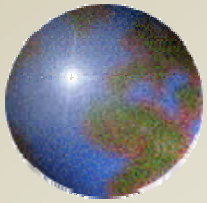
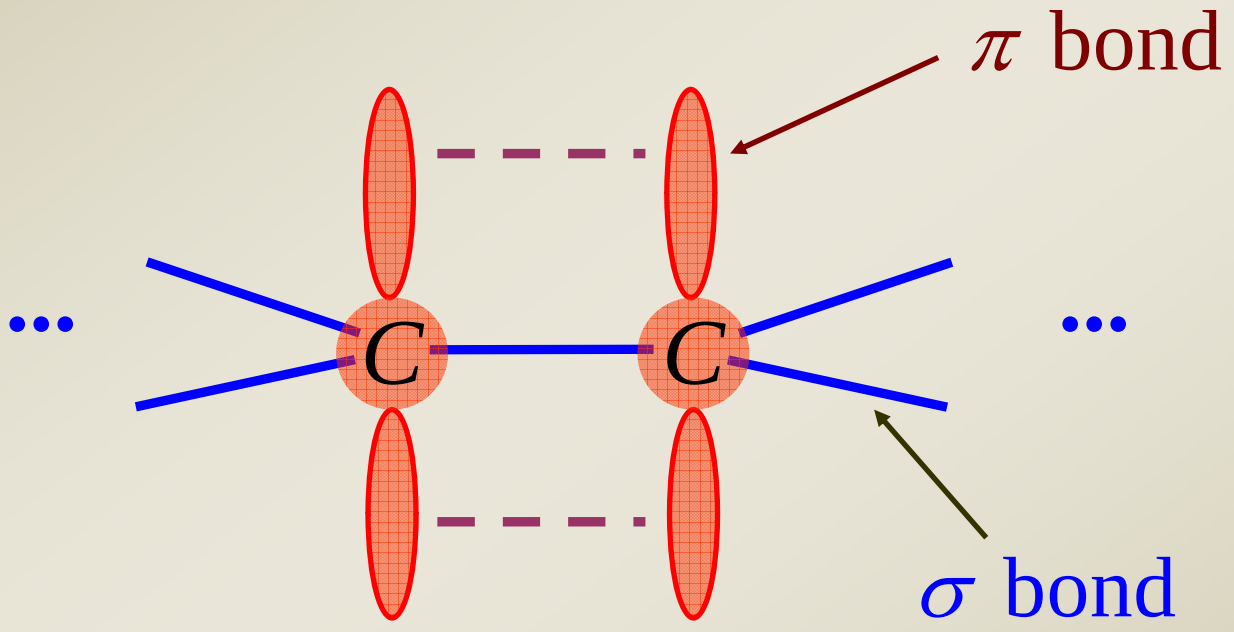


Fullerenes

Architect: Buckminster Fuller

Orbits



Carbon $1S^2\,\underbrace{2S^2\,2P^2}$

4 electrons in σ bonds (SP^2) + π bond or SP^3

Euler's Theorem

$$F=E-V+2$$

F = number of faces

E = number of edges

V = number of vertices

C_n n = number of carbon atoms

Each carbon has three edges.

