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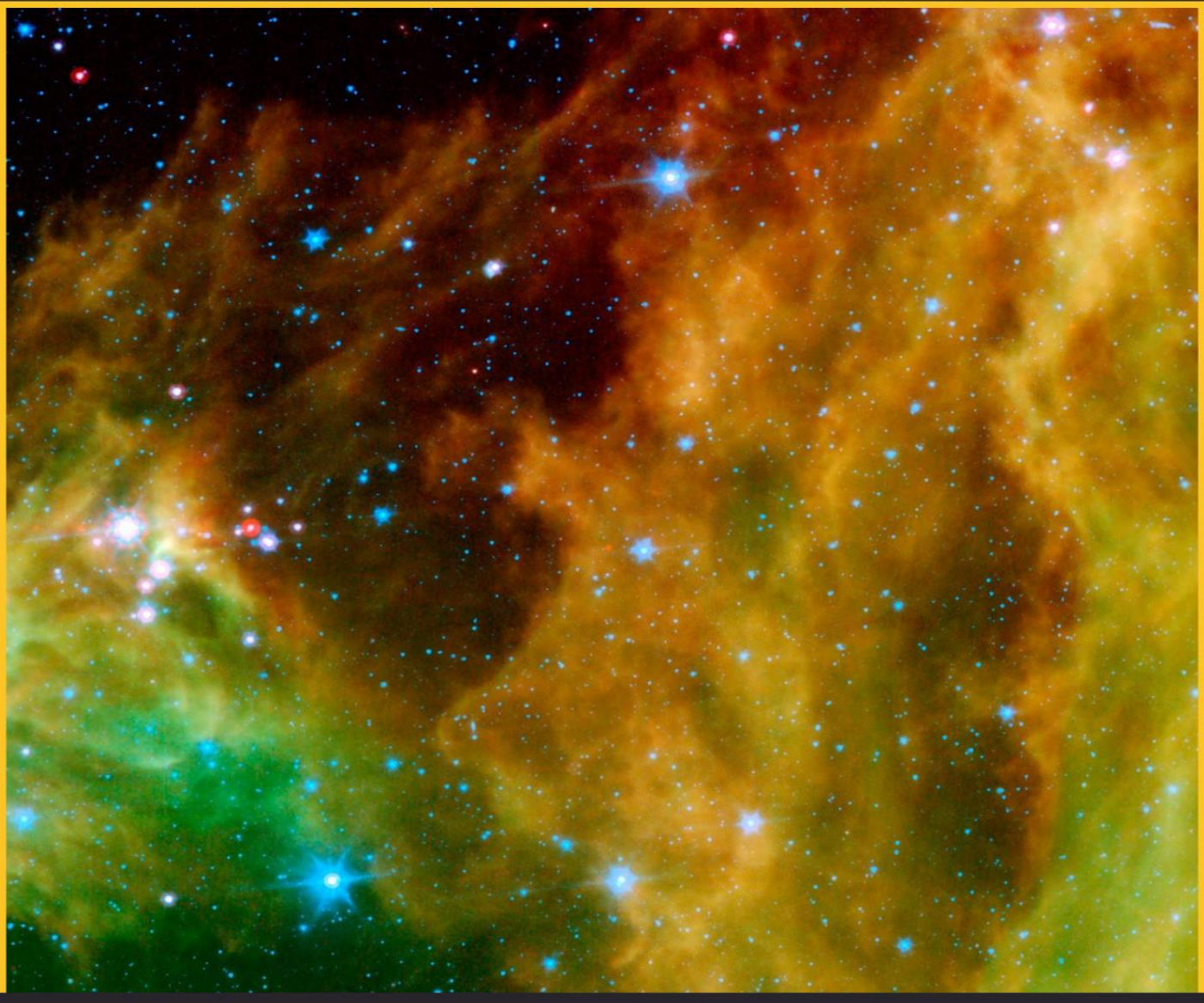

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APPLIED JURISPRUDENCE

UDC 343.9

Kuteleva M.A., Ganevich O.K., Romel S.A. Bribery as a form of corruption

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Abstract. *The article examines the phenomenon of corruption, which, as is known, is characteristic of all spheres of human activity. At the same time, the total domination of corruption in the state is achieved through the strategic spread of this phenomenon in institutions designed to prevent and counteract corruption, that is, in those institutions of power that the state and society place extremely high trust in, giving appropriate functions.*

Keywords: *corruption, illegal benefit, bribe, bribery, bribe giver, bribe taker.*

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The first mention of bribery takes place in written sources of the 14th century during the era of tsarism. Later, during the reign of Peter the Great, state officials were given salaries from the sovereign power, after which bribery was considered by the state as a crime. And much later, after the Bolsheviks came to power with the creation of a socialist state, “corruption did not disappear anywhere” [4, p. 152].

Currently, bribery is a certain form of manifestation of corruption, and corruption can also include a sufficient number of other illegal acts, such as embezzlement, collusion, fraud and abuse of power. In this we see a clear difference between bribery and corruption.

Mediation in bribery is a crime committed by an intermediary in bribery, who performs the instructions of the bribe giver or bribe taker, acting on their behalf [2, p. 147]. These crimes

are interconnected by the commonality of the object and subject, the content and nature of the criminal acts.

It should also be noted that the object of bribery is the activities of the public apparatus of power and administration carried out in accordance with the law, the interests of the state and municipal service.

Bribery refers to official crime. Official delinquency is a set of crimes committed by officials (and the persons who committed them) against state power, the interests of public service and service in local governments [1].

At the same time, bribery includes common features of related offenses. Thus, in the domestic theory of criminal law, stable norms have been formed to distinguish between crimes that cover the most typical situations. The delimitation of adjacent criminal structures is carried out according to the accepted common features that characterize the object, the objective side, the subject, the subjective side. Therefore, the following types of differentiation can be distinguished:

- by object;
- by subject;
- on the objective side (the most common);
- on the subjective side.

The problem of delimitation of crimes is one of the most complex and at the same time insufficiently developed by the theory of criminal law. A fairly large number of errors made by the courts in the application of criminal law norms fall on the wrong qualification of crimes.

Receiving and giving a bribe has similar features to the following crimes:

– Abuse of official powers (Article 285 of the Criminal Code of the Russian Federation);

– Commercial bribery (Article 204 of the Criminal Code);

–Bribing participants and organizers of professional sports competitions and spectacular commercial competitions (Article 184 of the Criminal Code of the Russian Federation);

– Separation of bribery from abuse of official powers (Article 285 of the Criminal Code of the Russian Federation).

Often, taking a bribe is associated with abuse of official powers, which is the use by an official of his official powers contrary to the interests of the service, when the act is committed out of mercenary or other personal interest and entailed a significant violation of the rights and legitimate interests of citizens or organizations or legally protected interests of society or the state.

The decision should be based on the general rule of competition of criminal law norms. Since taking a bribe is a special type of official abuse, the deed is qualified under Art. 290 of the Criminal Code of the Russian Federation [1].

In practical terms, distinguishing between a bribe and abuse of power presents a certain difficulty, since the signs of the elements of these crimes largely coincide. Both crimes are characterized by: encroachment on the same object; committing them from the subjective side only with direct intent; the single subject of the crime is an official. However, there are some differences in the features of the composition:

- a mercenary purpose when receiving a bribe is a mandatory feature, in case of official abuse - an alternative one;

- the composition of official abuse is constructed in the law as material (for its existence, the onset of consequences is necessary - a significant violation of law-protected interests), the composition of taking a bribe is formal.

The main differences between these crimes in practical terms are as follows.

In case of abuse of official powers, the law refers only to such an action (inaction) of an official that followed from his powers and was associated with the exercise of the rights and obligations that this person is endowed with by virtue of his position. The specified action when receiving a bribe is only one of the options for the possible behavior of an official, along with facilitating such actions (inaction) for the corresponding benefit of a property nature by virtue of official position.

Of no small importance in delimiting the receipt of a bribe from the abuse of official powers is the definition of the content of the benefits received by an official for the use of official powers. In particular, the receipt by an official of an intangible benefit for actions (inaction) related to the use of official powers excludes his liability for taking a bribe. If there is a significant violation of legally protected interests, such behavior of an official can be qualified as abuse of official powers. The content of the intent of the perpetrator is essential for distinguishing between the receipt of a bribe and the abuse of power. If the consciousness of the perpetrator covers the fact that material values are transferred to him illegally and for certain behavior in favor of the giver, there is a bribe taking. If an official does not have such consciousness, then his actions are qualified as abuse of official powers.

Thus, when qualifying, it is necessary to find out whether the abuse of power is an independent corpus delicti.

Separation of bribery from commercial bribery (Article 204 of the Criminal Code of the Russian Federation).

Commercial bribery has many features in common with receiving and giving a bribe, which undoubtedly raises questions about their correct distinction. The fundamental difference between the compositions of the crimes under consideration lies in the features of their subjects, which, accordingly, determines another object of encroachment.

The subject of receiving a bribe is an official who performs the relevant functions in state bodies and local governments, state and municipal institutions, as well as in the Armed Forces of the Russian Federation, other troops and military formations of the Russian Federation.

Thus, the difference in the subjects determines the difference in the objects of bribery and commercial bribery. In the first case, damage is caused to public relations that ensure the normal (legal) functioning of the state apparatus and the apparatus of local self-government, and in the second case, to the apparatus of commercial and other organizations.

The owner of valuables in such cases is liable for an attempted bribe or commercial bribery, if the transfer of valuables pursued the goal of committing the desired action (inaction) by the indicated persons, paragraph 20 of the Decree of the Plenum of the Supreme Court of the Russian Federation dated February 10, 2000 No. 6 "On judicial practice in cases of bribery and commercial bribery" [3].

Separation of bribery from bribing participants and organizers of professional sports competitions and spectacular commercial competitions (Article 184 of the Criminal Code of the Russian Federation).

For similar reasons, there is a distinction between bribery and bribery of participants and organizers of professional sports competitions and spectacular commercial competitions (Article 184 of the Criminal Code of the Russian Federation).

The distinction between the above crimes is clearly traced on the basis of the object, the subjective side and the subject.

The object of the crime under Part 4 of Art. 184 of the Criminal Code of the Russian Federation, are public relations that regulate the organization and holding of professional sports competitions and spectacular commercial competitions, and not the interests of the public service.

On the subjective side, this crime, in addition to direct intent, implies the presence of such a special purpose as influencing the results of competitions or contests.

Subject, according to Art. 184 (parts 3 and 4), is a circle of persons clearly defined by the legislator - athletes, sports judges, coaches, team leaders, organizers and other participants in professional sports competitions, as well as organizers or jury members of spectacular commercial competitions, while the subject of receiving a bribe may be only an

official, the signs of which are defined in the note to Art. 285 of the Criminal Code of the Russian Federation. An official who is at the same time an organizer, jury member (judge) of sports competitions, spectacular commercial competitions and receives illegal remuneration in order to influence the results of these competitions and competitions, should be liable only under Art. 184 of the Criminal Code of the Russian Federation. If it, using its official position, influences the indicated persons for the corresponding remuneration for the same purposes, then there is an element of taking a bribe.

