O X Y Z E N

THE CHEMISTRY E-NEWSLETTER

(Volume III, February 2025)

2024-2025 / Vol 36

Department established in 1972

Offers Undergraduate, Post-graduate and Doctoral Programmes

DBT STAR COLLEGE SCHEME SPONSORED DEPARTMENT

Department of Chemistry, Durgapur Government College represents a premier centre of teaching and research in the district. Use of MOODLE sites and Knimbus Digital Library by faculty members for uploading of courses and e-content provide access to learning resources for students beyond the classroom hours. Formative and summative assessment strategies include Class tests, Student Seminars, Quizzes, Role play by students as teachers, Viva-Voce etc. The Department has five laboratories, which include separate laboratories for UG and PG programmes and a Computer Laboratory.

The Department has international collaborations for computational research with University of Zakho, Iraq, Polydisciplinary Faculty of Taroudant, Ibn Zohr University, Morocco, Molecular Electron Density Theory Group of University of Valencia, Spain, Molecular Modelling and Spectroscopy Team MMST, University Chouaib Doukkali, El Jadida, Faculty of Science, Morocco, University of Kerela and researchers from several other institutes for computational studies. The Department is one of the participating departments under the DBT STAR COLLEGE SCHEME of the institution and has been organizing new experiments, workshops, hands on training programmes, seminars, invited lectures and interactive sessions, laboratory staff training programmes and several other initiatives since September 2022 focussed on the skill enhancement of students, faculty members and staff. Several equipment have been procured to strengthen the undergraduate teaching process under the scheme.

Our students have shown brilliant results with All India Ranks in JAM Examinations which include AIR 11 in 2020, AIR 64 and 209 in 2023 and AIR 99 in 2024. Students have been placed for higher studies in IIT, IISER, NIT, Banarus Hindu University, Calcutta University, Jadavpur University, The University of Burdwan and other institutes of national repute. Our students are also placed as post-doctoral fellows in international institutes.

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DEPARTMENT OF CHEMISTRY
DURGAPUR GOVERNMENT COLLEGE
J.N. AVENUE, DURGAPUR
DISTRICT-PASCHIM BARDHAMAN,
WEST BENGAL-713214

IN THIS ISSUE (2024-25)

STUDENT EDITORIAL BOARD

Bishnupriya Pal
UG Semester-IV
(Chemistry Honours)

Tania Shyam
UG Semester-IV
(Chemistry Honours)

Sneha Mondal
UG Semester-II
(Chemistry Honours)

Rajashree Maji
UG Semester-IV
(Chemistry Honours)

MESSAGE FROM PRINCIPAL DURGAPUR GOVERNMENT COLLEGE

It is a matter of great pleasure to know that the Department of Chemistry has come up with the third edition of, OXY-ZEN, The Chemistry Newsletter 2024-25, which will serve as a promising window for the students to evolve their creativity, subject expertise and portrayal of their thoughts with confidence. We aim to nurture young individuals to confidently and competently face the challenges of the intensifying competitive world beyond the campus walls and this newsletter will provide them wide exposure beyond the curricular activities. I acknowledge the sincere work of Department of Chemistry, who took the initiative to contribute their stimulated thoughts and skills in the completion of this piece of interesting work.
Best wishes for the success of OXY-ZEN, The Chemistry Newsletter 2024-25

Dr. Debnath Palit
Principal,
Durgapur Government College

"Move forward. Good things are up ahead."

MESSAGE FROM HEAD, DEPARTMENT OF CHEMISTRY

Dear Students, Faculty, and Staff,

I am delighted to extend a warm welcome to all of you as we put forward this edition of our newsletter. It is my privilege to address you through our college newsletter and share the exciting developments, achievements, and future plans of our department.

In the spirit of collaboration and continuous improvement, we strive to create an environment where curiosity and creativity thrive. Our dedicated faculty members are committed to providing you with the best educational experience, and our talented students continue to make us proud with their academic accomplishments and co-curricular activities.

As we navigate through this academic year, let us embrace the opportunities that come our way and work together to achieve our collective goals. I encourage you to actively participate in departmental events, engage in meaningful discussions, and contribute to the vibrant community we have built.

As we move forward, let us cherish the memories we create, celebrate our achievements, and continue to build a legacy of excellence at Durgapur Government College. Your enthusiasm and hard work are the cornerstones of our success, and I am confident that we will achieve great things together.

The Department is grateful to the Principal, Durgapur Government College, for his warm-hearted support in enhancing the quality of our academic environment.

My heartfelt thanks to all the faculty members, staff, and students for their unwavering support and dedication.

Dr. Snigdha Chandra
Associate Professor and Head
Department of Chemistry
Durgapur Government College

"Together, we will continue to uphold the tradition of excellence that defines Durgapur Government College."

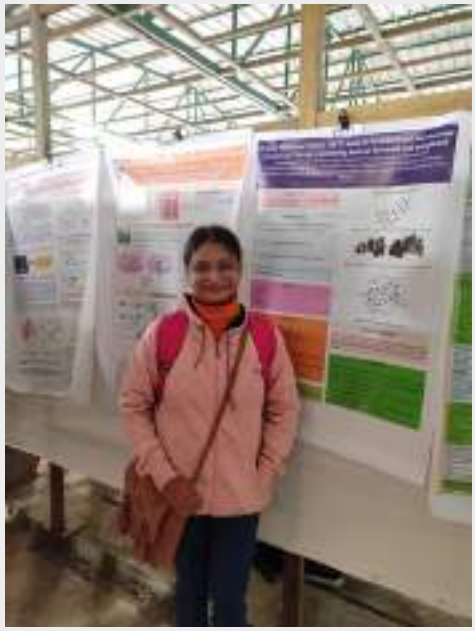
STUDENTS' ACHIEVEMENTS

Three Undergraduate students, Bishnupriya Pal, Rajashree Maji and Sneha Mondal presented their student project work conducted under the DBT STAR COLLEGE SCHEME in the INTERNATIONAL SEMINAR (ICBS-2025) on "Innovation, Expansion, Impacts and Challenges in Chemical and Biological Sciences" organized by Surendranath College, Kolkata on January 03, 2025.

One student, Bishnupriya Pal received the Second Best Poster Award in the International Conference.

Title of the Posters Presented:

1. **Density Functional Theory Modeling of L-citruline in terms of FMO theory and electron localization function (ELF) analysis**
2. **A Computational DFT Study to Comprehend the electronic structure of Rosmarinic Acid (Rajashree Maji)**
3. **Density Functional Theory (DFT) Analysis to understand the electronic structure of Chrysin, a promising Natural Flavonoid and Polyphnol (Sneha Mondal)**



STUDENTS' ACHIEVEMENTS

CHEMISTRY DEPARTMENT BECAME THE DEPARTMENTAL CHAMPION IN THE INTERDEPARTMENTAL ORAL PRESENTATION COMPETITION ORGANIZED UNDER THE DBT STAR COLLEGE SCHEME ON 16-12-2024

UNDERGRADUATE HONOURS STUDENT UTSHA GHOSH RECEIVED AWARD FOR BEING AMONG THE TOP THREE KNIMBUS LIBRARY USERS OF THE COLLEGE FOR 2024

UNDERGRADUATE HONOURS STUDENTS ANANYA KONAR AND UTSHA GHOSH RECEIVED SECOND PRIZE IN THE INTERDEPARTMENTAL POSTER COMPETITION ORGANIZED UNDER THE DBT STAR COLLEGE SCHEME ON 28-02-2024

UNDERGRADUATE HONOURS STUDENT SNEHA MONDAL RECEIVED THE BEST ORAL PRESENTATION AWARD IN THE ORAL PRESENTATION COMPETITION ORGANIZED UNDER THE DBT STAR COLLEGE SCHEME ON 16-12-2024

STUDENTS' ACHIEVEMENTS

UNDERGRADUATE HONOURS STUDENT SNEHA MONDAL WAS AWARDED THE SECOND PRIZE IN THE POSTER PRESENTATION COMPETITION ORGANIZED UNDER THE DBT STAR COLLEGE SCHEME TO CELEBRATE THE OCCSSION OF NATIONAL SCIENCE DAY ON 28-02-2025

SNEHA MONDAL PRESENTING HER POSTER TO PROFESSOR SYAMAL ROY, ICMR EMERITUS SCIENTIST, INDIAN INSTITUTE OF CHEMICAL BIOLOGY, KOLKATA AND DR. OINDRILLA MUKHERJEE FROM DEPARTMENT OF BIOTECHNOLOGY, GOVERNMENT OF INDIA

ACHIEVEMENTS OF RESEARCH SCHOLARS

Research Articles published by Scholars in Reputed International Journals

ASMITA MONDAL (registered under Dr. Nivedita Acharjee)

- Asmita Mondal, Nivedita Acharjee*, Haydar Mohammad-Salim, Mrinmoy Chakraborty (2024) Structural Chemistry (Springer), https://doi.org/10.1007/s11224-023-02270-5 (IF = 1.795)
- Jamelah S Al-Otaibi, Y.Sheena Mary, Y.Shyma Mary, Asmita Mondal, Nivedita Acharjee, Deepthi S. Rajendran Nair (2024) Journal of Molecular Liquids (Elsevier), 395, 123931 IF: 6.00) https://doi.org/10.1016/j.molliq.2023.123931
- Jamelah S Al-Otaibi, Y.Sheena Mary; Y.Shyma Mary; Asmita Mondal; Nivedita Acharjee; Deepthi S. Rajendran Nair (2024) Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy (Elsevier), 308 (2024) 123728 (IF: 4.4) https://doi.org/10.1016/j.saa.2023.123728
- .Jamelah S. Al-Otaibi, Y. Sheena Mary, Asmita Mondal, Nivedita Acharjee, M.S. Roxy, H.S. Yathirajan, Maria Cristina Gamberini (2024) Journal of the Indian Chemical Society (Elsevier), Volume 101, Issue 10, October 2024, 101235; https://doi.org/10.1016/j.jics.2024.101235 (IF = 3.20)

BARSALI BANERJEE (registered under Dr. Nivedita Acharjee)