$$\therefore \frac{3V}{2} = E \qquad F = \frac{V}{2} + 2$$

$F_S = S$ 面形之數目 ⇒

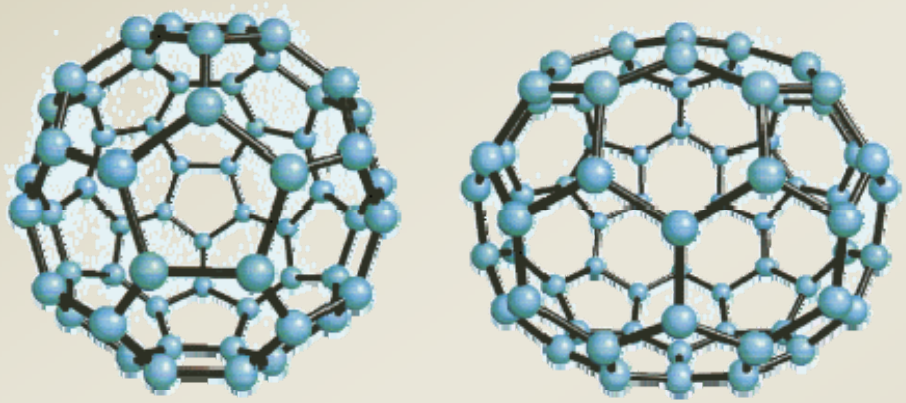
$$F = \sum_S F_S$$

$$E = \frac{1}{2}\sum_S SF_S \Rightarrow \sum_S (6 - S)F_S = 12$$

$$V = \frac{1}{3}\sum_S SF_S$$

Molecules with 5-fold symmetry

$$\sum_S (6-S)F_S = 12 \Rightarrow F_6 \text{ is arbitrary.}$$

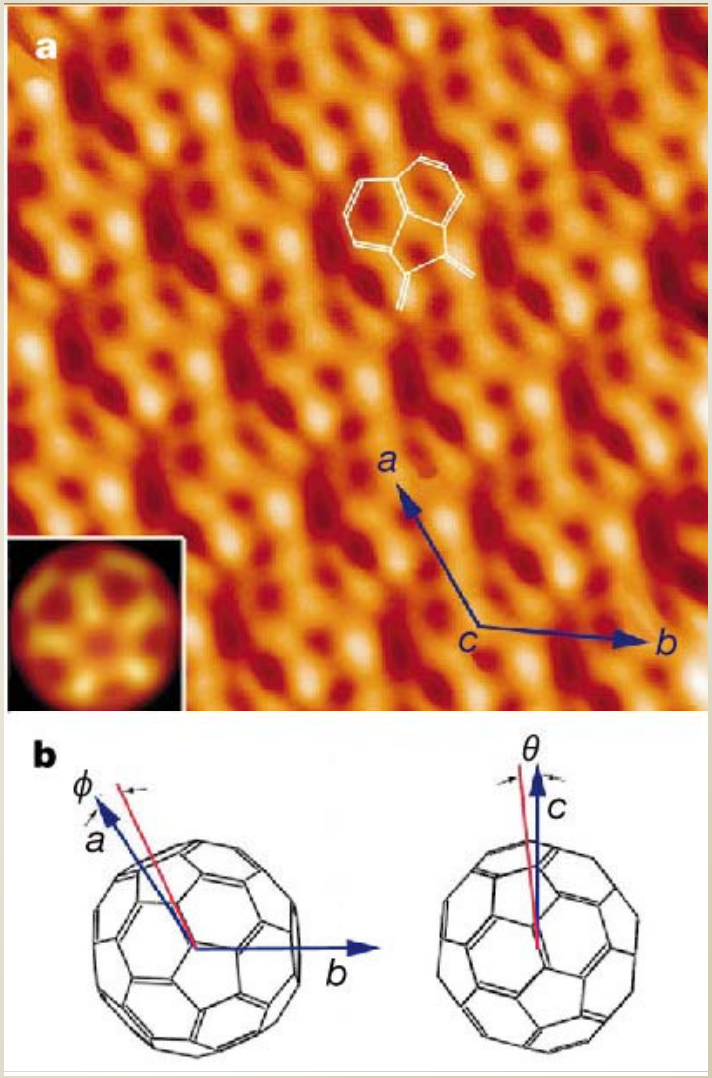


