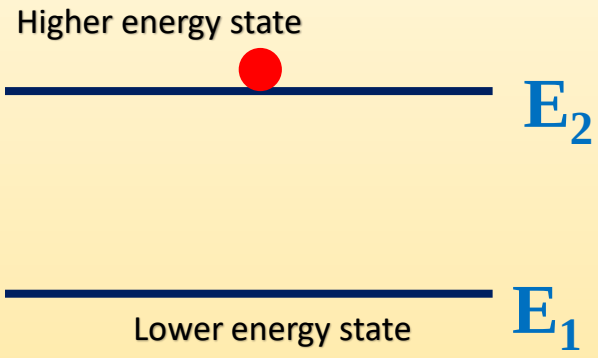



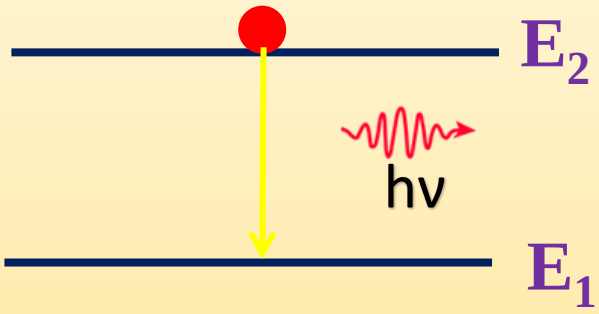

- When a photon of energy hv is incident on an atom/electron
- It **Absorbs** the energy and jumps to a higher energy state
- This occurs only if the energy of the incident photon is $E_2 - E_1 \leq hv$



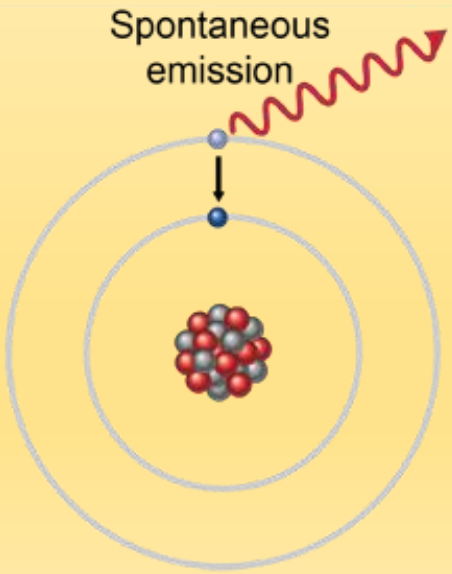
# INTERACTION OF LIGHT

## Emission → Spontaneous Emission



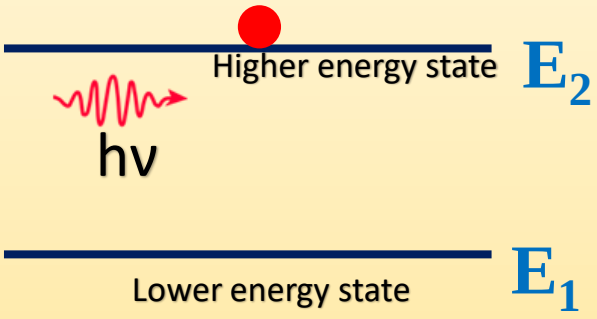



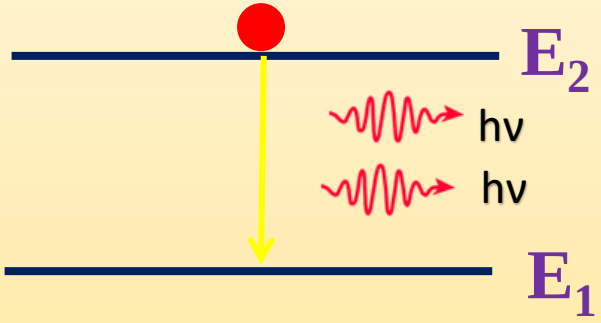

- The atom in the excited state remains for a shorter time period (lifetime ~ $10^{-8}$s)
- It jumps back to lower energy state emitting a photon hν
- It occurs spontaneously



