International Journal of
Health Systems and Medical Science

ISSN: 2833-7433
Volume 1 | No 5 | Nov-2022

Methods of Teaching the Subject of Electrical Conductivity Interactively

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Abstract: Several interactive methods can be used to make medical chemistry interesting in medical universities. This article provides information on the topic of electrical conductivity of electrolyte solutions through the cluster method, interesting and qualitative.

Keywords: electrolyte, electrical conductivity, non-electrolyte, osmosis, diffusion, Electrical conductivity, mechanism.

In most medical universities, some topics in medical chemistry are boring for students, so they do not actively participate in the class. In order to overcome these problems, we encouraged all students to actively participate in the lesson by using an interactive method in teaching the topic of electrical conductivity.

General structure of the lesson

2. Technological map of the training session based on the "Cluster" method

Stages of the lesson	Teacher activities	Students activities
Step 1 Organizational Moment(10 min)	1.Checking Student Readiness: A) Checking the cleanliness of the classroom B) Checking attendance C) Familiarizing themselves with the news of science and the day	Sharing scientific and daily news
Step 2 (8 min) Setting the theme and purpose of the lesson	1.The topic and purpose of the class are announced: "Fundamentals of Electrochemistry. Electrical conductivity. Conductivity." 2. Establishes that students have understood the objectives of the topic. 3. Poses a problem: In Russia, the place where lightning struck was considered the best place to dig a well. Giveanexplanation!	Voice their opinion on the issue
3 stage Main part: Learning new material (43 min)	1. Division into subgroups, choosing a name 2.Summarize students' knowledge. A) Find the unknown word in the reverse cluster (Cluster method) **(1-Application)** 3. Encourages the application of existing knowledge when learning new information, asks oral questions **(2 - Application)** 4. Gives individual assignments. Instructs each group member to describe 1 term on the topic. **(3 -Application)**	Work with the text to check their level of knowledge; Solve situational tasks; Answer questions; Writing; Work in subgroups;

	5. Encourages students to express their personal opinions.	
Step 4. Initial Self-Check (6 min)	1.Checks the knowledge gained on the new topic: Crossword puzzle **(4 -Application)**	Perform the task
Step 5. Reconfirmation and self-testing (10 min)	1. Students are asked to create clusters on the topic **(5 - Application).** 2. Poses oral questions to students and evaluates correct answers. Didactic game "True or false" **(6-Application) or** MSQ test **(7-Application)**	Discuss; Evaluate themselves and each other; Orally answer questions;
Step 6. Conclusion (3 min)	1. Explains to students the process of preparing for the next lesson. 2. announces grades for subgroups and students.	Ask questions Write down the task

3. Importance of the topic

Electrical shock in terms of mortality and disability is one of the leading causes of injury. In this regard, a detailed study of the etiology, pathogenesis, mechanism of death, principles of first aid in electrical trauma acquires importance and is necessary for a doctor of any specialty. However, modern textbooks and manuals on these issues do not adequately address them; they are incomplete and schematic, and some do not. The above mentioned was the reason for publishing the real lesson. The manual describes the features of electric current as a damaging factor, the most frequent causes of injury, gives a general description of electrical injury, and examines the mechanisms of action of electric current and factors determining the severity of the injury. Special attention is paid to the pathogenesis and manifestation of electrical trauma, the mechanisms of death in electrical trauma, and its distant consequences. Information on chronic electrical injuries, atmospheric electricity discharges and first aid principles in the event of electrical injury is provided.

4. Basic knowledge, skills, and abilities required to study the topic (interdisciplinary integration)

Names of previous disciplines	Learned skills
1. Medical and Biological Physics	Describe the electrodes. Measure potentials. Calculate equilibrium Nernst potential (using Nernst equation). Master the concept of membrane resting and action potentials. Describe the diffusion equilibrium potential. Describe electrocardiography, electroencephalography, electromyography; use of electrodes for ECG.

5. Tasks for independent work during the preparation for the lesson and in the classroom

5.1 List of basic terms, parameters, characteristics, which should be learned by the student in preparation for the class:

term	definition
Cathode	Negative electrode
Anode	The positive electrode of an electric cell,
Electric current	The orderly movement of charged particles (electrons, ions, etc.).
Electrode	In electrochemistry, a system consisting of two conductors in contact, one of which is an electronic conductor (conductor of kind I) and the other is an ionic conductor (solution or

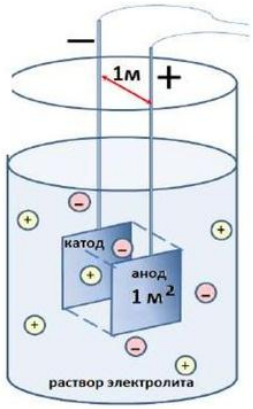
1st kind conductors	molten electrolyte, conductor of kind II). Solid and liquid conductors with electrons as carriers of electric current (electronic conductors). The passage of electric current through such conductors does not cause the movement of matter particles (ions). I type conductors include metals and some non-metals, such as graphite.
2nd kindconductors	Solid and liquid conductors where electric current carriers are ions (ionic conductors). The passage of electric current through such conductors causes the particles of matter (ions) to move. Type II conductors include solutions of salts, acids and bases in water and some other solvents, as well as molten and some solid salts.

