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The Effect of Using the Learning Cycle Method in Teaching Science on the Educational Achievement of the Sixth Graders

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ABSTRACT The study investigated the effect of using the learning cycle strategy in teaching on the achievement of sixth graders in science. To achieve this goal, eighty students were randomly selected then divided into two groups- the experimental group which was taught by using the learning cycle, and the control group which was taught by the traditional method. Data were collected using the following two instruments: a number of teaching situations which were planned by learning cycle and achievement test. To answer the questions, t-test was used. The study indicated that using the learning cycle reflects that there were greater effects on academic achievement. The researcher recommends that learning cycle should be used in science teaching, and more studies should be conducted about the effect of this method on other instructional variables.

INTRODUCTION

Improving education is the responsibility of all society institutions, including the educational institutions. The development of the individual's thinking can be accomplished with the help of various curriculums within the educational institutions if modern methods and the necessary requirements are available. All individuals have divergent degrees of ability, which need training and practice, as most scientific and technological achievements of humanity stem from the ideas of innovators.

Therefore, we need today teaching and learning strategies that provide us with a wide range and advanced educational potential that will help our students to enrich their information, develop their mental abilities and train them to be innovative and novel. However, this cannot be done without giving the students the opportunity to express, shape and test their ideas by providing them with appropriate sources, arousing their interests and inciting their deep thinking with the help of guided programs and various strategies and teaching methods.

The Constructivist Theory is one of the most important educational theories interested in arousing the learner's thinking and make him/her active, interactive and positive during the learning process. It emphasizes the fact that education is an active process towards building knowledge, and concentrates on the internal factors affecting the learner and what occurs in his/her mind when faced with educational situations like his/her previous knowledge, understanding concepts, ability to remember and process information, learning drive, thinking patterns, and anything that makes his/her learning meaningful. Constructivist thinking assumes that anything constructed by the learner becomes meaningful and compels him/her to form his/her own perspective about learning through the individual systems and experience and to find a relationship between the previous and the new knowledge (Zaitoon 2009; Gordon and Mordechai 2009). Constructivism views students as active thinkers that construct concepts about the world, and regards knowledge as a result of their thinking and activity (Wheatly 1991). Jean Piaget is very famous modern Austrian psychologist who identified himself as a cognitive psychologist interested in studying the stages of cognitive development. He is also the founder of constructivism, and was very interested in knowledge theory. He said, "The knowledge process is building or re-building the subject-matter of knowledge" (Shlayl 2003). Constructivist theory is concerned with the learning process, where it guides, develops and comments on new teaching methods, and identifies their effects on education (Baviskar et al. 2009).

Constructivism concentrates on building knowledge and claims that meaning remains subjective by the cognitive organ of the learner and is not transferred from teacher to learner. Furthermore, the learner's formation of meanings is an active psychological process which demands mental effort. It also concentrates on the learner and his/her activity during learning, and emphasizes meaningful learning based on understanding through the students' active role and effective participation in the activities they

do, in order to build their concepts and scientific knowledge. Artino (2008) points out that educational literature confirms that learners' success is contingent on their flowing, comprehensive cognitive inventory with its good utilization and application in solving problems; therefore, the learner is not static, and should acquire renewable concepts and knowledge, and should develop himself by himself in order to remain continual and interactive with others, so that he would be able to solve his/her real problems in meaningful tasks.

Many researchers have developed models and strategies derived from the constructivist theory, for instance, learning cycle, concepts maps, the V model, constructive analysis model, the realistic model, co-operative learning strategy, and teaching strategies based on the constructivist thought.

Learning cycle as a teaching strategy emerged first in the late 1960s when Robert Karbles and his colleagues implemented it in the science curriculum of the primary stage. This model was further developed in the early 1990s within the biology project of the primary stage developed by the science study committee; it was originally designed for the Science Study Improvement Curriculum (SCIS), which achieved good results in teaching science. Since its first emergence, many studies on its effectiveness were carried out, including the training of teachers before and during service and the effect of their implementation of the model on many educational results, like: students understanding of scientific concepts, thinking and their attitudes towards learning science. This success is attributed to the learning cycle method as an exploration process in teaching and learning (Martin et al. 1998).

In the beginning, learning cycle, as a teaching method, consisted of three stages: exploration, reaching a concept and application. However, as the objectives of science teaching developed further, learning cycle consisted now of four stages: exploration, explanation, elaboration and evaluation. The Biological Science Curriculum Study (BSCS), headed by Bybee in 1993, developed a constructivist study method called The 5 E Learning Cycle, which are the stages of (1) Engagement, (2) Exploration, (3) Explanation, (4) Elaboration and (5) Evaluation. The following is explanation of these stages (David 2003; Khataibah 2005).

