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 Universty
13:00 Reception at SHAO YUAN Gusest 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 Fragant 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, 1955

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 Depature 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, 1955

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.

***A*r 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

H_2SO_4 (conc.)	**H_2SO_4 (6 mol·dm^{-3})**
HNO_3(conc.)	**HNO_3 (6 mol·dm^{-3})**
HCl(conc.)	**HCl (6 mol·dm^{-3})**
$Ba(OH)_2$(satd.)	**NaOH (6 mol·dm^{-3})**
$BaCl_2$(0.5 mol·dm^{-3})	**$Ba(NO_3)_2$(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

NH_4Cl, $(NH_4)_2SO_4$, $NaNO_3$, $MgCl_2$, Na_2SO_4

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 [$Cu(gly)_2 \cdot xH_2O$]

Copper(II) amino acidate coordination compounds are monometric 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:

$CuSO_4 \cdot 5H_2O$(s)
$NH_3 \cdot H_2O$(3 mol·dm^{-3})
glycine(s)
95% ethanol,
acetone
NaOH(2 mol·dm^{-3})
$BaCl_2$(0.5 mol·dm^{-3})

Desk equipments

beaker 250 cm^3 ×4
graduated cylinder 100cm^3 ×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 $CuSO_4 \cdot 5H_2O$ (6.0 g) in 40 cm^3 of water with a 250 cm^3 beaker as a container.

(2) Add slowly 3 mol·dm^{-3} ammonia solution to the $CuSO_4$ 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 $Cu(OH)_2$ for the preparation of $Cu(gly)_2 \cdot xH_2O$.

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 $Cu(OH)_2$ 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 $Cu(gly)_2 \cdot xH_2O$

The Cu(II) content in $Cu(gly)_2 \cdot xH_2O$ 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 $Cu(gly)_2 \cdot xH_2O$.

Reagents

Standard KIO_3 (see the label on the bottle to get the accurate concentration)
H_2SO_4(1.0 mol ·dm^{-3}) as indicator.
KI(0.6 mol ·dm^{-3})
KSCN(2 mol ·dm^{-3})
Starch(0.5%)
$Na_2S_2O_3$ (to be standardized)

Desk equipments

buret 50cm^3 ×1
pipette 25cm^3 ×1
pipette bulb
beakers (dry) 100cm^3 ×2
volumetric flask 100cm^3 ×1
Erlenmeyer flask 250 cm^3 ×3
graduated cylinder 10cm^3 ×3, 100cm^3 ×1
wash bottle
single pan balance (shared)
hot water bath (shared)

Procedure

1. Standardization of $Na_2S_2O_3$ 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 mol·dm^{-3}) to the flask.
(3) Titrate immediately with $Na_2S_2O_3$ 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 parallely.

2. Determination of Cu(II) content in $Cu(gly)_2 \cdot xH_2O$

(1) Weigh 1.0—1.2 g (precision of ±0.0002 g) of $Cu(gly)_2 \cdot xH_2O$ 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 $mol \cdot dm^{-3}$).

(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 $Na_2S_2O_3$ 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 $Cu(OH)_2$.

2. Mass of $Cu(gly)_2 \cdot xH_2O$ = (g)

Percent yield

The expression for calculation

Name

Student's No.

Delegation

Student's Report for Practical
Problem III

1. Standardization of $Na_2S_2O_3$ Solution

1) The two equations for chemical reactions taking place during the standardization of $Na_2S_2O_3$.

i

ii.

