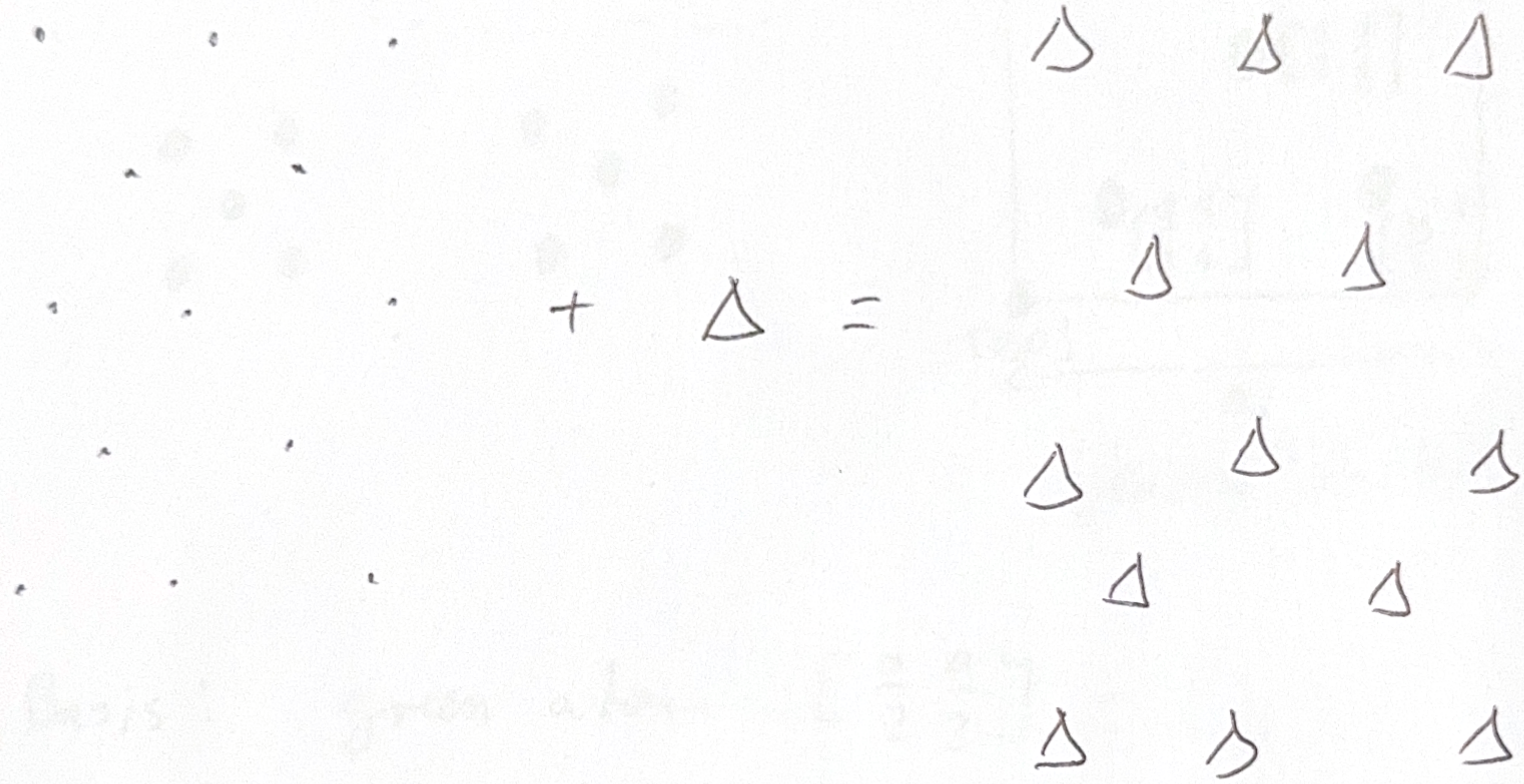
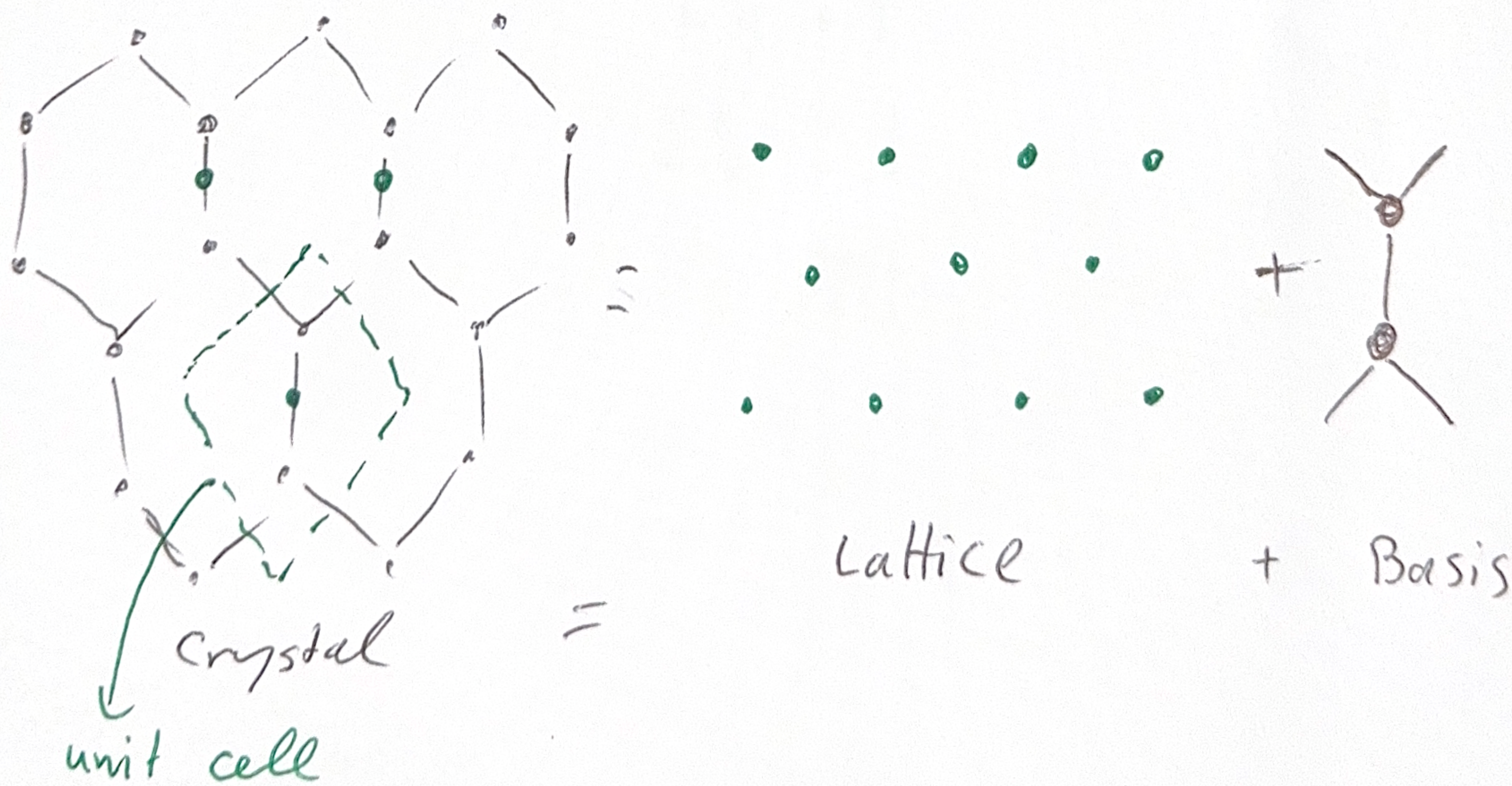
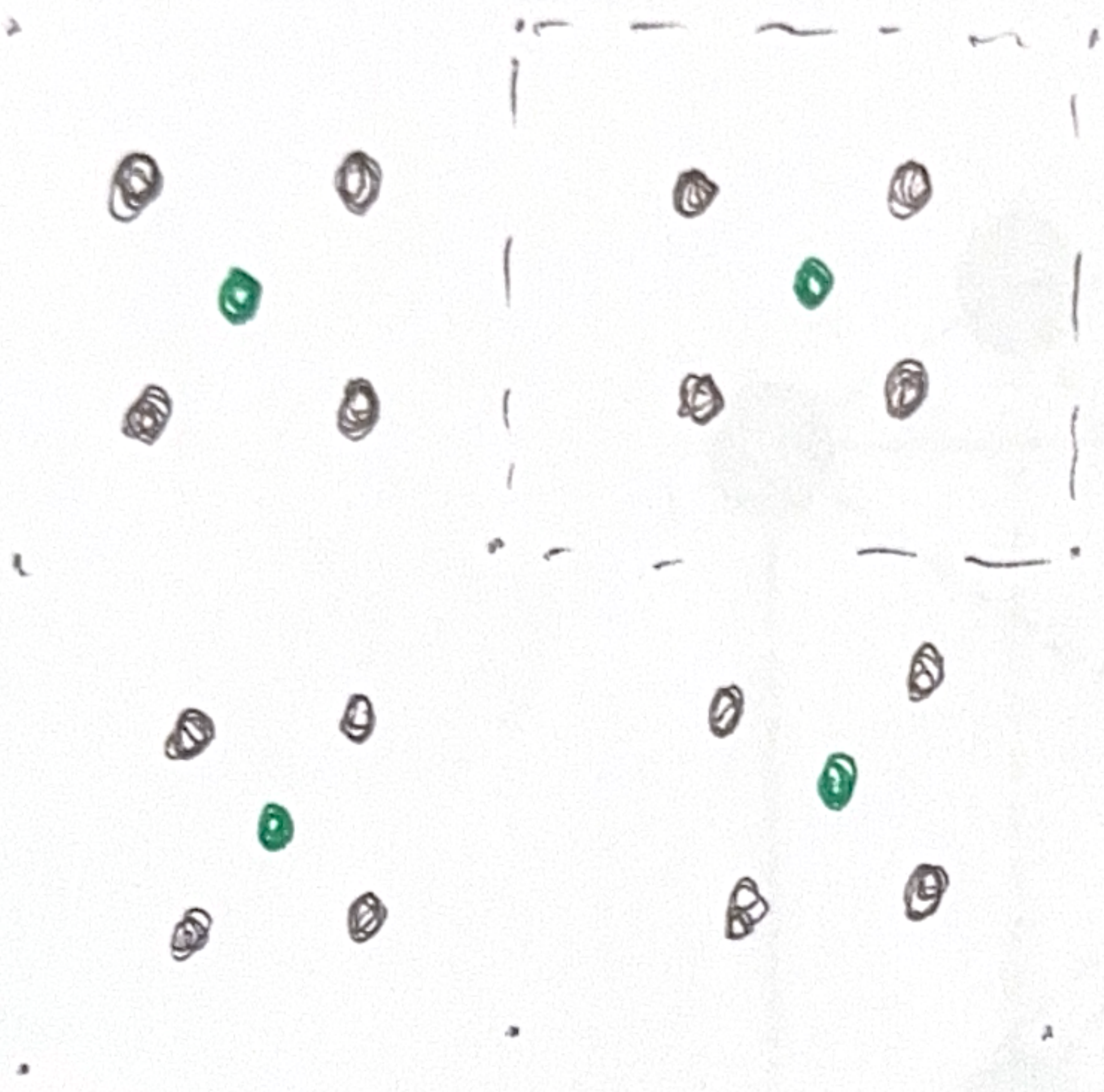