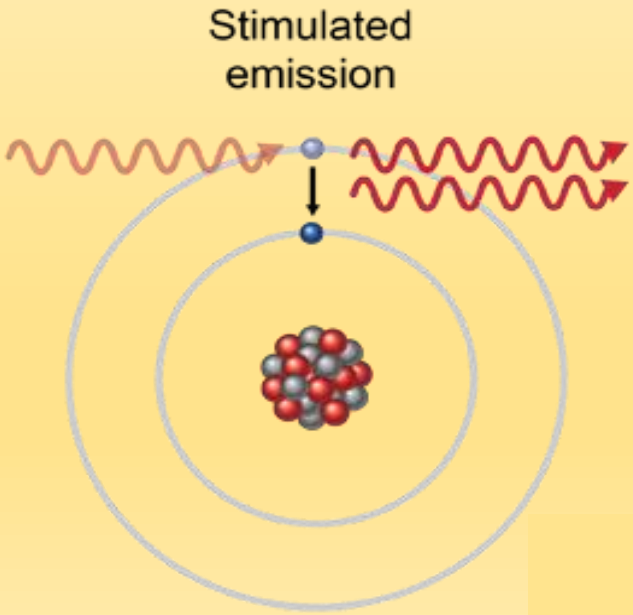
# INTERACTION OF LIGHT

## Emission ⟶ Stimulated Emission

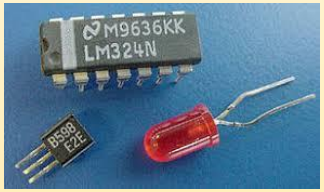


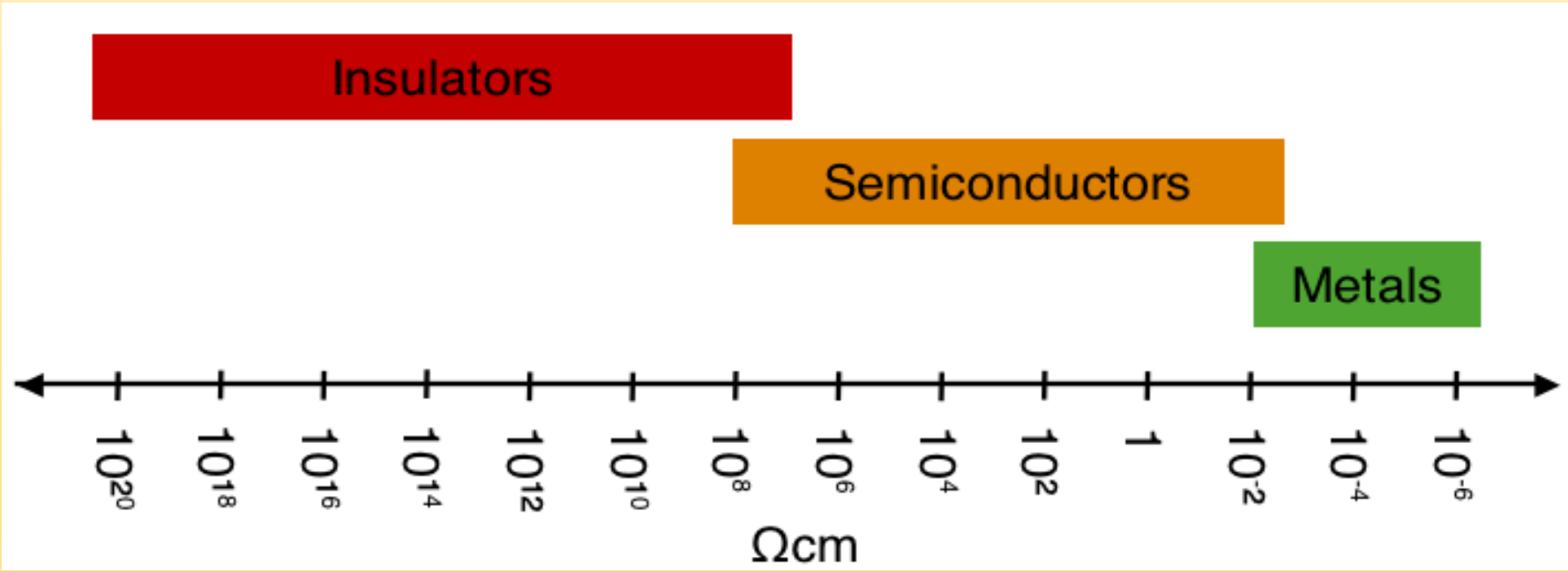




- The atom in the excited state when interacts with a photon
- It jumps back to lower energy state emitting a 2 photons of energies **hν**
- It occurs by stimulation



