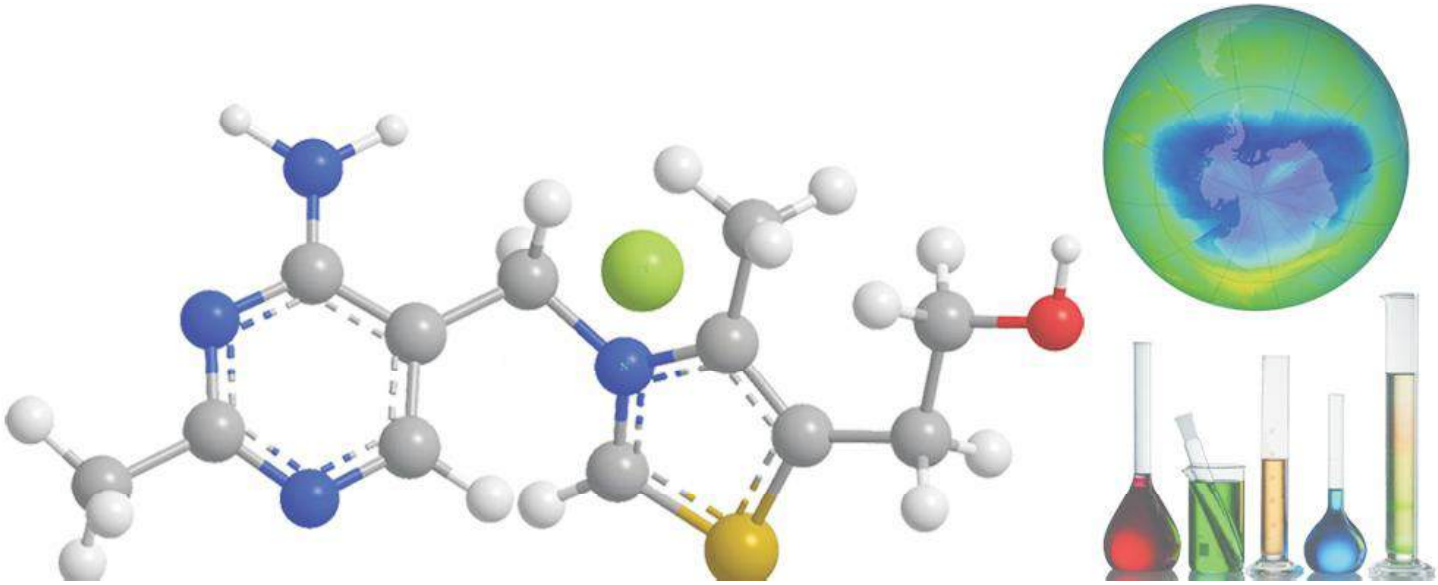
Climate Change
Research Institute

## Awareness and Capacity Building Workshop

# Chemistry and Environment

6th& 7th June 2019 at India International Center, New Delhi



## Activity Based Learning for Science Teachers in Schools

## World Environment Day 2019

# PROCEEDINGS

Organized by

**Climate Change Research Institute**

Jointly with

ROYAL SOCIETY OF CHEMISTRY

ओएनजीसी ONGC

INDIA INTERNATIONAL CENTRE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Jointly with

Royal Society of Chemistry, India Office

Oil & Natural Gas Corporation

India International Center

# Preface

The Workshop on Awareness and Capacity Building in 'Chemistry and Environment' as Activity Based Learning for Science Teachers in Schools was organized by the Climate Change Research Institute (CCRI) on June 6 & 7th, 2019 at India International Centre. The two days' Workshop on the occasion of World Environment Day was attended by Science Teachers from 14 schools in Delhi/NCR in addition to distinguished guests and invitees. The objective of the workshop was to train school teachers with various education models in the field of chemistry.

Due to interconnection between 'Chemistry and Environment', the environment day awareness workshop preceded the capacity building workshop conducted in association with The Royal Society of Chemistry, India office held in the Seminar Halls 2 & 3, India International Center. Chief Guest Dr. V. K. Garg, Ex- CMD, Power Finance Corporation Ltd. and Chairman JERC delivered the Inaugural Address. In the theme address Dr. MaltiGoel described role of Chemistry in causing environmental pollution as well as finding solutions for control of pollution in the context of ozone depleting refrigerants. Prof. G.D. Sharma, Former Secretary, UGC addressed the participants as Guest of Honor. Mrs. Maya Gupta, Director-Principal, Universal Public School delivered the Keynote Address.

The Institute recognizes the need for adopting new methodology to make science teaching more interesting in schools to attract them to opt for science in their future studies. It advocates for widespread learning about science & technology solutions to energy, environmental & climate change challenges through various educational campaigns, lectures, workshops and publications.

We are thankful to schools for nominating teachers and India International Center for excellent facilities for the workshop. We acknowledge generous support from Oil & Natural Gas Corporation and wholehearted cooperation from Delhi State Science Teachers Forum for making it a success. I end with a Quote from Henry Brooks Adams;

"*Teachers affect eternity, no one can tell where their influence stops*."

**Dr. (Mrs.) MaltiGoel**
Chief Executive and President
Climate Change Research Institute

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## Executive Summary

The Climate Change Research Institute (CCRI) in association with India International Center held a Teachers' Training Workshop for Activity Based Learning in Chemistry on June 6-7, 2019 to celebrate **World Environment Day 2019**. The workshop was conducted in collaboration with the Royal Society of Chemistry. In the Inaugural Session Chief Guest Dr. V.K. Garg, Ex- CMD, Power Finance Corporation Ltd and Chairman JERC said that future development of any nation is in the hands of teachers. He described environment concerns due to air pollution and importance of chemistry in our life and gave innovative ideas on how to mitigate plastic pollution. Dr. (Mrs.) Malti Goel, Chief Executive and President CCRI introduced the theme and said that chemicals produced from natural resources enhance our life in many ways, but their overuse is accompanied by environmental pollution as well as adverse health impacts. Knowledge about chemistry then helps to solve the environmental problems. She gave an example of 'ozone layer depletion' caused by certain chemicals as refrigerants. By 2030 more than 50% of world population will live in hot climates and would get exposed to frequent 'heat wave' events. India with a long term vision has launched Cooling Action Plan in 2018 and announced Global Cooling Prize is search of new chemicals as refrigerants so as to reduce demand for cooling energy. Guest of Honor on this day Prof. G.D. Sharma, Ex-Secretary UGC and Chairman SEED enlightened the participants about the need for changing the life styles to deal with the environment crisis due to climate change. He said education encourages people to use resources more efficiently. There is a need for everyone to learn how to recycle household waste. Mrs. Maya Gupta, Director-Principal Universal Public School in the keynote address giving examples from ancient Vedas provided insights about teachers' role in creating environment awareness among children.

