

# Information for Mentors at the International Chemistry Olympiad (IChO)

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## 1. Introduction

With each passing year, the International Chemistry Olympiad has grown in size, and consequently the number of participants has also increased. As these new participants cannot be expected to gather a firm understanding of the IChO solely through experience and word of mouth, the Steering Committee of the IChO has developed this document as a “reference guide” for all mentors, in order to provide a useful and practical understanding of the event.

This document describes to new mentors what they can expect and what is expected from them at the Olympiad. However, the contents merely give a description of the current *practice* of the Olympiads, and the formal and official *rules* are contained in the regulations of the IChO. All mentors should be familiar with these official regulations as well.

This document should be edited and updated regularly by each Olympiad organizer and by the Steering Committee. This document should be distributed by the organizers along with the application forms so that future mentors can use it.

This version was compiled by Gábor Magyarfalvi for the Steering Committee in 2004 with additional editing by Bryan Balazs. Last update was in 2014.

## 2. General expectations

Each nation is responsible for the selection of the two mentors accompanying their students to the IChO. The regulations require that the mentors have a good command of the English language, both oral and written. This requirement should not be taken lightly, as the proceedings of the Jury often require individual participation in the discussion, or at least the ability to follow the deliberations closely. See additional information on the Jury meetings below.

In addition, many countries have up to two scientific observers present at the IChO to assist in the professional duties of the mentors. The group of mentors and observers for a particular country, plus the students, is referred to as the “team” or “delegation”. It is the responsibility of each team to arrange their own transport (whether air, rail, or other ground transportation) to the official arrival location of the Olympiad. Transportation during the event, as well as all meals, are typically the responsibility of the organizer, and these interactions are an excellent opportunity to meet socially with representatives from other countries.

Ideally, the members of the team are professionals involved in the preparation and selection of the respective national teams. They are familiar with the preparatory problems and the Olympiad regulations including the syllabi. Ideally there is one or more secondary school teacher(s) and one or more person(s) with previous Olympiad experience among them. The discussion of theoretical problems is usually divided into two sessions, typically between synthetic and physical chemistry problems. In an ideal case this should fit the competence of the individual mentors. Basic computer and word processing skills (Windows and Word) are also expected from the mentors.

### **3. Day by day organization of an IChO**

#### **Pre-Olympiad**

Registration is organized through the head mentor for each country. The country receives the formal invitation by December of the year prior to the actual Olympiad. The registration information should be returned by the specified deadline, but if this deadline cannot be met, mentors should inform the organizers in a timely fashion. The organizer usually assists the teams to meet the visa requirements of the host country for the Olympiad, but obtaining the actual visa is the responsibility of the teams.

The preparatory problems are published on the web in January of the year of the Olympiad, but without the worked solutions. Hard copies with solutions are sent to each head mentor. Solutions are not made available to the general public before June, since several nations use these problems in their national exams.

It has become a custom at the Olympiads that many countries make the problems of their respective national Olympiads (or selection exams) available to mentors of other countries (translated or in the original language). This has been done via printouts, CD-ROMs or websites.

#### **The work of the International Jury**

Each Olympiad typically has four Jury sessions during the course of the event, arranged as follows although variations are allowed:

- 1<sup>st</sup> Jury Meeting (Day 2), to discuss issues raised by the mentors pertaining to the practical exam.
- 2<sup>nd</sup> Jury Meeting (Day 4), to discuss issues raised by the mentors pertaining to the theoretical exam.
- 3<sup>rd</sup> Jury Meeting (Day 7), to discuss any business matter that needs to be addressed.
- 4<sup>th</sup> Jury Meeting (Day 8), to present the overall scores on the exams (but without naming individual student's scores).

Jury sessions can be very arduous and lengthy. They are conducted in English and the command of English of some of the participants is not sufficient to effectively present, argue, and debate the relevant points. The Jury sessions may be exhausting, but it is critical that the correctness of the competition tasks be open for discussion and modification by the Jury. Note that suggestions for changes of phrasing and English spelling within the exams or other Olympiad documents should be raised in a Jury meeting only if these changes are necessary to properly convey the meaning.

It is important that all delegations are represented at the Jury sessions so that they are aware of all issues concerning the exams and other official matters. If a formal vote is required, the regulations require the presence of 75% of the mentors for a valid voting procedure.

#### **Practical exam**

Some issues have often arisen in the jury meeting regarding the practical exam. The following suggestions were accepted several times previously, with good results.

It is possible to have split laboratory sessions. That is, a morning session and an afternoon session can be held. Alternatively, laboratories can also be rotated in two sessions. Students obviously must be strictly separated, and the organizers must ensure that the equipment has been properly cleaned, dried, and redeployed at the lab spaces if it is being reused.

Theoretical questions in the practical, if any, should pertain to the essence of the experiment.