Some difficulties arise in matters of delimitation of bribery from various forms of theft of other people's property.

In the literature, when distinguishing between theft and bribery, it is indicated that the actions of the perpetrator contain the composition of theft, and not taking a bribe, if the following signs are present:

- the acquisition of material goods due to their withdrawal as a result of official abuse;
- transfer of material assets to an official by accomplices of theft or persons not involved in the crime, not for any actions in the service, but in the form of a division of illegally seized funds or for the stolen property being sold;
- intent aimed at the gratuitous illegal conversion of property into one's own property, even if it is transferred to an official either in the form of a share of the stolen property or in the form of payment for an unlawfully alienated material value.

In the case when an official receives or intends to receive material valuable material objects for actions committed by him through the use of his official position, which are included in the scope of the objective side of the theft of these values, then this can be defined not as bribery, but namely the receipt by the subject of the crime of his share from the stolen person (in the case under consideration, the official acts as the executor (co-executor) of the theft).

If an official did not take a direct part in the theft and received an unlawful reward for committing actions that were implemented using his official position, they could undoubtedly contribute to the theft, but at the same time did not become an element of the most objective side, and therefore, there is no theft of these valuables, and receiving a bribe.

A similar problem occurs in situations where a citizen personally receives a monetary reward, imitating his attitude towards an official who has virtual opportunities to perform actions in the interests of the giver, while, in reality, “the citizen is not such a person either, although is, but the commission of these actions is outside the scope of his service competence” [5, p. fifteen]. If the subject of criminal law relations receives material reward from the bribe giver in order to transfer it to the real official and appropriates some part for

himself, then his illegal actions should be qualified according to the totality of such crimes as complicity in giving (receiving) a bribe and at the same time embezzlement in the form fraud, which is sane to impute in the amount that the offender kept for himself.

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Lashina E.N. Discussion as a method of learning for the development and formation of reflective thinking

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Abstract. *One of the basic interactive methods of learning in the educational process – discussion – is considered in the article. The advantages of this method are described on the example of its use in practice when holding a conference for university students.*

Keywords: *interactive method of learning, discussion, debates, effectiveness, reflection, motivation.*

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There are many methods of learning a foreign language. In a non-linguistic university, the main criterion for choosing an appropriate method is good efficiency in a limited period of time with a fairly voluminous and lexically complex material. In education, three types of methods of learning have developed, established themselves and become widespread:

1. Passive methods
2. Active methods
3. Interactive methods

Each of them has its own characteristics.

The passive method is a form of interaction between students and the teacher, in which the teacher is the main actor and manager of the lesson, and students act as passive listeners, subordinate to the teacher's directives. Communication between the teacher and students in passive lessons is carried out through surveys, self-study, tests, tests, etc.

From the point of view of modern pedagogical technologies and the effectiveness of students' assimilation of educational material, the passive method is considered the most inefficient, but despite this, it also has some advantages. This is a relatively easy preparation

for the lesson on the part of the teacher and the opportunity to present a relatively large amount of educational material in the limited time frame of the lesson. Lecture is the most common type of passive method of learning. This type of lesson is widespread in universities, where adults study, fully formed people with clear goals to deeply study the subject.

The active method is a form of interaction between students and the teacher, in which the teacher and students interact with each other during the lesson and the students here are not passive listeners, but active participants in the lesson. If in a passive lesson the teacher was the main actor and manager of the lesson, then here the teacher and students are on an equal footing. If the passive method assumes an authoritarian style of interaction, then active methods of learning suggest a democratic style.

Interactive method. Interactive ("Inter" is mutual, "act" is to act) means to interact, to be in a conversation mode, a dialogue with someone. In other words, unlike active methods, interactive ones are focused on a wider interaction of students not only with the teacher, but also with each other and on the dominance of student activity in the learning process.

Many between active and interactive methods put an equal sign, however, despite the generality, they have differences. Interactive methods can be considered as the most modern form of active methods [1].

One of the most effective interactive methods of learning is discussion.

A discussion is a public discussion or a free verbal exchange of knowledge, judgments, ideas or opinions about any controversial issue or problem. If we talk about learning at a professional level, then in this situation, the discussion can be used in a number of situations where it is necessary to exchange the knowledge that people have, as well as all kinds of beliefs. All this provides all the necessary resources to form a new view of professional activity, this or that event, other people, as well as change the behavior model under certain circumstances, organize an intense thought process, and also contribute to the development of interpersonal relationships and achieve effective feedback [2].

In order for this method to work with a large number of participants, it is necessary to mix students into groups, taking into account their level of foreign language proficiency, and clearly and specifically define their work within the set cases. Next, the groups are invited to give arguments for and against as the easiest way to communicate between them.

Features of the group discussion method:

- participants in the discussion from different angles can see the problem by comparing opposite positions;

- mutual positions are specified, which reduces resistance to the perception of new information;

- in the process of open statements, the emotional bias in assessing the position of partners is eliminated, and thus hidden conflicts are leveled;

- a group decision is developed with the status of a group norm;

- you can use the mechanisms of assigning and accepting responsibility, increasing the involvement, reflection of the participants in the discussion in the subsequent implementation of group decisions;

- the need of the participants in the discussion for recognition and respect is satisfied if they have shown their competence, and thereby the efficiency of their return and interest in solving the group problem is increased [3].

Discussion as an interactive method of learning can take many forms.

There are the following types of discussion – a round table and debates [4].

1. A round table. The main purpose of the round table is to collect and systematize the discovered material on a given issue with further discussion and exchange of information. A characteristic feature of holding a round table is the simultaneous participation of a sufficient number of speakers for this form of discussion (25-30).

2. Debates. An obligatory component of this type of discussion is the presence of polar points of view on certain issues. Students must demonstrate argumentation skills when defending their own theses [5].

The debates were tested at the marathon event “Let’s play English”, which takes place annually at the St. Petersburg State University of Industrial Technologies and Design, the Higher School of Technology and Energy, St. Petersburg.

Fig. 1. Debates of the conference participants https://gturp.spb.ru/?p=49356

In practice, various interactive methods of learning were used to fully achieve the fastest possible acceptance and assimilation of new material, while all students, without exception, were involved in the process. During this, there was an intensification of the process of understanding, assimilation and application of knowledge in solving practical problems due to the more active involvement of students in the process of not only obtaining, but also the direct use of knowledge.

The marathon “Let’s play English” is divided into two parts. In the first part of the event, game methods of learning are used, in the second part – the conference – the discussion method is used.

Students, based solely on their own knowledge, choose to participate either in the game part only, which is designed for basic knowledge, or in the conference, designed for a slightly higher level, or both. Moreover, by mixing students in groups of four, according to the level of language proficiency, students with a basic level of English can take part in the second part, since within the groups they have the opportunity to actively interact with each other and provide support.

This approach helps to increase the motivation and reflection of the participants in solving the problems discussed, which gives an emotional impetus to the subsequent search activity of students, encourages them to take specific actions.

Summing up, it can be said that the method of discussion as one of the methods of interactive learning is increasingly used, including in professionally oriented learning. This is mainly because this method is problematic – it allows you to seamlessly integrate the knowledge of students from different areas when solving a specific problem, it makes it possible to apply language knowledge and skills in practice, while generating new ideas [6].

This method provides not only an increase in knowledge, skills, methods of activity and communication, but also the disclosure of new opportunities for students, and is also a necessary condition for the formation and improvement of competencies through the inclusion of participants in the educational process in a meaningful experience of individual and collective activities to gain experience, awareness and acceptance of values.

In addition, mastering the norms of rational speech communication, the rules for conducting discussions forms a responsible attitude to speech, which is one of the most important requirements for a modern specialist in any field of activity. The formation of debatable and argumentative skills is necessary for the full development of the communicative and intellectual self-sufficiency of the individual [7]. That is why the discussion method is one of the most effective interactive methods of learning of modern education in higher school, which develops and forms reflective thinking.

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UDC 740

Zak A. Characteristics of the methods of theoretical thinking among schoolchildren in grades 5-11

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Abstract. *The article presents a study aimed at studying the features of the application of methods of theoretical thinking by schoolchildren in grades 5-11. 209 students of 5-11 grades in individual experiments solved plot-logical problems of various types. As a result of the experimental work, the nature of the distribution of methods of theoretical thinking (analytical, reflective and synthesizing) among students of the fifth, sixth, seventh, eighth, ninth, tenth and eleventh grades was established.*

Keywords: *schoolchildren of grades 5-11, plot-logic tasks, verbal-sign form of action, individual experiments, methods of theoretical thinking.*

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1.Introduction.

When studying the thinking of younger schoolchildren (see, for example, A. Z. Zak [3]), we proceeded from the fact that theoretical thinking (as aimed at reflecting essential relations in the tasks being solved) is carried out in different ways depending on the content of these relations: the general principle of solving problems of a certain class (universal), the specific principles for solving subclasses of problems of this class (special) or the unity of the general and specific principles (the unity of the universal and the special, the whole).

In this case, it was supposed, in particular. that the development of theoretical thinking at primary school age consists in the assimilation of its initial forms by children, i.e. in the formation of schoolchildren's opportunities for solving problems in analytical and reflexive ways in a subject-effective plan.

This study is based on the assumption that the development of theoretical thinking in middle and high school consists in the development of its developed forms by students,

thanks to which they have the opportunity to solve problems in analytical and reflexive ways in visual-figurative and verbal-sign terms.

In our studies (see, for example, [4]), it was shown that when teaching in elementary school, favorable opportunities are created for children to master generalized methods of action that involve distinguishing between essential and non-essential data in the tasks being solved, i.e. e. to form in children the initial forms of a meaningful, theoretical approach to solving problems.

Based on the characteristics of the content of education in the middle and high school, it can be assumed that the age period of 10-17 years is a natural stage in the ontogenetic development of thinking, the content of which is the formation of developed structures of comprehending, theoretical thinking.

It should be noted that, according to the provisions of dialectical logic [1], theoretical thinking, considered as an action to form the concept of cognizable objects, should (include the consistent solution of such problems as highlighting in cognizable objects, first certainty, denoted by the category of the universal, then - certainty , denoted by the category of the special, and, in conclusion, the allocation of certainty, denoted by the category of the individual, the whole as a unity of the universal and the special.

It can be said, therefore, that the isolation of a general relation is a necessary condition for the selection of special forms of a general relation. In turn, the solution of this problem is a necessary condition for highlighting the unity of the universal relation and its special forms and, thereby, achieving the ultimate goal of theoretical thinking - the formation of the concept as the unity of the universal, particular and singular.

The noted characteristic of the certainties that a person distinguishes in cognizable objects at three stages of concept formation allows concretizing the content of his thinking in the following way.

At the first stage, the study of cognizable objects is associated with the allocation of a relationship that is universal for their existence, and the consideration of the characteristic features of this allocation is associated with an assessment of how essential and universal this relationship is.

At the second stage, the study of objects is associated with the identification of special forms of the previously discovered universal relationship, and the consideration of the features of this separation is associated with an assessment of how specific and isolated these special forms are.