(2) Volumes of $Na_2S_2O_3$ Solution

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

V(mean value)= cm^3

(3) Concentration of $Na_2S_2O_3$= mol·dm^{-3}

Expression for the calculation:

2. Determination of Cu(II) in $Cu(gly)_2 \cdot xH_2O$

(1) Chemical equation for the reaction between Cu^{2+} and I^-

(2) Mass of $Cu(gly)_2 \cdot xH_2O$ = g

3) Volumes of $Na_2S_2O_3$ solution

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

***V*(mean value)= cm^3**

(4) Mass % of Cu(II) in $Cu(gly)_2 \cdot xH_2O$ = %
Expression for the calculation:

(5) *X* Value in $Cu(gly)_2 \cdot xH_2O$

X **= (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

I $2\ NH_4Cl+Ba(OH)_2=BaCl_2+2NH_3\cdot H_2O$

or $NH_4^++OH^-=NH_3\cdot H_2O$

ii $(NH4)_2SO_4+Ba(OH)_2=2NH_3\cdot H_2O+BaSO_4\downarrow$

or $2NH_4^++SO_4^{2+}+Ba^{2+}+2OH^-=2NH_3\cdot H_2O+BaSO_4\downarrow$

iii $MgCl_2+Ba(OH)_2=BaCl_2+Mg(OH)_2\downarrow$

or $Mg^{2+}+OH^-=Mg(OH)_2\downarrow$

iv $Na_2SO_4+Ba(OH)_2=2NaOH+BaSO_4\downarrow$

or $SO_4^{2-}+Ba^{2+}=BaSO_4\downarrow$

Step two

$NH_3+HCl=NH_4Cl$

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)

$Cu^{2+} + 4NH_3 = Cu(NH_3)_4^{2+}$

$Cu(NH_3)_4^{2+} + 2OH^- = Cu(OH)_2 + 4NH_3$

one pt for one correct equation

2. Mass of $Cu(gly)_2 \cdot xH_2O$ = (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 $Na_2S_2O_3$ solution (10 pts)

(1) The two equations for chemical reactions taking place during the standardization of $Na_2S_2O_3$. (2 pts)

i $IO_3^- + 5I^- + 6H^+ = 3I_2 + 3H_2O$

or $8I^- + IO_3^- + 6H = 3I_3^- + 3H_2O$

ii $I_2 + 2S_2O_3^{2-} = 2I^- + S_4O_6^{2-}$

or $I_3^- + 2S_2O_3^{2-} = 3I^- + S_4O_6^{2-}$

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

(2) Volumes of $Na_2S_2O_3$ solution (4 pts)

V_1= cm^3 V_2= cm^3

V_3= cm^3

***V*(mean value)= cm^3**

1 pt for correct significant figures

3 times of titration (1 pt)

two or one titration (0 pt)

precision ≤ 0.04 cm^3 (2 pts)

(maximum-minimum)

0.04 cm^3 < precision ≤0.08 cm^3 (1 pt)

(3) Concentration of $Na_2S_2O_3$ $mol \cdot dm^{-3}$ (4 pts)

correct significant figures (1 pt)

error ±0.00015 — ±0.00020 $mol.dm^{-3}$ (3 pts)

±0.00021 — ±0.00025 $mol.dm^{-3}$ (2 pts)

±0.00026 — ±0.00030 $mol.dm^{-3}$ (1 pt)

2. Determination of Cu(II) in $Cu(gly)_2 \cdot xH_2O$ (10 pts)

(1) Chemical equation for the reaction between Cu^{2+} and I^-

$2Cu^{2+} + 4I^- = 2CuI + I_2$ (1 pt)

(2) Mass of $Cu(gly)_2 \cdot xH_2O$ = g (1 pt)

(3) Volumes of $Na_2S_2O_3$ (4 pts)

correct significant figures (1 pt)

3 times of titration (1 pt)

precision ≤ 0.04 cm^3 (2pts)

0.04cm^3<precision≤0.08cm^3 (1pt)

(4) Mass % of Cu^{2+} in $Cu(gly)_2 \cdot xH_2O$ =27.66%(Theo.) (1 pt)

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

(5) Calculation of x in $Cu(gly)_2 \cdot xH_2O$ (4 pts)

x = 1.00 (Theo.)

the ranges of x:

1.00±(0.00 — 0.10) (4 pts)

1.00±(0.11 — 0.15) (3 pts)