The following scheme for the grading of experimental measurement results has worked well in the past:

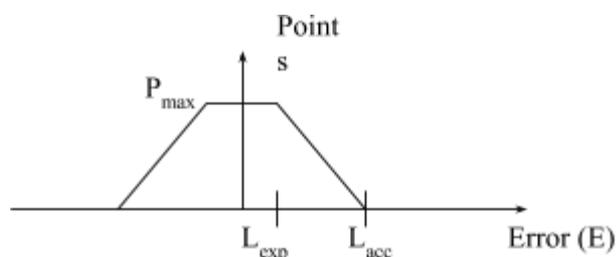
- Full marks should be awarded if the result is in a range that reflects the values expected by the examiners. The expected master value must come from the analytical procedure performed on the exam day.
- No marks should be given to results outside the limits of acceptable values.
- Both ranges, expected and acceptable, should reflect the examiners experiences.
- Between these two, a linear scale should be applied:

Numerically:  $P_{\max}$  points, if  $0 \leq |E| \leq L_{\text{expected}}$   
 0 points if  $L_{\text{accepted}} \leq |E|$

$$P_{\max}(1-(|E|-L_{\text{exp}})/(L_{\text{acc}}-L_{\text{exp}})) \quad \text{if } L_{\text{expected}} \leq |E| < L_{\text{accepted}}$$

( $P_{\max}$  – maximum points, E – error, L – range limits)

Graphically:



Typical values for a titration would be

$L_{\text{expected}} = 0.5\%$  relative error in the volume.

$L_{\text{accepted}} = 3\%$  relative error in the volume.

Ranges need not necessarily be symmetrical. For example, the accepted range above the true melting point should be rather narrow.

Students should be allowed to decide on the number of parallel measurements (for example, titrations) they make. Only the final value (probably a mean) as reported by the student should be graded. Marks should depend on experimental values, but not on precision. (This is based on the fact that students may make up concordant results.) The emphasis should be on marking practical work, therefore the results should be recalculated uniformly.

Errors in students' calculations should invoke a minor penalty, the magnitude of which should be suggested by the organizers and approved by the International Jury. Serious mistakes in applying the rules of evaluation of experimental errors can be penalized (e.g. number of significant figures differs in more than two digits from the correct, rounding errors exceeding accuracy). The magnitude of the penalty should be suggested by the organizers and approved by the International Jury.

Students can be penalized for asking for replacement samples, additional reagent(s), broken labware, or for not strictly following safety guidelines.

### The Catalyzer

The Olympiad has a newspaper, the Catalyzer, which appears daily during the Olympiad. It may contain news about the student participants and their excursions, articles

relevant to chemistry in the host country (for example, famous chemists), jokes, recognition of birthdays, etc. One of the Catalyzers contains the addresses of mentors, observers and students. Hosts usually welcome contributions from all participants!

## **Day 1.**

### **Arrival**

The organizing committee is responsible for the transport of participants from the international airport(s), or other official arrival locations, to the venue of the IChO. Hotel accommodation (not complimentary) is available for delegations that arrive early or leave late.

During the registration procedure, the identity of the team members and their health insurance are checked. The delegations are expected to sign an academic code that includes compliance with IChO Regulations and a voluntary communication ban (no use of phones, internet, not meeting with guests) on students, mentors and observers during critical parts of the competition. Checking compliance is at the discretion of the organizers. All participants receive a badge with their name, country and their function (student, mentor etc) indicated. These badges are expected to be worn throughout the event.

It has become customary during registration to give all participants a handbag or rucksack, containing general information, the program for the Olympiad, a T-shirt or other such memento, a notepad, writing equipment, and a calculator. The latter are to be used during the exams.

The teams meet the guides who will stay with the students during the Olympiad. Most often the guides are university students who can speak the native tongue of the students or English.

A welcome dinner is customary on the evening of the first day.

## **Day 2**

Day 2 includes the opening session, which is a formal event with many high-ranking officials present. The formality also extends to clothing. Some nations arrive in a special team uniform instead of the (suit/tie – dress) standard. T-shirts and jeans are not appropriate for this event.

During the opening session, the teams are presented. In some Olympiads, the students have carried their country's flag or had an image of the flag projected on the screen. At the Olympiad in Bangkok, photographs from each country were used.

Students are separated from the mentors soon after the opening ceremony and are not reunited until both exams have been completed.

After the opening ceremony, which may be followed by a reception, the mentors are taken to the laboratories where the practical examination will take place. They carefully check and acknowledge that the equipment at each workspace of their team members is complete and in good order. The head mentor receives 2 copies of the practical exam at this point.

