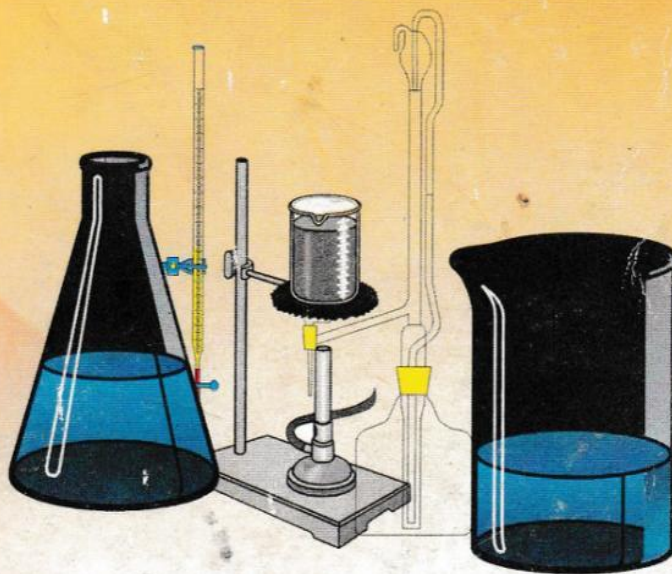




SCIENCE TEACHERS ASSOCIATION OF NIGERIA

CHEMISTRY PANEL SERIES 5

EFFECTIVE METHODS OF TEACHING INORGANIC CHEMISTRY



A Hand Book For
CHEMISTRY TEACHERS

Editors

Elder Olayiwola M.A. [Ph. D]. (MSTAN)
Walter S. Umoh [MSTAN]

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CHAPTER SEVEN

MASTERY LEARNING STRATEGY: AN EFFECTIVE APPROACH IN TEACHING/LEARNING REDOX REACTION

By

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INTRODUCTION

Chemistry is an essential ingredient in any meaningful science and technological development. In the Secondary School curriculum, Chemistry is taught under two broad concepts; organic and inorganic Chemistry. According to WAEC chief examiners' result of May/June 2008, about 83% of candidates failed to obtain five credits passes in Mathematics, English and three other subjects. Eze (2002) reported of low achievement and enrolment in Chemistry.

Meaningful learning requires appropriate teaching strategy for learners to assimilate and master concepts in Chemistry. Innovative teaching strategies have been developed and used to enhance students' poor performances in science. However, the problem persists due to the abstract nature of science, language problems, teaching strategies, teachers incompetence and lack of teaching facilities, (Ngozi and Ndokwo 2007). The use of mastery learning strategy which involves frequent assessment of students' progress with emphasis on students' participation and mastering of concept before moving from one concept to another in teaching and learning of redox reactions is very relevant now than ever.

Mastery Learning

Mastery learning is a remedial process aimed at bringing students to a level of mastering a concept. According to Adepoju (2003), mastery learning is an innovative strategy which is designed to make students perform beautifully well on an academic task. Researchers have reported that mastery learning technique will at any time yield better result. Abadon (2002) noted that students performed better in mathematics with high retention when taught with mastery learning approach. Gamba and Wachanga (2004) reported that students perform more when taught with mastery learning than with conventional method. Thus, the use of mastery learning involves

- Involving students in relevant hands – on, heart – on, and heads – on activity.
- Frequent assessment/ feed back
- Corrections with emphasis on cues
- Motivation
- Allotment of more time on task
- Reinforcement through assignment

The use of teaching method that promotes meaningful learning in a particular topic in chemistry is the first step to success. Hence mastery learning strategy which is based on students reaching a predetermined level of mastering one unit before moving to another unit is very appropriate for teaching and learning redox reaction.

Sample Lesson on Redox Reaction Using Mastery Learning Approach

Lesson : Redox reaction

Topic : Definition and balancing of redox reaction

Time : 80 minutes

Class : SSII

Teaching method : Mastery learning approach

Gender : Male and Female

Objectives : At the end of the lesson students should be able to:-

1. Define redox reaction
2. Balance redox equation in acidic medium
3. Balance redox equation in alkaline medium

Previous knowledge : Students have been taught

1. Types of reaction
2. Balancing of chemical equations

Presentation

Step 1 : The teacher briefly ask the students the following question

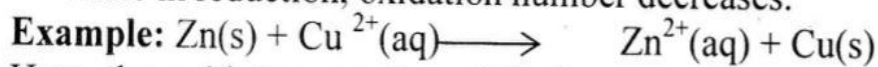
- a. Name any four types of chemical reaction
- b. Write a balanced equation for the following reactions
 - i. Calcium reacting with oxygen
 - ii. Sodium metal combines with chlorine
 - iii. Iron reacts with hydrogen chloride

Activity 1: Definition of redox reaction

Step 2: The teacher defines redox reaction as follows:

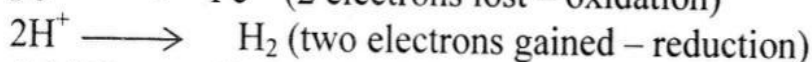
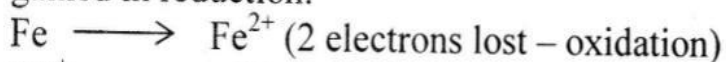
Redox reaction is a two way reaction involving simultaneous oxidation and reduction processes. The oxidation and reduction processes are identified by

1. **Change in oxidation Number:** In oxidation, oxidation number increases while in reduction, oxidation number decreases.

