THC TRIBUNE VOL : 3

ALL AROUND THE WORLD

'Weighing' atoms with electrons

The chemical properties of atoms depend on the number of protons in their nuclei, placing them into the periodic table. However, even chemically identical atoms can have different masses – these variants are called isotopes. Although techniques to measure such mass differences exist, these have either not revealed where they are in a sample, or have required dedicated instrumentation and laborious sample preparation. Researchers now report a new way for "weighing" atoms by atomic-resolution imaging of graphene, the one-atom-thick sheet of carbon.

Link: https://www.sciencedaily.com/releases/2016/10/161011131739.htm

New boost for quantum computing

A new technique has been created for creating NV-doped single-crystal nanodiamonds, only four to eight nanometers wide, which could serve as components in room-temperature quantum computing technologies. These doped nanodiamonds also hold promise for use in single-photon sensors and nontoxic, fluorescent biomarkers.

Link: https://www.sciencedaily.com/releases/2016/11/161102131409.htm

Nanoscale factories built to order

Performing chemical reactions inside tiny droplets can help manufacturers develop greener processes for coating drugs.
A discovery led by Singapore's Agency for Science, Technology and Research (A*STAR) could lead to improvements in the way drugs are delivered to the right parts of the body by uncovering the mechanisms that help oil, water, and free radicals mix in tiny droplets.

Link: https://www.sciencedaily.com/releases/2016/11/161103093124.htm

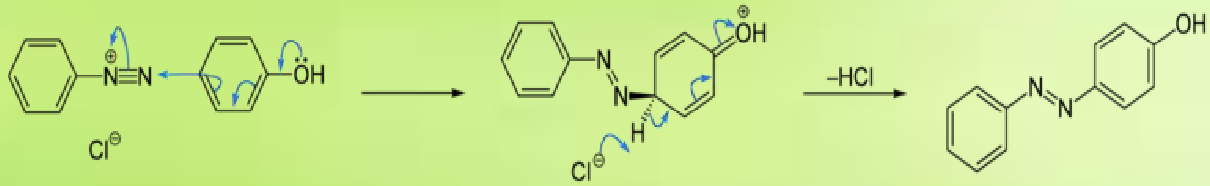
LEARNING ZONE

REACTION YOU MUST KNOW

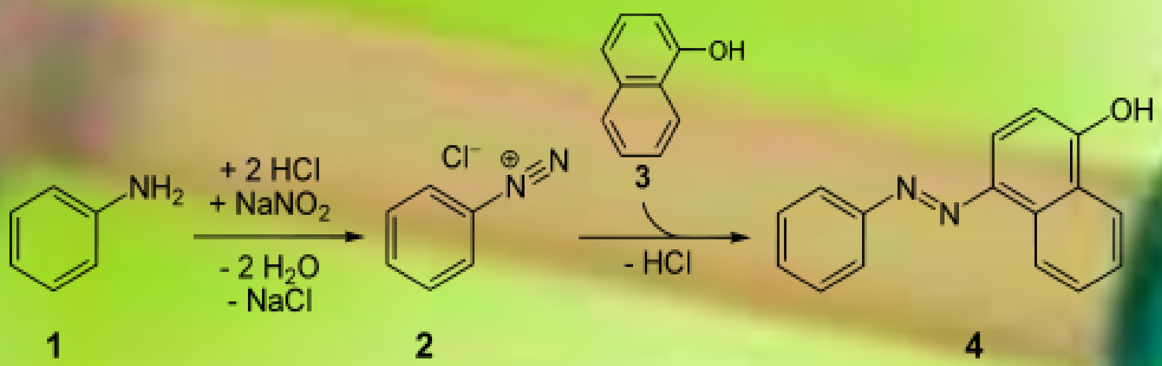
AZO COUPLING

An azo coupling is an organic reaction between a diazonium compound and another aromatic compound that produces an azo compound. In this electrophilic aromatic substitution reaction, the aryldiazonium cation is the electrophile and the activated arene is a nucleophile. In most cases, the diazonium compound is also aromatic.

