



## USE OF PISA RESEARCH IN FORMING STUDENTS' SCIENCE-RELATED COMPETENCES

**Abduvalieva Komila Khudoiberdievna**

Senior Lecturer at the Department of Methods of Teaching Chemistry,

Jizzakh State Pedagogical University

e-mail: [tunikom57@mail.ru](mailto:tunikom57@mail.ru), +998902641205

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### Abstract:

The article discusses the process of educating students who have a new worldview, thinking in the spirit of the present time, who are fluent in general education subjects, a foreign language, and who can compete with current personnel. In addition, some issues of teacher education are presented, the problems and solutions that arise when teaching the methodology are explained in detail.

The article also developed proposals and recommendations for the formation of students' competencies related to science and their further application in practical activities through the use of PISA studies in teaching chemistry.

**Keywords:** chemistry education, competence, PISA, water, salt, drinking water, water hardness, ice.

The future of every society is determined by how developed the education system is, which is its integral part and vital necessity. Today in the Republic of Uzbekistan, reforming and improving the system of continuous education, moving to a qualitatively new level, using advanced foreign experience, introducing pedagogical and information technologies and improving the efficiency of education are priority areas of the state policy being implemented [1].

Specific tasks have been set to achieve by 2030 the entry of the Republic of Uzbekistan into the top 30 advanced countries of the world in the ranking of the International PISA program, as well as the creation a national system for assessing the quality of education, aimed at determining the level of literacy of students in the natural sciences based on the organization of international research in the educational field.

Chemistry, which is included in the list of natural sciences, arose as a product of human activity, along with other disciplines, to satisfy natural needs, produce the necessary products, education, and, finally, knowledge of the secrets of various phenomena. Chemistry is a science that studies the properties of substances, as well as the laws of their transformation from one type to another. The subject of chemistry are all natural and synthetic substances [2].

Earth, water, air, celestial bodies in nature, all living and non-living beings, household items, food and much more is made up of chemicals. On the other hand, substances are compounds that are formed as a result of one or another interaction of 118 chemical elements currently known. Chemistry studies the properties of substances that are formed as a result of chemical changes, determines how they can be used, and is directly involved in the search for substances that are important for mankind [3].

<sup>1</sup> Mirziyoev Sh.M. Address of the President of the Republic of Uzbekistan Shavkat Mirziyoyev to the Oliy Majlis. Word of the people. December 30, 2020. No. 276. p-2.

<sup>2</sup> Ikhtikharova G., Bekchanov D., Akhadov M. Modern technologies for teaching chemistry / Tashkent - p. 2019. p. 223-230.

<sup>3</sup> Primkulova M., Ziyaeva R., Akbarova B., Khaydarova U. "Chemistry that we know and do not know" of the Publishing and Printing Creative House "Teacher" Tashkent - 2011.p-108.

PISA is a program that serves as a framework for motivating, persuading and consolidating students' knowledge about their level of preparation for big life.

Of course, a literate person seeks to participate in the discussion of problems related to natural sciences and technologies, and for this he must have the necessary competencies that allowed him to scientifically explain phenomena, evaluate and plan ongoing research, and also interpret information and available evidence using a scientific approach.

The PISA task block takes the form of real situations in which a problem occurs. In addition, each question, task is classified into the following categories: competence → types [4].

PISA is an international program for assessing the educational achievements of students, which consists in assessing the level of literacy in the natural sciences in the form of various tests [5].

PISA studies form the following competencies in students:

- Scientific explanation of phenomena;
- Ability to apply natural scientific research methods;
- Ability to draw conclusions based on scientific data.

Based on the literacy model and science competencies, below are examples of several PISA items:

### **Do animals like salt?**

The desire of people and animals for salty food, for food, is one of the most amazing mysteries of wildlife.

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<sup>4</sup> Akbarov B., Primkulov M. The book of the witty. "Uzbekistan" Tashkent -2015. S.-98.

<sup>5</sup> Dustmurodov T., Aloviddinov A. Interesting chemistry. "Academy" Tashkent 2005. S. - 73-74.

We know that people have valued salt for thousands of years and have used it for cooking. In ancient Mexico, salt was considered such a necessary product that every year one of the beautiful girls was sacrificed in honor of the god of salt. The information that when a prisoner was given unsalted food in prison, he went crazy due to lack of salt is widely known [6].

The fluid circulating in the body is a saline solution. Our body releases a certain amount of moisture in various ways, because of which the body also loses salt, these losses have to be compensated. On Earth, salt reserves are distributed as follows, namely, a significant amount of it is in ocean water, on land they are relatively small.

Salt in plants is contained in very small quantities. The salts in the soil are washed out by rainwater and merge first into rivers and then into the seas and oceans. Land animals once evolved from sea animals. The water in their body is exactly the same as in the body of their ancestors, and similar to sea water! Neither plants nor soil can provide them with enough salt, so they greedily pounce on any salty food. Only carnivorous animals that is, those who prey on other animals do not experience an excessive need for salt: it enters their body with the meat of the victims. On the other hand, most herbivores are very fond of salt.