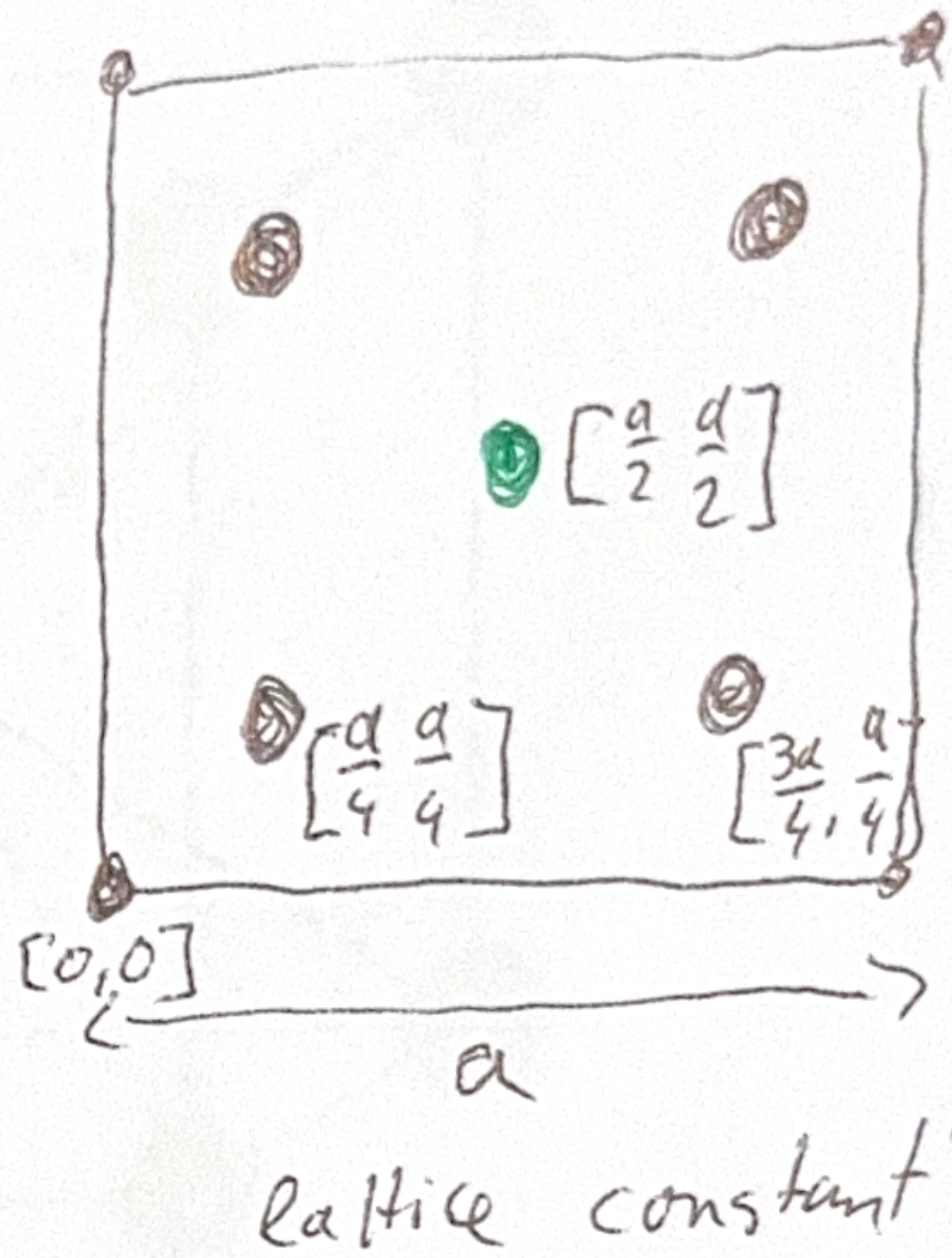
→ any periodic arrangement (structure) is a lattice of repeating motifs







