

Final Report

on

the 27th International Chemistry Olympiad

Beijing China

July 12-21, 1995

Sponsors:

**State Education Commission of China
China Association for Science and Technology
National Natural Science Foundation of China
Beijing Municipal Government
Chinese Chemical Society**

Welcome To 27th IChO

The IChO has a 27 year's history. On reviewing the changes in the focus and mode of the competition, we are aware of the reformed chemical education in the past quarter of features of science and technology and called for increasing number of top scientists qualified to create new concepts and novel methods. The school education was severely challenged by this demands, since the collective teaching is unfavorable to fostering the extraordinary students. Following this trend, the different quality of students in a class was leveled off by molding them into a group of indifferent individuals. The students were taught to keeping to the conventional ways of thinking and working. The potentiality and individual development have been ignored and suppressed. For this sake, peoples tried to reform the current education system in order to discover the latent potential of students and bring it out as fully as possible. Thus, the basis of chemical education has been changed from simple accumulation of knowledge to making innovations and creations. We can feel these changes by comparing the contents of IChO's. The history of IChO inspires us in how to reform the teaching approach in order to coping with the individual learning demand and capacity of each student. This is why there are more and more peoples interested in the IChO. IChO is an opportunity to exchange our new ideas and new viewpoints which are beneficial in rational design of chemical education for the future. In addition, IChO is also an opportunity to making friendship and for mutual understanding.

China is a country of a very glorious history, including the pioneer works in alchemy and the primitive chemical techniques, but we are facing the future. We are looking forward to a prosperous 21st century and a peaceful and friendly world. The IChO spirit, as the catalyst for our collaboration will last forever.

Wang Kui

Executive Chairman of the 27th IChO
Academician of Chinese of Sciences

*Schedule for Competitors***Wednesday, July 12, 1995**

Registration at Huangyuan Hotel

Thursday, July 13, 1995

09:00 Opening ceremony

10:30 Sightseeing: Campus and Museum of Art and Archaeology of Peking University

13:00 Reception at SHAO YUAN Guest House, Peking University

14:30 Lab-safety tutorial at DIAN JIAO LOU, Peking University

18:00 Dinner

Friday, July 14, 1995

06:50 Breakfast

08:00 Practical examination

14:00 Lunch (Free in afternoon)

18:00 Dinner

Saturday, July 15, 1995

07:00 Breakfast

08:00 Sightseeing: Summer Palace

12:00 Lunch (Free in afternoon)

18:00 Dinner

Sunday, July 16, 1995

07:00 Breakfast

08:00 Theoretical examination

13:00 Lunch

14:00 Departure for Fragrant Hill Hotel to meet mentors

18:00 Dinner with mentors

Monday, July 17, 1995

07:00 Breakfast

08:00 Sightseeing: Great Wall & Ming Tombs

12:00 Lunch at Great Wall

16:00 Departure for Huangyuan Hotel

18:00 Dinner

*Schedule for Mentors***Wednesday, July 12, 1995**

Registration at Huangyuan Hotel

Thursday, July 13, 1995

09:00 Opening Ceremony; 10:00 Inspection of Laboratory; 13:00 Reception; 15:00 Review software packages at Meeting Room 1 & 2 of FHH; 16:30 Meet authors to make comments and suggestions on practical examination at Multipurpose Hall 1 & 2 of FHH; 18:00 Dinner; 19:00 Full Jury for discussing practical examination at MH of FHH; 22:00 Translation til four o'clock next morning at Meeting Room 1 & 2 of FHH

Friday, July 14, 1995

07:00 Breakfast; 08:00 Departure for Sightseeing: Tian An Men Square, Forbidden City & Temple of Heaven; 12:00 Lunch at City Beijing; 16:00 Departure for FHH; 18:00 Dinner; 19:00 Pick up theoretical examination from scientific board at Lobby of FHH

Saturday, July 15, 1995

07:00 Breakfast; 08:00-11:00 Meet authors of theoretical examination; 12:00 Lunch; 14:00 Full Jury to discuss theoretical examination at MH of FHH; 20:00 Pick up revised theoretical examination at Lobby of FHH

Sunday, July 16, 1995

08:00 Sightseeing: Summer Palace; 15:00 Meet students at FHH; 18:00 Dinner with students; 19:00 Pick up copies of practical examination for grading at Lobby of FHH

Monday, July 17, 1995

07:00 Sightseeing as students; 19:00 Pick up copies of practical examination for

grading at Lobby of FHH

Schedule for Students

Tuesday, July 18, 1995

07:00 Breakfast

08:30 Party with Local students, divide into six groups

12:00 Lunch at school (Jiaozi, do it oneself)

13:00 Departure for Huangyuan Hotel

Free in afternoon

18:00 Dinner at Huangyuan Hotel

19:00 Departure for HAI DIAN Theatre, gala performance: acrobatics

21:00 Departure for Huangyuan Hotel

Wednesday, July 19, 1995

07:00 Breakfast

08:00 Departure for sightseeing: Tian An Men Square, Forbidden City & Temple of Heaven

12:00 Lunch at City Beijing

16:00 Departure for Huangyuan Hotel

18:00 Dinner

Thursday, July 20, 1995

07:00 Breakfast

08:00 Visiting research institute, divided into three groups

11:00 Departure for Huangyuan Hotel

12:00 Lunch

14:00 Departure for Fragrant Hill Hotel

15:00 Closing Ceremony in FHH

19:00 Closing Party at Garden in FHH

21 : 00 Departure for Huangyuan Hotel

Friday, July 21, 1995

07 : 00 Breakfast

08 : 00 Meet mentors and individual transportation of delegations

Schedule for Mentors

Tuesday, July 18, 1995

07:00 Breakfast

08:00- 11:00 Meet authors to arbitrate points on practical/theoretical examination

12:00 Lunch

13:30 continue arbitration

18:00 Dinner

18:40 Departure for gala performance at Theatre HAI DIAN WITH students

Wednesday, July 19, 1995

07:00 Breakfast

08:00 Departure for shopping

12:00 Lunch at FHH

15:00 Full Jury meeting to determine medals at MH FHH

19:00 Steering Committee meeting at Meeting Room 9 FHH

Tuesday, July 20, 1995

07:00 Breakfast;

08:00 Jury session for the future Olympiads at MH FHH

12:00 Lunch

15:00 Closing Ceremony at Banquet Hall FHH

19:00 Closing Party at Garden FHH

Friday, July 21, 1995

07:00 Breakfast

08:00 Departure for Huangyuan Hotel
Individual transportation

**27th INTERNATIONAL CHEMISTRY OLYMPIAD
PRACTICAL EXAMINATION****FRIDAY, JULY 14, 1995**

Please read the entire procedure and the Student's Report before beginning the experiment.

WARNING: You must wear your safety goggles in the Laboratory and use the pipette bulbs provided. Should you remove your goggles, or pipette by mouth, you will be given a warning. A second warning will result in a five point penalty. A third warning will result in removal from the laboratory. Removal from the laboratory will result in a zero mark for the practical examination.

NOTES:

- 1) Write your name, student number (see student's No. on the table) and the delegation at the top of each student's report sheet.
- 2) Begin only after the instructor has given a **START** message.
- 3) You will be given 5 hours to finish the whole practical exam, including writing your report.
- 4) All the answers are to be written on the student's report sheets within the blanks provided. Only those answers given on the correct positions will be taken into consideration.
- 5) Write your report with the ballpen provided.
- 6) Use deionized water except for cooling.
- 7) The significant figures should be used properly.

Ar of some elements

H	1.008	S	32.06
C	12.01	K	39.10
N	14.01	Cu	63.54
O	16.00	I	126
Na	22.99		

PRACTICAL PROBLEM I**Identification of Unknown Solutions****Reagents**

H₂SO₄ (conc.)	H₂SO₄ (6 mol·dm⁻³)
HNO₃(conc.)	HNO₃ (6 mol·dm⁻³)
HCl(conc.)	HCl (6 mol·dm⁻³)
Ba(OH)₂(satd.)	NaOH (6 mol·dm⁻³)
BaCl₂(0.5 mol·dm⁻³)	Ba(NO₃)₂(0.5 mol·dm⁻³)

Desk equipments

One test tube holder
five small test tubes

Problem

You are supplied with five different solutions contained in five test tubes labeled as A,B,C,D and E, respectively. The solution, in each test tube, contains one of the following compounds



Identify these solutions.

NOTES:

- (1) You can only select the provided reagents and use a procedure as simple as possible to complete your task. You are getting a mark not only according to the correct identification, but also to the number of steps you have taken.
- (2) You have to carry out the whole analysis by using the provided amount of these unknown solutions. Supplement of them will be available, but it will reduce the mark you obtain.

PRACTICAL PROBLEM II

Preparation of cis-Copper-bis-Glycinate Hydrate [Cu(gly)₂·xH₂O]

Copper(II) amino acidate coordination compounds are monomeric units for synthesizing important biopolymers such as metalloenzymes like ceruloplasmin, on which every living organism depends. In laboratory cis-copper-bisglycinate hydrate can be produced by the reaction of cupric hydroxide with glycine at a temperature of *ca.* 70°C.

Reagents:

CuSO₄·5H₂O(s)

NH₃·H₂O(3 mol·dm⁻³)

glycine(s)

95% ethanol,

acetone

NaOH(2 mol·dm⁻³)

BaCl₂(0.5 mol·dm⁻³)

Desk equipments

beaker 250 cm³ ×4

graduated cylinder 100cm³ ×1

filter flask (shared)

Buchner funnel 60mm ×1

watch glass ×2

dropper ×2

spatula ×1

glass stirring rod ×1

aspirator

thermometer (at least 100° C)

Procedure:

1. Preparation of Cu(OH)₂

(1) Dissolve your pre-weighted sample of CuSO₄·5H₂O (6.0 g) in 40 cm³ of water with a 250 cm³ beaker as a container.

(2) Add slowly 3 mol·dm⁻³ ammonia solution to the CuSO₄ solution, gently stirring, until the precipitate is completely dissolved and the solution is turning blue-violet.

(3) Add 2 mol·dm⁻³ NaOH solution to the above solution until no more precipitate formed.

(4) Filter the precipitate over a Buchner funnel under reduced pressure. Wash the precipitate with water until no SO_4^{2-} ion is detected in the filtrate.

(5) Collect $\text{Cu}(\text{OH})_2$ for the preparation of $\text{Cu}(\text{gly})_2 \cdot x\text{H}_2\text{O}$.

Write the equations for the main chemical reactions having taken place in the above procedure.

2. Preparation of cis-copper-bisglycinate hydrate

(1) Dissolve a pre-weighted sample of glycine (3.6 g) in 130 cm^3 of water and then warm the solution in a hot water bath (70°C). Add the $\text{Cu}(\text{OH})_2$ to the solution, gently stirring until the precipitate is dissolved. Perform a hot filtration and add 10 cm^3 of 95% ethanol.

(2) Cool the solution and then needle-like crystals appear, place it in the ice water bath for 10 min.

(3) Filter the crystals over a Buchner funnel under reduced pressure, wash once with 10 cm^3 of ethanol-water mixing solvent and then twice with 10 cm^3 acetone, squeeze the crystals as dry as possible on the funnel.

(4) Collect the crystals to a watch glass and dry it (consult your supervisor).

(5) Half an hour later weigh the product. Write the mass of product and the percentage of yield on your student's report. Give the expressions for calculation to show how you calculate.

PRACTICAL PROBLEM III

Determination of copper(II) content in $\text{Cu}(\text{gly})_2 \cdot x\text{H}_2\text{O}$

The Cu(II) content in $\text{Cu}(\text{gly})_2 \cdot x\text{H}_2\text{O}$ crystals prepared yourself can be determined by iodometry with starch solution as indicator. Based on the data obtained one can calculate the moles of hydrates of crystals in $\text{Cu}(\text{gly})_2 \cdot x\text{H}_2\text{O}$.

Reagents

Standard KIO_3 (see the label on the bottle to get the accurate concentration)

H_2SO_4 ($1.0 \text{ mol} \cdot \text{dm}^{-3}$) as indicator.

KI ($0.6 \text{ mol} \cdot \text{dm}^{-3}$)

KSCN ($2 \text{ mol} \cdot \text{dm}^{-3}$)

Starch (0.5%)

$\text{Na}_2\text{S}_2\text{O}_3$ (to be standardized)

Desk equipments

buret $50\text{cm}^3 \times 1$

pipette $25\text{cm}^3 \times 1$

pipette bulb

beakers (dry) $100\text{cm}^3 \times 2$

volumetric flask $100\text{cm}^3 \times 1$

Erlenmeyer flask $250 \text{ cm}^3 \times 3$

graduated cylinder $10\text{cm}^3 \times 3, 100\text{cm}^3 \times 1$

wash bottle

single pan balance (shared)

hot water bath (shared)

Procedure

1. Standardization of $\text{Na}_2\text{S}_2\text{O}_3$ solution

(1) Transfer 25.00 cm^3 of standard KIO_3 solution to an Erlenmeyer flask.

(2) Add 5 cm^3 of water, 10 cm^3 of KI solution and 5 cm^3 of H_2SO_4 ($1.0 \text{ mol} \cdot \text{dm}^{-3}$) to the flask.

