CRITERIA AND INDICATORS FOR THE SELECTION OF PROBLEMS AND EXERCISES FOR THE BIOLOGY OLYMPIAD

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ANNOTATION: This article highlights the main criteria and indicators for selecting problems and exercises used in the process of preparing for the biology Olympiad. The relevance of the issues, interdisciplinary integration, and focus on the development of students' level of knowledge and logical thinking are analyzed. At the same time, the division of problems into levels of varying difficulty, their features that stimulate critical thinking and form a creative approach are taken as a basis. Exercises selected on the basis of these criteria are important for acquiring deep knowledge in the field of biology, developing a research-based approach, and assessing the potential of Olympiad participants.

KEY WORDS: biology, olympiad, problem, exercise, selection criteria, knowledge level, thinking, first-level, second-level, third-level, fourth-level, fifth-level interdisciplinary integration.

INTRODUCTION

The use of olympiad exercises and assignments in biology lessons provides an opportunity for logical analysis and understanding of the problem, improvement of one's abilities and skills, constant work on oneself, deepening students' knowledge in the field of science, independent decision-making, the development of imagination, as well as the expansion and development of one's scientific worldview. It is known that olympiad tasks encourage students to think logically, improve their ability to compare and justify conclusions. During the lessons, students review the theoretical knowledge they have acquired within the framework of the topic and acquire skills in applying them in practice [2; 229-234-b.].

Deeper assimilation of general biological and specific biological concepts presented in the program, mastering biological concepts and knowledge, proving the validity of one's reasoning, setting goals, developing speed, forming interest in the topic, developing interest in various professions, mastering knowledge about the diversity of living organisms is manifested in student youth as a result of answering olympiad questions, solving problems and exercises, and implementing educational and practical tasks [3; 28-33 c.].

The level of mastery of the subject is characterized not only by theoretical knowledge, but also by the ability to apply the acquired knowledge in various situations. Students' acquired knowledge is determined not by the number of biological terms we require from them, but by their ability to apply them in solving problems [1; 61-b.].

In increasing the effectiveness of completing Olympiad tasks in biology, applying students' acquired knowledge in simple and unusual situations, and improving their theoretical and scientific skills, questions and tasks related to the topic are of great importance. One of the tasks facing specialists in the field and the methodology of teaching biology is the development of a methodology for the maximum implementation and use of olympiad tasks in biology lessons.

In the process of preparing gifted students for subject Olympiads, the teacher should pay special attention, first of all, to the student's level of knowledge in physics, chemistry, mathematics, and biology, as well as their ability to think logically. If, after identifying a gifted

student, they are taught the methodology of solving, along with the selection of Olympiad tasks, oriented from simple to complex, in accordance with their age characteristics, then the level of knowledge in the subject Olympiad will also increase and high results will be achieved [4; 64-66-b.].

A problem is achieving a certain result by applying the knowledge acquired by the student in finding a solution to the problem [5; 60-b., 6; 6-b.].

The content of the problem includes its condition and explanation.

The problem statement requires a complete solution to the problematic situation; in some cases, it may end in a question.

Problem statement - describes a specific situation, creates a learning problem, is aimed at finding unknown properties of a particular object [1; 63-b.].

An exercise is an action aimed at consolidating and developing the knowledge acquired by the student. Practice is a process that ensures the transformation of knowledge into skill, skill into skill, and skill into competence [6; 7-b.].

Biological problems and exercises used at different stages of the Olympiad differ in their difficulty level. In the final stages of the Olympiad, the presentation of problems and exercises aimed at developing students' creative skills in fully understanding the essence of biological laws and phenomena, as well as their practical application, is of great practical importance [7; 200-202-b.].

Only students with a high level of preparedness and thinking abilities can fully complete the tasks of the final stage. Olympiad tasks are formed on the basis of knowledge and skills that do not go beyond the curriculum of a general secondary school. Usually, when solving a problem, difficult calculations are not required, and main attention is paid to the biological essence of the problem.

Depending on the stage of organization of subject Olympiads, as well as taking into account the age characteristics of the students participating in them, problems and exercises are compiled. One of the main differences between the problems and exercises of the Olympiad at the international level and the problems and exercises of the Olympiad at the republican level is that the conditions of the problems and exercises consist of several complex stages, and there are many unknown quantities that need to be found [1; 63-64-b.].

One of the urgent tasks of research work on improving modern pedagogical education is to establish and achieve the effectiveness of the educational process aimed at the full mastery of tasks in biology, thereby increasing students' interest in the problems of the Olympiad.