C_{60} 12個pentagon $\because 3V = 5F_5 + 6F_6$

$\therefore 3\times 60 = 5\times 12 + 6F_6 \quad F_6 = 20$

C_{70} 12個pentagon $\because 3V = 5F_5 + 6F_6$

$\therefore 3\times 70 = 5\times 12 + 6F_6 \quad F_6 = 25$



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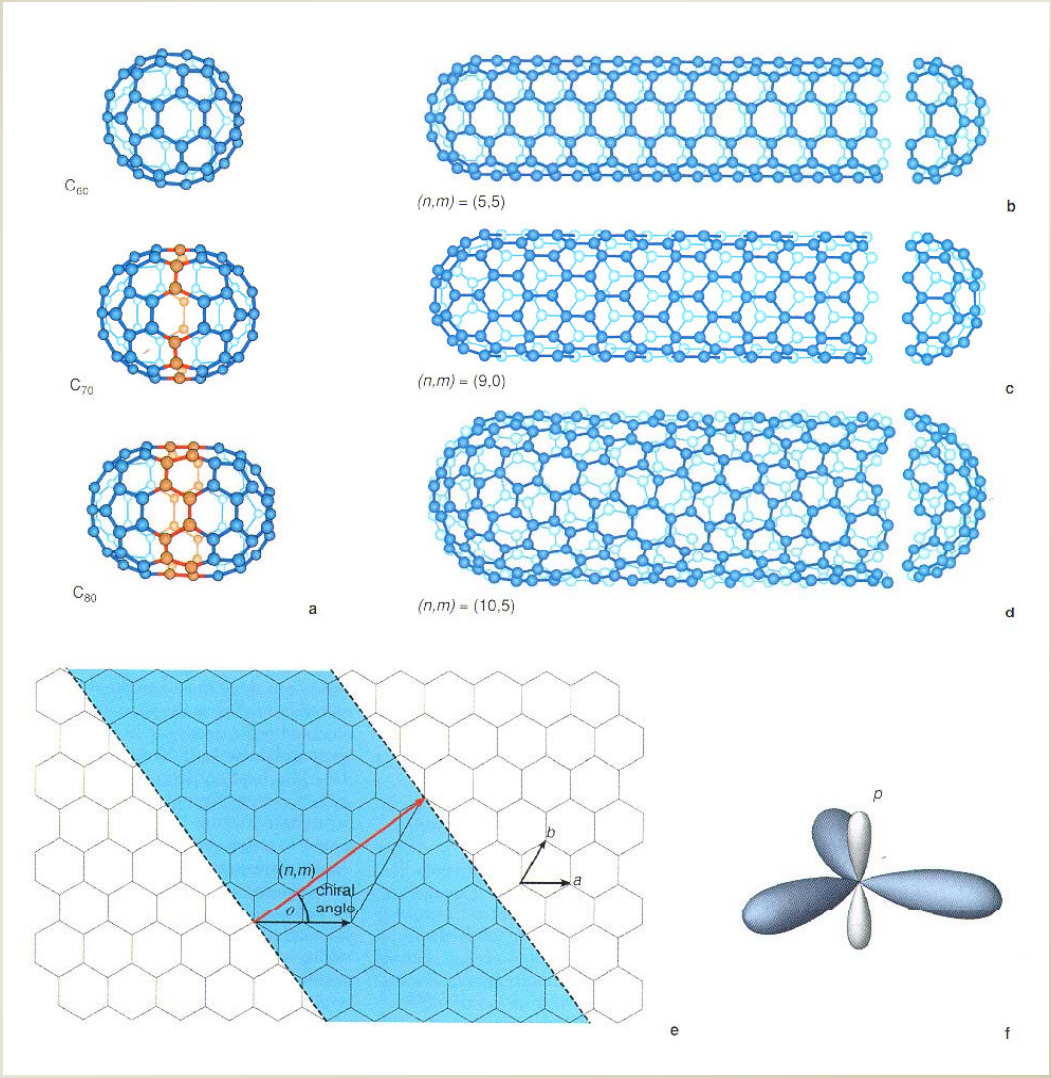
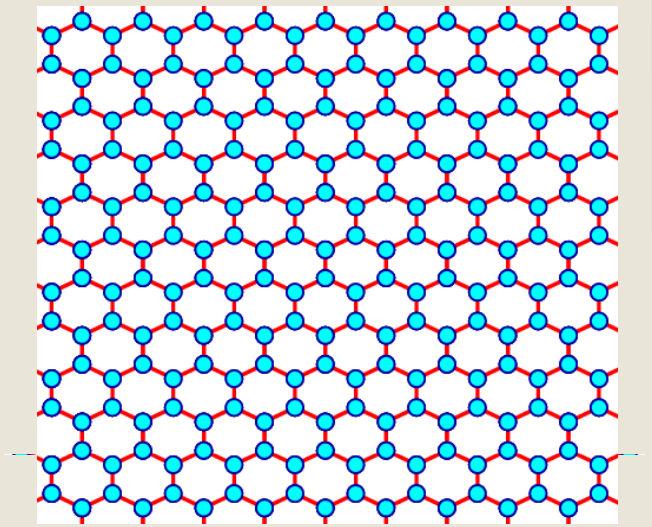
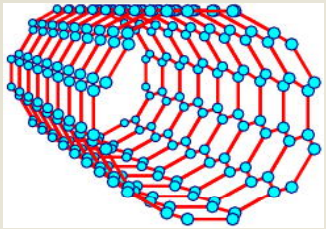
奈米碳管