(3) Titrate immediately with $\text{Na}_2\text{S}_2\text{O}_3$ solution.

(4) Add 2 cm^3 starch solution when the colour of the titrand turns pale yellow.

(5) Continue titrating until the blue color of the solution disappears.

(6) Proceed with step (1)—(5) twice parallelly.

2. Determination of Cu(II) content in $\text{Cu}(\text{gly})_2 \cdot x\text{H}_2\text{O}$

- (1) Weigh 1.0—1.2 g (precision of ± 0.0002 g) of $\text{Cu}(\text{gly})_2 \cdot x\text{H}_2\text{O}$ with a dry 100 cm^3 beaker as the container.**
- (2) Dissolve it with 40 cm^3 of water and 8 cm^3 of H_2SO_4 ($1.0 \text{ mol} \cdot \text{dm}^{-3}$).**
- (3) Transfer the above solution quantitatively to a 100 cm^3 volumetric flask and dilute to the mark.**
- (4) Transfer 25.00 cm^3 of the Cu(II) Solution to an Erlenmeyer flask, add 50 cm^3 of water and 10 cm^3 of KI solution to the flask.**
- (5) Titrate immediately with standardized $\text{Na}_2\text{S}_2\text{O}_3$ solution.**
- (6) Add 2 cm^3 of starch solution and 3 cm^3 of KSCN solution to the flask when the colour of the titrand turns from brown to pale yellow.**
- (7) Titrate continuously until the blue color of the solution disappears.**
- (8) Proceed with steps (4)—(7) twice parallelly.**

Name

Student's No.

Delegation

**Student's Report for Practical
Problem I**

1. Identification of unknown solutions

labels of solutions	A	B	C	D	E
chemical formulae					

2. Equations for chemical reactions taking place in each experimental step

step one (with the first reagent you choose)

step two (with the second reagent you choose)

step three (with the third reagent you choose)

If you proceed with more steps, write the corresponding chemical equations continuously.

Name

Student's No.

Delegation

**Student's Report for Practical
Problem II**

1. Equations for the main chemical reactions having taken place in the preparation of $\text{Cu}(\text{OH})_2$.

2. Mass of $\text{Cu}(\text{gly})_2 \cdot x\text{H}_2\text{O} =$ (g)

Percent yield

The expression for calculation

Name

Student's No.

Delegation

**Student's Report for Practical
Problem III**

1. Standardization of Na₂S₂O₃ Solution

1) The two equations for chemical reactions taking place during the standardization of Na₂S₂O₃.

i

ii.

(2) Volumes of Na₂S₂O₃ Solution

$V_1 =$ cm^3 $V_2 =$ cm^3
 $V_3 =$ cm^3

$V(\text{mean value}) =$ cm^3

(3) Concentration of Na₂S₂O₃ = $\text{mol}\cdot\text{dm}^{-3}$

Expression for the calculation:

2. Determination of Cu(II) in Cu(gly)₂·xH₂O

(1) Chemical equation for the reaction between Cu²⁺ and I⁻

(2) Mass of Cu(gly)₂·xH₂O = g

3) Volumes of Na₂S₂O₃ solution

$V_1 =$ cm^3 $V_2 =$ cm^3 $V_3 =$ cm^3

$V(\text{mean value}) = \quad \text{cm}^3$

**(4) Mass % of Cu(II) in $\text{Cu}(\text{gly})_2 \cdot x\text{H}_2\text{O} = \quad \%$
Expression for the calculation:**

(5) X Value in $\text{Cu}(\text{gly})_2 \cdot x\text{H}_2\text{O}$

$X = \quad$ (with precision of 0.01)

Expression for the calculation:

**Results key for practical problem I
(10 pts)**

1. Identification of unknown solutions (5 pts)

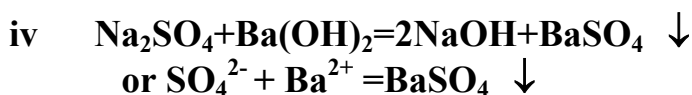
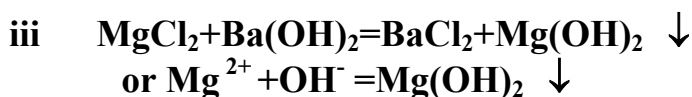
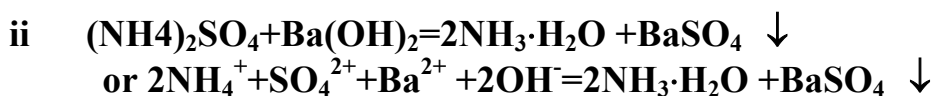
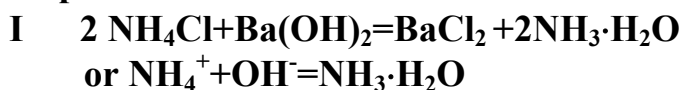
labels of solutions	A	B	C	D	E
chemical formulae					

1 pt for one correct identification

2. Equations for chemical reactions taking place in each experimental step

5 pts

Step one



Step two



5 pts for using Ba(OH)₂ and HCl or Ba(OH)₂ only

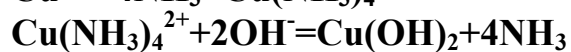
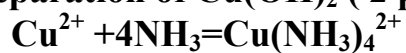
3 pts for using more than these two reagents

for one incorrect equation (-1pt)

**Results key for practical problem II
(12 pts)**

1. Equations for the main chemical reactions having taken place in the

preparation of Cu(OH)₂ (2 pts)



one pt for one correct equation

2. Mass of Cu(gly)₂·xH₂O = (g)

mass ≥ 2.6g (8 pts)

2.6 > mass ≥ 2.2 (6 pts)

2.2 > mass ≥ 1.5 (4 pts)

1.5 > mass ≥ 1.1 (2 pts)

1.0 > mass ≥ 0.5 (1 pt)

dripping (0 pt)

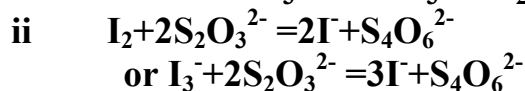
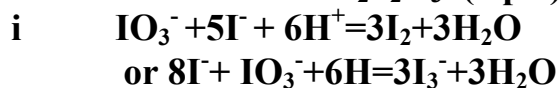
Percent yield

The expression for calculation

Results key for practical problem III (20 pts)

1. Standardization of Na₂S₂O₃ solution (10 pts)

(1) The two equations for chemical reactions taking place during the standardization of Na₂S₂O₃. (2 pts)



1 pt for one correct equation. (incorrect balance -0.5 pt)

(2) Volumes of Na₂S₂O₃ solution (4 pts)

$$V_1 = \quad \text{cm}^3 \quad V_2 = \quad \text{cm}^3$$

$$V_3 = \quad \text{cm}^3$$

$$V(\text{mean value}) = \quad \text{cm}^3$$

1 pt for correct significant figures

3 times of titration (1 pt)

two or one titration (0 pt)

$$\text{precision} \leq 0.04 \text{ cm}^3 \quad (2 \text{ pts})$$

(maximum-minimum)

$$0.04 \text{ cm}^3 < \text{precision} \leq 0.08 \text{ cm}^3 \quad (1 \text{ pt})$$

(3) Concentration of Na₂S₂O₃ mol·dm⁻³ (4 pts)

correct significant figures (1 pt)

$$\text{error} \quad \pm 0.00015 \quad \text{—} \quad \pm 0.00020 \text{ mol}\cdot\text{dm}^{-3} \quad (3 \text{ pts})$$

$$\pm 0.00021 \quad \text{—} \quad \pm 0.00025 \text{ mol}\cdot\text{dm}^{-3} \quad (2 \text{ pts})$$

$$\pm 0.00026 \quad \text{—} \quad \pm 0.00030 \text{ mol}\cdot\text{dm}^{-3} \quad (1 \text{ pt})$$

2. Determination of Cu(II) in Cu(gly)₂·xH₂O (10 pts)

(1) Chemical equation for the reaction between Cu²⁺ and I⁻



(2) Mass of Cu(gly)₂·xH₂O = g (1 pt)

(3) Volumes of Na₂S₂O₃ (4 pts)

correct significant figures (1 pt)

3 times of titration (1 pt)

$$\text{precision} \leq 0.04 \text{ cm}^3 \quad (2 \text{ pts})$$

$$0.04 \text{ cm}^3 < \text{precision} \leq 0.08 \text{ cm}^3 \quad (1 \text{ pt})$$

(4) Mass % of Cu²⁺ in Cu(gly)₂·xH₂O = 27.66% (Theo.) (1 pt)

mass % > 29% or mass % < 26% (0 pt pts)

(5) Calculation of x in Cu(gly)₂·xH₂O (4 pts)

$x = 1.00$ (Theo.)

the ranges of x :

- | | |
|--|----------------|
| $1.00 \pm (0.00 — 0.10)$ | (4 pts) |
| $1.00 \pm (0.11 — 0.15)$ | (3 pts) |
| $1.00 \pm (0.16 — 0.20)$ | (2 pts) |
| $1.00 \pm (0.21 — 0.25)$ | (1 pts) |

$t/^{\circ}\text{C}$	25	40
$k_{\text{c}} / \text{mol}\cdot\text{dm}^{-3}\cdot\text{s}^{-1}$	1.29×10^{-4}	2.50×10^{-4}

i) Write the equation for calculating the activation energy of reaction (c) and find the value.

ii) Assign the overall reaction order of reaction (c).

iii) Knowing that the rate determining step of reaction (c) is the monolayer adsorption of O_2 (g) on solid CuCl , write the overall rate equation of this heterogeneous reaction (c). Under what condition might the reaction order be the same as that you have given in ii)? Assume only O_2 can be adsorbed.

3. A copper plate was divided into two parts, $\text{Cu}(1)$ and $\text{Cu}(2)$. $\text{Cu}(1)$ was then hammered so that $\text{Cu}(1)$ and $\text{Cu}(2)$ are different in certain thermodynamic properties.

i) An electromotive cell with $\text{Cu}(1)$ and $\text{Cu}(2)$ was designed as $\text{Cu}(1)|\text{CuSO}_4(\text{aq})|\text{Cu}(2)$ and the electromotive force E of the above cell was expressed as $E = \phi_{\text{R}} - \phi_{\text{L}}$, where ϕ_{R} and ϕ_{L} being the right and left electrode potentials (i. e. half-cell potentials), respectively. Please choose the correct E value from the following and give the thermodynamic reason for your choice.

(A) $E < 0$ (B) $E = 0$ (C) $E > 0$ (D) can not decide

ii) Write the net cell reaction for the cell.

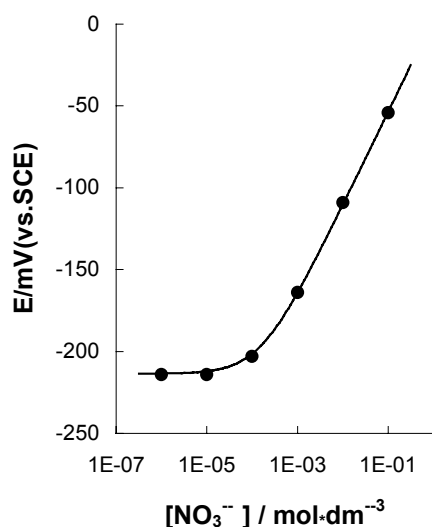
4. In a Cu-Zn alloy the molar fractions of Cu and Zn are 0.750 and 0.250, respectively. The structure type of the alloy is the same as that of pure copper, except Zn atoms substitute some Cu atoms randomly and statistically, i. e. at every atomic position, the probability of the occupation of Cu and Zn is proportional to the composition of the alloy. In this sense the alloy can be considered as composed of statistical atoms $\text{Cu}_x\text{Zn}_{1-x}$. X-ray analysis shows that the arrangement of atoms in the alloy is of the cubic face-centered close packing type. Density of the alloy $d = 8.51 \text{ g}\cdot\text{cm}^{-3}$. Calculate the radius of the statistical atoms in the alloy.

Given: $A_{\text{r}}(\text{Cu}) = 63.5$, $A_{\text{r}}(\text{Zn}) = 65.4$.

Problem 2

To control the quality milk serum, a dairy by-product, the concentration of NO_3^- ion in serum is monitored by means of an ion selective electrode.

Generally there is about 15 mg NO_3^- ion per liter in serum, measured on the basis of nitrogen mass.



1. For a nitrate ion selective electrode a calibration curve as shown left was obtained using a series of standard nitrate solutions containing $0.5 \text{ mol}\cdot\text{dm}^{-3} \text{ K}_2\text{SO}_4$, $1.0 \times 10^{-3} \text{ mol}\cdot\text{dm}^{-3} \text{ H}_2\text{SO}_4$ and $2.6 \times 10^{-3} \text{ mol}\cdot\text{dm}^{-3} \text{ Cl}^-$ ion as the background. Decide whether it is feasible to measure NO_3^- concentration in serum under the above conditions.

