Al-Mustaqbal University-College

Department of medical physics

The Second Stage

Third lecture

Types of Nano-materials

By:

Dr. Mohammed Hashim Abbas

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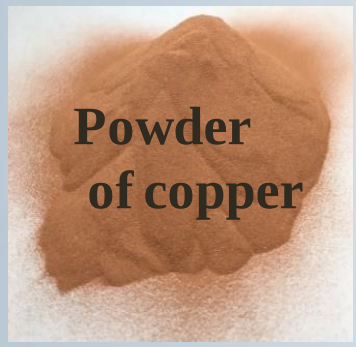
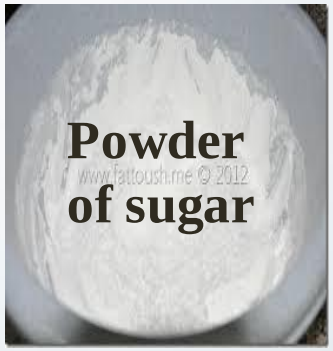
Types of Nano-materials (Nano-size)

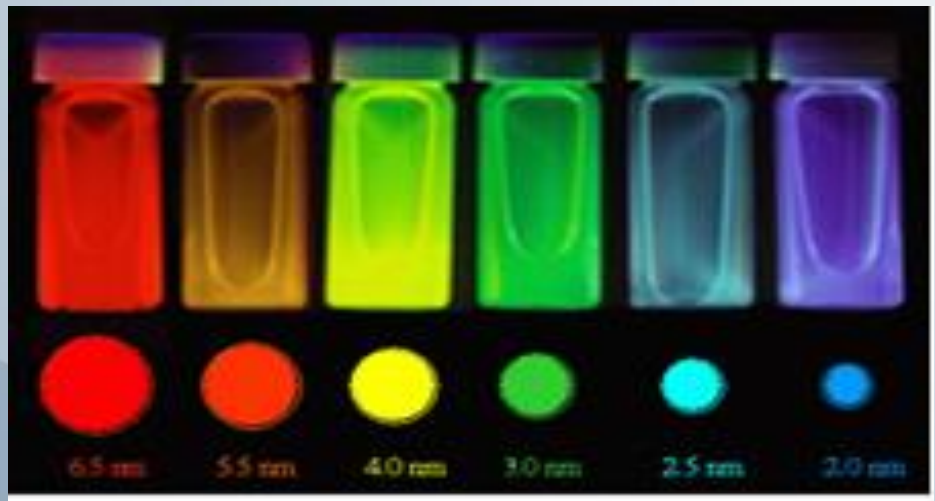
Nano-particles

A nanoparticle is a small particle that ranges between 1 to 100 nanometres in size. Most nanoparticles are made up of only a few hundred atoms.