The treatment of aniline with nitrous acid, produces a diazonium salt, in a reaction called diazotization. Diazonium salts are important synthetic intermediates that can undergo coupling reactions to form azo dyes and substitution reaction to effect the functional group present on aromatic rings.



Naphthols are popular acceptors. One example is the synthesis of the dye "organol brown" from aniline and 1-naphthol:



INFORMATION ZONE

HINDUSTAN PETROLEUM CORPORATION LIMITED (HPCL)

Hindustan Petroleum Corporation Limited (HPCL) (BSE: 500104, NSE: HINDPETRO) is an Indian state-owned oil and natural gas company with its headquarters at Mumbai, Maharashtra. It has about 25% marketing share in India among PSUs and a strong marketing infrastructure.

The Government of India owns 51.11% shares in HPCL and others are distributed amongst financial institutes, public and other investors. The company is ranked 367th on the Fortune Global 500 list of the world's biggest corporations as of 2016.

Selection Process: Gate 2017 Score and GD / Interview

Candidates appearing in different GATE paper other than that of their Qualifying Engineering discipline will not be considered for further selection procedure. i.e. If a candidate with Engineering in Mechanical, appears for CIVIL paper in GATE 2017, his /her candidature will not be considered for further short listing

On the basis of valid GATE 2017 marks, qualified candidates will be called for further selection process in a predetermined ratio in order of the category-wise discipline wise merit list.

Application Fees: Rs.265/- (Non -refundable) Application Fees for General & OBC-NC Category candidates and No fees for SC/ST/PwD candidates.

Payment Mode: Online (Net banking/ Debit card) and Offline (Bank Challan).

Age Limit

Maximum 25 years as on 30th June 2017 for the general category candidates i.e. candidates born on or after 30th June 1992; age relaxation for OBC (Non Creamy Layer)/SC/ST/PWD candidates will be applicable as per the Presidential Directives.

Educational Qualification

Candidates should have passed qualifying degree examinations and awarded bachelor's degree in engineering/technology in the above mentioned disciplines.

Applicant must possess 4 years full Graduate Engineering Degree with 60% Marks and 50% Marks for SC/ST/PWD Category in Mechanical, Civil, Electrical, Electronics &Telecommunication, Instrumentation and Chemical.
All the qualifications should be 4 years full time regular course/s from AICTE approved/UGC recognized University/Deemed University. The courses offered by Autonomous Institutions should be equivalent to the relevant courses approved/recognized by Association of Indian Universities (AIU)/UGC/AICTE Candidates (belonging to General and OBC-NC category) should have secured minimum 60% marks (aggregate marks of all semesters) in qualifying degree examinations, relaxed to 50% (aggregate marks of all semesters) for SC/ST/PWD candidates.

Candidates currently in final year of their engineering studies may also apply. However, if selected, they must be in a position to submit their final mark sheet by 31st August 2017.

How to Apply for HPCL Officers Recruitment 2017

Candidates are requested to read the complete instructions here under before proceeding to the application form.

i. Register for GATE 2017.

ii. Apply on HPCL website after obtaining GATE registration number from 10th Jan 2017 to 10th Feb 2017.

iii. Upon submission of application (in all respects), 12 digit Application number will be generated.

iv. Application fees of Rs.265/- to be paid (SC/ST/PWD candidates exempted) . Choose Payment option.

1. Through Challan at SBI.
2. Online payment through Credit/Debit Card.

The relevant link will be made available from 10th Jan 2017 under 'Careers

Opportunities' section

on **www.hpclcareers.com** or **www.hindustanpetroleum.com**. Online submission of the application will be allowed on the website up to 10th Feb 2017.

No other mean/mode of the application shall be accepted.

Important Dates

Commencement of online application by candidates for HPCL: 10th January 2017.

