REFLECTIVE APPROACH IN TEACHING PRE-DEGREE CHEMISTRY

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ABSTRACT

The study is a component of a larger investigation that focuses on exemplary practice in chemistry education. This case study involves an investigation of a chemistry teacher in two years intermediate education in Vijayawada, Andhra Pradesh, India. The study utilized an interpretive methodology in which the questions emerged from intensive observations of chemistry lessons in classes taught by a teacher. The principal finding was that a teacher focused on teaching for understanding. Once teacher tended to emphasize whole-class activities while the other times he utilized more small-group and individualized activities. The teacher was successful in his goal of teaching for understanding because he was effective classroom manager and he had strong science content knowledge that enabled him to focus on instructional strategies that facilitated student understanding. He asked appropriate questions, responded to student questions, and used effective cognitive monitoring strategies. The teacher was able to teach effectively because he had adequate content knowledge and pedagogical content knowledge.

Researcher adopted the method of action research to class room teaching where a classroom event triggers the process of reflection followed by critical analysis of the event which leads to change and subsequent reflection to observe that change and so on. He has taken two different texts to teach students. Out of two texts, one is explaining the metallurgy of Magnesium. In that case, he was successful as a teacher when he adopted comparative method of teaching metallurgy of Magnesium rather than the traditional method of teaching. The other one is explaining the properties of Hydrogen peroxide. In this case he was successful as a teacher by adopting discussion, interaction and discussion method.

Keywords: Chemical education, Reflective Practice, Metallurgy of Magnesium, Chemical properties of Hydrogen peroxide

INTRODUCTION

In Andhra Pradesh of India, people are crazy about studying Engineering and Medicine. To do that one has to study 10 classes (school level) +2 classes (college level) and Medicine or engineering (college level). To study 10 classes the student must join a school which is recognized by state board or CBSE or ICSE and must get through. Generally state board schools are more in number than CBSE (Central Board of Secondary Education) or ICSE (Indian school certificate education) schools.

More number of students joins state board schools. In India, normally the syllabus content in 10th class(more choice based if it is state board) is less when compared to 10+2 (two years intermediate education).Moreover the examination pattern in 10th class(S.S.C)is different from 10+2 (two years intermediate education)pattern. As EAMCET (Engineering agricultural Medical Common Entrance Test, multiple choice based) is connected to 10+2 (two years intermediate education)for getting a seat in higher education (engineering, medicine etc) every point and every line of Maths, physics and chemistry is very important for student to understand and to learn and also to apply the same concept in EAMCET. Normally, a rural back ground student, poor urban background student , student whose parent is economically potential and unaware of education does not take I.I.T foundation coaching which somewhat helps the student to get through 10+2 (two years intermediate education), will be in a difficult position to get interest in learning the subjects. Fortunately or unfortunately, the corporate colleges are interested in getting more admissions of 10+2 students, complete the syllabus within three months and give coaching for EAMCET.

The final exam (which is only considered to give qualifying certificate and which only helps in getting job)will be nearer and moreover students will be found busy preparing for regular Intermediate Public Examination(I.P.E). As the time is less for student and teacher, the student is unable to receive the concept of subject and teacher is not in a position to teach the concept and is not able to teach the application of concept. Even if he teaches how to apply the concept, student is unable to receive the same. However, some students whose age is more, relatively whose stamina is more relatively or who has had I.I.T foundation course are able to cope and that too to some extent. In preparing for Intermediate Public Examination(I.P.E), textual matter rather than objective type is important and teachers guide accordingly and students study accordingly whereas for preparing the EAMCET, concept as well as point wise textual matter is important for student and teacher guides accordingly. Student studies subject in English that is second language but not in mother tongue (not first language). Generally student is not a good learner of English and not a good reader of English and will feel difficult to go through the subject through English medium. Students forcibly take English medium of instruction to meet out the demands of the global market. First of all reading the subject and understanding the subject in English medium is difficult for a student and he gets disinterested in reading, understanding and learning the concept of subject in English medium of instruction.

Keeping the above points in view, one of the researchers who is also a Reader (equivalent to associate professor in chemistry) in chemistry proposed an alternative method for study of a few chapters i.e solid state chemistry, alkaline earth metals and chemical properties of Hydrogen peroxide, experimenting with nearly 400 students who are going to appear for 2008 EAMCET and was successful in his research.

