

Training Programme in Biology, Physics and Chemistry for Higher Secondary Teachers from Kerala State

7th to 19th January 1991

A REPORT



Regional College of Education, Mysore - 570 006

(National Council of Educational Research & Training, New Delhi - 110016)

1991

TRAINING PROGRAMME IN BIOLOGY, PHYSICS AND CHEMISTRY FOR HIGHER SECONDARY TEACHERS FROM KERALA STATE

7 - 19 TH JANUARY 1991

Three training programmes were conducted in the Regional College of Education, Mysore for 13 days each during 7-19th January 1991, following a request made by the Department of General Education, Ministry of Education, Govt. of Kerala, Thiruvananthapuram vide Government Order No. GO/PS/No.138/90/G. Edn. dated 27.6.1990. The training programmes were mainly confined to the class XI course of the NCERT curriculum. The specific objective of these training programmes was the transaction of the class XI NCERT text books in physics, chemistry and biology. A similar training programme is to be conducted by the University of Kerala for class XII course as per the Sl.No.5 of the above referred Government order.

Participants

60 Higher Secondary Teachers from Kerala State, 16 in Zoology, 16 in Botany, 15 in Physics and 13 in Chemistry participated in the training programmes. The names and addresses of the participants are given in the Annexure I.

Academic Co-ordinators

The following faculty members of RCE, Mysore were the academic coordinators.

1. Dr.C.K.Ashok Kumar (Botany & Zoology)
2. Dr.R.Narayanan (Physics)
3. Dr.T.J.Vidyapathi (Chemistry)

Resource Persons

23 faculty members from Regional College of Education, Mysore, 6 in Biology, 7 in Physics, 10 in Chemistry and two resource persons from the Chemistry Department, University of Kerala, Kerala worked as resource persons in these training programmes. Two resource persons in each subject of Physics, Chemistry, Botany and Zoology were to be deputed by the University of Kerala as per Govt. of Kerala order dated 27.6.1990. However, except for 2 resource persons in the area of chemistry, no other resource persons from the University of Kerala attended these training programmes. The names and addresses of the resource persons are given in the Annexure II.

Laboratory and Supporting facilities

All the laboratory staff and the office staff of the Department of Science and extension services were involved in these training programmes.

Laboratory and Library Facilities

Laboratory facilities including supply of chemicals, consumables and library facilities including photo copies were provided to the participants.


Financial Grants

The Regional College of Education spent Rs.14,444.65 for the purchase of chemicals, consumables required for conducting the practicals/activities, stationery items, photo-copying charges and refreshment for the participants. TA/DA to 60 participants and 2 resource persons from the University of Kerala were to be paid by the Govt. of Kerala. However, TA/DA were not paid at Mysore during these training programmes.

Report

The detailed report regarding the academic part of the programmes in biology, physics and chemistry are enclosed in the annexures III, IV & V. The academic report deals with the topics covered, lecture cum discussion sessions, laboratory sessions, demonstration experiments, film screened, guest lectures, supplementary reading materials for participants and time-table.

Date : 30th March 1991


(A.C. Banerjee)
Professor of Chemistry &
Head, Dept. of Science

ANNEXURE I

LIST OF PARTICIPANTS

Physics

Sriyuths

1. K.P.Kunhi Kelu Nair
Teacher
Govt. Higher Secondary School
Kamballur, Chirupuzha
Kasargod District
2. Aleyamma P. J.
Teacher
Govt. Higher Secondary School
East Hill
Calicut
3. Mary Devasia
Teacher
Govt. Higher Secondary School
Peralasseri, Mundalur P.O.
Kannur District
4. Sosamma Philipose
Teacher
Govt. Higher Secondary School
Kalavoor
Alleppey
5. S.Sushama
Teacher
Govt. Higher Secondary School
Neyyattinkara
Trivandrum District
6. Leelamma Varghese
Teacher
Govt. Higher Secondary School
Chittar, Pathanamthitta District
7. A. Anny
Teacher
Govt. Higher Secondary School
Kodungallur