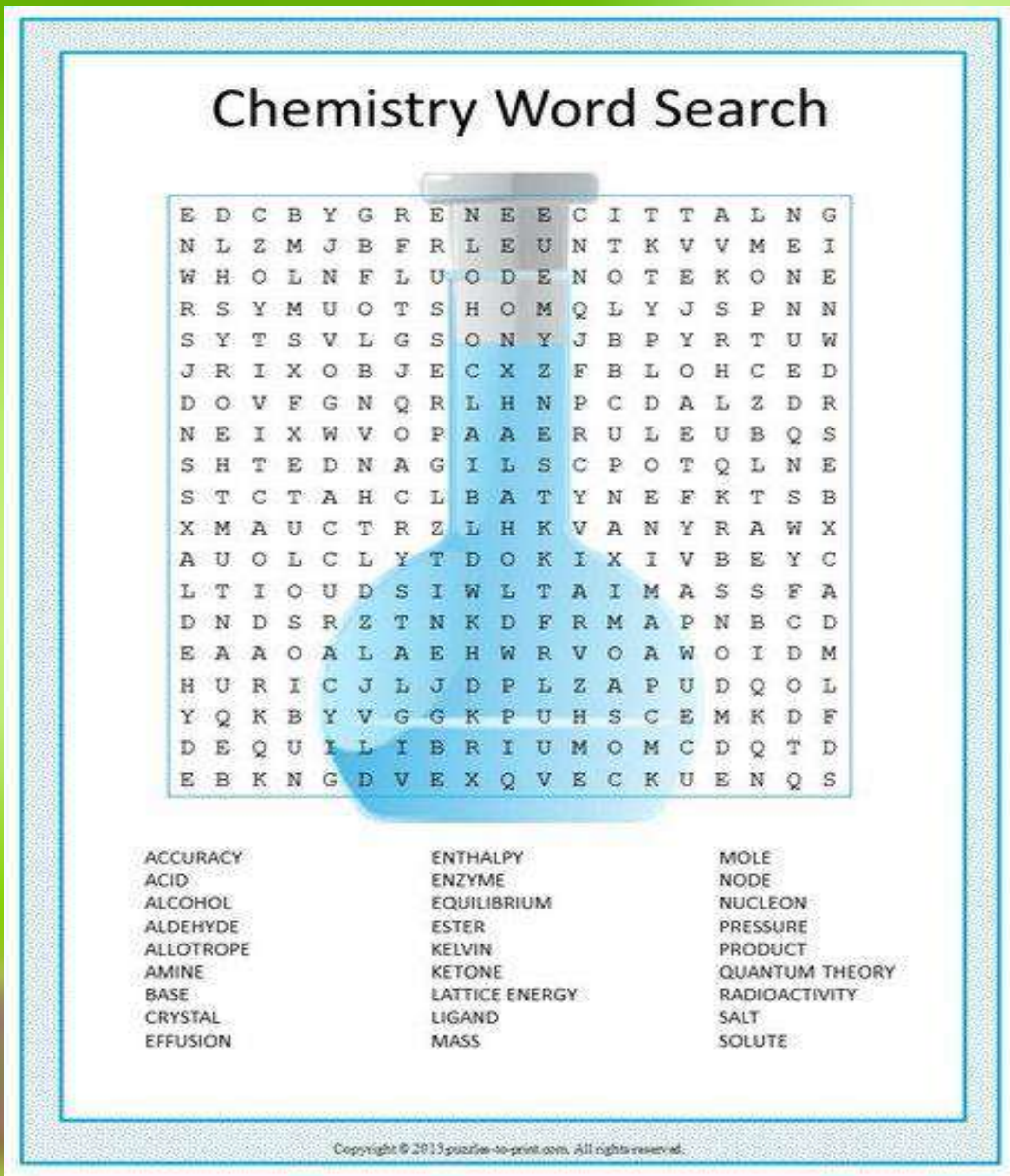
Last Date for Online Application by candidates for HPCL: 10th February 2017

Announcement of GATE-2017 Online Examination: 27th March 2017.

NOTE : The above information is based on 2017 selection process only.

