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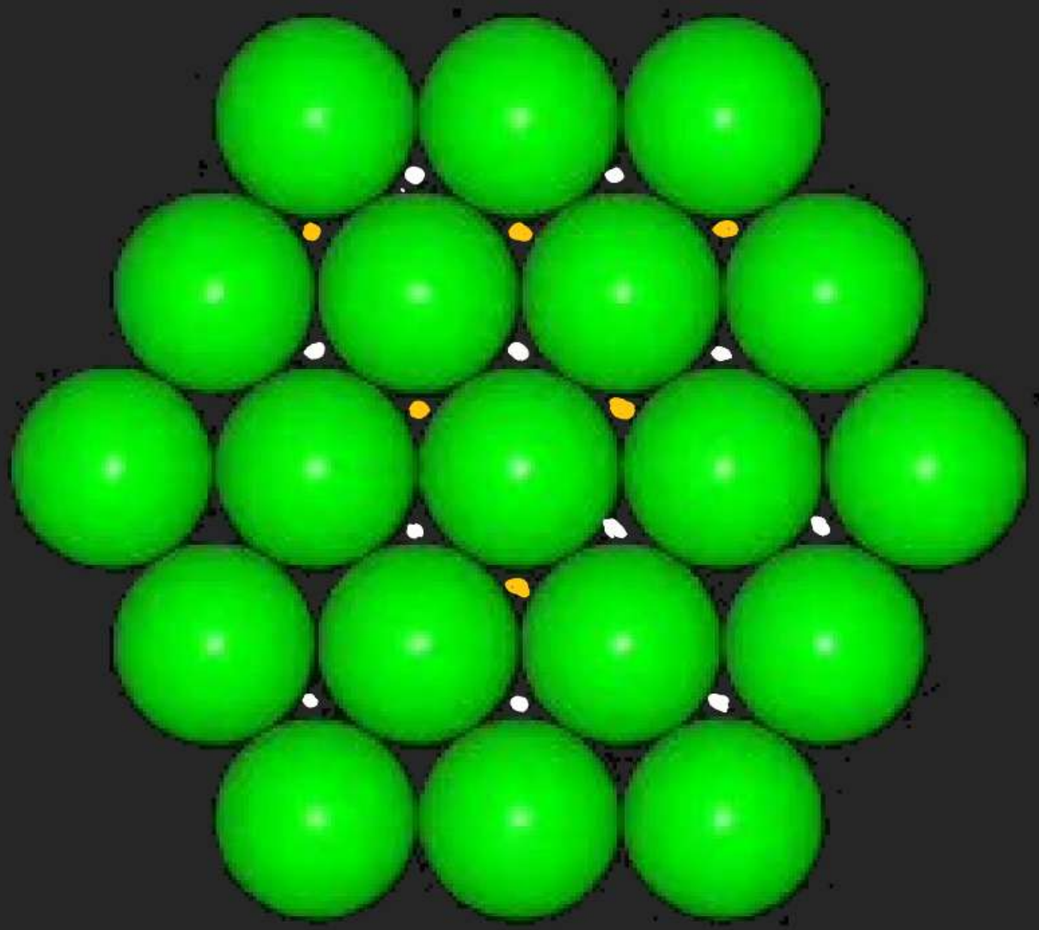

