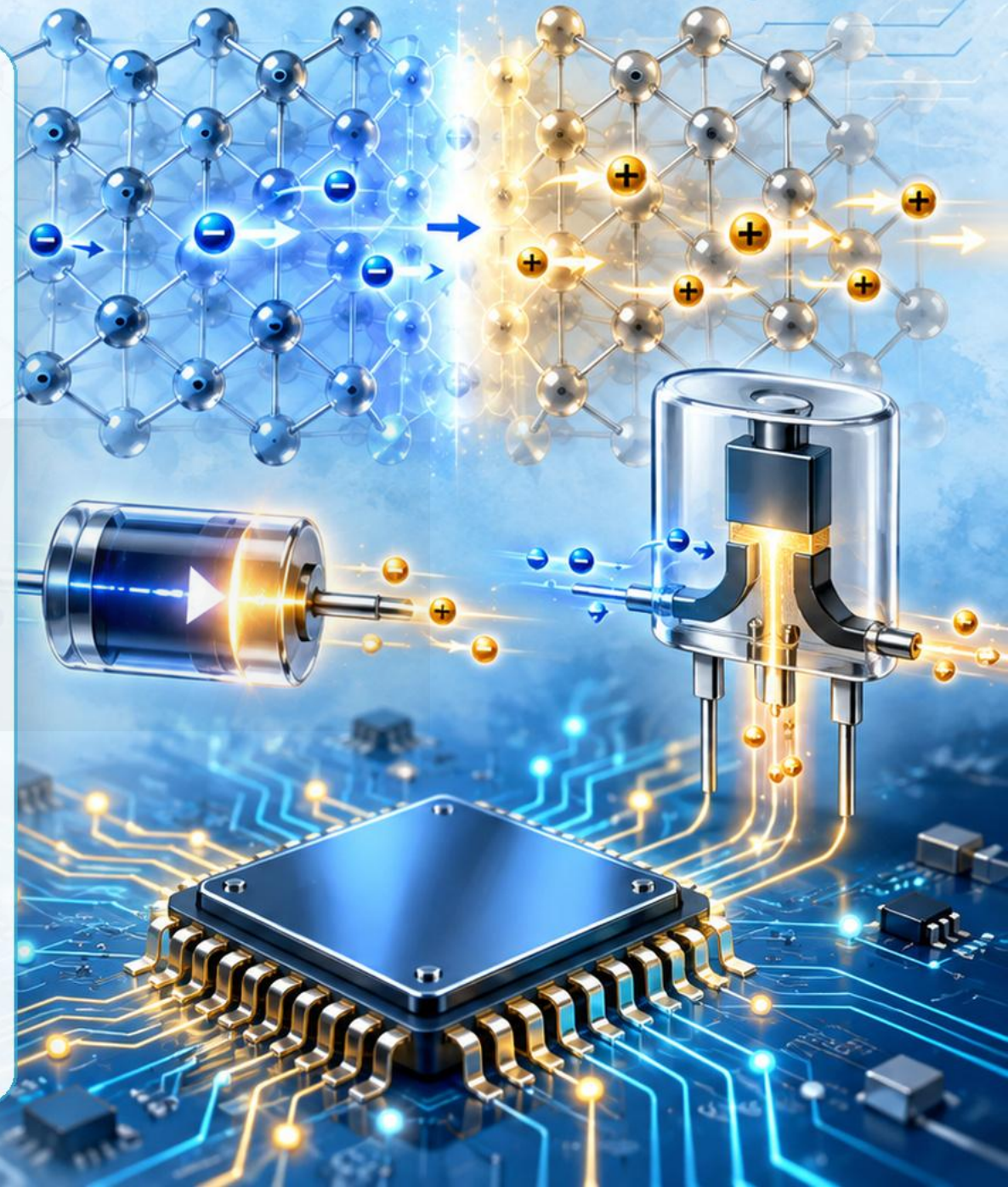


PHYSICS • CLASS 12

CHAPTER 14

Semiconductor Electronics

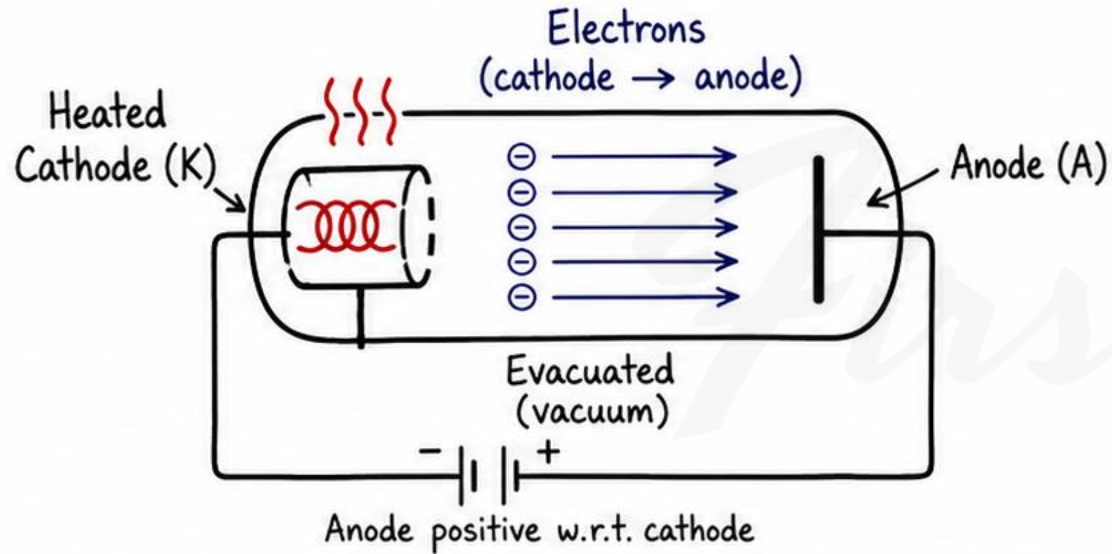
CHAPTER NOTES



FROM VACUUM VALVES TO SOLID-STATE

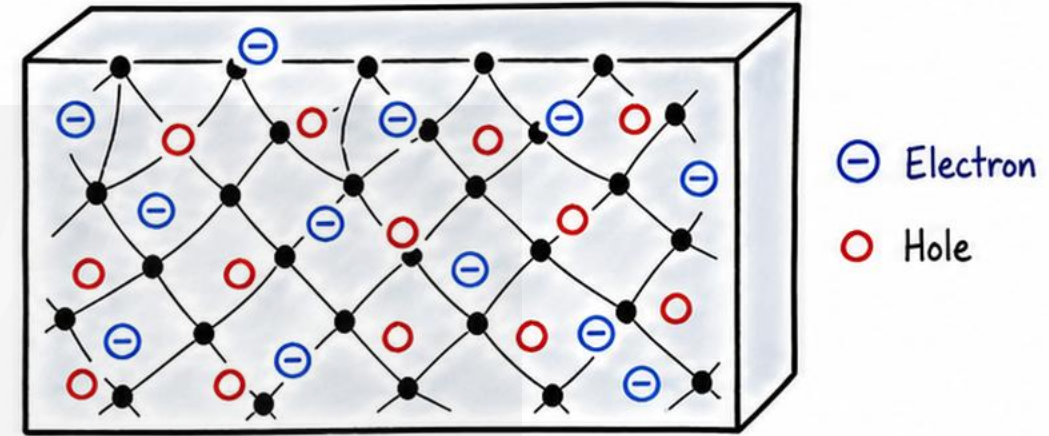
Electronics controls the number and direction of mobile charge carriers.

VACUUM VALVES



- heated cathode supplies electrons
- electrode voltages control one-way flow
- vacuum prevents collisions with gas
- bulky, high voltage and high power

SEMICONDUCTOR DEVICES



- carriers move within the solid
- light, heat or a small voltage can change carrier population or motion
- no heated cathode or evacuated envelope
- small, low-power, low-voltage and reliable