unit cell:



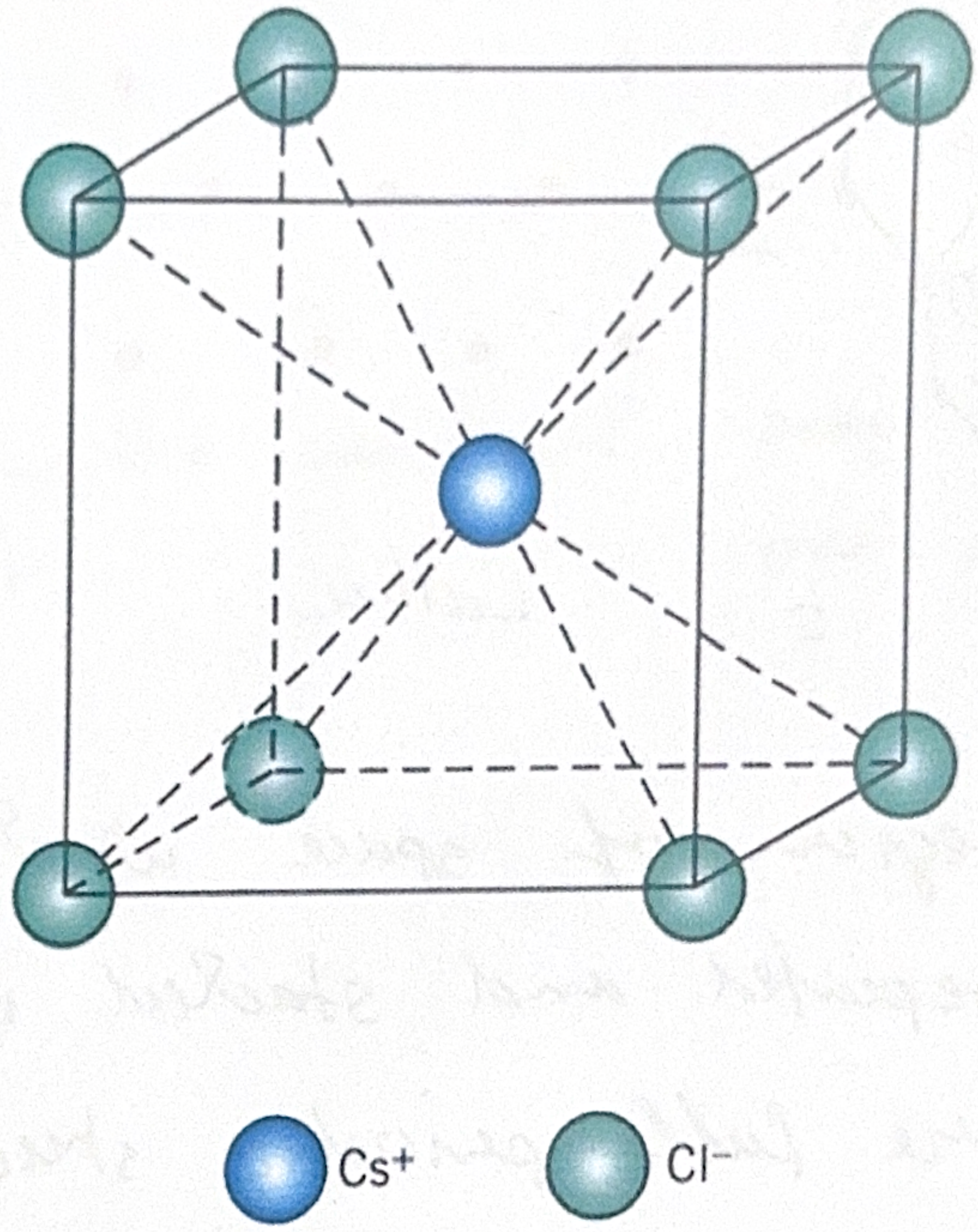
Basis: green atom $[\frac{a}{2} \frac{a}{2}] = [\frac{1}{2} \frac{1}{2}]$