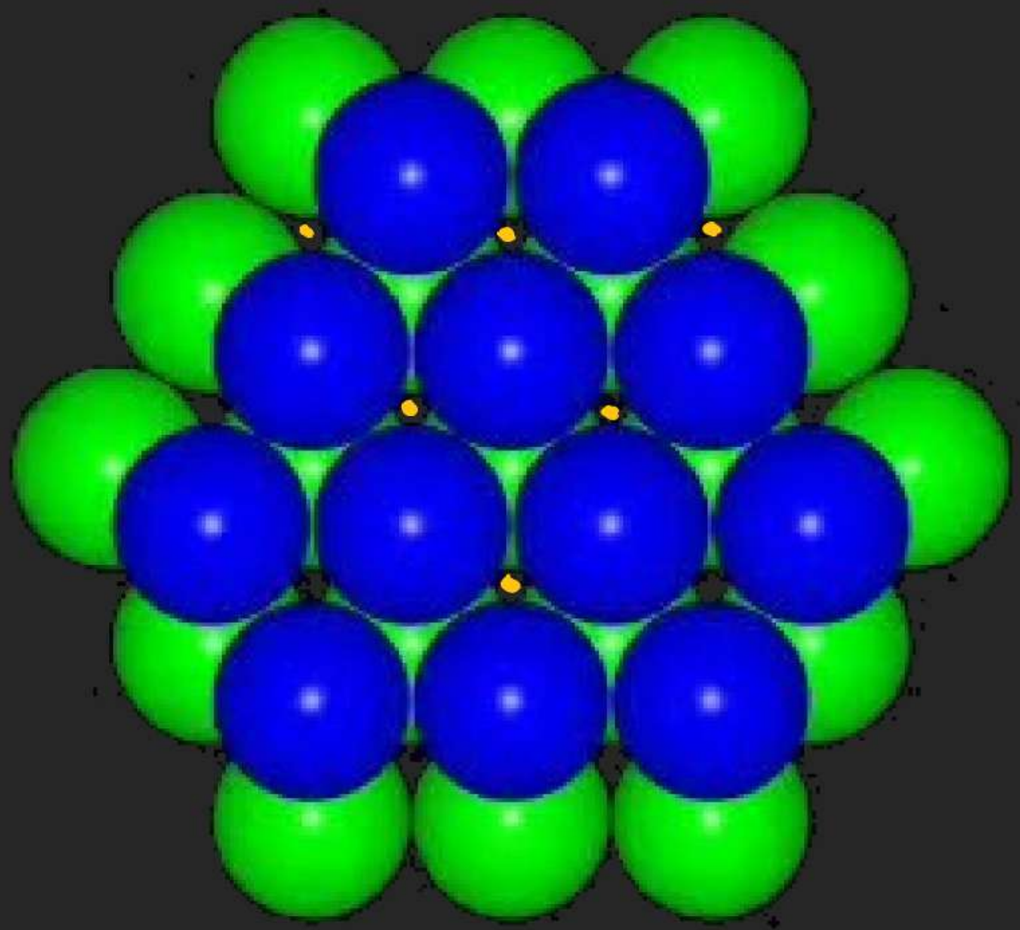

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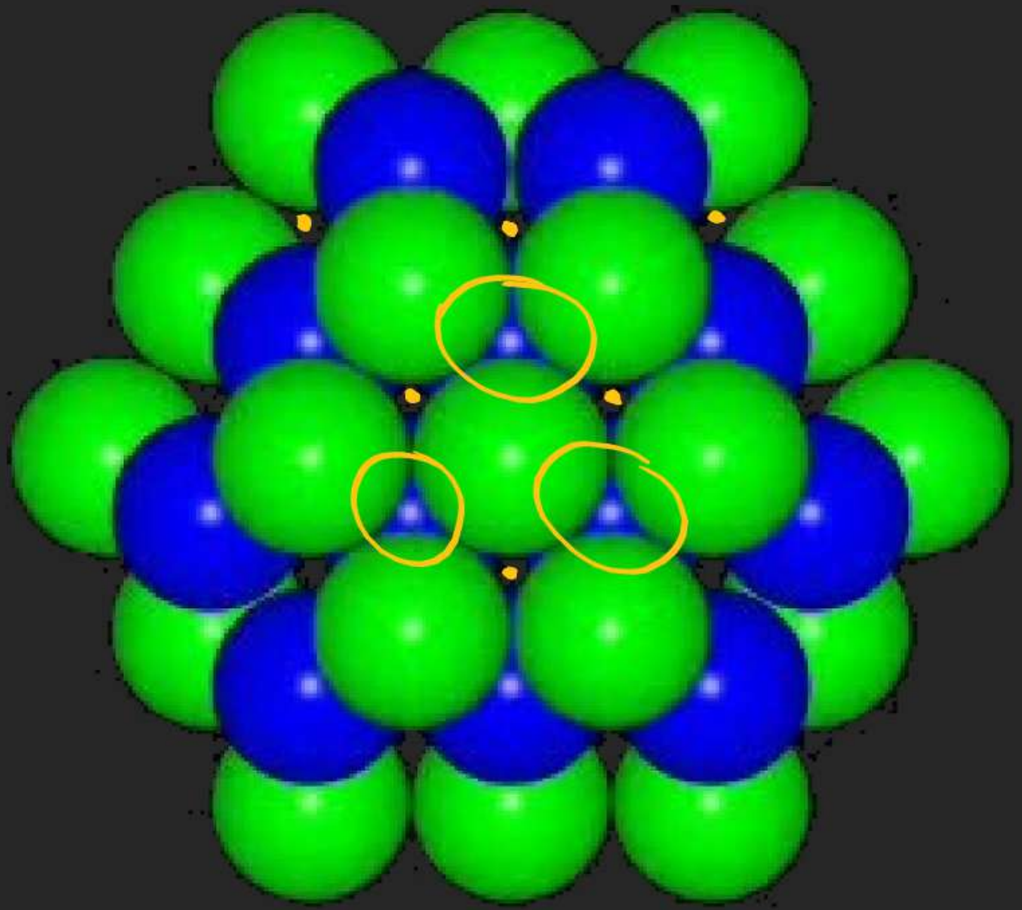
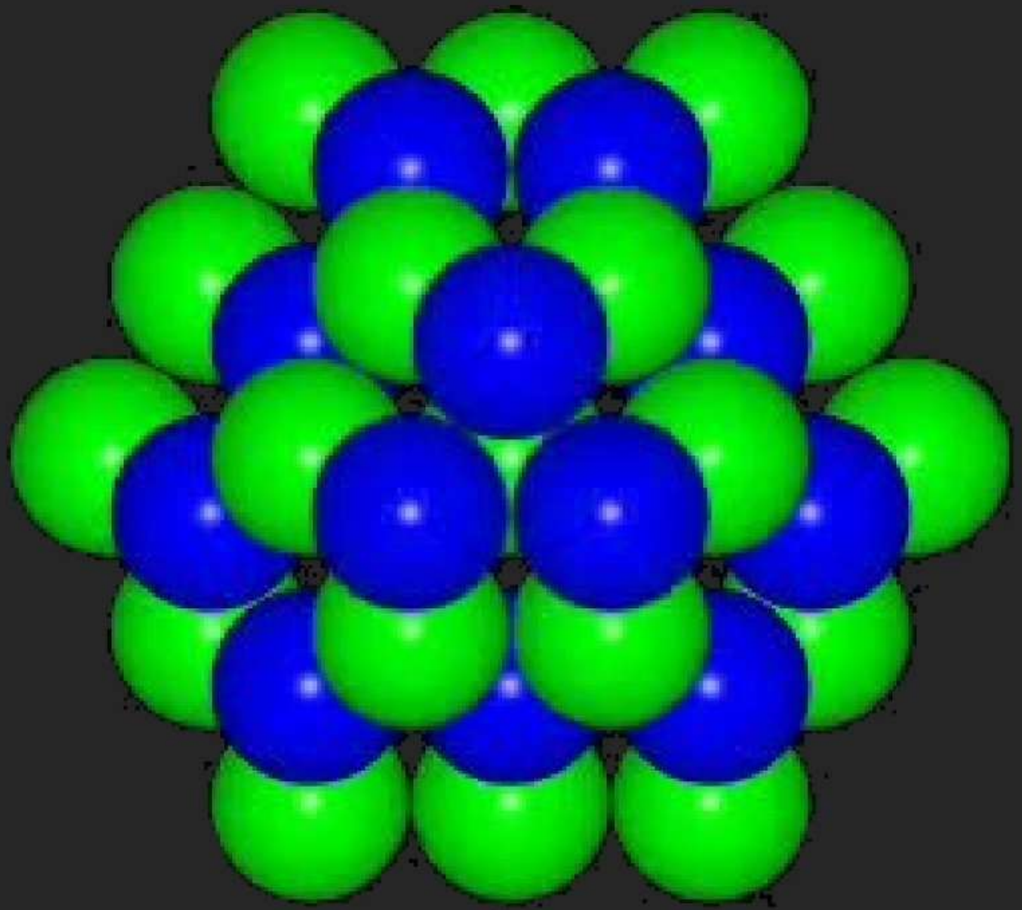
HCP