8. C.S.Sreekumari Amma
Teacher
Govt. Higher Secondary School
K.Puram (P.O) Tarur
Malappuram District
9. K.Radha Moni Amma
Teacher
Govt. Higher Secondary School
Kuzhymathycadu
Kottarakkara
10. M.N.Suseela
Teacher
Govt. Higher Secondary School
Karapuzha
Kottayam
11. K.M.Annamma
Teacher
Govt. Higher Secondary School
North Paravoor
Ernakulam District
12. S.Indira Amma
Teacher
Govt. Higher Secondary School
Koduvayur
Palakkad District
13. I. Abraham Daniel
Teacher
Govt. Higher Secondary School
Thariyote, Kavumunnam P.O.
Kalpetta
Wayanad District
14. Abraham Daniel
Teacher
Govt. Higher Secondary School
Elakaman
Trivandrum District
15. K.V.Sumathi
Teacher
Govt. Higher Secondary School
Kunjithang
Idukki District

Chemistry

16. S.Sathiyan
Teacher
Govt. Higher Secondary School
Kamballur
Via Cherupuzha, Kannur
17. B.Mohandas
Teacher
Govt. Higher Secondary School
Kuzhimathieadu P.O.
Kollam District
18. N.S.Jemini
Teacher
Govt. Higher Secondary School
Perallassei, Kannur District
19. Annamma Joseph
Teacher
Govt. Higher Secondary School
Kalavoor, Alleppey
20. B.Kumari Ambika
Teacher
Govt. Higher Secondary School
Neyyahinkara
Thiruvananthapuram
21. S.Jaya
Teacher
Govt. Higher Secondary School
Elakaman, Palayamkunnu
Varkala
Trivandrum
22. Sathee Rani K.G.
Teacher
Govt. Higher Secondary School
Kodungallur
23. P.K.Syamala
Teacher
Devadhar Govt. Higher Sec.School
Tanur, K.Puram P.O.
Malappuram District
24. Jessikutty Joseph
Teacher
Govt. Higher Secondary School
Chittar, Pathanamthitta District

25. P.M.Kunjoonjamma
Teacher
Govt. Higher Secondary School
Kurapuzha
Kottayam
26. I.V.Umayamma
Teacher
Govt. Higher Secondary School
Pasavoor, Ernakulam District
27. A.Naushad
Teacher
Govt. Higher Secondary School
P.O. Kakkallur
Kozhikhode
28. V.Karunakaran
Teacher
Govt. Higher Secondary School
Koduvayur, Palghat District

Biology

29. K.M.Reetha
Teacher
Govt. Higher Secondary School
Peralasseri
P.O. Mundalur, Kannur District
30. K.Sulatha
Teacher
Govt. Higher Secondary School
East Hill, Kozhikhode District
31. D.Girija
Teacher
Govt. Higher Secondary School
East Hill, Calicut
32. I.J.Mary
Teacher
Govt. Higher Secondary School
Kakkallur, Kakkallur P.O.
Kozhikhode District
33. T.J.Marykutty
Teacher
Govt. Higher Secondary School
Kamballur

34. O.M.Sebanniza Beevi
Teacher
Govt. Higher Secondary School
Kamballur
35. C.Mabsy Thomas
Teacher
Govt. Higher Secondary School
Peralasseri
Kannur
36. K.G.Saraswathi Bai
Teacher
Govt. Higher Secondary School
Neyyattinkara P.O.
Thiruvananthapuram
37. T.K. Lilly
Teacher
Govt. Higher Secondary School
Neyyattinkara
Trivandrum
38. Jessy Susan Philip
Teacher
Govt. Higher Secondary School
Elakamon, Palayamkunnur
Varakala, Trivandrum
39. B.Saraswathi Amma
Teacher
Govt. Higher Secondary School
Kuzhimathicadu
Quilon District
40. M.S.Ameena Bhai
Teacher
Govt. Higher Secondary School
Kuzhimathicad, Kollam
41. Moniamma Scaria
Teacher
Govt. Higher Secondary School
Kadunqallur Tiruchur District
42. Sosamma Varghese
Teacher
Govt. Higher Secondary School
Chittar, Pathanamthitta District

43. alsom Samuel
Teacher
Govt. Higher Secondary School
Chittar, Pathanamthitta District
44. S.Ponnamma
Teacher
Devadar Govt. Higher Sec. School
Manur, K.Puram P.O
Malappuram District
45. S.Indira
Teacher
Govt. Higher Secondary School
Kalavoor, Alleppey
46. Aleyamma Daniel
Teacher
Govt. Higher Secondary School
Kalavoor, Alleppey District
47. P.V.Rosamma
Teacher
Govt. Higher Secondary School
Karapuzha, Kottayam District
48. M.Susy Thomas
Teacher
Govt. Higher Secondary School
Karapuzha
Kottayam District
49. E.P.Piyamma
Teacher
Govt. Higher Secondary School
North Parvoor
50. M.V. Ajitha Kumari
Teacher
Govt. Higher Secondary School
Koduvayoor, Palakkad
51. J.Rosamma
Teacher
Govt. Higher Secondary School
Koduvayur, Palakkad
52. K.E. John
Teacher
Govt. Higher Secondary School
Kodungallur, Trichur District