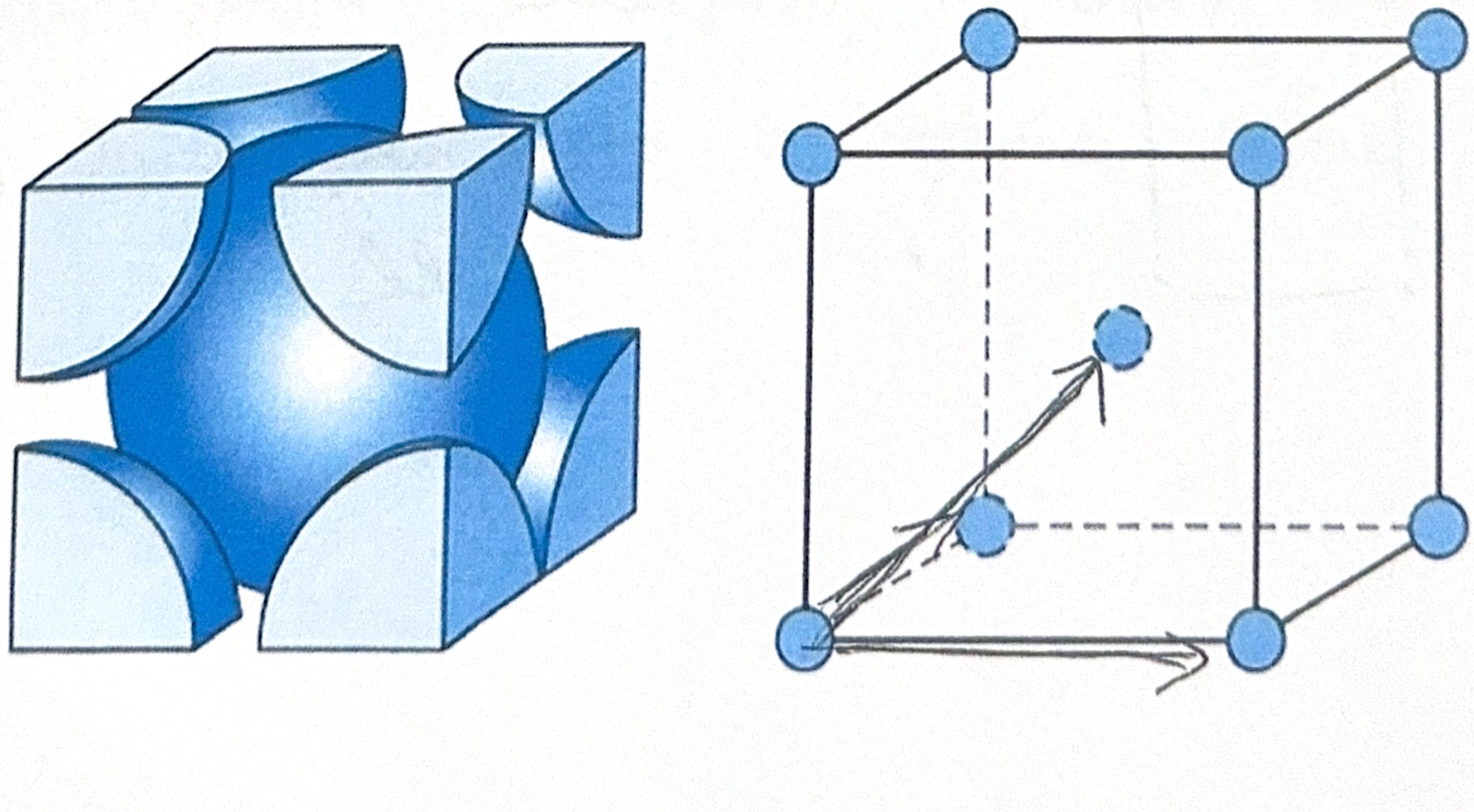
black atoms $[\frac{a}{4} \frac{a}{4}]$

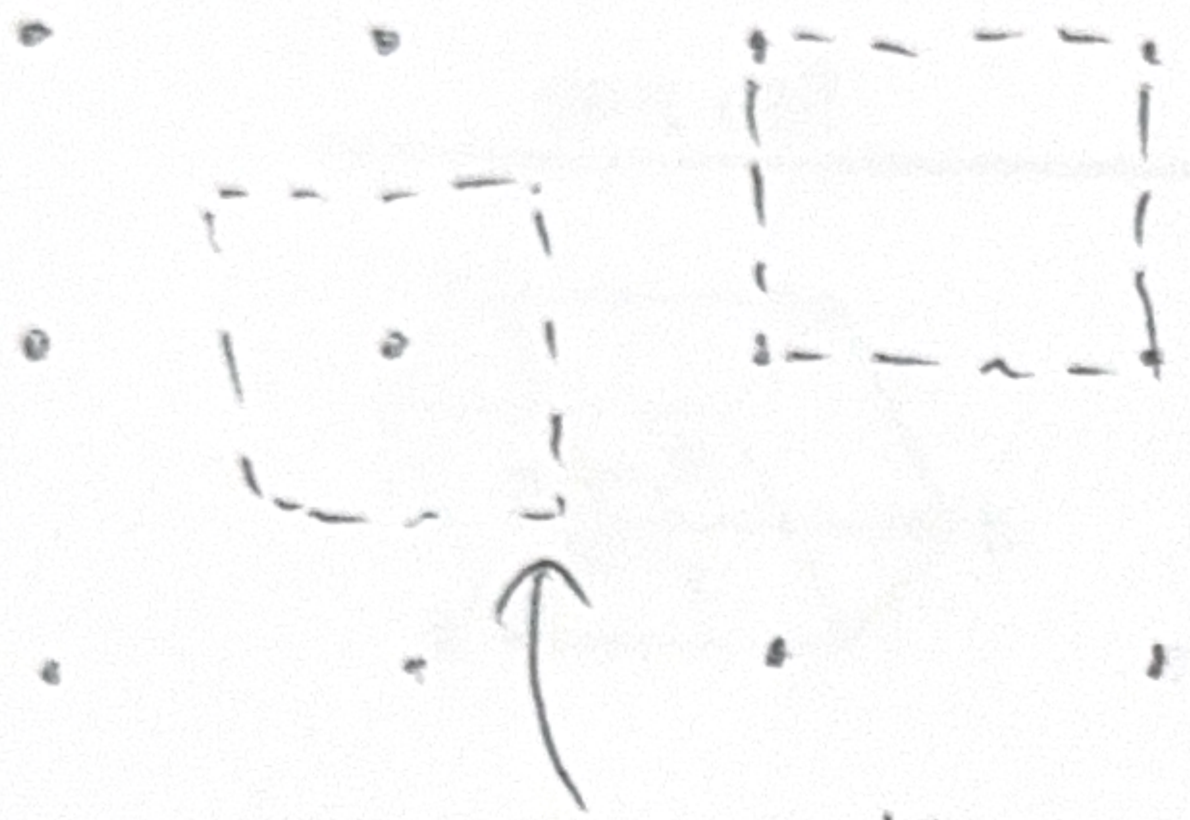
$[\frac{3a}{4} \frac{a}{4}]$

$[\frac{a}{4} \frac{3a}{4}]$

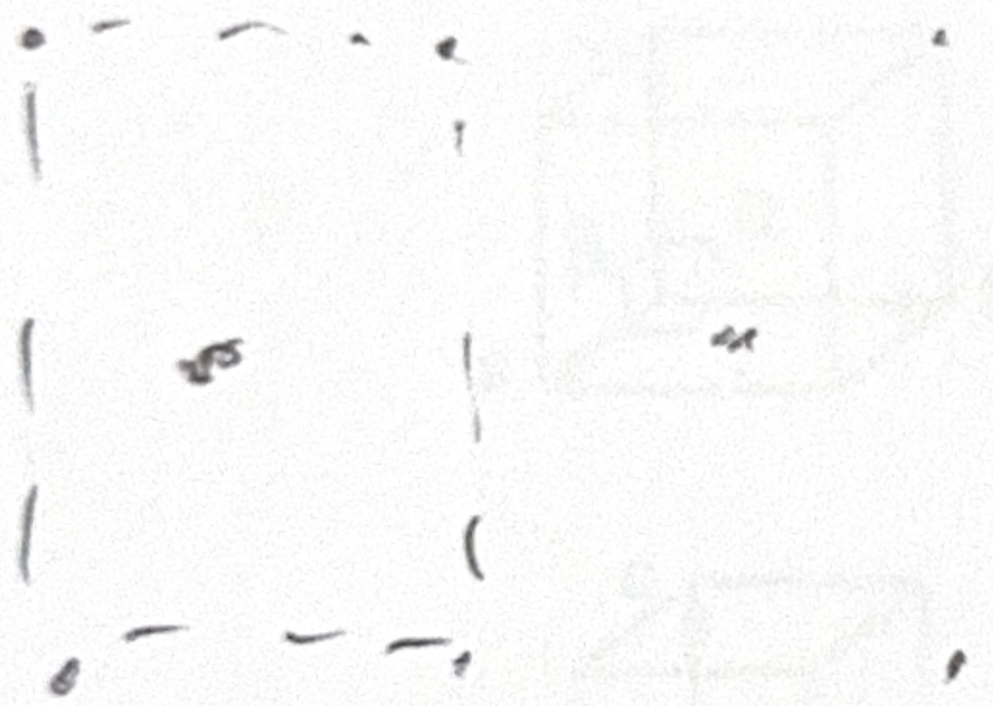
