

## Rationale for the restructuring of the syllabus of the IChO

The Steering Committee of the IChO has begun to work on an updated version of the syllabus (found in the appendix of the IChO regulations). A draft of the updated syllabus is attached to this letter.

The Steering Committee hopes to be able to finalize this draft in December 2007. We would like to invite any comments and suggestions to Gabor Magyarfalvi at [gmagyarf@chem.elte.hu](mailto:gmagyarf@chem.elte.hu). The new rules and the syllabus can then be discussed and voted upon by the International Jury at the 40<sup>th</sup> IChO in Budapest.

It has been the case that the implementation of the regulations/syllabus has not always been completely satisfactory with regard to keeping in line with the letter of the regulations with respect to the material the students are expected to know.

The primary reason for this seems to have been the balance the organizers tried to strike between incorporating the state of the art of chemistry into the tasks and keeping within the reach of the students. It is apparent that this imbalance should shift in favour of limiting the material at the olympiads which is not taught at secondary level education.

However, this poses a problem in that it is almost impossible to differentiate between the best students, especially if we define the knowledge that will be tested in the exams exactly. If the problem authors would stick to the letter of a set syllabus, then the problems would be repetitious and somewhat predictable. The best results would go to students who are good at reproducing exactly what they have learned, instead of the brightest and most creative students who take what they have learned and apply it to new situations.

The present syllabus might already be too restrictive in some aspects, so it is somewhat understandable that previous organizers have found it difficult to keep within the rules.

E.g.: if there is a problem concerning the pH of a carbon dioxide solution, that would exhaust all possibilities for the organizers to include questions not explicitly listed as allowed. (pH of multiprotic acids, equilibrium constants in partial pressures and Henry's law are all listed as level 3.)

The purpose of the syllabus and the preparatory problems is twofold. They should limit the organizers to keep the questions within the reach of the students. On the other hand, the fact that the international jury have a free hand in editing the problems risks that the most interesting tasks could also be left out by majority vote perhaps unwisely.

The points listed in the present syllabus are typically of two kinds:

- skills and concepts that the students should be able to use,
- factual knowledge that is expected to be known.

The beauty of chemistry is that one needs both facts and concepts to solve problems and understand phenomena, but these two categories would require rather different rules.

The first type of required knowledge (concepts and skills) is much more easy to list and limit in the syllabus. We now attempt to list those the students are expected to know in Appendix C.

The number of new concepts or fields is definitely an area where the problem authors should be restricted from including too many in the exam. Our recommendation is no more than 8 such topics (6 theoretical and 2 practical) in a preparatory problem set. If each topic can be taught and example problems can be practiced in a few hours then this can be accomplished well within the two week period of special training allowed.

Perhaps it would be better also that the preparatory problems can list these fields in their preamble explicitly.

We include a (not comprehensive) list of some possible new topics in the appendix.

The second type of knowledge (facts) is the more sensitive one. Luckily, if a problem is based on the knowledge of a fact, then it is usually a bad problem. There have been few of such problems at the Olympiads.

This is the aspect of the syllabus that needs to be confined strictly.

If the problem authors need to use facts possibly unfamiliar to many students, they should be conveyed explicitly in the problem itself, or alternatively they can be included and demonstrated in the preparatory problems, as the content and solutions of the preparatory problems is supposed to be known by all participants. Obviously the extent of the preparatory problems does not give much space to include lots of such 'facts'. We do not think that there could be explicit limits on these in the regulations if the 'fact' is expressed explicitly e.g. a specific equation or property. The authors should be aware that the International Jury will probably remove those questions from the exam if they are based on hidden information only.