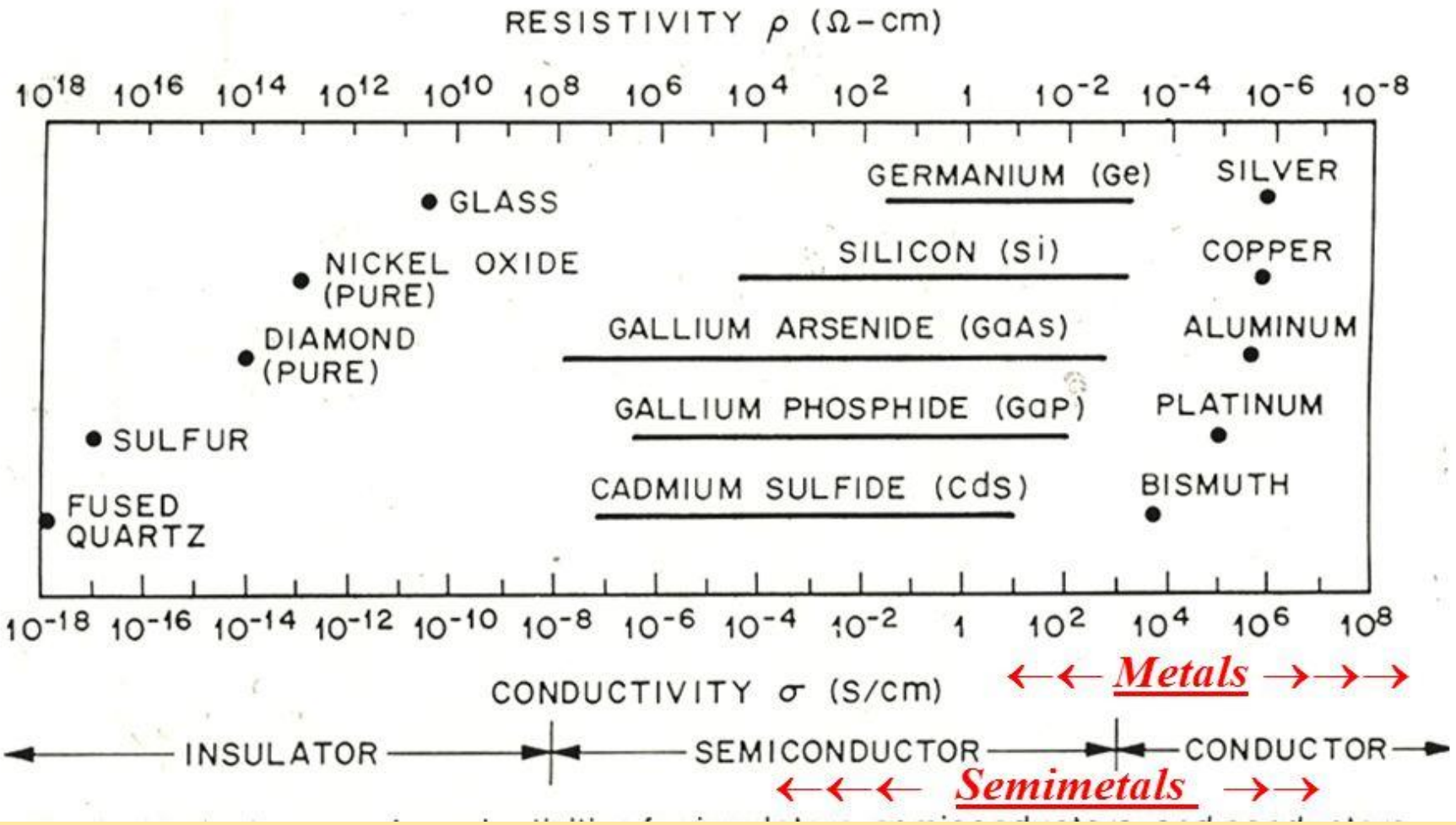
# SEMICONDUCTORS



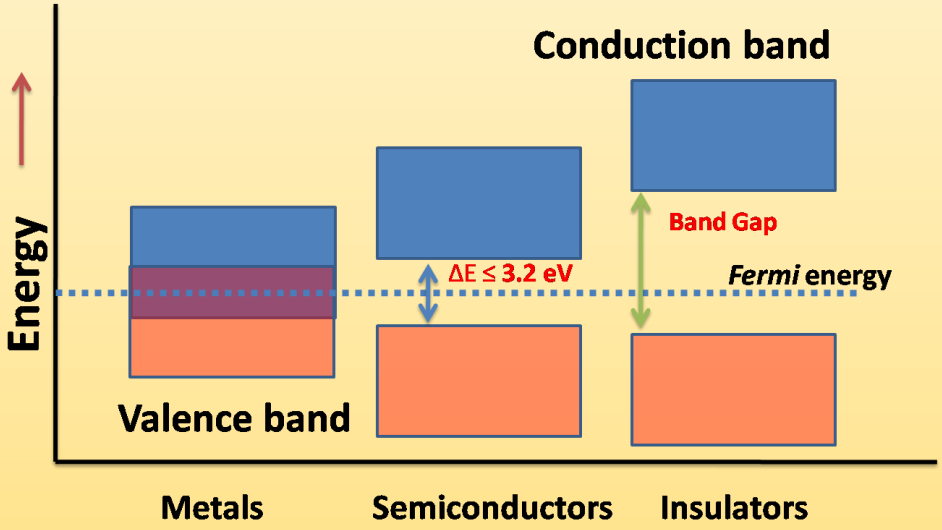



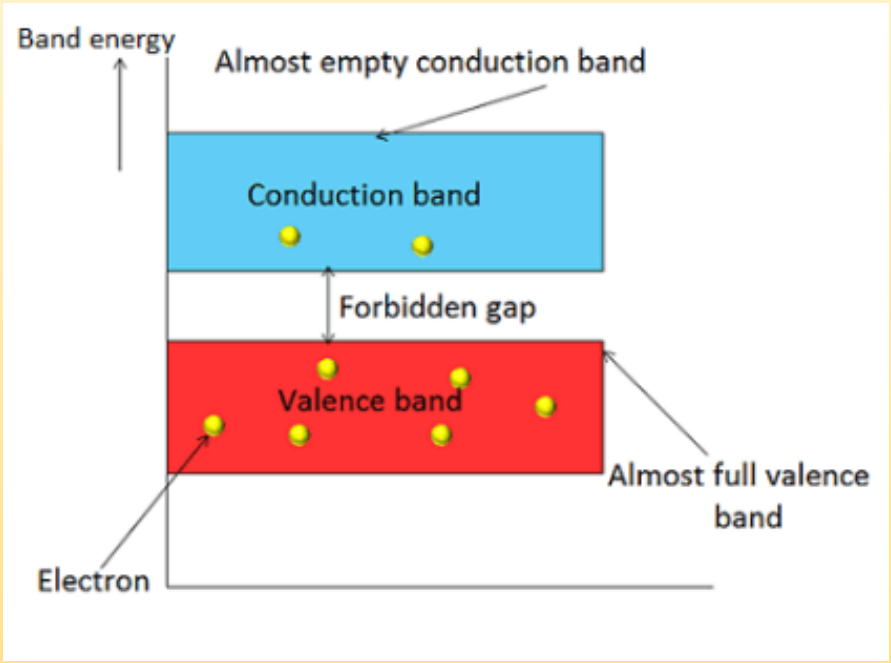
# Semiconductors