- Barsali Banerjee, Luis R Domingo, Haydar A Mohammad Salim, Asmita Mondal and Nivedita Acharjee (2025) Understanding [3+2] Cycloaddition Reactions of Difluoroallene to Nitrone and Diazoalkanes from the Molecular Electron Density Theory Perspective, New Journal of Chemistry (Royal Society of Chemistry) (accepted)

BHASKAR MONDAL (registered under Dr. Nivedita Acharjee)

- Bhaskar Mondal, Luis R Domingo*, Haydar A Mohammad Salim, Nivedita Acharjee* (2025) ChemPhysChem (Wiley), e202401106, (IF:2.3) https://doi.org/10.1002/cphc.202401106
- Bhaskar Mondal, Luis R. Domingo, Haydar A. Mohammad-Salim, Nivedita Acharjee (2024) Computational and Theoretical Chemistry (Elsevier), 114660 (IF: 2.80) https://doi.org/10.1016/j.comptc.2024.114660

Presentations of Research Scholars in Seminars and Conferences

- 2ND INTERNATIONAL CONFERENCE ON EMERGING AREAS OF CHEMISTRY (ICEAC) held at Tripura University, Agartala from 12th to 14th February, 2025, Oral Presentations by Asmita Mondal and Barsali Banerjee.
- ICBS-2025 (Innovation, Expansion, Impacts and Challenges in Chemical and Biological Sciences), held at Surendranath College, Kolkata on 3rd January, 2025, Oral Presentations by Asmita Mondal and Barsali Banerjee.
- ACS-CRSI Early Career Researchers' Symposium 2024, held at KIIT University, Bhubaneswar from 22nd to 23rd October 2024, Poster and Oral Presentation by Asmita Mondal.
- International Conference on Natural Sciences and Engineering for Sustainable Development organized by Centre for Organic Spintronics and Optoelectronic Devices in collaboration with Department of Physics, Kazi Nazrul University from March 06-07, 2024. Oral Presentation by Barsali Banerjee and Bhaskar Mondal
- 28th ISCB International Conference (ISCBC-2024). Held at Marwadi University, Rajkot, Gujarat from 8th to 10th January 2024, Oral Presentation by Asmita Mondal

Asmita Mondal

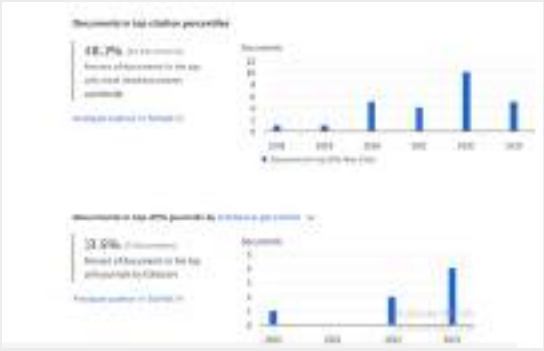
Barsali Banerjee

Bhaskar Mondal

FACULTY MEMBERS' ACHIEVEMENTS

- SCOPUS RECOGNITION FOR 48.1% OF RESEARCH PUBLICATIONS IN 25% MOST CITED DOCUMENTS WORLDWIDE
- SCOPUS RECOGNITION FOR 72.2 % INTERNATIONAL COLLABORATIONS IN THE PUBLISHED RESEARCH ARTICLES
- SCOPUS RECOGNITION FOR 13.5% OF RESEARCH PUBLICATIONS IN THE TOP 25% JOURNALS BY CITESCORE
- SCOPUS RECOGNITION FOR RESEARCH CONTRIBUTION TO UN SDGs, GOOD HEALTH AN D WELL BEING (GOAL 3), AFFORDABLE AND CLEAN ENERGY (GOAL 7) AND RESPONSIBLE CONSUMPTION AND PRODUCTION (GOAL 12)
- RECOGNIZED AS REVIEWER BY ELSEVIER
- RECOGNIZED AS REVIEWER BY AMERICAN CHEMICAL SOCIETY

Dr. Nivedita Acharjee
Assistant Professor
Department of Chemistry,
Durgapur Government College



NEW EXPERIMENTS CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

- SEPARATION OF CHEMICAL COMPOUNDS USING THIN LAYER CHROMATOGRAPHY
- ESTIMATION OF GLUCOSE IN COMMERCIAL PACK
- ESTIMATION OF VITAMIN C IN FRUITS AND VEGETABLES
- ESTIMATION OF AMINO ACIDS BY SORENSEN FORMOL TITRATION
- ISOLATION OF ESSENTIAL OIL FROM ROSE PETALS BY STEAM DISTILLATION METHOD"
- SPECTROPHOTOMETRIC ESTIMATION OF PHOSPHATE CONTENT IN SOFT DRINKS
- MILK TESTING FOR THE PRESENCE OF AMMONIUM COMPOUNDS, STARCH, CELLULOSE, CANE SUGAR ETC
- SYNTHESIS OF METHYL ORANGE
- DETERMINATION OF SAPONIFICATION VALUE OF OIL

WORKSHOPS CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

- **Two Day Online Workshop on Bioactivity Through Computation organized by Department of Chemistry** (March 27-28, 2024)

- **One Day Online Workshop on Biological Waste Disposal organized by Department of Botany, Chemistry and Zoology** (June 04, 2024)

https://www.youtube.com/watch?v=ojfNylL1uxc

- **One Day Workshop on Use of Water Analyzer organized by Department ofganized by, Geology DepaMathematicso** (June 18, 2024)

- **Workshop on "Calibration and Set up of pH meter, Potentiometer, Conductivity Meter, Water analyzer and Visible Spectrophotometer"** (August 17, 2024)

WORKSHOPS CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

- **Workshop on Augmentation of Scientific Aptitude through Bioinnovation and Entrepreneurship organized by Department of Botany, Chemistry and Zoology**
  (August 10, 2024)

- **Hands on Training on “Basic Home Appliances and "Instrumentation Process and Control of Different Scientific Equipment" in collaboration with Government Industrial Training Institute, Durgapur**
  (July 18-19, 2024 and September 23-24, 2024)

WORKSHOPS CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

Hands on Training on "Chem Draw Software and its applications"

October 01, 2024

WORKSHOPS CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

Workshop on Biological and Chemical Waste Disposal organized by Department of Botany, Chemistry and Zoology

February 12, 2025

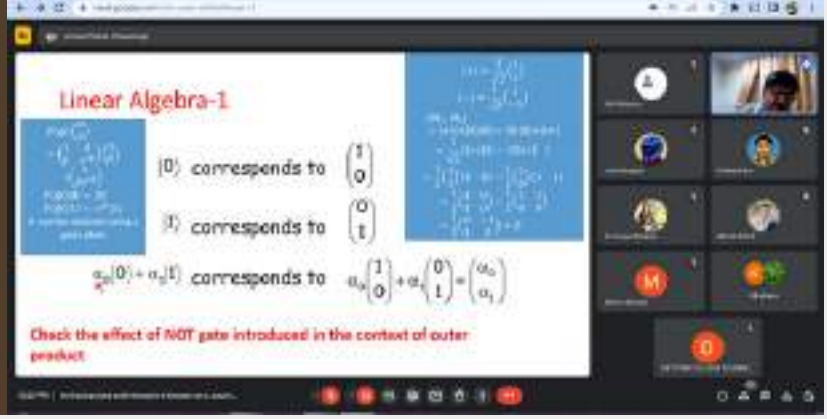
INVITED LECTURES CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

Online Invited Lecture and Interactive Session on "Visualizing DNA in action: A Multidisciplinary research methodology approach" by Dr. PADMAJA PRASAD MISHRA, Associate Professor, Chemical Sciences Division, Saha Institute of Nuclear Physics, Kolkata organized by Department of Chemistry and Physics https://www.youtube.com/watch?v=KpRXudW0zVc (May 20, 2024)

Online Invited Lecture and Interactive Session on "A Journey into Quantum Land" by PROFESSOR (Dr.) ANIRBAN PATHAK, Professor and Head, Department of Physics and Material Science and Engineering, Jaypee Institute of Information Technology, Noidaorganized by Department of Physics and Chemistry

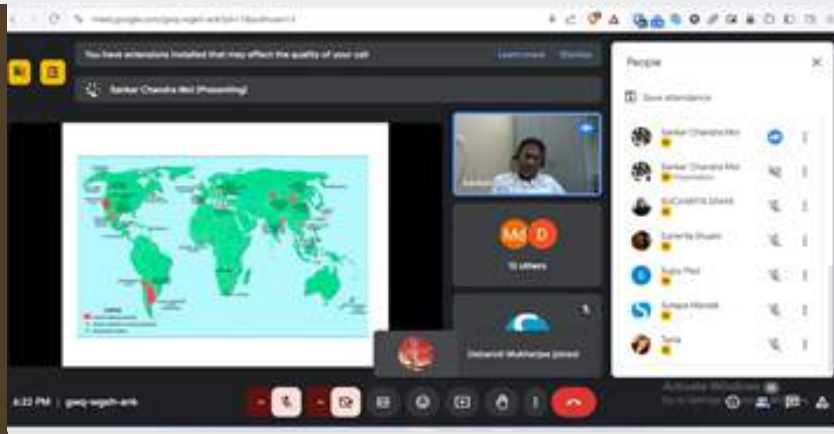
https://www.youtube.com/watch?v=5bj0I8O5lEY