FUN ZONE

CHEMISTRY WORDSEARCH



Chemistry Word Search

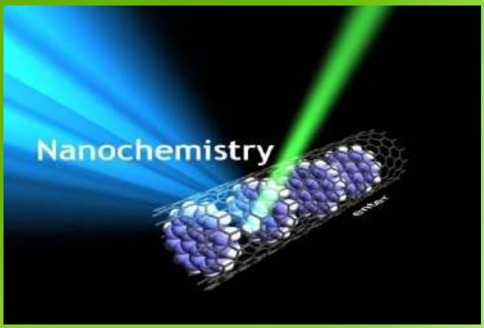
E	D	C	B	Y	G	R	E	N	E	E	C	I	T	T	A	L	N	G
N	L	Z	M	J	B	F	R	L	E	U	N	T	K	V	V	M	E	I
W	H	O	L	N	F	L	U	O	D	E	N	O	T	E	K	O	N	E
R	S	Y	M	U	O	T	S	H	O	M	Q	L	Y	J	S	P	N	N
S	Y	T	S	V	L	G	S	O	N	Y	J	B	P	Y	R	T	U	W
J	R	I	X	O	B	J	E	C	X	Z	F	B	L	O	H	C	E	D
D	O	V	F	G	N	Q	R	L	H	N	P	C	D	A	L	Z	D	R
N	E	I	X	W	V	O	P	A	A	E	R	U	L	E	U	B	Q	S
S	H	T	E	D	N	A	G	I	L	S	C	P	O	T	Q	L	N	E
S	T	C	T	A	H	C	L	B	A	T	Y	N	E	F	K	T	S	B
X	M	A	U	C	T	R	Z	L	H	K	V	A	N	Y	R	A	W	X
A	U	O	L	C	L	Y	T	D	O	K	I	X	I	V	B	E	Y	C
L	T	I	O	U	D	S	I	W	L	T	A	I	M	A	S	S	F	A
D	N	D	S	R	Z	T	N	K	D	F	R	M	A	P	N	B	C	D
E	A	A	O	A	L	A	E	H	W	R	V	O	A	W	O	I	D	M
H	U	R	I	C	J	L	J	D	P	L	Z	A	P	U	D	Q	O	L
Y	Q	K	B	Y	V	G	G	K	P	U	H	S	C	E	M	K	D	F
D	E	Q	U	I	L	I	B	R	I	U	M	O	M	C	D	Q	T	D
E	B	K	N	G	D	V	E	X	Q	V	E	C	K	U	E	N	Q	S

ACCURACY
ACID
ALCOHOL
ALDEHYDE
ALLOTROPE
AMINE
BASE
CRYSTAL
EFFUSION
ENTHALPY
ENZYME
EQUILIBRIUM
ESTER
KELVIN
KETONE
LATTICE ENERGY
LIGAND
MASS
MOLE
NODE
NUCLEON
PRESSURE
PRODUCT
QUANTUM THEORY
RADIOACTIVITY
SALT
SOLUTE

NOTE: Words can be from upward to downward(vice-versa), left to right(vice-versa) and diagonally.

EXPLORE ZONE

NANOCHEMISTRY



Nanochemistry or Nanotechnology are related with the production and the reactions of nanoparticles, nanostructures and their compounds. It is concerned with the unique properties associated with assemblies of atoms or molecules on a scale between that of the individual building blocks and the bulk material (from 1 to 1000 nm). At this level, quantum effects can be significant, and also new ways of carrying out chemical reactions become possible. This science use methodologies from the synthetic chemistry and the materials chemistry to obtain nanomaterials with specific sizes, shapes, surface properties, defects, self-assembly properties, designed to accomplish specific functions and uses. Nanomaterials can be created from virtually any material, such as metals, semiconductors and polymers, both in their amorphous and crystalline forms.

Nanochemical methods can be used to create carbon nanomaterials such as carbon nanotubes (CNT), graphene and fullerenes which have gained attention in recent years due to their remarkable mechanical and electrical properties.

There are a wide range applications of nanochemistry fabrication, such as semi-conductors electronics, advanced composite materials (e.g. carbon nanotube polymers), colloidal particles (e.g. in paint products), medicine etc. Nanochemistry uses semi-conductors that only conduct electricity in specific conditions.