## Conductivity/Resistivity Definition



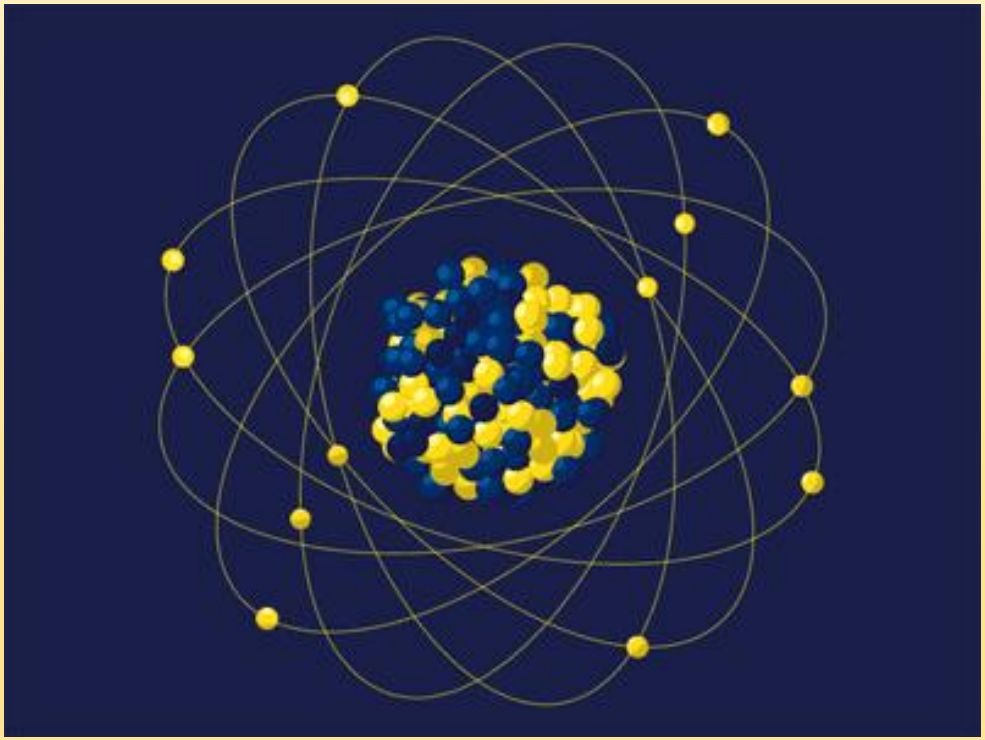
# SEMICONDUCTORS

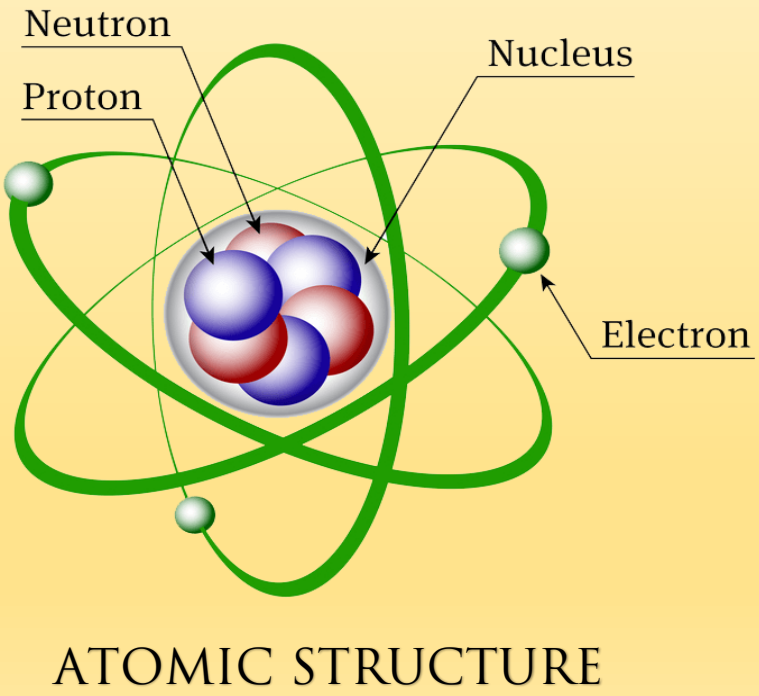


Materials are made up of _____ ???