1.00±(0.16 — 0.20) (2 pts)

1.00±(0.21 — 0.25) (1 pts)

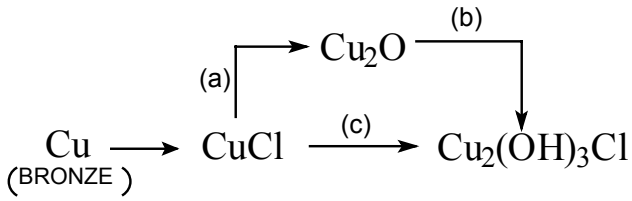
Theoretical Problems

Notes:

Give your solutions and answers only on the answer sheets.
Begin, when the bell rings.
The total time for you is 5 hours.

Problem 1

1. Excavated Chinese ancient bronze musical instrument, carillon, was covered entirely by rust. Chemical analysis showed that the rust contains CuCl, Cu_2O and $Cu_2(OH)_3Cl$. Simulation experiments showed that CuCl was formed first under the action of both air and Cl^- containing aqueous solution and then $Cu_2(OH)_3Cl$ produced through the following two different ways:



Given the molar standard formation Gibbs free energies of the species concerned, answer the following questions:

Species	$Cu_2O(s)$	$CuO(s)$	$CuCl(s)$	$Cu_2(OH)_3Cl(s)$	$Cl^-(aq)$	$OH^-(aq)$	$H_2O(l)$
$\frac{\Delta_f G_m^{\ominus}(298K)}{kJ\cdot mol^{-1}}$	–146	–130	–120	–1338	–131	–157	–237

i) Write balanced equations for reactions (a), (b) and (c).

ii) Calculate the molar standard Gibbs free energy $\Delta_r G_m^{\ominus}(298K)$ for reactions (a), (b) and (c).

iii) Decide the spontaneous direction of reaction (a) in air through calculation, when $T = 298K$, $C_{HCl} = 1.0\times10^{-4}$ mol·dm^{-3}.

2. Rate constants k_c for reaction (c) were measured at various temperatures in a simulation experiment in order to obtain its kinetic parameters. On the basis of the data given below, answer the following questions.

t/°C	25	40
k_c / mol·dm^{-3}·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, $Cu_{(1)}$ and $Cu_{(2)}$. $Cu_{(1)}$ was then hammered so that $Cu_{(1)}$ and $Cu_{(2)}$ are different in certain thermodynamic properties.

i) An electromotive cell with $Cu_{(1)}$ and $Cu_{(2)}$ was designed as $Cu_{(1)}|CuSO_4(aq)|Cu_{(2)}$ and the electromotive force E of the above cell was expressed as $E = \phi_R - \phi_L$, 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

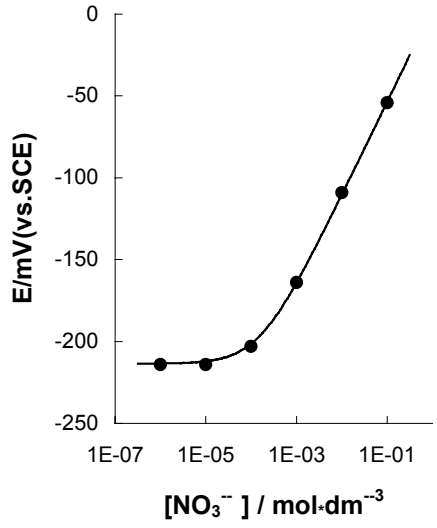
ii) Write the net cell reaction for the cell.

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 Cu_xZn_{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 g·cm^{-3}. Calculate the radius of the statistical atoms in the alloy.