A B A B A B





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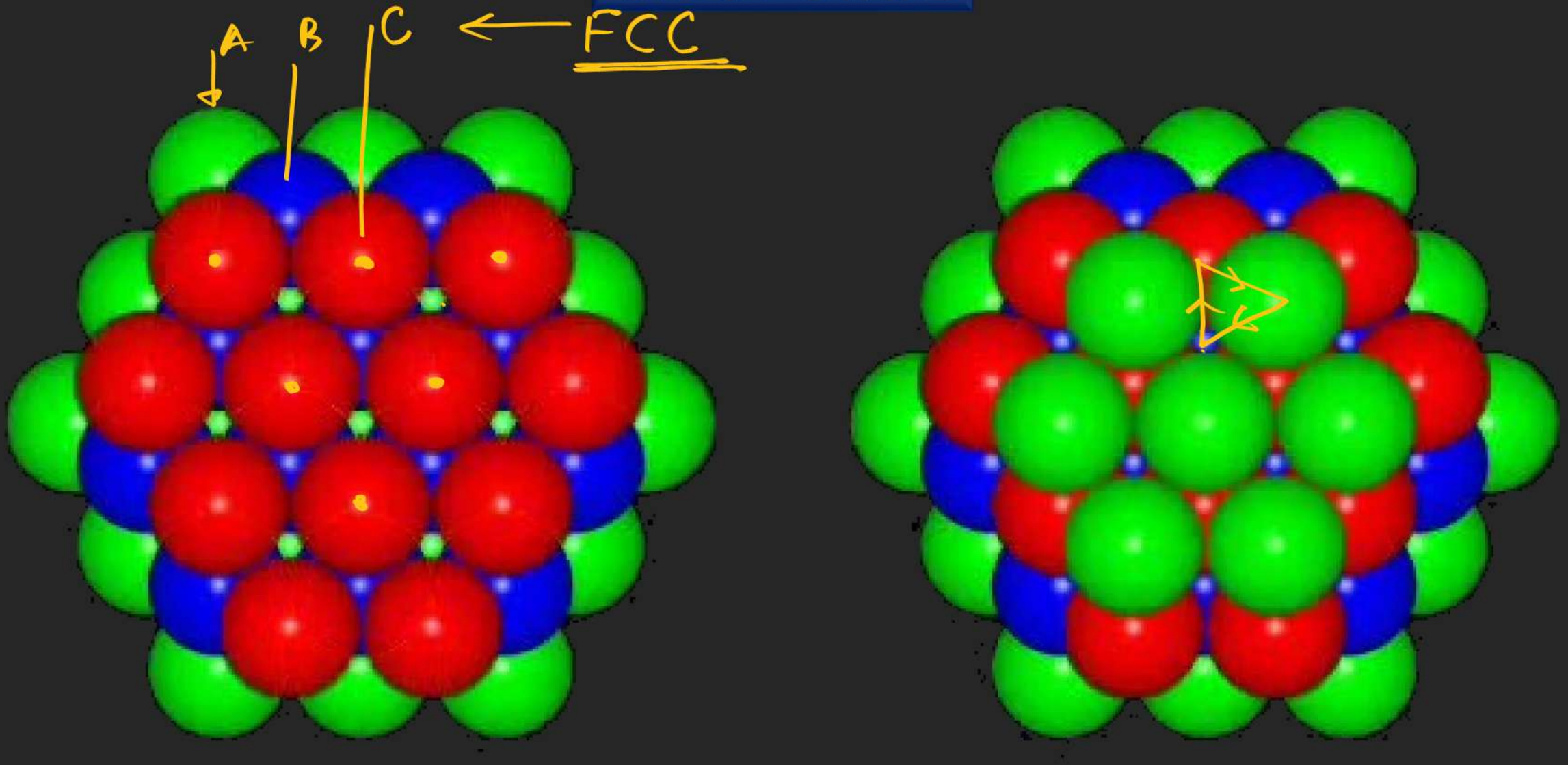

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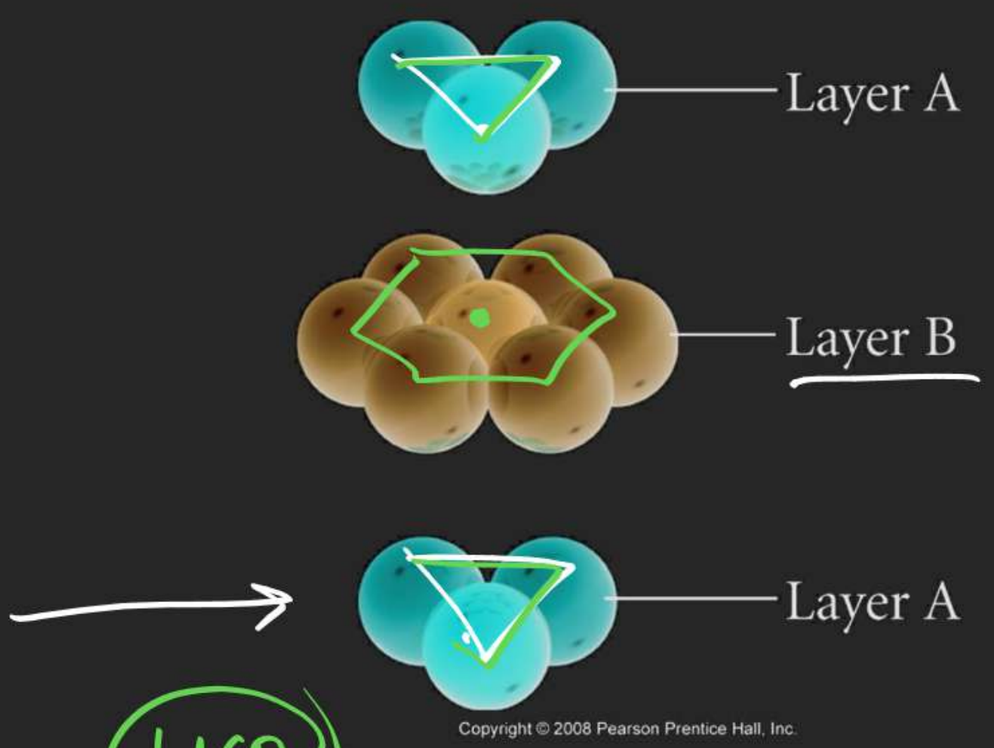
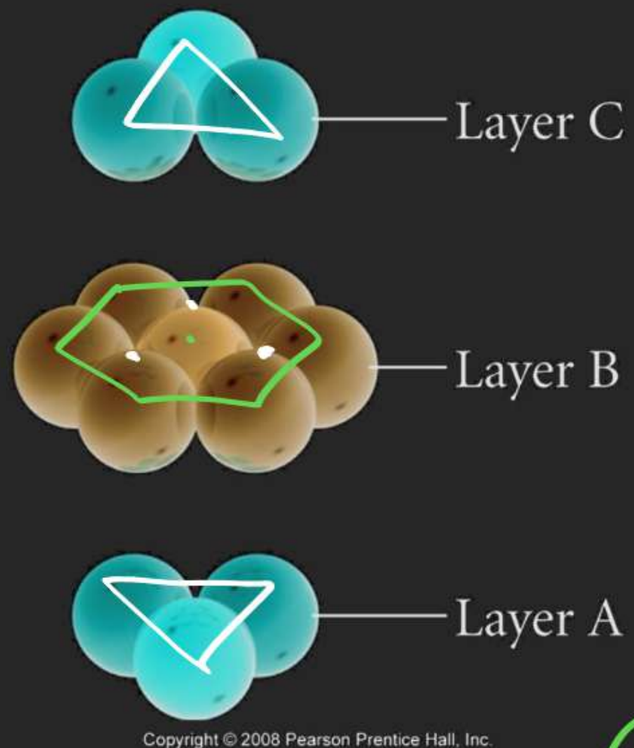
Stacking Patterns



HCP

Hexagonal closest-packed (hcp)

(closed packed)



Cubic closest-packed (ccp)

(closed packed)