Atoms

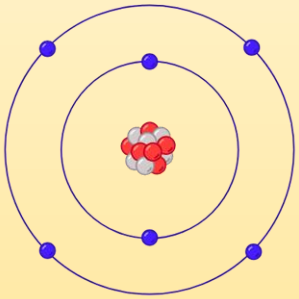




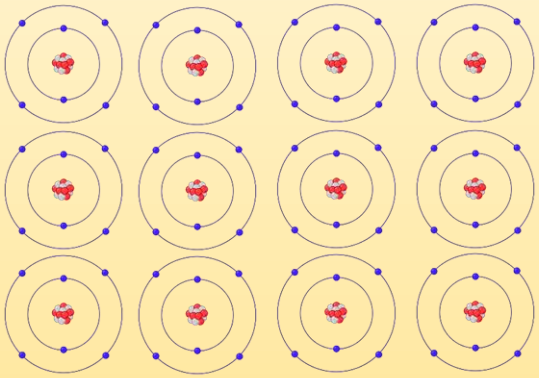

ATOMIC STRUCTURE

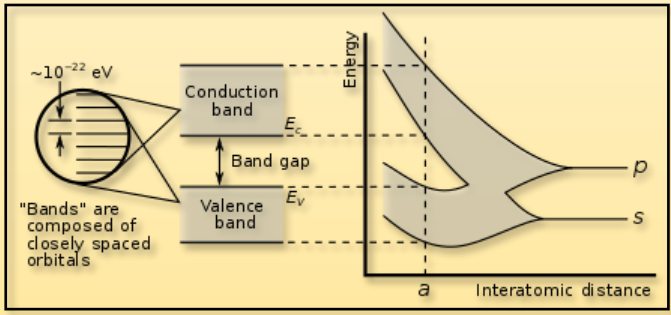
# Band theory of Solids

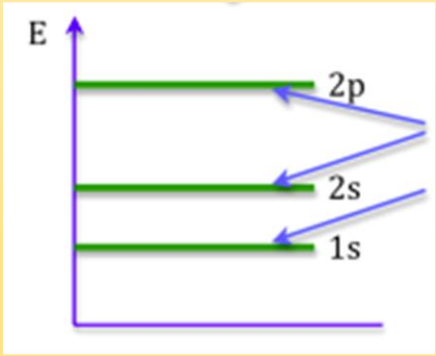
