

Assessment in Physics Olympiad

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Abstract:

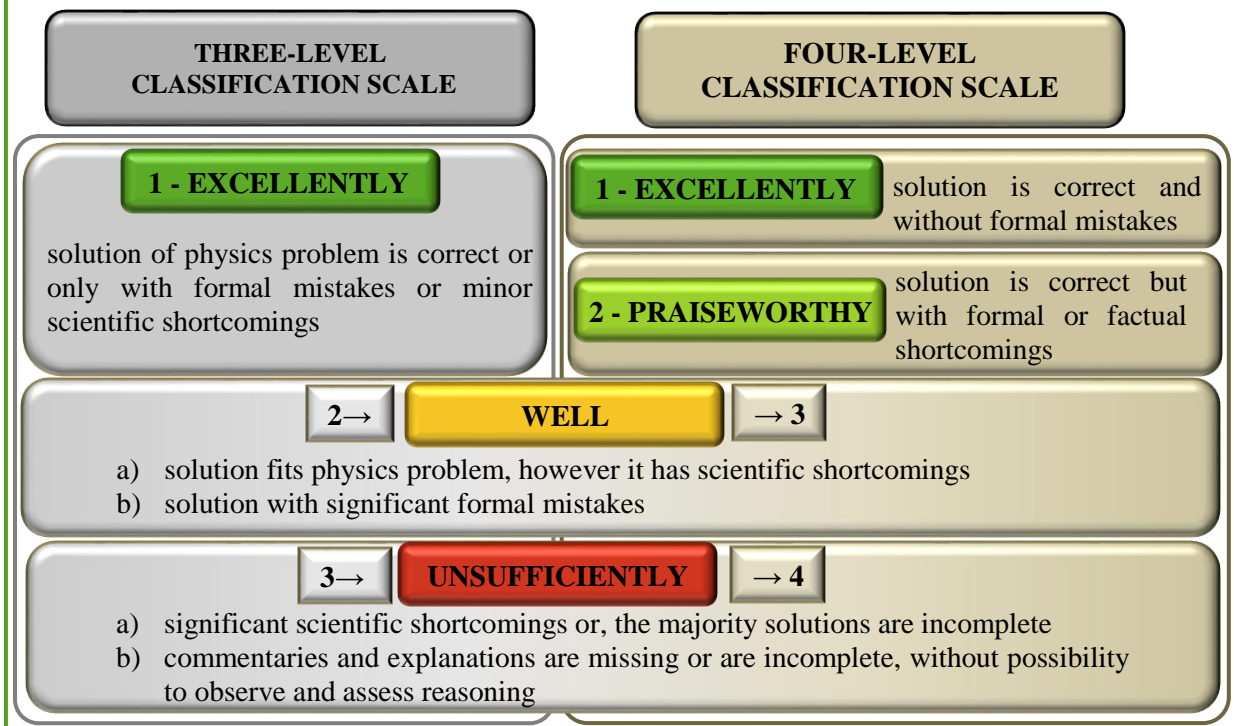
Physics Olympiad, as the important part of educational system, is organized for primary and secondary school students both at the national and international level. Its objective is to encourage Physics Olympiad participants to study physics and other related sciences as well as creating competitive environment for physics talents. Since 1967, when the first International Physics Olympiad was organized in Poland, not only individuals are compared according to their performance in solving physics problems, but also countries (number of medals per country). Importance of assessment in ranking is significant as it determines winners. Assessment methods underwent development, depending also on type of solved physics problem (theoretical or laboratory). This study is focused on assessment methods used in International Physics Olympiad in comparison with the Physics Olympiad organized in the area of Slovak republic (including also period when it was part of former Czechoslovakia).