At the third stage, the study of objects is connected with the identification of the unity of the universal relation and its special forms, and the consideration of the features of this

separation is with an assessment of how real this unity is, to what extent the totality of special forms exhausts the general relation.

From a psychological point of view, in particular, within the framework of the theory of activity of A.N. Leontiev [2], theoretical thinking is a complex cognitive action. In the course of its implementation, a person successively, with the help of appropriate methods, first singles out in cognizable objects a relationship that is universal for their existence, then special forms of this relationship and, further, singles out the unity of the universal relationship and its special forms, i.e. singular, whole.

Methods of theoretical thinking are carried out with the help of the study of cognizable objects and consideration of the features of this study, in particular in relation to the content of the problem being solved.

So, in the original method, analysis is the leading one, since its result directly coincides with the result of the whole action. Reflection plays a supporting role here.

Such an interaction of these acts is characteristic of a person's transition from reflecting a phenomenon to reflecting an essence: "The lack of reflection is characteristic of the analytical stage of cognition, when separate abstractions are singled out from the whole" [1, p.116]. This method is characterized as analytical.

In the next method, the situation is different: reflection is the leading one, since without reflecting the differences in the analysis of the various components of the content of tasks, the result of this action cannot be obtained. This way of theoretical thinking is characterized as reflexive.

When highlighting the unity of the universal and the particular, analysis and reflection equally ensure the successful implementation of this method. This method is characterized as synthesizing.

Considering the development of these methods as stages in the development of theoretical thinking, it is advisable to refer to the provisions of the theory of A. N. Leontiev [2] about the transformations of the components of objective activity.

At the same time, while developing the general scheme of the experimental situation, which could be embodied in various concrete materials, we also relied on the logical characteristics of theoretical thinking.

Firstly, the subject must be offered to solve not one, but several tasks objectively of the same class. At the same time, the observed features of the conditions of the proposed problems should differ quite clearly. Compliance with this requirement when constructing a specific technique will allow, with the successful solution of such problems, to observe the

fact of a theoretical approach to their solution, which is implemented, in particular, by implementing the analytical method of theoretical thinking.

Secondly, the proposed tasks should objectively relate to different subclasses of this class. This will make it possible, if all problems are successfully solved, to observe a meaningful grouping of problems, the basis of which is taken to be their objective belonging to different subclasses of the same class. This fact, according to our ideas, should testify to the implementation of the reflexive method of theoretical thinking.

Thirdly, it is expedient to select such a class of problems, in relation to which it was possible to develop problems not of two, but of several subclasses. In this case, opportunities are created for the successful solution of the proposed tasks and the allocation of tasks of different subclasses to observe the production of a new subclass of tasks of this class by a person. In the presence of such a fact, it can be assumed that, solving the proposed problems, he fulfilled not only the analytical and reflexive methods of theoretical thinking, but also the synthesizing one.

Thus, the general research strategy of our experiments in the study of theoretical thinking was to describe the typical procedural characteristics of mental activity, corresponding to corresponding to one result or another. In other words, the research task was to highlight the characteristics of the analytical, reflexive and synthesizing modes of theoretical thinking.

2.Materials and methods.

The experiments of this study were aimed at clarifying how, when solving problems in a verbal-sign form, there is a transition from orientation in their conditions using the analytical method of theoretical thinking to orientation using its reflexive method and, most importantly, to orientation using its synthesizing method in schoolchildren of 5-11 grades.

The “Difference-Coincidence” method was used, which is a variant of the “Different-Same” method, which was used earlier [5] when studying the transition of middle and high school students from orientation in task conditions using the empirical method to orientation using analytical method of theoretical thinking in solving plot-logical problems.

The “Difference-Coincidence” methodology is constructed in such a way that these two subclasses of problems (two problems in one subclass and one in another) do not exhaust all subclasses of problems of the proposed class. The subject has the opportunity, having successfully solved all the problems and having singled out both subclasses among them, to offer at least one more subclass of problems, i.e., to single out one more special form of the existence of a general relation. This will testify to the fact that when solving problems, a

synthesizing method of theoretical thinking was used, characterized by the allocation in the content of problems of the unity of the general relation and its special forms.

Thus, this technique makes it possible to distinguish by what method of theoretical thinking the problems were solved - analytical, reflexive or synthesizing. 30 students of the fifth, 29 of the sixth, 28 of the seventh, 29 of the eighth, 30 of the ninth, 31 of the tenth, 32 of the eleventh grade participated in solving the main problems in individual experiments.

The experiment with each student included four stages and lasted, on average, 30-40 minutes. At the first stage, three training tasks were solved, at the second, three main tasks were solved, at the third, a task was performed related to the formulation and substantiation of judgments about successfully solved main tasks, at the fourth, a task was performed, consisting in self-compilation of tasks.

2.1. The first stage of the experiment

The student was given a form with the conditions of three training problems - A, B and C. On this form it was necessary to write the answer to each problem. In addition, it was allowed to make various kinds of notes directly in the text of the problem conditions. Along with the form, a blank sheet of paper was given on which the student could make some notes in the course of solving these problems.

Training problems

Problem A: “Vanya, Petya and Seryozha play musical instruments. Some of them play the trumpet, some play the flute, some play the trumpet. Petya and Vanya play different instruments, Vanya and Seryozha play different instruments. Who plays the flute?” (Answer: Vanya).

Problem B: “Ira, Masha, Marina and Katya knitted things from wool. One of them knitted a hat, another knitted a hat, one knitted a scarf and one knitted a hat. Masha and Katya knitted different things, Masha and Marina also knitted different things. Which girl knitted a scarf?” (Answer: Masha).

Problem C: “Misha, Vitya, Vasya and Kolya were picking mushrooms. One of them collected mushrooms, one - russula, one - mushrooms, one - boletus. Vitya and Kolya were picking different mushrooms, Misha was picking aspen mushrooms, Vitya and Vasya were picking different mushrooms. Who collected russula?" (Answer: Vitya).

The marked training tasks were chosen based on the following considerations. The solution of problem A was necessary in order for the student to be able to operate with the original for the entire class of problems (presented in the “Different - the same” and “Difference - coincidence” methods), the ratio of the number of these objects to the number of their proposed properties: if out of three objects, - A, B, C, - two have the property "X", and one

has the property "Y", and if objects A and B, B and C have a different property, then, therefore, objects A and C have the property "X", and object B - property "Y".

The solution of problem B allowed the student to apply the specified initial relation in a situation with redundant information. The solution of problem C was necessary so that the doctrine could try to operate with the initial relation in a situation where these objects have three properties, and not two, as in problems A and B.

In the course of solving training problems, the student read the problem himself (silently or aloud). The experimenter helped with difficulties, both at the stage of understanding the text of the conditions of the problems (recommending to schematically depict the relationship between the characters of the problem and their properties), and at the stage of their solution. In the latter case, he offered questions that help the student understand the following actions: how to start solving the problem, as reported in the first part of the problem, what follows from the judgments presented in the second part, what you need to know in order to answer the question of the problem.

2.2. The second stage of the experiment

After the student solved (on his own or with the help) the training tasks, he was asked to solve the main tasks 1, 2 and 3.

Main problems

1. Petya, Vova, Misha, Igor and Oleg wrote an algebra test. One of them got a five, one got a three, one got a four, one got a two, one got a five. Vova and Misha got a different mark, Petya - a three, Igor and Vova - a different mark, Oleg - a two. What grade did Vova get? (Answer: Vova got a four).

2. Katya, Sveta, Lisa, Rita and Natasha lived far from the school. One of them was on a bus, one on a tram, one on a bus, one on a tram, one on a bus. Sveta and Rita rode different modes of transport, Katya rode a bus, Natasha and Rita rode different modes of transport, Liza rode a tram. What was Rita driving? (Answer: Rita rode the tram).

3. Fedya, Masha, Kolya, Larisa and Zhenya are preschoolers. Some of them were in the middle group, some were in the junior group, some were in the preparatory group, some were in the middle group, and some were in the senior group. Kolya and Larisa were in different groups, Zhenya was in the younger one, Masha and Kolya were in different ones, Fedya was in the preparatory one. Where was Kolya? (Answer: Kolya was in the senior group).

The solution of the main tasks was organized in the same way as the solution of the training ones. The student was given a form with the main tasks (where it was required to write answers and allowed to make notes) and a blank sheet of paper for various kinds of notes.

2.3. The third stage of the experiment

After successfully completing the three main tasks, the student had to choose one of the five opinions about these tasks and then justify his choice.

Opinions

1. All main tasks are similar.
2. All the main tasks are different.
3. The first and 2nd main tasks are similar, but the 3rd one differs from them.
4. The first and 3rd main tasks are similar, but the 2nd one differs from them.
5. The second and 3rd main tasks are similar, but the 1st one differs from them.

* * *

According to the results of the grouping of successfully solved main tasks, the subjects were divided into four groups - A, B, C and D.

2.3.1. Characteristics of the actions of students of the first group

The first group (out of those named) included students who characterized problems on the basis of the external features of their conditions, i.e., those who acted empirically in solving them.

Part of the subjects of group A (subgroup A1) chose the first opinion, justifying this by the fact that "... in all tasks there are 5 people ..." or "... in each task it is said about those who have different ...". The other part of the subjects of group A (subgroup A2) chose the second opinion, based on the fact that "... in all tasks they talk about different things - school, buses, pens ..." or "... in each task there are different children - in the first, boys, in the second, girls , in the third preschoolers ... ". It should be noted that in all classes from 5 to 11 the number of marked subgroups is approximately the same.

Observations of the actions of the subjects of group A (especially during the solution of the first main task) made it possible to note a number of characteristic features that were reproduced to the same or less degree in the solution of subsequent tasks.

So, some students (subgroup A1) tried immediately, after the first reading, to give an answer to the question of the problem, saying that "... Vova received three ...". At the same time, as it turned out, they were based on the coincidence of the order of the characters (in the first sentence of the problem) and their assessments (in the second sentence). After receiving an indication that the answer was wrong, they proceeded to repeatedly read the problem, trying to understand its meaning. It should be noted that such students met only in the fifth grade and constituted an insignificant part of group A.

Other students (they were in all classes and made up the majority in this group - subgroup A2) first read the problem many times, trying to learn its condition. One part of the students of subgroup A2 after that offered a solution based on their impression of the given

data (and not on the basis of reasoning), believing that Vova got five because "... Petya had a three, Oleg had a two and there are still two fives left ... ". Such students were a minority of subgroup A2 and were only in the fifth and sixth grades.

The second part of the students of subgroup A2, in the course of repeated reading, singled out (circled with a pen) those characters whose assessment was known ("Petya - three", "Oleg - two"). After that, they tried to understand what the remaining judgments meant ("Vova and Misha received a different assessment" and "Igor and Vova - a different assessment"), and could not independently compare and draw a conclusion. Such students made up the majority of the A2 subgroup in the fifth through sixth grades, half in the seventh grade, a minority in the eighth grade, and were absent in the upper grades.