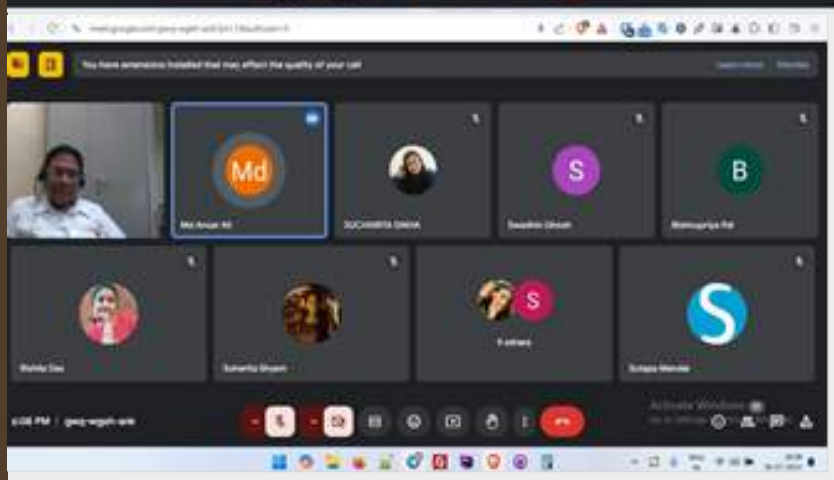
(May 23, 2024)



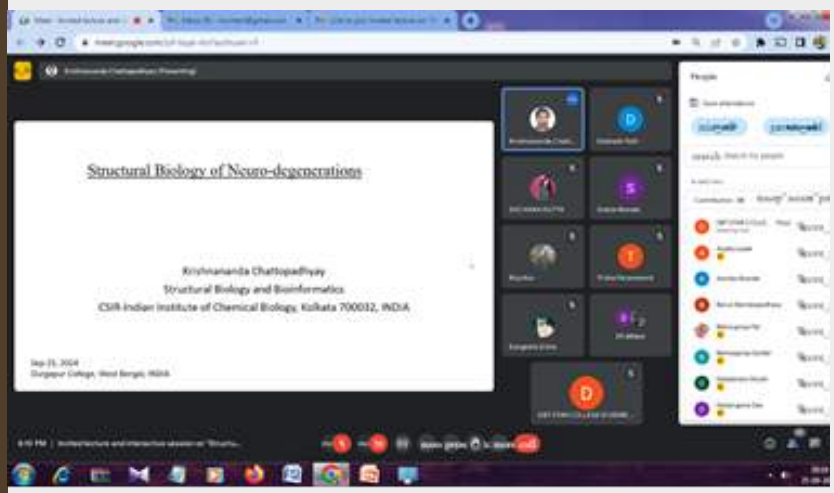
INVITED LECTURES CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

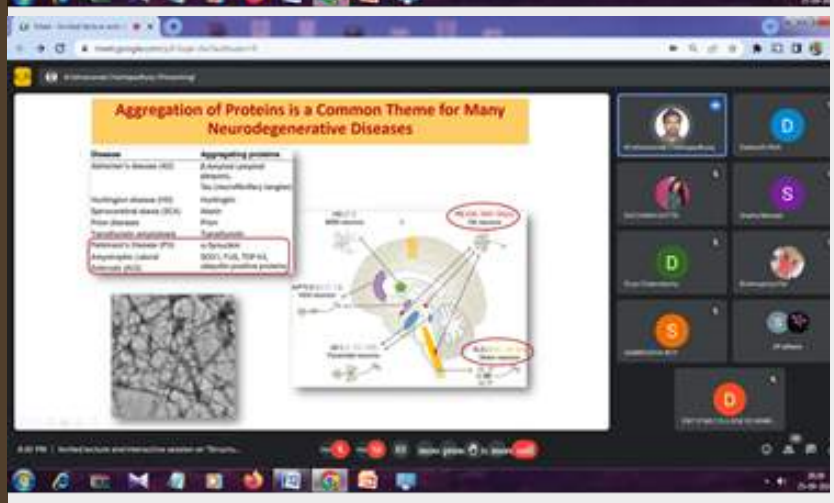
Invited Lecture and Interactive Session (Online)
"Chemical Toxicology with special emphasis on Heavy Metal Toxicity"
Dr. SANKAR CHANDRA MOI, Professor, Dept of Chemistry, National Institute of Technology, Durgapur
(July 26, 2024)





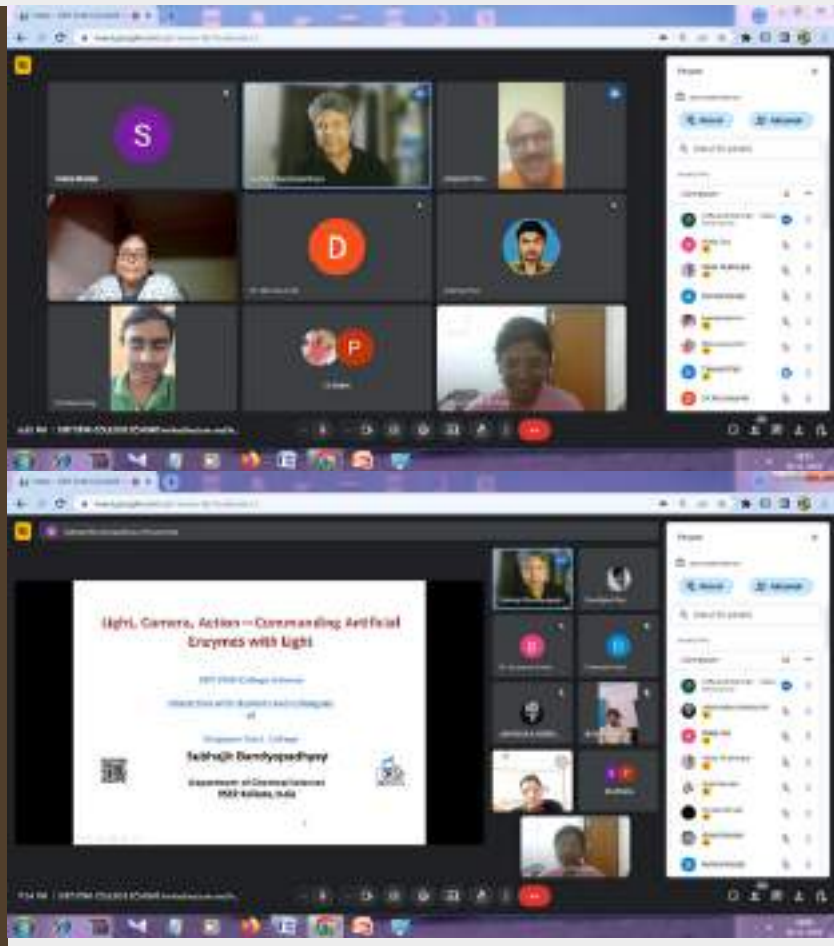
Invited Lecture and Interactive Session (online) on " Structural Biology of Neuro-degeneration"
Dr. Krishnananda Chattopadhyay, Chief Scientist & Head, Structural Biology & Bioinformatics Division, CSIR-Indian Institute of Chemical Biology, Kolkata
(September 25, 2024)



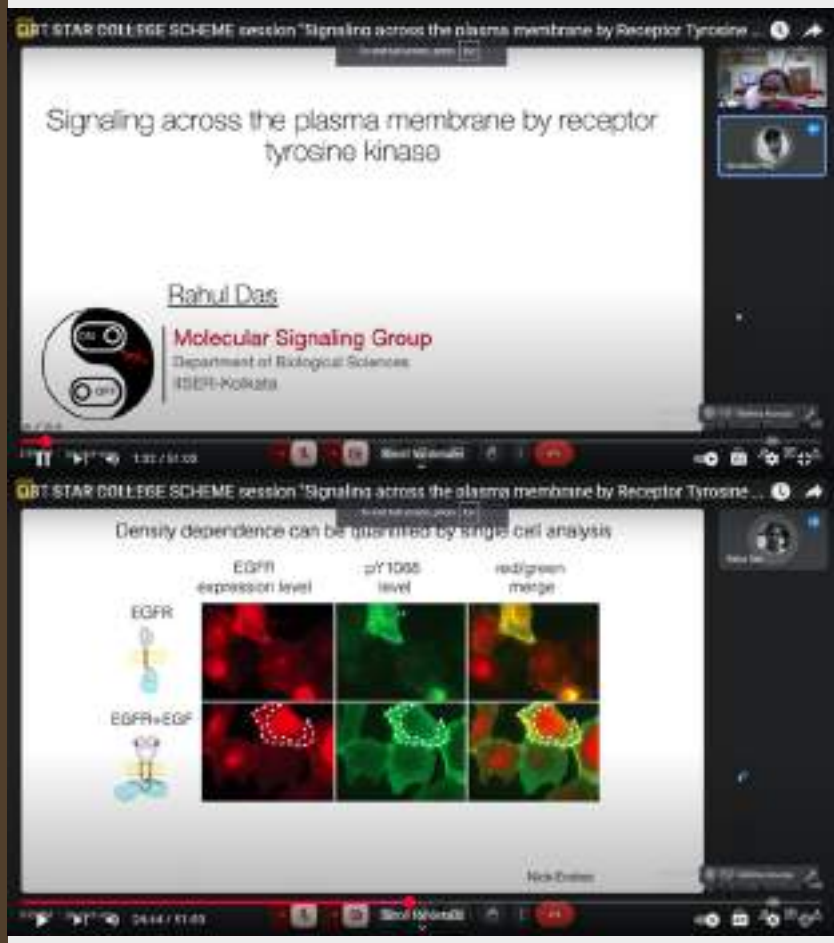


INVITED LECTURES CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

Online invited lecture and interactive session on "Light, Camera, Action—Commanding Artificial Enzymes with Light?" by Professor Subhajit Bandyopadhyay, Professor, Department of Chemical Sciences, Indian Institute of Science Education and Research Kolkata organized by Departments of Chemistry, Botany, Zoology and Physics (November 28, 2024)



Online invited lecture and interactive session on "Signaling across the plasma membrane by Receptor Tyrosine Kinase" by Dr. Rahul Das, Associate Professor, Department of Biological Sciences, Indian Institute of Science Education and Research Kolkata organized by Departments of Zoology, Botany and Chemistry (November 29, 2024)



INVITED LECTURES CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

Online invited lecture and interactive session on "Multicellular Behaviours in Bacteria: Implications in Bacterial Survival, Bioremediation and Therapeutics" by Professor Tapas Kumar Sengupta, Professor, Department of Biological Sciences, Indian Institute of Science Education and Research Kolkata organized by Department of Botany, Chemistry and Zoology (November 30, 2024)