This unique Workshop participated by teachers and mentors from different schools had a focus on enhancement of skills and knowledge in science teaching. Giving emphasis to

100% engagement through novel approaches, the resource person introduced activity based learning techniques such as; DART, use of Concept maps, Tarshia grids and Chemical reaction grids. Different playful tools were suggested like; Bingo, Word search, Ionic jigsaw and others for teaching chemical equations and topics like particle nature of matter so as to inspire school students to study science. 'Foldscope' - a low cost, paper microscope easy to assemble and designed to give optical quality similar to conventional microscope was demonstrated for detection of pollutants in air, water and soil. Teachers were urged to introduce it among children for monitoring of pollution data from their surroundings.

The active learning in science benefitted many teachers who felt that they could create magic in the classroom. '*Extremely interesting and useful*' noted some participants. The two day Workshop ended with distribution of certificates & mementoes and recommendations to hold more such programmes in future towards excellence in human resource development towards sustainability.

Institute's Bulletin '**Climate *SAR'*** on 'Climate Change and COP 24', vol. VI, no. 1, 2019 was released on this occasion.

# Awareness and Capacity Building Workshop on "Chemistry and Environment"

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## Activity Based Learning for Science Teachers in Schools on World Environment Day 2019

**6th& 7th June 2019 at India International Center, New Delhi**

*"Teachers need to be role models, inculcate moral values, inspire youth with value system and shape the students as nation builders. The way a teacher teaches in class, her dress up, knowledge all puts an impact on students. I was blessed with the best teachers in school and when I was studying in Class 5, one of my teachers give me a vision for my life. One day he was teaching about bird's flight and how birds create the lift and fly. He also explained how they change direction while flying. At that time I decided to opt for science after Class 10."*

- Dr. APJ Abdul Kalam, 2014

**Inaugural Address by the Chief Guest**

**Dr. V. K. Garg, Ex- CMD – Power Finance Corporation Ltd. and Chairman JERC**

1. The Inaugural address to the Workshop was delivered by Dr. V. K. Garg, Ex- CMD – Power Finance Corporation Ltd and Chairman JERC. He greeted participants, especially teachers coming from long distances to attend the workshop in 42$^{o}$C weather. Talking about the role and importance of teachers in life he said, a good teacher helps us to become good human being in the society and good citizen of the country. Teachers have great role in shaping students who are the future of a nation. Future development of any nation is in the hands of teachers. Teachers guide us through giving shape to society, today and tomorrow.

2. Giving an example of electricity generation, he said cost of fuel is the main factor in determining the cost of a unit of electricity. Only about 40 percent of the thermal energy in coal is converted to electricity. Coal based electricity systems are giving rise to increasing emission of $CO_2$ in the atmosphere resulting in a threat of global warming. In addition to $CO_2$ emissions, ash is generated and is getting accumulated in the ecosystem. With coal having 35% Ash, one unit of electricity produces about 0.3 kg of Ash. In the process of economic development consumption of energy is increasing for improving standards of living, for increasing urban/rural mobility and for growing industrial as well as agricultural products. We emit almost 20-21 billion tons of pollutant gases, whereas the nature can sustain 10-11 billion tons. By increasing pollution, we are depleting available oxygen in air we breathe.

3. Plastic is becoming an environment hazard, which is convenient to use but plastic waste releases harmful chemicals into the surrounding soil, which can then seep into groundwater or water sources like lakes & ponds. It gets shredded and goes into oceans, and this can cause serious harm not only to the species of marine life and also human societies. The chemical structure of most plastics renders them resistant to many natural processes of degradation and as a result they are slow to degrade. In the solid waste, plastic is the worst because it is easily available, light, capable of multiple uses, can handle liquids/wet products, but with its long life of hundreds of years it remains on earth for a longer period. The disposable plastic is therefore worst pollutant. We need to use less plastic, move towards environmentally sustainable products and services, and come up with technology that recycles plastic more efficiently.

4. He said chemistry is vital for life. Life is a chemical balance of different compounds and when this balance is disturbed, it can lead to sickness or even death. We take ventilator support, drips, injections and various other injections to pop-up the heart muscleor to pop-up the lungs or to pop-up the inert centers in the brain. These are all examples of regulating, balancing or accelerating the chemical reactions in the body.Entire science of bio-chemistry, molecular biology and biomedical technology aims to maintain and regulate chemical reactions of various parts of human body.

5. What teachers can do, is to inculcate fundamental awareness among the children about these concerns. The child needs to be taught even up to the secondary levels in schools, about what affects us every time the air we breathe, it is the pollution we breathe. Level of activity of mind, body, and our digestive system, the lungs, the heart, depends on oxygen which is, degraded by the pollution. How to minimize plastic pollution and maintain chemical balance in our system? He said when electricity is out for the 15 minutes we start looking for it why it is not there, if the phone is dead we get upset why the mobile is not working, but we know the deadliest enemy is travelling with us as air pollution, but we never look back because it doesn't affect me individually and immediately. This ignorance has lead us and brought us to this level where the environment is a casualty and is the least priority.

