CHAPTER-1

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1.1 Introduction

Chemistry is a branch of science, which concerns itself with the composition, properties, constitution and mutual interaction of different kinds of matter. The three major branches of chemistry are Organic, Inorganic and physical. The other branches of chemistry are Nuclear chemistry which deals with nuclear reactions, artificial transmutation of elements and radioactive isotopes, Biochemistry which describes the reactions of living processes in health and disease. Analytical chemistry deals with methods of analysis applicable to different types of compounds. Industrial or technical chemistry which applies principles of chemistry in the large-scale manufacture of different elements and compounds. Agricultural chemistry is devoted to the study of soil, water, fertilizers and compounds recovered from plants. Some other branches such as polymer chemistry, pharmaceutical chemistry, theoretical chemistry, applied chemistry, forensic chemistry etc.

Chemistry plays a very prominent role in our daily life. It is of greater importance in industries. Chemistry is useful in extraction of petrochemical products, and manufacture of a never ending list of products like fertilizers, synthetic fibers, synthetic rubber, new electrical insulators, new metal alloys. New radioactive isotopes used in diagnosis of disease, synthetic vitamins, hormones, sulpha-drugs, antibiotics, steroids, tranquilizers, antimalarials, antiseptic, dyes, insecticides, fungicides, synthetic protein foods, etc. have revolutionized the modern living and hold out hope of a better future.

The curriculum in XI standards is intended to provide a base for advanced courses in chemistry and for professional courses. Besides, the development of chemistry in the past few decades is terrific. To cope with this monstrous growth, a teacher has to use a highly efficient method. The following methods of teaching chemistry are recommended at the higher secondary level. Lecture method, Demonstration method, Lecture cum demonstration method, Problem solving method, Heuristic method, Scientific method and Project method.

The teacher is the key figure in the implication of educational programmes using any one or several of the above methods. In the context of the explosion of knowledge in science and

technology, a teacher's job in the twenty-first century is highly complex. A science is now supposed to teach not only the science of yesterday, but also to give some vague idea of the science of tomorrow. The traditional system of teaching science based only on text books shall be replaced by an approach where students and teachers work in collaboration on the voyage of discovery and the students are gradually led to the final answer as far as possible unaided. Teacher's duty is like a catalytic agent. S/he has to constantly update his/her knowledge and sharpen the ingenuity or else s/he may find himself in an embarrassing situation. And for this purpose knowledge of easy and difficult concepts to a teacher will be of great help.

This needs a lot of new research in the field of teaching and learning Chemistry. But the hurdle is "Educational Research is in its infant stage in India, its quantity is small enough and quality even less" (Bhatnagar & Saxena, 2009). Hence the research basis for chemical education is woefully weak. Therefore the NCERT and SCERT should try to bridge the gap between the educational research and the current school practices. The findings of the research work should diffuse, or percolate down to the teachers of all levels and they should be able to get the up-to-date information about the current researches in science education and implement them in their class-rooms.

But the picture is not completely dark but there have been many efforts and initiatives taken by the ministry like for the purpose of best practices in teaching and learning Chemistry to be available to all, massive online open education in India has been formally launched in the era of the Internet by the National Program on Technology Enhanced Learning (NPTEL) in the year 2003 for technical courses. This program was drafted by the IITs with professional help and advice from Carnegie Mellon University, Pittsburgh. Somewhat fortuitously, the NPTEL announcement coincided with the announcement of Open Courseware by MIT, Cambridge. The government of India fully funded the NPTEL and also launched the National Mission on Education through Information and Communication Technology (NMEICT) in 2009. Under these two initiatives, a large number of curriculum based courses in chemistry and chemical engineering have been made available since 2012. These freely available contents will work as guiding light for the new generation of teachers.

For identifying the difficulty in Chemistry first both the students and teachers will have to be on the same page as which topic is easy and difficult to learn Chemistry and which topics are easy or difficult to teach for teachers. The literature has identified the areas of cognitive development

and alternative conceptions (misconceptions) and many exceptions as having a major effect on how difficult pupils find Chemistry topics.

Findings show that the perceptions of the students and teachers are different in terms of difficulties which students have in a chemistry course. The perceptions of teachers and policy makers are mostly the same. While on the other hand both the teachers and policy makers agree that student-related factors, such as scientific language literacy have the most influence on students' successes in chemistry. [AJCE 4(2), Special Issue, May 2014]

Chemistry as a subject is so difficult only because it is less relatable to daily life events and it involves a lot of HOTS and abstract thinking.

"Concepts of chemical sciences are hard to grasp because learning new information is easiest when we have background information or a 'point of reference,' and with chemistry, that's challenging. A seasoned teacher, however, will be able to connect most chemical concepts to a macroscopic, real-world context." (Samuel, 2009)

A common but a key finding that cuts across the lessons learnt in the similar studies is about the students' lack of understanding of the Particulate Theory because almost every concept in chemistry depends on the particulate nature of matter, which lays the foundation for understanding of other concepts (Harrison & Treagust, 2002). As noted by Taber (1997), many students' problems in chemistry lie in not understanding the relation between the molecular and macroscopic representations because students have not grasped the role of models in chemistry. Students' misconceptions regarding these concepts are based on the fact that they live and operate within a macroscopic world of matter and do not easily follow shifts between macroscopic and submicroscopic levels.