2. Given the selective coefficients of Cl^- , SO_4^{2-} and ClO_4^- versus NO_3^- as follows:

$$K_{\text{NO}_3^-, \text{Cl}^-} = \frac{C_{\text{NO}_3^-}}{C_{\text{Cl}^-}} = 4.9 \times 10^{-2}; \quad K_{\text{NO}_3^-, \text{SO}_4^{2-}} = \frac{C_{\text{NO}_3^-}}{C_{\text{SO}_4^{2-}}^{1/2}} = 4.1 \times 10^{-3}; \quad K_{\text{NO}_3^-, \text{ClO}_4^-} = \frac{C_{\text{NO}_3^-}}{C_{\text{ClO}_4^-}} = 1.0 \times 10^{-3}$$

where the units of the concentrations are in $\text{mol}\cdot\text{dm}^{-3}$, which is the best to reduce the interference of Cl^- to NO_3^- determination, so as to control the error in the NO_3^- concentration within 1%, when there are $1.40 \times 10^{-3} \text{ mol}\cdot\text{dm}^{-3} \text{ NO}_3^-$ and $1.60 \times 10^{-2} \text{ mol}\cdot\text{dm}^{-3} \text{ Cl}^-$ in serum:

(A) AgNO_3

(B) Ag_2SO_4

(C) AgClO_4

Calculate the amount of the salt that should be added to 1 dm^3 of the sample solution to be measured.

3. The NO_3^- ion concentration was determined by this method at 298K. For

25.00 cm³ sample solution, the electric potential, E , is measured to be -160 mV. After adding 1.00 cm³ 0.100×10^{-2} mol·dm⁻³ NO₃⁻ standard solution to the above solution, E changes to -130 mV. Find the pNO₃ of the serum.

4. The selective coefficient of CH₃COO⁻ versus NO₃⁻ is

$K_{\text{NO}_3^-, \text{CH}_3\text{COO}^-} = 2.7 \times 10^{-3}$. If AgCH₃COO instead of Ag₂SO₄ is added to the sample solution of question 2, find the upper limit of the pH value, below which the same requirement in question 2 can be met.

$$K_{\text{sp}}(\text{AgCl}) = 3.2 \times 10^{-10}$$

$$K_{\text{sp}}(\text{Ag}_2\text{SO}_4) = 8.0 \times 10^{-5}$$

$$K_{\text{sp}}(\text{AgCH}_3\text{COO}) = 8.0 \times 10^{-3}$$

$$K_{\text{a}}(\text{CH}_3\text{COOH}) = 2.2 \times 10^{-5}$$

$$A_{\text{r}}(\text{N}) = 14.00$$

Problem 3

1,3-Dihydroxyacetone can be converted to glyceraldehyde. On standing this glyceraldehyde changes spontaneously into a six member cyclic dimer C₆H₁₂O₆. The infrared spectrum of the dimer shows no absorption peak between 1600—1800 cm⁻¹ and the dipole moment of the dimer is determined to be zero.

1. Write the Fischer projection structural formula(e) for the resulting glyceraldehyde and indicate configuration using D(+) and/or L(-).
2. Write the structural formula for the reaction intermediate of the conversion of 1,3-dihydroxyacetone to glyceraldehyde.
3. Write the structural formula for the dimer.
4. Using Haworth projection formula represent the possible stereoisomers which fit the dipole moment data.
5. Denote each chiral carbon atom in the above formulae with R or S.

Problem 4

Poly[(R)-3-hydroxyalkanoic acids], PHAs, are synthesized by a variety of bacteria and function as intracellular carbon and energy storage materials. These polymers are also biodegradable in environments, such as soil, anaerobic

sewage and sea water. The inherent biologically mediated environmental degradability, useful physical properties, slow hydrolytic degradation and other favorable properties make bacterial polyesters exciting materials for both disposable biodegradable plastics (*good for a clean environment*) and special medical products.

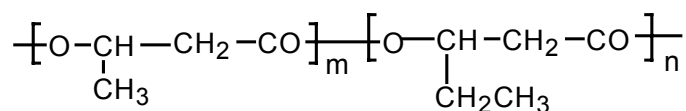
1. PHB, Poly(3-hydroxybutanoic acid), produced by bacteria contains only (R)-HB repeating units, while that synthesized by polymer chemists may contain only (R)-HB or only (S)-HB or both (R)-and (S)-HB in an alternating manner or both but in random distributions. Sketch chain structures of the atactic PHB, syndiotactic PHB and isotactic PHBs and denote each chiral carbon with (R) or (S). Five monomeric units are enough for each chain.

(Note: In "PHB", P means "poly" or "polymer of", HB represents the monomeric units contained in poly(3-hydroxybutanoic acid) molecules.)

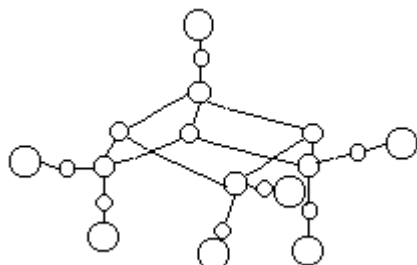
2. Suggest two types of monomers that could be used for polymer chemists to synthesize a PHB, regardless of the stereochemistry of the products.

3. Poly[(R)-3-hydroxybutanoic acid] can be synthesized by feeding the bacteria (such as *Alcaligenes Eutrophus*) with sodium acetate in a nitrogen-free media. It is believed that the key steps for the conversion of acetate to PHB are the activation of acetate molecules by coenzyme A and the subsequent formation of the coenzyme A activated acetoacetate, which is then reduced by a reductase to form coenzyme A activated monomer 3-hydroxybutyrate. Polymerization of the monomer is achieved by a polymerase which would build the polymer molecules with unique stereospecificity. Sketch these steps with structural formulae. For coenzyme A the conventional abbreviation, -S-CoA (-CoA is as good), should be used in the sketch.

4. If sodium propanoate is used (*as the sole carbon source*) in the feeding media instead of sodium acetate, the principal product will be a copolymer of 3-hydroxybutanoic acid and 3-hydroxypentanoic acid with the following generalized structure:



decomposition of proteins, forming $[\text{Fe}_4\text{S}_3(\text{NO})_7]^-$. The complex anion is bacteriostatic and antiseptic. X-ray crystallography shows that the complex anion has a structure as shown below:



i) Blacken all the circles corresponding to iron atoms and add symbols Fe(A), Fe(B), Fe(C) and Fe(D) beside the circles in the sequence of top \rightarrow left \rightarrow right.

ii) The configuration of 3d electron shell of the iron atoms has been studied with modern

structural analysis. Knowing that the mean oxidation number of the four iron atoms is -0.5 , give their configurations of 3d shell, respectively. Assume that each iron atom adopt sp^3 hybridization.

5. $[\text{Fe}_4\text{S}_3(\text{NO})_7]^-$ anion can be reduced and a new complex $[\text{Fe}_2\text{S}_2(\text{NO})_4]^{2-}$ is formed which contains a cyclic structure unit of Fe_2S_2 .

i) Write the structural formula for the anion $[\text{Fe}_2\text{S}_2(\text{NO})_4]^{2-}$.

ii) Give the oxidation state of each iron atom with Arabic numerals.

iii) $[\text{Fe}_2\text{S}_2(\text{NO})_4]^{2-}$ can be converted into $[\text{Fe}_2(\text{SCH}_3)_2(\text{NO})_4]^n$, a carcinogen.

Which of the following three species is added to $[\text{Fe}_2\text{S}_2(\text{NO})_4]^{2-}$: CH_3^+ , $\bullet\text{CH}_3$ or CH_3^- ? Assign the value of n .

Problem 6

A surfactant molecule can generally be modeled as Fig. 1, where a circle represents the polar head (PH), i.e. the hydrophilic part of the molecule, and a rectangle represents the non-polar tail (NT), i. e. the hydrophobic part of the molecule.

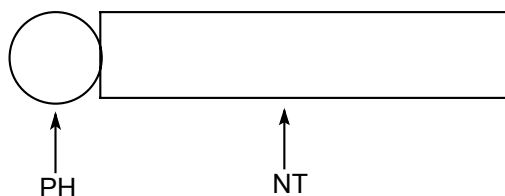


Fig. 11.

1. AOT is a surfactant. Its systematic name (IUPAC name) is sulfobutanedioic acid 1,4-bis-(2-ethylhexyl) ester sodium salt (formula $\text{C}_{20}\text{H}_{37}\text{NaO}_7\text{S}$).

i) Write the structural formula for

AOT and fill its PH and NT in the circle and rectangle on your answer sheet.

ii) Choose the type of surfactant AOT among the following.

A. non-ionic; B. Anionic; C. cationic; D. others.

2. Mixing an aqueous solution of 50 mmol AOT with isooctane (volume ratio 1:1), a micellar extraction system will be formed in the isooctane phase (organic phase).

i) Using the model as shown in Fig. 1, draw a micelle with 10 AOT molecules under the given condition.

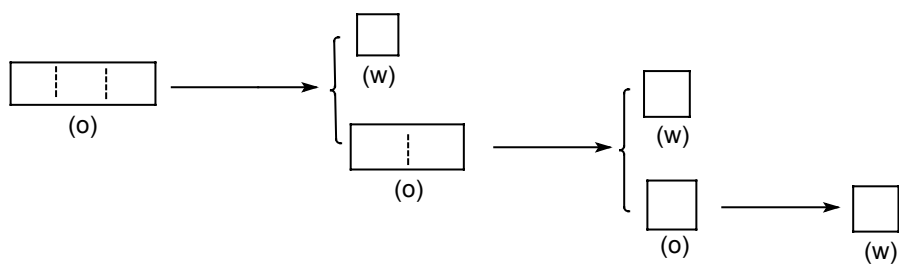
ii) What species are in the inner cavity of this micelle? Write their chemical formulas.

3. There is an aqueous solution containing the proteins as listed below:

protein	molecular weight (M_r)/ 10^4	isoelectric point (PI)
A	1.45	11.1
B	1.37	7.8
C	6.45	4.9
D	6.80	4.9
E	2.40	4.7
F	2.38	0.5

The separation of proteins can be performed by mixing the AOT micellar extraction system with the solution. Adjusting the pH value of the solution to 4.5, only three of the above listed six proteins can be extracted into the micelles. Which proteins will be extracted?

4. The three proteins entered into the micelles will be separated from each other by the following procedure shown as in Fig. 2. Each extracted protein can be sequentially transported into a respective water phase.

**Fig. 2**

Note: (w) represents water phase; (o) represents organic phase.

Fill the three extracted proteins in the left boxes first and then separate them by the procedure given, and give the separation conditions above each arrow as well.

Solutions and Marking grid for the Theoretical Problems of the 27th IChO

Problem 1 (total 17 points)

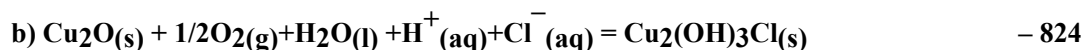
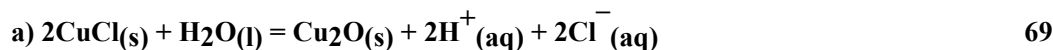
1.

i)

chemical equation

ii) (1. total 6 points)

$$\frac{\Delta_f G_m^\ominus(298\text{K})}{\text{kJ} \cdot \text{mol}^{-1}}$$



i) 2 points

ii) 2 points

iii) Calculation (dilute HCl solution can be considered as an ideal solution)

$$\begin{aligned} \Delta_r G_m(298\text{K}) &= \Delta_r G_m^\ominus(298\text{K}) + 2RT \ln [C_{\text{H}^+} / C_{\text{H}^+}^\ominus \cdot C_{\text{Cl}^-} / C_{\text{Cl}^-}^\ominus] \\ &= -22.3 \text{ kJ mol}^{-1} < 1 \end{aligned}$$

A. →

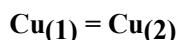
iii) 2 points

2. i) Formula : $\ln \frac{k_c(T_2)}{k_c(T_1)} = \frac{E_a}{R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$ (2. total 4 points) i) 1 point

$$E_a = 34.2 \text{ kJ} \cdot \text{mol}^{-1} \quad \text{+ 1 point}$$

ii) overall reaction order = 0 ii) 1 point

when $bp_{\text{O}_2} \gg 1$, $r = k_c \theta = \frac{k_c b P_{\text{O}_2}}{1 + b P_{\text{O}_2}}$; $r = k_c$, zero order + 1 point

3. i) (C) $E > 0$ (3. total 3 points)ii) Net cell reaction: i) 1 point

Thermodynamic reason for choosing 3 (C) is

$$\Delta_r G_m < 0, \Delta_r G_m = -nFE \quad \therefore E > 0 \quad \text{ii) 2 points}$$

4. $r = 1.30 \times 10^{-10} \text{ m}$ (4. total 4 points)

formula: $a = 2\sqrt{2}r$ 1 point

$$d = \frac{4(63.5 \times 0.75 + 65.4 \times 0.25) \times 10^{-3}}{a^3 N_A} \quad \text{1.5 points}$$

$$= 8.51 \times 10^{-3} \text{ kg} \cdot \text{m}^{-3}$$

$$r^3 = 2.209 \times 10^{-30} \text{ m}^3 \quad \text{1 point}$$

$$r = 1.30 \times 10^{-10} \text{ m} \quad \text{0.5 point}$$

total (17 points)

Problem 2 (total 20 points)

1. A 1 point

2. B 2 points

$$(1.4 \times 10^{-3} \times 0.01) \div [\text{Cl}^-] = 4.9 \times 10^{-4} \text{ mol dm}^{-3},$$

$$[\text{Cl}^-] = 2.9 \times 10^{-4} \text{ mol dm}^{-3} \quad 1 \text{ point}$$

$$\begin{aligned} \text{Excess } [\text{Cl}^-] &= 1.6 \times 10^{-2} - 2.9 \times 10^{-3} \\ &\cong 1.6 \times 10^{-2} \text{ mol dm}^{-3} \quad 1 \text{ point} \end{aligned}$$

To reduce the interference of Cl^- , at least $1.6 \times 10^{-2} \text{ mol Ag}^+$ ion, or $8.0 \times 10^{-3} \text{ Ag}_2\text{SO}_4$ has to be added to 1 dm^3 sample solution.