1. Engagement

Engagement stage is designed to help students understand the learning task and make connections between learning experiences. It should stimulate interest and prompt students to identify their own questions about the topic. Students explore the questions raised after they gain more understanding of the topic and the tools needed to investigate the ideas.

Activities in this stage include posing a question, defining problem, or demonstrating a discrepant event, then using small group discussions to stimulate and share ideas. To connect science to students' lives, we frequently use historical events, such as natural disasters, to stimulate curiosity and motivate learning. Instructors help students connect previous knowledge to the new concepts introduced in the unit.

2. Exploration

In the Exploration stage students have the opportunity to get directly involved with the key concepts through guided exploration of scientific, geographic, economic, and other data sets. They begin identifying patterns in the data and connecting them to Earth processes. This further arouses student curiosity and new questions develop. Frequently, students diverge from the slated activity to explore their own questions, continually building on their knowledge base. Through this process of questioning and exploration, students begin to formulate their understanding of the basic concepts. In this stage, instructors observe and listen to students as they interact with each other and the data sets. Probing questions help students clarify their understanding of major concepts and redirect their investigations when necessary. It is critical to allow adequate time at this point for students to thoroughly investigate the guiding questions in the module, as well as the questions they have generated themselves.

3. Explanation

In this stage, students are introduced more formally to the lesson's science concepts. Through readings and discussions, students gain understanding of the major concepts and can verify answers to questions or problems posed earlier. In addition, more abstract concepts not easily explored in earlier activities are intro-

duced and explained. As students formulate new ideas to interpret observations made in the Explore stage, appropriate vocabulary can be introduced. If students have unresolved questions, they may continue to look for solutions in the elaborate stage.

4. Elaboration

In the Elaborate stage, students expand on what they have learned and apply their new found knowledge to a different situation. They test ideas more thoroughly and explore additional relationships. Providing closure to the lesson and verifying student understanding is critical at this point.

5. Evaluation

The learning cycle provides opportunities for the instructor to continually observe students' learning and to monitor their progress using questioning techniques and discussions. More formal evaluation can be conducted at this stage. The assessment should be aligned with the styles and content of the learning experience. We have provided traditional assessments in the form of quizzes and ideas for alternative assessments such as using concept maps or having students create summary projects and reports. The multiple choice quizzes were designed and used primarily for assessing changes in student understanding as part of the evaluation of the materials.

Steps of Learning Cycle's Design

According to the Five E' s Learning Cycle Model – one of the strategies of the constructivist theory – knowledge is built by the learner, where the study subject is presented as a problem to be solved by the student using his/her previous experience. The following are the steps of designing a Five E's Learning Cycle model:-

1 Selecting the concept the students will learn and creating it carefully.
2 Creating the objectives of the concept or the problem.
3 Creating the educational activities used by the students to collect the necessary data in order to find out the concept.
4 Giving the students written instructions to help them collect the necessary data in order to find out the concept.
5 Selecting the educational activities to be used in the application stage.
6 Preparing concept evaluation tools that include the data collected by the students and the questions given to them at the end of the learning cycle or during its various stages.

The results of numerous studies revealed the effectiveness of the learning cycle on the educational results like achievement, scientific attitudes and thinking skills in all levels, which are fundamental objectives of the scientific education, and appeared in the general outlines of science curriculums in Jordan (The Education Development Conference on Developing Education towards the Knowledge Economy 2006)

Consequently, we can say that the learning cycle strategy makes great strides in the educational field as an effective teaching strategy due to its harmony with the nature of science and that the subject is a scientific knowledge and research and thinking method, and also because its attaches great importance to the learner. The aim of this study is to examine the effectiveness of the learning cycle on achievement of the sixth grade students.

Study Question

This study aims at examining the effect of teaching science using the 5 E's Learning Cycle model on developing scientific thinking skills of the eighth primary grade. Consequently, the study's problem is represented by the following main question:

What is the effect of teaching science using the learning cycle method on the educational achievement of the sixth grade in Jordan?

Study Hypothesis

In the light of the study's question, the study attempted to test the following zero hypothesis:

There is no statistically significant difference in the significance level ($\alpha = 0.05$) between the average degrees of the students of the control and experimental groups on the educational achievement attributed to the teaching method (5 E's learning cycle vs. traditional method).