There is evidence certain nanoparticles of silver are useful to inhibit some viruses and bacteria.

LET'S TALK CHEMISTRY

CHEMISTRY IN EVERYDAY LIFE

Why ice cubes are cloudy on the inside?

Have you even tried to see through an ice cube? It's always a little hazy. Isn't it strange that transparent water when frozen becomes cloudy ice? And did you know chemistry is at play even here?

What's in water?

Water consists of several gases and minerals like calcium and magnesium salts that are naturally dissolved in it. You cannot see them, but they are there.

These impurities in water reduce the temperature at which water freezes. Pure water will freeze at 0C, while water that has impurities in it will freeze at a temperature that is lower than this. In fact, the more the dissolved gas and minerals there is in water, the lower its freezing point will be.

When water freezes�

When water begins to freeze, a thin layer of ice starts to form on top. This is made from pure water as pure water freezes quicker than impure water.

The pure water becomes solid while the minerals and gases are still in a solution state. The rest of the liquid freezes slowly from the outside to inside. The centre of an ice cube is what freezes last.

There are layers of increasing concentration of impurities towards its centre. This concentration of gases results in light being refracted through the piece of ice causing it to look cloudy. Sometimes, the gases dissolved in the solution release in the form of microscopic bubbles which freeze as the ice freezes. You can also see these frozen bubbles if they are formed, inside the ice cubes.

NOBEL LAURATES IN CHEMISTRY

ERIC BETZIG, STEFAN W. HELL AND WILLIAM E. MOERNER (2014)



Eric Betzig | Stefan W. Hell | William E. Moerner

The Royal Swedish Academy of Sciences has awarded the 2014 Nobel Prize in Chemistry to Eric Betzig of Janelia Research Campus, Howard Hughes Medical Institute, Stefan W. Hell of the Max Planck Institute for Biophysical Chemistry and William E. Moerner of Stanford University "for the development of super-resolved fluorescence microscopy".

Optical microscopy was once held back by a limitation: that it could never obtain a better resolution than half the wavelength of light. Helped by fluorescent molecules the Nobel Laureates in Chemistry 2014 ingeniously circumvented this limitation and brought optical microscopy into the nanodimension.

In what has become known as nanoscopy, scientists visualize the pathways of individual molecules inside living cells. They can see how molecules create synapses between nerve cells in the brain; they can track proteins involved in Parkinson's, Alzheimer's and Huntington's diseases as they aggregate; they follow individual proteins in fertilized eggs as these divide into embryos.

In 1873, the microscopist Ernst Abbe stipulated a physical limit for the maximum resolution of traditional optical microscopy: it could never become better than 0.2 micrometers. Eric Betzig, Stefan W. Hell and William E. Moerner are awarded the Nobel Prize in Chemistry 2014 for having bypassed this limit. Due to their achievements the optical microscope can now peer into the nanoworld.

Two separate principles are rewarded. One enables the method stimulated emission depletion (STED) microscopy, developed by Stefan Hell in 2000. Two laser beams are utilized; one stimulates fluorescent molecules to glow, another cancels out all fluorescence except for that in a nanometre-sized volume. Scanning over the sample, nanometre for nanometre, yields an image with a resolution better than Abbe's stipulated limit.

Eric Betzig and William Moerner, working separately, laid the foundation for the second method, single-molecule microscopy. The method relies upon the possibility to turn the fluorescence of individual molecules on and off. Scientists image the same area multiple times, letting just a few interspersed molecules glow each time. Superimposing these images yields a dense super-image resolved at the nanolevel. In 2006 Eric Betzig utilized this method for the first time.

Today, nanoscopy is used world-wide and new knowledge of greatest benefit to mankind is produced on a daily basis.