1 point

(2. total 5 points)

$$3. DE = E_2 - E_1 = 0.059 \lg \{(C_X V_X + C_S V_S) / (C_X [V_X + V_S])\}$$

2 points

$$0.03 = 0.059 \lg [(25.00 V_X + 0.10) / (26.00 \times C_X)] \quad 1 \text{ point}$$

$$C_X = 1.7 \times 10^{-3} \text{ mol dm}^{-3} \quad 1 \text{ point}$$

$$\text{pNO}_3 = 2.77 \quad 1 \text{ point}$$

(3. total 5 points)

4. pH = 4.4 1 point

$$(1.4 \times 10^{-3} \times x) \div 1.6 \times 10^{-2} = 2.7 \times 10^{-3} \quad 2 \text{ points}$$

$$x = 3.1\% > 1\% \quad 1 \text{ point}$$

$$(1.4 \times 10^{-3} \times 0.01) \div [\text{CH}_3\text{COO}^-] = 2.7 \times 10^{-3} \quad 1 \text{ point}$$

$$[\text{CH}_3\text{COO}^-] = 5.2 \times 10^{-3} \text{ mol dm}^{-3} \quad 1 \text{ point}$$

$$1.6 \times 10^{-2} - 5.2 \times 10^{-3} = 1.08 \times 10^{-2} \text{ mol dm}^{-3} \quad 1 \text{ point}$$

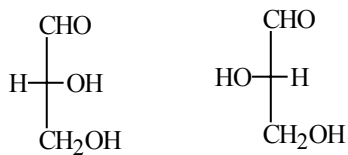
$$\{[\text{H}^+] \times 5.2 \times 10^{-3}\} \div (1.08 \times 10^{-2}) = 2.2 \times 10^{-5} \quad 1 \text{ point}$$

$$[\text{H}^+] = 4.3 \times 10^{-5} \text{ mol dm}^{-3} \quad 1 \text{ point}$$

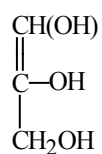
$$\text{pH} = 4.4 \quad (4. \text{ total 9 points})$$

Problem 3 (total 15 points)

1.

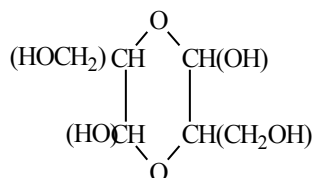
D(+)
1 pointL(-)
1 point

2.



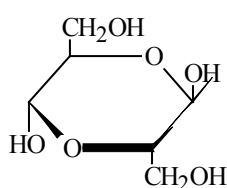
2 points

3.

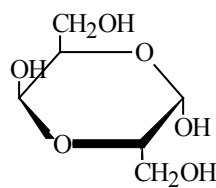


3 points

4.

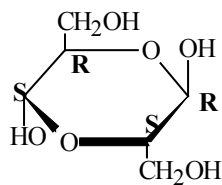


2 points

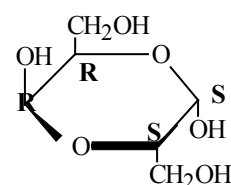


2 points

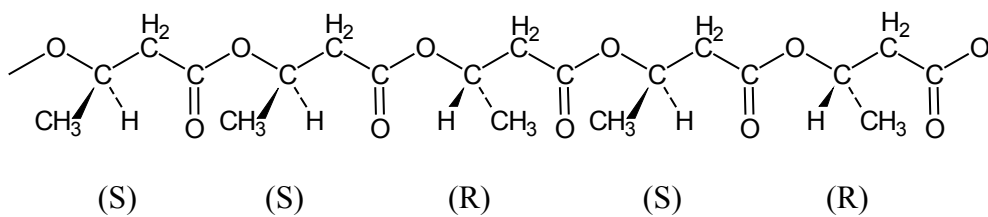
5.



2 points



2 points

Problem 4 (total 16 points)**1. Atactic PHB:**

1 point

other arrangements with (R) and (S) randomly distributed along the chain are correct, e.g.,

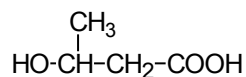
RSRRS, SRSSR, RRSRS, etc.

Syndiotactic PHB: This polymer has (R) and (S) units positioned along the chain in an alternating manner: RSRSR (or SRSRS). **1 point**

Isotactic PHB: All the chiral centers have the same configuration. There are 2 types of the isotactic PHBs: SSSSS and RRRRR **2 points**

(ref. Preparatory Problem 52)

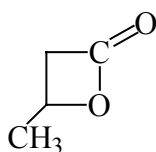
2. Monomer 1



3-hydroxybutanoic acid

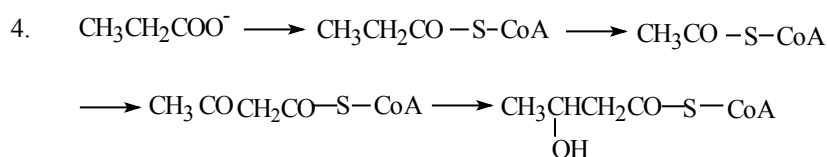
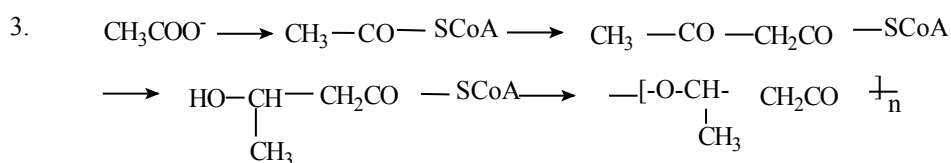
2 points

Monomer 2



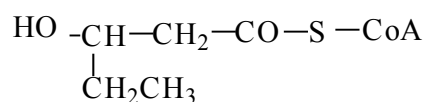
(Ref. Preparatory Problem 52)

2 points

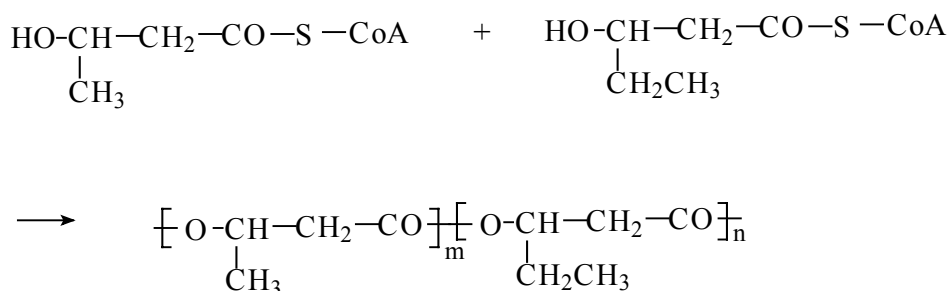


(coenzyme A activated monomer 3-hydroxypentanoic acid)

This monommmmer may also be written in the following way:



Polymerization together of these two monomers will result in the desired copolymer:



(Ref. Preparatory Problem 52 and 55) 4 points for Question 3
4 points for Question 4

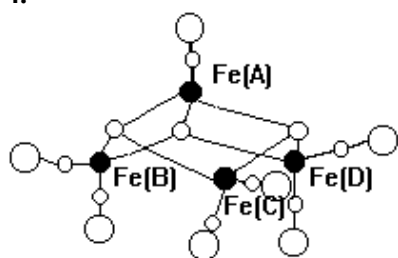
Problem 5 (total 18 points)

1. The HOMO of NO molecule is π^* , its electron arrangement is \uparrow ;
the LUMO of NO molecule is π^* . 1+1+1= 3 points

2. B. 1 point

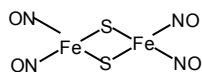
3. B. 2 points

4.



Fe(A) having $3d^7$ configuration; Fe(B), Fe(C),
Fe(D) having $3d^9$ configuration.
 $0.5 \times 4 + 0.5 \times 4 + 2 = 6$ points

5. i) 2 points



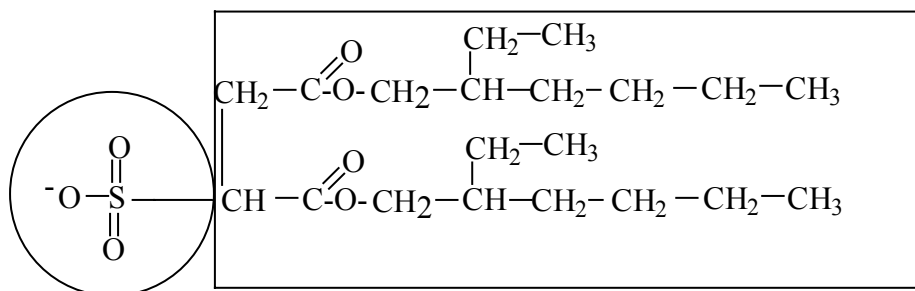
ii) Fe (-1) Fe (-1) 1+1 = 2 points

iii) The species added to S atom is $\underline{\text{CH}_3^+}$; n= 0 .

1+1= 2 points

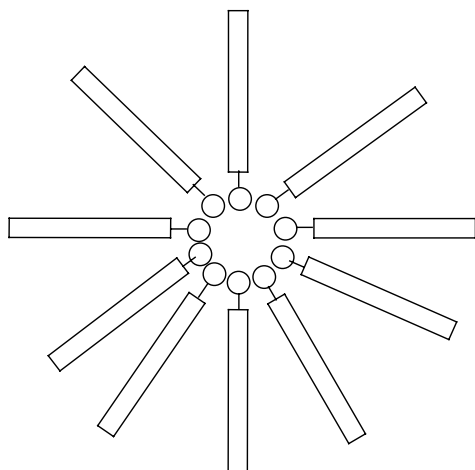
Problem 6 (total 13 points)

1. i) AOT molecule model: 1 point for PH; 1 point for NT.



ii) B. 1 point (3 points for question 1)

2. i)



1 point for direction of the molecules

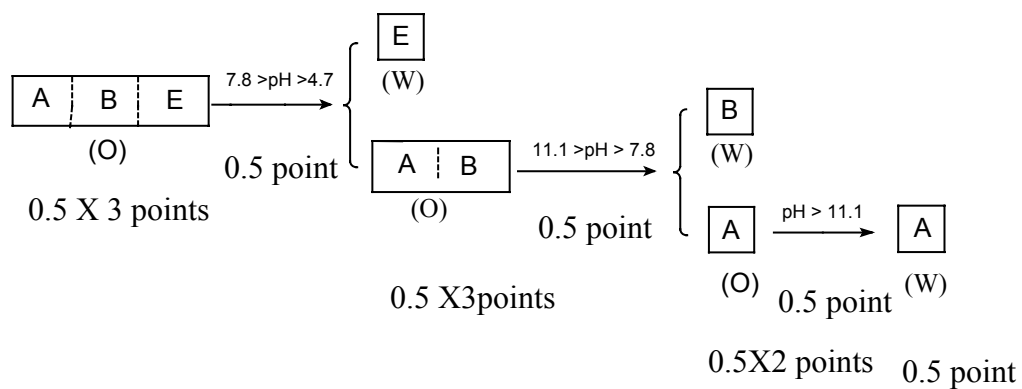
ii) H_2O , Na^+

1 point for species in the cavity

(2 Points for question 2)

3. A. B. E. (3 Points For question 3)

4. Fill the letters represented the extracted proteins in the frames and the separation conditions above the arrows respectively: (6 points for question 4)



The Conceptual Links between the Preparatory Problems and the Theoretical Problems

Theoretical Problem	Preparatory Problem
1	2, 5, 38-47
2	21-32
3	11-20
4	33-36, 52, 54-55
5	3-4, 8-9, 56-57
6	10, 48

Marking Grid for the Theoretical Problems

Problem	Blue points	Red points	
1		17	10
2		20	10
3		15	10
4		16	10
5		18	10
6		13	10
		total	60

4. $r =$ _____

formula:

Problem 2

1. Choose the answer by cycling the letter:

(A) Yes (B) No

2. Choose the answer by cycling the letter:

(A) AgNO_3 (B) Ag_2SO_4 (C) AgClO_4

The amount of the selected substance which should be added into 1 dm^3 of the sample solution

is _____ mol.