FCC

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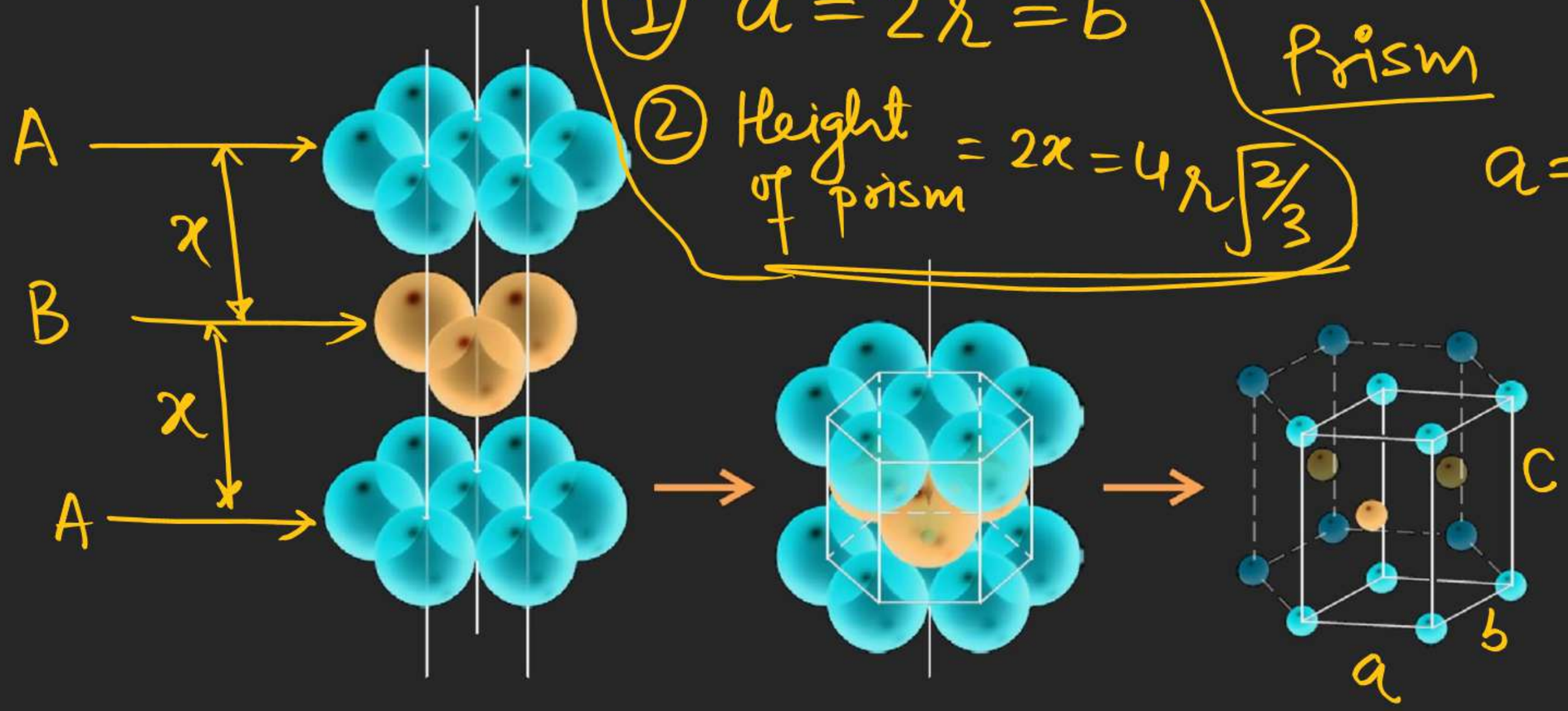
aba pattern ⟶ Hexagonal Unit Cell

① $a = 2r = b$

② Height of prism $= 2x = 4r\sqrt{2/3}$

Prism

$a = b \neq c$



Height of prism

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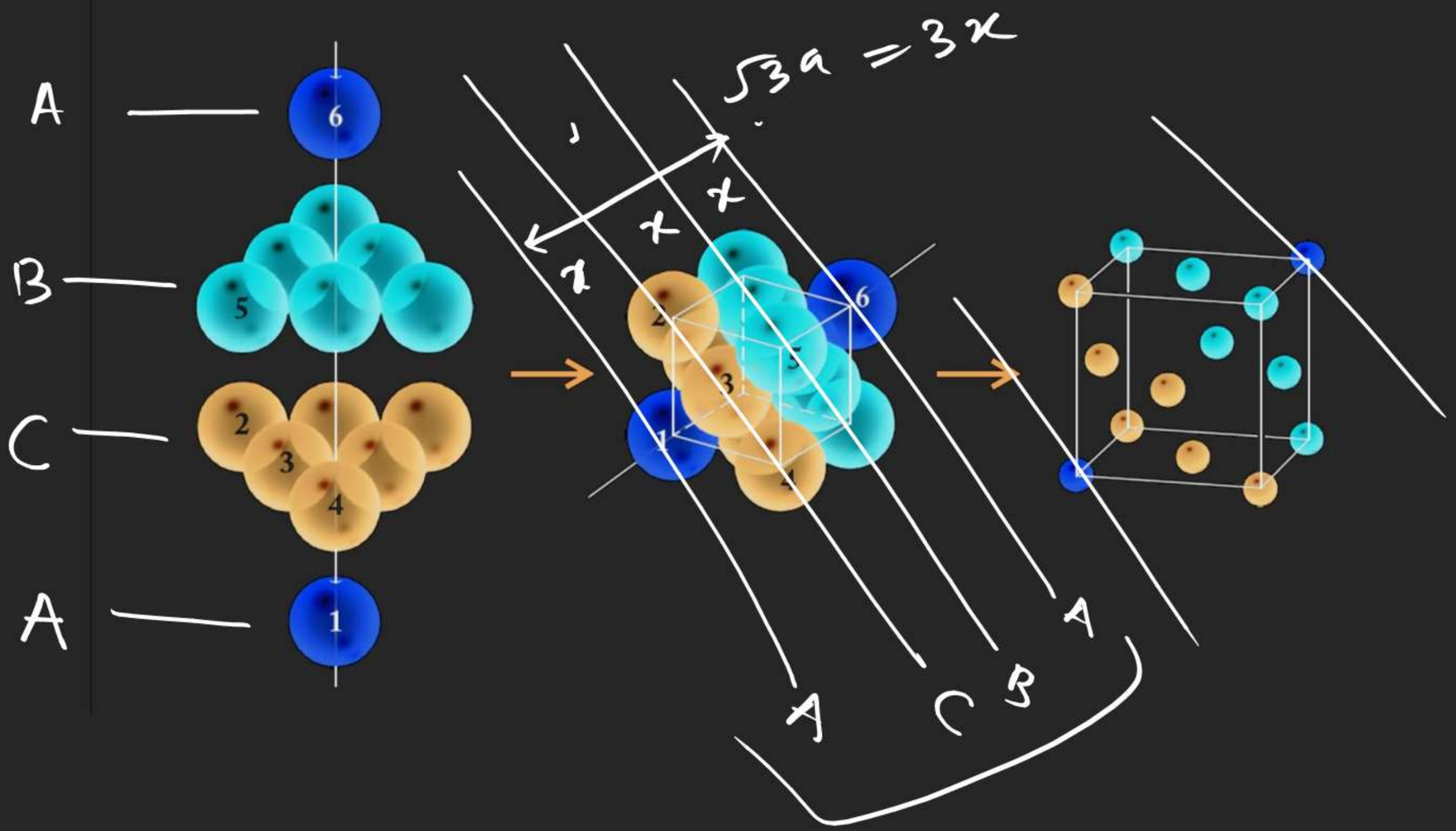
abc pattern → *Face-Centered Cubit Unit Cell*