Chemistry is an 'enabling science' as its core concepts are essential for almost every area of science. Chemistry is also a highly conceptual discipline, requiring an ability to deal with phenomena at both macroscopic and microscopic level, and to connect with symbolic representations and formulae used at each of these levels. Students may experience difficulties with their learning for they are very weak in not only fundamentals but also back ground study for the particular topic. The focus of this paper is on learning of science (chemistry) not only by students, but also by chemistry teachers and by chemists. Teachers themselves gain insights by learning along with their students. For the past twenty years, there has been much research and writing about the 'alternative conceptions' of students in their understandings and learning of science.
Research has shown that chemistry teaching is unpopular and irrelevant in the eye of students (Kracjik et al., 2001; Osborne and Collins, 2001: Sjoberg, 2001; WCS, 1999; ICASE, 2003).

- **does not promote higher order cognitive skills (Anderson et al, 1992; Zoller,1993).**
- **leads to gaps between students wishes and teachers teaching (Hofstein et al.2000; Yager and Weld, 2000; Holbrook and Rannikmae, 2002)**
- **is not changing, because teachers are afraid of change and need guidance (Aikenhead, 1997; Bell, 1998; Rannikmae, 2001a).**

A factor common to all of the above seems to be the lack of relevance of chemistry teaching. Although 10+2 chemistry programs set out to develop conceptual understanding in students and an appreciation of the way scientists do things, the relevance of the teaching in providing a useful education is suspect.

A Shift of Emphasis

There is a need for a shift of emphasis the teaching of chemistry. The shift is from learning chemistry as a body of knowledge to promoting the educational skills to be acquired through the subject of chemistry. And as attempts to gain 'education through chemistry' simply by gaining knowledge are shown to be unsuccessful, the approach needs to shift from one bound by subject chapter headings, or sections to one which more closely relates to the issues and concern within society. . This shift is promoted as a major attempt to move to more relevant chemistry teaching in the eyes of students.

Conceptual learning within the subject needs to be approached through encouraging student involvement. Teachers need to recognize that curricula promoting chemistry fundamentals, grouping chemistry concepts for scientific convenience, rather than for popularity.

The Suggested Way Forward For Chemistry Teaching

Much has been written about student centered teaching and teacher ownership of the teaching approach if the teaching is to be meaningful for students (Rannikmae, 2001b). Learning outcomes are specified at the beginning of the materials so as to clearly specify the learning intentions. The emphasis is thus on the outcomes of learning, rather than the process by which they are achieved, although student participation in the process is considered crucial. Active learning is promoted by learning outcomes related to chemistry skills. The individual or group activities enable students to achieve the learning outcomes.

These are geared heavily towards cooperative learning, promoting communication skills. As it is important all lessons are under the control of the teacher, the strategy for introducing the students' scripts , the manner in which they are used and the way the lesson is conducted, is for the teacher to determine. Moreover, it is suggested that there is much to be gained by teachers sharing the insights they have whilst teaching, with their peers and with their students. In passing, this raises the interesting question as to when a teacher's 'need to learn' becomes a sign of incompetence. Accepting the fallibility of authority demands a much more active role for the student and a necessity for a more critical view of the understandings of the teacher. It is argued that this brings learning closer to the 'real' practice of 'doing science' but requires more confidence, less certainty and more humility, from the teacher.

The paper explores the implications for teaching and learning and the relationship between the teacher and student. It highlights the valuation of 'learning' over that of 'knowing' and connects this with epistemological realities of being and becoming a scientist (or an educated citizen). This indicates a considerable reduction of flexibility and autonomy (and enjoyment) and a loss of available time and energy, because of much enhanced accountability and curriculum pressure. This last seems particularly significant since this inhibits teachers' engagement in research, development or even in reflective practice in their own classrooms. In the context of science (chemistry) education much has been written about constructivism and the ways in which learners make sense of their world by 'constructing' meanings and explanations for themselves (Driver & Easley 1978; Bodner1986; Driver et al 1994).