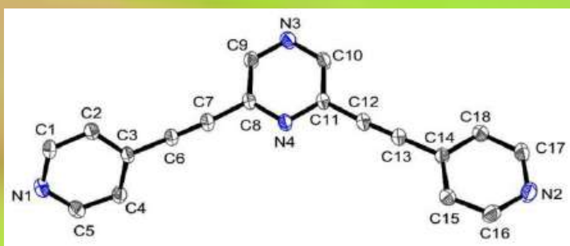
RESEARCH BY PROFESSORS

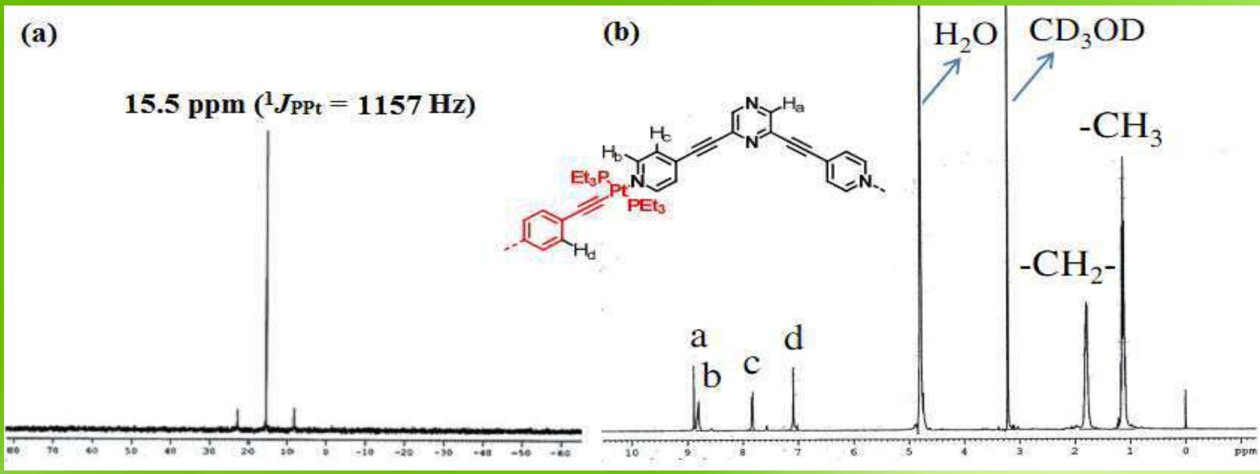
Pyrazine-Based Donor Tectons: Synthesis, Self-Assembly and Characterization

This is one of the research work of Mr. Neeladri Das (Assistant Professor) along with research scholars Sourav Bhowmick, Sourav Chakraborty, Subba reddy, Jogendra Behera.

Abstract

Two new supramolecular building blocks derived from pyrazine are introduced. These molecules, having pendant pyridine units covalently linked to central pyrazine ring, arestructurally rigid with pre'defined bite angles. Therefore they can act as donor tectons in design of supramolecular hexagons using coordination driven self'assembly protocol. Multinuclear NMR (including 1H DOSY) and mass spectrometry have been utilized toconfirm the purity and stoichiometry of these self assembled hexagonal ensembles. PM6 molecular modeling studies corroborate their hexagonal shape and nanoscalar dimensions.