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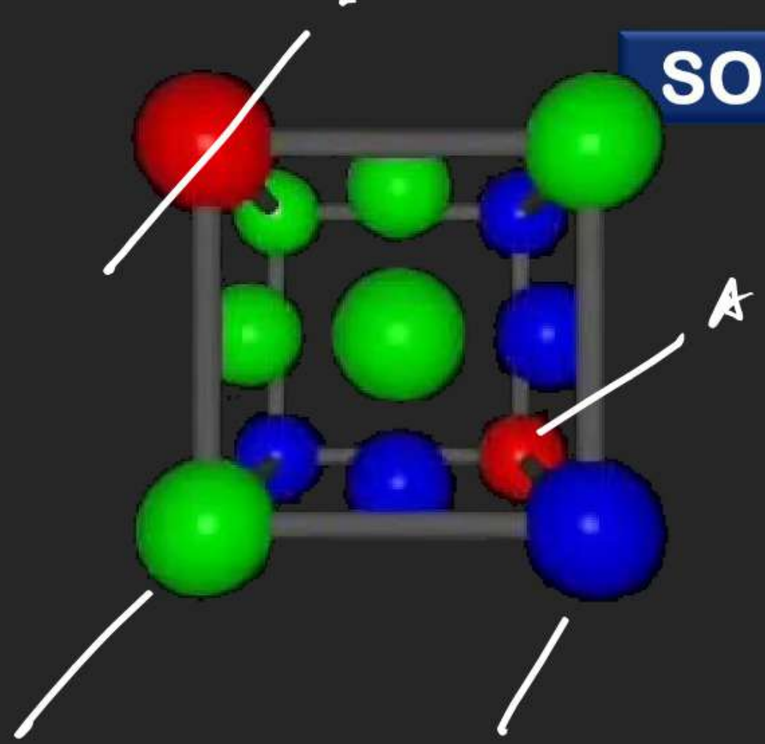