Given: A_r (Cu) = 63.5, A_r (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 mol·dm^{-3} K_2SO_4, 1.0×10^{-3} mol·dm^{-3} H_2SO_4 and 2.6×10^{-3} mol·dm^{-3} 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:

$$K_{NO_3^-,Cl^-}=\frac{C_{NO_3^-}}{C_{Cl^-}}=4.9\times10^{-2};\qquad K_{NO_3^-,SO_4^{2-}}=\frac{C_{NO_3^-}}{C_{SO_4^{2-}}^{1/2}}=4.1\times10^{-3};\qquad K_{NO_3^-,ClO_4^-}=\frac{C_{NO_3^-}}{C_{ClO_4^-}}=1.0\times10^{-3}$$

where the units of the concentrations are in mol·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 1.40×10^{-3} mol·dm^{-3} NO_3^- and 1.60×10^{-2} mol·dm^{-3} 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 cm^3 sample solution, the electric potential, *E*, is measured to be –160 mV. After adding 1.00 cm^3 0.100×10^{-2} $mol\cdot dm^{-3}$ NO_3^- standard solution to the above solution, *E* changes to –130 mV. Find the pNO_3 of the serum.

4. The selective coefficient of CH_3COO^- versus NO_3^- is $K_{NO_3^-,CH_3COO^-} = 2.7\times10^{-3}$. If $AgCH_3COO$ instead of Ag_2SO_4 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.

$K_{sp(AgCl)} = 3.2\times10^{-10}$ $K_{sp(Ag_2SO_4)} = 8.0\times10^{-5}$

$K_{sp(AgCH_3COO)} = 8.0\times10^{-3}$ $K_{a(CH_3COOH)} = 2.2\times10^{-5}$

$A_r(N) = 14.00$

Problem 3

1,3-Dihydroxyacetone can be converted to glyceraldehyde. On standing this glyceraldehyde changes spontaneously into a six member cyclic dimer $C_6H_{12}O_6$. 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.

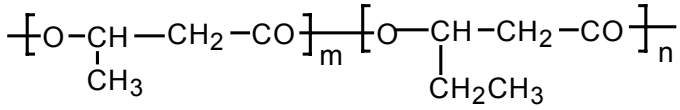
1. PHB, Poly(3-hydroxybutanoic acid), produced by bacteria contains only (R)-HB repeating units, while that synthesized by polymer chemists may contain only (R)-HB or only (S)-HB or both (R)-and (S)-HB in an alternating manner or both but in random distributions. Sketch chain structures of the atactic 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:



Rationalize the result.

(*Note: two different monomers are needed for the formation of the copolymer. The letters* m *and* n *in the structural formula are numbers of the units and have nothing to do with the answer, in other words, you may leave them out in your answer.*)

Problem 5

The action of nitric oxide upon human body is dual. The nitric oxide generated in nerve cells will damage the cells, while the nitric oxide generated in endothelial cells of blood vessels can relax the vessels and control blood pressure.

1. Indicate the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO) of NO molecule using one of symbols π, σ, π^* or σ^*, and indicate the electron(s) residing in the corresponding orbital using symbols $\uparrow$ and/or $\downarrow$.

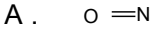
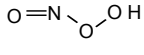
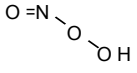
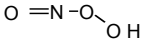
2. The relaxation of blood vessels is caused by a series of changes which are mediated by the coordination of NO molecule to iron ion, the latter being a component of an enzyme containing heme. It was known that the coordinated NO behaves as CO molecule (isoelectronic), which one of the following species really exists in the iron complex?

A. NO B. NO^+ C. NO^-

3. The cell damage is caused by free radical OH, which is one of the product of reaction between O_2^- and NO:

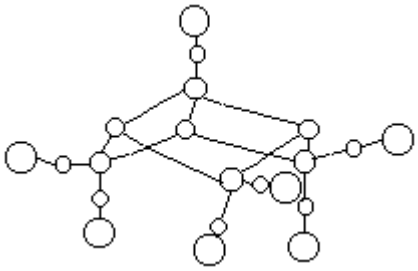
$$O_2^- + NO + H^+ \rightarrow HNO_3 \rightarrow NO_2 + OH$$

in which an intermediate with composition of HNO_3 is evolved. HNO_3 is a weak acid. Choose the structural formula with correct bond angles for the intermediate.