Online seminar on "THE GUT MICROBES—YOUR FRIENDS FOR LIFE" by DR. MOUMITA BHAUMIK (GHOSH), Scientist D, National Institute of Cholera and Enteric Diseases, Kolkata, West Bengal organized by Departments of Botany, Chemistry and Zoology (December 02, 2024)

INVITED LECTURES CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

One day online seminar on "Bioactive compounds derived from North-eastern biodiversity: a potential research field for drug development" by Dr. Jhimli Bhattacharyya, Associate Professor (Chemistry) and Head, Department of Science and Humanities, National Institute of Technology Nagaland organized by Departments of Botany, Chemistry and Zoology
(December 06, 2024)

"Invited Lecture and Interactive Session" on "Chemistry in Industry: Modern Applications" by Dr. Sourav Ranjan Das, Head, Department of Basic Science and Humanities, Dr. B. C. Roy Engineering College, Durgapur organized by Department of Chemistry
(January 08, 2025)

STUDENT PROJECT BASED ON FIELD WORK AND LABORATORY TESTING CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

Student Project on Industrial Pollutant Concentration Assessment in Ground Water involving field work for ground water collection from 9 sites of Durgapur Locality and laboratory Assessment.
(June-July, 2024)

Results of the Student Project Presented by students in Scientific Model Competition on 16-12-2024

RESEARCH LABORATORY VISITS TO INSTITUTES OF EMINENCE CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

Research Laboratory Visit to Department of Chemistry, National Institute of Technology, Durgapur
(August 05, 2024)

Research Laboratory Visit to National Institute of Biomedical Genomics, Kalyani
(August 07, 2024)

Research Laboratory Visit to AICTE IDEA Lab, Dr. B. C. Roy Engineering College, Durgapur
(August 17, 2024)

FIELD VISITS UNDER DBT STAR COLLEGE SCHEME (2024-2025)

Field Visit to Milk Farm at Durgapur Government College for collection of Milk Sample and comparison with the commercially available Milk samples by Laboratory Testing (July 22, 2024)

INDUSTRIAL VISITS CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

Industrial Visit to Sun Ceramics, Durgapur (July 20, 2024)

Industrial Visit to Jai Balaji Group of Industries, Durgapur (February 13, 2025)

LABORATORY STAFF TRAINING PROGRAMME CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

One Day Training Programme for the laboratory Staff on the Operation of Respirable Air Sample
(June 08, 2024)

One Day Training Programme on "Standard Solution Preparation using Dilution Method and by Weighing Method" and preparation of laboratory reagents" for laboratory staff
(August 16, 2024)

OUTREACH ACTIVITY FOR LOCAL SCHOOLS CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

Outreach activity on “Telescope making and Star Gazing programme” organized by Departments of Physics Chemistry and Mathematics under DBT STAR COLLEGE SCHEME for local schools at Durgapur
(July 11, 2024)

Outreach activity on “Telescope making and Star Gazing programme” organized by Departments of Physics Chemistry and Mathematics under DBT STAR COLLEGE SCHEME for local schools at Visva Bharati, Shantiniketan
(July 12, 2024)

OUTREACH ACTIVITY FOR LOCAL SCHOOLS CONDUCTED UNDER DBT STAR COLLEGE SCHEME (2024-2025)

An outreach activity on "Computer Based Simple 3D Modeling techniques for Game Based Science Learning for school students" organized by Department of Chemistry

December 11, 2024

DBT STAR COLLEGE SCHEME ADVISORY COMMITTEE MEETING

STUDENTS AND FACULTY MEMBERS OF CHEMISTRY DEPARTMENT INTERACTING WITH THE DBT STAR COLLEGE SCHEME ADVISORY COMMITTEE MEMBERS, Dr. Garima Gupta, Professor Anirban Basu and Professor Syamal Roy

(August 21, 2024)

DBT STAR COLLEGE SCHEME SCIENTIFIC MODEL COMPETITION

Glimpses of the Models prepared by Students of Department of Chemistry

(December 16, 2024)

DBT STAR COLLEGE SCHEME ORAL PRESENTATION

Glimpses of the Oral Presentation by Students of Department of Chemistry

(December 16, 2024)

WRITING BY STUDENTS

Bishnupriya Pal,
Student of Semester-IV (UG Chemistry Honours)

Unlocking the power of L-Citrulline : A student led research journey

Name - Bishnupriya Pal
Roll no - 23CEMH007
Sem - 4

I am thrilled to share my research experience and findings on L-Citrulline, an amino acid that has shown remarkable potential in improving overall health and well-being. Using Density Functional Theory (DFT) studies, we have got insights into the molecular structure of L-Citrulline.

- ***What is L-Citrulline ?***

L-Citrulline is a non-essential amino acid that plays a crucial role in various physiological processes.

Benefits:

- Improves blood flow
- Boosts exercise performance
- Supports heart health
  Neuroprotective effects

WRITING BY STUDENTS

Bishnupriya Pal,
Student of Semester-IV (UG Chemistry Honours)

Our Research Experience

Using DFT studies, we were able to investigate the electronic structure and properties of L-Citrulline. This allowed us to gain a deeper understanding of its molecular behavior and interactions. Our research experience was invaluable, and we are excited to share our findings with the scientific community.

I am proud to say that our poster presentation won 2nd place at the Internation Conference at Surendranath College ! Our poster provided a visually engaging representation of our research, highlighting the benefits and mechanisms of L-Citrulline. We received excellent feedback from the judges and attendees, and we are thrilled to have had the opportunity to share our work with a wider audience.

Final Thoughts

We believe that our research on L-Citrulline has the potential to make a significant impact on human health and well-being. A millions thanks to our respected Principal, Dr. Debnath Palit sir and Dr. Nivedita Acharjee ma'am and other teachers for supporting and encouraging us in this journey.

WRITING BY STUDENTS

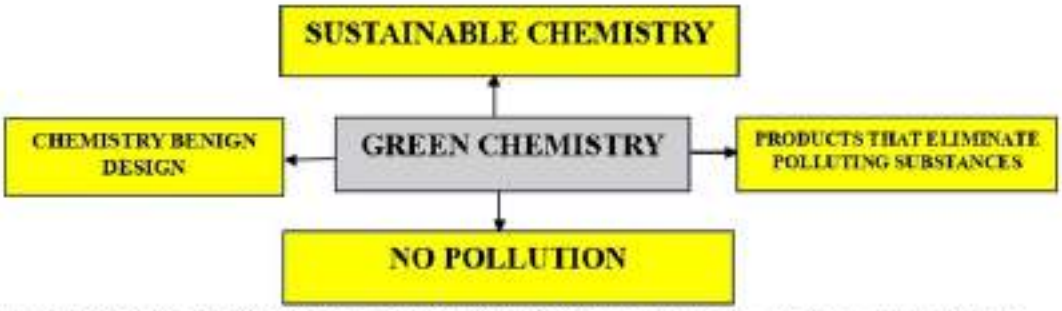
Sneha Mondal

Student of Semester-II (UG Chemistry Honours)

GREEN CHEMISTRY:WASTE TO WEALTH

INTRODUCTION-"Green chemistry" also called "sustainable chemistry", is a philosophy of chemical research and engineering that encourages the design of products and processes that minimize the use and generation of hazardous substances. It applies to organic, inorganic and analytical, physical chemistry and biochemistry. The terms "environmental chemistry" and "green chemistry" based on the environmental protection agency. The term "sustainable" has been used very freely for wide range of issues, which have had very little or nothing to do with sustainability. Sustainable and green chemistry is very simple but one of the important terms is just a different way of thinking about how chemistry and chemical engineering can be done.

- **PURPOSE-**To realise the aforementioned ambition of creating sustainable production modes and contributing to the SDGs with green chemistry, new technologies would need to be developed and embedded in complex socio-political-economic systems in a way that is beneficial for the people, planet, and prosperity. It is therefore essential that the development and diffusion of green chemistry products and processes is accompanied by thorough consideration for ethical, social, political, legal and economic aspects. For instance, careful attention must be given to the unintended consequences. Main aim of "green chemistry" is to reduce chemical related impact on human health and virtually eliminate contamination of the environment through dedicated, sustainable prevention programs. "Green chemistry" searches for alternative, environmentally friendly reaction media and at the same time strives to increase reaction rates and lower reaction temperatures. The "green chemistry'gobeyond concerns over hazardous from chemical toxicity, and include energy conservation, waste reduction, and life cycle considerations such as the use of more sustainable or renewable feedstocks and designing for end of life or the final disposition of the product.



- **FRAMEWORK OF "GREEN CHEMISTRY"-**Frameworks such as 'sustainable chemistry'and 'safe and sustainable by design' have been developed to take environmental, social, and economic dimensions into account.However, the socio-economic assessment is optional in the application of 'safe and sustainable by design' according to the methodological guidelines provided by the European Commission Consequently, social and economic dimensions are often neglected. Social and economic sustainability assessments were conducted in less than a third of the research projects, while hazard, safety, and human health assessments were conducted in more than half of them, as reported by the surveyed partners of the Partnership for

the Assessment of Risks from Chemicals (PARC) program. Therefore, other frameworks are still needed to ensure green chemistry research and innovation can contribute to sustainable industrial transitions considering technical, environmental as well as social, ethical, economic and political considerations. The Responsible Research and Innovation (RRI) framework is proposed here as promising alternative.

It has been recently argued that the RRI (Responsible Research and Innovation) framework offers a promising approach to integrate "ethics dimensions" into "chemists' scientific practices" and it was suggested that also green chemistry could benefit from it. RRI can provide a more holistic approach for integrating societal values, ethical considerations into green chemistry practices, and addressing the needs of different stakeholders throughout the entire R&D process highlights the value of combining green chemistry and RRI, but notes that there is a lack of understanding on how RRI principles can be incorporated in green chemistry practice besides the suggested educational initiatives (e.g., interdisciplinary collaboration and communication training for chemistry researchers). This study aims to address this challenge.