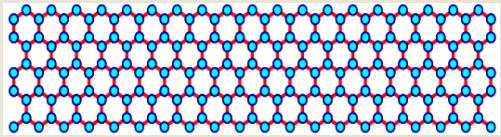


Graphene: Graphite sheet

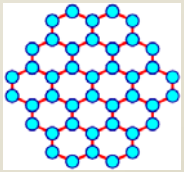




Nanotube

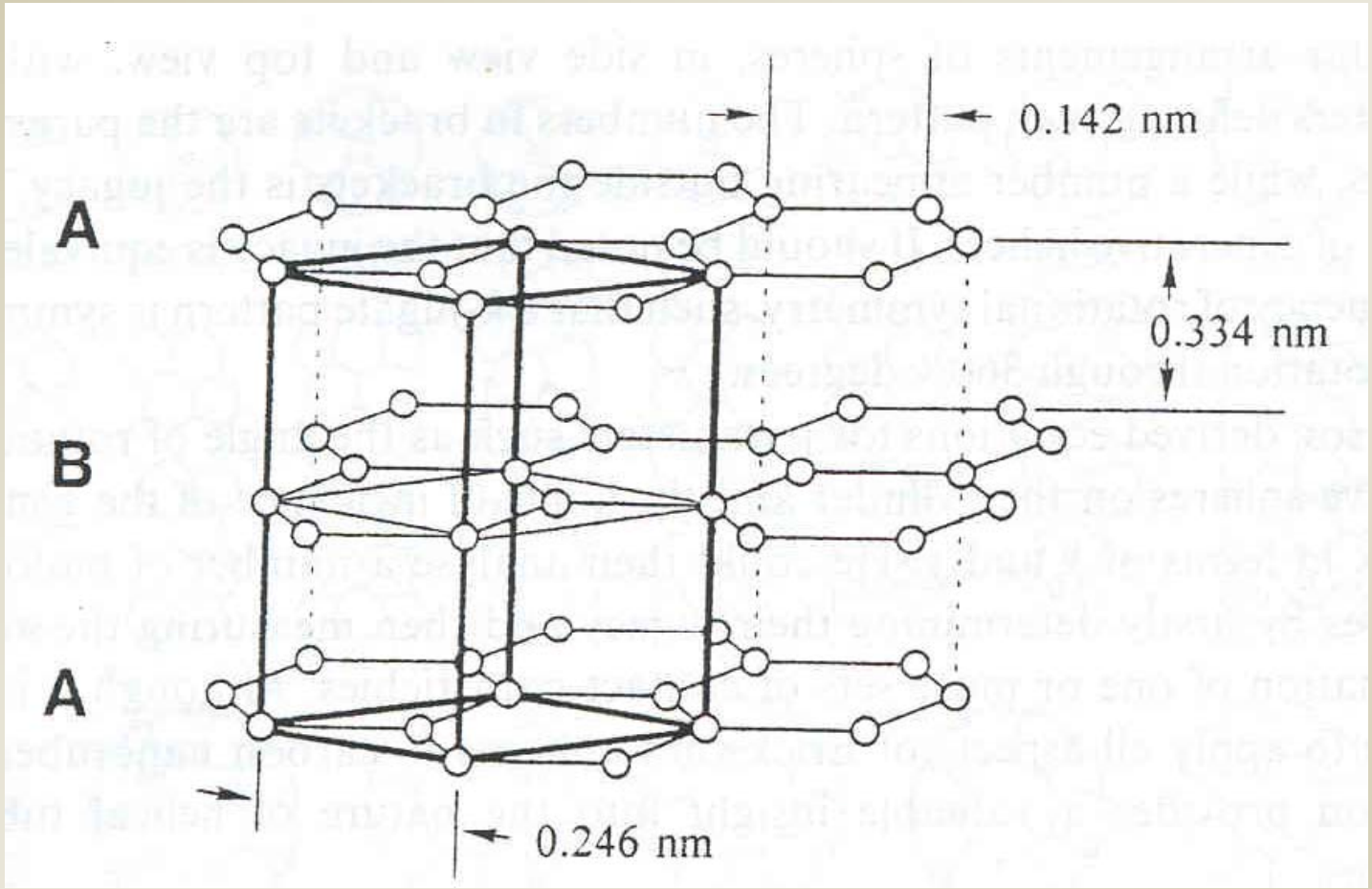


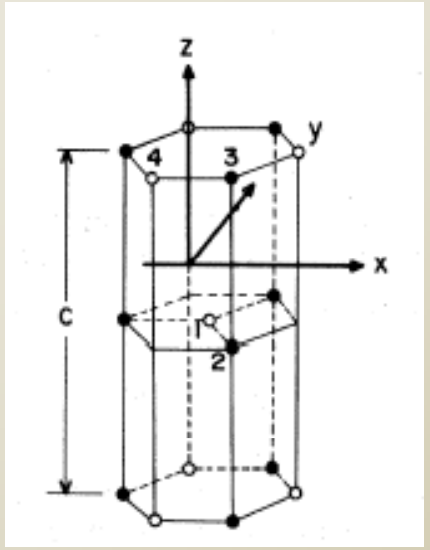
Nanoribbon



Nanoparticle

石墨的結構





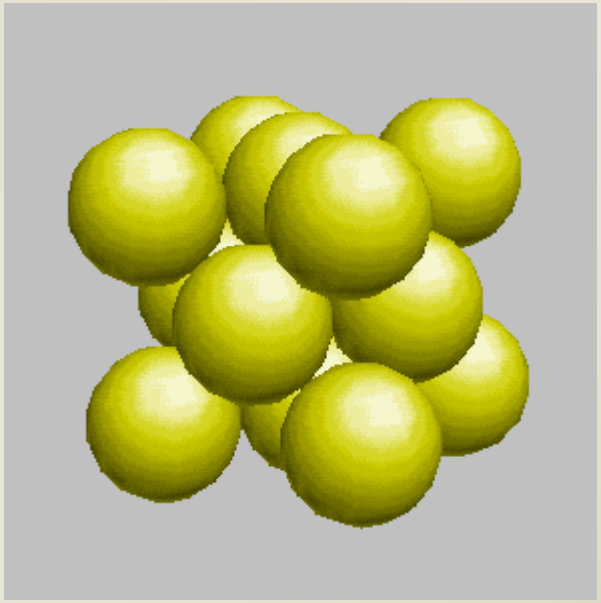
Unit cell

Crystal and Orientations of C_{60}

$T > 250^{\circ}C$

Free rotational motion

$\rightarrow$ isotropic