Single atom



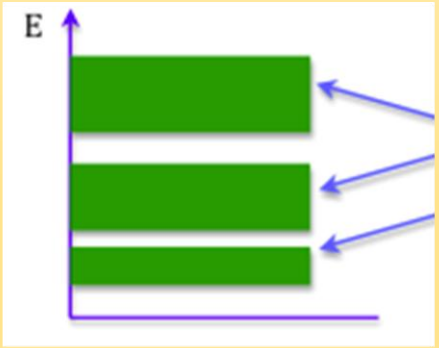
Atoms in a solid





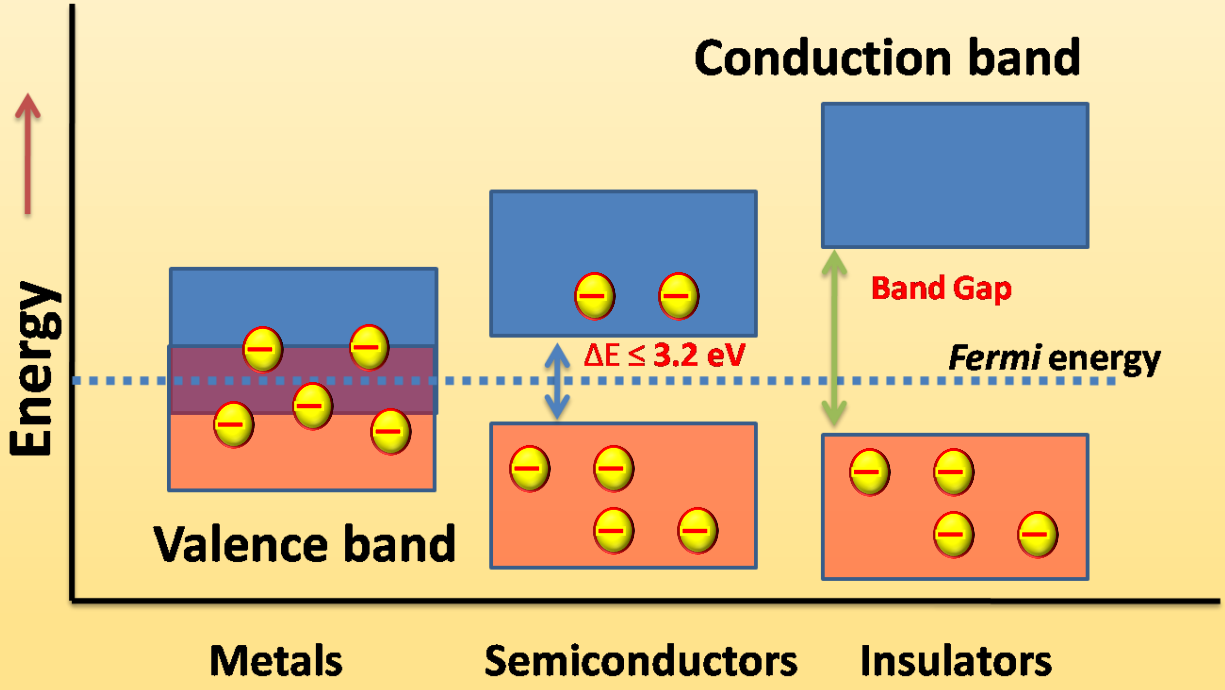




discrete energy levels




energy bands

# Band theory of Solids