$[\frac{3a}{4} \frac{3a}{4}]$


Cs+
Cl−





primitive unit cell: only contains one lattice point

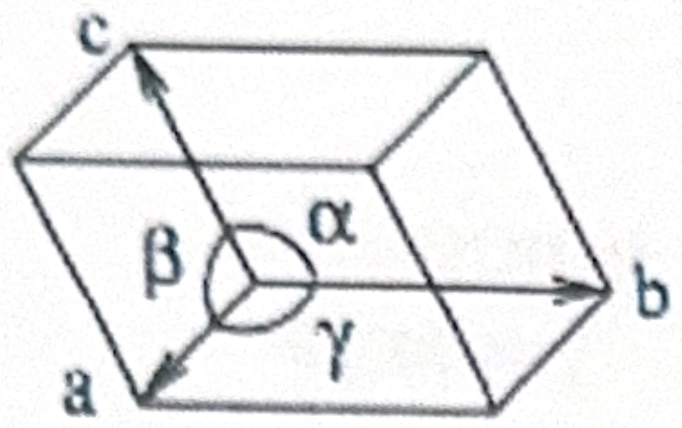
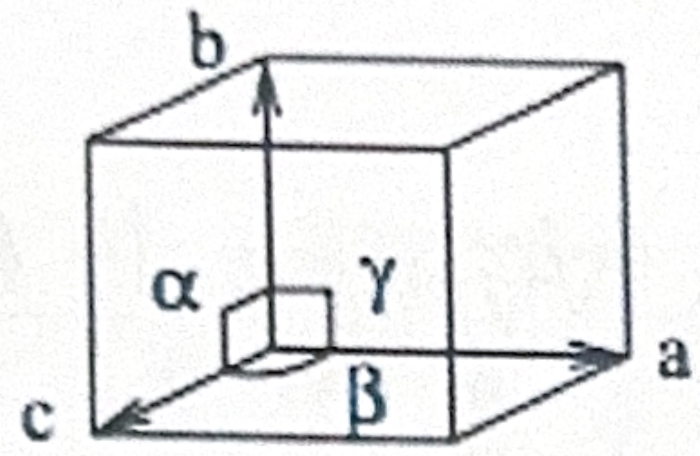