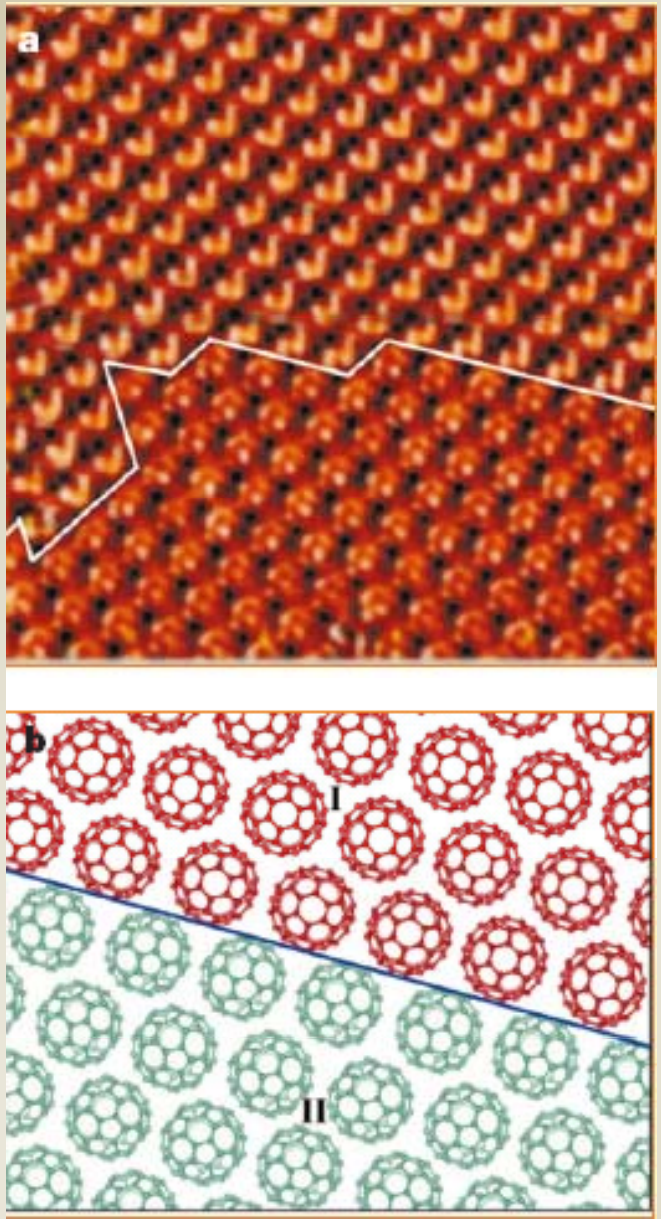
$T < 250^{\circ}C$ corner, 3 face atoms form

4 penetrating Simple Cubic lattices

with 4 different orientation of 3-fold axes along 4 <111>

(rotation about these axes smeared out 5-fold symmetry)

2D Crystal with 5-fold symmetric molecules



$100A \times 100A$

Orientation Sudden

Changed across domain

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