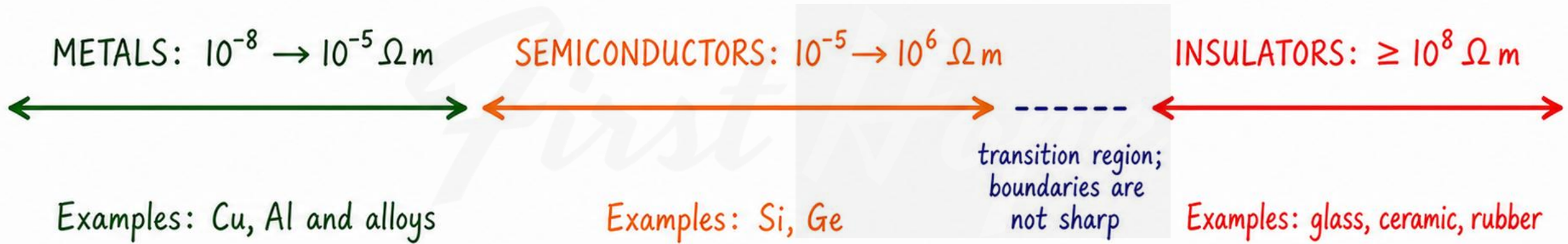
CONTROLLED CARRIERS → DIODES → RECTIFIERS & ELECTRONIC CIRCUITS

CLASSIFYING ELECTRICAL MATERIALS

$$\sigma = \frac{1}{\rho}$$

ρ : resistivity ($\Omega \text{ m}$)

σ : conductivity (S m^{-1})



- Ranges are illustrative, not sharp boundaries; temperature, doping and purity can shift ρ by many orders.