53. P.Abdul Razak
Teacher
Devdhar Govt. Higher Sec. School
Ilanur, K.Puram P.O.
Malappuram
54. K.M.Abdul Rahiman
Teacher
Govt. Higher Secondary School
N.Paravur
55. K.P.Radhakrishnan
Teacher
Govt. Higher Secondary School
Kokkallur, Kokkallur P.O.
Balassery (via)
Badagare, Kozhikode
56. S.Devarajan
Teacher
Govt. Higher Secondary School
Thariode, Karummannam P.O.
Kalpettanur, Wayanad
57. P.M.Maya
Teacher
Govt. Higher Secondary School
Thariode, Kavumannam P.O.
Kalpettanur, Wayanad
58. Malathy Vijayan
Teacher
Govt. Higher Secondary School
Kunchithanny, Idukki District
59. Lillykutty George
Teacher
Govt. Higher Secondary School
Kunchithanny, Idukki District
60. R.V.Harikumari
Teacher
Govt. Higher Secondary School
Elakamon, Trivandrum District

ANNEXURE II

LIST OF RESOURCE PERSONS

Physics

1. Dr.R.Narayanan - Academic Coordinator
Lecturer in Physics
Regional College of Education
Mysore
2. Dr.Somnath Datta
Professor of Physics
Regional College of Education
Mysore
3. Dr.S.G.Gangoli
Reader in Physics
Regional College of Education
Mysore
4. Dr.S.N.Prasad
Reader in Physics
Regional College of Education
Mysore
5. Dr.N.N.Swamy
Reader in Physics
Regional College of Education
Mysore
6. Mr.P.Ramachandra Rao
Reader in Physics
Regional College of Education
Mysore
7. Mr.N.R.Nagaraja Rao
Lecturer in Physics
Regional College of Education
Mysore

Chemistry

1. Dr.T.J.Vidyapati - Academic Coordinator
Lecturer in Chemistry
Regional College of Education
Mysore
2. Dr.A.C.Banerjee
Professor of Chemistry
Regional College of Education
Mysore
3. Dr.V.Kesavan
Reader in Chemistry
Regional College of Education
Mysore
4. Dr.A.S.Janardhan
Reader in Chemistry
Regional College of Education
Mysore
5. Dr.G.T.Bhandage
Lecturer in Chemistry
Regional College of Education
Mysore
6. Dr.B.S.Raghavendra
Lecturer in Chemistry
Regional College of Education
Mysore
7. Dr.J.Seetharamappa
Lecturer in Chemistry
Regional College of Education
Mysore
8. Dr.R.C.Aryan
Lecturer in Chemistry
Regional College of Education
Mysore
9. Dr.M.S.Sreemathi
Lecturer in Chemistry
Regional College of Education
Mysore

10. Dr.P.M.Radhakrishna
Lecturer in Chemistry
Regional College of Education
Mysore

11. Prof.C.P.Joshua
Professor of Chemistry
University of Kerala
Trivandrum

12. Prof.M.Rajasekharan Nair
Professor of Chemistry
University of Kerala
Trivandrum

Biology

1. Dr.C.K.Ashok Kumar - Academic Coordinator
Reader in Botany
Regional College of Education
Mysore

2. Dr.M.Z.Siddiqui
Reader in Zoology
Regional College of Education
Mysore

3. Mr.S.P.Kulkarni
Lecturer in Zoology
Regional College of Education
Mysore

4. Dr.N.Sreeramulu
Reader in Botany
Regional College of Education
Mysore

5. Dr.L.Srikantappa
Reader in Zoology
Regional College of Education
Mysore

6. Dr.V.V.Anand
Reader in Botany
Regional College of Education
Mysore

ANNEXURE III

BIOLOGY PROGRAMME

Thirty two freshly recruited higher secondary Biology teachers, 16 each from Botany and Zoology disciplines were deputed by the Kerala Government to undergo this training programme.