From the analysis of educational, methodological, and scientific literature on the study of olympiad programs, types of olympiad tasks and exercises, selection criteria, and indicators used in biology, it became known that the use of these programs and resources in the school educational process increases the possibilities of improving the content and quality of educational work, demonstrating students' creativity in problem tasks, understanding and identifying the problem, and forming creative abilities and skills.

In the content of the Olympiad tasks and exercises used in biology, the following necessary tasks should be solved:

assimilation of knowledge and integration of information by students;

Formation of the process of independent decision-making and assessment by students;

encouraging students to develop their own scientific thinking;

the ability of students to apply the theoretical and practical knowledge learned during classes

to solve the tasks of the Olympiad;

development of skills in comparing contradictory information.

The assigned biology assignment must meet the following methodological and didactic conditions:

the content of the selected questions and the arguments contained in them must be reliable;

the content should be fully covered, expressed at different levels of complexity and in a comprehensible text;

the selected questions must be clear and understandable [5; 59-b.].

Problems and exercises used in biology olympiads must meet the following criteria and indicators:

problems and exercises related to biology directly reflect the process in practice;

requires knowledge of such subjects as chemistry, physics, mathematics for the performance of olympiad tasks;

when solving complex olympiad problems in biology, it is required to compare previously learned information;

different levels of complexity of biology assignments.

U.E.Rakhmatov, in his dissertation for the degree of Doctor of Philosophy (PhD), divided the tasks presented to students into five types according to the level of complexity. This should not be confused with the level of knowledge acquisition. In didactics, it is possible to divide the acquired knowledge into 3 groups: the ability to perform exemplary tasks, reproductive assimilation, and the ability to solve creative problems [5; 60-b., 6; 7-b.].

Below, we will consider the difficulty levels through the tasks given to students at different stages of the Olympiads.

In first-level problems, they are mainly related to comparing simple knowledge based on checking students' memorization abilities, understanding simple rules in the information given in the problem, and knowing biological terms [6; 7-b.]. First-level problems and exercises will be used in the test questions of subject Olympiads organized throughout the country. If a student is well-prepared for subject Olympiads, they will have the opportunity to complete the tasks of this stage without difficulties and errors. Below we will consider the problems and exercises given to students at different stages and classes of Olympiads organized at the national level.

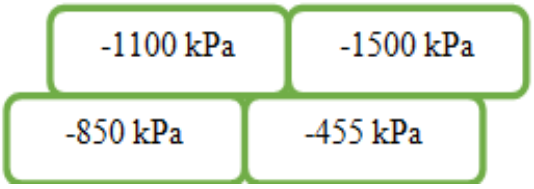
Problem 1. The number of primary germ cells of the diploid corn variety (n=10) is 630. These cells divided by meiosis and mitosis. If 20% of all sperm participated in the fertilization of the egg cell, determine the number of sperm that participated in the fertilization of the central cell [8; 85-89-b.].

The second level of complexity requires the ability to apply certain biological laws and compare individual phenomena when solving olympiad problems and exercises, as well as the ability to interpret information and logically connect the processes in the given task using concepts about the content of the subject [6; 7-8-b.]. Secondary questions and tasks are widely used in written assignments of national Olympiads held at the school level, and in some cases, in test trials. Below, we will examine the problems and exercises given to students in various grades and stages of republic-level olympiads.

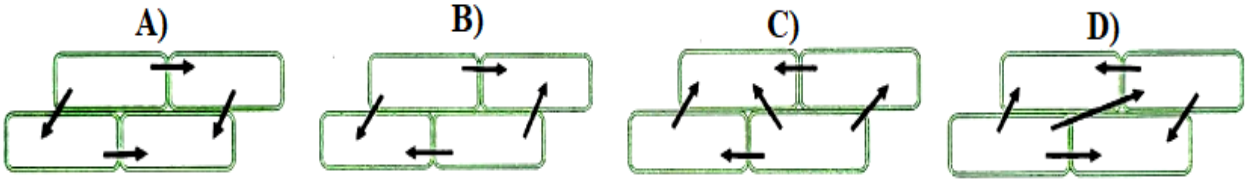
Problem 2. There are two DNA molecules with lengths of 34 nm each. The nucleotides of guanine in the first DNA molecule and thymine in the second DNA molecule are equal. If the second DNA molecule has 260 hydrogen bonds, determine the number of hydrogen bonds in the first DNA [8; 46-b.].