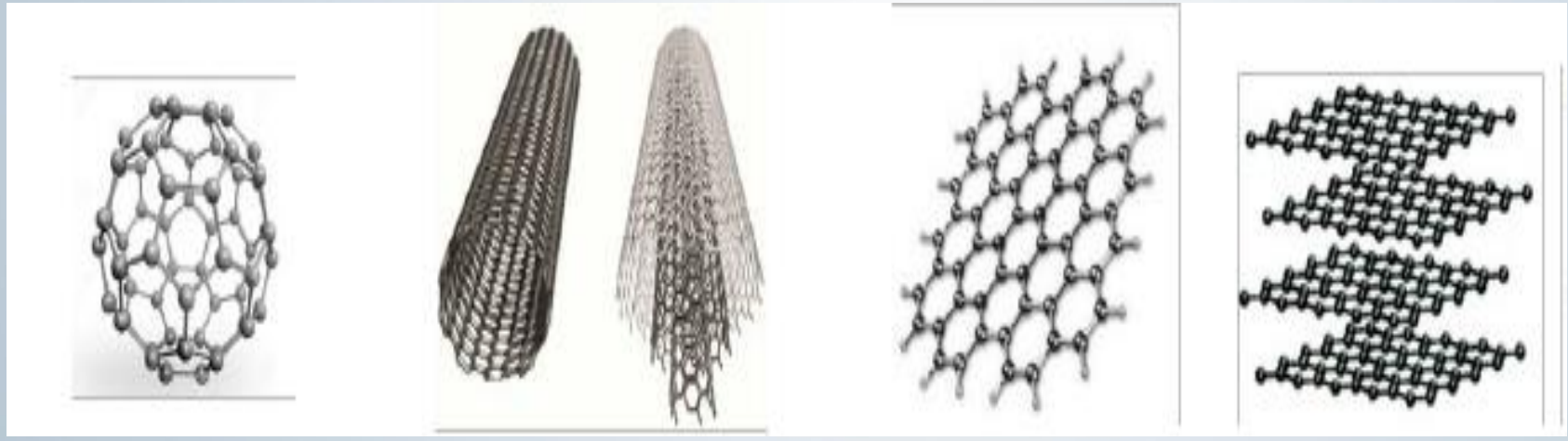
Powder

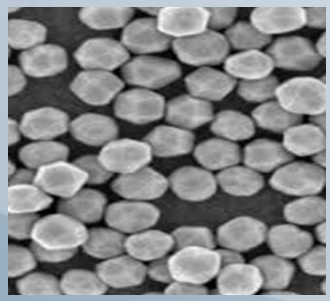


Liquid

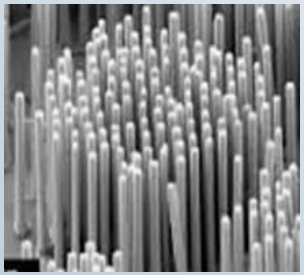
Nano-structures

A nanostructure is defined as any structure with one or more dimension, measuring in the nanometer scale range

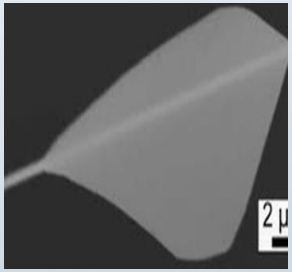




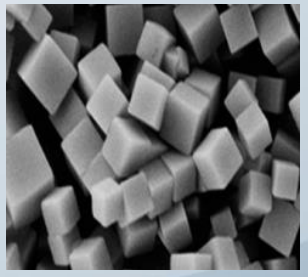
0D



1D



2D



3D

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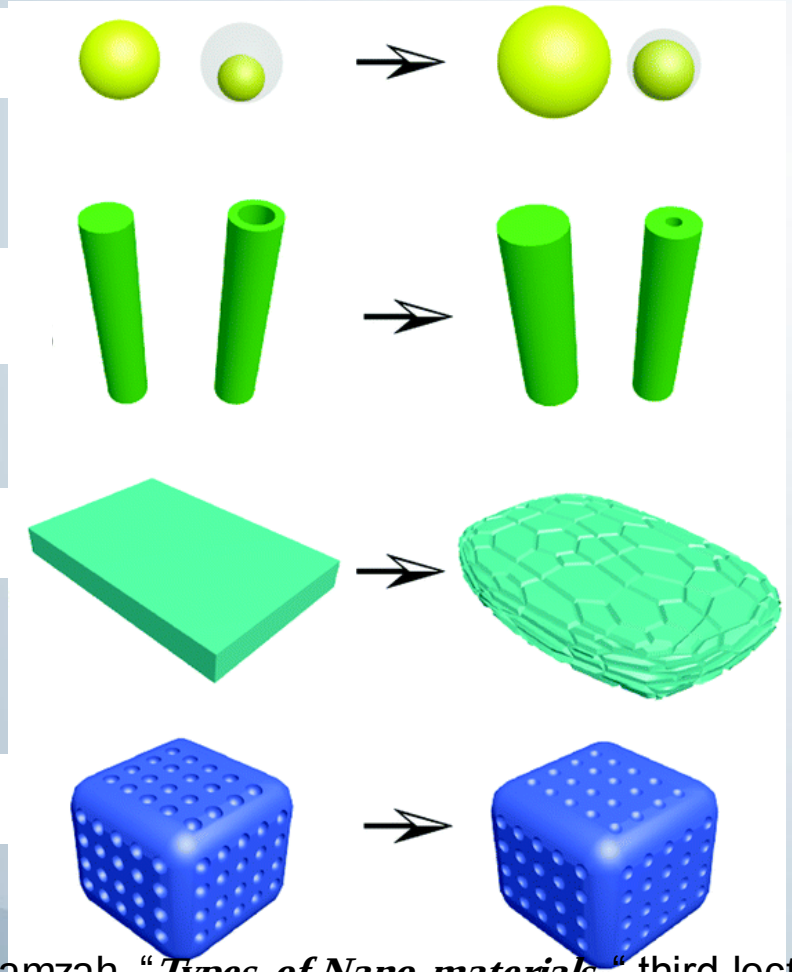
Types of nano-structures

The nano-structures could be classified depending on the dimension and shape into:



Quantum Dots

One Dimensional

Two Dimensional

Three Dimensional

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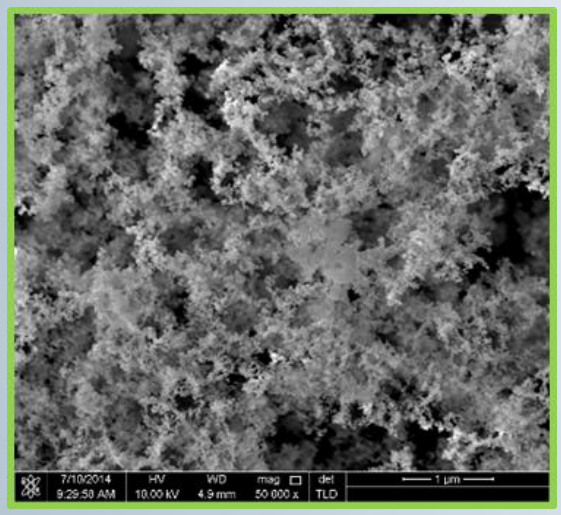
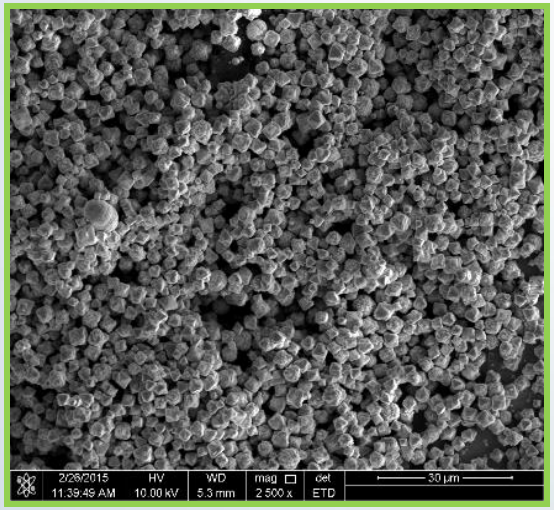
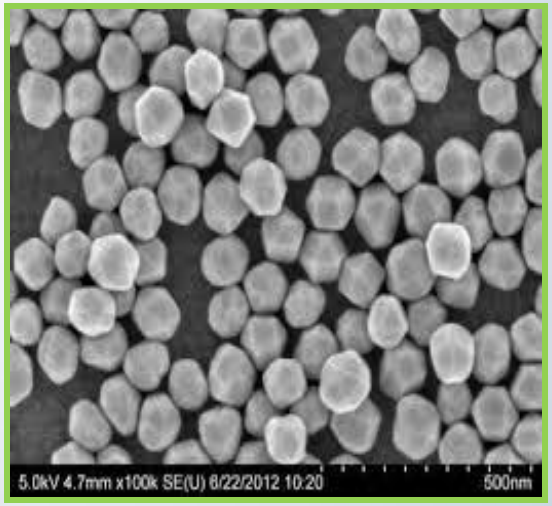
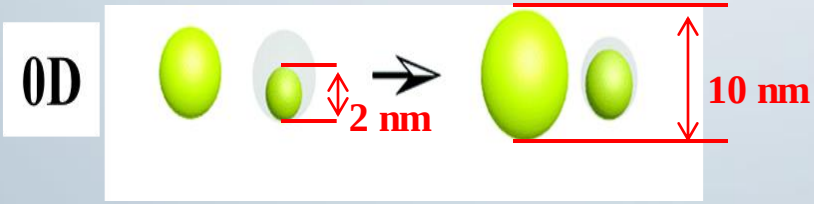
Quantum Dots (0D)

are tiny particles or nanocrystals with diameters in the range of 2-10 nanometers (10-50 atoms)









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properties of 0D nanostructures

1- 0D diameters can range from about 2-10 nm.

2- 0D represent the smallest type of nano-structures.

3- 0D represents the best in properties compared to other types.

4- 0D can be found as nano-balls shaped.

5- 0D can used for various applications

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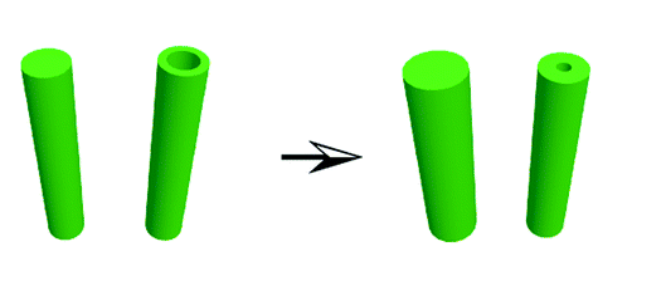
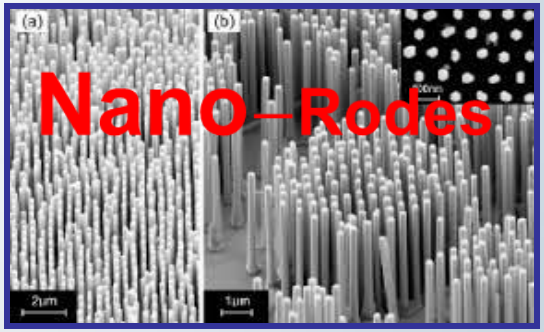
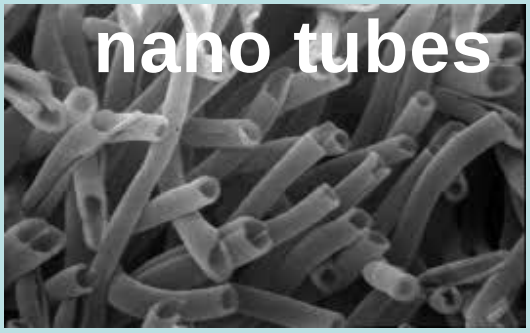
One Dimensional Nanostructures (1D)