Fig. 1: Stamp Created in the occasion of International Physics Olympiad; retrieved 10.2.2017 in Slovak republic (Čáp, 2017)

DEVELOPMENT OF ASSESSMENT METHODS IN THE REGION OF SLOVAK REPUBLIC

Physics Olympiad (PhO) in Slovak republic started its history with first PhO organized in former Czechoslovakia in 1959/60. It was organized usually in three rounds for PhO participants competing in certain number of categories depending on educational system. Nowadays it is organized for secondary schools (A, B, C, D categories) and primary schools (E, F, G categories), with A-category for the best and oldest PhO participants as the basis for choosing Slovak representation at International Physics Olympiad (iPhO). Assessment methods, are essential in determining participants who advance to next rounds as well as winners. First main type of assessment methods used in the beginning of PhO (first 26 years of PhO) is displayed in fig. 2 – classification scale. Consideration of certain features of PhO participants' solutions was considered and one of 3 or 4 defined marks was chosen as the assessment of solution.

Fig. 2: Characteristics of classification scales used for assessment of PhO participants' solutions



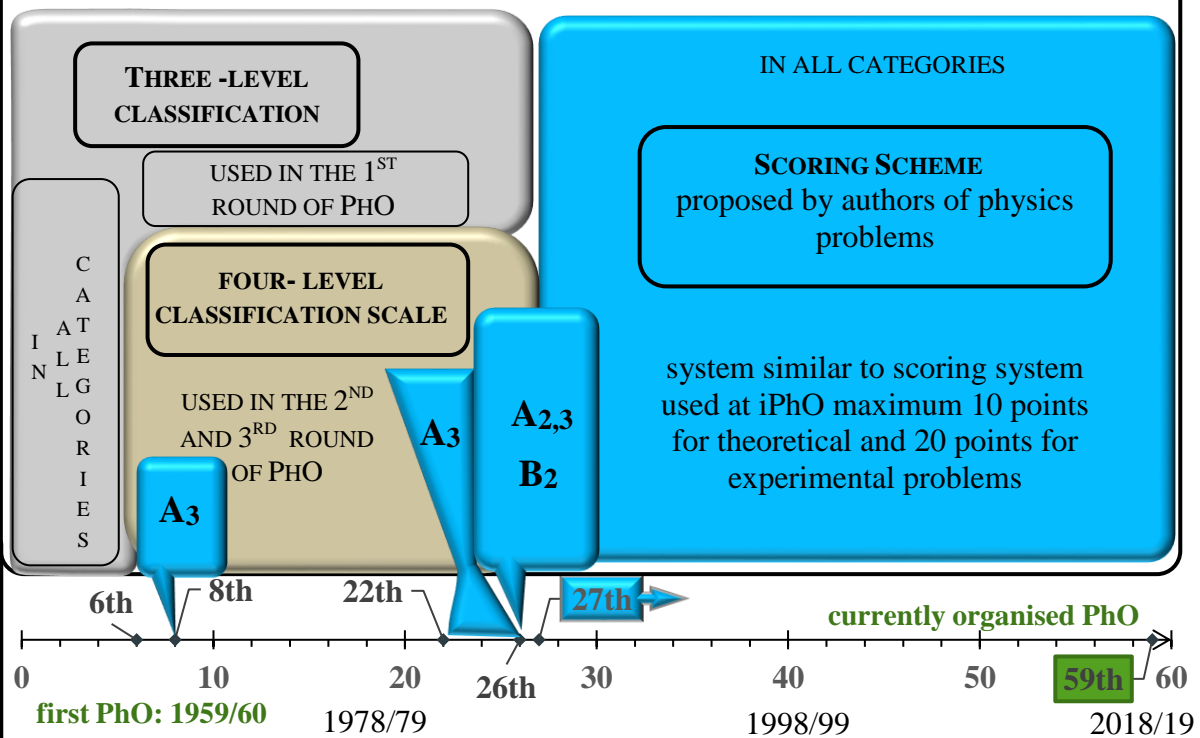
In the 21st PhO rules for ranking PhO participants when using the method of classification scales were unified. Example of ranking of first 10 PhO participants solving four physics problems is given in Fig. 2. Problem distinguishing between PhO participants with the same marks – especially in higher categories for determination of winners and those who advance to next rounds – lead to the implementation of new assessment method. Scoring scheme was used in certain period in 2nd and 3rd rounds (bottom indexes) of A and B categories (denoted as A_{2,3}, A₃, B₂) and since 27th PhO in all categories (Fig. 3). Participants named as “Successful PhO solvers” are recognized according to some rules and their development can be seen in Fig. 3 (bottom part).