Study Terminology

Learning cycle is a teaching method or model that can be used to design curriculum's content

and the strategies of science teaching. It stresses the interaction between teacher and student and is based on activities in order to advance the students' sensory and formal deduction patterns (Abdulsalam 2001:99).

Procedurally, it means a cognitive study strategy that derives its reality from the constructivist theory. Basically, it emphasizes the learner's active interaction during educational situations, where this is done through five stages:

The Traditional Method: is a teaching method in which the teacher has the greater role. It depends on explanation, illustration and discussion, where the teacher presents the students with the concept and its explanation, then discusses it with them.

Study Importance

Study importance stems from the increasing interest in developing science teaching methods as it explores the effectiveness of a modern teaching method based on the constructivist theory, and, thus, it keeps pace with the modern and contemporary educational trends in using educational strategies derived from learning theories. It also utilizes the educational applications of teaching models to obtain educational results that develop thinking and improve experience in order to create a generation capable of thinking skillfully and creatively and to solve problems with minimum time and effort.

On the other hand, the study may benefit science curriculum developers and educational supervisors due to its practical research significance because the study elements and procedures were described using a modified learning cycle, which provides natural science teachers and students, and educationalists in general, with the opportunity to know the procedures of the learning cycle, its application methods and its effect on the educational achievement. Furthermore, the researcher hopes that the study will contribute to drawing attention to using modern knowledge methods in science and the suitable educational and environmental conditions necessary to apply them.

Review

Some previous studies were revised, like Mosheno and Lawson (1999), which were applied on a sample of (123) secondary school students in order to identify both the effect of texts created according to the learning cycle and the effect of conventional texts on the students' comprehension of scientific concepts using inductive thinking. Study's results showed that students who studied using the learning cycle had surpassed the traditional group.

Khataiba and Nawaflah (2000) aimed at exploring the effects of implementing the learning cycle method on the achievement of vocational first high-school students in chemistry. Study's sample consisted of (30) students who studied the topics of oxidation and reduction. The researchers applied score experimental of (20) items in the first three fields of Bloom's pyramid. Study's results showed a pre-eminence of the experimental group which studied using the learning cycle.

Odom and Kelly (2001) revealed the effectiveness of a proposed strategy which combines the learning cycle with the concept maps to help high-school biology students acquire the concepts of diffusion and osmosis. The study sample consisted of (4) semesters of a high school's biology students, where the first semester was to be taught using the learning cycle; the second, using concepts maps; the third, using explanation lessons; and the fourth, using the proposed strategy which combines the learning cycle with the concept maps. The researcher conducted an achievement experimental of diffusion and osmosis concepts, and a similar one after (7) weeks of the experiment. The study revealed a preeminence of the proposed strategy, which combines the learning cycle with the concept maps, over the other teaching methods

Shlayel (2003) aimed to explore the effect of implementing learning cycle in teaching science on achievement, endurance of learning effect and knowledge processes of the seventh grade students. The study sample consisted of (84) students of the seventh primary grade: (42) for the experimental group and (42) for the control group. The most significant results the study produced were:

There were statistically significant differences on level ($\alpha = 0.05$) between the average degrees of the students in both experimental and control group according to the dimensional achievement experimental, and in favor of the experimental group.

There were statistically significant differences on level ($\alpha = 0.05$) between the average

degrees of low-achievement students in both experimental and control group according to the deferred achievement experimental to measure the endurance of learning effect, and in favor of the experimental group.

There were statistically significant differences on level ($\alpha = 0.05$) between the average degrees of students in both experimental and control group according to knowledge process experimental, and in favor of the experimental group.

Scolavino (2002) determined the effectiveness of the learning cycle strategy for teachers before the service within the Milwaukee Area Collaborative Science Teacher Education Program (MACSTEP). The researcher used quantitative methods to collect information, which consisted of three questionnaires to analyze and measure the quantity of information of teachers before the service about the learning cycle strategy. The study concluded the effectiveness of implementing the learning cycle strategy by teachers before the service.

A study by Cavallo (2003) aimed to examine students' interpretations of chemical reactions using open-ended questions during the learning cycle, with a study sample of (60) students of the ninth primary grade, the results revealed a positive change in students understanding when implementing the learning cycle compared to the students studied using the traditional method.

Kevin (2003) explored the effect of the constructivist learning cycle on students' achievement in studying the law of mechanics. Study's sample consisted of two groups: (1) an experimental group studied using the learning cycle, and (2) a control group studied using the traditional method. Study's results showed a pre-eminence of the experimental group.