When solving third-level olympiad problems and exercises, it is required to be able to logically connect several biological laws and theories simultaneously. Students can use knowledge related to the content of a medium-difficulty subject when solving third-level olympiad tasks. Students who have the ability to accurately assess third-level tasks will be able to distinguish between scientific and non-scientific questions, to identify facts proving a scientific opinion [6; 8-b.]. Problems and exercises of this level are used in written work questions at district and higher stages of Olympiads of various levels held at the republican level, and in some cases, in test tasks at the final stage of the Olympiad. Below, we will examine the problems and exercises given to students in various grades and stages of republic-level olympiads.

Problem 3. The diagram below shows the water potential of four neighboring plant cells (the water potential in clean water is 0) [1; 70-b.].



From the image above, identify the movement of water between cells based on the phenomenon of osmosis and mark which of the following answers is correct.



They should be able to use their knowledge acquired in interdisciplinary subjects such as chemistry, physics, and mathematics when solving Olympiad tasks and exercises of the fourth level of complexity [6; 8-9-b.].

Students can use more complex knowledge related to the content of a sufficiently complex subject when solving fourth-level olympiad tasks. Students who can cope with the tasks of this stage will be able to interpret unknown information, draw conclusions based on it, and justify their judgments. Exercises and problems of this level are used in the written work of students in grades 10-11 at the regional (city) and republican stages of various Olympiads held throughout the republic. Below, we will examine the problems and exercises given to students at various stages and grades of Olympiads organized at the republic level.

Problem 4. The Vatican, located in the territory of Rome, is the smallest officially recognized state in the world. As of 2019, the Vatican's population was 825. Of these, 132 people with the first blood group (OO), 396 people with the second blood group (AA, AO), 165 people with the third blood group (BB, BO), and 132 people with the fourth blood group.

1. Calculate the frequency of ABO genes expressing blood groups in this population. Write down and explain the complete solution of the problem.

2. Calculate how many people are homozygous for these alleles.

3. Calculate how many people are heterozygous for blood groups II and III [8; 230-232-b.].

The conditions for fifth-level olympiad problems and exercises are quite difficult, it is difficult to understand the logic hidden in the task, the student must be able to apply several laws and theories for completion, as well as apply the knowledge gained in chemistry, physics, and mathematics [6; 9-10-b.].

Students who can complete the tasks of the fifth level Olympiad can easily research the question from a scientific point of view, distinguish information related to the topic in the interpretation of information. They also rely on knowledge acquired outside the school curriculum. Because solving problems and exercises of this level of the Olympiad requires special training from the student. Problems and exercises of this level are used in written work questions of students at the republican stage of Olympiads of various levels held at the republican level and at various stages of international Olympiad qualifications. Below, we will examine the problems and exercises given to students at various stages and grades of Olympiads organized at the republic level.

Problem 5. It is known that gene mutations (from a to e) and deletions (from 1 to 7) occur on a specific chromosome. Theoretically, the following results were obtained when crossing individuals with homozygous recessive mutations with individuals subjected to deletion. In the obtained results, the non-mutated phenotype was marked with plus (+), and the mutant phenotype with minus (-).

	a	b	C	d	e
1	-	+	-	+	+
2	+	-	+	-	-
3	+	+	-	+	+
4	-	+	+	-	-
5	+	-	+	+	-
6	-	-	+	-	-
7	-	+	+	-	+

1. Determine the chromosomal sequence of mutated genes.

2. Create a diagram (map) of chromosome fragments deleted relative to the sequence of mutations [9; 123].

In the process of selecting and creating a database of biology olympiad exercises and assignments, the teacher should select them based on the age and abilities of the students. At the same time, when selecting olympiad problems and exercises, the difficulty level should always increase from simple to complex.

It is advisable to select problems and exercises of the first and second levels when forming Olympiad tasks for 7th and 8th grade students (named after Al-Khwarizmi), problems and exercises of the first, second, and third types when compiling Olympiad problems for 9th grade students, problems and exercises of the third and fourth types when compiling questions for 10th grade students, problems of the fourth and fifth difficulty level when compiling problems for 11th grade students, as well as when compiling Olympiad problems for students participating in the initial stage of international Olympiads.

The higher the level of complexity of the Olympiad problems and exercises, the more thinking and difficult logical connections are required.

When selecting problems and exercises for the Biology Olympiad, it is necessary to be based on such criteria as accuracy, relevance, interdisciplinary connection, gradually increasing levels of difficulty, and the development of the student's creative thinking. Correctly chosen problems serve not only to strengthen theoretical knowledge, but also to develop practical research activities.

Therefore, careful planning and a scientific-methodological approach are important factors in the preparation of competition materials for the Olympiad.

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