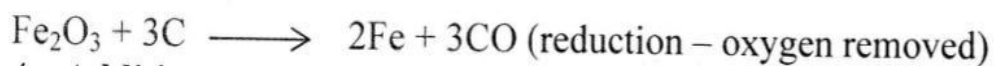
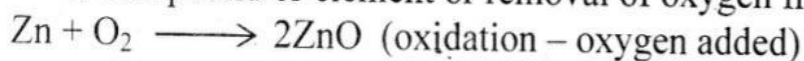


Here, the oxidation number of Zn increases from 0 to 2 while that of copper decreases from +2 to 0.

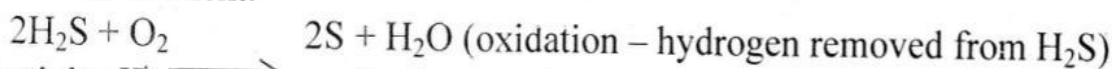
2. **Loss or Gain of electrons:** In oxidation, electron is lost while electron is gained in reduction.



3. **Addition or Removal of Oxygen:** Oxidation involves addition of oxygen to compound or element or removal of oxygen from compound.



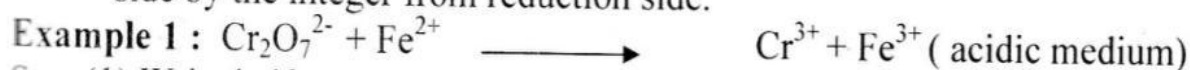
4. **Addition or Removal of Hydrogen:** Oxidation is the removal of hydrogen from a compound while reduction is the addition of hydrogen to compound or element.



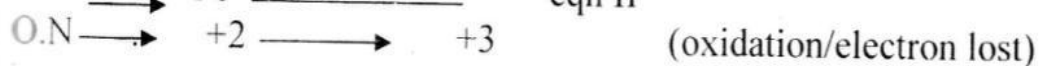
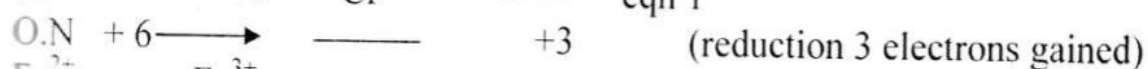
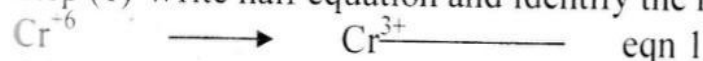
Activity II: Balancing of redox reaction

In balancing a redox equation, these rules should be followed

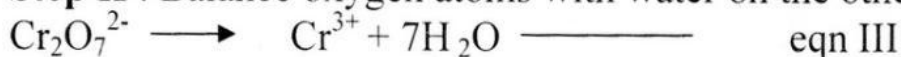
1. Note the medium of the reaction.
2. Write the half cell equation
3. Calculate the oxidation number of reactants and products
4. Balance oxygen atoms with water molecule in the opposite side.
5. Balance hydrogen atoms by adding water to the side in which hydrogen is less.
6. If acidic medium, balance excess electron with H^+ and if alkaline medium, balance it with OH^- .
7. Multiply the reduction side by integer from oxidation side and oxidation side by the integer from reduction side.



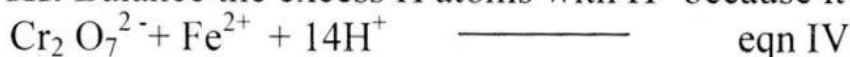
Step (1) Write half equation and identify the reduction as shown



Step II . Balance oxygen atoms with water on the other side.



Step III. Balance the excess H atoms with H^+ because it is in acidic medium.



Step IV. Add equation III and IV



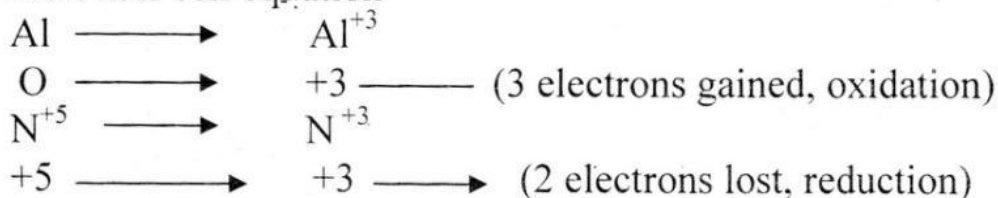
Step V. Multiply oxidation by 3 and reduction by 2 where necessary to balance Cr and Fe.



Step VI. Count each atom on the reactant side and ensure it corresponds with the atoms on the product side. Review the balancing from step I to step VI to ensure mastery.

Example II: $\text{Al} + \text{NO}_3^- \longrightarrow \text{AlO}_2^- + \text{NH}_3$ (alkaline medium)

Step I: write half cell equation



Step II: Balance the oxygen with water molecule



Step III : Balance the excess H atom with OH^- because it is an alkaline medium.



Step IV: Add equation II and III



Step V: Multiply oxidation side by 2 or multiple of 2 and reduction side by 3 or multiple of 3.



Step VI: Count each atom on the reactant and ensure that it correspond with those on the product side.



STUDENTS ASSIGNMENT

- $\text{I}^- + \text{NO}_2 \longrightarrow \text{I}_2 + \text{NO}$ (Acidic Medium)
- $\text{MnO}_4^- \longrightarrow \text{MnO}_4^{2-} + \text{O}_2$ (Alkaline Medium)

CONCLUSION

The use of mastery learning strategy in teaching redox reaction will not only enhance students participation but also promote retention and achievement.

A shift from teacher centred to student centred is a must to enhance students' mastery of concepts thereby reducing the high failure rate in chemistry. Teachers should assess students frequently, motivate, provide feedback and correction to students so as to help them know the level of mastering a concept.

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