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Advantages of Using Intellect Maps in Chemistry Lessons

Abstract

The aim of this study is to learn the effect of using intellect maps during the Chemistry lessons and by this method on the mastering of the topic, the productivity of the lesson.

The study is based on the example of teaching the topic Ammonia using the intellect map method, which is recommended for teaching Chemistry in secondary schools. It has been shown that during the teaching of the subject, the written text that explained the content of the lesson should be consistent with the sequence in the corresponding mind map specially constructed by each student, and the branching to start from the main idea (topic name) should be carried out clockwise, covering the details and subtleties of the subject. It has been determined that the application of inductive and deductive methods in the form of interaction in the teaching of Chemistry serves to more easily master the topics of the subject of Chemistry. The main forms of thought are to create logical and critical thinking in students which are inductive thinking (induction) and deductive thinking (deduction). Induction is to unite examples under one principle according to them, that is, carry these examples to a general principle (from the specific to the general); the other form of thinking is deductive thinking (deduction). It has been noted that inductive thinking involves moving from the parts of a single whole (from the specific) to the whole, and deductive thinking involves moving from a single whole (from the general) to the parts of the whole.

Keywords: *intellect map, complete, ammonia, thinking, experiment, inductive, deductive, logical, critical, creative, wit brains*

Introduction

During the research, the keywords are presented to the students form an ideafrom the topic, and the student pays attention to the words that are appropriate, similar and synonymous to those keywords, and records them. Note that keywords mean the terms, concepts and expressions that express the main content of the topic and the essence of its individual paragraphs and are most often used in the text. Conducting research with mind maps, mapping also develop soft skills in students, as students master the lesson by seeing, hearing, feeling, and discussing. The fact that the keywords on the considered intellect consist of chemistry terms, concepts and expressions serves to enrich the chemical language by strengthening the interaction between the chemical language and the corresponding mind map and to increase the productivity of learning with the help of the wit map method (Kan & Dermer, 1983). Working with intellect maps also accustoms students to the correct spelling and pronunciation of relevant words and expressions (Mammadova & Shadlinskaya, 2017).

During the study, students were provided with a textbook, test booklet, a skeleton of a mind map prepared with special keywords, colored pencils and paper as a source. The goal is to make the student think logically, critically and creatively using keywords and branches of the map (Babayev & Babayeva, 2023).

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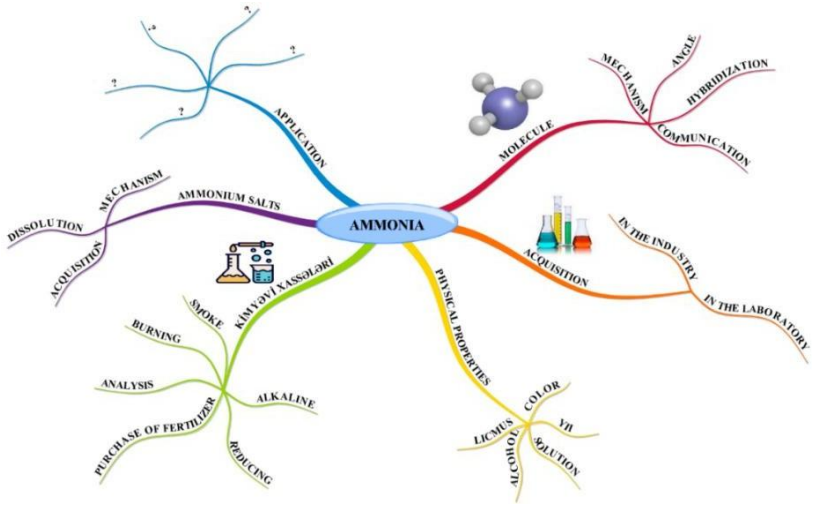
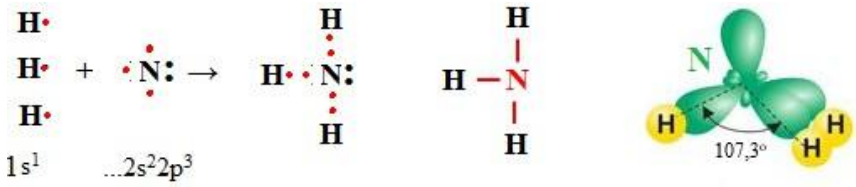
In order to improve the topic and transfer knowledge from short-term memory to long-term memory, each student solves the test using the intellect map he/she has prepared. At this time, he/she completes the test by adding and noting the map using the textbook.