Content

The programme was kept flexible enough to meet the academic requirements of the participants to a maximum possible extent. As they are handling the NCERT text books for the first time it was thought better and beneficial to ascertain from them their needs, their difficulties both in terms of theory and practicals. The entire programme was planned after a detailed discussion with the participants in this direction. It was decided to have two sessions a day, the morning session devoted to content enrichment and the afternoon session for performing activities/practicals/demonstrations.

Theory

The following topics were dealt with at length. Each lecture was for one hour duration followed by a discussion for about half an hour. A few of the lectures were delivered by guest lecturers from the University of Mysore.

1. Photosynthesis
2. Micro molecules
3. Macro molecules
4. Structural organisation of the cell
5. Animal respiration

6. Neuro endocrine integration
7. Biotechnology
8. Cell reproduction
9. Biotic community
10. Five Kingdoms
11. The Ecosystem
12. Cellular respiration
13. Cell membrane
14. Biosphere
15. Enzymes
16. Genes and Chromosomes
17. Origin and Evolution of life
18. Genetic engineering
19. Environmental Pollution
20. Life cycle of silk worms.

A synopsis of many of the lectures were provided to the participants well in advance. Some relevant portions from standard books were also photocopied and given to them.

Practicals

With the exception of a few demonstrations, all activities were individually performed by the participants. These include the activities included in the practical syllabus.

1. Preparation of slides
2. Study of animal and plant cells and tissues
3. Cyclosis
4. Experiments in photosynthesis

5. Experiments in aerobic and anaerobic respiration
6. Dissection of rat
7. Study of blood groups
8. Mitosis and meiosis
9. Plasmolysis and osmosis and factors affecting permeability of cell membrane
10. Food stuffs
11. Life cycle of silk worm
12. Movements
13. Enzymes and urine analysis
14. Study of parasites
15. Experiments in Ecology and Transpiration
16. Identification of plants and animals

Discussion

The discussion on the organisation and execution of the projects mentioned in the syllabus was of immense value. The participants were exposed to a large number of projects and project reports in Biology prepared by the students of higher secondary school. In addition to this, they were briefed on (1) preparation of chemicals and reagents, (2) the suppliers (3) maintenance of stock and stock registers (4) maintenance of microscopes and a list of essential items to begin the lab. work.

Suggestions

1. It was not possible to complete the entire Biology course of higher secondary school within this short period. Moreover, the participants were not yet familiar with the 12th Std. Biology text book. Therefore, the training programme was mainly centered around the Biology text books of 11th Std. It is suggested that a similar, but well planned and coordinated training programme for a longer duration be held in this summer itself (May/June 1991) to cover the 12th Std. books.

2. The availability or otherwise of the resource persons should be made sure well in advance so that the last minute adhoc arrangements could be dispensed with.

TIME TABLE FOR THE BIOLOGY PROGRAMME

Day	9.00 - 10.00 a.m.	11.00 to 11.15	11.15 a.m. to 12.45 pm	12.45 to 2.00	2.00 - 5.00 p.m.
MONDAY 7.1.91	Registration- Inauguration		Identification of difficult topics followed by discussion		Discussion on lab. work/practicals
TUESDAY 8.1.91	Macromolecules (VVA)	B R E A K	Photosynthesis-1 (NS) Neuro endocrine integration (MZS)	I	Preparation of slides, cells, animal tissues (SPK) Plant cells, tissues, structure of stem, cyclosis (CKA)
WEDNESDAY 9.1.91	Structural organization of the cell (Dr.N.V. Ashwatha Narayan)		Photosynthesis - 2 (NS) Animal respiration (SPK)	U N D	Photosynthesis, aerobic respiration(NS) Dissection of rat, blood groups (MZS)
THURSDAY 10.1.91	Cell Reproduction (LS)		T I A	Biotechnology (Dr.Khadervali)	L
FRIDAY 11.1.91	The Ecosystem (Dr.Ashwatha Narayan)		Biotic community (CKA)		Cells in isotonic, hypertonic, hypotonic solutions, factors affecting permeability of cell membrane, study of stomata measurement (VVA) Foodstuffs, plasmolysis (SPK)
SATURDAY 12.1.91	Micro and macro molecules (VVA)		Five Kingdoms (Bot.CKA Zoo. MZS)		Life cycle of silk worm, sericulture Lecture at Sericulture Dept. (Dr.Honnaiah)