Day 2 typically also includes a chance for the mentors to speak with the authors of the exam questions, and the 1<sup>st</sup> Jury meeting. The discussions in this Jury meeting can be shortened considerably if the delegations study the problems and use the opportunity to discuss them individually with the authors *before* the full jury meeting. Many of the issues that mentors may have with the tasks may be resolved in one-on-one discussion with the authors before the task is discussed in the entire international jury.

After the scientific committee has had a chance to discuss the changes suggested by the mentors, the first jury session can begin. The final text of the exams, marking scheme (blue points) and red points are all introduced for formal acceptance during the meeting. Once the final text is agreed upon, it is made available in printed (duplicate) and electronic form to the mentors of all of the participating countries.

### **Day 3**

This is the day set aside for translation. If the Olympiad is shorter by one day, this day of the Olympiad is usually missing and the translation takes place during the night. Computers are available for each country to translate the final text of each exam into the language used by the students. Teams using a common language usually cooperate. It might be useful to let the organizers know about the cooperation beforehand so that they can distribute computers accordingly. It is up to the organizer whether to allow the use of laptop computers. Computers generally use Windows and Microsoft Word. If a country has special equipment requirements, such as a special keyboard, they have to bring them.

The final versions of the translated exams must be handed in by the head mentor. The scans of the various exams are made public on the Internet as a check of the translation quality and its adherence to the original text.

Because a number of countries finish their translation fairly rapidly, it is possible to organize a small excursion toward the end of Day 3.

### **Day 4.**

This is a day of excursion for mentors and guests and the day of the practical exam for the students. The mentors receive the copies of the theoretical exam (2 copies per nation).

Day 4 also typically includes the 2<sup>nd</sup> Jury meeting, in which the theoretical exam questions are discussed. For the theoretical exam, it is even more important for manageable Jury meetings that the mentors have time to study the exam for several hours and to meet (beforehand) with the authors individually. For discussion of the theoretical exams, a split session has become the norm, i.e., half of the problems are considered in one room and the other half in another. Both mentors participate – one in each session.

### **Day 5.**

Day 5 is typically reserved for translation of the theoretical exam, and the translation session usually starts around 09.00. Most countries are finished by 17.00.

### **Day 6**

During Day 6, the mentors are free while the students take the theoretical exam. Quite often the mentors are taken on an extensive excursion with the observers and guests. In the evening, there can be a reunion dinner, which is the first opportunity for the students and mentors to meet since their separation earlier on.

### **Day 7**

Day 7 is typically reserved for marking (grading) of the exams. After the examinations, the answer sheets are copied. One is marked by the authors, the other by the mentors who receive their copy this day. Even though they are required to mark, there is usually time for an excursion.

Day 7 also includes the 3<sup>rd</sup> Jury meeting, in which business matters are discussed. Organizers might choose to report about the practical work at the 3<sup>rd</sup> Jury meeting (error distributions, yields) before mentors know their students' results. In case of irregularities the marking scheme can be corrected.

### **Marking**

A detailed marking scheme should be presented with the exam to the International Jury. Points for partial solutions are best decided by the organizers using common sense during correction, and they should be awarded uniformly as all possible errors cannot be pointed out

beforehand. For example: If the question is to provide a balanced chemical equation, then partial credit should be awarded to those who correctly identify the reactants and products, but fail to correctly balance the equation. The Jury should only discuss partial marks in the most critical cases.

Students are asked and are expected to show their work. This will help to award partial marks. If a student omits simple or trivial steps from his or her line of reasoning, or uses a different solution, he or she should receive full marks, if the results explicitly asked for are correct and the work is shown. However, if the result of a complicated problem is given but without any supporting work, no points are awarded.

Full marks should be awarded for a question if the student solves it correctly and consistently using a faulty result from another question (consequential marking). There is no double penalty (often referred to as “double jeopardy”).

The grading is usually done so that the marks are integer (blue points). The final (red) points (60 for theory and 40 for practical) are divided between the tasks using predetermined weights.

## **Day 8**

Day 8 consists of arbitration, in which the grading of the student exams by the scientific committee and the mentors is compared. The common practice is to have a number of sessions, each involving 12 to 18 countries. The sequence of countries in the discussion is randomly drawn.

The members of the scientific committee handle the arbitration for their own questions (typically, each author handles his or her question). There is a time limit put on the discussion but, in difficult cases, the delegation may be asked to return later. In cases where no agreement can be reached, the chair of the scientific committee has the final decision. If a delegation still disagrees, appeal to the Jury is possible. This appeal will be decided upon before allocation of the medals. (There is no precedent for this possibility.)

Discussion during arbitration is usually unavoidable and sometimes can become quite heated. The situation should be handled tactfully, as usually quite competent professionals are involved. Haggling for points without justification is not an acceptable behavior.

The final scores of their students must be made available for the mentors for a final check.

