28-11-19 Thursday

4. ADVANCED CONCEPTS/TOPICS IN CHEMISTRY

Supramolecular chemistry: The chemistry concern in chemistry systems composed of a discrete no. of molecules in which the strength of the forces responsible for spacial organisation of system. These forces range from weak molecular forces, electrostatic charge, hydrogen bonding to strong covalent bonding provided the electronic coupling strength remains small relative to the energy parameters of the component is called supramolecular chemistry.

Supramolecular chemistry: weaker and reversible non-covalent interactions. hydrogen bonding, metal coordination, hydrophobic forces, vander waal forces, pi-pi interactions, electrostatic effects.

Traditional chemistry: Covalent - bond.

Concepts involved in supramolecular chemistry:

1) Molecular assembly.
2) Molecular folding.
3) Molecular recognition
4) Host - guest chemistry.
5) Mechanically interacted locked molecular architectures.
6) Dynamic covalent chemistry.

* Supramolecular chemistry roots is developed by Nobel Laurate Hermann Emid Fischer in 1894
* Host guest chemistry is developed by Donald J. Cram, Jean Marie Lehn and Charles J. Pederson nobel prize in 1987.
* Molecular machines and highly self assembly structures developed by James Fraser Stoddart in 1990.

*Miller developer sensors and methods of electronical and biological interfacing.

Self Assembly:

04-12-19 Wednesday

Orderly (or) disorder arrangement.

Inter-folding Intra-self assembly.

Applications:

1, Thin film self assembly mono layers (SAM) are inexpensive and widely used bidogy and electronics non-electromechanical house hold goods, studying membranes properties of cells.

2, For coating moulding tools for polymer replication, self assembly mono layers are used.

Characteristics of molecular motors:

Molecular motors are biologically molecular machanics that essentially agent of movement in living organis-ms.

A motor is a device that consumes energy in one form and converts into mechanical work.

Ex: Protein based molecular motors use of chemical free energy released by the hydrolysis of ATP to mechanical work.

Types of Motors:

1, cytoskeletal motors: myosins, kenesin, dyoein.

2, polymerisation motors: actin, microtubes, dynamin.

3, rotaty motors: F_0F_1 – ATP synthesis, ATP synthase.

4, nucleic acid motors: RNA polymerase, helicases.

5, enzymatic motors: catalase, urease, adolase, hexakinase etc

6, synthetic rotary molecular mass: chemically driven rotary molecular motors (repeated by kelly and co-workers in 1999).

- light driven rotary molecular motors (reported by Ben in 1999).

10-12-19 Tuesday

Molecular Machines; Nanites of Nanomachines:

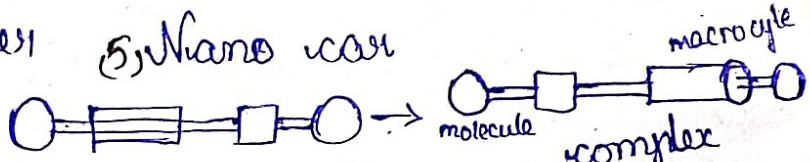
A molecular machine is a molecular compound that produces quasi mechanical movements, in response to specific stimulite.

Jean-Pierre Sauvage, Grace J. Fraser stoddart and Bernard L. Feringa → were awarded Nobel Prize in 2016 (synthetic molecular machines)

Synthetic molecular machines: (simple & small).

J.F. Stoddart

(1) Molecular motors
(2) Molecular propellers
(3) Molecular switch
(4) Molecular shuttle
(5) Nano car



Biological molecular machines: The most molecular machines are found with in cells, often in the form of multi protein complexes.

A rotaxane is a mechanically interlocked molecular architecture consisting of a dubble shaped molecule which is threaded through a macrocycle. Which is derived from Latin. Rota means wheel, axis means axle

1) capping (soft material)
2) clipping (half part)
3) slipping (direct) (bangle)

Applications:

1) Molecular machines.
2) Potencial use of protosides in molecular electronic switching elements and molecules shuttle.
3) Nano logic molecular
4) Altrastable
5) Nano recording.