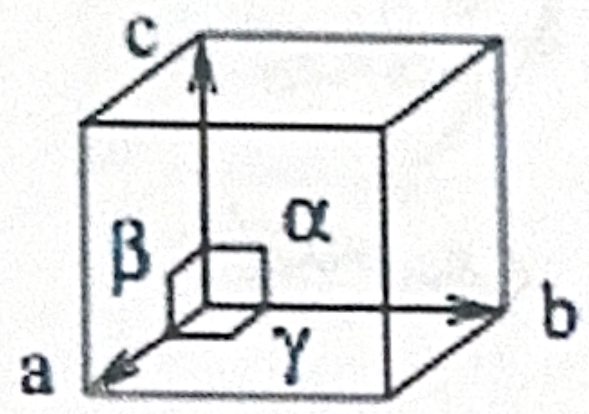
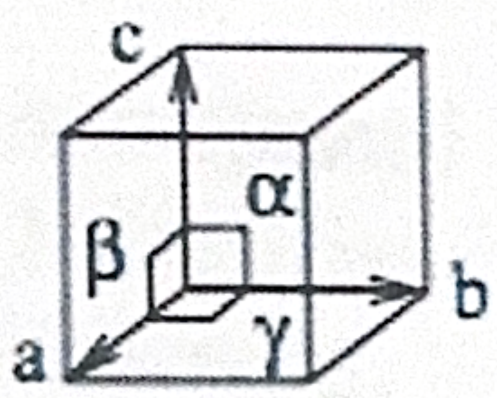
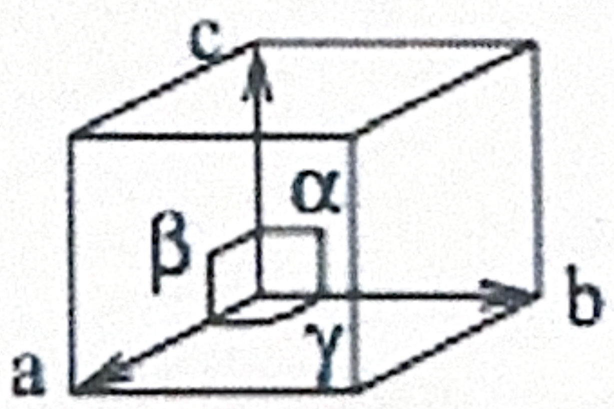
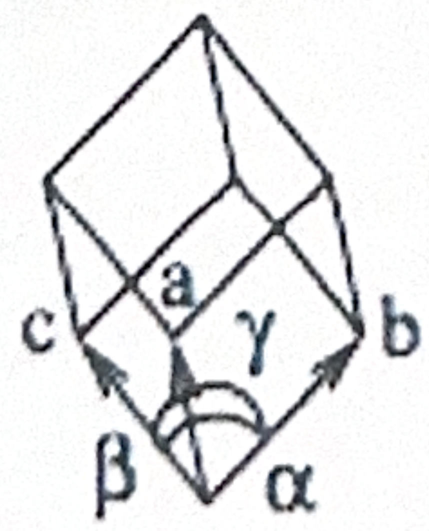
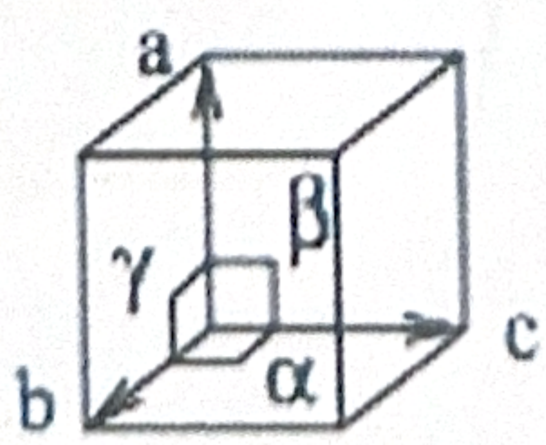