Lindgren and Bleicher's (2005) findings were applied on 40 teachers of the primary stages and showed that implementing learning cycle had positive effects on teachers' understanding and increased students' comprehension of the scientific concepts.

Cambel's research (2006) which was applied on a sample of 40 students of the fifth primary grade, showed that implementing the learning cycle in teaching science had an effect in bringing about a conceptual change for the students of the experimental group, compared to the students of the control group, who studied using the traditional method.

Abu-Rumman (2007) aimed at investigating the effect of implementing a modified learning cycle strategy in teaching science on acquiring scientific concepts and developing scientific attitudes for the higher primary stage students in Jordan, with a sample of (50) students, and it showed a pre-eminence of the students who used the learning cycle in acquiring scientific concepts.

Al-Khawaldah (2007) investigated the effectiveness of a modified learning cycle strategy and the concepts map on the achievement of first-grade high-school students in biology and on their acquiring of science operations. The results showed the effect of the strategy of the learning cycle and concepts map on students' achievement and science operations skills.

The researcher noticed the diversity of previous studies in various scientific fields, and also the diversity of their samples that included primary and high-school grades. Moreover, they had various main points and focused on one or more of the following variables: scientific knowledge achievement and thinking and its various levels. This study is similar to some previous studies on the effect of implementing the learning cycle on educational achievement. The resear-cher benefited from previous studies by identifying the procedures of implementing the learning cycle in teaching, how to utilize them, and how to use scientific content to a content that can be taught using the learning cycle strategy, and also using it to show and interpret the results. The current study differs from previous ones in the environment in which it was carried out, as no study was previously carried out on the effect of a modified learning cycle on the educational achievement of the sixth grade students and the study community, which the previous studies did not discuss.

METHODOLOGY

The sample consisted of (80) students distributed in two groups: (1) an experimental group which was selected randomly and studied using the 5 E's Learning Cycle model, and (2) a control group studied using the traditional method.

Instruments

The study implemented the following instruments:

First: Previous Scientific Knowledge Test in Its Primary Form

The test consisted of (15) multiple-choice items , which were developed after determining the concepts necessary to study the topics of: states of matter; luminosity; thermal conduction; electric conduction; magnetization; properties of iron, copper and aluminum; natural change; mixtures and solutions; chemical change; properties of acids; and alkalis and salts. Moreover, the test checked the equivalence of two groups concerning their previous knowledge. The items were presented to a group of science teachers, who were asked to express their opinion concerning their suitability for the test and the linguistic and scientific formulation. Consequently, some items were modified or deleted. Its stability was confirmed by applying it on (30) students outside the sample, and the stability coefficient amounted to (0.74). In its final form, the experimental consisted of (10) items, Appendix (1).

Second: Educational Situations Were Prepared According to the Following Steps

1- Determining the educational topics, which were: states of matter; luminosity; thermal conduction; electric conduction; magnetization; properties of iron, copper and aluminum; natural change; mixtures and solutions; chemical change; and properties of acids, alkalis and salts from the science book of the sixth primary grade adopted by the Ministry of Education since 1992/ 1993, and analysis such topics into their main components of facts, concepts, principles, laws and theories.

2- Distributing educational topics to the classes, and designing educational situations that include behavioral objectives, the necessary educational materials, and guidance related to the concept to be explored, and questions the teacher must ask to help students master each phase of the learning cycle. The numbers of pages related to the necessary activities and experience have been mentioned in the text book.

In order to confirm the validity of the prepared educational situations, the plans of educational situations were presented to an arbitration committee of (6) science teachers of the sixth primary grade, and to another group of science supervisors. Some modifications were introduced on the educational situations in accordance to the observations and recommendations of the arbitration committee. The stability of the educational situations was confirmed through the so-called stability through persons. Accordingly, the educational situations were presented to (6) science teachers, who were asked to express their opinion on the steps and procedures of the educational situations and their stability. (80%) of educational situations agreed by the arbitrators were adopted. There were (6) educational situations given in (10) classes, (45) minutes, Appendix (2) includes example.

Three: Educational Achievement Test

One of the study's requirements is to build the educational achievement test by taking the following steps:

1- Determining the previously mentioned educational situations, analysis them up to their components and deriving the behavioral objectives. This is the first step in preparing the score experimental.