Catenanes: It is a mechanically interlocked molecular architecture consisting of two or more interlocked macrocycles.

Synthesis: (i) Threading followed by clipping.

(ii) Double clipping

Properties:

(1) Many catenane is the ability of the ring to rotate with respect to one another.

(2) Catanane change the colour by changing the recognisation sides

Applications:

(1) Used in molecular switches structures, motors, fabrication of molecules, molecular electronic devices, molecular sensors and chemical sensors.

Prototype (materialisation): Prototype derived from greek meaning "first impression"

A prototype is an early sample or model of release built of a product to test it concept or process or to act as a thing to be replicated or learned from. It is a term used in a variety of contexts including design, electronic or software programming.

Types of prototypes:

(1) Proof-of-principle prototype.
(2) A working prototypes.
(3) A visual prototype
(4) A user experience prototypes.
(5) Functional prototypes
(6) A paper prototypes.

Applications:

(1) Technology demonstrators in mechanical and electrical engineering.

(2) Electronic prototypes.

(3) Computer programming (JAVA string prototype).

(4) Data prototyping

(5) Scale modelling (military)

(6) Metrology

(7) Natural sciences

11-12-19 Tuesday

Linear motion in Rotorcare:

Linear motion are also called rectilinear motion, which is one dimensional motion along a straight line describe mathematically using 1-1 partial dimension

* Uniform linear motion with constant velocity (or) Zero acceleration.

* Non-uniform linear motion with variable velocity (or) non-Zero acceleration.

Mathematical relation b/w position 'x' and time 't'.

The motion in which all the particles of the body move through the same distance in the same time is called

(1) Rectilinear motion.

(2) Curvilinear motion.

Displacement: $\Delta x = x_2 - x_1$, Time: $\Delta t = t_2 - t_1$.

Velocity: $v_{avg} = \frac{\Delta x}{\Delta t} = \frac{x_2 - x_1}{t_2 - t_1}$

Instaneous velocity: $v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$

Acceleration: $a_{avg} = \frac{\Delta v}{\Delta t} = \frac{v_2 - v_1}{t_2 - t_1}$

Jerk: $d = \frac{1}{2}(v_f + v_i)t$

Acid - Base Controlled molecular shuttle:

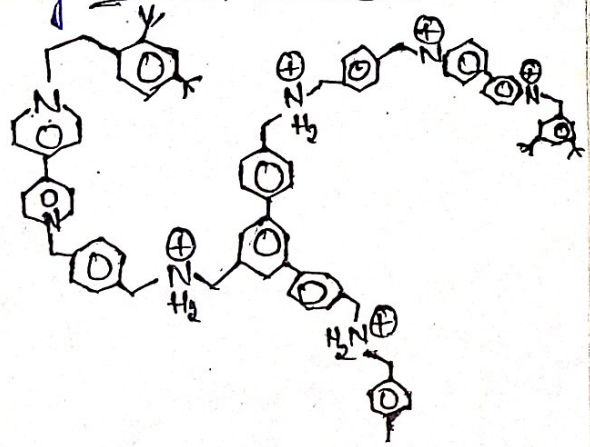
The deprotation of rotaxane moves the macrocycle away from this side to the other and reprotonation moves back the macrocycle back. Such molecular shuttles are called acid-base controlled molecules shuttle.

Molecular Elivator: It is a molecular machines that behaves like a nano scale elivator which is made up of a platform like component interlocked with a trifurcatie rig like components which is moulding 3.5 nanometers in size.

Super bundle
+3,5-di-tet-butyl benzyl
+NH_4PF_6

$\xrightarrow{H_2O}$

ammonium phosphorus hexa fluoride



Molecular Switches:

A molecular switch is a molecule that can be reversible shifted b/w 2 or more stable states in response to environmental stimuli, changed as pH, light, temp, ion micro environment in the presence of

1) Acetachromic molecular switches (pH)
2) Photochromic "
3) Coordination switching
4) Displacement "
5) On and off "
6) Rearrangement switching