3. The pNO_3 value of the milk serum is _____ .

Calculation procedures:

4. The pH value has to be lower than _____ .

Calculation procedures:

Problem 3

1. Fischer projection formula and its configuration

2. Reaction mechanism**3. Structural formula of the cyclic dimer****4. Haworth projection formula of the possible stereoisomers which meet the dipole moment data.****5. Mark all chiral carbon atoms using the R, S system.****Problem 4****1. Draw the chain structures for:****Atactic PHB****Syndiotactic PHB**

Isotactic PHB

2. Suggest two types of monomers for the synthesis of PHBs by structural formulae.

Monomer 1 and 2:

3. Sketch the 4 key steps for the conversion of acetate to PHB with structural formulae. The conventional abbreviation for co-enzyme A, -S-CoA (or -CoA) should be used in the sketch.



4. Rationalize the formation of the copolymer of 3-hydroxybutanoic acid and 3-hydroxypentanoic acid when sodium propanoate is used as the sole carbon source.

Problem 5

1. The HOMO of NO molecule is _____, its electron arrangement is _____ ; the LUMO of NO molecule is _____.

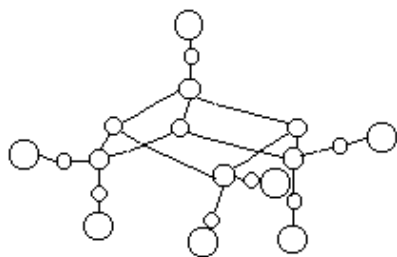
2. Choose the correct answer by circling the proper letter.

A. B. C.

3. Choose the correct answer by circling the proper letter.

A. B. C. D.

4.



Iron atom(s) _____ has 3d_□ configuration;

Iron atom(s) _____ has 3d_□ configuration.

5. i) and ii)

iii) The species added to S atom is _____ ; n= _____ .

Problem 6

1. i) AOT molecule model:



ii) Cycling the letter of the best choice:

A. B. C. D.

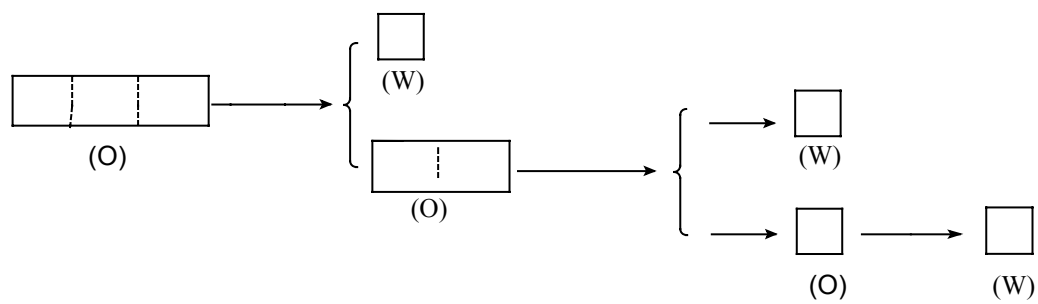
2. I) Draw a 10 molecule model for the given micelle:

ii) The chemical formula(s) of the substance(s) in the micelle inner cavity _____.

3. Cycling the letters represented the three extracted proteins entered in the micelles:

A. B. C. D. E. F.

4. Fill the letters represented the extracted proteins in the frames and the separation conditions above the arrows, respectively:



Medalist List of the 27th IChO

Ord.	NAME	Delegation	Score	Medal
001.	KIANI Roozbeh	Iran	95.641	Gold
002.	ZHANG Jianhui	China	93.310	Gold
003.	JALALI Ali	Iran	92.389	Gold
004.	LUO Hongpeng	China	91.526	Gold
005.	RAZZGHI Mehdi	Iran	90.501	Gold
006.	JIAO Yuchen	China	89.736	Gold
007.	Luca ARGENTI	Italy	89.205	Gold
008.	CHEN Jingyang	China	89.075	Gold
009.	Igor A GARIEV	Russia	88.327	Gold
010.	Ludek MECA	Czech Republic	88.057	Gold
011.	Alexandru Ioan POPA	Romania	86.553	Gold
012.	Leonard MADA	Romania	86.136	Gold
013.	CHOY Dawen	Singapore	84.991	Gold
014.	Ladislav KISS	Slovakia	84.255	Gold
015.	Jiri JANECEK	Czech Republic	83.495	Gold
016.	Johannes SCHIMPL	Austria	83.297	Gold
017.	Mikhail SEREBRIAKOV	Russia	83.182	Gold
018.	Thomas BARK	Germany	82.996	Gold
019.	ROSTA Edina	Hungary	82.294	Gold
020.	SHAHAKBARI	Iran	82.138	Gold
021.	Philip M. GRANT	UK	82.115	Gold
022.	Reinhard ULLRICH	Austria	81.795	Silver
023.	Eduardas GAIDAMAUSKAS	Lithuania	81.793	Silver
024.	Daniel J. A. LATREMOLIERE	France	81.687	Silver
025.	Wendelin STARK	Switzerland	81.165	Silver
026.	Stefan Alexandru CARP	Romania	81.017	Silver
027.	Julian M. L. BEAN	U.K.	80.558	Silver
028.	YEH Kuo-Liang	Chinese Taipei	80.212	Silver
029.	Vilius PIGAGA	Lithuania	79.682	Silver
030.	Luis Ivan TUBERT-BROHMAN	Mexico	79.405	Silver
031.	Giovanni GIULIANO	Italy	79.047	Silver
032.	WU Chia-Hung	Chinese Taipei	79.000	Silver
033.	Liviu MIRICA	Romania	78.910	Silver
034.	Piotr LIPIEC	Poland	78.720	Silver
035.	Brian Schou RASMUSSEN	Denmark	78.198	Silver
036.	Anton SAMOTEYKIN	Ukraine	77.930	Silver
037.	Katharina GAMMER	Austria	77.903	Silver
038.	Thoralf KRAHL	Germany	77.877	Silver
039.	Wichet PHOTHIWISUTWATHEE	Tailand	77.836	Silver
040.	Julian Leon HUPPERT	Australia	77.801	Silver
041.	Martin WALKO	Slovakia	77.164	Silver
042.	Rahmi ILKILIC	Turkey	76.940	Silver

043. Jason WONG	USA	76.846	Silver
044. Francois MARION	France	76.711	Silver
045. Vladimir VEGH	Slovakia	76.578	Silver
046. Moritz BORGMANN	Germany	76.293	Silver
047. LIN Chih-Kai	Chinese Taipei	76.000	Silver
048. Claudia ZIPPERLE	Austria	75.190	Silver
049. Ulf PETERS	Germany	75.043	Silver
050. Matthew Gilbert HEATON	Australia	74.464	Silver
051. Paul PEIJZEL	The Netherlands	74.418	Silver
052. BAE Seung-Bin	Korea Republic	74.259	Silver
053. Anders LOGG	Sweden	74.168	Silver
054. Ian CUMPSTEY	UK	73.535	Silver
055. BUNKOCZI Gabor	Hungary	73.123	Silver
056. Prashant MISHRA	USA	73.027	Silver
057. Tan Say Lock	Singapore	72.705	Bronze
058. Carlos A. FIGUEROA	Argentina	72.340	Bronze
059. Chun Fung Man	Canada	71.974	Bronze
060. Ain Uustare	Estonia	71.492	Bronze
061. Tan Wei-Tze Shawn	Singapore	71.087	Bronze
062. Szekeres Zsolt	Hungary	70.835	Bronze
063. Robert L. Jack	UK	70.744	Bronze
064. Jaak Suurpere	Estonia	70.719	Bronze
065. Per Hindborg Hemmingsen	Denmark	70.157	Bronze
066. Oliver Geoge Mailes	Australia	69.829	Bronze
067. Bengu Sezen	Turkey	69.641	Bronze
068. Mustafa Demirplak	Turkey	69.303	Bronze
069. Rodrigo M. Zapata-Zorza	Argentina	68.788	Bronze
070. Andrea Magro	Italy	68.761	Bronze
071. Pierre-Mayeul Badaire	France	68.749	Bronze
072. Salih Ozcubukcu	Turkey	68.538	Bronze
073. Mark James Abraham	Australia	68.527	Bronze
074. Irine Peng	New Zealand	68.415	Bronze
075. Bjorn Moden	Sweden	68.304	Bronze
076. Tomasz Zielinski	Poland	68.273	Bronze
077. Adam Sikora	Poland	68.179	Bronze
078. Elliot Waingold	USA	67.886	Bronze
079. Nagymate Emese	Hungary	67.835	Bronze
080. Lin Chi-Wang	Chinese Taipei	67.825	Bronze
081. Sebastian Klinke	Argentina	66.946	Bronze
082. Lubomir Flak	Slovakia	66.945	Bronze
083. Pornthep Meethunkih	Thailand	66.330	Bronze
084. Rossen Pavlov Apostolov	Bulgaria	66.190	Bronze
085. Lim Sangmin	Korea Republic	66.155	Bronze
086. Chirs Dams	The Netherlands	65.961	Bronze

087. Andres Zelcer	Argentina	65.897	Bronze
088. Maxxim Kryuchkov	Ukraine	65.761	Bronze
089. Boril Stefanov Tchernev	Bulgaria	65.659	Bronze
090. Park Kihyun	Korea Republic	65.650	Bronze
091. Konstantine Yunriviech Tchegeaev	Russia	65.590	Bronze
092. Jiri Franta	Czech Republic	65.493	Bronze
093. Ben Clark	New Zealand	64.940	Bronze
094. Christian Ingemann Mikkelsen	Denmark	64.753	Bronze
095. Gaetano Mangiapia	Italy	64.586	Bronze
096. Stavros Stavrakis	Cyprus Republic	63.442	Bronze
097. Christopher Mason	Canada	63.337	Bronze
098. Bartosz Dybowski	Poland	63.135	Bronze
099. Juris Fotins	Latvia	63.073	Bronze
100. Charnsak Thongsornkleeb	Thailand	62.934	Bronze
101. Petr Matousek	Czech Republic	62.384	Bronze
102. Mikkel Hindkaer Dahl	Denmark	62.240	Bronze
103. Yaroslav Filinchuk	Ukraine	61.270	Bronze
104. Constantine Katsanos	Greece	60.620	Bronze
105. Viatchislav Chtcherban	Russia	60.342	Bronze
106. Gary Michael Sawka	USA	60.124	Bronze
107. Tore August Kro	Norway	60.122	_____
108. Terence Ho Wai-Luen	Singapore	60.074	_____
109. Tomaz Maras	Slovenia	59.976	_____
110. Cho Chang-Ho	Korea Republic	59.826	_____
111. Ludovic Berthelot	France	59.535	_____
112. Emilia Kirilova Belemzova	Bulgaria	59.318	_____
113. Ruth Deboer	The Netherland	58.859	_____
114. Konstantin Pasichnichenko	Ukraine	58.859	_____
115. Hayden Callow	New Zealand	58.639	_____
116. Joel Torres Alacan	Cuba	58.037	_____
117. Daniel Puntener	Switzerland	57.610	_____
118. Martin Lersch	Norway	57.477	_____
119. Simon Brugger	Switzerland	57.090	_____
120. Jexandre Dimitrov Apostolov	Bulgaria	56.773	_____
121. Hsu Fong	Canada	56.703	_____
122. Christophe Schlicht	Switzerland	56.341	_____
123. Jose Luis Garcia-Ojeda	Mexico	55.695	_____
124. Raphael Robert Julia Bochlandt	Belgium	54.572	_____
125. Bjarte Hitland	Norway	54.439	_____
126. Hetly Jolink	The Netherlands	54.084	_____
127. Alexei Lulia	Estonia	53.586	_____
128. Andrew Baldwin	New Zealand	52.977	_____
129. Tobias Andersson	Sweden	52.863	_____
130. Daechapon Lersuwanaroj	Thailand	52.765	_____

131. Pranas Japertas	Lithuania	52.631	_____
132. Vesna Kroselj	Slovenia	52.312	_____
133. Eladio Arvelo	Venezuela	51.775	_____
134. Carlos Armando Quevedo-Lerma	Mexico	51.389	_____
135. Brandon McDonald	Canada	50.902	_____
136. Magnus Aberg	Sweden	50.730	_____
137. Ole Kristian Holen	Norway	50.596	_____
138. Janis Garancs	Latvia	49.729	_____
139. Edgars Liepins	Latvia	49.655	_____
140. Damjan Janes	Slovenia	49.629	_____
141. Arthur Jogi	Estonia	49.153	_____
142. Laurynas Riauba	Lithuania	47.896	_____
143. Grigorios Tanos	Greece	47.131	_____
144. Schmits Raphael	Belgium	46.630	_____
145. Prodromos Philippou	Cyprus Republic	46.351	_____
146. Janez Rifel	Slovenia	46.144	_____
147. Panayiotis Kyzas	Cyprus Republic	45.593	_____
148. Antti Niskanen	Finland	43.970	_____
149. Bougard Bruno	Belgium	43.532	_____
150. Helmars Smits	Latvia	43.004	_____
151. Nasos Charalanbides	Cyprus Republic	42.739	_____
152. Abdullah Husain	Kuwait	41.188	_____
153. Rachid Faouzi	Belgium	41.044	_____
154. Camilo Contreras	Venezuela	40.695	_____
155. Markku Ursin	Finland	38.325	_____
156. Emmanuel Trevino-Garza	Mexico	37.601	_____
157. Ioannis Galionis	Greece	36.804	_____
158. Theodoros Gegas	Greece	36.538	_____
159. Otto H. Seppala	Finland	26.324	_____
160. Amenah Al-Yousef	Kuwait	18.547	_____
161. Mutlaq Al-Sihan	Kuwait	17.441	_____
162. Niko S. Jaakkola	Finland	13.833	_____
163. Maha Al-Shmmari	Kuwait	3.482	_____