conventional unit cell: contains more than one lattice point

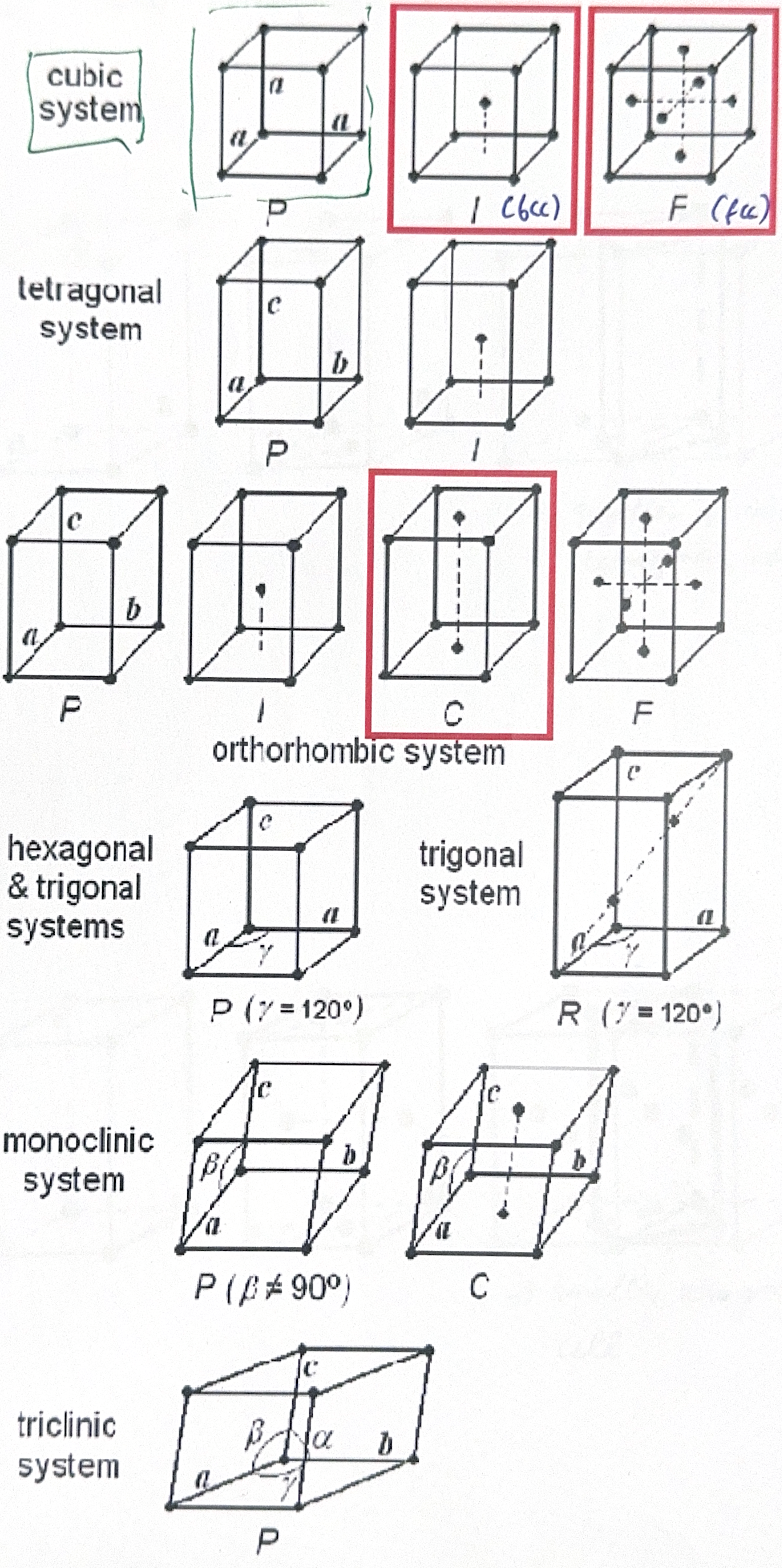
Basis: Description of objects in unit cell with respect to a reference lattice point.

and Bravais lattices (14)