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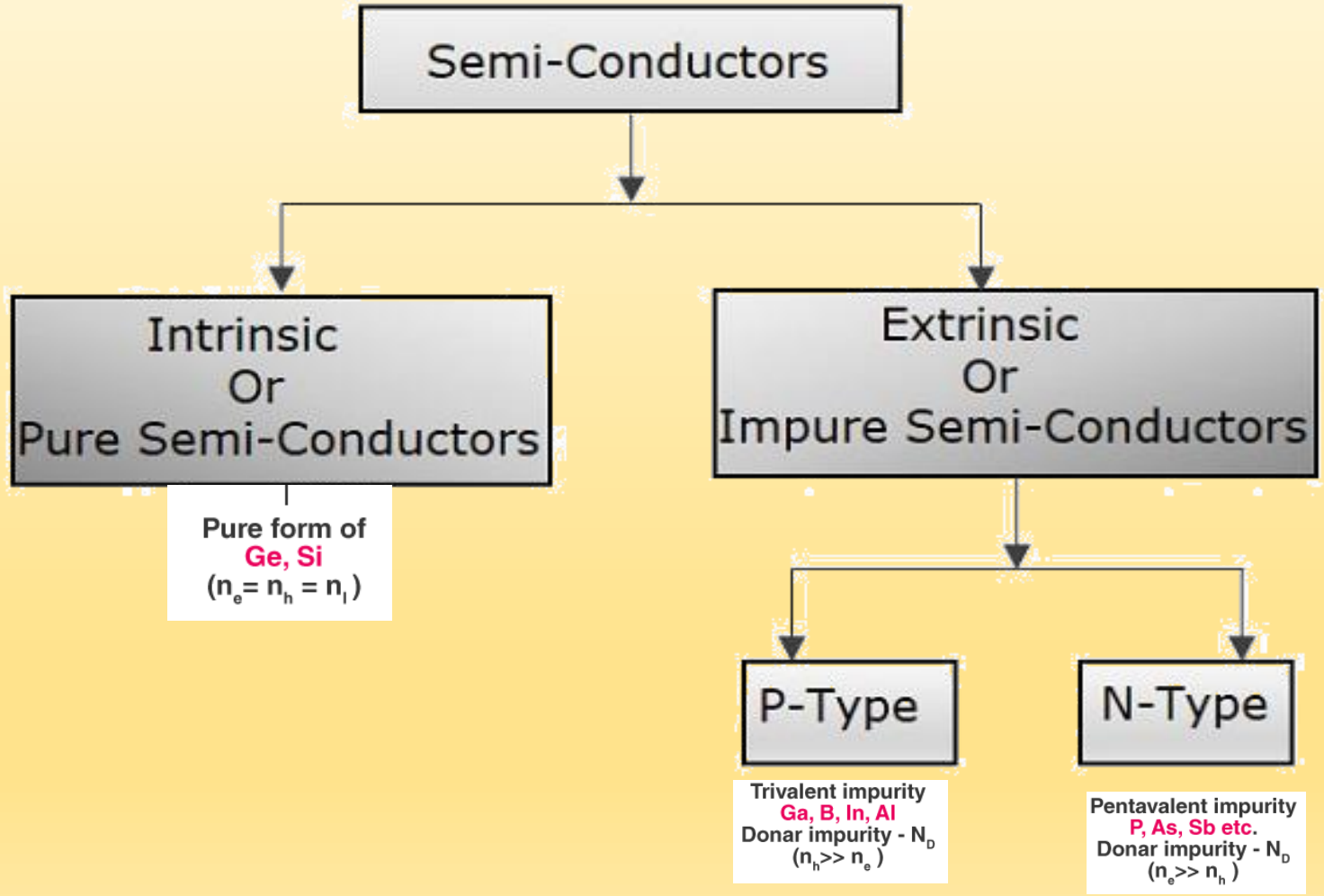
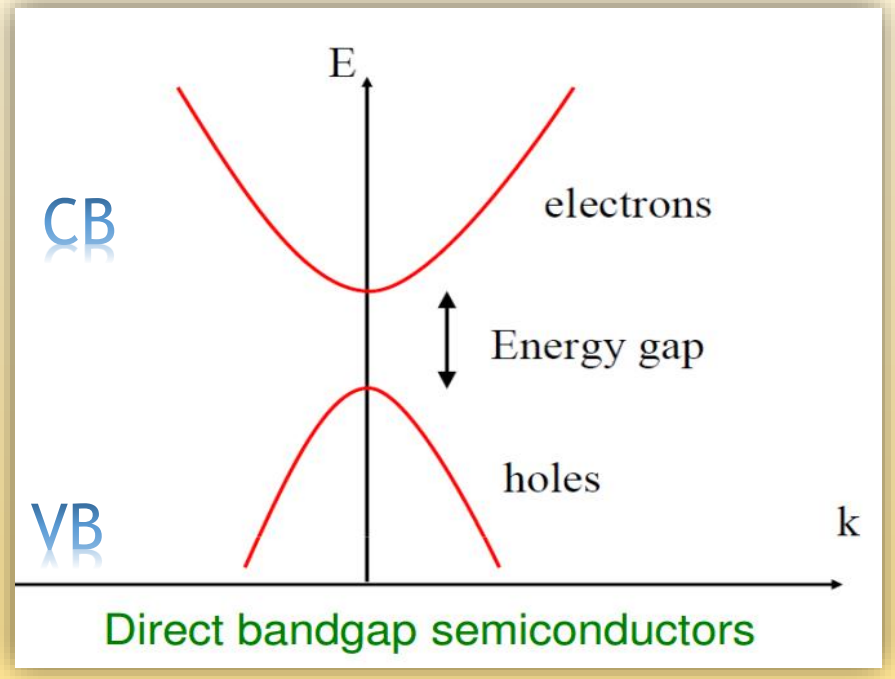
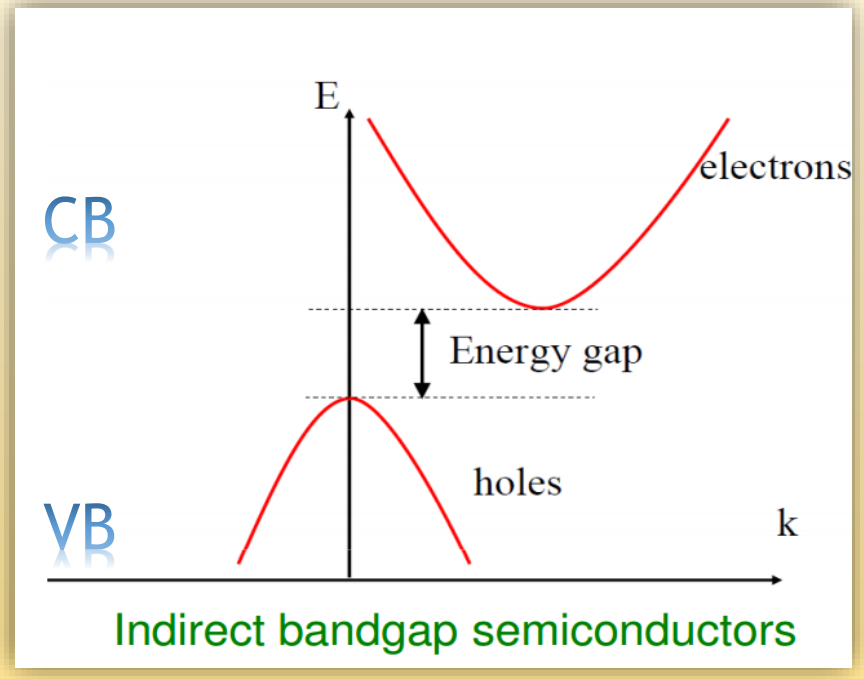
# Classification of semiconductors