Delegation

No	Name	Theo.1	Theo.2	Theo.3	Theo.4	Theo.5	Theo.6	Thtotal	Pract.	total
full	points	10	10	10	10	10	10	60	40	100

Argentina

1. Carlos A. Figueroa

5.278	0.500	6.667	8.750	7.500	9.286	37.981	34.359	72.340
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2. Sebastian Klinke

6.111	2.500	6.667	6.875	5.278	4.643	32.074	34.872	66.946
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3. Rodrigo M. Zapata-Zorza

2.778	3.500	8.667	5.625	6.111	9.286	35.967	32.821	68.788
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4. Andres Zelcer

3.333	4.500	7.333	8.750	2.778	5.357	32.051	33.846	65.897
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Australia

1. Mark James Abraham

7.222	1.500	2.667	8.750	8.333	9.286	37.758	30.769	68.527
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2. Matthew Gilbert Heaton

7.778	3.000	6.000	10.00	5.000	6.786	38.567	35.897	74.464
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3. Julian Leon Huppert

8.333	6.500	10.00	9.375	7.778	6.071	48.057	29.744	77.801
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4. Oliver Geoge Mailes

6.111	4.000	10.00	6.250	5.556	7.143	39.060	30.769	69.829
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Austria

1. Katharina GAMMER

8.333	8.750	5.333	8.750	8.889	9.643	49.698	28.205	77.903
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2. Johannes SCHIMPL

7.222	4.500	10.00	10.00	8.333	7.857	47.912	35.385	83.297
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3. Reinhard ULLRICH

8.333	4.000	2.667	10.00	8.333	10.00	43.333	38.462	81.795
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4. Claudia ZIPPERLE

8.056	7.500	8.000	6.875	5.556	5.357	41.344	33.846	75.190
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Belgium

1. Bruno Bougard

1.111	4.000	6.000	1.875	4.722	4.286	21.994	21.538	43.532
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2. Raphael Schmits

5.000	2.000	0.667	1.250	4.444	2.500	15.861	30.769	46.630
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3. Raphael Robert Julia Bochlandt

2.500	1.500	4.667	8.750	6.111	6.429	29.957	24.615	54.572
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4. Rachid Fauzi

1.111	0.500	4.667	5.938	1.667	3.571	17.454	23.590	41.044
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Delegation

No	Name	Theo.1	Theo.2	Theo.3	Theo.4	Theo.5	Theo.6	Thtotal	Pract.	total
full	points	10	10	10	10	10	10	60	40	100

Bulgaria**1. Rossen Pavlov Apostolov**

6.111	1.500	4.667	7.813	5.000	5.714	30.805	35.385	66.190
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2. Boril Stefanov Tchernev

5.000	1.500	3.333	8.125	5.000	3.214	26.172	29.487	65.659
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3. Jexandre Dimitrov Apostolov

3.889	0.500	5.333	7.500	3.333	7.500	28.055	28.718	56.773
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4. Emilia Kirilova Belemezova

6.667	1.500	3.333	6.875	5.000	1.071	24.446	34.872	59.318
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Canada**Chun Fung Man**

8.889	10.000	4.000	8.750	7.222	2.857	41.718	30.256	71.974
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Christopher Mason

6.667	5.000	2.667	6.875	6.111	6.785	34.106	29.231	63.337
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Hsu Fong

5.833	5.000	4.000	8.438	5.556	4.286	33.113	23.590	56.703
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Brandon McDonald

6.667	2.000	1.333	3.750	6.667	5.357	25.774	25.128	50.902
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China**1. Chen Jingyang**

9.722	7.000	7.333	8.750	8.056	8.214	49.075	40.00	89.075
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2. Jiao Yuchen

9.444	10.00	7.333	9.375	7.778	7.857	51.787	37.949	89.736
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3. Luo Hongpeng

10.00	9.500	7.333	9.375	8.889	6.429	51.526	40.00	91.526
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4. Zhang Jianhui

10.00	10.00	7.00	10.00	6.667	9.643	53.310	40.00	93.310
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Chinese Taipei**WU Chia-Hung**

6.111	7.500	6.667	8.438	6.111	10.000	44.827	35.385	79.000
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YEH Kuo-Liang

7.222	4.000	8.667	8.438	6.667	9.643	44.637	34.359	80.212
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Lin Chi-Wang

7.500	4.000	4.000	6.250	6.111	7.143	35.004	32.821	67.825
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LIN Chih-Kai

6.389	4.000	8.000	6.875	6.111	8.214	39.589	36.410	76.000
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Cuba**Joel Torres Alacan**

7.778	3.500	4.667	6.250	3.333	0.714	26.242	31.795	58.037
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Delegation

No	Name	Theo.1	Theo.2	Theo.3	Theo.4	Theo.5	Theo.6	Thtotal	Pract.	total
full	points	10	10	10	10	10	10	60	40	100

Cyprus

Stavros Stavrakis

3.333	4.000	2.667	8.750	6.111	6.786	31.647	31.795	63.442
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Prodromos Philippou

7.222	1.250	2.667	8.750	2.222	3.214	25.325	21.026	46.351
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Panayiotis Kyzas

4.444	1.500	3.333	6.250	1.944	6.071	23.542	22.051	45.593
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Nasos Charalanbides

6.667	0.500	0.000	3.125	5.000	2.857	18.149	23.590	42.739
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Czech Republic

Jiri JANECEK

8.056	7.500	10.000	8.125	7.222	4.643	45.546	37.949	83.495
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Jiri Franta

5.278	4.000	3.333	6.875	5.000	3.571	28.057	37.436	65.493
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Petr Matousek

5.000	2.500	4.000	8.125	2.778	3.571	25.974	36.410	62.384
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Ludek MECA

7.500	9.500	10.000	8.438	8.333	4.286	48.057	40.000	88.057
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Denmark

Brian Schou RASMUSSEN

7.222	6.000	8.667	7.500	8.333	7.143	44.865	33.333	78.198
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Per Hindborg Hemmingsen

8.056	7.250	2.333	7.500	8.333	6.429	39.901	30.256	70.157
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Christian Ingemann Mikkelsen

7.500	7.500	4.000	8.125	3.333	2.500	32.958	31.795	64.753
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Mikkel Hindkaer Dahl

6.389	5.500	6.000	5.625	8.333	3.214	35.061	27.179	62.240
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Estonia

Ain Uustare

6.667	7.500	7.333	9.375	4.444	6.429	41.748	29.744	71.492
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Jaak Suurpere

6.667	7.500	9.333	9.063	7.222	7.857	47.642	23.077	70.719
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Alexei Lulia

6.111	4.500	2.667	2.500	2.222	0.714	18.714	34.872	53.586
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Arthur Jogi

3.056	0.500	6.667	3.750	2.222	3.214	19.409	29.744	49.153
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Delegation

No	Name	Theo.1	Theo.2	Theo.3	Theo.4	Theo.5	Theo.6	Thtotal	Pract.	total
full	points	10	10	10	10	10	10	60	40	100

Finland

Antti Niskanen										
	1.944	2.500	0.667	2.500	2.778	1.786	12.175	31.795	43.970	
Markku Ursin										
	1.944	2.500	0.667	5.000	5.000	3.214	18.325	20.000	38.325	
Otto H. Seppala										
	1.111	1.000	4.667	1.563	3.889	1.786	14.016	12.308	26.324	
Niko S. Jaakkola										
	0.556	0.000	0.000	1.250	4.444	1.429	7.679	6.154	13.833	

France

Daniel J. A. LATREMOLIERE										
	8.333	9.000	8.667	8.125	9.889	8.929	51.943	29.744	81.687	
Francois MARION										
	8.333	4.000	10.000	6.875	8.611	6.071	43.890	32.821	76.711	
Pierre-Mayeul Badaire										
	6.667	9.500	2.667	5.000	5.556	5.000	34.390	34.359	68.749	
Ludovic Berthelot										
	5.556	0.500	8.000	7.500	6.111	5.714	33.381	26.154	59.535	

Germany

Thomas BARK										
	8.889	4.000	4.667	10.000	6.667	9.286	43.509	39.487	82.996	
Thoralf KRAHL										
	8.889	8.500	10.000	10.000	9.444	6.429	53.262	24.615	77.877	
Moritz BORGMANN										
	8.333	9.000	2.667	6.250	7.222	10.000	43.472	32.821	76.293	
Ulf PETERS										
	8.611	7.500	9.333	6.250	5.278	6.789	43.761	31.282	75.043	

Greece

Constantine Katsanos										
	4.722	1.750	3.333	8.125	7.222	5.714	30.866	29.744	60.620	
Grigorios Tanos										
	1.389	2.500	2.667	6.250	4.444	3.214	20.464	26.667	47.131	
Ioannis Galionis										
	1.389	2.000	2.667	7.500	3.889	5.000	22.445	14.359	36.804	
Theodoros Gegas										
	1.111	1.000	2.667	8.125	8.333	6.071	27.307	9.231	36.538	

Delegation

No	Name	Theo.1	Theo.2	Theo.3	Theo.4	Theo.5	Theo.6	Thtotal	Pract.	total
full	points	10	10	10	10	10	10	60	40	100

Hungary**ROSTA Edina**

8.056	7.500	8.667	7.500	7.778	5.357	44.858	37.436	82.294
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Nagymate Emese

6.389	0.500	4.000	6.875	4.444	5.714	27.922	40.000	67.922
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BUNKOCZI Gabor

5.833	3.500	3.333	10.000	8.333	5.714	36.713	36.410	73.123
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Szekeres Zsolt

7.222	3.500	5.333	7.500	5.000	5.357	33.912	36.923	70.835
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Iran**SHAHAKBARI**

9.722	2.000	8.667	10.000	8.333	3.929	42.651	39.487	82.138
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KIANI Roozbeh

9.167	10.000	10.000	10.000	10.000	7.500	56.667	38.974	95.641
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JALALI Ali

10.000	6.000	10.000	10.000	8.889	7.500	52.389	40.000	92.389
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RAZZGHI Mehdi

8.333	7.000	10.000	9.375	7.222	8.571	50.501	40.000	90.501
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Italy**Gaetano Mangiapia**

6.111	9.000	4.667	5.000	5.000	2.500	32.278	32.308	64.586
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Luca ARGENTI

6.667	10.000	10.000	9.375	7.778	10.000	53.820	35.385	89.205
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Giovanni GIULIANO

9.444	5.500	4.667	9.375	7.222	6.429	42.637	36.410	79.047
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Andrea Magro

8.333	4.000	4.000	6.875	7.778	3.929	34.915	33.846	68.761
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Korea Republic**BAE Seung-Bin**

9.444	5.500	6.667	6.250	8.889	5.714	42.464	31.795	74.259
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Lim Sangmin

8.056	4.000	3.000	6.875	6.111	7.857	35.899	30.256	66.155
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Park Kihyun

5.833	3.500	5.333	6.875	7.222	7.143	35.906	29.744	65.650
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Cho Chang-Ho

6.944	3.000	5.333	6.875	5.000	8.571	35.723	24.103	59.826
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Delegation

No	Name	Theo.1	Theo.2	Theo.3	Theo.4	Theo.5	Theo.6	Thtotal	Pract.	total
full	points	10	10	10	10	10	10	60	40	100

Kuwait

Abdullah Husain

3.889	1.000	4.000	0.938	3.889	2.857	16.573	24.615	41.188
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Amenah Al-Yousef

2.500	0.000	0.000	0.000	2.778	2.500	7.778	10.769	18.547
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Mutlaq Al-Sihan

1.667	2.000	1.333	0.313	1.111	1.786	8.210	9.231	17.441
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Maha Al-Shmmari

0.833	0.000	0.000	0.000	1.111	0.000	1.944	1.538	3.482
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Latvia

Juris Fotins

3.889	2.000	6.667	6.250	5.000	2.857	26.663	36.410	63.073
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Janis Garancs

2.500	2.000	8.000	4.375	3.889	1.786	22.550	27.179	49.729
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Edgars Liepins

1.111	2.000	4.000	5.313	4.714	0.714	17.860	31.795	49.655
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Helmars Smits

3.611	1.500	5.333	5.938	4.167	1.429	21.978	21.026	43.004
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Lithuania

Eduardas GAIDAMAUSKAS

8.889	9.500	8.000	7.000	8.889	4.643	46.921	34.872	81.793
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Vilius PIGAGA

8.056	7.500	10.000	8.750	6.667	1.786	42.759	36.923	79.682
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Laurynas Riauba

2.778	1.000	3.333	7.500	8.889	2.857	26.357	21.539	47.896
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Pranas Japertas

4.167	5.000	2.667	7.500	5.000	2.143	26.477	26.154	52.631
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Mexico

Luis Ivan TUBERT-BROHMAN

5.833	9.000	5.333	8.125	5.556	6.071	39.918	39.487	79.405
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Jose Luis Garcia-Ojeda