The third part of the students of subgroup A2, after repeatedly reading the problem and separating known data from unknown ones, did not try to derive an answer, but tried to pick it up, comparing the remaining two judgments. Some students said, for example, like this: "... If Vova got five, then Misha got four. …This is not at odds with the conditions. So, Vova - five ... ". When the experimenter reported that this was not true, the students easily agreed with this and said "... then Vova - four ...". Other students of this subgroup spoke differently: "... If Vova got four, then Petya got five. So, Vova - four ... ".

Thus, for the third part of the students of subgroup A2, as can be seen, it was typical to consider only one of the two judgments. Some even considered the second judgment ("Igor and Vova received different marks") as superfluous, sometimes saying "... why is this, if it is already clear that Vova received four ...".

The students of the fourth part of the A2 subgroup, after repeatedly reading the problem and separating the known from the unknown, did not try (unlike the students of the third part of the A2 subgroup) to operate with only one of the judgments characterizing the difference in the properties of the proposed pairs, but compared both of these judgments and, as a rule, did not quickly, but still correctly, they made, for example, the following conclusion: "... if Vova and Misha have different grades, and Vova and Igor have different grades…, and only two fives and one four remain…, then Misha and Igor have the same grades, fives , and Vova has a four ... ".

In conclusion, it should be noted that students who used the selection of an answer (the third part of subgroup A2) and reasoning by comparing both judgments (the fourth part of subgroup A2) in solving problems were in all classes. However, their numbers in this subgroup steadily increased and in the upper grades they made up a significant majority of the A2 subgroup (and, consequently, of the entire A group, since the students who made up the A1 subgroup were only in the fifth grade).

In addition, it should be pointed out that the students of the named parts of subgroup A2 retained the noted methods of mental activity in solving both subsequent tasks. At the same time, their preliminary orientation in the conditions of the problems was reduced slightly, since they also read the conditions of the problems many times and circled the known data with a line.

2.3.2. Characteristics of the actions of students of the second group

The second group (group B) included subjects who chose the first opinion, since "... in each task there are three people, where one differs from the other two ..." or "... everywhere it is said first that two children have something different, then two more and it is clear that one is different from the two ... ".

This testified to the fact that when solving problems they acted in an analytical way of theoretical thinking, since they characterized problems on the basis of a single meaningful approach. Thus, they pointed to the significant generality of the solution of problems of the proposed class, since its construction is really based on the ratio of the number of these objects and the number of their proposed properties - in each task, the conclusion is made on the basis of a comparison of pairs of characters with different properties: in the first task - this is Vova with Misha and Igor with Vova, in the second problem - Sveta with Rita and Natasha with Rita, in the third problem - Kolya with Larisa and Masha with Kolya.

Observations of the actions of the subjects of group B made it possible to note the following. Firstly, these students (unlike a number of subjects of the A2 subgroup) did not read the conditions of the tasks many times, but usually limited themselves to two or three readings (and in the senior classes, mostly two) and did not trace with a pen what was known ("Estimates of Petya and Oleg"), but simply said: "... it means that the three and two are already taken ...".

Secondly, they never used the selection of answers based on consideration of only one judgment about the nature of endowing a pair of characters with properties ("Vova and Misha received a different assessment"), but always compared both such judgments and made a consistent conclusion that Vova received a B .

They acted in the same way in solving the remaining two main problems, directing their attention, as one could see, to the selection of the conditions for the formulation of two judgments from the text, often noting that the rest was not important.

2.3.3. Characteristics of the actions of students of the third group

The third group (group B) included subjects who acted in a reflexive way of theoretical thinking, because, justifying the fourth judgment they chose, they managed to reveal a significant difference in the implementation of the general method for constructing and solving

all these problems, to highlight the typical features of the method that provides with the need to successfully solve problems of different subclasses.

At the same time, one part of the students (subgroup B1) expressed a judgment about the commonality of tasks 1 and 3 in a more specific form, for example: "... in the first task there are four types of assessments and in the third four types of groups in kindergarten, and in the second there are only two types of transport, bus and tram...", and the other part of the students (subgroup B2) in a less specific form, for example: "... in the first and third tasks there are many different ones, and in the second - few...".

Thus, the subjects of group B identified two subclasses among the tasks of the proposed class: the first and third tasks were built on the basis of one type of initial relation (i.e., the ratio of the number of given objects to the number of proposed properties), which manifests itself in the fact that five objects are endowed with four properties, and the second task - based on a different kind of initial relationship - in this case, five objects are endowed with two properties.

Thus, the students of this group managed to reveal a significant difference in the implementation of the general method for constructing and solving all these problems, to highlight the typical features of the method that, with the need, ensure the successful solution of problems of different subclasses.

It is important to note that in the fifth, sixth, seventh and eighth grades, among the subjects of the group under discussion, students from the B1 subgroup prevailed, in the ninth grade the number of subgroups B1 and B2 was almost the same, and in the tenth - eleventh grades the students of the B2 subgroup prevailed.

Observations of the actions of the subjects of group C made it possible to note that, along with the actions characteristic of the subjects of group B (identifying two judgments in the text of tasks and operating with them in the course of reasoning), when faced with the third task, they quickly discovered its relationship with the first, noting those points that they then expressed as justification for their choice of the fourth opinion, pointing out, in particular, four types of preschool groups in the third task and four types of assessments in the first task.

2.3.4. Characteristics of the actions of students of the first group

The fourth group (Group G) included those subjects who were able not only to identify tasks of different subclasses, but also to compose new tasks. The experimenter suggested to them: "What task can you come up with so that five people do something, for example, catch different fish, or read different books, or take different exams, and so that the new task is not composed in the same way as the first with the third and not in the same way as how is the second one?"

The subjects of this group were able to propose tasks of another subclass, where a new kind of initial ratio of tasks of the proposed class was realized (i.e., the ratio of the number of given objects to the number of proposed properties), when five objects are endowed with three properties. It is interesting to note that, regardless of age, most often the students chose the plot with catching fish, using the number of fish caught as a comparable property in some cases, and the type of fish in others.

It should be noted that some of the subjects of this group (subgroup D1) offered tasks where five objects (for example, A, B, C, D, E) are endowed with three properties (for example, x, y, z) in such a way that three objects (for example, A, B, C) have one property (for example, "x"), and the other two have others, for example: D belongs to the property "y", D - the property "z".

In particular, there was such a task: “Grisha, Vova, Misha, Seryozha and Zhenya were fishing. Three caught one fish each, one caught two fish and one caught three. Grisha and Vova caught a different number of fish, Vova and Misha - also a different number, Seryozha - one fish, Zhenya - three fish. How many fish did Vova catch?”

Another part of the subjects of this group (subgroup D2) offered tasks where five objects are also endowed with three properties, but these properties are distributed differently: two objects (for example, A and B) have one property (for example, the property "x"), two objects (for example, C and D) are endowed with another property (for example, the property "y") and one object (for example, E) - with a third property (for example, the property "z").

In particular, there was such a task: “Kolya, Vanya, Igor, Maxim and Alyosha were fishing. Two caught pike, two - ruff and one walleye. Kolya and Vanya caught different fish, Vanya and Igor - also different ones, Maxim - ruff, Alyosha - zander. Who did Vanya catch?” It is interesting to note that, regardless of age, students of the D1 subgroup prevailed in the D group.

Observations of problem solving by the subjects of group D (“synthesizing”) showed that their actions are characterized by the same features as the actions of the subjects of groups B and C (i.e., “analysts” and “reflexives”). At the same time, however, in contrast to the “reflexive” ones, the “synthesizers” actively reacted to the substantive difference between the second task and the first one, saying, as a rule, that “… it’s different here, there are only two types…” or “… this task is easier, only bus and tram... And when solving the third problem, they usually noted (after the first reading) that "... here again there are four types, ... as in the first one ..." or "... in this problem again there are more different things, as in the first one ...".

3. Results.

The results of solving problems by schoolchildren in grades 5-11 are presented in the table.

Table.

Distribution of subjects with empirical (A), analytical (B), reflexive (C) and synthesizing (D) methods of solving plot-logical tasks in grades 5 – 11 (in%)

Grades	Test groups				
	A	B	C	D	B+C+D
Fifth	43,9	29,7	16,5	9,9	56,1
Sixth	41,4	27,6	13,8	17,2	58,6
Seventh	35,7	25,0	17,9	21,4	64,3
Eighth	31,0	24,1	20,7	24,2	69,0
Ninth	26,1	20,0	26,2	26,7	73,9
Tenth	5,8	19,4	26,8	29,0	74,2
Eleventh	18,8	15,6	31,2	34,4	81,2

Analysis of the data presented in the table allows us to note the following. First, there is a relatively significant (by 7.3%) change, from grade 5 to grade 6, in the size of group D (ie, schoolchildren who acted in a synthesizing way). This happens, as can be seen from the table, due to a slight decrease in the number of group A ("empiricists") - by 2.5%, group B ("analysts") - by 2.1% and simultaneously with a very slight increase in the number of group B (“reflexive”) – by 2.7%.

Secondly, in grades 5–8 there are fewer “reflexives”, and in grades 9–11 there are more than “analysts”, and there are more “synthesizing” in all grades (except the fifth) than “reflexive”. At the same time, from grade 5 to grade 11, the number of “analysts” decreases, and the number of “reflexive” ones increases.

Thirdly, the proportion of “synthesizers” (Group D) among “theoreticians” (Group B + C + D) is increasing: in grade 5, the ratio of marked groups is 9.9% and 56.1% (i.e., the share of “synthesizing ” among the “theorists” is 18.8%), and in the 11th grade - 34.4% and 81.2% (i.e. the share of “synthesizers” among the “theorists” is already 42.4%).

4. Conclusion.

The study was aimed at studying changes in the nature of their orientation in schoolchildren from grades 5 to 11 in the conditions of solving plot-logical tasks in a verbal-sign form. In particular, of serious research interest was the question of when schoolchildren in grades 5-11 undergo a transition from orientation in the conditions of tasks using the analytical method of theoretical thinking to orientation using its reflexive method and, most importantly, to orientation using his synthesizing way.

A total of 209 schoolchildren enrolled in the fifth, sixth, seventh, eighth, ninth, tenth and eleventh grades participated in individual experiments.

The data obtained in the noted experiments and presented in the table indicate that during the period of study in grades 5-11, the theoretical method of solving plot-logical problems in its synthesizing form develops quite evenly. At the same time, it is important to note, as follows from the data presented in the table, that during the period of study in the middle and senior classes, the number of schoolchildren characterized by the implementation of the synthesizing method of theoretical thinking in solving problems is almost one third among graduates of a complete secondary school.

This gives reason to believe that the majority of peers will have the opportunity to solve plot-logical problems in a verbal-sign form in a synthesizing way of theoretical thinking only a few years after graduation.

