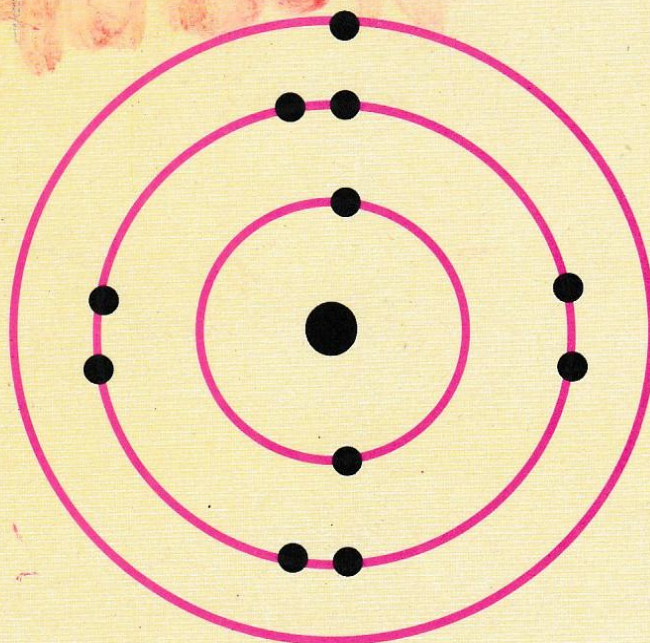


**SCIENCE TEACHERS
ASSOCIATION OF NIGERIA**

CHEMISTRY PANEL SERIES 8

**TEACHING
PARTICULATE NATURE
OF MATTER AND
CHEMICAL COMBINATIONS**



**A HANDBOOK FOR
CHEMISTRY TEACHERS**

PROBLEM-BASED LEARNING APPROACH FOR TEACHING ELECTROVALENT, COVALENT AND CO-ORDINATE COVALENT BONDING IN SS CHEMISTRY

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Introduction

The method of teaching chemistry in secondary schools has made the subject appear as if concepts have no application on students' knowledge effectiveness. The concepts taught in chemistry have various applications in the real world and problem-based learning approach (PBL) can expose students to discovering important concepts and making interconnections for generalizations. PBL is a cooperative learning approach that uses intellectual curiosity as its driving force for students learning. The major idea behind PBL is that it uses problems, asking questions and setting tasks to trigger motivation for learning and stimulating students' interest to stay focused on the task. It challenges students to be more self-directed and explore variety of ways in a learning environment to keep learners attention on the assignment. Problem-based Learning works best in small groups where learners learn to carry out activities themselves by brainstorming on a given topic and principle. Kenyon and Reiser (2005) posited that Problem-based Learning is a pedagogic approach for implementing inquiry – step process, using advance organizer for identifying facts in a problem, generating ideas about the problem and identifying just what the problem is. It guides students in developing tasks that give adequate feedback in order to test their ideas (hypotheses). It is constructive, self-directed, collaborative and contextual.

Penick (2006) in Ogumeyo (2007) stated that for a teaching strategy to be effective, it should not only be active but should be

meaningful to equip students with skills, knowledge and attitudes that can be used to solve problems in new situations. According to Obodo (2004), students' interest can be aroused by involving them in relevant chemistry-probing activities that result in the child developing a positive attitude toward the subject. There is, therefore, need to adopt innovative teaching strategy that will generate students' interest, retention of what is learnt and improve their conceptual understanding in chemistry problems. This could be achieved through the use of Problem-based Learning.

Instructional Objectives

By the end of the lesson, learner should be able to:

- Illustrate different bond-type with specific examples on the chalkboard
- Mention types of with (chemical) bonding.
- Explain, using their own words, the terms electrovalent bonding.
- Describe the types of covalent combinations

Entry Behaviour

The students have already learnt about balancing equations. They come into the class with prior knowledge. Teachers ask questions relating to previous knowledge the students may have had.

Instructional Materials

Illustrative periodic table charts (prepared by the students), textbooks, and elements such as sodium, potassium, calcium, fluorine and chlorine given by the teacher and needed for chemical combination activities.