Day	9.00 - 10.00	11.00 to 11.15	11.15 a.m. to 12.45 pm	12.45 to 2.00	2.00 - 5.00 p.m.
SUNDAY 13.1.91	Cellular respiration (NS)		Five Kingdoms (CKA)		Group work
MONDAY 14.1.91	Aminoacids, Proteins, (VVA)	B R E A K	Cell membranes (LS)		Osmosis, anaerobic respiration, Tropisms (NS) Enzymes, urine analysis (SPK)
TUESDAY 15.1.91	Group work	B R E A K	Group work	L U N C H	Group work
WEDNESDAY 16.1.91	Biosphere (SPK)	B R E A K	Micro and Macromolecules (VVA)	L U N C H	Parasites, Ecology transpiration (CKA)
THURSDAY 17.1.91	Enzymes (Dr.Srinivasa Reddy)	B R E A K	Genes and Chromosomes (LS)		Identification of plants (VVA) Animals (LS)
FRIDAY 18.1.91	Life-its origin evolution and main- tenance (MZS)		Genetic engineering (Dr.Honnaiah)		Discussion on projects Lab-setting, preparation of chemicals, reagents, preservation techniques
SATURDAY 19.1.91	Environmental Pollution (Dr.Ramaswamy)		Discussion on Lab. activities		Finalisation of Lab. activities and report. Valedictory Function

ANNEXURE IV

PHYSICS PROGRAMME

On an average two lecture-cum-discussion sessions were devoted for each chapter of the class XI book (Part I and Part II). The emphasis on the topics were based on the difficulties expressed by the teachers.

Chapter 3 : Motion in one Dimension

Key ideas:

- i) The motion of real objects are quite complex and can be understood in terms of two basic types of motion - translatory and rotatory.
- ii) Uniform and non-uniform motion
- iii) Concepts of displacement, velocity relative velocity, etc.
- iv) Why $v(t) \approx \frac{\Delta x}{\Delta t}$?
- v) Positive acceleration does not necessarily mean speeding up and negative acceleration does not necessarily mean slowing down.
- vi) Do we require a quantity - rate of change of acceleration ?

Chapter 4 : Motion in Two and Three Dimension:

Key ideas:

- i) A brief discussion on vectors
- ii) Do all quantities having magnitude and direction qualify to be termed as vectors?
- iii) Motion in a plane can be discussed using the position vector r and can be resolved along two perpendicular directions.
- iv) How different coordinates can be selected for different types of motion for the sake of convenience.

Chapters 5 & 6: Laws of Motion and Work, Power and Energy

Some of the common misconceptions were removed using a number of examples and questions and exercises. The concepts of inertia, inertial mass and motion in a plane were reinforced using PSSC films. A few of the experiments done by the participants relate to this topic. The main emphasis in the chapter on work, power and energy was on the conservation of mechanical energy. The concepts were emphasised using problems and exercises.

Chapter 7: Center of Mass, Rigid Bodies and Rotational Motion

Chapter 8 : Gravitation

Topics Discussed:

i) System of particles, ii) Motion of a system of particles, iii) Linear motion and the associated law iv) The center of mass and linear motion of the center of mass v) Rotational motion and motion about the center of mass vi) The law of angular momentum vii) Motion of a top and other types of gyroscopes viii) The law of gravitation ix) Conservation of orbital angular momentum under a central force x) Constancy of areal velocity xi) Principle of equivalence as a prelude to Einstein's theory of gravitation.

Chapter 9 : Molecules

Key ideas:

i) Historical aspect of the development of atomic/molecular theory ii) The size of an atom/molecule. iii) The randomness of molecular motion - Brownian motion iv) Examples of Brownian motion v) Avogadro number and the concept of mole vi) Interatomic and intermolecular forces and their nature.

Chapter 10: Properties of Matter

Topics discussed include i) the importance of stress-strain curve ii) Moduli of elasticity iii) Difference between stress and pressure iv) Design of bridge, railway line, etc. v) Aneroid barometer - discussion and demonstration.

Chapter 11: Heat and Thermodynamics

Topics discussed include - i) Ideal gas temperature scale, ii) First law of thermodynamics. Topics on specific heat, triple point etc. were discussed through problem-solving.

Chapters 12 & 13: Oscillations and Waves

Two films (PSSC) on Periodic Motion and Sound waves were screened and discussed. The discussion of the lesson was done through problem-solving sessions.

A set of eleven experiments were selected and set up. (See list enclosed). Each teacher performed each of these experiments through regular laboratory session. Instructions for doing the experiments were given and the results obtained were discussed.