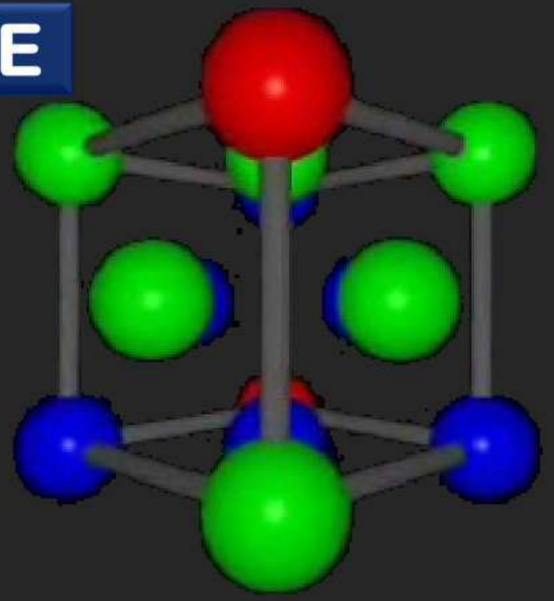

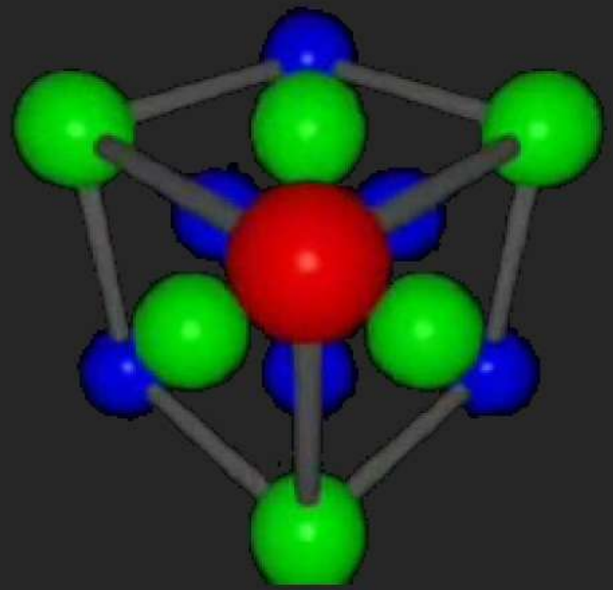

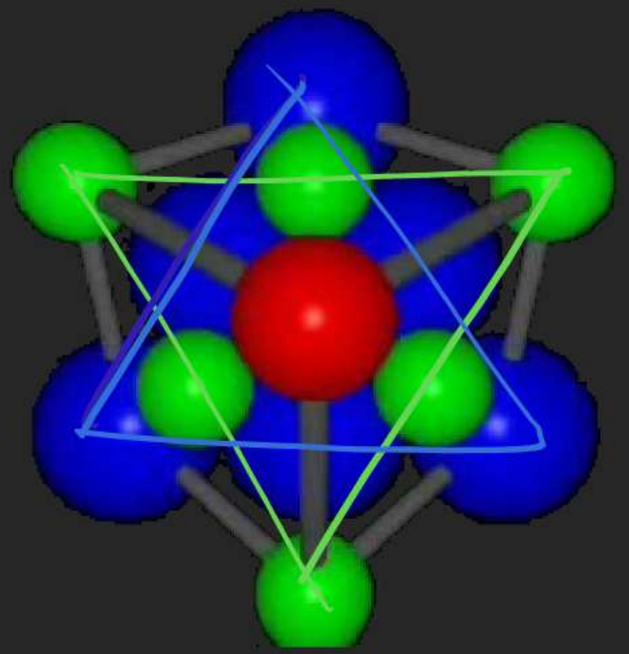

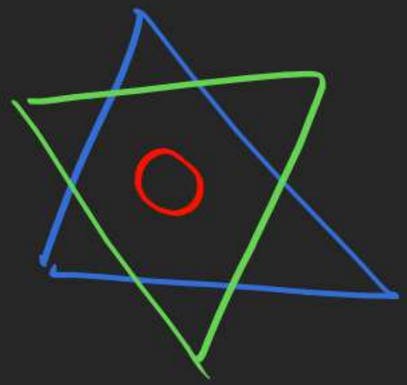

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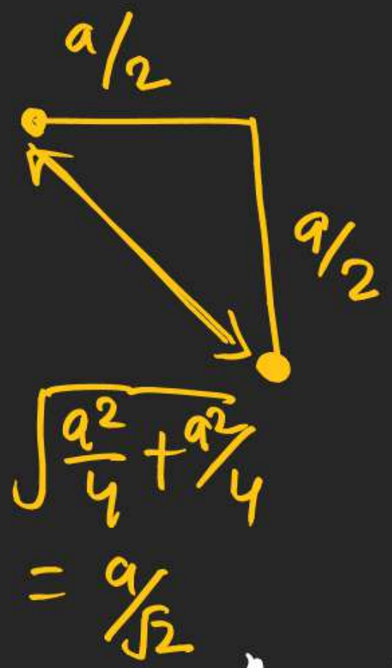
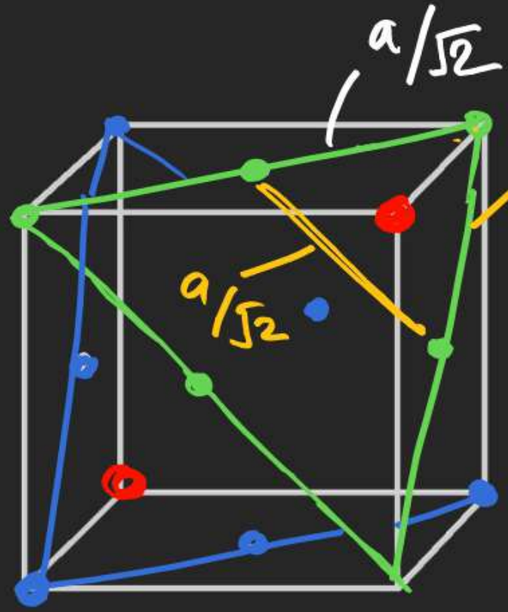
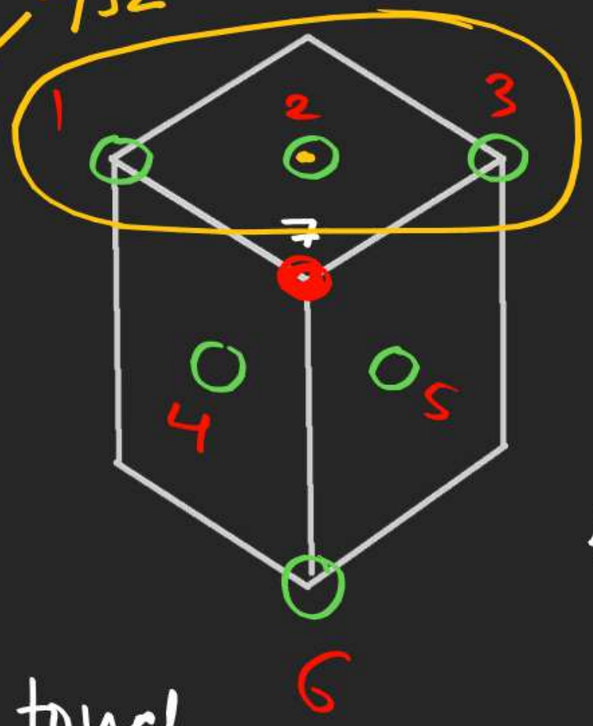
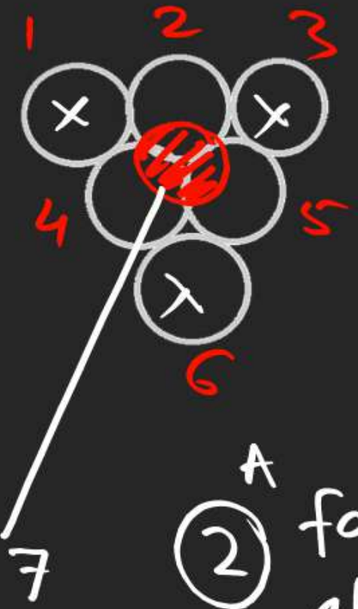
Face centred Cubic (FCC) [Cubic closed packing CCP]









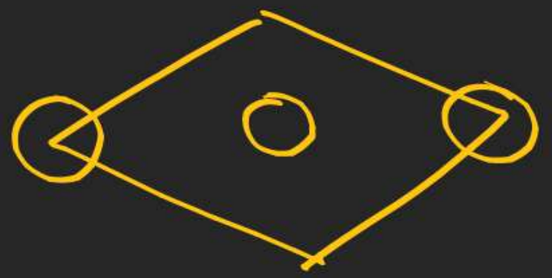
1. Atoms at the adjacent do not touch each other

2. face centred atom touches all its corner atoms

(3) A face centred atoms also touch all other centred atom which are ⊥ar to its plane

(4) Coordination no = 12

(5) $\sqrt{2}a = 4r$



(6) no. of atom per unit cell

$$= \frac{1}{8} \times 8 + \frac{1}{2} \times 6$$

$$= 1 + 3 = 4$$

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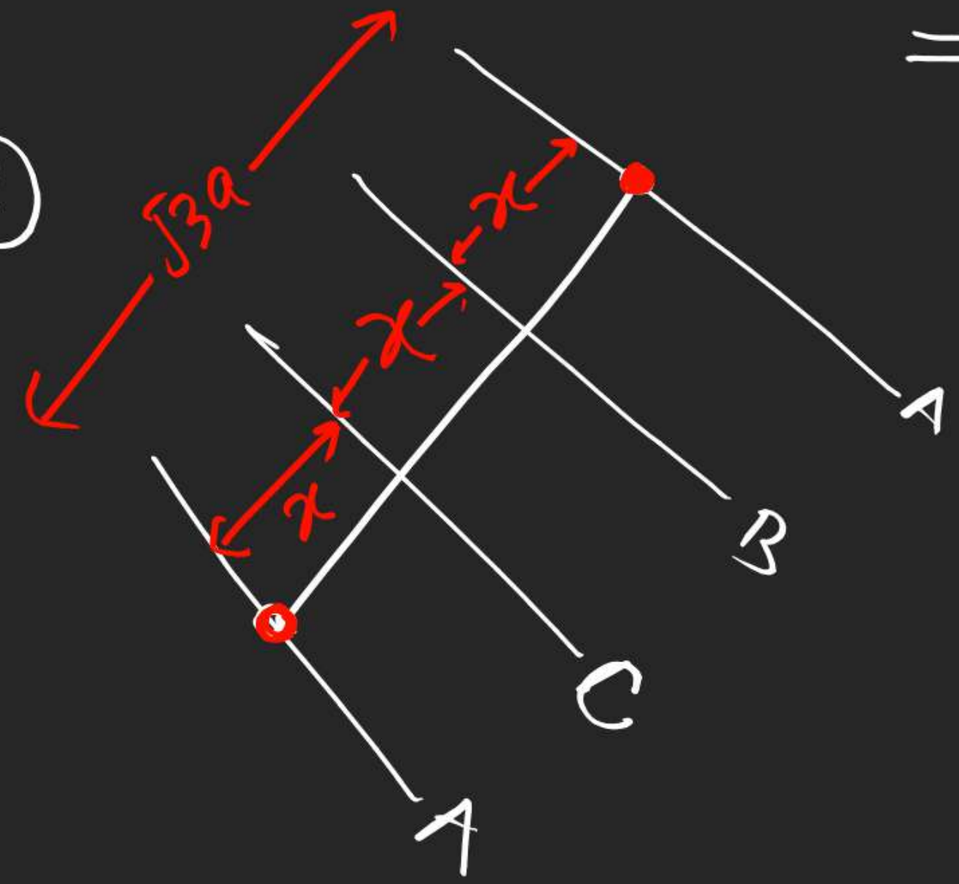
(7) Packing fraction $= \dfrac{4 \times \frac{4}{3}\pi r^3}{a^3} \times 100$

$(\sqrt{2}a = 4r)$

$= 74\%$

(8)