6. To fight and defend from pollution, we need to raise awareness among the students with opportunities to acquire the required knowledge, skills, attitudes, and values needed to protect, conserve and improve the environment for its present and future generations. I am happy that we are holding a Workshop with the theme 'Chemistry and Environment' on the World Environment Day. **He commended the Institute for bringing together School Teachers, who are our torch bearers for the society and the nation.**

## Theme Address - Why Chemistry and Environment?

**Dr. (Mrs.) MaltiGoel, Chief Executive and President, Climate Change Research Institute**

1. Dr. (Mrs.) Malti Goel, President, Climate Change Research Institute (CCRI)extended warm welcome to all the dignitaries, invitees and teachers who attended in large numbers, despite vacations. Environment is most fundamental to man in growth and development. It forms the basis of understanding many other concepts that evolve around it including sustainable development. What is the relation between chemistry and environment? With the thought of chemistry we think of chemicals which explode on reaction and of acid burns creating fires. But we forget that chemistry is everywhere.

3. Chemistry is vital because we are fully dependent on different chemicals as they form compounds having applications in all aspects of our life from toothpaste, lotions and soap to medicines for protection of health, clothes, dwelling and automobiles. It is indispensable in all human activities. Human body is a storehouse of chemicals. Foods we eat, water we drink are chemicals. Food inside the body gets converted to energy through chemical reactions. Chemistry, as science of substances and their transformations to new substances, grows incrementally and can lead to creation of new materials.

4. Theme 'Chemistry & Environment' is important since chemistry has an important role to play both in environment pollution and its control. Composition of all matter around us in the Nature i.e. air, water, rivers, oceans, rocks & minerals etc. can be understood from the study of chemistry and chemical reactions. At the same time production, processing and use of chemicals leads to environmental pollution in air, water and soil and health impacts.

There we can use Chemistry to solve the environmental problems such as air pollution, climate change, ozone depletion etc. and make correct use of chemicals.

5. Chemistry should be viewed as a scientific tool which could harness natural resources to enhance our lives in many ways. Knowledge about chemistry tells us about correct use of chemicals. Periodic Table describes very interesting journey of discovery of new chemical elements. In 1930s Chlorofluorocarbon (CFC)molecule was developed. This manmade chemical was nonreactive, non-toxic, and stable having unique properties. It was found good for refrigeration and its use started growing as we require refrigeration in our homes, industries, cars and in commercial buildings.

6. Ozone layer is found at the height of 25km. It is only 2-3mm thick and forms a thin blanket around earth in the Stratosphere. Ozone layer in the atmosphere doesn't allow harmful ultra violet radiation to reach the earth.The atmosphere extends up to 100 kms, it gets rarefied with height. Troposphere is the region extending up to 10 to16 kms, which is most suited for the living conditions and has the highest air density.

7. The Chloroflorocarbon is a greenhouse gases containing Chlorine, Fluorine and Carbon atoms; once in the atmosphere it remains there for a long time because of its non-reactive property. It drifts slowly upwards to the Stratosphere (~ 10 to 50 km above the Earth's surface), where CFCs are broken down by ultraviolet (UV) radiation from the Sun, releasing free chlorine atoms which destroy ozone molecules. First CFCs break, then chlorine from CFCs reacts with ozone. Chlorine oxide and oxygen are formed. Chlorine monoxide (ClO) reacts with oxygen atom, releasing the chlorine atom and forming an oxygen molecule ($O_2$).The chlorine atom attacks another ozone molecule ($O_3$). In this manner a chain of reactions occur causing ozone depletion.

8. In 1987 a global agreement was made as "Montreal Protocol on Substances that Deplete the Ozone Layer". The Protocol became an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion. Deadlines were given to all signatories to phase out gradually CFCs use by 2010 and new chemicals developed as refrigerants. New materials as Hydro-chloro-fluoro-carbons (HCFCs) and HFCs (Hydro-fluoro-carbons) were synthesized to have lower ozone depleting potential compared to CFCs.The HFCs have only 10% potential of ozone depletion, but later found to have global warming potential higher than CFCs. This has led to *Kigali Amendment to the Montreal Protocol*, under which countries promised to reduce the use of HFCs by more than 80% over the next 30 years.

9. India is one of the first countries in the world to develop a comprehensive Cooling Action plan which has a long-term vision to address the cooling requirement across the sectors and

lists out actions which can help reduce the refrigeration energy demand. All residential and commercial buildings, cold-chain, refrigeration, transport and industries have to work for its success.

10. To achieve these targets search for new refrigerants is on;$CO_2$ is one of the natural refrigerants. Ammonia and hydrocarbons such as propane & butane are other natural refrigerants. Use of carbon dioxide ($CO_2$) as a refrigerant was granted a British patent as early as in 1850. With its apt thermos-physical properties it was being used as refrigerant until 1940s. After the arrival of synthetic refrigerants CFCs its use had started waning. Currently the use of anthropogenic $CO_2$ captured from its point sources is being envisaged in future applications.

11. As an incentive to promote development of safe refrigerants and savings in energy costs; a **Global Cooling Prize** has been announced. Development of a residential cooling solution that will have at least five times less climate impact than in today's standard RAC units is targeted. It could prevent up to 100 gigatons (Gt) of $CO_2$-equivalent emissions by 2050 and mitigate up to 0.5˚C of global warming by 2100. It is too early to say whether we succeed in it or not, but already companies are competing for a Global Cooling Prize.

12. **The Royal Society of Chemistry, India office under 'Yusuf Hamied Inspirational Chemistry Programme' is associated in conducting highly accredited Teachers' Training Programme for next two days. The ONGC a Maharatna Energy Company, having international presence, is supporting this important workshop.**

## Remarks by Guest of Honor

**Prof. G. D. Sharma**
**Former Secretary, UGC**
**and Chairman, SEED**

1. Prof. G. D. Sharma Former Secretary, UGC in his address talked about the global warming and relationship between environment & human societies. The interaction between humans and environment can be understood in terms of (i) use of resources and (ii) production of waste. We are increasingly extracting natural resources from the Earth, which is causing problems of over-exploitation and waste generation. Cutting down forests to clear land for growing crops or building houses has led to severe environment degradation.

2. Awareness of what causes environmental hazards is necessary. The education for reducing waste and environment degradation is important. Giving an example of plastics use, he said plastic waste is non-degradable and non-convertible. It gets into a marine life and get recycled into human system and creates number of serious implications and diseases.