A general lecture was given on "Errors in Measurement". The importance of estimating errors in measurement and the use of significant figures in calculations were discussed quoting examples. This was followed by the PSSC film "Coulomb's Law". The film was discussed from the point of view of the processes of science and why experimentation is very important in science.

Materials supplied to the teachers

- i) Errors in measurement and significant figures
- ii) Xerox copy - Liquefaction of gases - Ideal gas versus real gas behaviour
- iii) Xerox copy - First law of thermodynamics
- iv) Instruction sheets for experiments
- v) Discussion sheet for experiments on collision

List of Experiments for the

- 1. Study of Acceleration of a body under the action of different unbalanced forces.
- 2. Study of acceleration of bodies of different masses subjected to a constant unbalanced force.
- 3. To compare the inertial mass of a given body with known masses using an inertial balance. (Page 29-XI).
- 4. Study of law of conservation of momentum in one dimensional collision.
- 5. Study of law of conservation of momentum in two dimensional collision.
- 6. Determination of spring constant of two springs (Page 144-XI)
- 7. Estimation of the size of an oil molecule (Page 103-XI)
- 8. Study the variation of pressure with temperature of air at constant volume. (Page 136 - XI)
- 9. To find g with the help of a ball rolling down an inclined plane.
- 10. To find the frequency of a.c. using a sonometer.
- 11. Experiment using ticker tape timer.

TIME TABLE FOR THE PHYSICS PROGRAMME

Date/ Weekdays	Morning Session I 9.30 am - 11.00 am	Morning Session II 11.15 am - 12.30 pm	Afternoon Session 2.00 pm - 5.00 pm
7.1.1991 Monday	Registration & Inauguration (General)	General Session with Physics Group	Lab. Session + Errors in Measurements and significant figures (PRR)
8.1.1991 Tuesday	Laws of Motion (SNP)	Centre of Mass (SD)	Lab. Session (RN+ NNS)
9.1.1991 Wednesday	Motion in one dimension (PRR)	Laws of Motion (SNP)	Lab. Session (NRN + RN)
10.1.1991 Thursday	Centre of Mass, Rigid bodies, Rotational Motion (SD)	Oscillations & Waves (SGG)	Lab. Session (RN + NRN)
11.1.1991 Friday	Heat and Thermodynamics (RN)	Molecules (NNS)	Lab. Session (NNS + PRR)
12.1.1991 Saturday	Heat and Thermodynamics (RN)	Molecules (NNS)	Lab. Session (RN)
14.1.1991 Monday	Gravitation (SD)	Work, Power & Energy (SNP)	Lab. Session (RN + NRN)
15.1.1991 Tuesday	Oscillation & Waves (SGG)	Motion in Two and Three Dimensions (PRR)	Lab. Session (RN + SNP)

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Date/ Weekdays	Morning Session I 9.30 am - 11.00 am	Morning Session II 11.15 am - 12.30 pm	Afternoon Session 2.00 pm - 5.00 pm
16.1.1991 Wednesday	Gravitation (SD)	Properties of matter (NRN)	Lab.Session (RN + NRN)
17.1.1991 Thursday	Work, Power & Energy (SNP)	Motion in Two and Three Dimensions (PRR)	Lab.Session (RN + PRR)
18.1.1991 Friday	Properties of Matter (NRN)	Oscillations & Waves (SGG)	Lab. Session (RN + SGG)
19.1.1991 Saturday	Motion in One-Two-Three dimensions (PRR)	Valedictory Session at 11.30 a.m.	

ANNEXURE V

CHEMISTRY PROGRAMME

The Lecture cum Discussion sessions were held in the forenoon of everyday during the entire period of the workshop. The following are the topics covered during these sessions.

1. Atoms, molecules and chemical arithmetic, measurement in chemistry, chemical classification of matter, laws of chemical combination and Dalton's atomic theory, atomic mass and chemical equation.
2. Elements, their occurrence and extraction - Earth as a source of elements, elements in sea, extraction of metals, mineral wealth of India and qualitative tests of metals.
3. States of Matter - The gaseous state, kinetic molecular theory of gases, the solid state and the liquid state.
4. Atomic Structure - Constituents of the atom and electronic structure of atoms.
5. Chemical families - periodic properties. Mendeleev's periodic table, Modern periodic law, types of elements and periodic trends in properties.
6. Bonding and Molecular Structure - Chemical bonds and Lewis structure, shapes of molecules, quantum theory of covalent bonds, the coordinate covalent bond, bonding in solid state, the hydrogen bond and resonance.
7. Energetics - Energy changes during a chemical reaction, internal energy and enthalpy, heat of reaction, source of energy, what decides the direction of spontaneous change in a chemical reaction.
8. Chemical equilibrium - How to recognise chemical equilibrium, equilibria involving physical changes and chemical changes, effect of changing the conditions of a system on equilibrium, equilibria involving ions and equilibrium systems in nature.