2- Preparing the specifications list which contained the content and objectives dimensions. The content dimension included the following topics: states of matter, luminosity, thermal conduction, electric conduction, magnetization, properties of iron, copper and aluminum, natural change, mixtures and solutions, chemical change and properties of acids, alkalis and salts. The percentages were adopted according to number of pages, number of classes and the significance of each topic. The objectives included the levels of cognitive field, remembering, understanding and comprehension, and application. Each level was given a percentage after consulting with a number of science teachers.

3- Preparing the test items according to the specifications list. In its primary form, test had (30) multiple-choice items, each one is followed by four choices, one of them is right. One mark was given to the right answer, and a mark of zero to the wrong answer.

To confirm the validity of test, it was presented to an arbitration committee consisting of one group of science teachers and another of science supervisors who hold academic degrees and professional qualification in science curriculums and methods and in measurement and evaluation. They were asked to express their

opinion in the light of the following standards: items' relevance to the topic, measurement and suitability of choices, linguistic articulation and any other suggestions. Some items were modified or deleted to result in (26) items. The test's stability was found by applying on (40) students from the study community and from outside the sample. Responses were applied on the test's items, and the stability coefficient was calculated using the (KR.-20) method as it conforms to the nature of the experimental, whose items may be answered using a double-sided variable (0 and 1) The stability variable was (0.79) which is rather high and has statistical significance; therefore, it be relied upon in this study. Moreover, test items were analyzed, and difficulty and preference coefficients were calculated. Some items were deleted, and the experimental included, in its final form, (19) items, Appendix (3).

RESULTS

First: Results of the Equivalence of the Experimental and the Control Group

In order to check the equivalence between the experimental and control group, the researcher applied the previous scientific knowledge experimental on the sample's individuals before carrying out the analysis. The researcher used the T-experimental to compare the marks of the two groups (control and experimental group). The results showed no statistically significant differences on level (a = 0.05) between the averages of both the experimental and control group, which indicates that both groups are equivalent in acquiring the pre-concepts necessary for the topics: states of matter, luminosity, thermal conduction, electric conduction, properties of metals, magnetization, properties of iron, natural change, mixtures and solutions, chemical change, and separation methods, Table 1 shows the means, standers deviation and t-test.

Second: Results of the Scientific Achievement of the Sample's Individuals

Research hypothesis stated that (There is no statistically significant difference ($\alpha = 0.05$) between the averages of the scientific achievement of sixth grade students who did not learn using the learning cycle and their counterparts who learnt using the traditional method.

Table 1: Means, standard deviation and t-test

Group	*Number*	*M*	*Std.D.*	*t- value*
Experimental	40	7.50	1.30	1.03
Control	40	8.30	1.55	

In order to test this hypothesis, data were collected by measuring scientific achievement after applying the test prepared for this aim, and averages and standard deviations were derived. T-test was used to compare the performance of both study's groups. The results showed a statistically significant difference on level ($\alpha = 0.05$) between the average marks of both study's groups in favor of the experimental group. Table 2 shows the means, standard deviation and t-test.

Table 2: Means, standard deviation and t-test

Group	*Number*	*M*	*Std. D.*	*t- value*
Experimental	40	17.21	4.05	4.64
Control	40	15.12	3.83	

DISCUSSION

Learning using the learning cycle method is an active cognitive process, in which the student goes through various, explorative educational experiences which enable him to explore the knowledge intended to be taught. The learner engages in a mental activity represented by the re-organization, re-arrangement and alternation that the learner introduces to the learning material. Consequently, learning using the learning cycle strategy is indeed a meaningful learning that increases learner's educational achievement.

Learning cycle strategy is concerned with the entire content to be learnt and with the cognitive structures the learner has. Therefore, this method deals with the selection and organization of content experiences in order to facilitate the material to be learnt within learner's cognitive structures and create new knowledge structures to bring about cognitive development. Furthermore, this method is concerned with increasing learner's motivation towards learning, a thing that increases achievement and stresses the importance of practice, which helps to learn actively.

Learning cycle helps the learner to evaluate himself by himself, and to reach a formula of

what he understood of relationships that connect concepts, details, models and applications, which is the opposite of the traditional method which deals only with the learning material and gives it an absolute importance in the teaching and learning process, where the teacher plays a fundamental role. This will eventually lead to a memorizing learning without observing individual differences amongst learners. This result conforms to the results of (Shlayl 2003; Scolavino 2002; Odom and Kelly 2001).

Finally, the study recommends the use of learning cycle in teaching scientific concepts and designing instructional software. More researches should be conducted to test further effects of learning cycle as instructional method with a larger number of students, in different types of schools, and for different age groups.