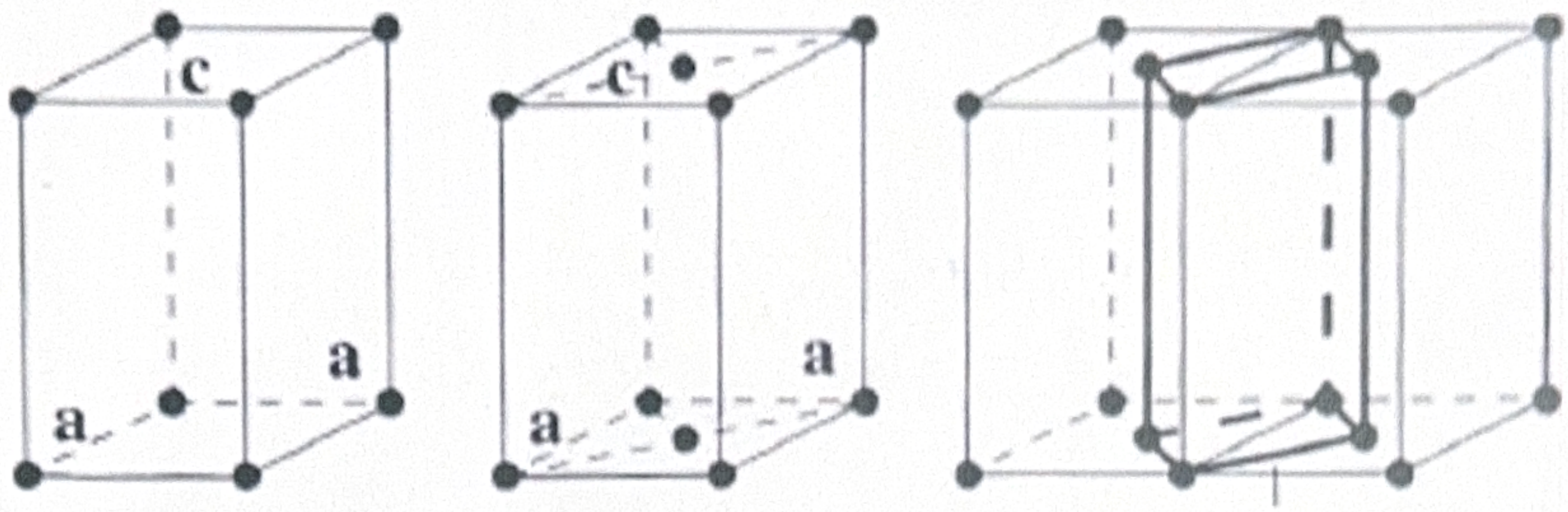
7 crystal systems needed to describe all crystals in nature

unit cell	name	geometry
	triclinic (anorthic)	$a \neq b \neq c \neq a$ $\alpha \neq \beta \neq \gamma \neq \alpha$
	monoclinic	$a \neq b \neq c \neq a$ $\alpha = \gamma = 90°$ $\beta \neq 90°$
	orthorhombic	$a \neq b \neq c \neq a$ $\alpha = \beta = \gamma = 90°$
	tetragonal	$a = b \neq c$ $\alpha = \beta = \gamma = 90°$
	trigonal hexagonal	$a = b \neq c$ $\alpha = \beta = 90°$ $\gamma = 120°$
	rhombohedral	$a = b = c$ $\alpha = \beta = \gamma \neq 90°$
	cubic	$a = b = c$ $\alpha = \beta = \gamma = 90°$

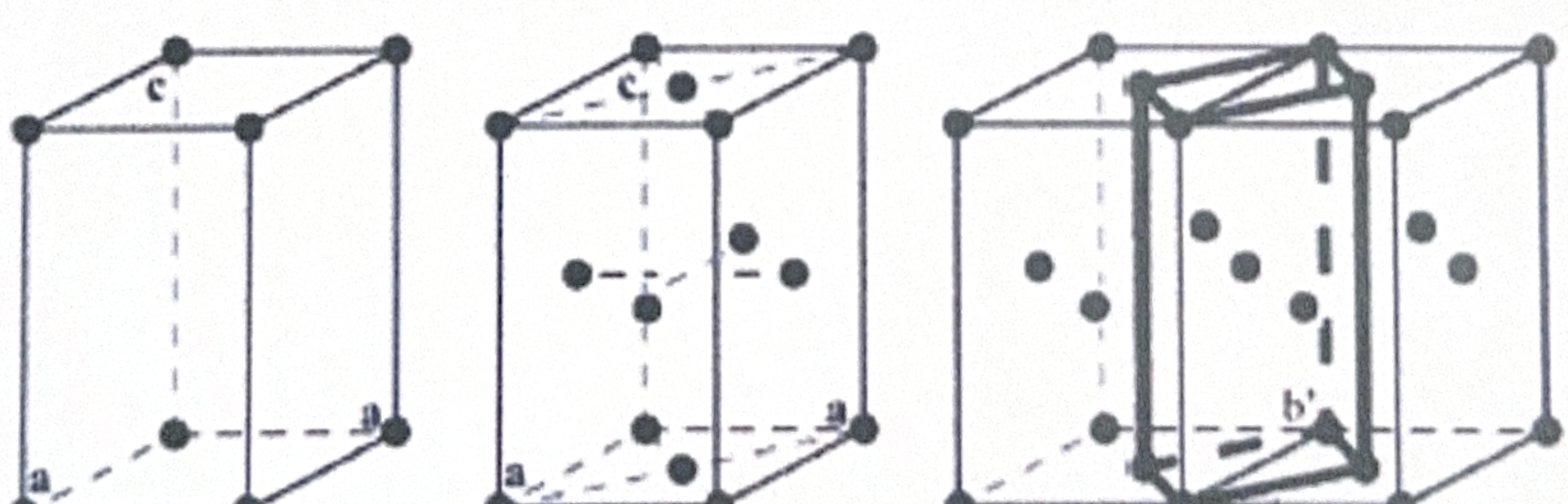
Centering types and Bravais lattices (14)



Example: Why tetragonal-C and -F impossible?



→ smaller primitive tetragonal cell



→ smaller tetragonal-I cell