9. Redox reactions - Oxidation and reduction as an electron transfer process, redox reactions in aqueous solutions - Electrochemical cells, emf of a cell, emf dependence on concentration and temperature, electrolysis, oxidation number and balancing of oxidation reduction equations.
10. Reaction rates - Rate of reaction, order of a reaction, factors affecting the rate of a reaction, effect of light on reaction rates and how fast are chemical reactions.
11. Carbon and its compounds - Elemental carbon, carbon compounds, organic compounds of carbon and nomenclature of organic compounds.
12. Chemistry of non-metals I - Hydrogen, oxygen, water and hydrogen peroxide and nitrogen.,
13. Chemistry of non-metals II - Boron, silicon, phosphorus, sulphur, halogens and noble gases.
14. Chemistry of lighter elements - Sodium and potassium, magnesium and calcium, aluminium and cement.
15. Structure and shapes of hydrocarbons - Alkanes, stereoisomerism and chirality, alkenes, alkynes and arenes.
16. Preparation and properties of hydrocarbons - Sources of hydrocarbons, laboratory preparation of alkanes, alkenes and alkynes, physical properties of alkanes and reactions of hydrocarbons.
17. The molecules of life - The cell, carbohydrates, proteins, nucleic acids and lipids.

Laboratory Sessions:

The afternoon sessions of the workshop were mostly devoted to the laboratory work. This includes pre-lab. discussion, conduct of various experiments-suggested under class XI practical syllabus-by the participants of the workshop and post-lab. discussions.

Experiments Conducted:

1. a) Preparation of copper (II) sulphate crystals.
b) Basic laboratory techniques - (i) cutting a glass tube/rod
c) Preparation of an acid solution of desired normality/ molarity from a concentrated one.
d) Study of the shift in equilibrium between ferric ions and thiocyanate ions by increasing/decreasing the concentration of either ions.
2. a) Preparation of standard oxalic acid solution.
b) Determination of strength of given sodium hydroxide solution by titration against standard oxalic acid and calculate the mole ratio in which the acid reacts with the base.
c) Determination of concentration of given solution of dilute HCl by titration with standard sodium carbonate solution and calculate the mole ratio for the reaction.
3. Systematic macro qualitative inorganic analysis.
a) Analysis of anions
b) Analysis of cations
4. Determination of solubility of benzoic acid in water at different temperatures and plotting of a solubility curve.
5. Study of the effect of iodide ion concentrations on the rate of reaction between KI and H_2O_2 in aqueous solution.

6. a) Determination of heat of neutralisation of the reaction between strong acid (HCl) and a strong base (NaOH).
b) Determination of heat of solution of potassium nitrate.

7. a) Construction of galvanic cells and measurement of their emfs.
b) Determination of pH of some solutions
i) acidic solution and ii) bases
c) Study of pH change by common ion effect in case of weak acids and weak bases.

8. a) Determination of melting point
b) Determination of boiling point
c) Detection of Nitrogen, Halogen and sulphur in an organic compound
d) Preparation of acetylene and study of its acidic character.

Demonstration Experiments:

Some interesting experiments in chemistry were actually demonstrated by Dr.B.S.Raghavendra to the participants of the workshop in one of the afternoon sessions. The whole programme was made more interesting and enlightening by Dr.A.S.Janardhan by his critical approach to the explanations for the various observations made during the course of demonstrations.

Items presented:

1. Combustibility of hydrogen
2. Decomposition of $KClO_3$
3. The invisible flame
4. Catalytic decompositions - acetone and hydrogen peroxide
5. Alchemy at work

6. The magic flower
7. Explosiveness of hydrogen

Films Screened:

Chemical Education Material Study (CHEM Study) films on the following titles were screened for the benefit of participants and this was followed by post-film discussions.

Titles:

1. The Hydrogen atom (a quantum mechanical model)
2. Chemical families
3. Electrochemical cells
4. Chemical bonding

Guest Lecture:

A guest lecture was organised on a topic of current interest and it was attended by the participants from the biology as well as chemistry sections.