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CLINICAL MEDICINE

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Gromakova A.I., Luschik M.V., Makeeva A.V. The effect of smoking on the cardiovascular system

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Abstract. *The analysis of literature data on the influence of smoking on the development of cardiovascular pathology and changes in the rheological properties of blood. The harmful effect of tobacco smoke on the body has been studied and the mechanism of its action has been described. Attention is paid to the problem of "passive smoking", as well as the characteristic environment for its development. The composition of tobacco smoke is considered, the harmful effects of toxic substances contained in a cigarette on the body are explained in detail. We mention how the hemostasis system suffers as a result of prolonged smoking, the risks of thrombosis and the asymptomatic moment of thrombus detachment. Comparisons of the health and mortality of a smoker, based on the statistics of the health organization, with people who do not smoke or quit smoking are given. In conclusion, the authors' position on the topic of smoking is given as an important social problem.*

Keywords: *smoking, cardiovascular system, nicotine, passive smoking, circulatory system, heart disease, blood pressure, health organization.*

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Introduction. Many people know that smoking has one of the most negative effects on the human body. However, most do not know exactly how addiction develops, and then various diseases. Every year, diseases of the cardiovascular system become the cause of death of millions of people around the world. Currently, it has been proven that the consequences of smoking can lead to the development of coronary heart disease, various arrhythmias and arterial hypertension.

Materials and methods. Analysis of literature data proving the harmful effects of smoking

on the cardiovascular system, study of the harmful effects of smoking on the development of a number of pathologies, including diseases of the cardiovascular system

Results. It has been proven that the risk of sudden death increases when smoking cigarettes. For example, the probability of heart and vascular diseases will be 4 times higher in a smoker compared not only with a non-smoker, but also a person who has given up smoking. It is shown that the frequency of myocardial infarction increases twice, and atherosclerosis - three times.

The whole problem lies in nicotine and other toxic compounds contained in tobacco smoke. And then what happens in the cardiovascular system during smoking? Nicotine, getting into the blood, causes a sharp release of adrenaline, therefore, the walls of blood vessels contract, blood pressure rises and the heart rate increases. The smoker's circulatory system does not return to its original state, and the heart continues to beat hard even 20-30 minutes after smoking a cigarette.

In addition, nicotine disrupts the permeability of cell membranes, which contributes to ionic imbalance and the development of calcium deficiency. As a result, the mechanism of contractions of the striated musculature is disrupted and the normal operation of the heart muscle becomes impossible without this essential element. A high dose of nicotine reduces the level of prostacyclin. This hormone relaxes the blood vessels after the previous contraction. That's how everything is interconnected.[3]

However, as mentioned, nicotine is not the only "culprit" of the depression of the cardiovascular system. For example, carbon dioxide replaces oxygen when it enters the bloodstream when smoking. What causes hypoxia or oxygen starvation of the heart and brain, as well as other organs. It has been proven that atherosclerosis occurs due to the high content of "harmful" lipoproteins. And which compound increases their content? This is carbon monoxide, which is part of tobacco smoke, which is extremely toxic for a reason. It is known that the content of carboxyhemoglobin in the blood of a smoker is approximately about 5-15%, but it can reach 20%. This concentration is characteristic of mild acute carbon monoxide poisoning. Subsequently, the blood is not able to carry the right amount of oxygen from the lungs to the tissues, and then the oxygen supply of the heart muscle (myocardium) is significantly disrupted, which leads to the development of coronary heart disease. In addition, this component of tobacco smoke significantly damages the endothelium of blood vessels and increases the risk of narrowing of the coronary arteries.[1]

The hemostasis system also suffers from the effects of smoking. In smokers, blood coagulates faster due to an increase in the level of fibrinogen and an increase in blood

viscosity, as well as changes in the adhesive properties of platelets. That's why the risk of thrombosis increases. The consequences are disappointing: myocardial infarction, brain stroke, lung infarction. The worst thing is that the formation of blood clots and even the moment of their separation is absolutely asymptomatic. [2]

It is also interesting that "passive smoking" contributes to the development of diseases peculiar to smokers. The term "passive smoking" means unintentional and unwanted inhalation of air poisoned by substances released during smoking. Almost every person on the planet has been a passive smoker at least once, without even knowing it. This is especially true for large cities and large megacities. The harm of smoking for people who are in the same room with a smoker arises from the fact that he is forced to absorb substances from the smoke exhaled into the environment from another person. The main stream enters the smoker's lungs, and the part of the smoke that is released into the atmosphere is inhaled by everyone who is nearby.

Around the world, about 600,000 people die every year from the terrible consequences of passive smoking. About 400,000 of this number die from heart ailments.[7]Such statistics were provided by the World Health Organization.[9]

8 million people die from the effects of tobacco use every year. [8]Moreover, 7 million of them are consumers and former tobacco users, and more than 1.2 million are "passive smokers". In a study conducted among British male doctors, the probability of death in middle age (45-64 years) was 3 times, and in retirement age (65-84 years) - 2 times higher in smokers compared to those who have never smoked.[10]

Discussion. Nicotine is a slow-acting poison, so smoking tobacco is not just a bad habit, but a very serious social problem. Many advertising companies offer their customers to experience freedom and incredible sensations by inhaling and exhaling tobacco smoke, selling and promoting their goods in every possible way under various packages.[5]Vapes, electronic cigarettes, to which a considerable part of young people have managed to get used, are not a safe alternative to conventional tobacco smoking.[4]

And if euphoria occurs first, then the mechanism of addiction triggers, leading to disastrous consequences not only for the smokers themselves, but also for others. Perhaps this article will make you think about the dangers of smoking and give it up forever.[6]

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UDC 33

Glushchenko V.M., Pronkin N.N. Developing a strategy to achieve the goals of ensuring information security of the metropolis

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Abstract. *In the article on the basis of the system analysis the strategy of achieving the goals of information security of the Moscow metropolis is considered. In accordance with the statement of the problem, focused on changing the existing state, the development of strategies is conducted in terms of change in relation to some basic variant of development.*
Keywords: *Moscow megapolis, information security, private strategy.*

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It is necessary to develop a unified strategy of the system that would ensure the most effective elimination or mitigation of existing problems. We can say that the task ahead is to formulate a unified strategy from particular strategies for solving individual problems. The essence of the strategy for solving each individual problem is the implementation of certain changes in the problem system (element) and its external environment.

In accordance with the formulation of the problem of solving a problem focused on changing the existing state, the development of strategies is carried out in terms of changes in relation to some basic development option, resulting from extrapolation of the prevailing trends, and the available ways and possibilities for implementing changes. The list of such changes characterizes the structure of the strategy and at the same time sets target standards for the development of complexes of measures for its implementation.

The active solution of the problem, as it was noted, involves the elimination or compensation of the factors that cause the occurrence and reproduction of the problem. In

order to consider from these positions, the issues of developing a single strategy for the development of a problem system, it is necessary to analyze the structure of the factors of the problem situation and, on this basis, to investigate the structure of measures to eliminate them, in order to identify those elementary blocks from which a single strategy can be assembled.

One of such blocks is a private strategy, which is understood as a set of actions aimed at eliminating a problematic situation or in one of the subsystems in one of the activities of the Moscow Government. As a rule, private strategies combine elementary, object, group and functional strategies.

Since the quality of functioning of a single subsystem (line of activity) can be influenced simultaneously by several negative factors, each of which can be eliminated and compensated in various ways, it seems appropriate to initially consider a possible control effect characterized by a single object, as well as a subject and a method of influence on a separate factor. These impacts can be grouped in various aspects: concrete results, objects, subjects and the mechanism of impact. If they are combined from the position of a common control object, i.e. a factor that is the subject of control, then for each factor an appropriate strategy can be selected that allows it to be eliminated or compensated – an elementary strategy. In other words, the controlling influence on the factor is the basis for combining several subjects, forms and methods of management into an elementary strategy.

A set of control actions aimed at improving the quality of functioning of a certain functional element of the system gives an object strategy.

Combining object strategies into groups of the same type of functional elements belonging to different functional subsystems of the problem system is a group strategy.

Object strategies can also be combined on the basis of improving the properties of functional subsystems to which the corresponding elements belong. Such an association will form a functional strategy.

Mixed strategies will be considered a set of private strategies combined on the basis of improving various problematic characteristics of the system in question as a whole.

The combination of mixed strategies provides a general strategy for changing other properties of the problem system. At the same time, it is obvious that the costs and results of the implementation of individual mixed strategies and their arbitrary combinations vary. Therefore, the formation of a unified strategy is the task of choosing the most effective combination of options for the implementation of mixed and separate private strategies.

In the process of forming a unified strategy for solving the problem, the first source of information for us is developments on individual private strategies, but at the same time we can also obtain characteristics that go beyond the scope of the developments carried out.

This implies the active use of expert analysis. Therefore, the second source of information is expert estimates.

Based on the choice of a single strategy for solving the problem for each particular strategy, the normative properties of the functional subsystems implementing them are formed, then it is necessary to assess the achievability of these normative properties by each real system. In the case of a negative assessment, the unified strategy should be revised accordingly, and in the case of a positive assessment, it is necessary to proceed to the next stage of analysis – determining the conditions under which these normative properties can be achieved.

It should be noted that during the development of the strategy, the task arises of forming alternative options for achieving the required characteristics of the various elements of the system under consideration and the links between them.

There are two approaches to its solution: the first, a purely expert approach based on the use of heuristic procedures such as "brainstorm", Delphi method, etc., and the second approach based on the widest possible systematic view of the object of planning and management and on more or less ordered procedures relations with each of the elements of this object of possible control actions. It is quite difficult to determine in advance which approach will be more effective. Apparently, they should complement each other. For example, a formal-logical approach can set a kind of strategy skeleton, which then acquires concrete content using heuristic methods.

Theoretically, the number of alternative ways to solve problems in the field of ensuring the information security of a megalopolis can sometimes be significant. Some of the alternative solutions may seem quite acceptable, some naive. The question, obviously, is whether we can actually list all possible ways to solve the problem and whether there is hope to analyze all these ways, compare them with each other. Both from a theoretical and practical point of view, a positive answer should be given to the first part of the question: in principle, for any problem in the field of ensuring information security of a megalopolis, theory and practice can suggest a list of specific ways to solve them. As for the second part of the question – about the possibility of analyzing all these ways and comparing them, it is possible to answer only by considering a specific problem, probable ways to solve it and options that can be developed in sufficient quantity on each way of solving the problem. Thus, a contradiction may arise: if all possible strategies cannot be chosen for analysis, then the best solution to the problem may not be found. In other words, the "problem solving tree" will not give us what it was made for.

Let's consider how this contradiction can be practically resolved. Obviously, here we need to answer the question of how many strategies should be developed. Practice in various fields of activity shows that the maximum possible number of alternatives is, as a rule, seven. Most often, five alternatives are taken, and if there is no time to solve the problem, you can limit yourself to three.

Thus, if the number of alternative options being developed for each of the ways to solve the problem is in the range of 3-7, then it is practically possible to proceed to the following procedure - identifying the advantages and disadvantages of each alternative solution strategy in relation to the goal or goals.