Clearly it would be ludicrous to suggest that such professionals *should not know* the facts and understand the theoretical principles of the material they are teaching to others. However, the contention in this paper is that, even though it is clearly better that teachers and chemists should know and understand the fundamentals of chemistry, there is no abrupt, qualitative change in the nature of that knowledge and understanding at the point of graduation or acceptance into the profession. Even after we have gone through very careful preparation for presenting a teaching session there can be no absolute assurance that everything will be correct. Some of the remaining sources of *uncertainty* include:

- **The authority from which the material was originally learned or the texts referred to may have become outdated or been in error.**
- **We may be so sure that we are right that no need is perceived to make any further checks.**

- **We may be making the unwarranted assumption that the words we use have the same meanings for everyone else. ☐**
- **We may not have anticipated questions that arise *as a consequence* of teaching.**

E.g. new personal insights or questions from even more insightful students may be an outcome of the teaching. In these cases, learning by the teacher *must follow* the teaching. This paper exemplifies chemistry learning *by the teacher* with examples being taken from personal reflection and also by taking feedback from subsequent debate with colleagues. A Personal Reflection on Teachers' Learning provide three means that enhanced my learning:

- **by asking myself critical questions**
- **by students asking me critical questions**
- **discussion with a colleague**

PURPOSE OF THE STUDY

The purpose of this study is to determine grade 12 students' conceptual understanding of metallurgy of magnesium and chemical properties of hydrogen peroxide. More specifically, the study attempts to:

- **Explore the students' knowledge of concepts related to reaction writing, oxidation reactions and reduction reactions, electrolysis , anodic and cathodic reactions etc.**
- **Determine the effectiveness and exemplary learning materials in solving problems as well as creating the students' awareness about metallurgy of magnesium and chemical properties of hydrogen peroxide.**

THEORETICAL FRAMEWORK

Teaching and learning usually go together, i.e. one has to be taught by a person or read an instructional material in order to learn, and learning is evidence that one has been taught. if learning is considered to be a process of knowledge construction, then the role of the student in constructing such knowledge becomes important.

It is incumbent upon the teacher to create an environment which encourages learning. The teacher should use teaching methods that will make the lesson interesting and encourage students' creativity and critical thinking.

My biggest challenge at the time of the study was how to have sufficient time while confronted at the same time while preparing my students for the E. A. M. C. E. T. Because of these students' weak academic background, I had to cover concepts of all chapters, which they ought to have learnt in the 10 +2 before preparing them for the examination. I had also to teach them how to develop and use concept maps as a learning tool. Another challenge I faced was the students' apathy, lack of enthusiasm and interest in their work as well as their poor attitudes towards education in general. As a teacher I had to make my lessons as interesting as possible.

Also, I had to accommodate the students' weaknesses without compromising the standard of the lesson. Despite these obstacles a concerted effort was made to ensure that all the students gained sufficiently in the exercise. Students come to the learning environment with their own conceptual understandings, which may or may not be scientifically valid. However, as they interact with the teacher and learning materials, they ultimately construct, de-construct and modify their own understandings based on their new learning experience.

Depending on the success of the instruction, students might accommodate, assimilate or reject what they have been taught in a given lesson or a set of lessons. The success or otherwise of instruction to a large extent, depends on the relevance of what is taught from their daily lives. Hence, a student might partially or totally accept new knowledge or keep his/her own ideas and what is taught in a science class side by side.

Need for reflective practice for subject teaching

Teachers need tremendous efforts to handle the present day curriculum and student community. They should broaden their horizon to reach the level of their students to satisfy their queries. They should face the challenges of electronic media and try to get an important position in the present world in teaching their subject.

In the old scenario, the teacher was the boss. In the new scenario, the teacher becomes guide, mentor and finally a facilitator. The teacher is no longer the rage on the stage but the guide to a student in learning process. The teacher does not funnel information into their student's heads. They should guide the students in learning activity. The teacher is considered as the researcher, reflective practioner, decision maker and even as a strategists or give an idea about different strategies for different concepts to the students. Some times, students choose their own path of learning the subject with the help of teacher.