- **PRINCIPLES-** Environmental protection agency developed 12 principles of "green chemistry", which helps to explain the balancing the nature. The principles are-

1.Prevention of waste formation- It is better to preventwaste than to treat or clean up waste after it is formed. The ability of chemicals to redesign chemical transformations to minimize the generation of hazardous waste is an important first step in pollution prevention. The first principle suggests that prevention is better than cure i.e. stop pollution at source. The process design should be such that waste by-products are minimized.

Example-**Antibodies**

2.Maximize atom economy-Synthetic methods should be designed to maximize the incorporation of all materials used in the process in to the finalproduct. The process should be so redesigned to give maximum yield and maximize efficiency. Atom economy is a concept that evaluates the efficiency of a chemical transformation, and is calculated as a ratio of the total mass of atoms in the desired product to total mass of the atoms in the reactants.

$$\% \text{ Atom Economy} = \frac{\text{No. of atoms incorporated} * 100}{\text{No. of atoms in the reactants}}$$

choosing transformations thatincorporate most of the starting materials in to the products are more efficient
and minimizes waste.

Example- **Re-engineered Product**

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3.Less Hazardous Chemical Synthesis-

Synthetic methodologies should be designed to use and generate substances that contains little or no toxicity to human health and environment. Some toxic chemicals are replaced by safer ones for a green technology, when reagent choices exist for a particular transformation. The principle focuses on choosing reagents that pose the least risk and generate only harmless by products.

Example- **Certain Solvents & Building Blocks**

4.Designing Safer Chemicals and Products-

Chemical products should be designed to pressure efficacy of function while reducing toxicity.Such products should be explored which retain their effective functions with simultaneous reduction of toxicity, if any is associated with the products. This principle of green chemistry emphasizes designing of safer chemicals.

Example- **Certain Thermometers**

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5.Safer Solvents and Auxiliaries-The use of auxiliary substances (i.e. solvents, separation agents etc.) should be made unnecessary wherever possible.Development of dry reaction techniques follows this principle of Green Chemistry.

Example- **Greener Solvents**

6.Design for energy efficiency-Energy requirements should be recognized for their environmental and economic impacts and should be minimized. Synthetic processes should be conducted at ambient temperature and pressure.

Example- **Certain Antibodies, Enzymes, etc.**

7. Use of renewable feedstocks-A raw material or feedstock should be renewable rather than depleting wherever technically and economicallypracticable. The raw material should be renewable for assured production.

Example- **Biobased Solvents**

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8.Reduce derivatives-Unnecessary derivatization should be avoided whenever possible because it generates waste. Derivatization results in increase in number of steps required in the process and each additional step requires reagents and can generate more waste. Instead, more selective and better alternative synthetic sequences that eliminate the need of functional group protection should be adopted.

9.Use of Catalysts-Catalytic reagents are superior to stoichiometric reagents. Catalysts are used in small amounts and can carryout a single reaction many times and hence preferred to stoichiometric reagents, which are used in excess and work only once. They can enhance the selectivity of a reaction, reduce the temperature of a transformation, reduce reagent base waste and avoid unwanted side reactions leading to a clean technology.Apart from heavy metal catalysts softer catalysis like zeolites, phase transfer catalysts.

Example- **Certain Transition Metal Catalysts**

10.Design for degradation-Chemical products should be designed so that after use undergoes degradation and do not persist in the environment.Based on lessons learned from experience of use of DDT as insecticide, this principle suggests that the breakdown of chemical product should not be harmful even in long run.

Example-**Biodegradable Surfactants**

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11.Real-time analysis for pollution prevention-

Analytical methodologies need to be further developed to allow real time, in process monitoring and control prior to the formation of hazardous substances. Developing analytical process monitoring tools are equally important as far as the development of product is concerned. The quick detection of harmful substances can help in quick curative action.

12. Inherently safer chemistry for accident prevention-Substances and the form of a substance used in a chemical process should be chosen to minimize potential for chemical accidents, including releases, explosions and fires. One can learn lessons from Bhopal Gas Tragedy that this principle is very important.

Example- **Certain Grignard Reagents in 2-MeTHF**

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➢ **BENEFITS OF GREEN CHEMISTRY-**

1.Environment: Many chemicals are released into the environment either on purpose (like insecticides) while being
used, unintentionally (like emissions during manufacturing), or through disposal. Green chemicals are eitherrecycled for additional use or breakdown into harmless compounds. When harmful substances are present in the environment, plants and animals are less harmed. less chemistry to disturb ecosystems and use of landfills should be reduced, especially those for hazardous waste.

2.Human health: Elimination of persistent toxic chemicals that may enter the system of food chain;reducetoxic pesticides that are toxic only to specific pests and degrade rapidly after use. Clean water as less release of hazardous chemical wastes to water leading to cleaner drinking and recreational water. Increased worker safety in the chemical sector; decreased use of dangerous substances; reduced need for personal protective equipment; and decreased risk of mishaps (such as fires or explosions).

3.Safer consumer goods of all kinds will be produced: New, safer products will be sold; some products, like medications, will be produced with less waste; and some products, like insecticides and cleaning supplies, will take the place of less safe alternatives.

4.Economy: Permit the replacement of a waste product for a purchased feedstock. greater chemical yields, which require less feedstock to produce the same amount of product. waste reduction by doing away with expensive remediation, hazardous waste disposal, and end-of-pipe treatments. Fewer synthetic stages frequently enable quicker product manufacturing, higher plant capacity, and energy and water savings. improved performance, using less product to fulfil the same function. increased ability of chemical producers and their clients to compete.Reduced use of petroleum products, slowing their depletion and avoiding their hazards and price fluctuations.

Benefits of green chemistry include:

- Reduction of waste at its source
- Preservation of raw materials.

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- **EXAMPLE OF "GREEN CHEMISTRY"-**

Green chemistry has been used in a wide variety of products and processes, from the medical field to computer technology to household paint and more. Here are a few examples:

1.Packing peanuts made from renewable plant starch- that can be composted and are much less hazardous than styrene.

2.Non-bisphenol thermal receipts-that use imaging technology rather than toxic bisphenol-A (BPA) and bisphenol-S (BPS) inks.

3.Lithium-ion battery alternatives- that reduce the chemicals used, size, and broadens operating temperatures.

- **GREEN CHEMISTRY AND POLLUTION PREVENTION ACT OF 1990-**In the federal **"Pollution Prevention Act of 1990"**, Congress declared that it is "the national policy of the United States that pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner."

The law defines **source reduction** as any practice which reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and, reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants. The term includes equipment or technology. modifications,process or procedure modifications, reformulation or redesign of products, substitution of raw materials and improvements in housekeeping, maintenance, training, or inventory control."

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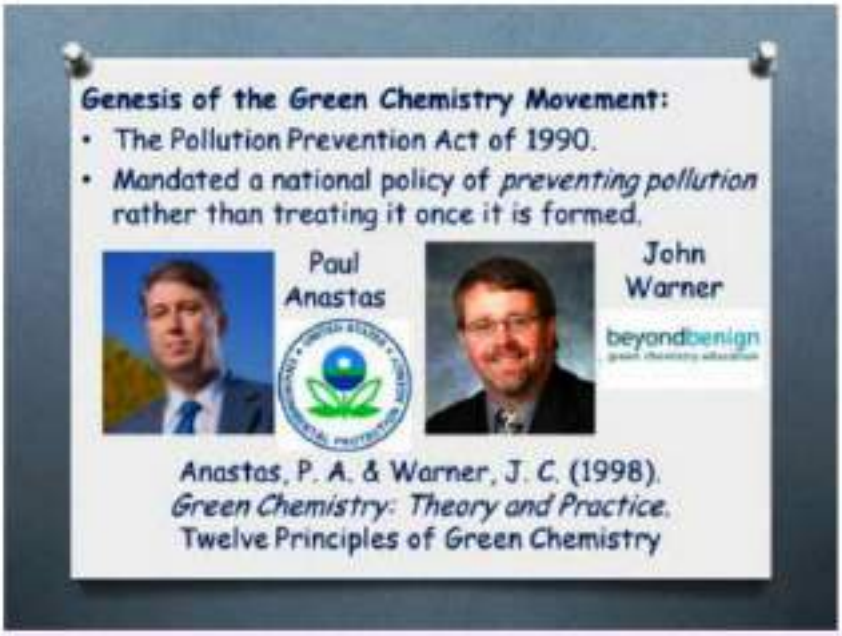

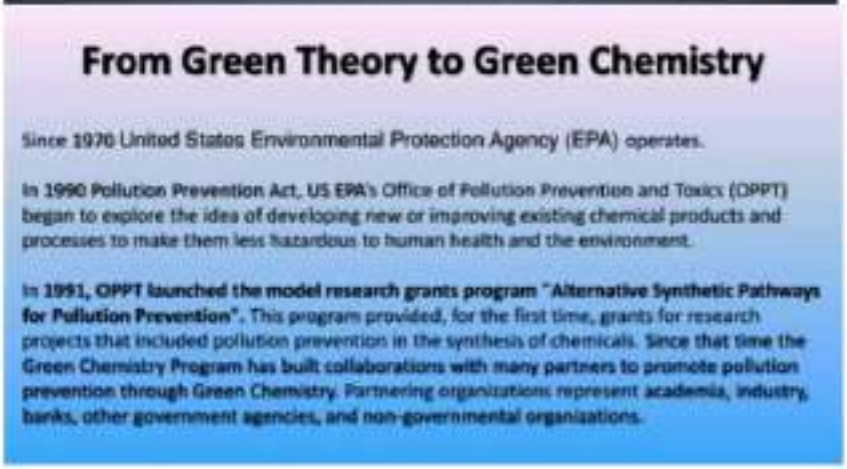

➢ **RESOURCES FOR GREEN ALTERNATIVES-**

1.Solvents-Solvent selection is a key priority in greening chemistry because solvents are used in high volumes and many of them are flammable and toxic compounds. Their usage creates large amounts of waste, air and water pollution, and other health and environmental impacts. Consider green alternative solvents with low toxicity, minimal safety concerns, and little impact on the environment to make a greener process or product.