The choice of a rational variant of the information security strategy of the city of Moscow, even if there is a list of advantages and disadvantages of alternatives, is the most difficult. The complexity is manifested in the fact that in order to evaluate alternative solutions to the problem, it is necessary to find a single measure of all advantages and disadvantages for all alternatives. In other words, to find a way to determine the indicator of the effectiveness of solutions to the problem, which would be expressed in comparable quantities. Then, having the corresponding performance indicators for many alternative solutions to the problem, you can choose the best solution for the maximum (minimum) value of the indicator.

Techniques for choosing the best solution are reduced to three groups of methods. The first group consists of methods based on the use of quantitative characteristics of alternative elements. The second group includes methods based on the use of qualitative characteristics of alternative elements. The third group includes methods based on the use of both quantitative and qualitative characteristics of alternative elements.

When considering these groups, it should be emphasized that the implementation of problem-solving methods involves the widespread use of experiments. It is from them that the correctness of the evaluation of alternatives and the choice of the best solution will largely depend.

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TECHNOLOGY, ENGINEERING

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Dudin B.M. Valence electric potential

Электрический потенциал валентности

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Abstract. *It is unlikely that a unit charge, which was not detected by either Coulomb or Millikan, and whose numerical value is accepted by agreement and included in the definition of Faraday's constant, reflects the true value of the quantitative parameters of the electrolytic process. Therefore, there is every reason to redefine the Faraday constant experimentally with a direct electrolytic process.*

Keywords: *Faraday's constant, amount of electricity, valence, valence charge, mole, molar mass.*

Аннотация*. Маловероятно, что единичный заряд, который не обнаружен ни Кулоном, ни Милликеном, и численное значение которого принято по соглашению и включено в определение постоянной Фарадея отражает истинное значение количественных параметров электролитического процесса. Поэтому есть все основания переопределить постоянную Фарадея опытным путём при непосредственном электролитическом процессе.*

Ключевые слова*: Постоянная Фарадея, количество электричества, валентность, валентный заряд, моль, молярная масса.*

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Терминология и электролиз

Есть, однако, одно счастливое обстоятельство:
каковы бы ни были наши мнения, им не изменить и
не расстроить законов природы.
М. Фарадей

Большое значение в изучении электролитических процессов и гальванических элементов принадлежит английскому учёному Майклу Фарадею. В честь его заслуг, исследований в области электричества, одной из фундаментальных физических постоянных, определяющей соотношение между электрохимическими и электролитическими процессами, присвоено его имя.

Постоянная Фарадея (**F**) определяет то количество электричества, которое необходимо затратить на восстановление из электролита одного моля вещества.

Численное значение постоянной **Фарадея F** определяют из соотношения [2]:

$$F=e\cdot N_A, \text{ Кл/моль}$$

где e = 1,602 176 634·10^{-19} Кл (точно) — элементарный электрический заряд; N_A = 6,022 140 76·10^{23} моль$^{-1}$ (точно) — постоянная **Авогадро**.

Роль, которая отведена элементарному электрическому заряду (e) в данном соотношении, вызывает некоторое недоумение. Во-первых, Милликен в своей экспериментальной установке не мог выделить единичный заряд. Во-вторых, его результаты имели очень большой разброс, что вызывает недоверие к полученным им результатам. Наконец, существует ли электрон в том виде, как его представляет современная физика, до сих пор подвергается сомнению. [4] Видимо по этой причине «…В единицах Международной системы единиц (СИ) постоянная Фарадея в точности равна F = 96485,332 123 310 0184 Кл/моль [1]. Точное численное значение постоянной Фарадея следует из точно установленных (*не измеренных в физическом эксперименте с конечной погрешностью, а определённых соглашением*)[1] численных значений заряда электрона и постоянной Авогадро. Это соглашение действует с 2019 года, после изменения определений основных единиц СИ, когда все определения стали привязаны только к значениям фундаментальных физических констант» [2]. Такой подход к определению постоянной Фарадея не отражает истинное его значение.

Моль — это количество специфицированных структурных элементов (атомов, молекул, ионов или любых других объектов) в одном моле вещества численно равно постоянной Авогадро (N_A).

Количество вещества (кг), выделяемого при прохождении через электролит 1 Кл электричества (Q = I·t = 1 *Ампер*·1 *сек*.), называется **электрохимическим эквивалентом Э** (кг/Кл).

Фарадей, находясь у истоков изучения электролитических процессов, понимал, что без единой терминологии невозможно взаимопонимание между учёными-исследователями при обмене и обсуждении результатов научных экспериментов. Поэтому после консультаций с коллегами он обосновал целую группу терминов, которая и в настоящее время остаётся актуальной и признана всем сообществом физиков [3].

[1] Курсив и подчёркивание — автора.

Электрод[2] — это то вещество или та поверхность, которая ограничивает протяжение разлагаемого вещества в направлении электрического тока.

Анод — это та поверхность, около которой электрический ток входит; он представляет собой *отрицательный* конец разлагаемого тела (около него выделяются кислород, хлор, кислоты и т.д.), и он находится около положительного электрода.

Катод — это та поверхность, около которой ток покидает разлагаемое тело, он является его *положительным* концом (горючие вещества, металлы, щелочи и основания выделяются около катода), и он находится в соприкосновении с отрицательным электродом.

Электролит — Фарадей под этим термином понимал вещества, непосредственно разлагающиеся электрическим током, причем их элементы освобождаются. Несмотря на то, что в настоящее время всем известно, что никаких сил для распада молекул не требуется — они сами собой диссоциируют в электролитическом растворе. Однако сам термин остался без изменений.

Электролиз — физико-химический процесс, состоящий в выделении на *электродах* составных частей растворённых веществ или других веществ, являющихся результатом вторичных реакций на электродах, который возникает при прохождении электрического тока через раствор либо расплав *электролита*.

Анионы$^{-}$ — это те вещества разлагаемого тела, которые переносятся *к* аноду$^{+}$.

Катионы$^{+}$ — это те вещества разлагаемого тела, которые переносятся к катоду$^{-}$.

Ионы — этот термин используется в тех случаях, когда идёт речь об анионах и катионах без акцента на персонализацию.

«Это тот язык, на котором мы говорим и поныне: электролит, электролиз, ион, анион, катион, электрод, анод, катод; с тех пор как эти слова произнесены впервые, они не сходят со страниц» [3] всех учебных пособий.

Во времена Фарадея было принято следующее направления тока в электрической цепи, [3] «что ток идет от положительного места к отрицательному, то лишь в согласии с *традиционным*, хотя до некоторой степени *молчаливым*, соглашением, заключенным между учеными и обеспечивающим им постоянное, ясное и определенное средство для указания направления сил этого тока.»

Как этот процесс можно представить в современном виде. Для этого рассмотрим те процессы, которые происходят в электролите и во внешней электрической цепи. Причиной этих процессов является материальная частица (**мч**) — одна из структурных

[2] ήλεχτρου — янтарь и όδός — путь.

составляющих среды эфира, которая обладает преимущественно инерционным вращением относительно собственной оси ($E_{вр}$≈100 %) и слабым, либо отсутствием прямолинейного движения ($E_{пр}$≈0 %). Эти **мч** являются настолько тонкой структурой, что присутствуют в структуре всей вещественной материи, начиная с химических элементов, их соединений и вплоть до космических объектов. А также с прочими материальными частицами эфира они составляют ту среду, в которой обитают все объекты, в том числе и мы с Вами. Эти частицы, которым была присвоена аббревиатура **мч,** чтобы отличать её от прочей среды эфира, в проводнике с током приобретают новый статус — материального носителя тока **(мнт)**. Материальные носители тока и **мч** по сути — это одни и те же частицы эфира, и не проявляющие между собой ни взаимного притяжения, ни отталкивания. По отдельности каждая **мч** никаким зарядом не обладает. Однако превышение **мч** или их недостаток в материальном теле относительно нейтрального состояния, обуславливает их как положительно или отрицательно заряженные тела. Нейтральное состояние — это, когда **мч** находятся в динамическом равновесии между телом и той средой, в которой оно находится. Предельное присутствие **мч**, в том числе, и в нейтральном объекте определяется физическими свойствами материального тела и концентрацией **мч** в окружающей среде.

В процессе диссоциации в растворах химические соединения распадаются под действием растворителя на два иона. Однако **мч** (потенциальные **мнт**) распределяются между ионами не равномерно, а как будет показано ниже, пропорционально валентности химических элементов. Те химэлементы, которые заберут с собой излишки **мч**, приобретут положительный заряд, и будут именоваться катионами, а те, которые отдадут такое же количество **мч**, окажутся отрицательно заряженными, т.е. анионами.

После подобного вступления можно перейти и к определению направления тока в электрической цепи. Соединим электроды анод$^{+}$ и катод$^{-}$ с источником постоянного тока. Источник тока выполняет функцию обычного насоса для перекачивания “жидкости” (а точнее **мч**) из одного провода в другой. Ионы в электролите приобретут целенаправленное движение: катионы$^{+}$ пойдут к катоду и отдадут электроду излишки своих **мч** и перейдут в электрическую цепь уже как **мнт**; анионы$^{-}$ пойдут к аноду и приобретут недостающее количество **мч**, **мнт** из электрической цепи перейдут к аниону уже как **мч**.

В итоге **мнт** идут от катода к источнику тока, а от источника по второму проводу, направляются к аноду.

Катионы$^{+}$, отдав излишки **мч** (n·Σмч, где n – валентность химического элемента), становятся электрически нейтральными и выделяются на катоде в виде осаждений (омеднение, золочение, …) или переходят в раствор электролита, где могут вступать во вторичные взаимодействия. Анионы$^{-}$, получив такое же количество **мч** (n·Σмч), выделяются на аноде либо переходят в раствор, где также могут вступать во вторичные взаимодействия. Сумма материальных частиц (n·Σмч) не является единым материальным телом, как это трактует академическая физика, что это якобы электрон с его отрицательным зарядом. По факту (Σмч) определяет заряд (количество электричества), необходимый для нейтрализации одной валентности иона химического элемента. Составные элементы (Σмч) физически не связаны с химическими элементами, они могут свободно выходить из них и также входить, поддерживая динамическое равновесие, но в то же время существенно влияют на свойства химэлементов в определении их валентности и физических свойств.

Электрические параметры при электролизе

Производство и потребление электроэнергии в быту и в промышленности учитывается в киловатт-часах (Квт·час). При электролизе же основным электрическим параметром процесса является *количество электричества* (электрический заряд) **Кулон** (Кл). Против понятия Кулон как *количество электричества возражений нет, но в природе нет отдельных зарядов ни положительных, ни отрицательных, поэтому трактовать Кулон как электрический заряд неправомерно*. Материальные частицы, находясь внутри вещественной материи и поддерживая динамическое равновесие с окружающей средой, никакого заряда телу сообщить не могут, но после того, как им созданы условия для перемещения по проводникам, они приобретают новое свойство — материальных носителей тока (**мнт**). Эти **мнт** и определяют то количество электричества, которое идёт по проводам и выполняет всю ту полезную работу, на которую они способны. Ошибочным является и приписывание Милликену определения опытным путем величины единичного заряда, выраженной в кулонах как $1{,}602176634 \cdot 10^{-19}$ Кл. В опытах Милликена невозможно было получить единичный заряд, тем более ещё и измерить его. Об этом можно прочесть в работе [4], в которой подробно проанализирован опыт Милликена. Точное значение константы $1{,}602176634 \cdot 10^{-19}$ фактически утверждено директивно, приписано заряду электрона со знаком минус и не имеет ни практического, ни теоретического, ни научного значения. Электрон, которому физики отвели место как материальной частице, вращающейся вокруг ядра химических элементов, лишен здравого смысла, так как ядра химических элементов плотно упакованы во фрактальные

структуры [6], в которых нет пространства никаким материальным телам, которые при этом могли бы еще и вращаться вокруг какого-либо центра.