Guest: Dr.Khadervalli from the Department of Chemical and Biological Sciences of ORLIGON GRADUATE CENTER, USA.

Topic: Biotechnology today - with special reference to biodegradation of environmental pollutants.

Supplementary Reading Materials:

At the request of the participants of the programme, additional reading materials were supplied to them on the following topics.

1. Nomenclature of organic compounds (7 pages)
2. Laboratory manual for chemistry experiments (40 pages) (Class XI CBSE syllabus)
3. Tables of thermodynamic data (4 pages)

4. Chemical equilibrium : How far do reactions go?
(47 pages)
5. Stoichiometry (35 pages)
6. Rates of chemical reactions (36 pages)
7. Chemistry and our environment (13 pages)

TIME TABLE FOR THE CHEMISTRY PROGRAMME

Day/Date	Forenoon Session (Lecture cum Discussion)				Afternoon Session	
	9.00 - 10.00 a.m.	10.00 - 11.00 a.m.	11.20 am to 12.10 pm	12.10 to 1.00 p.m.	2.00 p.m. to 4.30 p.m.	
Monday 7.1.91	Registration & Inauguration		Group Discussion -----		(2 pm - 3.15 pm)	(3.30 - 4.30 p.m.)
					Atoms, molecules and chemical arithmetic-1	States of Matter - 1 GTB
Tuesday 8.1.91	Chemistry of non-metals II(1) JS	Atoms, molecules & chemical arith- metic- 2 ACB	States of Matter-2 GTB	Atomic Structure 1 BSR	Laboratory Session	
Wednesday 9.1.91	Chemistry of non metals-II(2) JS	Atomic Structure (2) - BSR	Atoms, molecules, & Chemical arithmetic-3 ACB	States of Matter-3 GTB	Laboratory Session	
Thursday 10.1.91	Periodic proper- ties-1 BSR	Energetics-1 ASJ	Guest Lecture - Biotechnology- today		Laboratory Session	
Friday 11.1.91	Chemical equi- librium- 1 ACB	States of Matter- 4 GTB	Periodic proper- ties-2 BSR	Chemistry of lighter elements - 1 JS	Screening of CHEM study films	
Saturday 12.1.91	Chemical equi- librium-2 ACB	Chemistry of non- metals-I (1) BSR	Energetics-2 ASJ	Chemistry of lighter elements-2 JS	Laboratory Session	
Sunday 13.1.91	States of Matter -5 GTB	Reaction Rates-1 ACB	Energetics - 3 ASJ	-----	Group Discussion	

Day/Date	Forenoon Session (Lecture cum Discussion)				Afternoon Session 2.00 p.m. to 4.30 p.m.
	9.00 - 10.00 a.m.	10.00 - 11.00 a.m.	11.20 am - 12.10 pm	12.10 to 1.00 p.m.	
Monday 14.1.91	Reaction rates-2 ACB	States of Matter-6 GTB	Carbon & its com- pounds-1 VK	Bonding & Molecular Structure - 1 MRN	Laboratory Session
Wednesday 16.1.91	Elements, occurrence & extraction -1 JS	Carbon & its compounds-2 TJV	Bonding & mole- cular structure-2 MRN	Energetics-4 ASJ	Laboratory Session
Thursday 17.1.91	Preparation & properties of hydrocarbons-1 RCA	Redox reactions 1 MRN	Structures and shapes of hydrocarbons-1 CPJ		Demonstration Experiments
Friday 18.1.91	Preparation & properties of hydrocarbons-2 RCA	Structure & shapes of hydrocarbons-2 CPJ	Redox reactions - 2 MRN -----		Laboratory Session
Saturday 19.1.91	Molecules of Life - CPJ -----		Presentation of Group Reports and Valediction		

Tea Break : 11.00 a.m. to 11.20 a.m.

Lunch Break : 1.00 p.m. to 2.00 p.m.

Venue: Lecture cum discussions - Chemistry Lecture Theatre : Lab. Sessions - Lab. No.5 of Chemistry Section

CPJ : Prof.C.P.Joshua; MRN : Prof.M.Rajasekharan Nair; ACB : Prof.A.C.Banerjee; VK : Dr.V.Kesavan;
 ASJ : Dr.A.S.Janardhan; GTB : Dr.G.T.Bhandage; BSR : Dr.B.S.Raghavendra; TJV : Dr.T.J.Vidyapati;
 JS : Dr.J.Seetharamappa; RCA : Dr.R.C.Aryan.