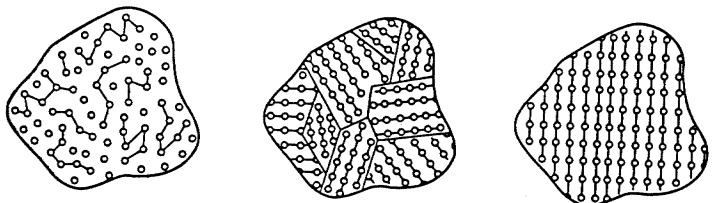
Table 1.2 Abbreviated Periodic Chart of the Elements.

II	III	IV	V	VI
4 Be	5 B	6 C	7 N	8 O
12 Mg	13 Al	14 Si	15 P	16 S
30 Zn	31 Ga	32 Ge	33 As	34 Se
48 Cd	49 In	50 Sn	51 Sb	52 Te
80 Hg	81 Tl	82 Pb	83 Bi	84 Po



(a) Amorphous
No recognizable long-range order

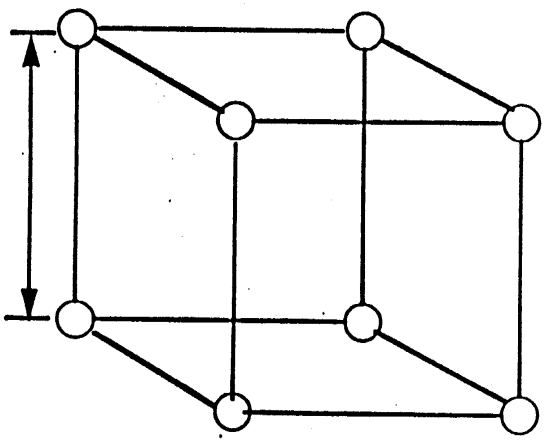
(b) Polycrystalline
Completely ordered in segments

(c) Crystalline
Entire solid is made up of atoms in an orderly array

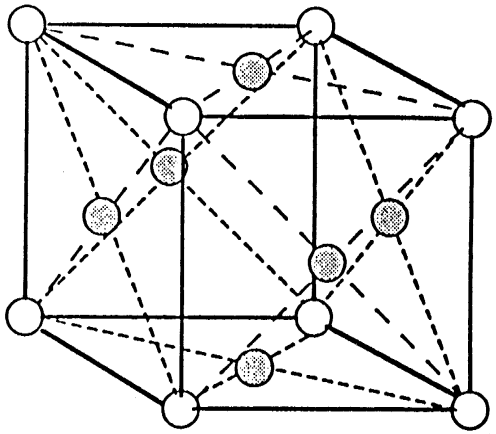
Fig. 1.1 General classification of solids based on the degree of atomic order: (a) amorphous, (b) polycrystalline, and (c) crystalline.

Cubic Crystals

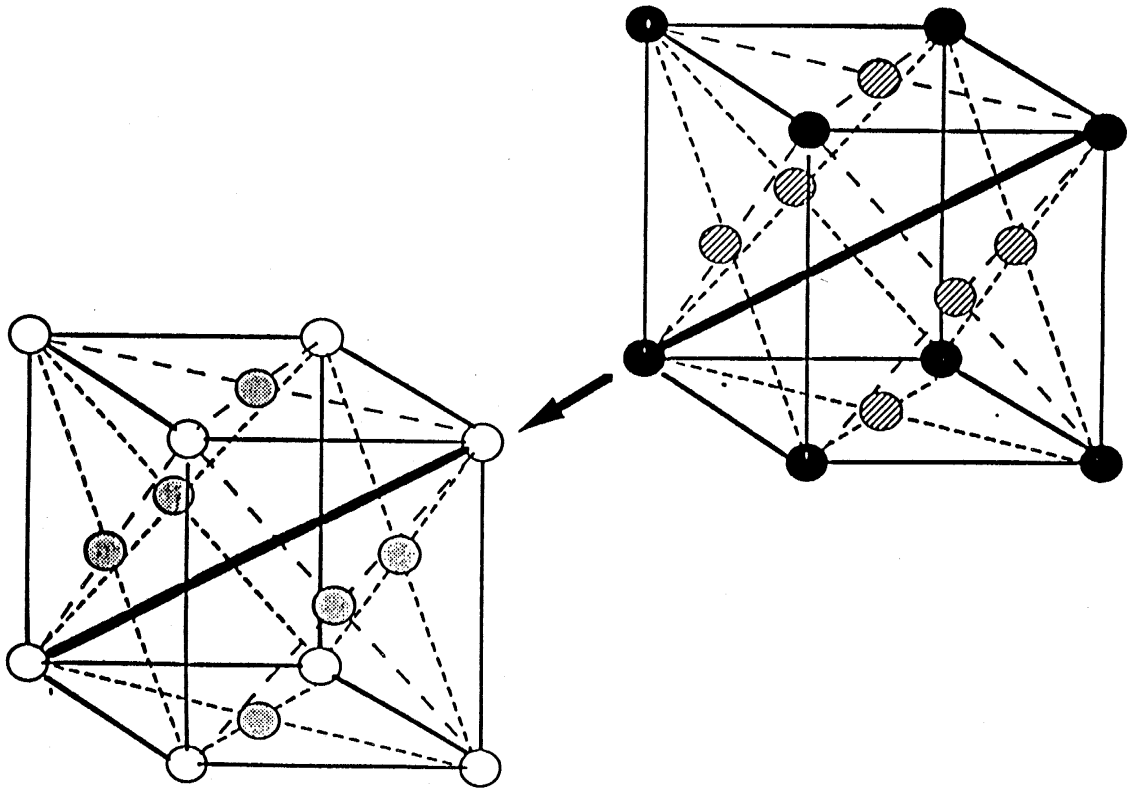
Semiconductor crystal structures can be described using cubic crystals as a basis.



(a is the lattice constant)



The drawing below illustrates the construction the basic lattice:



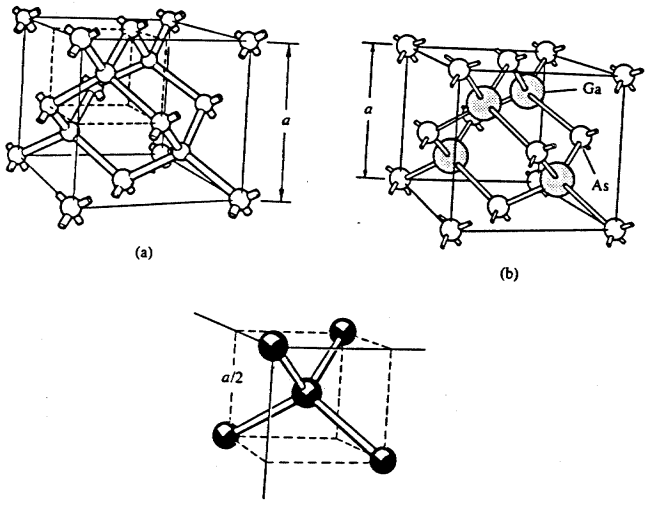


Fig. 1.4 (a) Diamond lattice unit cell. (b) Zincblende lattice unit cell (GaAs used for illustration). (c) Enlarged top corner of the part (a) diamond lattice emphasizing the four-nearest-neighbor bonding within the structure. The cube side length, a, is 5.43 Å and 5.65 Å at room temperature for Si and GaAs, respectively.

The Tetrahedral Bond

The diamond and zincblende lattices are characterized by tetrahedral bonds.

Each atom has 4 nearest neighbor atoms as shown