Поэтому к электролитическому процессу эта константа, численно равная «заряду электрона», не имеет никакого отношения. Однако если признать, что константа ($1{,}602 \cdot 10^{-19}$) якобы есть величина единичного заряда, как и было принято в то время, тогда произведение ($e \cdot N_A$) действительно будет отражать то количество электричества, которое необходимо затратить для восстановления одного моля вещества. Применительно к электролитическому процессу постоянная $1{,}602 \cdot 10^{-19}$ Кл будет иметь совсем другой физический смысл, а именно то количество электричества, которое необходимо для нейтрализации одновалентного иона, т.е. Σмч = $1{,}602 \cdot 10^{-19}$ Кл. При этом под знаком суммы учитываются не любые **мч**, находящиеся в растворе электролита, а только те, которые находятся в ионах и кратны их валентности. При переходе мч в электросеть они становятся теми материальными носителями тока, которые и определяют то количество электричества, которое участвует при нейтрализации ионов. Естественно, что численное значение валентного количества электричества ($1{,}602 \cdot 10^{-19}$) как постоянной величины потребует экспериментального подтверждения на примерах электролитических процессов.

По определению 1 Кл равен количеству электричества, проходящего через поперечное сечение при силе тока 1 А за время 1 с (1Кл=А·с).

За единицу силы тока принят **Ампер,** который при прохождении по двум параллельным проводникам в вакууме на расстоянии 1 м один от другого на участке в 1 м вызывал бы силу взаимодействия, равную $2 \cdot 10^{-7}$ Н [8].

Итак, мы имеем единицу силы тока, определённую опытным путём, используя силовое взаимодействие между проводниками с током, постоянную единичного заряда (e) или как мы полагаем Σмч, постоянную Авогадро и наконец, постоянную Фарадея (стр. 41), все они приняты по соответствующим соглашениям и маловероятно, что могут отражать истинную картину природного явления электролиза.

Постоянная Фарадея потому и называется постоянной, что при определённых условиях для восстановления из электролита одного моля вещества требуется одинаковое количество электричества для всех химических элементов равное 96485[3] Кл. Такое значение константы видимо вполне удовлетворяет практиков при реализации электролитических процессов.

[3] Здесь и далее принято округлённое целочисленное значение постоянной Фарадея.

В то же время было ещё одно интересное высказывание по этому вопросу, сделанное Дж. Стони, который «используя результаты, полученные Фарадеем, … предположил, что все электрические заряды состоят из элементарных фундаментальных зарядов. Стони показал на примере электролиза, что каждую валентность следует связывать с минимальным электрическим зарядом» [5]. Это направление, по нашему мнению, было наиболее правильным с небольшим допущением, что в природе нет никаких, в том числе и фундаментальных зарядов. Однако предложение Стони не было воспринято научным сообществом, а была принята гипотеза Лоренца, согласно которой электрон вошёл структурным элементом в строение химических элементов. Минимальный электрический заряд или минимальное количество электричества, необходимое для нейтрализации одновалентного иона, по мнению Стони и должно быть той константой, которая и должна была бы войти в определение постоянной Фарадея, а не e — единичный заряд электрона, который ни физически, ни теоретически не связан с электролитическим процессом.

Как показывает практика, все электролитические процессы совершаются в строгом соответствии с валентностью химических элементов.

Валентность — это свойство атома химического элемента присоединять или замещать определённое число атомов другого химического элемента. Валентность — величина целочисленная и может принимать значения от 1 до 8. У некоторых химических элементов валентность постоянная, у других — разная в различных соединениях.

Валентный заряд (или валентное количество электричества)

Постоянную Фарадея (96485 Кл/моль), вычисленную с помощью константы, якобы принадлежащей единичному заряду ($1{,}602176634 \cdot 10^{-19}$), нельзя признать правдоподобно отражающей количество электричества, затрачиваемое на выделение одного моля *одновалентного* вещества. Виртуальный электрон и виртуальный его отрицательный заряд не могут гарантировать стопроцентную достоверность постоянной Фарадея.

Массу вещества (m, кг), выделяемую на электроде, определяют по формуле:

$$m = Э \cdot Q ,$$

где $Q = I \cdot t$, количество электричества, Кл; Э — электрохимический эквивалент, кг/Кл

$$Э = \frac{1}{F} \cdot \frac{M}{n},$$

где F = 96485 Кл/моль, постоянная Фарадея; M — молярная масса химических элементов, кг/моль; n — валентность химических элементов.

Молярная масса (M) — это масса 1 моля вещества, выраженная в граммах. Молярную массу одного моля любого химического элемента находят из таблиц Д.И. Менделеева. Молярная масса численно равна атомной массе, с той лишь разницей, что молярная масса имеет размерность г/моль.

Маловероятно, что постоянная квазиединичного заряда достоверно отражает количественную сторону электролитического процесса, но на общую закономерность процесса она не должна оказывать существенного влияния. Поэтому определим, как изменяется валентный заряд (валентное количество электричество) в зависимости от молярной массы и валентности химических элементов.

Проанализировав все химические элементы, было обнаружено, что независимо от молярной массы и валентности для нейтрализации одного моля любого одновалентного вещества требуется затратить 96485 Кл электричества.

Таблица 1

Зависимость валентного количества электричества от валентности химических элементов азота (N) и золота (Au).

Химический элемент	M, г/моль	Валентность	Э, мг/Кл	$F_в$, Кл/моль	$F_{в(i+1)}$-$F_{вi}$, Кл/моль
N	14	1	0,1451	96485	
N	14	2	0,0725	192970	96485
N	14	3	0,0483	289455	96485
N	14	4	0,0362	385940	96485
Au	196,97	1	2,0414	96485	
Au	197,97	2	1,0259	192970	96485
Au	198,97	3	0,6873	289455	96485

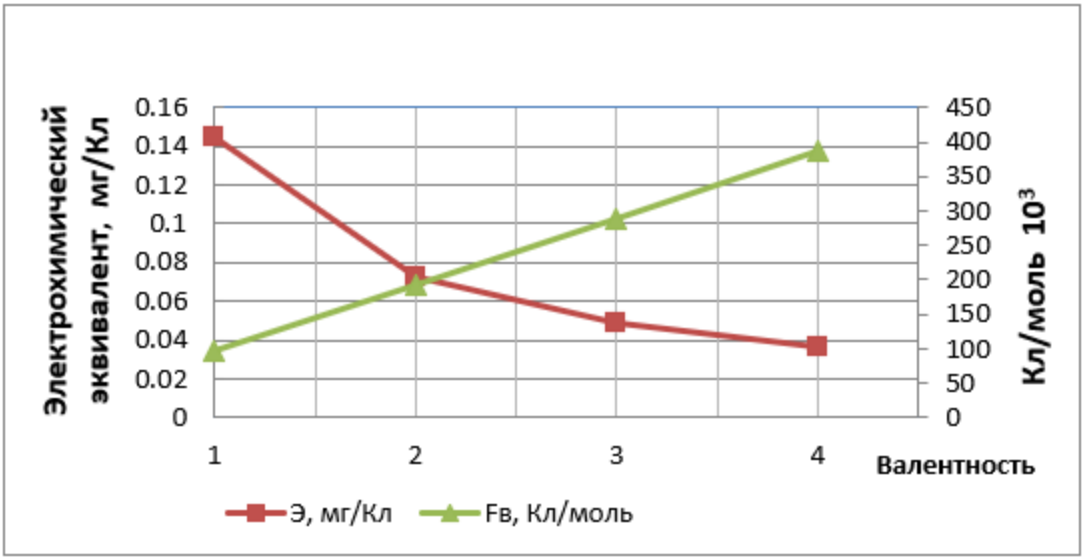

Рисунок 1 — Зависимость электрохимического эквивалента и количества электричества от валентности азота.

В качестве примера в таблице 1 приведены данные по двум химическим элементам — азоту и золоту, первый из которых имеет четыре валентности, а второй три. Как следует из таблицы, на 1 моль вещества затрачивается одно и то же количество электричества на одну валентность, и дополнительно такое же количество — на каждую последующую валентность ($F_в$ = 96485 Кл/моль). В соответствии с определением понятия *моль* в нём содержится N_A **мч**, т.е. равное постоянной Авогадро. Тогда Σмч — валентный заряд (или валентное количество электричества) будет равно частному от деления $F_в$/ N_A, т.е. Σмч = $1{,}60217^{-19}$ Кл. Не зависит валентный заряд и от молярной массы химических элементов (таб. 1 на примере N и Au).

Для наглядности на рис. 1 изображены графики изменения электрохимического эквивалента Э и валентного количества электричества $F_в$, в зависимости от валентности химического элемента азота (N).

Заключение

Непонятно на каком основании для определения фундаментальной константы — постоянной Фарадея по формуле $F = e \cdot N_A$, принято значение единичного заряда, причём принятого по всеобщему соглашению. Да, размерность постоянной Фарадея (Кл/моль) правильно отражает физическую сущность электролитического процесса. Однако большое сомнение вызывает постоянная единичного заряда (e) якобы полученная из опытов Милликена. Во-первых, Милликен в своей экспериментальной

установке [4] никак не мог получить единичный заряд и тем более измерить его. Во-вторых, результаты опытов имели настолько большие разбросы, что в результате физики пришли к некоторому соглашению, но не имеющему ничего общего с единичным зарядом.

Согласно определению, 1 Кл равен количеству электричества, проходящего через поперечное сечение проводника при силе тока 1 А за время 1 с. Отсюда следует, что количество электричества воспринимается только в движении. В стационаре, в любой ёмкости электричество содержаться не может. А электроны, как утверждают физики, существуют и в свободном состоянии, следовательно, они не могут иметь размерность Кл. Как неоднократно упоминалось, те материальные частицы, которые и определяют величины зарядов, сами между собой не взаимодействуют, т.е. никакого отношения не имеют к положительным и отрицательным частицам, которых, по нашему мнению, в природе вообще-то и не существует! Данное положение изложено и аргументировано доказано в работе И.О. Ярковского [7].

Электрон — это надуманное понятие материального тела, которого в природе не существует, и немало “копий” учёные поломали, пытаясь обосновать его существование, и всегда безуспешно.

Понятие единичного заряда, и тем более его численное значение, в природе физических явлений не имеет под собой никакой материальной основы.