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APPENDIX

APPENDIX (1)

Previous Scientific Knowledge Test

* Choose the correct answer

1- Amount of space occupied by the body refers to the:-

A- Size B-Mass C- Figure D- Density

2- Amount of gravity land an object refers to

A- Density B-Weight C- Mass D- Figure

3- Mass unit is measured by

A- Newton B-cm3 C- Kilogram D- Watt

4- The dissolving of salt in the water is an example of :-

A- Elements B – Compounds C- mixtures D- crystals

5- Materials that the characteristics are changed after compound are:

A- Crystals B- Compounds C- Mixtures D- Solutions

6- Made up a smaller part of its material :-

A- Compound B- Element C- Mixture D-Atom

7- Material consisting of the same type of atoms are called :

A- Element B- Compound C - Mixture D-Solution

8- Material consisting after reaction of two or more atoms of elements are :

A- Element B-Compound C- Mixture D- Solution

9- Air is an example of a - :

A- Element B- Element C-solution D-Crystals

10- symbolic of element is derived from:

A-Atomic numbers B-Atomic weights C- First sections of the name D- states

Appendix (2)

Educational Situations

Subject: States of matter

Materials found in the three cases are: solid, liquid, gases

Exploration phase

- required materials and sensory experiences :- :

Nail of iron, copper wire, water, oil, glass graduated cylinder, cone , football, blower, balloon. (The materials are placed in front of students to help students recognize these concrete materials , The teacher poses the following questions to students: -

1 – Name the materials that you see before you.

2 – What are these materials is composed of ? Do are all of them the same composition ?

Then (activity number (1) p 50 of the Science book for Grade VI)

Interpretation phase

- Teacher can help students ask the following questions:

1 - When you move the water from the graduated cylinder to a glass cup size change ? how do know ?

2 - When you move the water from the cup to the glass ,. Does its you like? Do you change the size?

3 - When you repeat the same process with the other materials notice note the changes that you get to shape and size.

4 - Note the shape and size of the balloon, and compare it with the ball shape and size.

Expansion phase

The teacher asks questions to help students connect previous concepts their with experiences and the apply of concepts link knowledge with life, and clarify the relationship between science, technology and society.

1 - Give examples of substances that have a always fixed shape ?

2 - Give examples of substances that have a always fixed volume?

3 - interpret, A gas cylinder - 20 liters- can be to fill the laboratory

APPENDIX (3)

Educational Achievement Test

*** Choose the correct answer**

1- One of the following materials is solid :-

A- Iron B- Wood C- Water D- Rubber

2- One of the following materials conducts electricity :

A- Copper B- Oil C- Rubber D- Plastic

3- One of the following material does not conduct heat :

A- Iron B- Copper C- Aluminum D- Rubber

4- The symbol of Hydrogen is

A- H B- O C- N D- P

5- Na symbol of an item for

A- Phosphorus B- Sulfur C- Sodium D- Copper

6- Electric wires are made of

A- Iron B- Copper C- Aluminum D- Chlorine

7- Aircraft structures are made of

A- Aluminum B- Iron C- Copper D- Sodium

8- Cars bodies are made of

A- Iron B- Aluminum C- Copper D- Sodium

9- One of the following is a natural change

A- Melting iron B- Iron rust C- Combustion of paper D- The interaction of iron and acid

10- Bronze is consisted of :

A- Copper and iron B- Copper and gold C- Copper and tin D- Iron and tin

11- sea water can be separated by :

A- Distillation B- Nomination C- Evaporation D- Leaching

12- One of the following is chemical change is:

A- Iron rust B- Melting ice C- Analysis of sea water D- Burning the candle

13- Compound containing hydrogen linked with no metal is an example of

A- Oxide B- Acids C- bases D- Salts

14- Compound containing oxygen and metal is:

A- Oxide B- Rules C- Acid D- Base

15- Compound containing hydroxide is:

A- Oxide B- Acid C- Base D- Salts

16- If there is an interaction of copper and oxygen product is :-:

A- oxide copper B- copper hydroxide C- acid D- salt

17- One of oxides used in coloring glass is:

A- B oxide copper B- zinc oxide C- silicon dioxide D- tin oxide

18- One of the following acids used in the manufacture of fertilizers and explosives is:

A- Citric b - c nitric - sulfuric d- hydrochloric

19- One of the bases used in the manufacture of soap:

A-Sodium hydroxide B- a calcium hydroxide C- potassium hydroxide D- Magnesium hydroxide