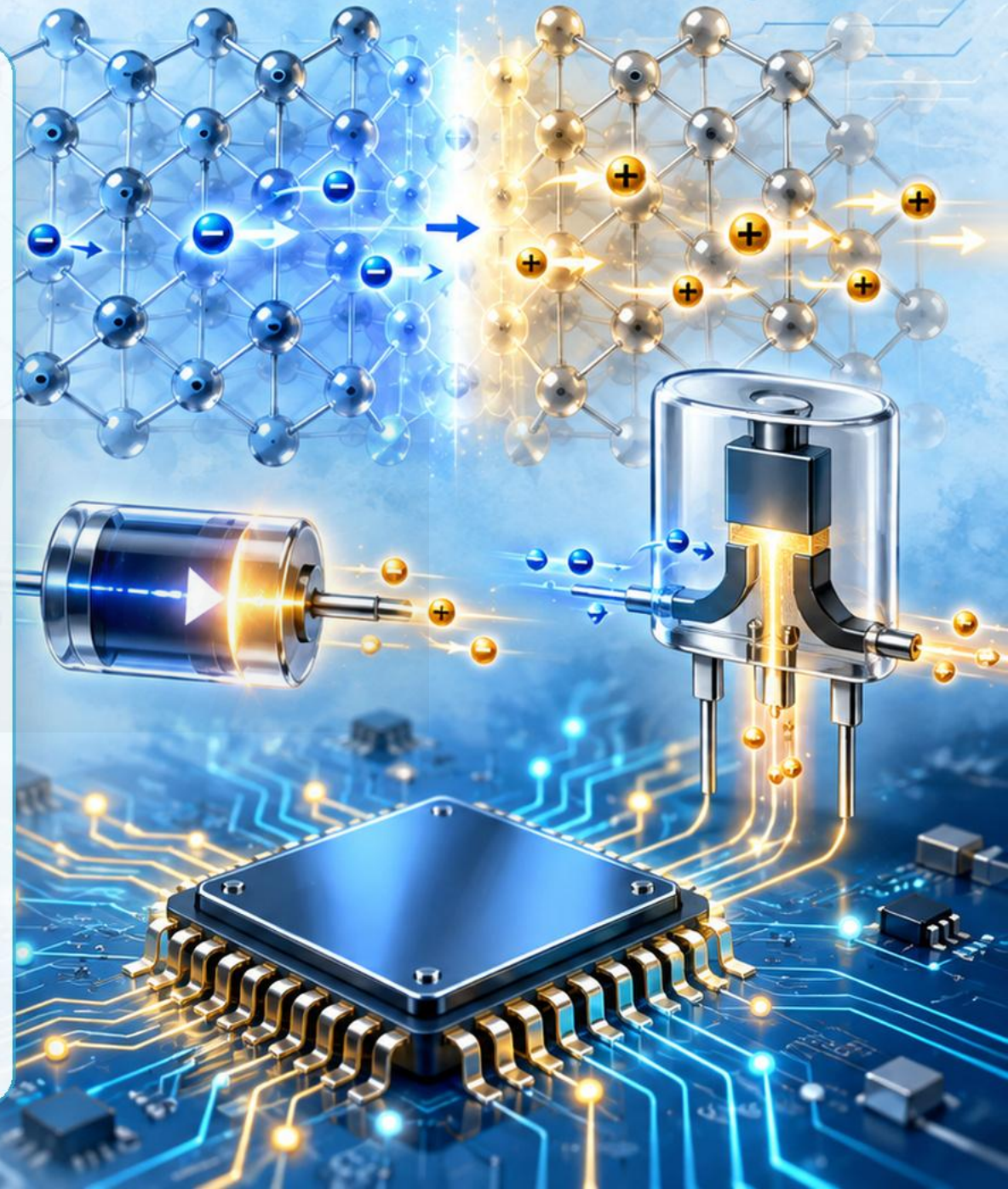


PHYSICS • CLASS 12

CHAPTER 14

Semiconductor Electronics

NCERT SOLUTIONS



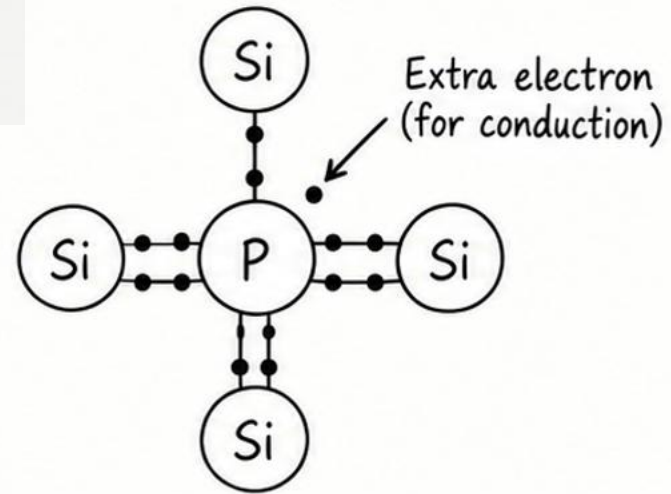
N-TYPE SILICON – EXERCISE 14.1

Q. In an n-type silicon, which statement is true?

- (a) Electrons are majority carriers and trivalent atoms are the dopants.
- (b) Electrons are minority carriers and pentavalent atoms are the dopants.
- (c) Holes are minority carriers and pentavalent atoms are the dopants.
- (d) Holes are majority carriers and trivalent atoms are the dopants.

Answer: (c)

A pentavalent donor atom has one extra valence electron compared with silicon. It supplies an electron for conduction, so electrons are majority carriers and holes are minority carriers. The dopant is pentavalent, not trivalent.