In this fast changing global scenario, no other processes excepting reflective practice, which is highly beneficiary is the best and could serve the ever growing needs of the subject learners. Or subject teachers. Reflective practice aims at the development of alternative teaching strategies that improves the teaching skills of the students. It involves aspects such as:

- **felt need**
- **quick feed back**
- **Immediate result improvement in concept learning and applicability.**

Reflection plays an integral role both in action and learning from the action. Developing reflective process involves asking and answering. The fundamental questions:

- **What I do?**
- **How do I do it?**
- **What does this mean for both myself as a professional and those whom I serve?**

Reflective teaching involves giving careful thought to the instructional choices made throughout the process of planning and teaching. It is anticipating and assessing the impact these choices have a student learning, and deciding how this information should be used to make round instructional decisions in the future.
Results and Discussion

REFLECTION 1

Before Reflection

Researcher cum teacher explained the extraction of metallurgy monotonously as one man shoe i.e traditional teaching in India and has taken oral and written feed back from students and was found unsatisfactory. In the text especially lot of confusion arises regarding electrolyte, electrode, product at cathode and product at anode, inert gas used, any other gas used, maintaining of temperature, several different processes and finally extraction of Mg from sea water.

When researcher explains the extraction of metallurgy, students understand the subject but confusion arises for I.P.E as well as E.A.M.C.E.T model tests.

After Reflection

Then on the next day students are made into groups and given the columns of a table and asked to fill up the same by reading the text book. Students have prepared a comparative table by discussing with fellow students and taking suggestions from teacher and practiced well. Then researcher has drawn the table on the black board and discussed the various preparation or extraction techniques of magnesium by telling stories related to those techniques.

Students enjoyed, practiced and remembered each and every word used in the class room. The following is the material given in the text book prescribed for two years intermediate students by the Board of Intermediate Education. Minerals: Magnesium is distributed in nature in combined form. We find it sea water, in human blood, in the leaves (as chlorophyll) etc.Minerals of Magnesium:

Magnesite – $MgCO_3$; dolomite – $CaCO_3$ $MgCO_3$; carnalite- $KCl.MgCl_2 .6H_2O$; kieserite – $MgSO_4$ H_2O; Epsom salt or epsomite – $MgSO_4 .7H_2O$; kainite – $K_2SO_4 .MgSO_4 . MgCl_2 .6H_2O$; asbestos– $CaMg_3(SiO_3)_4$.
Sea water contains $MgCl_2$ and $MgSO_4$.

In our country, magnesite and dolomite are largely available in the states of Tamilnadu and Karnataka. Major amounts of these minerals are exported. Metallurgy of Mg: Mg metal is industrially prepared from the sources viz. carnalite, magnesite or sea water.

Mg from Carnalite

To get magnesium from carnalite, the mineral must be dehydrated to get anhydrous mineral before molten mineral is electrolysed. While preparing anhydrous mineral, removal of first four molecules of the water is relatively easy. The removal of last two molecules is very difficult.

The reason is that $MgCl_2$ undergoes hydrolysis forming Mg compounds which are insulators. Then, it becomes difficult for the Electrolysis to be carried out. However, HCl is present in large amounts; the following reaction can be prevented.

$$MgCl_2 + H_2O \longrightarrow Mg(OH)Cl + HCl$$

That is why during the dehydration of carnalite, in the last stages, the mineral is heated to 350^0C in a current of HCl.

Afterwards, it is mixed with equal amount of NaCl and heated to 700^0C. The presence of KCl and NaCl in anhydrous $MgCl_2$ prevents hydrolysis and also increases the electric conductivity.

The anhydrous $MgCl_2$ obtained in this manner is electrolysed in iron tanks (see fig. 001). The reactions that take place are

Ionization: $MgCl_2 \longrightarrow Mg^{2+} + 2Cl^-$
At Cathode (reduction): $Mg^{2+} + 2e^- \longrightarrow Mg$
At Anode (oxidation): $2Cl^- \longrightarrow Cl_2 + 2e^-$

The iron tank itself functions as the cathode. The tank contains about 6.7 tons of electrolytes. By maintaining at 700^0 C, not only mineral is in molten state but also metal obtained is in molten state.