$\sqrt{3}a = 3x$ ← distance bet^n two adjacent hexagonal layer

$$x = \frac{a}{\sqrt{3}} = 2r\sqrt{\frac{2}{3}}$$

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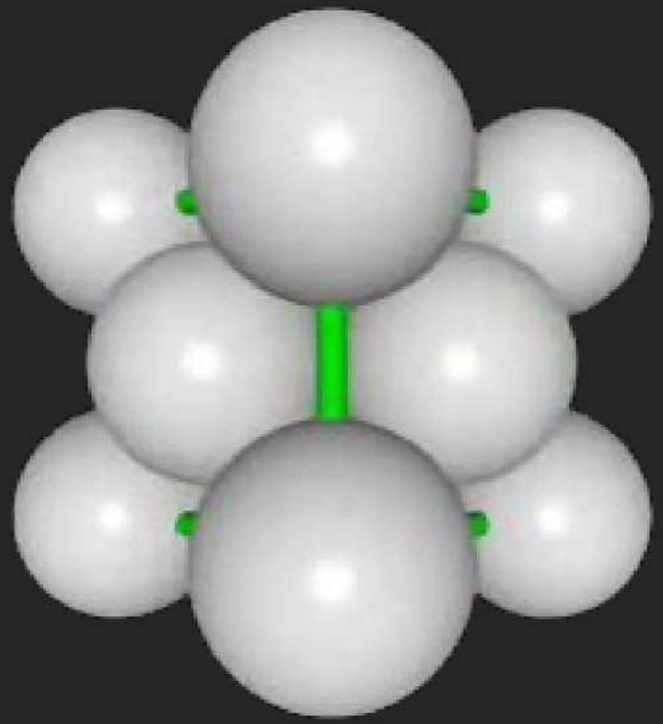
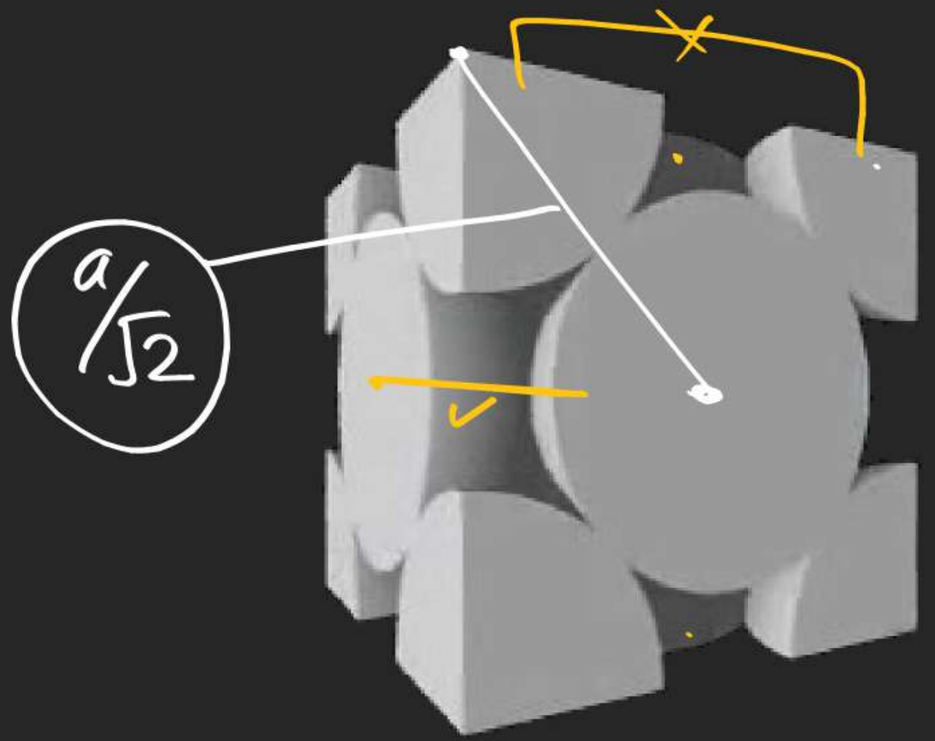
face diagonal = $\sqrt{2}a$

body diagonal = $\sqrt{3}a$





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① Distance of nearest atom from a given atom and no. of such atom $a/\sqrt{2}$, 12

② Distance of 2nd nearest ...

$= a$, 6

③ Distance of 3rd nearest $\sqrt{1.5}a$, 24

④ 4th nearest $\sqrt{2}a$, 12

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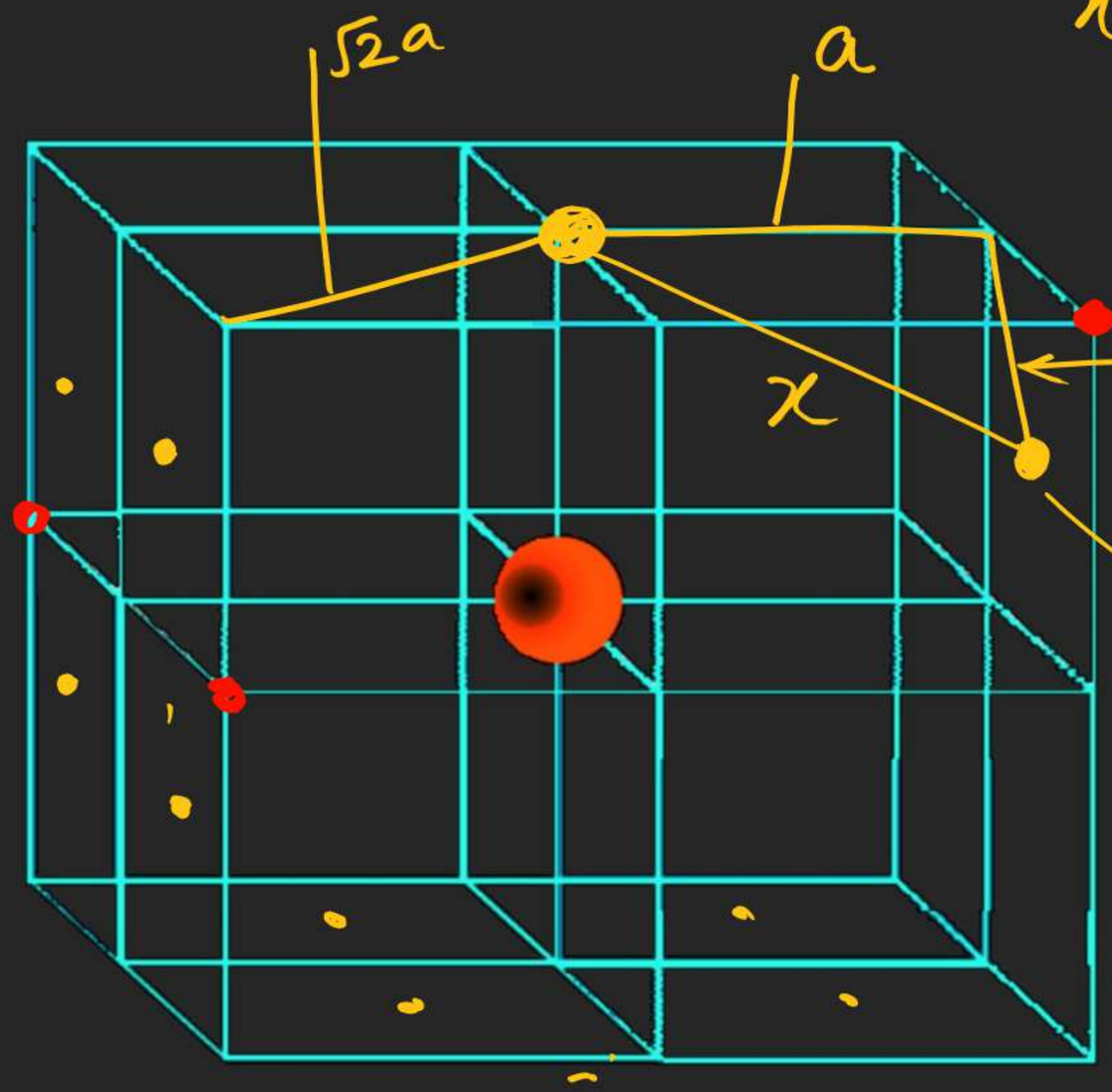