2.Products-

- Green Lab Supplies and Equipment Guide: List ofeco-friendly laboratory equipment and lab consumables.
- Safer Choice-Certified Products and DfE-Certified Disinfectants :EPA developed the Safer Choice label for cleaners and detergents and the Design for the Environment logo for disinfectants to make it easier for people to find products with ingredients that meet a high standard for human and environmental health.

- ACT Label Database: The ACT label is an eco-nutrition label for laboratory products, including consumables, chemicals, and equipment. By emphasizing accountability, consistency, and transparency (ACT) around manufacturing, energy and water use, packaging, and end-of-life, ACT makes it easy to choose safe, sustainable product.
- Cleaner Solutions Database: Find safe green products for industrial and janitorial applications. Provides information on the effectiveness of different cleaning chemicals and equipment for a variety of surfaces and contaminants.

3.Reagents-

- Green Lab Supplies and Equipment Guide:List of eco-friendly laboratory equipment and lab consumables.
- Safe Choice-Certifiedand DfE-Certified Disinfectants : EPA developed the Safer Choice label for cleaners and detergents and the Design for the Environment logo for disinfectants to make it easier for people to find products with ingredients that meet a high standard for human and environmental health.
- ACT Label Database:The ACT label is an eco-nutrition label for laboratory products, including consumables, chemicals, and equipment. By emphasizing accountability, consistency, and transparency (ACT) around manufacturing, energy and water use, packaging, and end-of-life, ACT makes it easy to choose safe, sustainable products.
- Cleaner Solutions Database:Find safe green products for industrial and janitorial applications. Provides information on the effectiveness of different cleaning chemicals and equipment for a variety of surfaces and contaminants.

➢ **FUTURE DIRECTIONS-**

For eco-friendly processes green chemistry is revolutionary and emerging technology. Nano-fertilizers, nano pesticides as well as plant transformation gene delivery applied to agriculture have the potential to disrupt many of the great problems facing humanity in the coming days.

Green chemistry attempts to create and manufacture cost-competitive chemical products and processes that reduce pollution at its source, achieving the highest degree of the "pollution-prevention" hierarchy. Green chemistry is expanding, with interest growing in university and industrial settings. The hunt for procedures that utilize fewer harmful chemicals, make less waste, and require less energy has progressed. However, there are still numerous obstacles to overcome in the transition to a more sustainable future. Green chemistry may help the environment at every stage of the life cycle, including material extraction, transformation, processing, and manufacturing; packaging, shipping, and distribution; consumer use; and end-of-life management.

- Green nanochemistry
- Supramolecular Chemistry
- Oxidation Reagents and Catalysts
- Biometric Multifunctional Reagents
- Combinatorial Green Chemistry
- Non-Covalent Derivatization Techniques

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- **CONCLUSION-**Green chemistry represents a crucial approach to minimizing the environmental impact of chemical processes and products. By focusing on sustainable practices, reducing wastes, conserving energies, and utilizing renewable resources "green chemistry" plays a significant role in promoting both ecological well-being and economic efficiency. Through innovative solutions such as safer chemicals, more efficient processes and reduced toxicity "green chemistry"offers a pathway to cleaner, more sustainable future while advancing scientific and industrial progress. Its widespread adoption is key to addressing the global challenges of pollution, resource depletion and climate change.

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THE CHEMISTRY OF DISAPPEARING INK

DISAPPEARING INK

We may have heard about disappearing ink or invisible ink, especially in movies, television programs, or any kind of entertainment program..

Disappearing Inks Pens

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B.Sc. In Chemistry

WHAT IS DISAPPEARING INK?

Inks that are visible for a period of time without the intention of being made visible again are called disappearing inks.

Disappearing ink is a special type of ink that vanishes over time, usually due to chemical reactions.

DISAPPEARING INK BY USING CHEMICALS

Disappearing inks typically rely on the chemical reaction between thymolphthalein and a basic substance such as sodium hydroxide. Thymolphthalein, which is normally colorless, turns blue in solution with the base. As the base reacts with carbon dioxide, the pH drops below 10.5 and the color disappears.

Disappearing Ink in Acid & Basic Form

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HOMEMADE INVISIBLE INK

Materials Required

- Lemon
- Water
- Candel or heat
- Bowl
- Spoon
- White Paper
- Cotton

Invisible Inks Before & After Using

Procedure

1. Squeeze all the juice from the lemon into the bowl and add some drops of water.


2. Mix the water and lemon juice with a spoon.
3. Dip the cotton swab into the mixture and write a message onto the white paper.

4. Wait for the juice to dry so it becomes completely invisible.

5. When you are ready to read your secret message or show it to someone else, heat the paper by holding it cl to the candle or heat source.

Scientific explanation

Lemon juice is an organic substance that oxidizes and turns brown when heated.

Diluting the lemon juice in water makes it very hard to notice when you apply it the paper, no one will be aware of its presence until it is heated and the secret message is visible.

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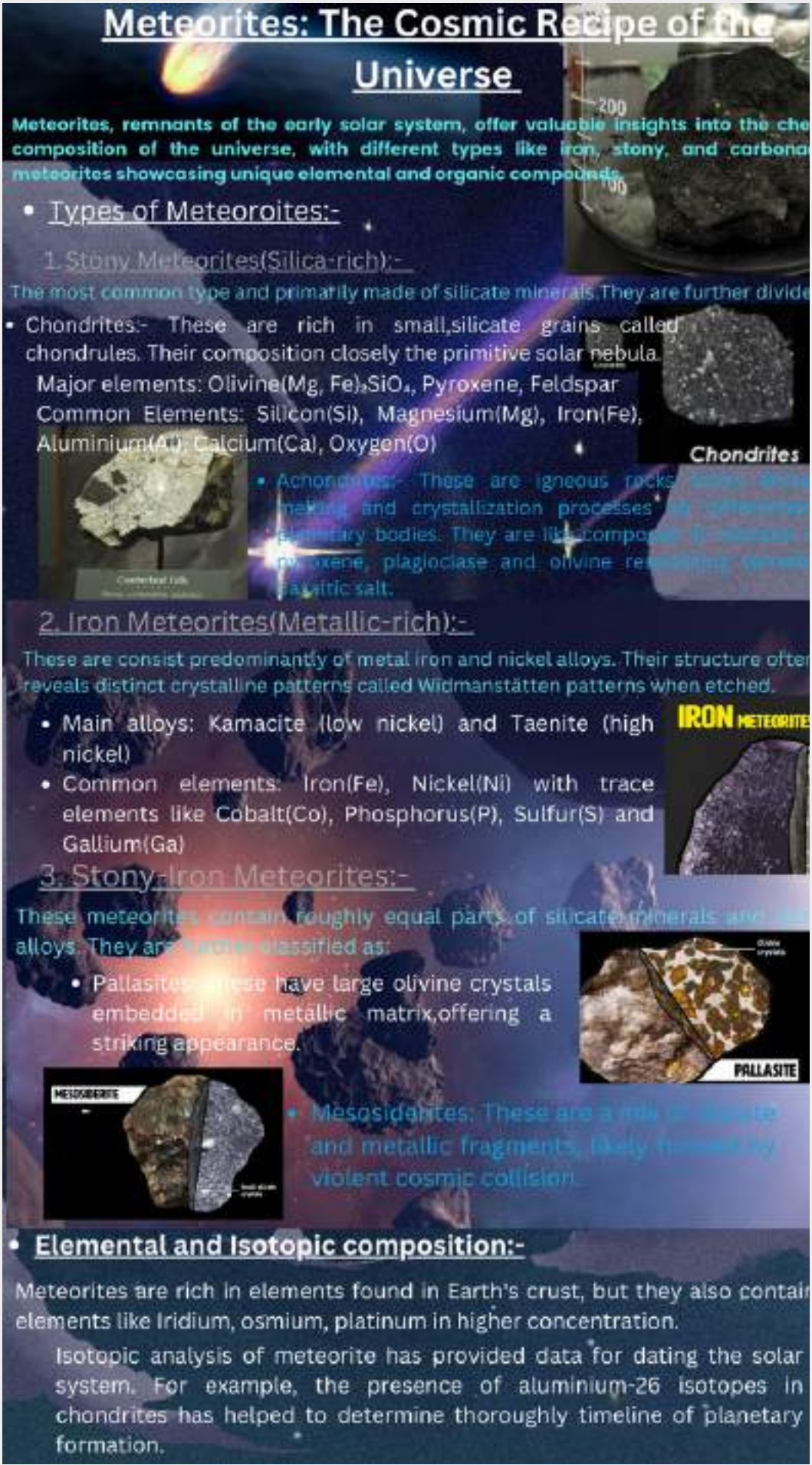

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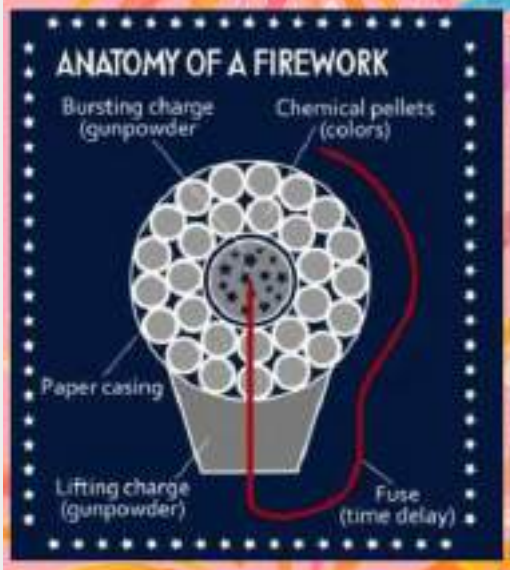
CHEMISTRY OF FIREWORKS

What's inside firework?