Main Part

Ammonia is a polar covalently bonded, angularly structured, polar molecule. In the NH_3 molecule, nitrogen has a valence of III and an oxidation state of -3. In the ammonia molecule, the nitrogen atom forms a $4sp^3$ hybrid orbital in the sp^3 hybridization state. 3 of them are covered by the –s electron clouds of the hydrogen atom, forming a $3sp^3$–s sigma bond, and one orbital remains free. The molecule has the shape of an irregular pyramid or tetrahedron, and the valence angle is 107.3º (Babayev & Babayeva, 2021).



Industrial Production

Ammonia is obtained by the direct interaction of nitrogen and hydrogen.

$$N_2+3H_2 \overset{t,p,kat}{\longleftrightarrow} 2NH_3 + Q$$

Lab Production

It is obtained by heating ammonium salts with alkalis. At this time, the obtained ammonium hydroxide decomposes into water and ammonia.

$$NH_4Cl + NaOH \overset{t}{\rightarrow} NH_3\uparrow + H_2O + NaCl$$

Physical Properties

Ammonia is a colorless gas with a characteristic pungent odor, lighter than air, and very soluble in water. Under normal conditions, up to 700 liters of ammonia dissolve in one liter of water. When ammonia dissolves in water, part of it reacts with water and forms ammonium hydroxide. Therefore, a solution of ammonia in water is called ammonia water or liquid ammonia. At high pressure, ammonia liquefies and hydrogen bonds form between molecules in liquid ammonia.

Chemical Properties

1. Ammonia burns in pure oxygen, forming nitrogen, and when oxidized in the presence of a catalyst, it forms nitrogen monoxide and water.

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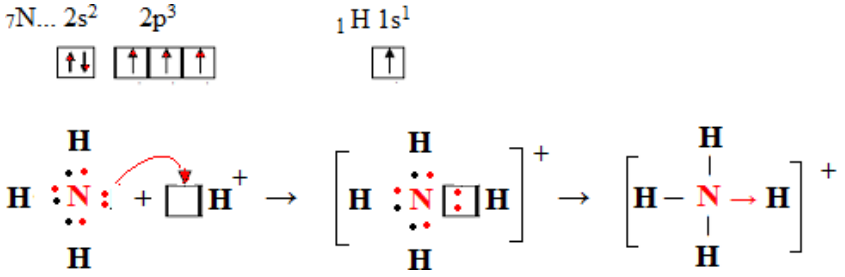
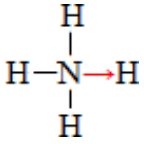
$4NH_3 + 3O_2 \xrightarrow{t} 2N_2 + 6H_2O$ $4NH_3 + 5O_2 \xrightarrow{t,kat} 4NO + 6H_2O$

− Ammonia does not burn in air.
− Ammonia is a chemically active, basic molecule.
− Ammonia's aqueous solution turns litmus blue.

2. Since ammonia is a basic molecule, it enters into combination reactions with water and acids by the donor-acceptor mechanism. In this case, the oxidation state of nitrogen does not change, its valence increases by one unit (Babayev & Babayeva, 2021).

$NH_3 + HOH \leftrightarrow NH_4OH$ $NH_4OH \leftrightarrow NH_3 + HOH$



Ion	Graphic formula	Oxidation state	Valence
NH_4^+ (ammonium ion)		N (– 3) H (+ 1)	N – IV H – I

Ammonia enters into combination reactions with acids, forming **ammoniumsalts**. Depending on the basicity of the acid and the molar ratio of ammonia, it forms normal and acidic salts.