Anode is made of graphite coated with lead. The anode is surrounded by a porcelain hood. Chlorine formed during electrolysis is let out through this hood. Initially, all the air in the cell is replaced by hydrogen or coal gas. The magnesium metal produced in the process floats on the electrolyte which is skimmed of from time to time. It is 99.9% pure.

Mg from Magnesite

Magnesium metal can also be obtained from magnesite. Magnesite is calcined and the magnesia thus obtained is melted and electrolysed. In industry magnesia is mixed with magnesium, barium and sodium fluorides and the molten mixture is electrolysed in steel tanks at 900-950^{0}C, (Fig.001)

$$MgCO_3 \xrightarrow[\Delta]{} MgO + CO_2$$

As iron rods introduced from the bottom of the tank into the electrolyte act as cathodes. From the top of the tank, a series of suspended carbon rods acts as anodes. Magnesium metal rises to the top, gets cooled by the air and forms a scum.

This prevents the oxidation of the molten metal by air. The metal is removed periodically and fresh amounts of magnesia are added simultaneously to the tank. Magnesium oxide can be reduced to to the metal by other methods. Hansging method is one of them. In this method. The MgO is mixed with 'C' and heated to about 2000^0C

In an electric furnace.

$$MgO + C \longrightarrow Mg + CO$$

The forward reaction is an endothermic reaction and so proceeds only at high temperatures. The metal formed is in vapour state (m.p of Mg=650 ^{0}C and b.p=111^{0}C) mixed with "CO" gas.

To prevent the back reaction, the vapours are quenched as soon as they come out of the electric furnace. This is done in another chamber maintained at 200^0 centigrade with hydrogen gas or natural gas.

Mg only solidifies which is separated and purified by distillation in vacuum.

In other methods , MgO is reduced with silicon or ferrosilicon or with calcium carbide at 1200 -1500

$$2MgO + Si \longrightarrow 2Mg + SiO_2$$
$$3MgO + FeSi \longrightarrow 3Mg + FeSiO_3$$
$$3MgO + CaC_2 \longrightarrow 3Mg + CaO + 2\ CO\ .$$

From Sea water

Sea Water contains $MgCl_2$ and $MgSO_4$ in dissolved state. There are three main stages in the extraction of Mg from sea water.

a) Precipitation of $Mg(OH)_2$ from sea water by the addition of slaked lime

$$MgCl_2 + Ca(OH)_2 \longrightarrow Mg(OH)_2 + CaCl_2$$
$$MgSO_4 + Ca(OH)_2 \longrightarrow Mg(OH)_2 + CaSO_4$$

a) **Conversion of Mg $(OH)_2$ into anhydrous $MgCl_2$ or $MgSO_4$. The reactions are**

$$Mg(OH)_2 + 2HCl \longrightarrow MgCl_2 + 2H_2O$$
$$Mg(OH)_2 \longrightarrow MgO + H_2O$$

b) Electrolysis of anhydrous $MgCl_2$ or MgO(as described earlier) (Table: 1)

Table 1

The table prepared by students under the guidance of teacher is given below

	From carnalite	from Magnesite	from MgO	From MgO	From sea water
Name of The Method	**Electrolysis**	**Electrolysis**	**Thermal reduction**	**Thermal reduction by Hansging Method**	**By using slaked lime**
Electrolyte	**Anhydrous $MgCl_2$ +NaCl**	**MgO(Magnesia) is mixed with MgF_2 ,BaF_2,NaF**	**Substance taken is MgO**	**Substance taken is MgO**	**Substances present in sea Water +$MgCl_2$**
	The presence of KCl&NaCl in anhydrous $MgCl_2$ prevents Hydrolysis& & also increases The electrical Conductivity	**The presence of MgF_2 ,BaF_2 &NaF in MgO prevents hydrolysis & also increases the electrical conductivity***	**---**	**---**	**-------**
Ionisation	**$MgCl_2 \rightarrow Mg + 2Cl^-$**	**Not mentioned In the text book But students understand In the following way. $MgO \rightarrow Mg + O^{2-}$ $MgF_2 \rightarrow Mg + 2F^-$ $BaF_2 \rightarrow Ba + 2F^-$ $NaF \rightarrow Na + F^-$**	**-------**	**--------**	**----------**
Reaction At cathode	**$Mg^{2+} + 2e^- \rightarrow Mg$**	**$Mg^{2+} + 2e^- \rightarrow Mg$**	**-----**	**--------**	**----------**
Reaction At anode	**$2Cl^- \rightarrow Cl_2 + 2e^-$**	**Not mentioned In the text book**			
Gas is Used to Prevent oxidation	**H_2 or coal gas**	**------------------**	**H_2 or natural gas**	**----**	**---------**
Temperature	**350^0C(I) 700^0 C(F)**	**900-950 ^0C**	**2000^0 C**	**$1200\text{-}1500^0$ C**	**Not mentioned**