- **Fuel:- Source of electrons to react with oxidizer and burn**
- **Oxidizer:- Receives electrons, releases energy when reacting with fuels**
- **Binder:- Holds everything together, makes everything stable**
- **Colour Compounds:- Produce a certain colour when combined and burned**



- **The gunpowder is also known as 'black powder'. It is the most important component which was discovered by Chinese alchemists. It is a mixture of saltpeter, sulfur and charcoal. When black powder is ignited sulfur dioxide and carbon dioxide is released as energy which causes the explosion of the fireworks.**

Darkside of Fireworks

WRITING BY STUDENTS

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A Chemical Journey Through Time

History has never lacked brains. Our world has always been blessed by so many intellectuals centuries after centuries. Thanks to the power of their minds we transformed from being species that used to hunt wild animals and live in the caves to a species that can create synthetic organisms with altered DNA ,demonstrating the possibility of manipulating life's building blocks. The human's brain is so powerful that it alone has made us the strongest organism that has ever lived on earth. The best part about it is that the brain is so incredibly adaptable and can form new connections (synapses) and learn new skills throughout the life which makes our potential never ending.

Now, the world of chemistry has also been bestowed by plenty of such geniuses in the history of mankind. The study of chemistry, while rooted in ancient practices like alchemy and metal working, transitioned into a more scientific discipline during the 17^{th} and 18^{th} centuries.

Alchemy alone is a very compelling topic to discuss as it was not just a pursuit of practical knowledge but also had philosophical and spiritual dimensions, with alchemists seeking to understand the fundamental nature of metal and cosmos. Now most of us may or may not be very familiar to the science of alchemy. So, What is Alchemy? While alchemy's origins are debated, but it's often linked to ancient Egypt and China with evidence pointing to old kingdom of Egypt (c. 3200 BC) and belief in immortality in China dating back to the 8^{th} Century BC. Alchemy basically is a form of ancient practice that blends elements of science, philosophy, and mysticism having key aims like :-

1) Chrysopoeia : the transmutation of base metals (like lead) into noble metals (like gold).
2) Elixir of immortality : The creation of a substance that could grant eternal life.
3) Panacea: the discovery of universal cure for all diseases.

In today's world it's considered a pseudoscience but we can't disavow the Alchemy's influence that can be seen in the development of chemistry, medicine and metallurgy that laid the groundwork for modern chemistry by developing laboratory, techniques, theories and terminologies some of which are still used today. Alchemists experimented with various substances and techniques, leading to the development of process like refining ores, producing gunpowder, making glass and ceramics, tanning leather and creating inks, dyes and paints. Alchemists also made the first attempt at organising and classifying substance which eventually led to the development of periodic table. The pursuit of alchemy, even if unsuccessful in its primary goals, spurred scientific curiosity and experimentation contributing ultimately to the advancement of knowledge. Greek philosophers like Aristotle and Democritus laid the foundation for western chemistry, proposing ideals about matter, elements and atoms. Roman developed practical application of chemistry such as metal working, dyeing, and perfume - making.

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The middle age of chemistry has seen several golden ages including prominent examples like Islamic golden age and European alchemy. Islamic scholars, like Al- Razi and Al- Kindi made significant contributions to chemistry, introducing laboratory techniques and equipments. Alchemy continued to evolve in Europe, with practitioners seeking to discover the Philosophers' stone.
The scientific revolution of chemistry occurred somewhere around 1500 – 1700 CE. Andreas Libavius, a German alchemist is considered the first modern chemists introducing laboratorial techniques and equipments. Robert Boyle, an Anglo- Irish chemist established the scientific methods, The Law of gas pressure, and coined the term Chemical reaction. A French chemist, Antoine Lavoisier discovered oxygen, established the concept of elements, and developed a systematic method of chemical nomenclature.

The development of modern chemistry dates back to 1700 – 1900 CE. With eminent scientists like Joseph Priestley, an English chemist discovered oxygen and developed the concept of chemical affinity. Dimitri Mendeleev, a Russian chemist, developed the periodic table predicting the existence of undiscovered elements. Marie Curie, a Polish born physicist and chemist, discovered radioactivity, isolated radium and polonium and use of X ray. She won the Nobel Prize in physics for her research of radiation phenomena. She also won the second Nobel Prize in chemistry for the discovery of polonium and radium.

The evolution of modern chemistry led to astounding advancement of science in the 20Th Century. The development of quantum mechanics by physicist like Max Planck, Neils Bohr and Erwin Schrödinger revolutionised our understanding of chemical bonding and reactivity. The discovery of antibiotic vitamins and hormones in the field of organic chemistry led to significant advances. The development of new materials like plastic, semiconductor and nanomaterials transformed industries and daily life.

The very recent modern chemistry centres on fields like Green Chemistry to focus on sustainable, environmentally friendly chemistry that has led to the development of new eco- friendly materials and processes. Nanotechnology, the manipulation of matter at the nanoscale has opened up new possibilities for materials science, medicine, and energy. Computational chemistry, the advances in computational power and algorithms that has enabled chemists to stimulate and predict chemical behaviour, accelerating discovery and innovation. The future of chemistry also looks pretty promising including plans like artificial photosynthesis, carbon capture and utilization, space based chemistry, etc.

Chemistry's rich history is a testament of human curiosity, ingenuity and perseverance. From ancient alchemy to modern materials science, chemistry has evolved, adapting to new discoveries, technologies and societal needs.

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CARBON NANOMATERIALS

INTRODUCTION:-

For carbon chemistry and technology, Carbon nanomaterials define as those materials whose structural elements like molecules, clusters have dimensions in the range of 1/100nm. All allotropic modifications of carbon are formed on the nanometer-scale independently of the method of their synthesis. These carbon nanomaterials play an important role in nanoscale science and technology and are thus describe in some depth. The discovery of fullerenes has stimulated further research and humanity has concentrated considerable attention to the nanoscale world. With their appearance the terms "nanoparticles", "nano chemistry", "nanotechnology", etc. have come into wide use.

TYPES OF CARBON NANOMATERIALS: -

- Fullerenes:Spherical molecules composed entirely of carbon atoms arranged in hollow structure, resembling a soccer ball. They have unique optical and electronic properties.
- Carbon nanotubes (CNTs):Cylindrical tubes made of carbon atoms with exceptional mechanical strength, electrical conductivity and thermal conductivity.
- Carbon nanofibers: Fibrous structures with diameters in the nanometer range, used to reinforce composite materials and enhance their mechanical properties.
- Graphene:A single layer of carbon atoms arranged in a two-dimensional honeycomb lattice. It exhibits remarkable electrical conductivity, mechanical strength and flexibility.
- Carbon Quantum Dots:Nanoscale carbon particles with unique optical and electrical properties, making them suitable for applications in bioimaging and sensing.

APPLICATIONS OF CARBON NANOMATERIALS: -

- Electronics: Carbon nanomaterials are widely used in applications such as transistors, interconnects and sensors.
- Biomedical applications:CNMs serve as drug delivery systems, bioimaging agents, and components in tissue engineering due to their biocompatibility and functionalization potential.
- Environmental applications:They are used in water purification, air filtration, and act as a catalyst for environmental remediations processes.
- Energy storage:They are highly used for the performance of batteries and supercapacitor by improving charge storage capacity.

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CHEMISTRY GOES GREEN: THE PATH TO SUSTAINABILITY

SAMRIDDHAROY, SEM-4

WHAT IS GREEN CHEMISTRY?

Green chemistry is the design and development of chemical processes and products that reduce or eliminate the use and generation of hazardous substances. The primary goal of green chemistry is to promote sustainability by making industrial processes more efficient and environmentally friendly.

BACKGROUND:

It follows 12 principles, including waste prevention, atom economy, safer solvents, energy efficiency, and the use of renewable feedstocks. Unlike traditional chemistry, which often leads to pollution and resource depletion, green chemistry aims to create sustainable solutions for industries such as pharmaceuticals, agriculture, energy, and manufacturing.

GREENCHEMISTRYANDSUSTAINABILITY:

Sustainability, in the context of green chemistry, refers to the ability of human society to meet its current needs without compromising the ability of future generations to meet theirs. This includes reducing the use of non-renewable resources, minimizing waste generation, protecting ecosystems, and promoting social equity.

Green chemistry promotes sustainability in various ways:

1. Resource Efficiency: By focusing on atom economy and renewable feedstocks, green chemistryreducestheconsumptionoffiniteresourceslikefossilfuelsandminimizes

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Environmental degradation caused by resource extraction.

2. Waste Reduction: Many traditional chemical processes generate significant amounts of waste, including hazardous by-products. Green chemistry aims to design processes that produce little or no waste, which is a key component of sustainability.
3. Energy Efficiency: Green chemistry promotes energy-efficient chemical reactions that reduce the consumption of energy, lowering green house gas emissions and contributing to the fight against climate change.
4. Pollution Prevention: By using safer reagents and designing environmentally friendly chemical processes, green chemistry helps prevent pollution and reduces the harmful effects of chemicals on ecosystems and human health.
5. Circular Economy: Green chemistry supports the concept of a circular economy, where products and materials are reused, refurbished, and recycled, and reducing waste and Environmental impact. For example, green chemistry can be used to develop biodegradable plastics or recyclable materials.

Real-world Applications of Green Chemistry:

Green chemistry has already had a significant impact in various industries:

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- Pharmaceuticals: Green chemistry is widely used in pharmaceutical synthesis to reduce the use of toxic solvents, minimize waste, and improve the overall sustainability of drug manufacturing. Techniques like catalysis and solvent-free reactions are commonly employed to achieve these goals.

- Agriculture: Green chemistry is helping to develop sustainable pesticides and fertilizers that are less toxic to humans, animals, and the environment. Biodegradable pesticides andintegratedpestmanagementsystemsareexamplesofgreenchemistryapplications in agriculture.
- Energy: Green chemistry plays a crucial role in the development of cleaner energy technologies, such as biofuels and solar cells. Research into new catalysts and more efficient energy storage solutions is advancing the transition to renewable energy sources.
- Materials Science: The development of sustainable materials, including biodegradable plastics and recyclable composites, is another significant area where green chemistry is making strides. These materials help reduce plastic pollution and the consumption of non-renewable resources.

Challenges and the Future of Green Chemistry

Despite its potential, the wide spread adoption of green chemistry faces several challenges:

- Economic Barriers: Transitioning to greener processes can require significant investment in research and development, infrastructure, and retraining of workers. This initial cost can be a barrier for small and medium-sized enterprises.