Fig. 2: Former ranking method

Ranking of participant	Classification of 4 physics problems			
1	1	1	1	1
2	1	1	1	2
3	1	1	2	2
4	1	1	1	3
5	1	2	2	2
6	1	1	2	3
7	2	2	2	2
8	1	2	2	3
9	1	1	3	3
10	1	1	1	4

Fig. 3: Development of Assessment methods in Slovak Physics Olympiad

METHODS OF ASSESSMENT THROUGHOUT ALL YEARS OF ORGANIZING PHYSICS OLYMPIAD IN SLOVAK REPUBLIC



CORRECTLY/SUCCESSFULLY SOLVED (AT LEAST) 50 % OF GIVEN PHYSICS PROBLEMS
= marked 1 or 2 in three level scale, or 1, 2, 3 in four level scale

Secondary schools: Primary schools
 in the 1st round: 6/9 5/7
 in the 2nd round: 2/4 2/4
 in the 3rd round: 3/5
 number of correctly solved/given physics problems

USED IN THE 2ND ROUND OF PHO

AT LEAST 2 PHYSICS PROBLEMS SOLVED CORRECTLY, ASSESSED 5 OUT OF 10 POINTS AND MINIMUM 14 POINTS (IN 26TH PHO 15)

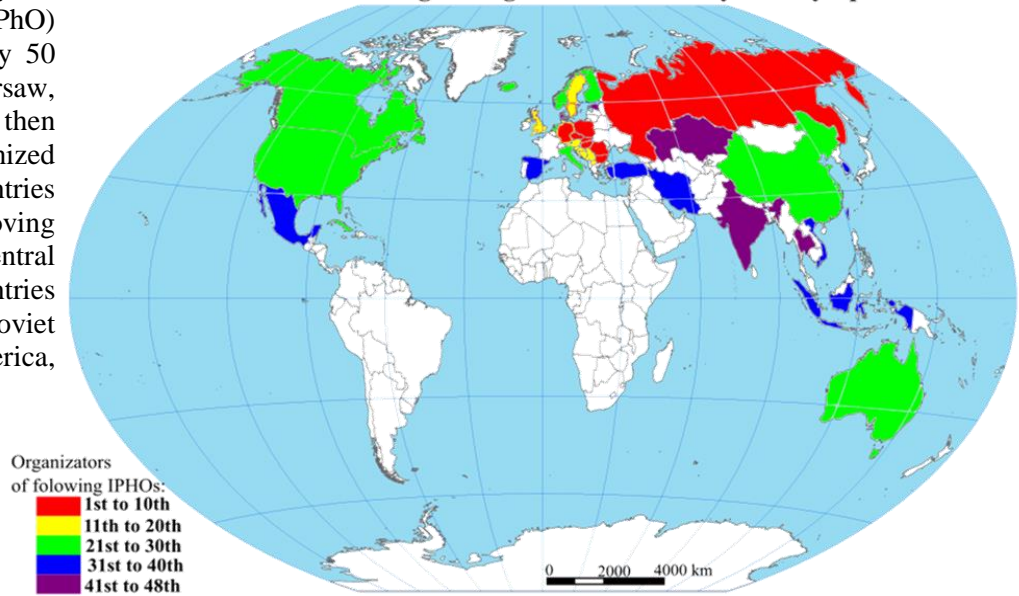
MINIMUM REQUIREMENTS TO GET TITLE „SUCCESSFUL PHYSICS OLYMPIAD PROBLEM SOLVER“

DEVELOPMENT OF ASSESSMENT METHODS IN INTERNATIONAL PHYSICS OLYMPIAD

International Physics Olympiad (PhO) started its history 50 years ago in Warsaw, Poland and since then it has been organized by various countries (Fig. 4) – moving from Central European countries with former Soviet Union to America, Asia, Australia.