In the evening of Day 8, the 4<sup>th</sup> jury session is held. The first item on the agenda is the allocation of the medals. This is done on the basis of a merit list presented on screen in a format which makes it impossible to correlate the numbers on the screen with individual student marks. This practice at the Olympiads usually keeps even mentors in suspense about the final results and medals until the awards ceremony. Most countries also keep the students uninformed about their performance until the awards ceremony is over.

Extra prizes could be given for the best theoretical work and for the best practical work, but an extra prize for the best female student is not recommended.

The agenda for the 4<sup>th</sup> Jury meeting is extended by the Steering Committee to discuss general questions concerning future Olympiads and regulations or any other business of interest to the Jury. This general discussion can also take place on the previous evening.

## **Day 9**

Day 9 consists of the closing ceremony which usually takes place at a special venue. See also the previous remarks on the opening sessions.

Clothing is typically formal again for students as well. T-shirts and jeans are best avoided. Celebration at the awards (with flags, banners, etc.) should be discreet and not bother fellow students.

The program of the closing ceremony has a number of set items:

- Discussion of the results by the Chair of the Scientific Committee
- Awarding of the medals. The medal ceremony starts with the honorary mentions, then bronze, silver and gold medals in that order. The best three students (in terms of scores) are mentioned separately.
- The official handing of the IChO flag to the next organizer is done at the end of the ceremony. The representative of the next Olympiad is also allotted some speaking time.

In addition to the above, there are usually some cultural events, and the ceremony is usually followed by a farewell party.

The final issue of the Catalyzer contains the allocation of the medals and is available at the closing ceremony. Note that the Olympiad is a competition between individuals, not countries, so country rankings are not included.

### **Day 10**

This day typically involves the departures of all of the delegations. The organizer can help with any necessary travel arrangements.

## **4. Sample documents**

Some parts of the exams do not change much from year to year, such as the instructions accompanying the exams and the safety regulations. Here we include relevant samples that can be translated beforehand to save time in the translation sessions. Team members should also become aware of the rules before the Olympiad.

### Instructions for Lab Practical

- At all times while you are in the laboratory, you must wear safety eye glasses or your own glasses if they have been approved, and use the pipette filler bulb provided. You will receive only ONE WARNING from the laboratory supervisor if you remove your glasses or fill a pipette by mouth. A second infringement will be considered a major fault incompatible with further experimental work, and you will be dismissed from the laboratory with a resultant zero score for the entire experimental examination.
- Do not hesitate to ask a demonstrator if you have any questions concerning safety issues.
- This examination has **xx** pages and **xx** pages of answer sheets.
- Total points for this examination is **xx**.
- The official English version of this examination is available if you wish to see it.
- Please carefully read the text of each experimental task and study the layout of the answer forms before you begin your experimental work.
- Work must begin only when the START command is given.
- Use only the pen and calculator provided.
- Write your name and personal identification code (posted at your workstation) in the upper corner of the first page of each problem's answer sheet. Write your name and code on all remaining answer sheets.
- You have 5 hours to complete all of the experimental tasks, and record your results on the answer sheets. You must stop your work immediately after the STOP command is given. A delay in doing this of more than 3 minutes will lead to cancellation of the current task and will result in zero points for that task.

- All results must be written in the appropriate areas on the answer sheets. Anything written elsewhere will not be marked. Do not write anything on the back of your answer sheets. If you need more paper for working, request it from the supervisor.
- Write relevant calculations in the appropriate boxes when necessary. If you provide only the end results for complicated problems, even if correct but with no supporting work, you receive no score.
- A Periodic Table and a table of constants will be provided for your use. Take all atomic masses and physical constants from there.
- Use the appropriate waste containers for disposal of chemical and other waste materials.
- The number of significant figures in numerical answers must conform to the rules stated in the exam questions for evaluation of experimental errors. The inability to perform calculations correctly will result in penalty points, even if your experimental technique is flawless.
- Chemicals and lab ware will be refilled or replaced without penalty only for the first incident. Each further incident will result in the loss of 1 point from your 40 practical exam points.
- If you need to ask for a refill of chemicals that you exhausted or replacement of equipment that you broke, turn to the supervisor. He will make a note on the first page of the answer sheets. Remember that such replacements carry a penalty, except for the first.
- In case of failure of equipment out of your control, please turn to the supervisor. They will do their best to remedy your problem immediately. We hope that no such event will occur. If you feel that such a failure caused a significant delay in your work that was not compensated adequately, please make a short note on the first page of your answer sheet explaining the incident.
- When you have finished the examination, you must put all of your papers into the envelope provided. Only papers in the envelope will be marked.
- Do not leave the examination room until you are directed to do so.

Information for IChO Mentors (2014 Revision)

*Reference:*

<http://www.ichosc.org/documents-of-the-icho/information-for-mentors>