A.  B.  C.  D. 

4. For preservation of meat, sodium nitrite is usually added and as a result NO is, then, formed. Consequently, NO reacts with the sulfur and iron atoms from

decomposition of proteins, forming $[Fe_4S_3(NO)_7]^-$. 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 → left → 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. $[Fe_4S_3(NO)_7]^-$ anion can be reduced and a new complex $[Fe_2S_2(NO)_4]^{2-}$ is formed which contains a cyclic structure unit of Fe_2S_2.

i) Write the structural formula for the anion $[Fe_2S_2(NO)_4]^{2-}$.

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

iii) $[Fe_2S_2(NO)_4]^{2-}$ can be converted into $[Fe_2(SCH_3)_2(NO)_4]^n$, a carcinogen. Which of the following three species is added to $[Fe_2S_2(NO)_4]^{2-}$: CH_3^+, $\bullet CH_3$ 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.

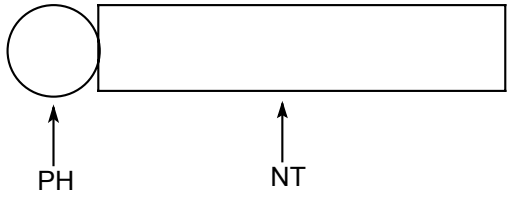


Fig. 11.

1. AOT is a surfactant. Its systematic name (IUPAC name) is sulfobutanedioic acid 1,4-bis-(2-ethylhexyl) ester sodium salt (formula $C_{20}H_{37}NaO_7S$).

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.

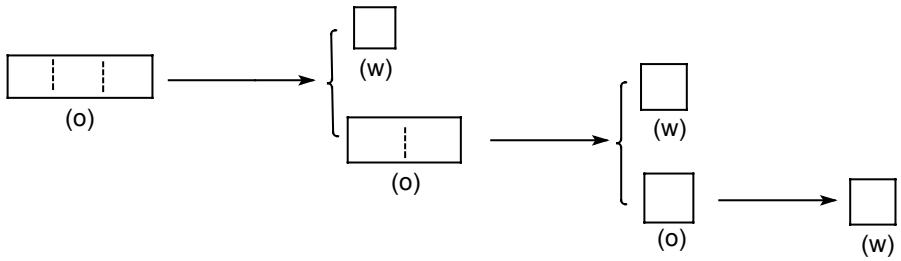


Fig. 2

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) **ii)** **(1. total 6 points)**

chemical equation	$\frac{\Delta_f G_m^\ominus(298K)}{kJ\cdot mol^{-1}}$
a) $2CuCl_{(s)} + H_2O_{(l)} = Cu_2O_{(s)} + 2H^+_{(aq)} + 2Cl^-_{(aq)}$	**69**
b) $Cu_2O_{(s)} + 1/2O_{2(g)} + H_2O_{(l)} + H^+_{(aq)} + Cl^-_{(aq)} = Cu_2(OH)_3Cl_{(s)}$	**– 824**
c) $2\,CuCl_{(s)} + 1/2O_{2(g)} + 2H_2O_{(l)} = Cu_2(OH)_3Cl_{(s)} + H^+_{(aq)} + Cl^-_{(aq)}$	**– 755**

i) 2 points

ii) 2 points

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

$$\Delta_r G_m(298K) = \Delta_r G_m^\ominus(298K) + 2RT\ln[C_{H^+}/C_{H^+}^\ominus \cdot C_{Cl^-}/C_{Cl^-}^\ominus]$$

$$= -22.3\ kJ\ mol^{-1} < 1$$

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 kJ· mol^{-1}** **+ 1 point**

ii) overall reaction order = 0 **ii) 1 point**

when $bp_{O2} \gg 1$, $r = k_c\theta = \frac{k_c bP_{O_2}}{1 + bP_{O_2}}$ **;** $r = k_c$**, zero order** **+ 1 point**