➤ elemental: Si, Ge

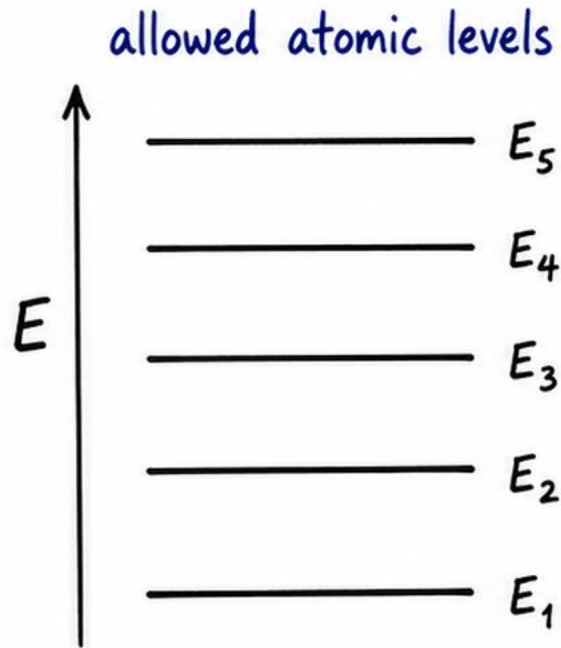
➤ compound: GaAs, CdS, InP

➤ organic/polymer semiconductors also exist

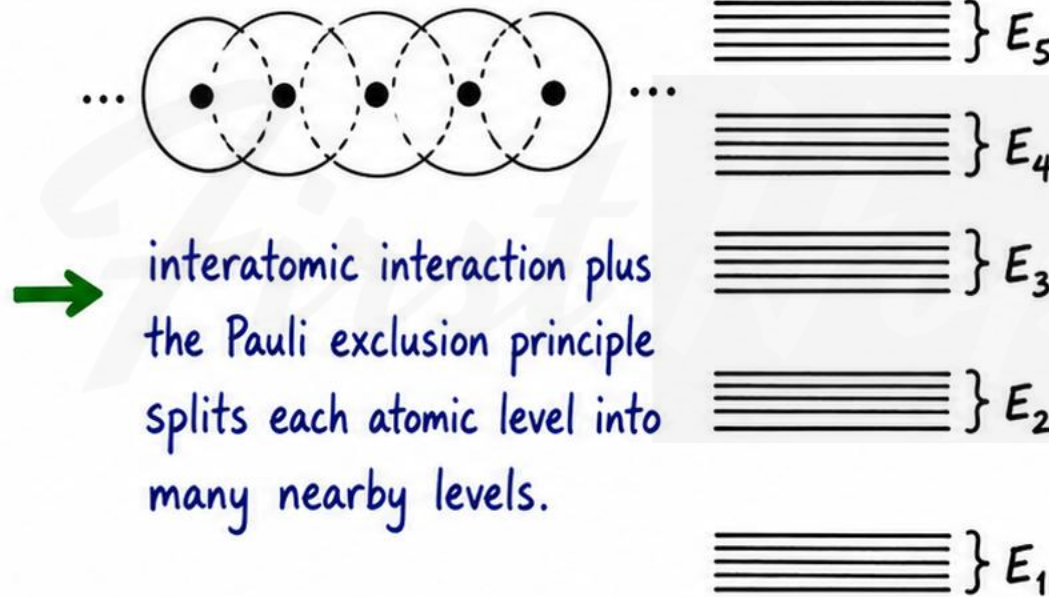
LOW $\rho \iff$ HIGH σ

HOW ENERGY BANDS FORM

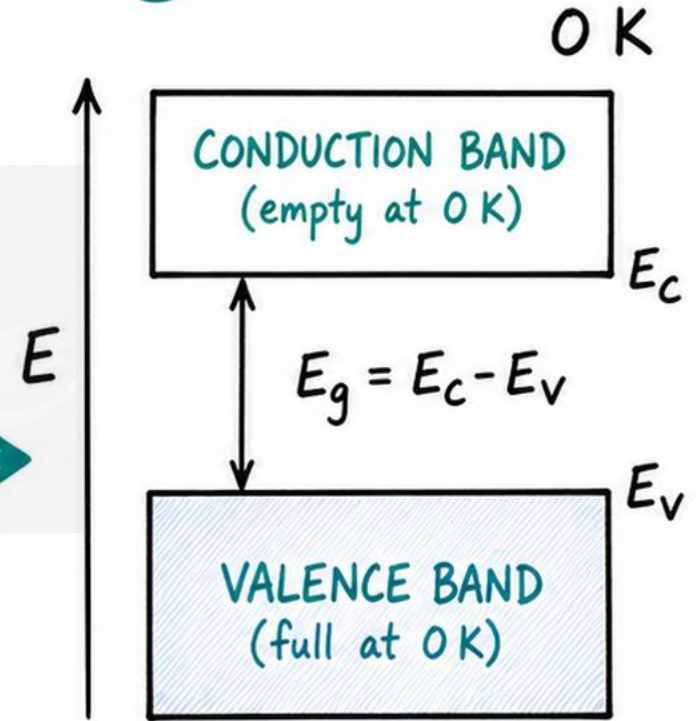
① ISOLATED ATOM



② N IDENTICAL ATOMS APPROACH



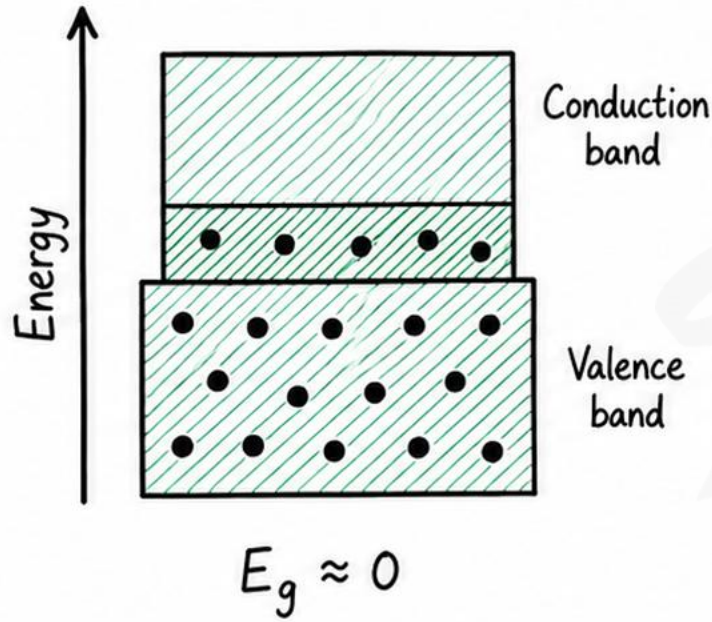
③ SOLID



- For Si and Ge: four valence electrons per atom form four covalent bonds;
in the ideal crystal at 0 K the valence band is full and the conduction band is empty.