$$x^2 = a^2 + a^2/2$$

$$x = \sqrt{3/2}\, a = \sqrt{1.5}\, a$$

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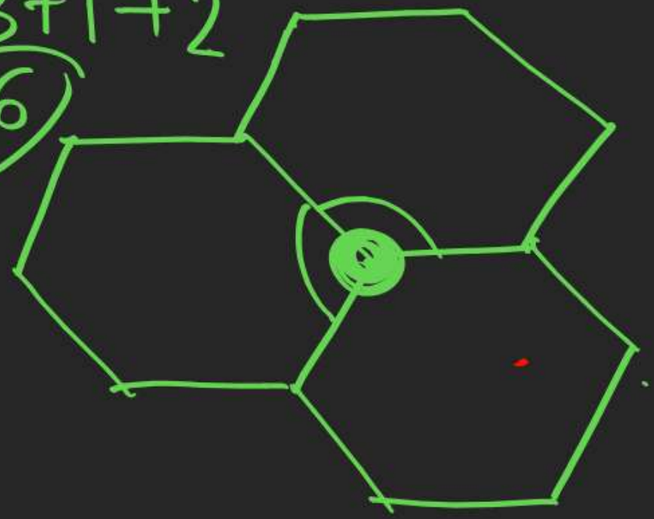
Hexagonal closed packed (HCP) Unit cell

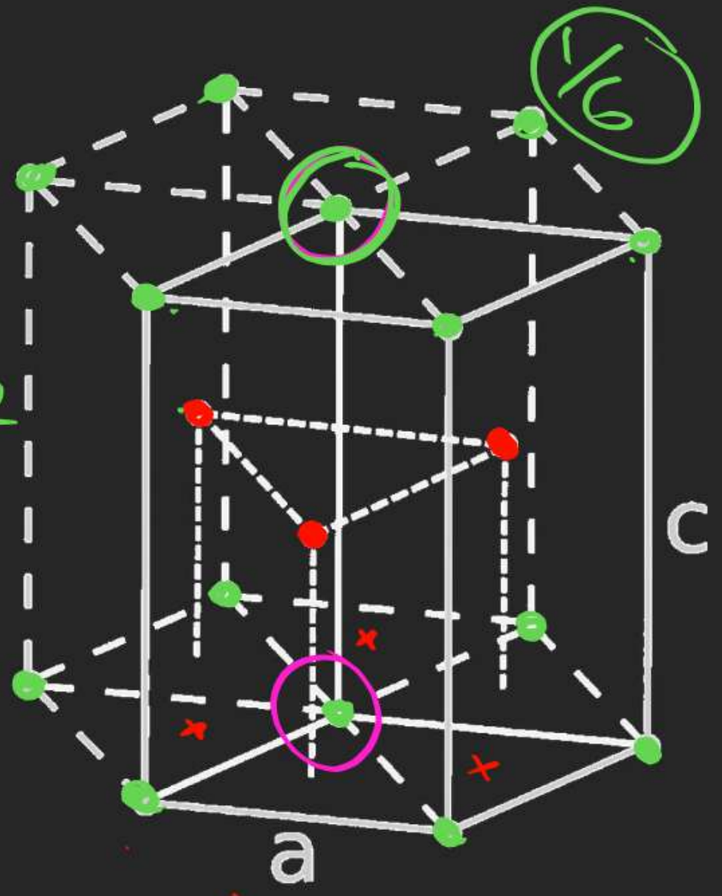
(5) No of atoms per prism =

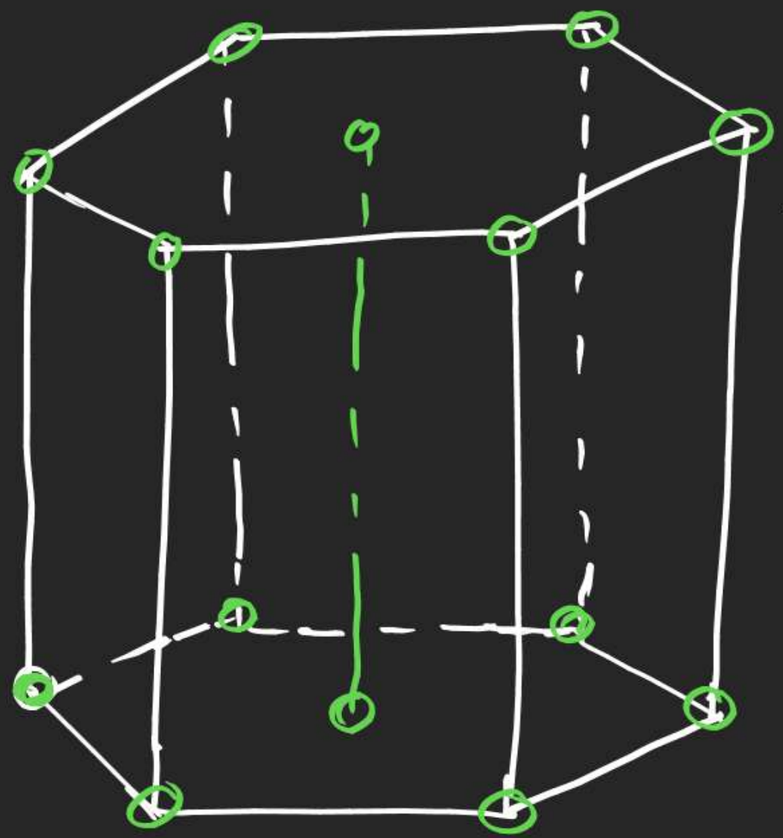
$= 3 + \frac{1}{2} \times 2 + \frac{1}{6} \times 12$

$= 3 + 1 + 2$

$= 6$







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(6) no. of atoms per unit cell = $6/3 = 2$

(7) Coordination no. $= 12$

(8) Packing efficiency $= \dfrac{6 \times 4/3 \pi r^3}{\text{Vol. of prism}} \times 100$

$\frac{\sqrt{3}}{4} a^2$

$$= \frac{6 \times 4/3 \pi r^3}{\left[6 \times \frac{\sqrt{3}}{4}(2r)^2\right] \times 4r\sqrt{2/3}} \times 100$$

$= \underline{74\%}$

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$$\text{Density} = \frac{\text{mass}}{\text{Volume}}$$

$$= \frac{\text{mass of unit cell}}{\text{Volume of unit cell}}$$

$$\underline{\text{Density}} = \frac{Z \times \frac{M(gm)}{N_A}}{a^3}$$

$Z = 1$ SC

$= 2$ BCC

$= 4$ FCC

$\underline{Fe} = \underline{56}\ gm$

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$0-I \quad 16-24$

$5-I \quad 6-12$

H.W