5.2. Theoretical questions for the class:

1. Electrical conductivity of electrolyte solutions. Specific and molar conductivity
2. Determination of degree and dissociation constant by conductometric titration
3. Conductometric titration

6. Summary of the topic

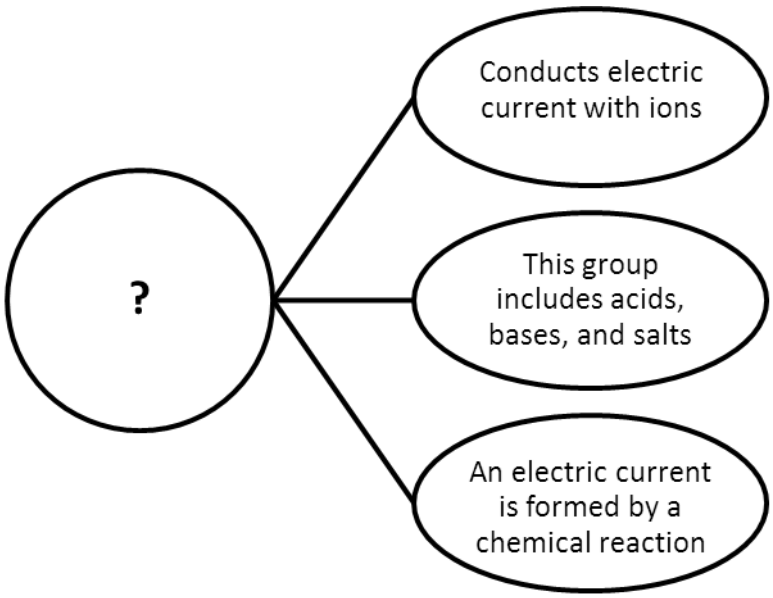
term	definition
The subject of electrochemistry	Electrochemistry is a branch of physical chemistry that studies the laws of the relationship between chemical and electrical phenomena. The main subject of electrochemistry is the processes occurring at the electrodes when current flows through solutions - electrode processes.
Development of electrochemistry	Galvani, Volta, and Petrov (18th and 19th centuries)-discovered and studied electrochemical (galvanic) elements Arrhenius (1887) - theory of electrolytic dissociation (developed by Debye and Hückel (1923))
Electrochemical reactions	Electrochemical reactions occur at the boundary electrode (conductor of the first kind) - electrolyte (conductor of the second kind).
Electro conductivity	Conductivity K is the inverse of electrical resistance R. $I = \frac{1}{R}$;om^{-1}
Resistance	The total resistance of a conductor R (Ohm = V/A) is proportional to the electrical resistivity (ρ), the length of the conductor (l, m) and inversely proportional to its cross-sectional area (S, m^2) $R = \rho\frac{l}{s}$;ом

 *Specific conductivity*	Specific conductivity is the electrical conductivity of one cubic meter of solution filling the space between flat electrodes of the same, very large area, located at a distance of 1 m. $\aleph = \frac{1}{R} \cdot \frac{l}{S}$;ом*см$^{-1}$ Depends on the concentration, temperature, nature of the electrolyte, and concentration of the solution.
Molar conductivity of the electrolyte	The molar conductivity of an electrolyte is the product of the equivalent conductivity by the number of gram-equivalents in 1 mole of the dissociating substance.
Conductometry	Conductivity (from conductivity and metrics) - a set of electrochemical methods of analysis based on measuring the electrical conductivity of solutions. Conductometryis used to determine the concentration of solutions of salts, acids, bases and to control the composition of some industrial solutions.
Ion mobility	The molar conductivity corresponding to one type of ion is called ion mobility.
Kohlrausch's Law	Kohlrausch's law (or the law of additivity of conductivity in an infinitely diluted electrolyte) states that in an infinitely diluted solution the transfer of electricity is carried out by all ions independently of each other, and the total molar electrical conductivity of the solution is equal to the sum of the molar electrical conductivities of the individual ions. The law was experimentally established in 1879 by F. Kohlrausch, later explained on the basis of the theory of electrolytic dissociation. As the concentration of solutions increases, the interaction between the ions increases and Kohlrausch's law is not fulfilled.
Conductometric titration	A titration method in which the equivalence point is fixed by a sharp change in the conductivity of the solution under study is called conductometric titration.