In chemistry many great themes such as periodicity, the mole, the structure of atoms, bond formation, kinetics, chemical equilibrium, energetic and electrochemistry have been introduced with time. This requires innovative methods of teaching and not the traditional method emphasizing only rote memory. Besides, the curriculum should be periodically reviewed, the difficult parts be identified and feedback be received from the teachers and students as well to make the teaching-learning process dynamic, effective and inspirational. And for this purpose knowledge of easy and difficult concepts to a teacher will be of great help, that is the main purpose of the present study.

1.2 Statement of the Problem

Taking the scenario into consideration, the investigator has taken the problem to identify the easy and difficult concepts of Chemistry. The problem of the present study is stated as ***"IDENTIFICATION OF EASY AND DIFFICULT CONCEPTS OF CHEMISTRY FOR THE STUDENTS FROM XI STANDARD: A STUDY"***.

1.3 Need and Significance of the Study

The higher secondary stage is a preparatory stage for professional courses, and class 11th prepares the foundation for this. At this level the two most aspired professional courses in the science field are Engineering and Medical. At this stage Chemistry plays an important role in shaping the future of these aspiring young generations. But Chemistry is considered one of the most fearful and confusing subjects. The blame is not entirely on the students. Teachers ought to have adopted various techniques to make these abstracts and concepts easy to understand but for that purpose a teacher has to have a thorough understanding of the problematic concepts for students and reasons for the same. Only with this aim in mind, the present investigator selected this topic to point out difficult areas in XI standard chemistry to ensure a high quality student which will play an effective role in this society as engineers, doctors and scientifically enlightened citizens. Students have many personal and academic problems with a lot of obstacles in the way of academic progress. The educators should find out the problems faced by the students, help them to understand themselves, make the best use of their abilities and talents, solve their problems independently, make their own unique contributions to the society and the nation to the fullest possible extent. Sometimes students who are unable to find out the causes for their academic failures lose interest, become irregular in work and attendance and may leave the institution. In today's world where teachers have a busy schedule, it is noticed that only a few teachers have time to go deep into the learning problems of students. If students can be helped just a little bit by concerned teachers things will be different. So the investigator, who is also a chemistry teacher, takes up the challenge of finding out the difficulty level of the important concepts of chemistry for the XI standard students and to find out the reason for that. The present study will be conducted, in order to identify the easy and difficult concepts of Chemistry for the students from the XI class.

1.4 Operational Definitions of Key Terms

1) **Chemistry-**

Conceptual Definition: Oxford Advanced learners' dictionary defines chemistry as "The scientific study of the structure of substances, how they react, when combined or in contact with one another and how they behave under different conditions" . Chemistry is both an exciting and living subject. The study of chemistry is to discover new metals, improve industrial products, Biochemical products, medicinal products , atomic energy and their interactions . Such information is of vital importance for the development of modem technology.

Operational Definition: Chemistry in present study can be defined as a Science subject in XI standard, in which the investigator aims to identify the easy and difficult topics.

2) **Concept-**

Conceptual Definition: As per the Cambridge Dictionary the word 'Concept' refers to *a principle or idea about something that exists*'. Other definitions of Concept are as follows-

A concept is an idea or abstract principle.

An idea, theory, etc. about a particular subject.

Operational Definition: Concept in present study can be defined as targeted Principles of Chemistry i.e. *Mole concept, Atomic models, Periodic classification, Bonding theories, Hybridisation, The gaseous state, Spontaneity in Thermodynamics, Equilibrium in chemical reactions, Redox reactions* and *Oxidation number,* which prepares the base for further studies.

1.5 Objectives of the Study

The purpose of this investigation is to identify the easy and difficult concepts of chemistry for students in XI standard. So, the following are enlisted as objectives of the study -

1) To find out the easy and difficult concepts out of some important targeted concepts in Chemistry for XI standard students.
2) To find out the reason/reasons for any concept to be easy or difficult for students
3) To find out the achievement of XI standard students in different targeted concepts of Chemistry.

1.6 Delimitations of the Study

Due to the unavailability of resources and paucity of time, it is not possible to cover every aspect of the associated variables related to the problem under investigation. Hence the study is delimited to the following -

1) The study is confined to students of Prayagraj only. Other regions could not be included due to time constraints and available resources.
2) The number of students was only 38.
3) The present study is focused on XI standard students only.
4) The present study is focused on English medium students only. Thus results may not be generalized to Hindi medium students.
5) The present study is focused on CBSE board students only. Thus results may not be generalized to State Board students.

1.7 Chapterization of the Study

Chapter 1 has dealt with a brief introduction, statement of the problem, need and significance of the study, operational definition of key terms, objectives and delimitation of the study.

In chapter 2 a brief review of related literature is discussed.

In chapter 3 the methodology adopted for the present study is discussed. This chapter includes methods of research, research design, variables of the study, the population of the study, a sample of the study, tools used for the collection of data, data collection procedure, scoring procedure and plan for analysis of data together with the statistical techniques used in the study are discussed.

Chapter 4 deals with the analysis and interpretation of the data.

Chapter 5 presents a brief summary of the study. It will also present needs and importance, findings, educational implications and suggestions for further research.