are those with a dimension within the range between 1 and 100 nm.

1D







properties of 1D nanostructures

(a) 1D represent the highest surface-to-volume ratio

(b) Electron confinement properties

(c) Polar nature of the 1D nanostructure

(d) 1D have larger useful for electron transport

(e) 1D can be found as nano-rods, nano-needles, and nano-wires

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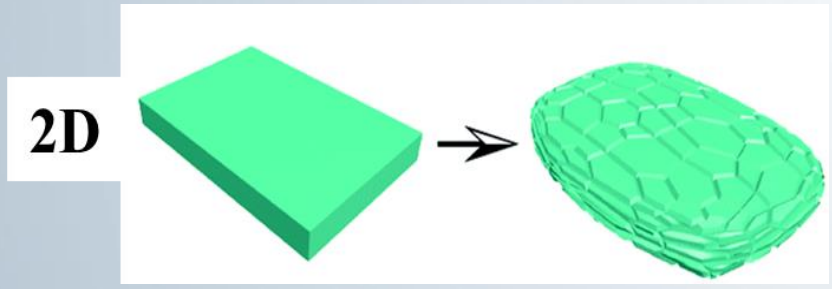
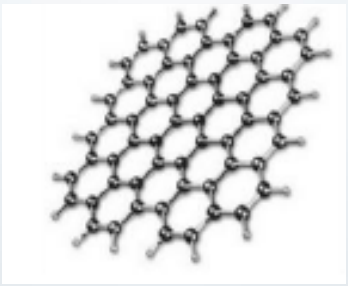
Two Dimensional Nanostructures (2D)

are composed of thin layers that may have a thickness of at least one atomic layer.





properties of 2D nanostructures

1- 2D represent single layer materials

2- 2D consisting of a single layer of atoms

3- 2D ease tuning of the molecular in the crystal.

4- Can be found as nano-leaves, nano-flags, and nano-sheet

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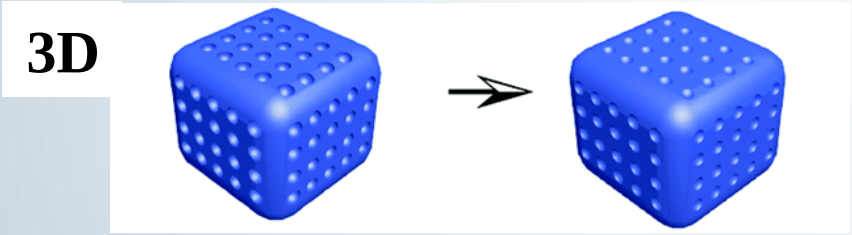
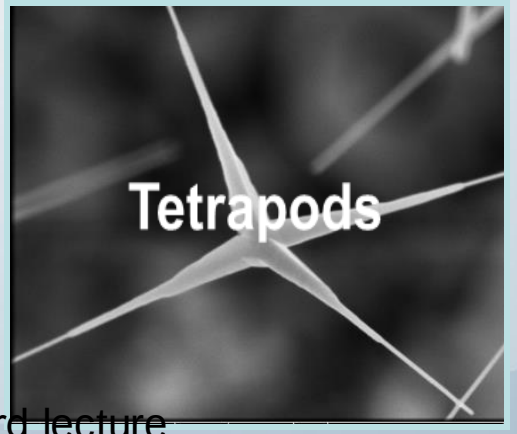
Three Dimensional Nanostructures (3D)

are materials that are not confined to the nanoscale in any dimension. This class can contain dispersions of nanoparticles, bundles of nanowires.



Such as; Nanocubes and Tetrapods



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properties of tetrapods structure

1- Tetrapods appear four arms at 109.5° angle with each other

2- The sensors based on tetrapods can give multiple responses to a single signal at the same time

3- The tetrapods could be designed as multiterminal sensors for enhancing response

4- The junctions in the arms of tetrapods play a critical role in the electrical properties

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