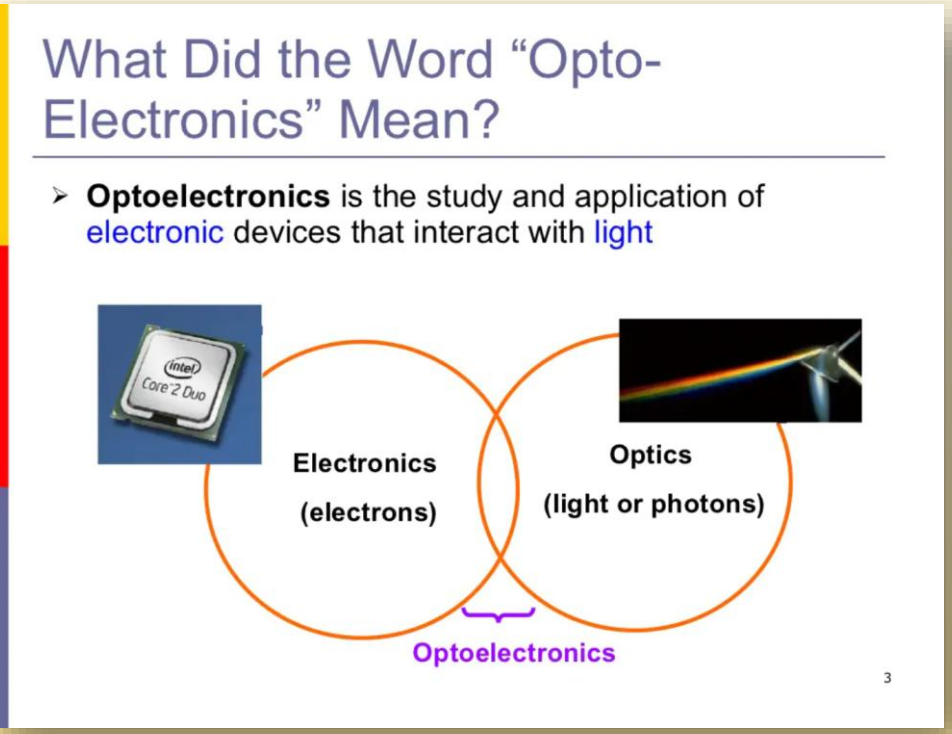



Eg : GaAs

Eg : Germanium, Silicon

# Optoelectronic devices



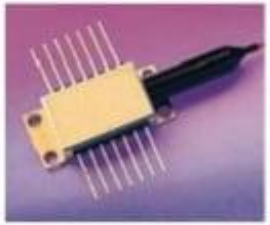

**Optoelectronic devices can be classified into photoconductive and photovoltaic devices.**

- **Optoelectronics is a branch of electronics that combines both electronics and optics.**
- **Optoelectronic devices find varied applications in telecommunications, military services, medical field, and automatic control systems.**
- **Light is emitted from a material when it is stimulated by the incident energy.**
- **If the energy is in the form of photons, photoluminescence is produced.**

# Optoelectronic devices

## Examples of Optoelectronic Devices

Telecommunication laser



Newport.com

Blue laser

TDK

Optical fiber

Corning

LED traffic lights

Rsc.org

Photodiodes

Hamamatsu

Solar cells

Wikipedia