Application

1-Application

"In the cluster below, find an unknown term"



2-Application

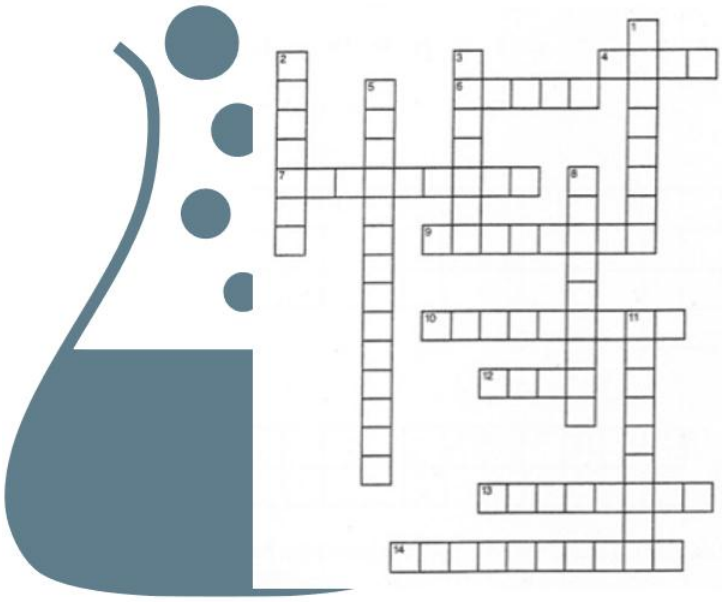
1. What is a cathode?
2. What is an anode?
3. What is an electric current?
4. What is an electrode?
5. What are conductors of kind 1? Give examples.
6. What are conductors of kind 2? Give examples.
7. Which metal is the best conductor?
8. Why aren't gold and silver usually used as a conductor, even though they have the highest electrical conductivity?
9. What is electrolysis?

3-Application

Define the following terms (give appropriate formulas)

1. electrochemistry
2. Resistance
3. electrical conductivity
4. Give examples of the resistivity of some tissues and body fluids.
5. What is resistivity and what parameters does it depend on?
6. What is molar electrical conductivity and what parameters does it depend on?
7. Conductometric titration

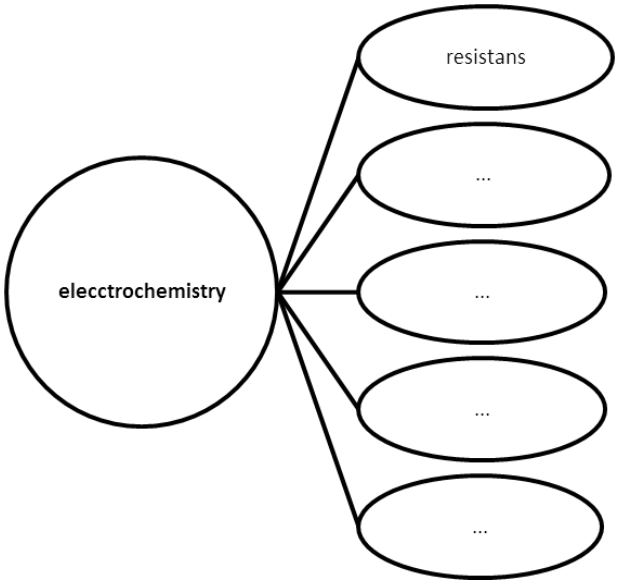
4-Application



Across	Down
4.Unit of electrical potential 6.Electrode where oxidation takes place 7.Both atoms and _____ must be balanced in a redox equation 9.The anode in an electrochemical cell has this charge 10.Gain of electrons 12.Voltage of an electrochemical cell when it reaches equilibrium 13.A substrate that is oxidized is the ___ agent 14.Allows the flow of ions in an electrochemical cell	1.The Cathode in a voltaic cell has this charge 2.Another word for an electrochemical cell 3.Electrode where reduction takes place 5.Process of layering a metal onto a surface in an electrolytic cell 8.Loss of electrons 11.A substance that is reduced is the____ agent

5-Application

Fill in the following cluster with the appropriate terms



6 - Application

Which of the following statements is true?

a) The cathode is the positive electrode which attracts anions to it.

b) The anode is the positive electrode which attracts cations to it.

c) The cathode is the negative electrode which attracts cations to it.

Which of the following statements is false?

a) Reduction occurs at the anode.

b) The positive electrode attracts negative ions

c) Oxidation occurs at the anode.

Which of the following statements is FALSE?

(a) Oxidation and reduction half-reactions occur at electrodes in electrochemical cells.

(b) All electrochemical reactions involve the transfer of electrons.

(c) Reduction occurs at the cathode.

(d) Oxidation occurs at the anode.

7 - Application

MCQ to theme electrochemistry

In the electrolysis of molten lead (II) bromide using graphite electrodes:

a) Lead forms at the cathode and bromine forms at the anode

b) Bromine forms at the cathode and lead forms at the anode.

c) Hydrogen forms at the cathode and bromine forms at the anode.

In the electrolysis of molten aluminium oxide, the electrodes are made from:

a) Aluminium

b) Steel

c) Carbon

The ore from which aluminium oxide is obtained is called

a) Haematite.

b) Magnetite.

c) Bauxite.

Which of the following half equations occurs at the anode in the electrolysis of aluminium oxide?

a) $Al^{3+} + 3e^- \rightarrow Al2$

b) $O^{2-} \rightarrow O_2 + 4e^-$

c) $O^{2-} \rightarrow O + 2e^-$

In conclusion, the effectiveness of teaching using various interactive methods is much higher than traditional lesson

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