# Carbon Nanostructures

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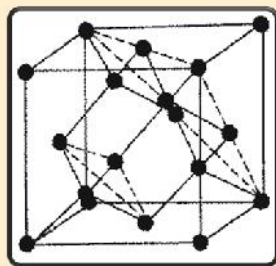*Maria Dimitropoulou (English Language and Literature Teacher)*
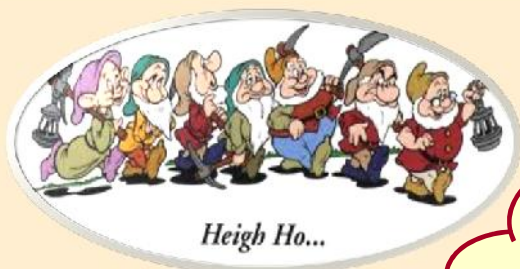
Nanotechnology is the study and appropriate manipulation of matter with the view to the design and production of material in a nanometer scale (1 nm = 10^{-9} m); that is, in a scale of one billion to one meter.

Heigh Ho...

ALLOTROPIC CARBON FORMS:
Graphite
Diamond
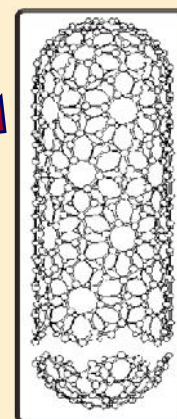Graphene
Fullerene
Nanotubes
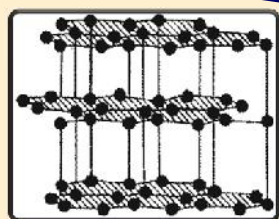
Graphite

Diamond

Graphene

Fullerene

Nanotube

The Nobel Prize in Physics for the year 2010 was awarded to the Dutch Physicist Andre Geim and his Russian-British colleague Konstantin Novoselov for the their innovative experiments on *graphene*, a two-dimensional material which consists of carbon atoms placed in a cell-resembling arrangement. The name of the material comes from graphite, one of the many existing forms of carbon in nature and the suffix -ene, used in 1962 by the German physicist Hanns-Peter Boehm, to describe one-molecule-thick carbon sheets. The importance of graphene is mostly related to its potential uses: its two-dimensional quality makes it particularly sensitive to electrical changes; thus it can be easily used as a sensor even for gas elements. In electronics, its properties render it suitable for the construction of semiconductors and integrated circuits. Moreover, it can be used in the construction of photovoltaic systems which would be affixed to our windows, without hindering visibility.

Fullerenes are carbon structures with a spherical shape which contain alternating single and double bonds. They were discovered in 1985 by Harold Kroto and Richard Smalley (Nobel Prize in Chemistry, 1996). Their surface consists of five-member and six-member rings of carbon. The most well-known fullerene is the one consisting of 60 carbon atoms. Other well-known fullerenes are the ones with 70, 76 and 84 carbon atoms.

Carbon nanotubes are graphite cylinders and were discovered in 1991 by Sumio Iijima. Nanotubes can be multiple-rolled with a central tube surrounded by one or more layers of graphite or single-rolled, where there is only one tube and no extra graphite layers.

Nanotube applications
- Transistors, replacement of solicium, diodes, nanocapacitors, quantum computers
- Flat organic screens
- Radar radiation diversion paint
- Signal amplification in mobile phones
- Replacement of optical fibers, electrical cables
- High sensitivity nanosensors
- Material strengthening: stronger alloys and polymers in vehicles (spaceships, airplanes, cars), in bulletproof items, tools etc.
- Cell storage of hyper condensed hydrogen
- Artificial muscles

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