Introduction

Supramolecular chemistry utilizes non'covalent interactions for design of complex architectures. These complex frameworks often utilize several multidentate ligands of two or more types as that bind with each other using non'covalent interactions. Coordination driven self assembly of finite supramolecular architectures has emerged as a popular field of research in modern supramolecular chemistry.Among others, one important feature of this synthetic protocol is the yield of finite two and three dimensional frameworks in a single step reaction.This methodology however necessitates design of new building blocks (tectons) for construction of supramolecular architectures.In this context, two types of supramolecular building blocks are utilized, namely donor and acceptor ligands.While Pd(II) and Pt(II) based inorganic or organometallic complexes are most popular acceptor tectons, donor tectons are predominantly organic molecules that contain two or more pyridineunits as pendant functional groups.In the context of two dimensional metallamacrocycles, polygonal frameworks of various shapes and sizes have been designed over the past two decades.Interestingly, there are less literature reports of higher polygons (pentagons, hexagons, etc.) than smaller ones (such as molecular rhomboids, triangles, rectangles and squares).This is because, design of higher polygons generally requires self'assembly of a relatively larger number of donor and acceptor building blocks in comparison to the self'assembly event of smaller polygonal macrocycles. Therefore synthesis of higher polygons (pentagons, hexagons, etc.) is more complex and challenging than relatively smaller polygons such as square, rhomboid or triangles. More recently, we have reported in literature a newacceptor tecton derived from pyrazine.This pyrazine based ditopic organometallic complex contains platinum ethynyl motifs. Continuing our research interest to enrich the existing literature with new tectons and their application in self assembly of supramolecular frameworks, herein we describe synthesis and characterization of two new ditopic pyrazine based donor tectons that contain two pyridyl rings covalently connected to a central pyrazine ring. These donor tectons are interesting because they contain several N centers (in pyridine or pyrazine rings) that can potentially coordinate with metal centers. Therefore, these ligands qualify to act asdonor building blocks in the self assembly of finitemetallamacrocycles. To illustrate this point, synthesis and self assembly of two new platinum(II)'based molecular polygons is reported herein. These metallamacrocycles were characterized by multinuclear NMR spectroscopy including H DOSY, ESI'TOF mass spectrometry and elemental analyses techniques. Further insight into the shape and size of these hexagonal macrocycles was obtained by employing molecular simulation using PM6 semiempirical molecular orbital method. Our studies suggest that the resulting metallamacrocycles are in nanoscalar dimensions.

For full text : https://www.researchgate.net/publication/290474059_Pyrazine-Based_Donor_Tectons_Synthesis_Self-Assembly_and_Characterization

Q & A ZONE

Are you planning to go abroad for internship? Do you find it to be an uphill task? Most of us dream of foreign internship but only few among us turn it in reality. Well today we have with us one among those few Ms. Ravneet Kaur(CST FINAL YEAR STUDENT). She did her internship project from University of Tokyo (JAPAN) and shared her memorable experience with us.

ThC : Please tell us a little about your project work.

Ravneet: My summer internship project was about the development of novel metal nanoclusters for the selective oxidation of alcohols to aldehydes. This work was done with the help of Pt:PVP nanoclusters. Another part of my project was to study size dependence of these nanoclusters on alcohol oxidation.

ThC : What it takes to get an internship/project abroad?

Ravneet: For getting an internship abroad, one should have a good project in one's CV. IITians are known for their technical ingenuity all over the world! But apart from that if one has done a good project beforehand, it sure helps in getting a project on a similar topic abroad.

ThC : How is it like to work with a completely new set of people at place most of us can only dream about?

Ravneet: The experience is completely enthralling! It takes some time to adjust to not only the new set of people, but also their work culture and environment. But once you're comfortable you start enjoying the new things coming up your way. In all, I found the experience challenging but I gained many things from this as well.

ThC : How the project work helped you in learning? Are you doing anything related to it at present?

Ravneet: I did my previous internship in development of novel metal nanoclusters as well. I can say that I have gained a lot of knowledge about nanocluster chemistry from my two internships combined. This experience has helped me visualize science a lot better. The way of working in the lab was also a learning experience.

ThC: Is working abroad a completely different experience to that in India?

Ravneet: Yes, I do believe so. I have been fortunate enough to work in one of the greatest labs in India as well as abroad. Working abroad was different because of different work ethics, different language and different environment. You have to observe certain things and adapt to them. But yes, one thing that is common is the passion for science and innovation.

ThC: What are your future plans about your career?

Ravneet: All I know of now is that I would like to work in a research based field. It thrills me to come up with something innovative that can be used for societal advantage.

ThC: Any suggestions for juniors!!

Ravneet: I would like to say that read a lot about various research developments in scientific articles and journals. Explore your interests and try to choose a project in that field. Also do not shy away from applying at various places for internships(in India as well as abroad). This way, at least one option should work for you!

ThC: Thanks for talking with us. We hope a bright future ahead of you.

ON BEHALF OF THC

DIVYANSHU KHANDELWAL