3. He also highlighted few aspects of renewable and non- renewable sources of energy. The sources of energy have been constantly changing from animal to bullock carts to engines& automobiles requiring fossil fuels. Technology has its own advantage for development and is helping to address different problems as well as causing disadvantages. New technology improves quality of life for human beings and as a side effect it makes it complex and can have a negative effect on the environment. As we go to the new sources of energy for electricity such as solar & wind, our development process starts changing in a big way.He said if you protect the environment; the environment protects you and highlighted the

example of *Bishnoi* community of Jodhpur, who is famous for protection of trees and animals.

4. He also cited examples from other countries and shared how South Korea and France do waste management and have adopted recycling processes in a big way. We must have the Reuse, Recycle and Recover mantra for all the products, which are polluting the environment. Education encourages people to use resources more efficiently and recycle household waste. By increasing awareness, education can encourage people to reduce their impact on the environment through more efficient use of resources, especially in areas of resource scarcity.

5. **He praised the theme of the Workshop and said this is a very aptly chosen topic as Chemistry and Environment and complimented the organizers**.

## Keynote Address


**Mrs. Maya Gupta, Director-Principal, Universal Public School, PreetVihar, New Delhi**

1. Mrs. Maya Gupta, Director-Principal, Universal Public School, Delhi NCR in her Keynote address shared her views on the World Environment Day theme Beat - Air Pollution. She said environment is everything that is around us, living or nonliving organisms, including physical, chemical and other natural forces which have direct or indirect impact on us. They provide conditions for development and growth as well as for risks and damage. The main purpose of Environment day campaign is to promote the understating of importance of environment issues, encouraging worldwide awareness and action for the protection from environment degradation.

2. Mrs. Gupta said *five basic elements* in ancient Indian and Greek philosophy are; Earth, Water, Air, Fire, and Ether (Space). These are responsible for maintaining requisite balance in the functioning of the nature and complexity of all matter. Knowledge of five elements or Deities allows a yogi to understand the laws of nature and to use yoga to attain greater health, power, knowledge, wisdom and happiness.

3. Our ancient Vedas, have several references on environmental protection, ecological balance, weather cycles, rainfall phenomena, hydrological cycle, that directly indicate the high level of awareness among people of that time. Natural factors or indiscrete human activities could result in imbalance of Seasons; Rainfall pattern; Crops; Atmosphere; and Water bodies. *Havan* and *Gayatri mantra* have very significant roles in the improvement of environment. Sound of chanting of *Mantras* and *Shlokas* are blended together to achieve the desired physical, psychological and spiritual benefits.

4. *Yagya* or *Hawan* is the most simple and effective way to tap the unlimited power of nature and to purify the atmosphere of poisonous gases. The research in Japan found that the *Aarti* performed in temples has positive effect in the 1km area, so that no diseases will spread. Ancient rituals are very important and should be adopted in this era to certain extent. Yoga creates a pure nutritional and medicinal atmosphere. Nature and religion have a big association to respect and upgrade the environment.

5. Mrs. Gupta also reminded the audience about the last year theme of World Environment Day, *Beating Plastic Pollution*. Plastic excessive use has put the world under threat. To, save the planet there is need by living wisely close to nature and taking the actions to stop the plastic waste. We should avoid use of non-recyclable materials. Teachers have a role in sensitizing students about of it and consequences of using plastic and other materials. We should adopt 3'Rs concept is Reduce, Reuse and Recycle. Environment is everyone's responsibility. Government as policy maker, Parents as role model and first educator, and the Educational institutions. Teacher therefore have very important role.

6. She also suggested teachers to guide students on simple ways to protect the Environment. *Hawa aane de* campaign for raising air pollution awareness suggests open your windows & let the fresh air come. We need to conserve the resources too by simply our future generation using our natural resources wisely and not wasting them.

## Introduction to Teachers' Workshop

**Mrs. Vimala Oak, Resource Person, Royal Society of Chemistry, India Office**

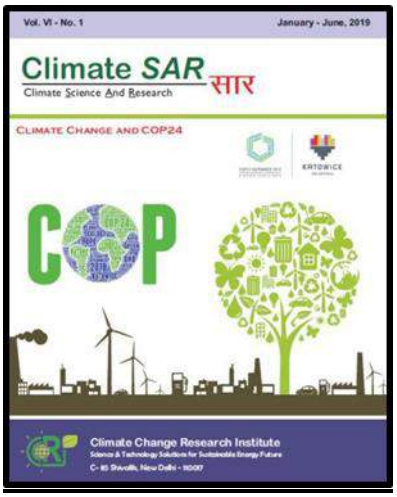
1. Resource Person, Royal Society of Chemistry (RSC), India office, Mrs. Vimala Oak said that the deliberations in the Inaugural Session of the Workshop on the entire concept on environment protection and role of chemistry are very helpful. The RSC has introduced activity based learning matching with the schools syllabus and the focus of the workshop is not chemistry alone, but science as a whole. With the help of our group of students, we are monitoring teaching and pedagogy work carried out together.

2. Mrs. Oak shared and experience of Sholapur and said that people collected water from shallow little ponds and water became a commodity. Then the idea of Water Bank came and they joined together. They could conserve water and grow greenery as well. People's unity makes way to water harvesting gainfully. With the initiative through community work and awareness it helped to reduce the temperature of the surroundings because of growing trees.

3. The objective of the workshop is to expose the school teachers with various activity based learning education models developed under 'Yusuf Hamied Inspirational Chemistry programme'. Teachers can apply these techniques in their lessons. There are three workshops including minor experiments to be conducted in a two days event. It will make learning Science interesting and meaningful. RSC resource material was distributed to the registered participants.