- Regulatory and Policy Issues: Existing regulations may not always align with the principles of green chemistry. Governments must create policies that encourage the development and adoption of sustainable chemical practices, including incentives for research and innovation.
- Technological Limitations: While green chemistry has made great progress, many challenges remain in areas like developing more efficient and scalable processes, as well as overcoming the technical hurdles in the replacement of hazardous chemicals with safer alternatives.

CONCLUSION

Green chemistry is an essential driver of sustainability in the chemical industry. By focusing on environmentally friendly chemical processes, resource efficiency, and waste reduction, it offers significant potential to create a cleaner and more sustainable world. The continued support for green chemistry research, education, and policy development is vital to ensuring a healthier, more sustainable future for generations to come.

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- https://greenchemistryandcommerce.org
- https://www.nature.com/natsustain
- https://www.greenchemistryworld.com

WRITING BY STUDENTS

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BE THE EXCEPTION–JUST LIKE CHEMISTRY !!

Tania Shyam

Be the Exception—Just Like Chemistry!

Chemistry is a subject of colors, reactions, and transformations. Yet, many find it daunting due to its numerous exceptions. But what if we saw those exceptions not as obstacles, but as inspirations? In reality, **chemistry mirrors life**—it doesn't always follow rigid rules. Instead, it adapts, reacts, and sometimes even defies expectations.

Take elements and compounds, for instance. Noble gases were once believed to be completely inert, yet xenon defied expectations. Similarly, carbon's tetrahedral nature should prevent benzene's stability—yet resonance ensures its unique aromaticity. Just as chemistry challenges its own principles, **we too should question norms, innovate, and embrace change.**

History's greatest minds did just that. Marie Curie and Dmitri Mendeleev broke conventions, much like an unstable isotope undergoing spontaneous transformation. Even beyond science, athletes, artists, and entrepreneurs **act as catalysts—sparking change without being consumed by limitations.**

Every reaction in chemistry happens for a reason. Sometimes, overcoming challenges is like surpassing an activation energy barrier—difficult, but necessary for progress. Life is full of such hurdles, pushing us to adapt, evolve, and break barriers.

So, **be like chemistry**—embrace your vibrant potential, challenge the expected, and transform every obstacle into an opportunity for change.

THINK OUT OF THE BOX!!

WRITING BY STUDENTS

Sneha Moshan

Student of Semester-IV (UG Chemistry Honours)

CHEMICAL TOXICOLOGY

■ Unveiling The Silent Threats Of Modern Life

SNEHA MOSHAN
Semester –4th
BSc. Chemistry Honours.

(a)

Different experiments and notations related to Chemical Toxicity

(b)

Some Hazardoussymbols,use to aware usabout the harmful nature of the chemicals.

In today's modern world, we are constantly exposed to a variety of chemicals-many of which are essential for convenience, hygiene, and industrial progress. However, alongside their benefits, some chemicals pose potential risks to human health and the environment.

Chemical toxicology, the study of how chemicals affect living organisms, plays a crucial role in identifying and understanding these risks.

From the food we eat to the air we breathe and the products we use daily, toxic substances can silently accumulate in our bodies, leading to health issues such as hormonal imbalances, respiratory problems, and even chronic diseases like cancer. Chemicals found in plastics, cosmetics, household cleaners, and processed foods may seem harmless in small doses, but prolonged exposure can have significant long-term effects.

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In our busy modern world, we often overlook the invisible dangers lurking in our everyday lives. **Chemical toxicology**, the study of how chemicals affect living things, helps us understand these hidden threats. Let's explore how common chemicals in our environment can impact our health.

A. Hidden Chemicals in Daily Life

Our daily routines expose us to various chemicals that may harm our health over time:

1. Household Products: A Mix of Hidden Chemicals

Many everyday items contain substances that could be harmful:

- **Parabens and Phthalates:** Found in skincare and beauty products, these can interfere with our hormones.
- **Volatile Organic Compounds (VOCs):** Present in cleaning supplies, they can pollute indoor air.
- **PFAS ("Forever Chemicals"):** Used in nonstick cookware and waterproof fabrics, these persist in the environment and accumulate in

2. Processed Foods: More Than Just Empty Calories

The food we consume can also introduce harmful chemicals:

- **Artificial Preservatives:** Some, like BHA and BHT, have been linked to cancer risks.
- **Pesticides:** Non-organic produce may contain pesticides associated with neurological and reproductive issues. Recent studies have found that exposure to multiple pesticides significantly increases the risk of childhood cancers.
- **Food Packaging Chemicals:** Substances such as BPA can leach into food and disrupt our hormonal systems.

3. Environmental Toxins: The Air We Breathe and the Water We Drink

Our surroundings are filled with pollutants that silently affect us:

- **Micro plastics:** Tiny plastic particles have been detected in human blood and lungs, raising concerns about long-term health effects.
- **Heavy Metals:** Contaminants like lead and mercury in drinking water can impair brain development.
- **Air Pollution:** Emissions from industries and vehicles increase the risk of respiratory diseases and cancer.

B. The Impacts Of Toxic Chemicals On Our Health

Chemical toxicity occurs when a chemical substance causes harm or adverse effects to a living organism, often due to its corrosive, carcinogenic, or mutagenic properties. Exposure to toxic chemicals can happen through various routes, including inhalation, ingestion, or skin contact, and can lead to a range of health problems, from mild irritation to severe illness or even death.

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- **Cancer:** Many industrial chemicals are known to cause cancer.
- **Hormonal Disorders:** Chemicals like BPA mimic hormones, leading to fertility issues and metabolic disorders.
- **Nervous System Damage:** Pesticides and heavy metals have been linked to cognitive decline and developmental disorders in children.

C. Recent Research Highlights

D. How to Reduce Exposure?

- Use **BPA-free** and **phthalate-free** containers.
- Choose **Organic** or **Natural** cleaning products.
- Avoid processed foods with artificial additives.
- Ventilate your home to reduce indoor air pollution.
- Filter your water to remove contaminants.
- Opt for **fragrance-free** personal care products.

E. Conclusion:

" All Substances are poisonous , there is none , which is not a poison ", mainly the dose differentiates a poison and a remedy .

So, understandingChemical toxicology helps us recognize the hidden dangers in modern life. By staying informed, making mindful choices, supporting and following the safer regulations, we can protect ourselves and future generations as well as our environment from the silent threats that surrounding us.

ART BY STUDENTS

Kushal Pramanik

Student of Semester-VI (UG Chemistry Honours)

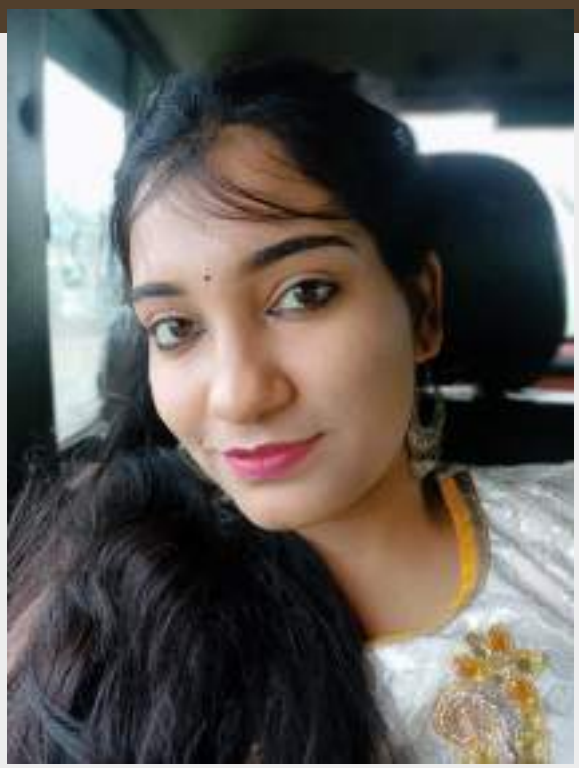
1. Madhubani art
2. Jute pencil pouch
3. Fridge magnet
4. Gone art
5. Umbrella art
6. Glass painting
7. Bottle art with mouldit

ART BY STUDENTS

Pratyasha Das
Student of
Semester-II (UG
Chemistry Honours)

Diya Chakraborty
Student of
Semester-II (UG
Chemistry Honours)

ART BY STUDENTS

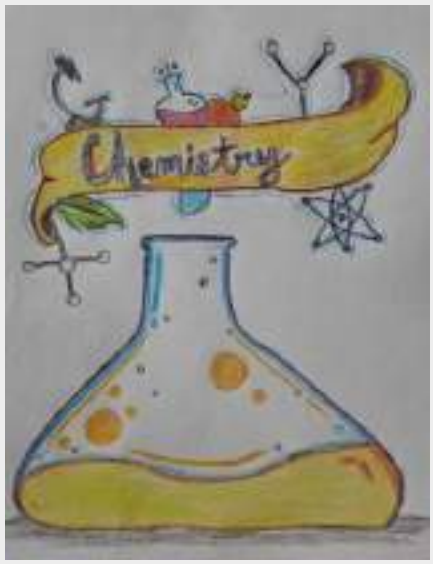


Riya Kar
Student of
Semester-II
(UG Chemistry)

ART BY STUDENTS

Soumili Chatterjee
Student of
Semester-II (UG
Chemistry Honours)

Debam Ghosh
Student of
Semester-IV
(UG Chemistry)



Rajdip Patra
Student of
Semester-VI (UG
Chemistry Honours)

ART BY STUDENTS

Kushal Pramanik

Student of Semester-VI (UG Chemistry Honours)

Painting name:
'"The watcher'
Medium:
oil on canvas

Painting name:
'The Neptune ??'
Medium:
oil on canvas

PARENT TEACHER MEETINGS

Regular Parent-Teacher Meetings are conducted to cater to the students' needs and issues

(February 12, 2025)

INTERDEPARTMENTAL ROAD ART COMPETITION

Participation of Students of Department of Chemistry in the Interdepartmental Road Art Competition (Prize won for BEST USE OF COLOURS)

(February 25, 2025)