3.611	1.250	6.667	6.875	4.444	4.643	27.490	28.205	55.695
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Carlos Armando Quevedo-Lerma

3.889	2.000	3.333	5.000	2.222	5.714	22.158	29.231	51.389
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Emmanuel Trevino-Garza

3.333	1.000	1.333	5.625	4.167	2.143	17.601	20.000	37.601
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Delegation

No full	Name	Theo.1 10	Theo.2 10	Theo.3 10	Theo.4 10	Theo.5 10	Theo.6 10	Thtotal 60	Pract. 40	total 100
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The Netherlands

Paul PEIJZEL

4.167	2.000	7.333	7.500	4.444	10.000	35.444	38.974	74.418
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Chirs Dams

8.056	0.750	5.333	10.000	5.000	9.643	38.782	27.179	65.961
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Ruth Deboer

4.722	0.000	8.000	8.750	6.387	5.357	33.218	25.641	58.859
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Hetly Jolink

1.944	0.500	6.000	5.625	3.889	5.357	23.315	30.769	54.084
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New Zealand

Irine Peng

7.778	5.000	3.333	8.125	6.111	6.786	37.133	31.282	68.415
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Hayden Callow

5.278	4.750	2.667	1.875	6.667	8.929	30.166	28.205	58.639
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Andrew Baldwin

6.111	4.500	2.667	5.000	6.667	3.929	28.874	24.103	52.977
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Ben Clark

6.944	4.250	2.000	7.500	5.556	5.357	31.607	33.333	64.940
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Norway

Tore August Kro

3.611	7.500	5.667	1.250	7.222	0.000	25.250	34.872	60.122
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Martin Lersch

1.944	3.500	6.667	5.000	5.000	3.571	25.682	31.795	57.477
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Bjarte Hitland

4.444	2.000	3.333	1.250	7.222	2.875	21.106	33.333	54.439
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Ole Kristian Holen

1.944	2.750	0.000	3.125	4.444	5.000	17.263	33.333	50.596
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Poland

Piotr LIPIEC

5.278	8.500	5.333	6.250	5.000	7.143	37.504	30.769	68.273
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Tomasz Zielinski

8.889	5.000	5.333	7.813	8.333	6.429	41.797	36.923	78.720
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Adam Sikora

6.667	4.500	9.333	3.125	7.778	8.571	39.974	28.205	68.179
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Bartosz Dybowski

5.556	6.500	2.667	8.125	2.778	5.714	31.340	31.795	63.135
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Delegation

No	Name	Theo.1	Theo.2	Theo.3	Theo.4	Theo.5	Theo.6	Thtotal	Pract.	total
full	points	10	10	10	10	10	10	60	40	100

Romania

Alexandru Ioan POPA

8.333	10.000	4.667	10.000	10.000	7.143	50.143	36.410	86.553
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Liviu MIRICA

8.889	9.000	10.000	9.375	8.056	10.000	55.320	23.590	78.910
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Stefan Alexandru CARP

6.389	6.500	6.000	8.750	8.333	6.071	42.043	38.974	81.017
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Leonard MADA

7.778	7.500	10.000	9.063	8.333	5.000	47.674	38.462	86.136
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Russian Federation

Mikhail SEREBRIAKOV

9.444	7.000	4.000	10.000	6.667	6.071	43.182	40.000	83.182
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Viatchislav Chtcherban

5.833	9.000	2.667	5.000	6.111	2.500	31.111	29.231	60.342
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Igor A GARIEV

9.722	8.500	10.000	8.750	6.667	5.714	49.353	38.974	88.327
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Konstantine Yurievich Tchegaev

6.667	4.250	4.667	9.063	6.667	6.071	37.385	28.205	65.590
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Singapore

1. Choy Dawen

10.000	7.500	5.333	10.000	7.222	7.500	47.555	37.436	84.991
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2. Ho Wai-Luen Terence

6.944	3.000	3.333	8.750	5.556	4.286	31.869	28.205	60.074
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3. Tan Say Lock

8.056	7.000	7.000	8.125	7.222	6.071	43.474	29.231	72.705
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4. Tan Wei-Tze Shawn

8.611	2.000	5.333	4.688	3.889	9.643	34.164	36.923	71.087
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Slovakia

1. Martin WALKO

6.111	3.500	7.333	7.500	6.667	9.643	40.754	36.410	77.164
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2. Lubomir Flak

4.444	3.500	4.667	8.750	5.556	4.643	31.560	35.385	66.945
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3. Ladislav KISS

6.389	9.000	4.667	8.125	6.944	9.643	44.768	39.487	84.255
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4. Vladimir VEGH

6.389	4.500	6.667	8.438	5.556	9.643	41.193	35.385	76.578
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Delegation

No	Name	Theo.1	Theo.2	Theo.3	Theo.4	Theo.5	Theo.6	Thtotal	Pract.	total
full	points	10	10	10	10	10	10	60	40	100

Slovenia

1.	Vesna Kroselj	5.556	3.000	4.000	5.000	5.278	1.786	24.620	27.692	52.312
2.	Tomaz Maras	5.556	4.000	8.667	8.750	6.667	4.286	37.925	22.051	59.976
3.	Janez Rifel	4.444	0.500	0.667	5.625	5.000	7.857	24.093	22.051	46.144
4.	Damjan Janes	1.667	3.250	2.667	4.375	3.889	2.500	18.347	31.282	49.629

Sweden

1.	Tobias Andersson	2.222	1.500	3.333	3.750	5.556	2.143	18.504	34.359	52.863
2.	Anders LOGG	8.333	2.000	3.333	6.875	8.333	7.857	36.732	37.436	74.168
3.	Bjorn Moden	8.056	4.000	6.000	5.313	6.667	7.500	37.732	30.769	68.304
4.	Magnus Aberg	6.111	3.500	2.333	2.500	4.444	1.071	19.960	30.769	50.730

Switzerland

	Wendelin STARK	8.889	8.500	2.667	8.750	7.222	8.214	44.242	36.923	81.165
	Christophe Schlicht	3.333	7.500	3.333	1.875	5.556	5.000	26.597	29.744	56.341
	Simon Brugger	5.833	2.000	2.667	7.500	5.556	0.714	24.270	32.820	57.090
	Daniel Puntener	3.333	2.000	2.667	5.313	6.944	6.071	26.328	31.282	57.610

Thailand

	Wichet PHOTHIWISUTWATHEE	8.611	5.500	8.000	6.250	8.889	5.714	42.964	34.872	77.836
	Pornthep Meethunkih	6.389	5.000	6.000	7.500	4.444	5.714	35.048	31.282	66.330
	Charnsak Thongsornkleeb	7.222	3.000	3.333	6.250	7.222	8.214	35.242	27.692	62.934
	Daechapon Lersuwanaroj	6.111	5.000	2.000	8.125	1.667	6.786	29.688	23.077	52.765

Delegation

No	Name	Theo.1	Theo.2	Theo.3	Theo.4	Theo.5	Theo.6	Thtotal	Pract.	total
full	points	10	10	10	10	10	10	60	40	100