I=initial,F=final ,* * the matter is not there in the text book but students understand with respect to earlier one.

REFLECTION 2

Before Reflection

Students are facing difficulty in learning the chemical properties of H_2O_2. The teacher monotonously explained the chemical properties of H_2O_2 which are given in the text book. But students are not happy which was grasped by teacher from the faces of students because face is index of mind.

Immediately teacher has taken written feed back from the students. Here teacher as a researcher is student friendly and students were given full freedom in writing the feed back without any hesitation or second thought.

Students have shown their dissatisfaction of the subject taught as expected by researcher. Then researcher cum teacher reflected and changed his method of teaching and spent some more hours to satisfy the students though time constraint is there.

After Reflection

The researcher first familiarized the important names and formulae of the reactants and products and then the teacher made the students into groups and asked them to discuss and practice. Names and formulae are given below:

H_2O_2	Hydrogen peroxide		
PbS	Lead sulphide	$PbSO_4$	Lead sulphate.
$FeSO_4$	Ferrous sulphate	$Fe_2(SO_4)_3$	Ferric Sulphate
KNO_2	Potassium nitrite	KNO_3	Potassium nitrate
KI	Potassium Iodide	I_2	Iodine
Na_2SO_3	Sodium sulphite	Na_2SO_4	Sodium Sulphate
Na_3AsO_3	Sodium arsenite	Na_3AsO_4	Sodium arsenate
$K_4Fe(CN)_6$	Potassium ferro cyanide	$K_3Fe(CN)_6$	Potassium ferricyanide
HCHO	Formaldehyde	HCOOH	Formic acid
Hg	Mercury	HgO	Mercuric Oxide
CrO_4^{2-}	Chromate ion	CrO_5	Chromium peroxide
Cl_2	Chlorine	HCl	Hydrogen Chloride
Br_2	Bromine	HBr	Hydrogen Bromide
Ag_2O	Silver oxide	Ag	Silver
PbO_2	Lead dioxide	PbO	Lead monoxide
O_3	Ozone	O_2	Oxygen
$K_4[Fe(CN)_6]$	Potassium ferrocyanide	$K_3[Fe(CN)_6]$	Potassium ferrocyanide
$CO(NH_2)_2$	Urea	$CO(NH_2)_2 . H_2O_2$	Hyperol

Now students got familiarized with the names and formulae of those compounds/molecules.

Then researcher explained the concept of oxidation (Addition of oxygen and loss of electrons) and concept of reduction (Addition of hydrogen or removal of oxygen and gain of electrons) and also quoted the following example.

$$Na_2SO_3 + H_2O_2 \longrightarrow Na_2SO_4 + H_2O_2$$

In this case H_2O_2 gives up oxygen to Na_2SO_3 and becomes H_2O and Na_2SO_4. The Oxidation state of sulphur is increased from +4 to +6 in the conversion of sodium sulphite into sodium sulphate.

Then students understand the concept of oxidation. Then students are divided into groups and were given some reactants and were asked to identify products and write equations for them individually.