## Release of Bulletin Climate SAR on 'Climate Change and COP 24' Vol. VI, No. 1, 2019

*The Bulletin of Climate Change Research Institute was released. The Climate SAR bulletin on 'Climate Change and COP24' is information dissemination. The Vol. VI, no.1 has a focus on the 24th Session of the Conference of Parties (COP 24) to the UNFCCC. Highlights of the meeting held at Katowice, Poland from December 3-14, 2018 are presented. The main task of COP 24 was to finalize 'Rulebook' for implementation of Paris Agreement on Climate Change. This included guidelines on how governments will measure, report and verify their NDC's targets to limit global warming to 2°C and possibly, even 1.5°C.*




### Presentation of Mementoes

The Mementos were presented to the Guest Speakers on behalf of the CCRI;

- Dr. V. K. Garg, Ex- CMD – Power Finance Corporation Ltd and Chairman JERC
- Prof. G. D. Sharma, Ex-Secretary, UGC and Chairman SEED
- Mrs. Maya Gupta, Director-Principal, Universal Public School, Delhi NCR
- Mrs. Vimala Oak, RSC Resource Person

## Activity Based Training Workshop for Science Teachers in Schools

The Inauguration was followed by the Teachers Training Workshop. Three main workshops are; *Moving Towards Active Learning & Modeling Active Approaches, Chemical Reactions & Equation (2 & 3) and The Particle Nature of Matter.*

## WORKSHOP 1: MOVING TOWARDS ACTIVE LEARNING AND MODELING ACTIVE APPROACHES

During the first workshop *(Towards active learning)*, teachers were introduced to the concept of active learning, new techniques and ways to plan a lesson around active learning. All participants are made into random groups of six members each and carried out the different activities.

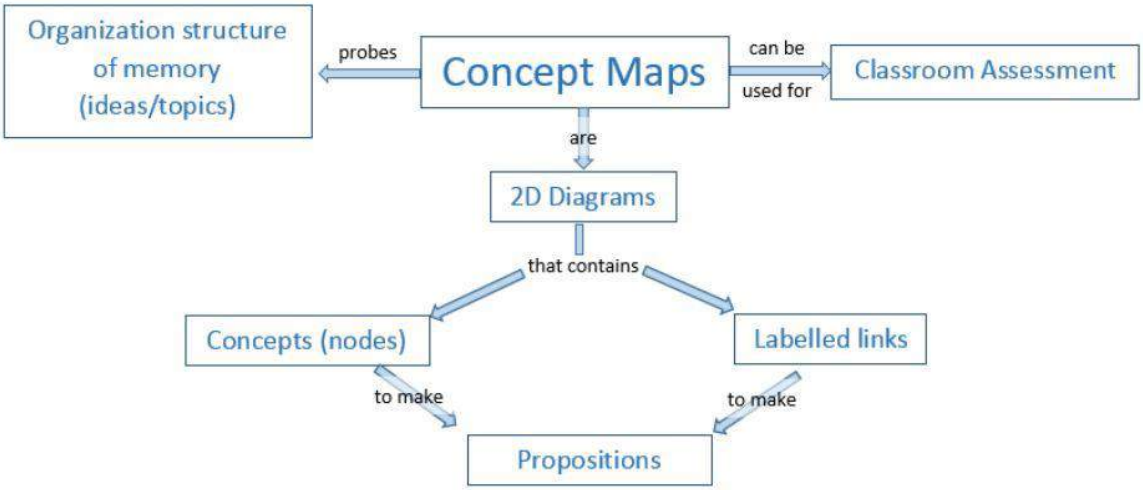
- **DART** (Directed activities related to texts) which can be grouped into three main categories i.e. (i) reconstruction activities, (ii) analysis activities and (iii) text restructuring. The reconstruction activities use modified text. Original text is often organized and then given to pupils in segments or as sections of text with gaps. Whereas analysis activities use unmodified text and pupils select information from the text and then represent in a different form. This type of activity helps pupils develop their analytical skills. In text restructuring activity, it involves reading a text and then restructuring the information in another format, such as a Concept Map, or rewriting in another style. This is really helpful for teaching students about ways of writing notes. Some examples of Chemistry such as;

  - the extraction of iron from its ore
  - reaction of alkali metals with water
  - separation of substance
  - synthetic materials

  were demonstrated through videos to explain the concept of DART

- **Concept Maps**, are very useful as they show how concept or key ideas can be linked together both within a topic and across related topics. A concept map is a

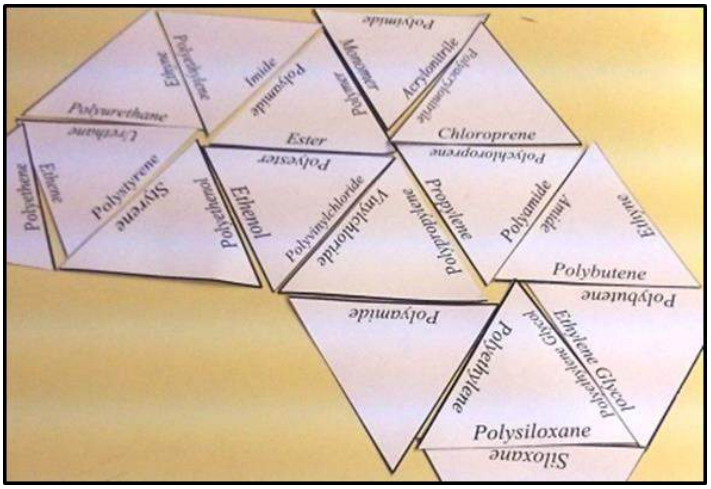
visualization of knowledge that is organized by the relationships between the topics. At its core, it is made of concepts that are connected together by lines (or arrows) that are la-belled with the relationship between the concepts. The concepts are usually found in circles or boxes.




Methodology of Concept Maps

Concept maps are a cross disciplinary active learning technique that help students manage concepts into sub-concepts, synthesize information, see a larger picture and develop higher-order thinking skills and strategies. Concept maps can summarize a part of a book, connect historical events, describe how a business is run, develop a personal care plan or patient treatment, describe how the body works. Concept map can be used as a pre-class assignment, small group activity, whole class activity or a way to summarize the information at the end of a class or project. Instead of reading explanations to students, Maps provide a way to quickly grasp through students thinking process and held in understanding of concepts better.

**Tarsia Puzzle** is made up of a series of paired statement or question and answer or key word and definition that appear to be randomly arranged on a series of geometric tiles example triangles. To solve the puzzle, we need to do is to correctly match up the pairs. As the pairs are correctly matched up one by one, a larger tiled pattern emerges. Tarsia puzzle are fun to do and generally students find them much more engaging than simply working through a series of questions in an interesting way. It also helps to develop their thinking skills as they work through problems. They are particularly useful for doing revision as all the statements provided are correct.