Turkey

Rahmi ILKILIC

8.889 7.000 8.667 9.375 8.889 6.429 49.248 27.692 76.940

Bengu Sezen

8.333 5.750 8.000 10.000 8.611 5.357 46.052 23.590 69.641

Mustafa Demirplak

6.944 2.500 8.000 10.000 6.667 7.500 41.611 27.692 69.303

Salih Ozcubukcu

68.538

UK

Philip M. GRANT

8.611 6.500 4.000 10.000 8.333 9.286 46.730 35.385 82.115

Julian M. L. BEAN

6.944 9.500 8.000 5.625 6.111 6.429 42.609 37.949 80.558

Robert L. Jack

8.333 4.000 4.000 7.500 8.889 5.714 38.437 32.308 70.744

Ian CUMPSTEY

3.889 2.000 7.333 6.250 8.056 8.571 36.099 37.436 73.535

Ukraine

Anton SAMOTEYKIN

6.667 4.000 4.000 8.750 6.667 2.857 32.940 32.821 65.761

Maxim Kryuchkov

5.000 5.750 4.667 6.250 7.222 5.714 34.603 26.667 61.270

Yaroslav Filinchuk

8.889 9.500 2.000 8.750 6.667 5.714 41.520 36.410 77.930

Konstantin Pasichnichenko

3.889 2.500 2.667 8.750 5.000 2.500 25.306 33.333 58.859

USA

Jason WONG

8.056 4.000 5.000 8.750 7.222 5.357 38.385 38.462 76.846

Elliot Waingold

7.778 2.000 2.333 8.125 7.778 5.000 33.014 34.872 67.886

Gary Michael Sawka

6.111 3.000 4.000 6.250 6.111 2.857 28.329 31.795 60.124

Prashant MISHRA

7.778 7.500 5.333 8.750 6.111 6.786 42.258 30.769 73.027

Venezuela

Eladio Arvelo

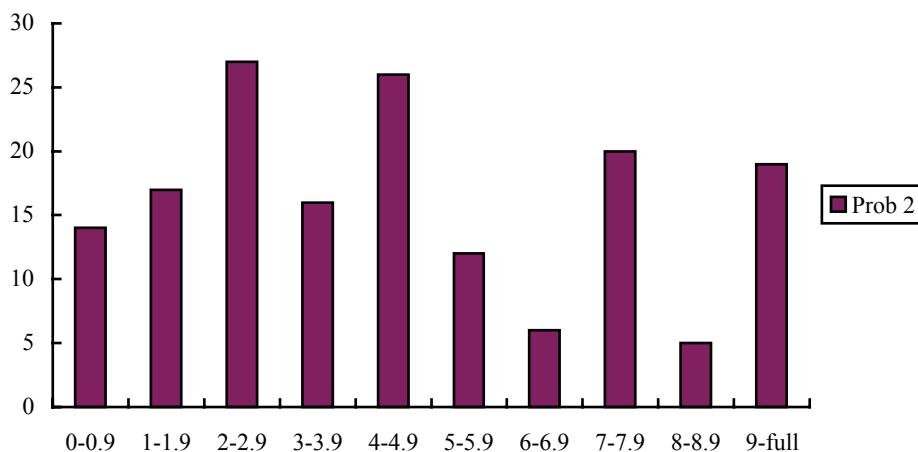
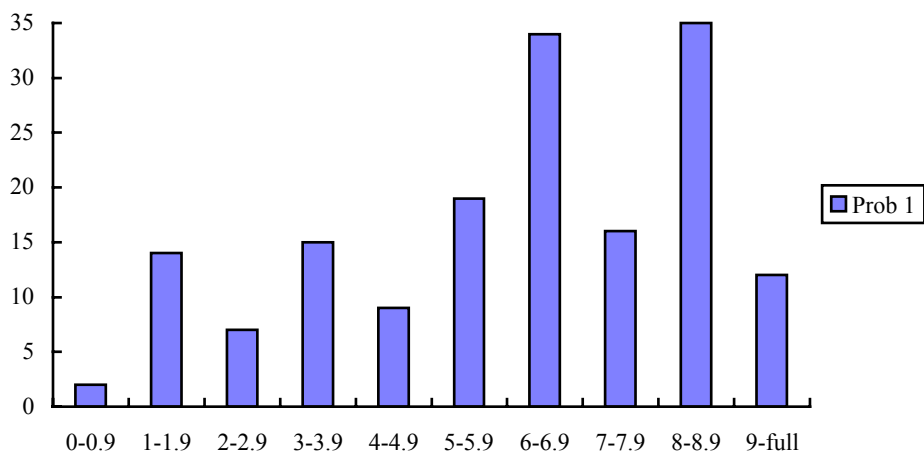
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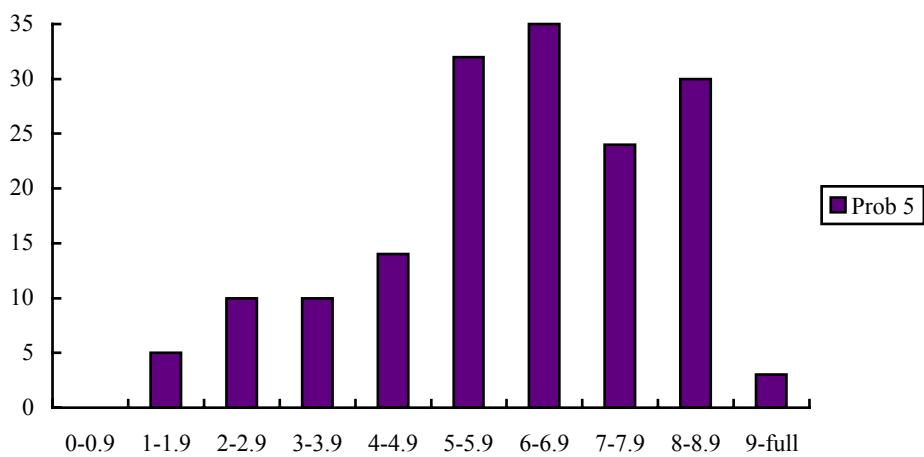
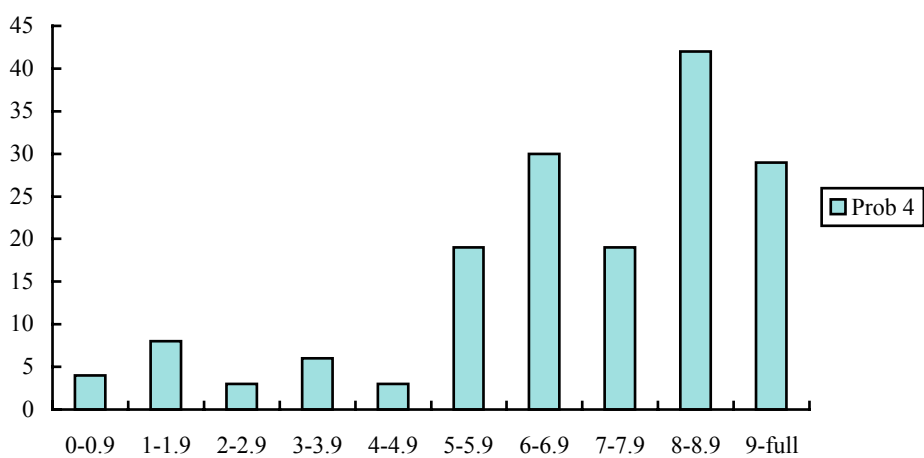
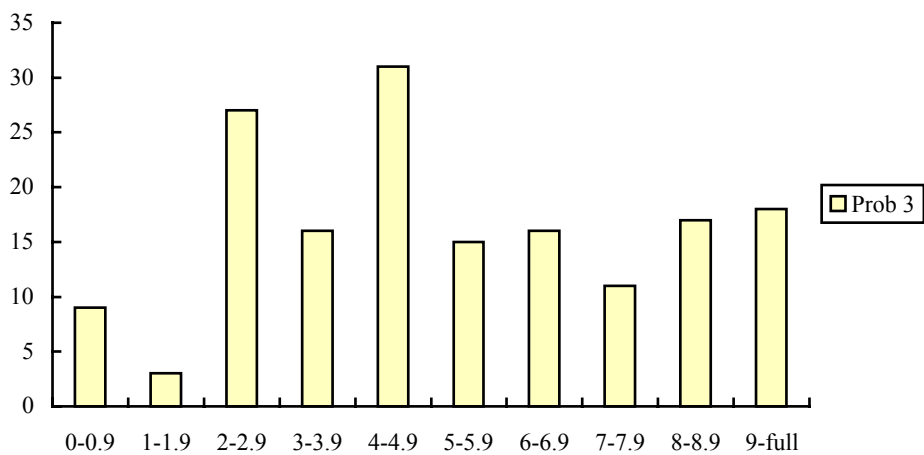
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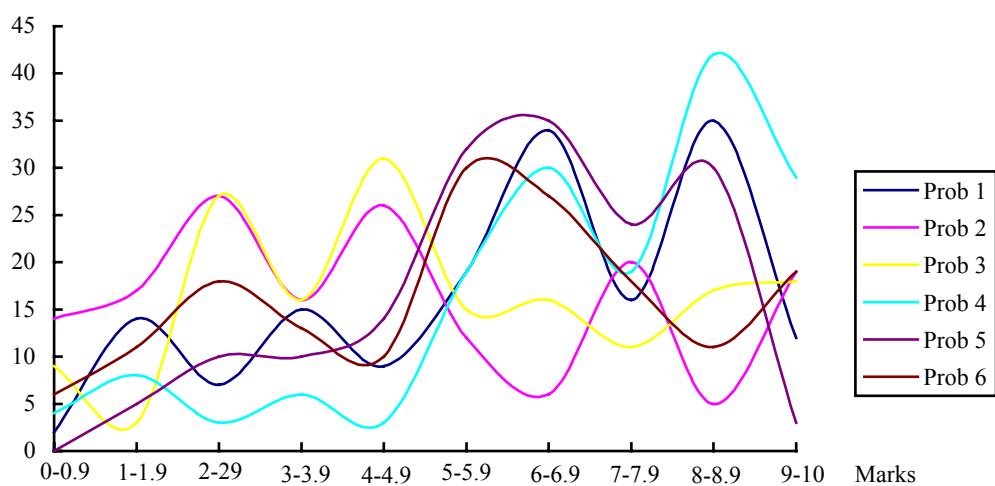
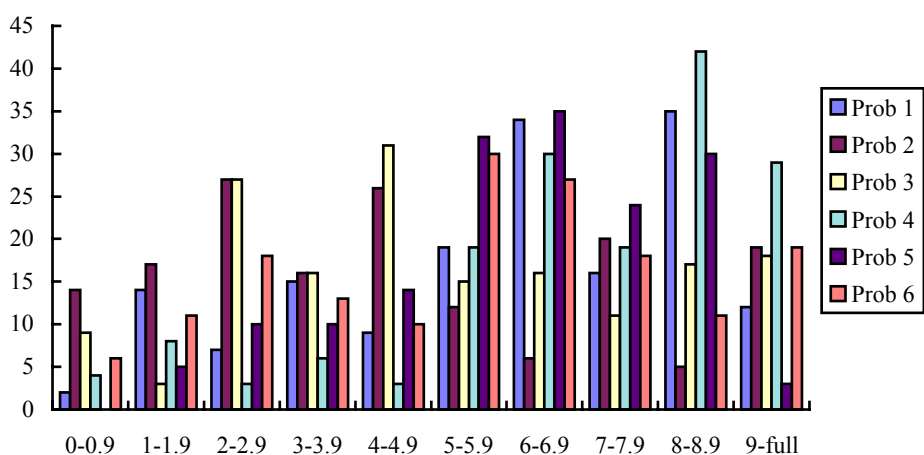
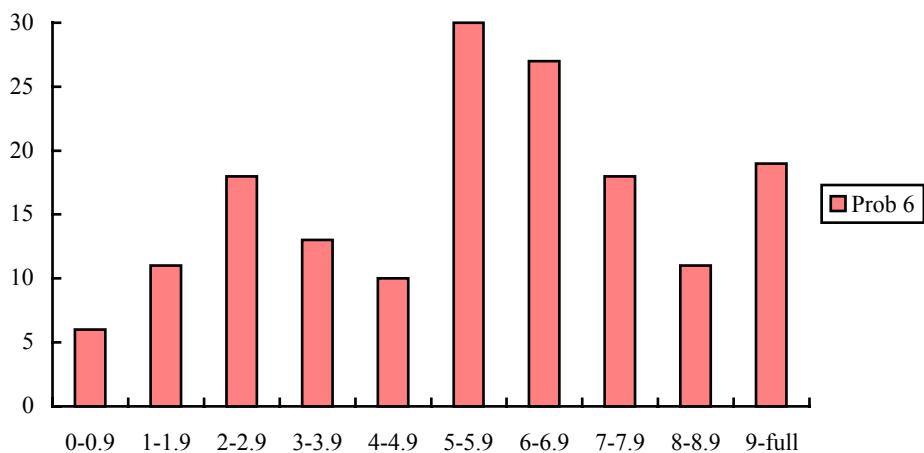
Statistic Figures of the 27th IChO Competitors' Response Results

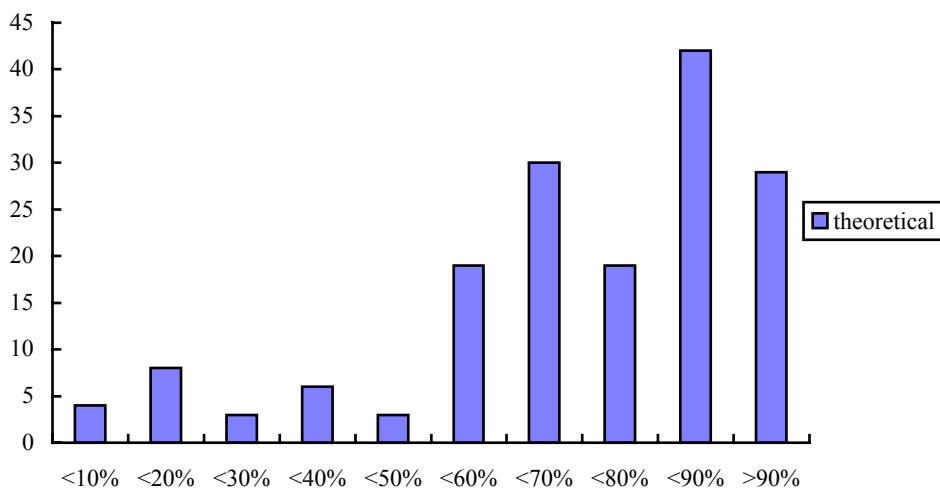
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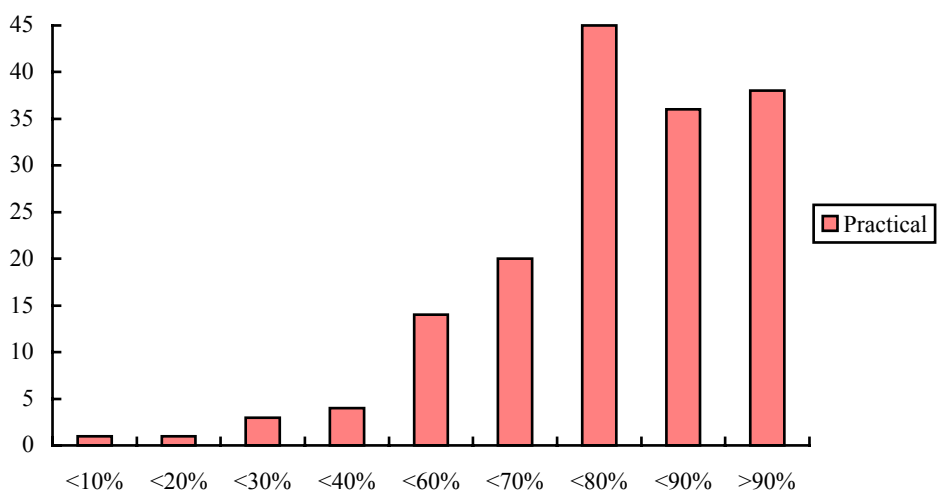
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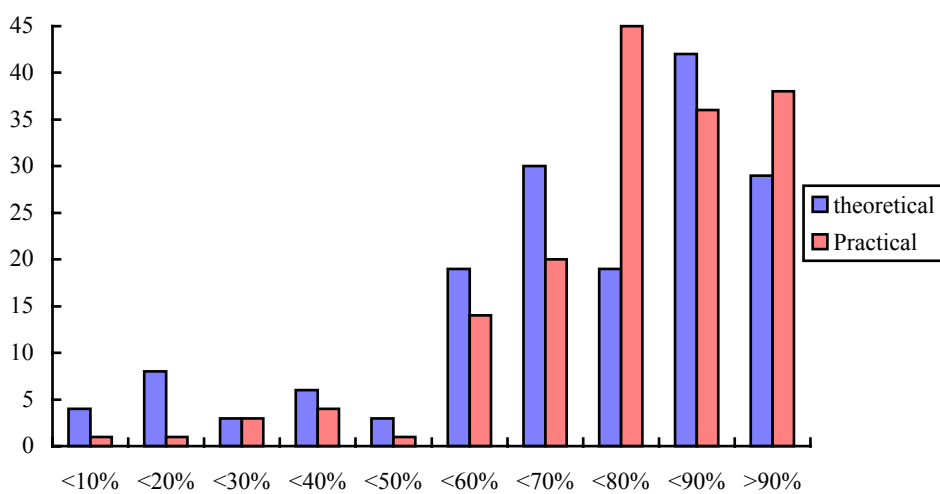


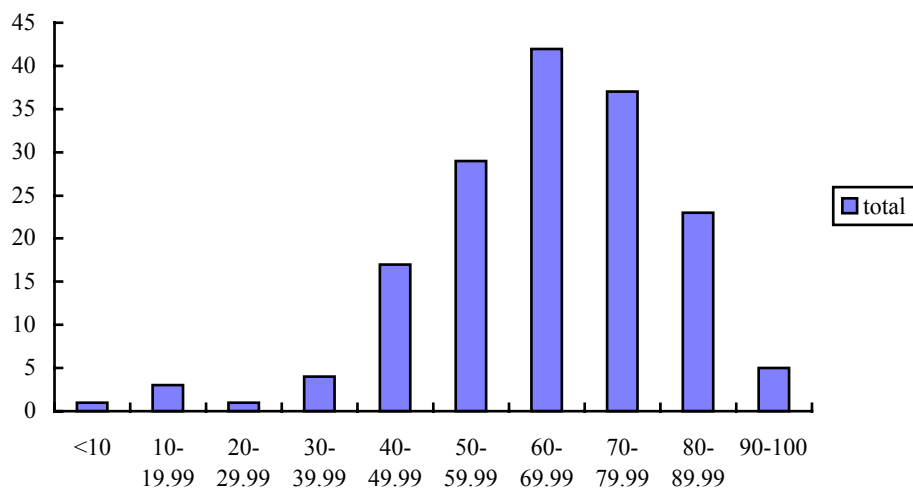


Practical Problem:



Total:





edited by WU Guo-Qing
e-mail: guoqing_wu@21cn.com
Dec. 1995.