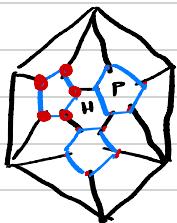




Exp: 1 → Fullerene, Graphene & Nanotubes.

1.(a)



Icosa

V	E	F	Δ
12	30	20	

Truncated "

$$12 \times 5 = 60$$

C_{60}

$$30 + 60$$

$$= 90$$

$$12P + 20H$$

1(b)

$$V - E + F = 2$$

C_{70}, C_{76}, C_{82}

bond C

C bonded to 3 other C

3 edge / vertex

Pentagons & hexagons only.

always $1P = 12$

increase as n ↑

Pentagonal dodecahedron

12

T Σ

12

0

20 H

1(a) Let C_n have P pentagons and H hexagons

$$F = P+H$$

$$V = n$$



$$E = \frac{3n}{2} = \frac{5P+6H}{2}$$

$$3n = 5P+6H$$

$$V - E + F = 2$$

$$n - \frac{3n}{2} + P+H = 2$$

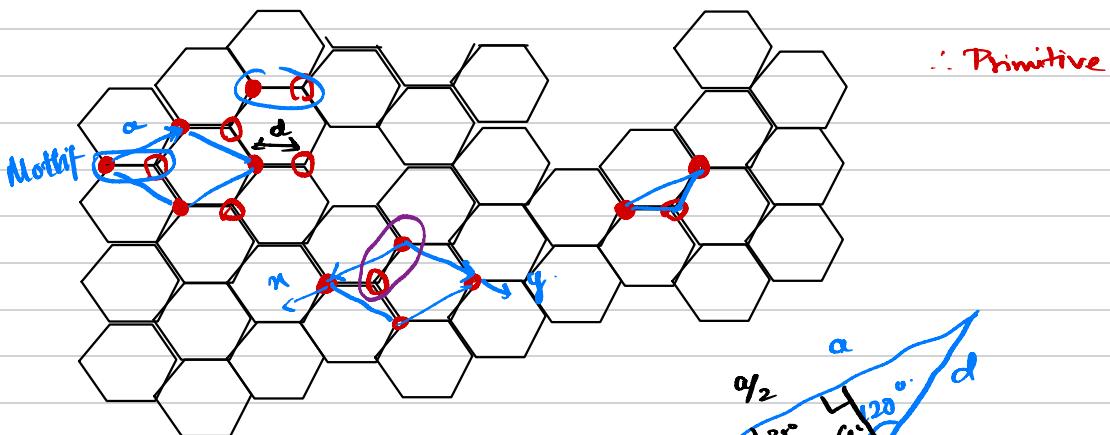
$$-\frac{n}{2} + P+H = 2 \Rightarrow -n + 2P + 2H = 4$$

$$\Rightarrow -3n + 6P + 6H = 12$$

$$n = 6P + 6H = 12 + 3P + 6H$$

$$P = 12$$

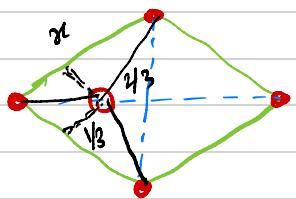
● → Lattice Pt.
○ → atom.



$$d \cos 30^\circ = \frac{a}{2}$$

$$a = \sqrt{3}d$$

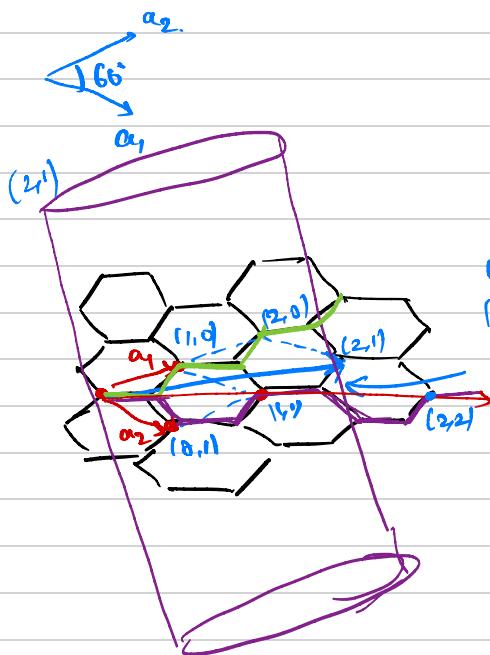
$$\Rightarrow d \frac{\sqrt{2}}{2} = \frac{a}{2}$$



$$\frac{x}{a} = \frac{2}{3} \Rightarrow x = \frac{2}{3}a.$$

$$\frac{y}{a/2} = \frac{2}{3} \Rightarrow y = \frac{1}{3}a.$$

Nanotube

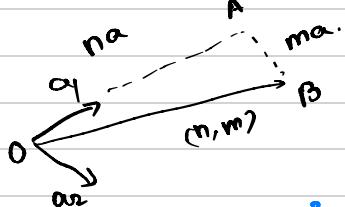


Wrapping vector.
(n,m)

Chiral vector.
(n,n)

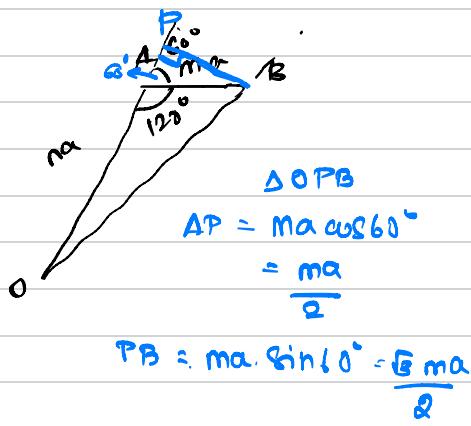
(n,m)

(n,0) tube.
Zig -Zag tube.
(n,n) arm chair



$$OB^2 = OP^2 + PB^2$$

$$OB^2 = (OA + AP)^2 + PB^2$$



$$\begin{aligned}\Delta OPB \\ AP &= ma \cos 60^\circ \\ &= \frac{ma}{2}\end{aligned}$$

$$PB = ma \sin 60^\circ = \frac{\sqrt{3}ma}{2}$$

$$\begin{aligned}
 OB^2 &= \left(na + \frac{ma}{2}\right)^2 + \left(\frac{\sqrt{3}ma}{2}\right)^2 \\
 &= n^2a^2 + \frac{m^2a^2}{4} + \frac{nma^2}{2} + \frac{3m^2a^2}{4} \\
 &= n^2a^2 + m^2a^2 + nma^2
 \end{aligned}$$

$$OB^2 = (n^2 + m^2 + nm) a^2$$

$$L = OB = \sqrt{n^2 + m^2 + nm} a$$

$$\tan \theta = \frac{PB}{OP} = \frac{\sqrt{3}m}{2n+m}$$