Tarsia Puzzle

- **Card Sorting** provides students with the opportunity to work with key words, terms and concepts. The idea is that the students sort the cards into different categories either defined by the teacher or themselves. Card sorting promotes group work by providing a structure for students to talk in a meaningful way and with one another about the content. It also helps teachers to informally assess their understanding by asking individual groups to justify their card sorting decision. There are several different types of card sort, ranging from matching exercise to Follow-me loop games and Dominos. Card sorting, can be easily produced using the 'Formulator Tarsia' software available from Hermitech Laboratory. This strategy gives students the opportunity to work with vocabulary, terms, and concepts. The group discussions help the participants to interact and share their knowledge with each other.

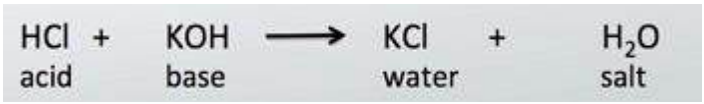
## WORKSHOP 2: CHEMICAL REACTIONS AND EQUATIONS

The second workshop was on Chemical Reactions & Equation and how to increase students confidence when dealing with chemical equations. This workshop build on the active learning strategies met in the earlier workshop by utilizing some of the techniques previously met and introducing a few new ones. The active learning approaches used in this workshop are designed to examine students' current understanding of chemicals reaction and to help them become more confident in their use of chemical formulae and writing balanced chemical equation. This increase in confidence will undoubtedly lead to students making faster and deeper progress in chemistry. Videos are valuable educational resource as they contain lots of pictorial information, often portrayed in an interesting way. They can help students to learn by seeing things they cannot experience in the classroom.

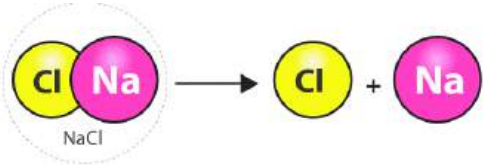
Teachers performed using micro techniques of reactions i.e. decomposition reaction, double displacement reaction, neutralization reaction, iron extraction etc.

- *Displacement reaction* is a chemical reaction in which a more reactive element displaces a less reactive element from its compound.


- *Neutralization* is a chemical reaction in which an acid and a base react quantitatively with each other.




- *Decomposition* reaction is a type of chemical reaction in which a single compound breaks down into two or more elements or new compounds.




- *Double displacement* reaction, is a type of chemical reaction where two compounds react, and the positive ions (cation) and the negative ions (anion) of the two reactants switch places, forming two new compounds or products.


Use of Fun Methods like **Connect Four** and **Bingo** were explained to understanding chemical reactions. Bingo is an incredibly fun game to play in groups, and can help rehearse anything from chemistry or chemical reactions.

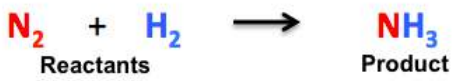
- **Word search** activities in chemistry lessons are fun to do and can help students to both recognize and spell long chemicals names. The example activity included in this workshop is a chemical reactions word search in which the students look for the hidden chemicals words within a letter based grid. The words may be made up from letters that are in either a horizontal, vertical or diagonal line.

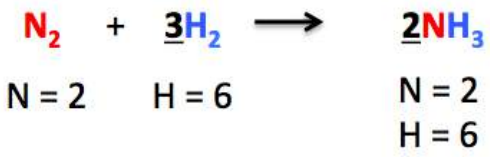
In **Word Equation** activity, students work individually, reading and interpreting text by looking for patterns. It involves an opportunity for students to;

- Use words and equations to describe reactions;
- Use patterns in reactions to make predictions about other reactions;
- Represent chemical reactions by word equations.

❖ **Balancing of Chemical equation**, has a equation having the same number of atoms of elements involved in a reaction in both products and reactant A chemical equation has the substances that react (reactants) and the substances that are produced (products). In general, a chemical equation looks like this:

**Reactants → Products**




The balancing of an equation helps in understanding the reaction and gives knowledge of atomic composition of products.

## WORKSHOP 3: THE PARTICLE NATURE OF MATTER

The theme of third workshop was to explain *the particle nature of matter in solids liquids & gaseous forms.* It explained with examples;

- Matter is made up of discrete particle
- Bonds or forces exist between particles and explain how particles move
- Particles are in constant random motion
- How the space between particles is filled?
- How compressible are solids, liquids and gases?
- What happens when substances dissolve?
- How does precipitation take place?
- Melting, freezing, evaporation and diffusion in liquids.

Computer simulations and animations act as very powerful leaning tools in the class room and offer visual representation of abstract ideas. Particles in motion resources help visualize how particles are arranged and behave;

- In the solid state

- In the liquid state
- In the gaseous state
- During a range of changes in State
- During a range of key chemical processes

**Demonstration of Foldscope**

'Foldscope' - a low cost, paper microscope easy to assemble and designed to give optical quality similar to conventional microscope was demonstrated for detection of pollutants in air, water and soil. Its use in detection of pollutant particles was demonstrated. Teachers were urged to introduce it among children for monitoring of pollution from their surroundings and create long term data, which could help in developing pollution control guidelines in the long run.

## Closing Remarks by Dr. Mrs. Malti Goel

Dr. Mrs. Malti Goel congratulated the participants who completed two days activity based learning and thanked Ms. Bhakti and Ms. Vimala Oak, Royal Society of Chemistry for effectively coordinating this training. She said there should be more such programmes to highlight importance of teaching methods especially in the context of sustainability. According to a UNESCO stud, the course content in most Asian countries are designed for economic development and not for sustainable development.

It is hoped that skills acquired from this program are adequate to enable participants successfully carry out changes in teaching methods, which would require further commitment and some force. This workshop included a set of accompanying practical activities which can be carried out in either a laboratory or a normal classroom. These experiments will help the teachers to create good impact on the students towards chemistry. Evidently, the active learning workshop is benefited teachers who felt they could create magic in the classrooms. The workshop has provided an opportunity with an opportunity for every teacher to plan what he/she would do next apart from the above mentioned resource material and techniques.