The students' responses are given below:

(1) $KNO_2 + H_2O_2 \longrightarrow KNO_3 + H_2O$
(2) $Na_2SO_3 + H_2O_2 \longrightarrow Na_2SO_4 + H_2O$
(3) $PbS + H_2O_2 \longrightarrow PbSO_4 + H_2O$
(4) $FeSO_4 + H_2O_2 \longrightarrow Fe_2(SO_4)_3 + H_2O$
(5) $HCHO + H_2O_2 \longrightarrow HCOOH + H_2O$
(6) $Hg + H_2O_2 \longrightarrow HgO + H_2O$
(7) $KI + H_2O_2 \longrightarrow 2KOH + H_2O + I_2$
(8) $K_4[Fe(CN)_6] + H_2O_2 + H_2SO_4 \longrightarrow K_3[Fe(CN)_6] + 2H_2O + K_2SO_4$
(9) $CrO_4^{2-} + 2H_2O_2 + 2H^+ \longrightarrow CrO_5 + 3H_2O$

The students have used the concept of addition of oxygen from H_2O_2 to reactant for oxidation property in case of 1st, 2nd, 3rd, 4th, 5th and 6th reactions. They have used the concept of loss of electrons by reactant for oxidation property in case of 7th, 8th and 9th reactions.

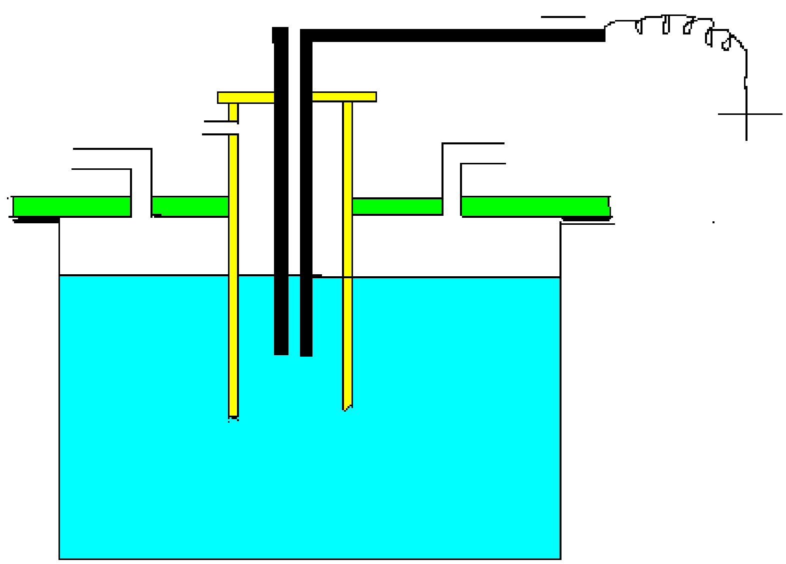

Figure: 1
Preparation of magnesium from carnalite

Then some students are not comfortable with the 3rd reaction. By cooperative learning, the students got their doubts clarified and got satisfied during the interaction with the researcher. Some students are not happy with 4th reaction and they have discussed with the researcher cum teacher and got clarified about the conversion of ferrous (+2) into ferric (+3). Then Major problem arouse with maximum number of students in case of 7th, 8th and 9th reactions. Then they have discussed about the increase in oxidation states of iodine, iron and chromium respectively .Researcher already revised the concept of calculation of oxidation state of atom in a compound. So they are happy in learning and reproducing the oxidation properties of H_2O_2.

On the other day researcher concentrated on concept of reduction. He quoted one example and explained the concept of reduction.

(1) $PbO_2 + H_2O_2 \longrightarrow PbO + H_2O_2 + O_2$

He stated that H_2O_2 takes up one oxygen from reactant PbO_2 and becomes H_2O and O_2 as shown by an equation. Students are divided into groups and were given some more reactants and were asked to write the products and finally reactions.

(2) $Ag_2O + H_2O_2 \longrightarrow 2Ag + H_2O + O_2$

(3) $O_3 + H_2O_2 \longrightarrow O_2 + H_2O + O_2$

(4) $Cl_2 + H_2O_2 \longrightarrow 2HCl + O_2$

(5) $Br_2 + H_2O_2 \longrightarrow 2HBr + O_2$

(6) $K_3[Fe(CN)_6] + H_2SO_4 + H_2O_2 \longrightarrow K_4[Fe(CN)_6] + K_2SO_4 + 2H_2O$

The students have used the concept of removal of oxygen for 1st , 2nd and 3rd reactions. They have used the concept of gaining of electrons by the reactant. The students are very happy in learning, especially interacting with fellow students and expressed unanimously about their satisfaction during the task.

RESULT

The examination was conducted and compared to the previous year batch, more than 95% of students performed well in the weak end examination.

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