3. **i) (C)** $E > 0$ **(3. total 3 points)**

ii) Net cell reaction: **i) 1 point**

$Cu_{(1)} = Cu_{(2)}$

Thermodynamic reason for choosing 3 (C) is

$\Delta_r G_m < 0$, $\Delta_r G_m = -nFE$ $\therefore E > 0$ **ii) 2 points**

4. $r = 1.30\times10^{-10}$ **m(4. total 4points)**

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

$$d = \frac{4(63.5\times0.75 + 65.4\times0.25)\times10^{-3}}{a^3 N_A}$$ **1.5 points**

$$= 8.51\times10^{-3}\,kg\cdot m^{-3}$$

$r^3 = 2.209\times10^{-30}$ **m^3** **1 point**

$r = 1.30\times10^{-10}$ **m** **0.5 point**

total (17 points)

Problem 2 (total 20 points)

1. A 1 point

2. B 2 points

$(1.4\times10^{-3}\times0.01)\div[Cl^-] = 4.9\times10^{-4}$ mol·dm^{-3},

$[Cl^-] = 2.9\times10^{-4}$ mol·dm^{-3} 1 point

Excess $[Cl^-] = 1.6\times10^{-2} - 2.9\times10^{-3}$

$\cong 1.6\times10^{-2}$ mol·dm^{-3} 1 point

To reduce the interference of Cl^-, at least 1.6×10^{-2} mol Ag^+ ion,

or 8.0×10^{-3} Ag_2SO_4 has to be added to 1 dm^3 sample solution.

1 point

(2. total 5 points)

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

2 points

$0.03 = 0.059$ lg $[(25.00\ V_X + 0.10)\div(26.00\times C_X)]$ 1 point

$C_X = 1.7\times10^{-3}$ mol·dm^{-3} 1 point

$pNO_3 = 2.77$ 1 point

(3. total 5 points)

4. pH = 4.4 1 point

$(1.4\times10^{-3}\times x)\div1.6\times10^{-2} = 2.7\times10^{-3}$ 2 points

$x = 3.1\% > 1\%$ 1 point

$(1.4\times10^{-3}\times0.01)\div[CH_3COO^-] = 2.7\times10^{-3}$ 1 point

$[CH_3COO^-] = 5.2\times10^{-3}$ mol·dm^{-3} 1 point

$1.6\times10^{-2} - 5.2\times10^{-3} = 1.08\times10^{-2}$ mol·dm^{-3} 1 point

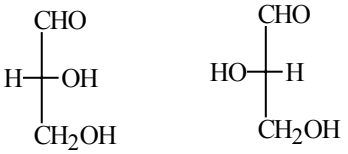
$\{[H^+]\times5.2\times10^{-3}\}\div(1.08\times10^{-2}) = 2.2\times10^{-5}$ 1 point

$[H^+] = 4.3\times10^{-5}$ mol·dm^{-3} 1 point

pH = 4.4 (4. total 9 points)

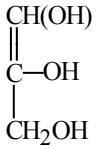
Problem 3 (total 15 points)

1.



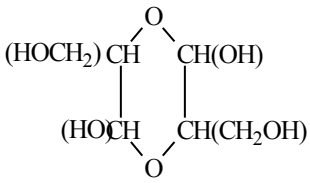
D(+) L(-)
1 point 1 point

2.



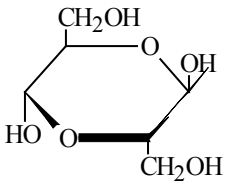
2 points

3.

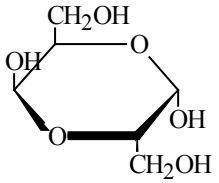


3 points

4.

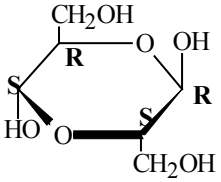


2 points

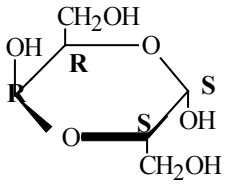


2 points

5.