CONTENT	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES
Introduction <ul style="list-style-type: none"> • Meaning of concepts • Chemical combination 	Teacher shows students some elements like Na, K, Ca, Al, F, Cl, and tries to facilitate the meaning of chemical combination by allowing students take charge of their learning.	They answer the following questions <ol style="list-style-type: none"> 1. What is chemical combination? 2. Name some Group 1 & 2 elements used for practical activities. 3. How many valence electrons does sodium have?
Types of chemical combination	Allow students to attempt to suggest types of chemical combinations. Teacher explains types of chemical combinations, which include electrovalent and covalent combinations.	<ol style="list-style-type: none"> 4. How many types of chemical combinations exist? 5. How is chemical combination achieved? 6. How is electrovalent combination different from covalent combination?
Electrovalent combination	Allow students attempt to define electrovalent combination. Guide students to identify these elements in Groups 1 and 2 to investigate their physical properties and how they are involved in chemical combination by losing one or two electrons depending on the group.	<ol style="list-style-type: none"> 7. How are electrovalent elements identified? 8. What amount of energy is required to lose electrons? 9. What is a valence shell? 10. what characterizes Group 1 and 2 elements in their valence shells?
Electrovalent bond	Guides students into how electrovalent bonds are formed. Electrovalent bond is formed when a metal atom (M-atom) transfer one or more electrons to a Non-metal atom (Non-M- atom) Electrons involved in the transfer reside in the outer most shells of the atoms Alkali Metals include Sodium (Na^{11}) ($\text{K}^2 \text{L}^8 \text{M}^1$) Potassium (K^{19}) ($\text{K}^2 \text{L}^8 \text{M}^8 \text{N}^1$) Calcium (Ca^{20}) ($\text{K}^2 \text{L}^8 \text{M}^8 \text{N}^2$)	<ol style="list-style-type: none"> 11. How is electrovalent bond formed? 12. Where do the electrons involved in the transfer reside? 13. How is the stable duplet or octet structure attained? 14. Give three examples each of alkali metals and alkali earth metals. 15. Which atoms have only one valence electrons in their outermost shell? 16. Why is Aluminium atom less reactive than calcium atom? 17. Why is a great amount of energy required to dispose of the valence electron of Ca?
Electrovalent bond formation	Non-metals on the other hand like. Fluorine (F^9) ($\text{K}^2 \text{L}^7$) and Chlorine (Cl^{17}) ($\text{K}^2 \text{L}^8 \text{M}^7$) are extremely reactive like Alkaline metals. With seven valence electrons, they need to	<ol style="list-style-type: none"> 18. What group does chlorine and Fluorine belong on the periodic table? 19. How many valence electrons does Fluorine and

	accept only one more electron to attain a stable octet configuration. Guides learners to identify non-metals such as Fluorine and Chlorine in Group 7 of the periodic Table. Facilitate learners to attempt generating ideas on how electrons are transferred or gained from one atom to the other on the chalkboard. Give clue on metallic particle becoming positively charged because after donating its valence electrons, they possess excess protons in their nucleus while the non-metallic particles acquire negative charges.	chlorine possess? 20. How do they attain stable octet configuration? 21. What charge does the metallic particle acquire in electrovalent combination? 22. What charge does the non-metallic particle acquire in electrovalent combination? 23. What are charged particles called? 24. What forces hold charged particles together?
Characteristics of electrovalent compounds	Guide learners to attempt stating through practical participation the different characteristics of electrovalent compounds.	25. List four characteristics of electrovalent compounds.
Covalent combination	Guide student to attempt distinguishing between covalent and electrovalent combination. Give clues only when necessary. These are bonds formed between two-atoms by sharing a pair of electrons to attain the stable octet structure. Examples are diatomic molecules like H ₂ , Cl ₂ , O ₂ and formation of water molecules and organic compounds. Covalent bond may be single, double or a triple bond	26. What is covalent combination? 27. How does covalent combination differ from electrovalent combination? 28. Why do atoms share a pair of electrons?
Types of covalent combinations	1. Ordinary covalent combination 2. Coordinate covalent combination	
Characteristic of covalent compounds	Allow students to attempt to sketch probable structure of covalent combination, using the above mentioned molecules and bond formed between Hydrogen and Chlorine. Students determine from their illustrative sketches on the chalkboard the characteristics of covalent compounds. They are guided to make suggestions: 1. They contain only molecules 2. They are mainly organic compounds 3. They are often gases and volatile liquids 4. They have low melting and boiling points	29 State three features of covalent compounds.
Co-ordinate or dative covalent bond	Guide students to compare ordinary and co-ordinate covalent bonding making use of simple examples on the chalkboard with the periodic table as a	30. What is the name given to the atom that contributes the pair of electrons? 31. Is a coordinate covalent

	facilitating guide. • A type of covalent combination with only one of the participating atom contributing the electrons to form the shared pair (an atom with lone-pair of electrons). Examples are NH_3 , H_2O • H: Is^1 gains an electron to form a H^- ion • N: forms NH_4^+ . Here, lone pair of electrons in the valence shell of N-atom in NH_3 is donated for sharing with the empty is orbital of a proton, H^+ .	bond stronger than a covalent bond? 32. Describe dative bond formation. 33. How are coordinate covalent bonds different from other covalent bonds? 34. What is an example of a coordinate covalent bond? 35. Is ammonia a coordinate covalent bond?
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Evaluation

Illustrate the differences between ordinary and dative covalent bonding.

State two reasons why lone pairs result in the formation of dative covalent bonds.

Describe why less energy is required for the release of electrons in electrovalent combination.

Conclusion

A teacher's use of appropriate innovative teaching approach keeps the learner focused. Using a problem to trigger tasks, problem-based learning approach provides the motivation and interest for learning concepts in chemistry.

References

<http://www.emedicalprep.com/aipmt.2011-cutoffs.html>.

Kenyon, L. P. & Reiser, F. B (2005). Integrating the nature of science into inquiry teaching. NARST (2005). North-western University.

Obodo, G. C. (2004). Principles and Practice of mathematics education in Nigeria. Enugu: General Studies Division, ESUT.

Ojokuku, G. O. (2010). Understanding chemistry for Senior Secondary Schools. MacChin Multimedia Designers, Zaria.

Penick, J. (2006) in Ogumeyo, A. S. (2007). Creativity as a tool for enhancing effective teaching and learning of science and mathematics. *Journal of qualitative Education*, 3 (2), 101-108.