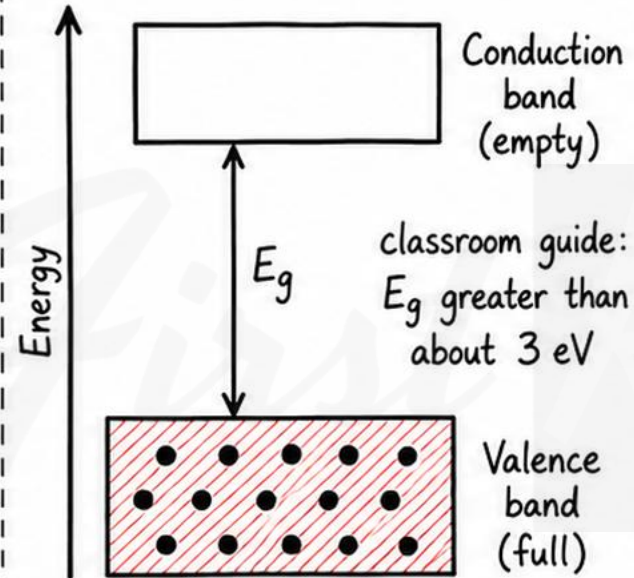
METALS, INSULATORS & SEMICONDUCTORS

METAL



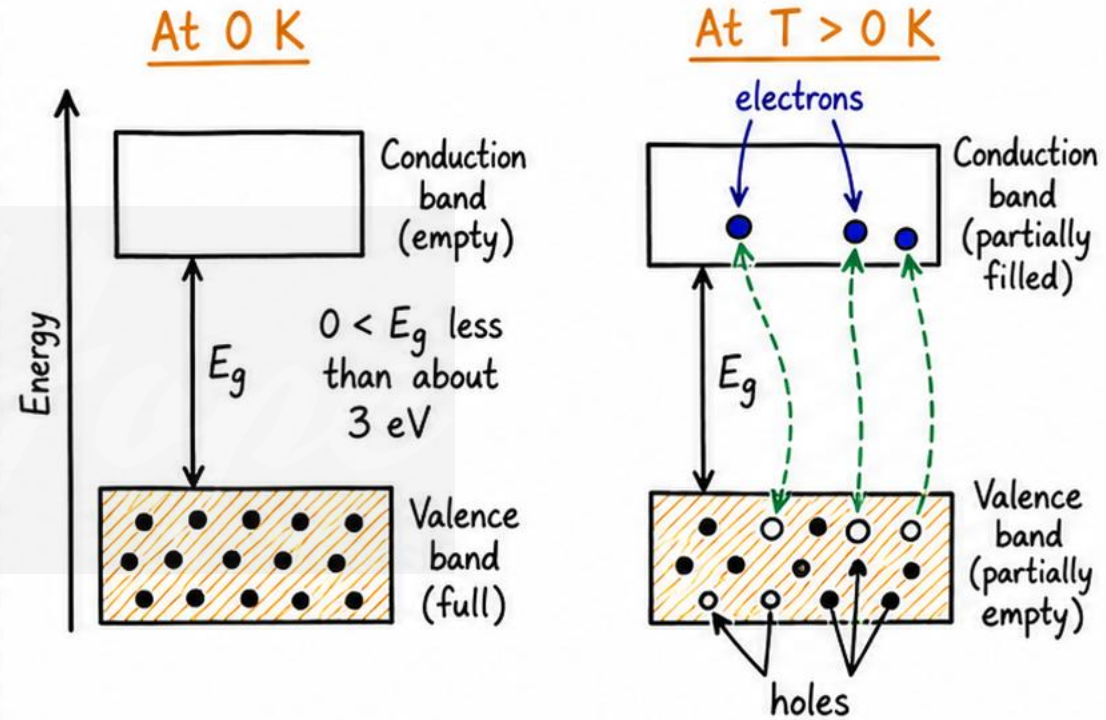
- many nearby empty states $\rightarrow$ high conductivity

INSULATOR



- ordinary thermal energy cannot excite appreciable carriers

SEMICONDUCTOR



- a few thermally excited electrons in conduction band and matching holes in valence band

★ The 3 eV boundary is a useful guide, not a universal sharp law.



FREE PREVIEW

[Click here to visit our website](#)

SCHOOL NOTES & NCERT SOLUTIONS

Complete notes and
NCERT solutions are
available on
FirstHope app only.



[Scan or click here](#)

Click here to get the app

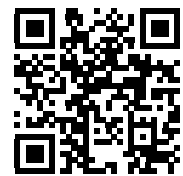


Available on Google Play

JOIN THE FIRSTHOPE COMMUNITY

Join our Telegram channel

Click here to join Telegram



[Scan or click here](#)

@FirstHope_CBSE_Notes

Instagram

@firsthope.school

[Click here to follow >](#)

YouTube channel

@firsthope.school

[Click here to watch >](#)

FirstHope website

firsthope.co.in

[Click here to visit our website >](#)

CBSE / Class 9 / Class 10 / Class 11 / Class 12

Preview notes and NCERT solutions. Full PDFs in the FirstHope app.