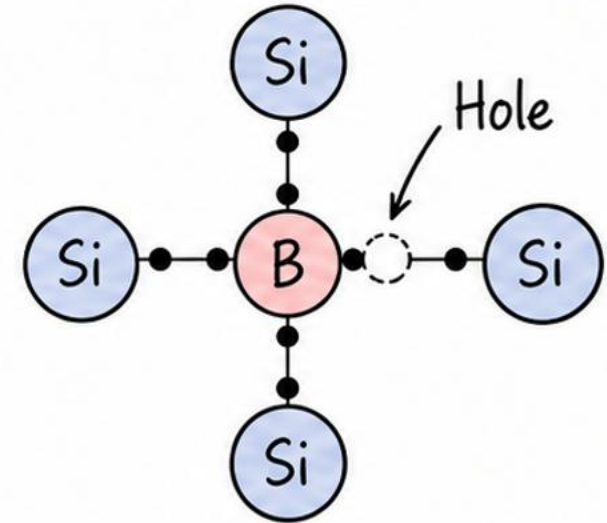
Pentavalent donor (P) in silicon
with one extra electron

P-TYPE SILICON – EXERCISE 14.2

Q. Which of the statements given in Exercise 14.1 is true for p-type semiconductors?

Answer: (d) Holes are majority carriers and trivalent atoms are the dopants.

A trivalent acceptor atom makes one bond short of an electron in a silicon lattice, leaving a hole. Holes are the majority charge carriers; thermally generated electrons are the minority carriers.



n-type semiconductor	p-type semiconductor
Dopant : Pentavalent donor atom	Dopant : Trivalent acceptor atom
Majority carriers : Electrons	Majority carriers : Holes
Minority carriers : Holes	Minority carriers : Electrons

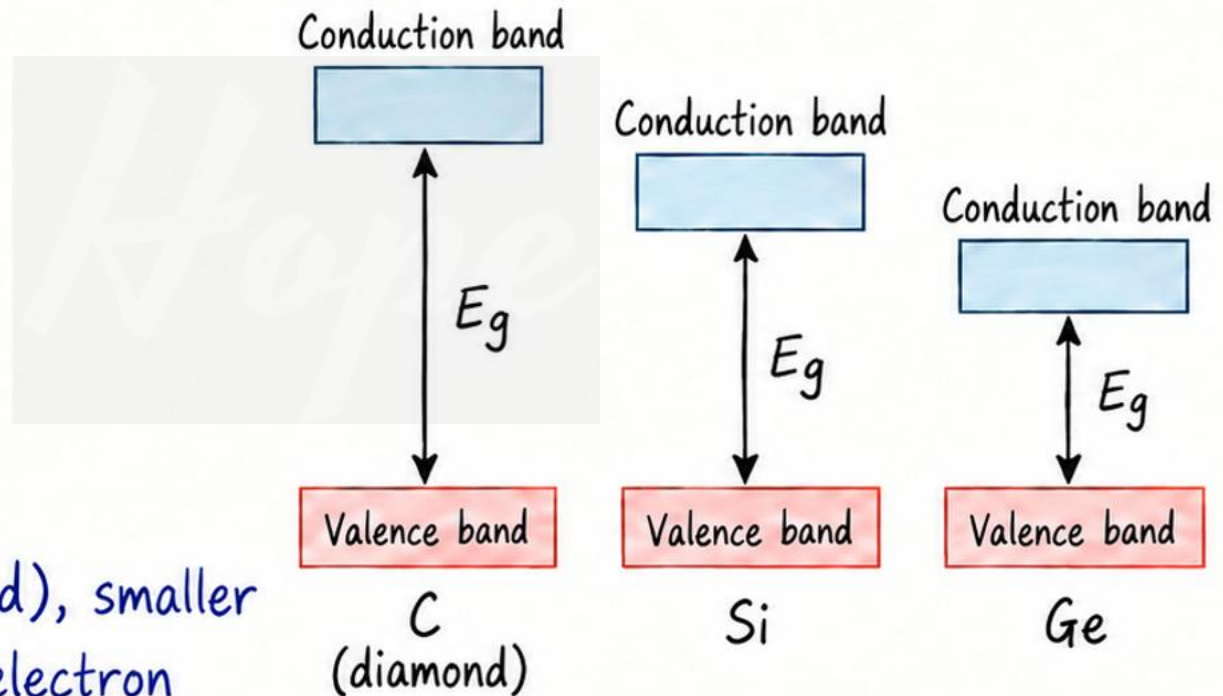
ENERGY BAND GAPS – EXERCISE 14.3

Q. Carbon, silicon and germanium each have four valence electrons. Which relation between their valence-to-conduction band gaps is true?

- (a) $(E_g)_{\text{Si}} < (E_g)_{\text{Ge}} < (E_g)_{\text{C}}$
- (b) $(E_g)_{\text{C}} < (E_g)_{\text{Ge}} > (E_g)_{\text{Si}}$
- (c) $(E_g)_{\text{C}} > (E_g)_{\text{Si}} > (E_g)_{\text{Ge}}$
- (d) $(E_g)_{\text{C}} = (E_g)_{\text{Si}} = (E_g)_{\text{Ge}}$

Answer: (c)

The energy gap is largest for carbon (diamond), smaller for silicon, and smallest for germanium. The electron needs less energy to reach the conduction band in Ge than in Si; diamond has a much larger gap.



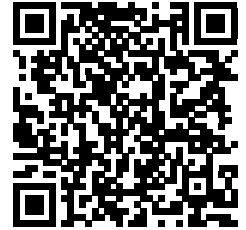


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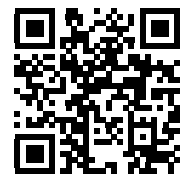


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