В настоящее время, при наличии аттестованной приборной базы, можно с высокой степенью точности и достоверности определить количество материального вещества (m, кг), выделяемого при электролитическом процессе, и количество затраченного для этого электричества ($Q=I\cdot t$, Кл). Это позволяет с высокой степенью точности (и контролируемой погрешностью) определить количество электричества (Σмч), необходимого для нейтрализации одной и всех последующих валентностей ионов химических соединений.

Количество восстанавливаемого вещества в процессе электролитического процесса определяется по формуле:

$$n = m/M, \text{ моль}$$

где — M молярная масса, г/моль.

Тогда постоянная величина электролитического процесса ($F_в$) может быть определена как

$$F_в = Q/n, \text{ Кл/моль}$$

Постоянная $F_в$ — это и есть та постоянная Фарадея, которая с допустимой погрешностью будет определять то количество электричества, которое необходимо для выделения из электролита одного моля одновалентного вещества.

Тогда валентное количество электричества, рассчитанное по формуле

$$\Sigma мч = F_в / N_A, Кл,$$

будет более точно отражать физический заряд одновалентного иона. У двухвалентного иона физический заряд будет равен $2 \cdot \Sigma мч$, у 3-х валентного — $3 \cdot \Sigma мч$ и т.д.

В природе нет элементарных частиц обладающих положительным либо отрицательным зарядом. Электрический потенциал и электрический ток в проводниках обеспечивает атом эфира с соответствующими свойствами поименованные в статье как **мч** и **мнт**, что по факту является одной и той же частицей в зависимости от её места в электрической цепи.

Как долго нам будут преподносить современную квазифизику как фундаментальную науку о Вселенной, о Природе? Разве среди физиков нет думающих ученых, которым доступно понимание творений Всевышнего? Неужели в мире в настоящее время нет гениев подобно Тесле, Ньютону, Фарадею, Ломоносову, Менделееву, Ярковскому, … которые смогли бы снять позорный префикс с понятия физики …?

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Korolev A.E. Interconnection of design and technical characteristics of tractor diesels

Взаимосвязь конструкторских и технических характеристик тракторных дизелей

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Abstract. *The article analyzes the impact of the design execution of engines on their technical and economic performance work. The information characteristic of 15 tractor diesels of all power levels is considered. Statistical estimates of parameters are obtained and correlation relationship between them is established. Patterns of changes in the studied factors were revealed, which make it possible to determine the main directions of engines improvement.*

Keywords: *tractor diesels, parameters of construct, technical indicators, range of change, correlation, regularities*

Аннотация. *В статье анализируется влияние конструкторского исполнения двигателей на их технико-экономические показатели работы. Рассмотрена информационная характеристика 15 тракторных дизелей всех уровней мощности. Получены статистические оценки параметров и установлена корреляционная взаимосвязь между ними. Выявлены закономерности изменения изучаемых факторов, которые позволяют определить основные направления совершенствования двигателей.*

Ключевые слова: *тракторные дизели, параметры конструкции, технические показатели, диапазон изменения, корреляция, закономерности*

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Двигатели имеют многолетние устоявшиеся схемы компоновочного исполнения, а в связи с постоянным обновлением материалов ведётся поиск наилучшего сочетания размеров и формы деталей [1, 2]. Конструкции двигателей развиваются и совершенствуются в направлениях максимальной адаптации их к условиям эксплуатации, повышения экономичности и надёжности [3]. При этом любые конструкторские решения неизбежно вызывают изменения рабочих параметров технических объектов [4].

Для анализа взята выборка из 15 дизелей малой, средней и высокой мощности.

Основными конструкторскими признаками были приняты: отношение хода к диаметру поршня (S/D), степень сжатия (ε) и рабочий объём цилиндра ($V_ц$), а эксплуатационными - цилиндровая эффективная мощность ($N_ц$), частота вращения коленчатого вала (n) и цилиндровый расход топлива ($G_ц$). Конструкторские параметры характеризуют исполнительные размеры базовых деталей, а эксплуатационные - тепловые и динамические процессы. Результаты статистической обработки исходных данных приведены в табл. 1.

Таблица 1.

Обобщённая характеристика дизелей

Наименование показателей	Значение показателей		
	среднее значение	среднее квадратическое отклонение	коэффициент вариации
Отношение хода к диаметру поршня	1,1	0,13	0,12
Степень сжатия	16.2	0,91	0,06
Рабочий объём цилиндра, л	1,8	0,64	0,36
Цилиндровая эффективная мощность, кВт	21,3	10,96	0,51
Частота вращения коленчатого вала, мин$^{-1}$	1883,0	238,05	0,13
Цилиндровый расход топлива, кг	5,2	2,78	0,53

Отсюда следует, что три параметра (S/D, ε, n) изменяются в узком диапазоне, т.е. для них уже установлены оптимальные границы изменения. У трёх других параметров ($N_ц$, $G_ц$, $V_ц$) наблюдается значительное рассеивание, в этом направлении продолжается поиск их рационального соотношения. Корреляционным анализом выявлена взаимосвязь между исследуемыми показателями (табл. 2).

Таблица 2

Коэффициенты парной корреляции оценочных параметров

Параметр	S/D	ε	$V_ц$	$N_ц$	n	$G_ц$
S/D	1	-0,15	0,21	-0,18	-0,73	-0,23
ε	-0,15	1	-0,36	-0,22	0,38	-0,18
$V_ц$	0,21	-0,36	1	0,86	-0,49	0,85
$N_ц$	-0,18	-0,22	0,86	1	0,25	0,99
n	-0,73	0,38	-0,49	0,25	1	0,32
$G_ц$	-0,23	-0,18	0,85	0,99	0,32	1

Между конструкторскими признаками уровень связи низкий, хотя знаки в полной мере соответствуют процессам, происходящим в двигателях. Среди рабочих

показателей следует отметить практически абсолютную взаимосвязь мощности и расхода топлива, а знаки также адекватно отражают термодинамические циклы в двигателях. Конструкторское исполнение дизелей в наибольшей мере влияет на мощность, расход топлива и в средней степени определяет скоростной режим. На основе регрессионной обработки исходной информации установлены характеристические зависимости (рис. 1…3).

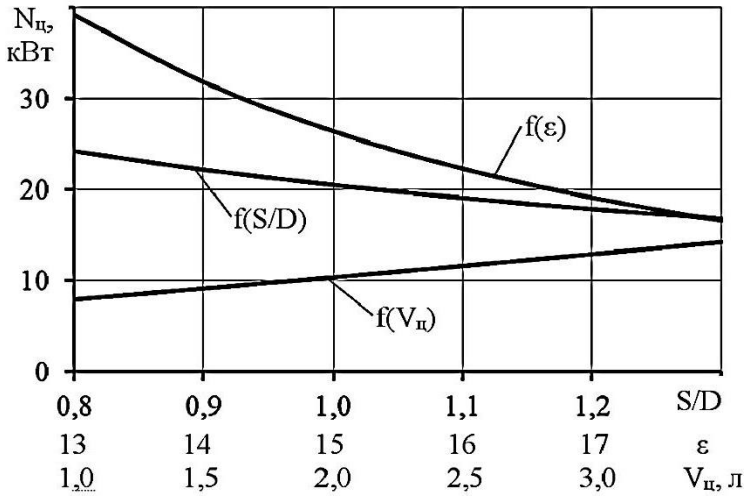

Рисунок 1. Влияние отношения хода к диаметру поршня, степени сжатия и рабочего объёма цилиндра на цилиндровую эффективную мощность двигателя

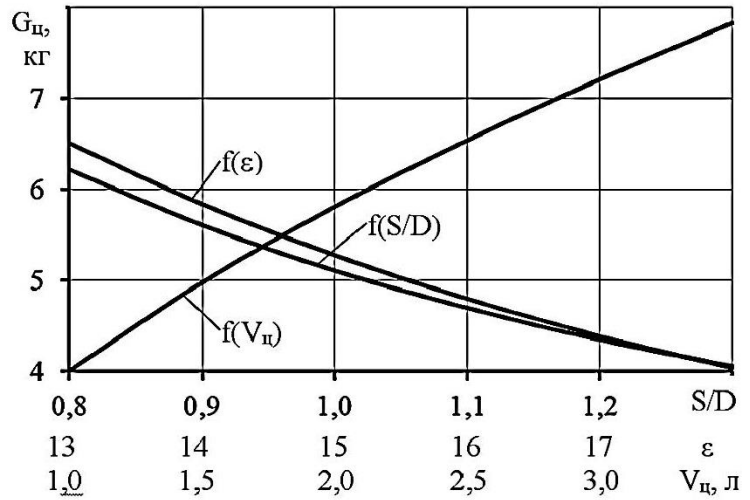

Рисунок 2. Влияние отношения хода к диаметру поршня, степени сжатия и рабочего объёма цилиндра на цилиндровый расход топлива двигателя

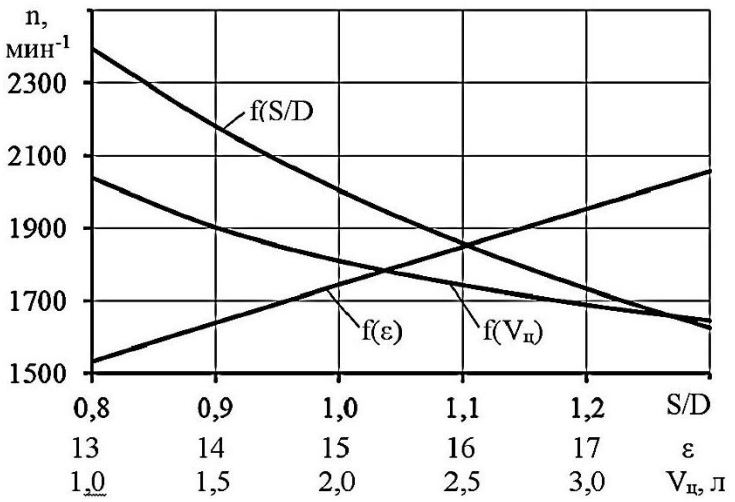

Рисунок 3. Влияние отношения хода к диаметру поршня, степени сжатия и рабочего объёма цилиндра на частоту вращения коленчатого вала

Полученные закономерности достаточно точно показывают современные тенденции в двигателестроении. Отношение S/D является одним из основных параметров, влияющих на конструкцию двигателя, короткоходное их исполнение даёт возможность повышения частоты вращения вала и соответственно мощности, роста коэффициента наполнения цилиндров, а также понижения тепловых потерь. Однако при этом увеличиваются габаритные размеры и масса двигателя, поэтому целесообразным для дизелей является $S/D \geq 0{,}9$. С увеличением степени сжатия ε возрастают все индикаторные и эффективные показатели двигателя. Это допустимо только до определённого предела, который ограничивается качеством материалов и совершенством формы камеры сгорания, а превышение его приводит к росту механических потерь и износа деталей. Приращение рабочего объёма цилиндров имеет положительные и отрицательные последствия, поскольку одновременно нарастает мощность и расход топлива, снижается частота вращения коленчатого вала, но повышается крутящий момент. Результаты проведённых исследований позволяют определять оптимальное сочетание конструкторских решений в зависимости от назначения и достижимых технических характеристик дизелей.

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