Dr. Malti Goel thanked the honoured guests who had taken time from their busy schedule for the Inauguration and made some of the prospective viewpoint about the Environment. Thanks are due to Schools' Authorities for nomination of teachers during summer holidays, the CCRI staff for their hard work and to IIC for excellent facilities. The two days training workshop was ended with distribution of certificates to the participating teachers.

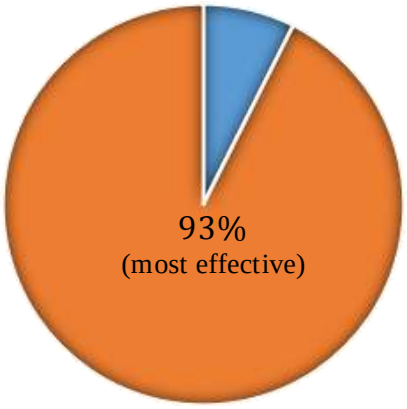
Annexure 1

# Feedback to the Workshop by School Teachers

- The World Environment Day awareness programme and two days' Yusuf Hamied Inspirational Chemistry Workshop were attended by forty teachers. The attendance consisted of a mix of researchers, teachers, and principals. A sample Feedback form about the Workshop was circulated among the teachers. Twenty seven evaluation forms were collected at the end of the workshop. The objective of the workshop is to train the school teachers with various education models in the field of chemistry.

## I. Summary Findings

***93% of participants found the Workshop most effective, well-structured, comprehensive, rich in content and useful for activity based learning***




- All the participants agreed that, the programme on World Environment Day 2019 was interesting.
- All the participants would like to attend such awareness workshops in the future.
- 70% of the participants strongly agreed to the content of the course, was easy to follow. The remaining 30% of the participants thought more practical related activities should be included in the content of the course.

- Most of the participants said that, they will use given materials for design their own activities on different topics for teaching purpose.
- Most of the participants agreed with objectives of the workshop, which were clearly defined.
- 90% of participants strongly agreed with material distributed were helpful for teaching purpose.
- Most of the participants suggested that, demonstration and hands on experiments should be included to make workshop more interesting.
- Some participants recommended that, more such workshops should be organized and focused on environment related theme.
- Participants recommended including additional topics and more group and interactive sessions in future workshops.
- Most participants mentioned that they would recommend the workshop to their colleagues and recommended that more such training workshops should be organized.
- The arrangements of the workshop, food and catering services were highly appreciated by all the participants.

## II. Individual Feedback

**1. Have your expectation met? Please explain.**

- Yes, we all know the content, but how to make it interesting through various activities, easily conducted and prepared learnt from the workshop.
- Yes, because in this workshop, I have learnt different strategies of active learning.
- Yes, I learnt how I can engage every students of class in our topic and inspire them.
- Yes, Lots of activities and experiments was nicely explained and will help me to take the topic more effectively in my classrooms.

**2. Did you find the Experiments interesting? Please explain.**

- Yes, Interesting and can be easily implemented in the class at low price
- Yes, the DART activity was awesome that can be introduced in the class room.
- Yes, new methods for making the students understand and learn the chemical equations and reaction easily.
- Yes, the activities especially related with fold-scope were quite interesting.

**3. What did you like most about this training?**

- Interactive lectures with good material
- How to motivate and make the subjects matter as interesting as possible to the students.

- The way trainer interact, it is not only lecture, but learning by doing, that can be remembered for longer time.
- Innovative method of teaching which facilitate the teachers to ensure continuous involvement of students in the class.
- Active learning methods like concept map, show me board, DART and card sorting.

**4. How do you apply these teachings in your School?**

- Through class room activities and students participation.
- Will apply all the active learning methods and create scientific attitude in students.
- Will use given materials for design own activities on different topics for teaching

**5. What are your suggestions for further Workshops?**

- Some demonstration and hands on experiments should be included to make workshop more interesting.
- More practical activities should be conducted especially at micro-scale Practicals.
- The workshop should be more focused on environment as sometimes it seems lacking of theme.
- Little more visuals aid and ICT related activities should be there for future workshop.
- Further workshop should include some activities and Practicals at senior secondary level.

**Representative Schools in the Activity Based Learning for Science Teachers and Awareness Workshop on World Environment Day**

1. Army Public School, Shankar Vihar, New Delhi
2. Birla Vidya Niketan, PushpVihar, Sector – IV, New Delhi
3. Delhi Police Public School, Safdarjung Enclave, New Delhi
4. Kamal Model School, Mohan Garden, New Delhi
5. Lal Bahadur Shastri School, Gopal Prasad Shastri Marg, Sec-III, R.K. Puram, New Delhi
6. Mount Abu School, Rohini, Delhi
7. Mata Sukhdevi Public School, National Highway 1, Nangli Poona, New Delhi
8. GSKV, Laxmi Nagar, Laxmi Nagar, Delhi
9. Sadhu Vaswani International School, Shanty Niketan, New Delhi
10. ITL Public School, Sector -9 Dwarka, New Delhi
11. Universal Public school, A Block, PreetVihar, New Delhi
12. N. P.CoEd. Sr. Sec. School, Laxmi Bai Nagar, New Delhi
13. Yuva Shakti Model School, Rohini, Sector 3, Delhi
14. Mount Carmel School, Sector 22, Dwarka, New Delhi

**India International Centre &**

**Climate Change Research Institute**

**Awareness and Capacity Building Workshop on**

# World Environment Day 2019

*Theme: 'Chemistry and Environment'*

## Activity Based Learning in Schools - Teachers' Training Workshop

**In collaboration with**

**RSC-Bengaluru, ONGC- Dehradun, DSSTF- Delhi**

**June 6-7, 2019**

PROGRAMME

**6th June 2019**

| | |
|---|---|
| 09:30-10:00 Hrs. | **Registration** |
| 10:00-11:15 Hrs. | **INAUGURAL SESSION** |
| 11:15-11:30 Hrs | Tea |
| 11:30-13:40 Hrs. | **WORKSHOP 1 -Moving Towards Active Learning** |
| 13:40-14:40 Hrs. | Lunch Break |
| 14:40-16:30 Hrs. | **WORKSHOP 1(CONT.)- Modeling Active Approaches** |
| 16:30-17:00 Hrs. | Using videos in Chemistry Lessons |
| 17:00 Hrs. | Tea |