Development of assessment methods and rules for awarding prizes can be seen in Fig. 5.

Fig. 4: Countries Organising International Physics Olympiad

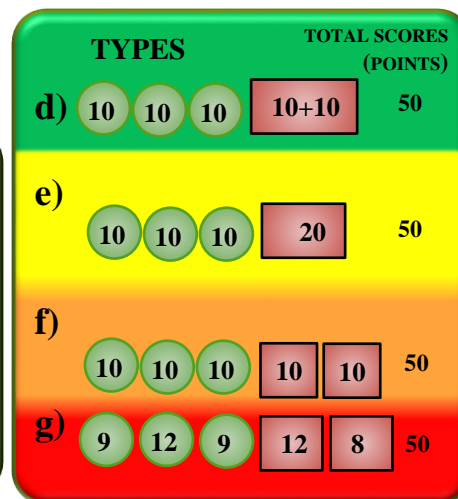
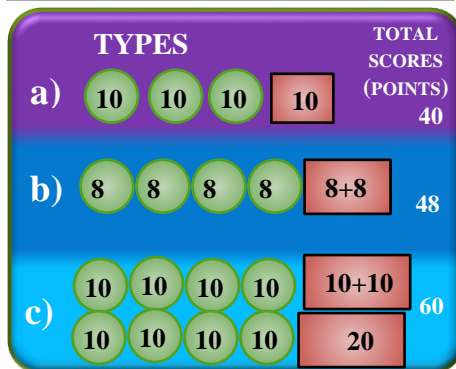


Organizers of following IPHOs:
 1st to 10th (red)
 11th to 20th (yellow)
 21st to 30th (green)
 31st to 40th (blue)
 41st to 48th (purple)

Fig. 5: Assessment methods and awarding rules in International Physics Olympiad

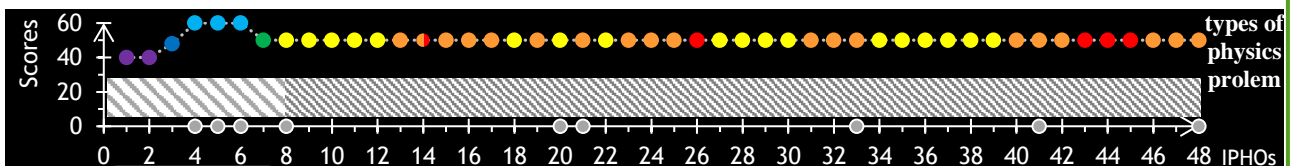
DEVELOPMENT OF SCORING TYPES IN INTERNATIONAL PHYSICS OLYMPIAD

3 OR 4 THEORETICAL PHYSICS PROBLEMS + 1 OR 2 EXPERIMENTAL PROBLEMS



10 theoretical physics problem with its total scores
 10 experimental physics problem with its total scores
 10+10

marking scheme not preserved or general classification
 marking scheme/ breakdown/code, grading scheme/ guidelines, scores in solution



100 % = total scores

100 % = total scores of certain number of best PhO participants
 a) 1, b) 5 since 20th IPHO, c) 3 since 31st IPHO

Awards according to number of participants

Gold:	6 %	8 %	since 41 st IPHO
Silver:	18 %	25 %	
Brozne	36 %	50 %	
Honourable mention	60 %	67 %	



RULES FOR AWARDING PRIZES IN INTERNATIONAL PHYSICS OLYMPIAD

Conclusion

To sum up, there are two main types of assessment methods used in studied Physics Olympiads - general classification scale and scoring scheme. Advantage of first method was that the most important qualities of PhO participant's solution were assessed as the whole, however with some difficulties in ranking of PhO participants. Scoring schemes provided us with possibility to easily rank performance of PhO participants in solving physics problems but with higher demands on creation of scoring scheme.

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