$NH_3 + HCl \rightarrow NH_4Cl$ $NH_3 + H_3PO_4 \rightarrow NH_4H_2PO_4$
ammonium chloride ammonium dihydroorthophosphate

$NH_3 + H_2SO_4 \rightarrow NH_4HSO_4$ $2NH_3 + H_3PO_4 \rightarrow (NH_4)_2HPO_4$
ammonium hydrosulfate ammonium hydroorthophosphate

$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$ $3NH_3 + H_3PO_4 \rightarrow (NH_4)_3PO_4$
ammonium sulfate ammonium orthophosphate

Ammonium salts are obtained from the reaction of ammonium hydroxide with acids.

$NH_4OH + H_2SO_4 \rightarrow NH_4HSO_4 + H_2O$

Ammonium salts are solid, well soluble in water, hydrolyzed compounds, and decomposed mainly into ammonia and the corresponding acid when heated.

$(NH_4)_2CO_3 \xrightarrow{t} 2NH_3 + CO_2 + H_2O$ $NH_4HCO_3 \xrightarrow{t} NH_3 + CO_2 + H_2O$

The nature of the decomposition of ammonium salts depends on the acid residue in the salt. Salts of acids such as HF, HCl, HBr, HJ, H2S, etc. decompose when heated, and turn back into salt when cooled. The formation of ammonium chloride is observed in the form of white smoke, this reaction is also called a **fireless smoke** reaction.

$$NH_4Cl \xrightarrow{heated} NH_3 + HCl \xrightarrow{cooled} NH_4Cl$$

Some ammonium salts do not decompose into ammonia and acid.

$$NH_4NO_3 \xrightarrow{t} N_2O + 2H_2O \quad NH_4NO_2 \xrightarrow{t} N_2 + 2H_2O$$

$$(NH_4)_2Cr_2O_7 \xrightarrow{t} N_2 + Cr_2O_3 + 4H_2O$$

The decomposition of ammonium salts of polybasic acids occurs in stages.

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$$(NH_4)_2SO_4 \xrightarrow{t} NH_3 + NH_4HSO_4 \quad NH_4HSO_4 \xrightarrow{t} NH_3 + H_2SO_4$$

The interaction of ammonium salts with alkalis is used in the **determination of ammonium ion (qualitative reaction)**. In this case, pungent-smelling ammonia gas turns wet litmus paper blue.

$$2NH_4Cl + Ca(OH)_2 \xrightarrow{t} 2NH_3\uparrow + 2H_2O + CaCl_2$$

Ammonium chloride is used in soldering metals.

$$2NH_4Cl + 4CuO \xrightarrow{t} CuCl_2 + 3Cu + N_2 + 4H_2O$$

3. Ammonia interacts with carbon dioxide to form urea.

$$CO_2 + 2NH_3 \xrightarrow{t} CO(NH_2)_2 + H_2O$$

4. Ammonia is a strong reducing agent. It reduces some metals from their oxides.

$2NH_3 + 3CuO \xrightarrow{t} 3Cu + N_2 + 3H_2O$ $8NH_3 + 3Fe_3O_4 \xrightarrow{t} 9\ Fe + 4N_2 + 12H_2O$

5. Ammonia decomposes when heated. $2NH_3 \xleftrightarrow{t} N_2 + 3H_2$

(Abbasov & Aliyev, 2020).

Research

Pedagogical experiments show that the brains map program, colored pencils and specially constructed mind maps, visual observation, comparison and discussion methods make students more enthusiastic about the topic. In the preparation of intellect maps, the sequence of ideas and connections, the selection and visualization of keywords are of great importance (Açkalmaz & Telkenar, 2015). Depending on the goal, intellect maps can be used in Chemistry lessons by individual students or by dividing tnem into small and large groups.

Conclusion

During the experiment, it was determined that as a result of the extensive use of terms, keywords, concepts and colored pencils during the lesson conducted using the wit map method, the productivity of learning the subject increases, the correct spelling and pronunciation of the used keywords and expressions becomes easier, and it creates conditions for the enrichment of students' Chemistry knowledge and skills.

The study shows that the material mastered by students using the wit map method remains in memory better and for a longer time than the material learned using other methods. Because the learning process with intellect maps is compatible with the learning styles of all students (visual, auditory, kinesthetic, digital) (Babayev & Babayeva, 2024).

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