**7th June 2019**

| | |
|---|---|
| 09:30-10:00 Hrs. | **Registration** |
| 10:00-11:20 Hrs. | **WORKSHOP 2 - Chemical Reactions & Equation (2 & 3)** |
| 11:20-11:35 Hrs. | Tea |
| 11:35-13:05 Hrs. | **Practical Session** |
| 13:05-14:00 Hrs. | Lunch Break |
| 14:00-16:45 Hrs. | **WORKSHOP 3 - The Particle Nature of Matter** |
| 16:45-17:00 Hrs. | Closing Remarks |
| 17:00 Hrs. | Tea |

Annexure 2

## Climate Change Research Institute

6th & 7th June 2019 at India International Center, New Delhi

## List of Participants

| Sr. No. | Name | Designation/Organization |
|---|---|---|
| 1. | Sh. D. A. Misra | Principal (Retd.) Directorate of Education, Delhi |
| 2. | Dr (Mrs.) Malti Goel | President, Climate Change Research Institute |
| 3. | Sh. Neeraj Gupta | Climate Change Research Institute |
| 4. | Dr. G.D. Sharma | SEED- Science for Equity Empowerment and Development |
| 5. | Justice P.S. Narayana | Former Judge, High Court of Andhra Pradesh |
| 6. | Sh. P.N. Varshney | Executive Chairman, Delhi State Science Teachers' Forum |
| 7. | Dr. Anjana Sen | Independent Consultant |
| 8. | Sh. Gautam Sen | Ex-Vice President, Reliance |
| 9. | Sh. V.S. Verma | Member, Central Electricity Regulatory Commission |
| 10. | Sh. L. K. Bansal | Climate Change Research Institute |
| 11. | Dr. V. K. Garg | Ex- CMD – Power Finance Corporation Ltd. |
| 12. | Dr. Anil Vashistha | Deputy Director of Edv. (Rtd) GN Delhi |
| 13. | Mrs. Geeta Rajan | Advisor IIPP |
| 14. | Sh. K. D. Pandey | Shanti Ideal Convent Jain Vihar |
| 15. | Ms. Maya Gupta | Principal, Universal Public School |
| 16. | Ms. SangeetaAggarwal | Universal Public School |
| 17. | Mrs. Vimla Oak | Teacher Developer, Royal Society of Chemistry, Bengaluru |
| 18. | Ms. Anjali Kakkar | Teacher, Army Public School |
| 19. | Ms. AnkitaRana | Teacher, Army Public School |
| 20. | Ms. Sheetal Sharma | Teacher, Army Public School |
| 21. | Mr. Harish Rautela | Teacher, Birla VidyaNiketan |

| | | |
|---|---|---|
| 22. | Ms. Deepika Seth | Teacher, Delhi Police Public School |
| 23. | MsNitu Singh | Teacher, Guru Nanak GaribNiwaj Education School |
| 24. | Ms Kiran Bhatt | Teacher, Guru Nanak Education Society |
| 25. | Dr. Vaishali Mishra | Teacher, ITL Public School |
| 26. | Mrs. Seema Manocha | Teacher, Kamal Model Sr. Sec. School |
| 27. | Ms. Swati Gautam | Teacher, Kamal Model Sr. Sec. School |
| 28. | Mr. KuldeepVerma | Teacher, Kamal Model Sr. Sec. School |
| 29. | Mr. AmitPandey | Teacher, Kamal Model Sr. Sec. School |
| 30. | Ms. VineetaRai | Teacher, LalBahadurShastri School |
| 31. | Ms. ShailjaGusain | Teacher, LalBahadurShastri School |
| 32. | Ms. Kanchan Bhatt | Teacher, LalBahadurShastri School |
| 33. | Ms. PrabhaDhaundiyal | Teacher, LalBahadurShastri School |
| 34. | Ms. Aakriti Sharma | Teacher, LalBahadurShastri School |
| 35. | Ms. ShumailaBano | Teacher, Mata Sukhdevi Public School |
| 36. | Ms. Nivedita | Teacher, Mata Sukhdevi Public School |
| 37. | Ms. GulshanChauhan | Teacher, Mata Sukhdevi Public School |
| 38. | Ms. Bobby Gupta | Teacher, Mount Carmel School |
| 39. | Mrs. MeenakshiMalhari | Teacher, GSKV, Laxmi Nagar |
| 40. | Ms. AnjuGoyal | Teacher, Universal Public school |
| 41. | Ms. Arti Bhatia | Teacher, Universal Public school |
| 42. | Mrs. KiranManglik | Principal, N P CoEd. Sr. Sec. School |
| 43. | Ms. ShrutiKhandelwal | Teacher, Yuva Shakti Model School |
| 44. | Ms. SonaliVerma | Teacher, Mentor Teacher GGSSS, R. Nagar |
| 45. | Ms. PragyaKiran | Teacher, Mentor Teacher DoE (Directorate of Edu.) |
| 46. | Mr. Aditya Sharma | Climate Change Research Institute |
| 47. | Mohammad Abrar | Climate Change Research Institute |
| 48. | Mr. Alok Kumar | Climate Change Research Institute |
| 49. | Mr. Sunil Kumar | Climate Change Research Institute |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## Vision & Mission

To become a Centre for Excellence in developing human resources and technical capacity building in the area of climate change adaptation and mitigation

## Organizers

Climate Change Research Institute is founded with a mission to promote environment education, innovation and teachings. It aims to address wide strata of society about the consequences of climate change on our lives and taking control measures. Institute is taking initiative to create awareness on energy security and sustainability through lectures in schools and college, workshops and internet reach. Its future work plan would include development of educational tools on topics of scientific and societal interest; such as energy, health and water in the climate change context. Research and studies would be undertaken on science & technology measures aimed at climate change mitigation and ways of reducing the emission of $Co_2$.

For further information: CEO, Climate Change Research Institute, C-85 Shivalik, New Delhi-110017,
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