### **Question 1: What salts do you know? Do all salts taste salty?**

To complete this task, students must gain knowledge about the physical

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<sup>6</sup> Akholidinov R.Sh., Ibragimov Kh.I. Continuity in the system of general secondary education scientific and pedagogical foundations of provision / / Collection of materials of the Republican scientific and practical conference. "Continuous educational process - topical issues of improvement" - Tashkent. 2004. pp. 12.

and chemical properties of salts, including their color, taste, classification.

Evaluation criterion: salts are divided into medium, acidic, basic and complex. We most often use table salt NaCl, which is basically a medium salt. We also use NaHCO<sub>3</sub> acid salt as baking soda in our daily life.

Another salt that can increase appetite is ammonium carbonate NH<sub>4</sub>(CO<sub>3</sub>)<sub>2</sub> known as baking powder. There is a special salt that is given to animals - this is the sylvinite salt NaCl•KCl. Of the salts, only table salt NaCl has a salty taste, and all other salts have a bitter or sour taste.

### **Question 2: What salts do plants use?**

When completing this task, students should have knowledge of plant nutrition with mineral fertilizers.

Evaluation criterion: The fertilizers we give to plants are also considered salts. Salts such as NaNO<sub>3</sub>-sodium nitrate, KNO<sub>3</sub>-potassium nitrate, ammonium nitrate, ammonium phosphate are widely used. It is through these fertilizers that plants absorb the necessary elements such as Na, K, P.

### **Question 3: What effect do salts have on living organisms?**

Evaluation criterion: 0.9% sodium chloride solution is considered to be medicine with physiological saline and is used for washing the blood, replenishes sodium deficiency in various pathological conditions of the body and temporarily increases the volume of fluid circulating in the vessels. 0.9% sodium chloride solution is used as a stock solution (solvent) for other drugs.

These questions aim to assess students' competence in the scientific interpretation of information and evidence.

### **Why does water turn to ice?**

If you pay attention to a freezing pond, lake or river, then you probably initially noticed that the water begins to freeze on the surface. Have you ever thought that a lot of things in our lives could change if ponds, lakes, seas start to freeze from the bottom? After that, not only would the climate on earth change, but many creatures living in the water would die completely. Now let's see how the water in the pool turns into ice.

As the air above the water cools, it also cools the top layer of the water, and the cold begins to sink down, becoming heavier compared to the warm layer below. This process continues until the temperature of the water in the entire pool reaches 4 degrees Celsius. But the temperature will drop. The upper layers of water do not sink when they reach temperatures below 4 degrees. Because water that has cooled to a temperature below 4 degrees becomes lighter. Thus, the upper layers of water freeze.

When the temperature reaches the freezing point - 0 degrees or even lower, ultra-small crystals begin to form. Each such crystal will have six rays. They merge with each other, forming an ice crust on the surface of the water.

Ice is sometimes clear. However, sometimes this does not happen. Why? When water freezes, very small bubbles start to come out of it. They stick to the beams of ice crystals. The more ice crystals that form, the more bubbles form. This creates opaque ice. If water flows under the ice, the air bubbles come together to form clear ice.

The volume of water, along with some other substances, does not narrow during the transition from liquid to solid. When it freezes, it expands to one-ninth of its volume, so when nine liters of water freezes, it forms 10 liters of solid ice. For this reason (due to freezing water) in winter, the car radiator or water pipes expand and crack.

**Question 1: How much of the earth's surface is drinking water?**

Evaluation criterion: 70 percent of fresh water is in ice sheets, and 30 percent is in moist or hard-to-reach underground soil layers. The sources note that one percent of the fresh water reserves on earth can be used by mankind.

**Question 2: What do you mean by water hardness? What methods do you use to soften water?**

In completing this task, students should know the physical and chemical properties of water. In the process of using them in everyday life, students can draw the necessary conclusions for themselves.

Evaluation criterion: there is no pure water in nature: it always contains an admixture of some substances. In particular, water interacts with salts in the earth's crust, acquiring a certain hardness. If the concentration of these cations in water is high, then the water is called hard, if it is low - soft. These same cations give natural waters special properties. Hard water deteriorates the quality of the fabric during washing and a lot of soap has to be used, since soap is spent on binding  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  cations, and foam is formed only after these cations are completely precipitated.

Some synthetic detergents wash well in hard water, as calcium and magnesium salts dissolve easily in them. It will be difficult to cook food in hard water, and vegetables boiled in it will not taste good. Tea is poorly brewed and the taste disappears. At the same time, from a sanitary and hygienic point of view, these cations are not dangerous, with a large amount of magnesium  $\text{Mg}^{2+}$  cations, the taste of water is bitter, as in the sea or ocean, and has a laxative effect on the human intestines.

Various methods are used to treat water hardness: when boiling, calcium cations precipitate in the form of  $\text{Ca}^{2+}$  carbonate.

These questions aim to assess students' competence in the scientific interpretation of information and evidence.

Summarizing the above, it can be noted that new educational approaches in modern Uzbekistan, the organization of a training system using advanced foreign experience, ensuring continuity and continuity in the teaching of chemistry, are considered as a priority in the educational process. Using PISA technology and shaping chemistry lessons in the context of the above recommendations, together we will achieve the goal and create the basis for the preparation of competent and competitive personnel.

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