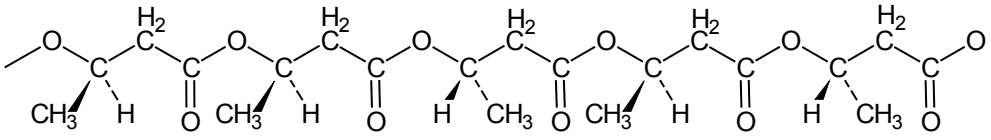
2 points



2 points

Problem 4 (total 16 points)

1. Atactic PHB:



(S) (S) (R) (S) (R)

1 point

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

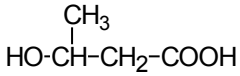
RSRRS, SRSSR, RRSRS, etc.

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

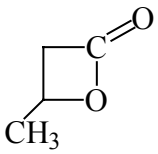
(ref. Preparatory Problem 52)

2. Monomer 1

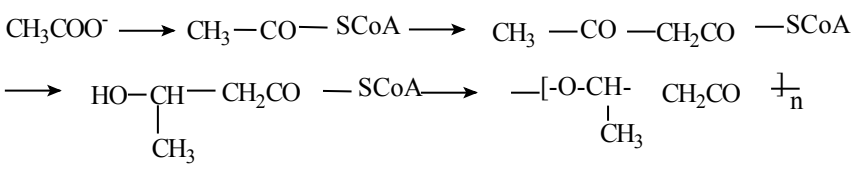


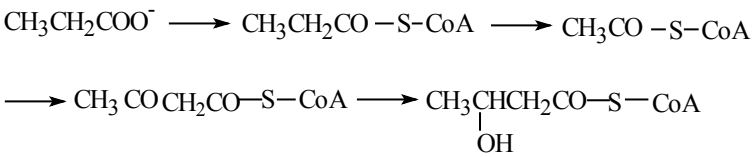
3-hydroxybutanoic acid **2 points**

Monomer 2



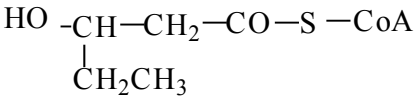
(Ref. Preparatory Problem 52) 2 points

3. 

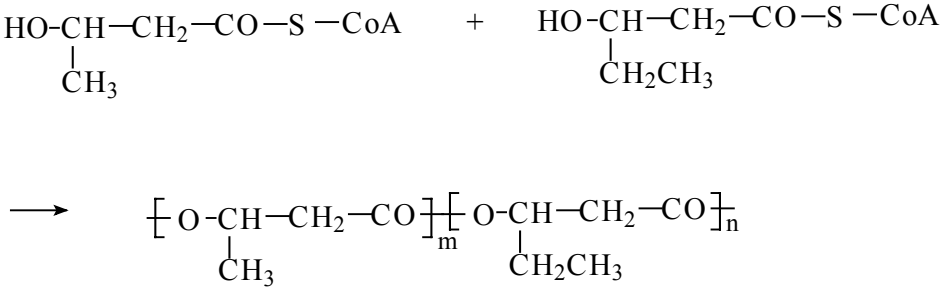
4. 

(coenzyme A activated monomer 3-hydroxypentanoic acid)

This monommmer 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

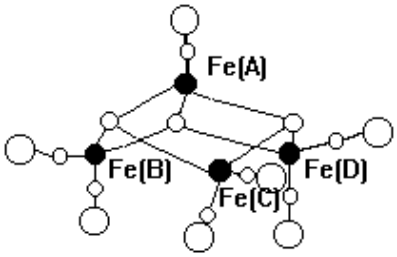
Problem 5 (total 18 points)

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

2. B. 1 point

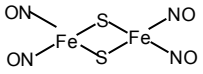
3. B. 2 points

4.



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

5. i) 2 points

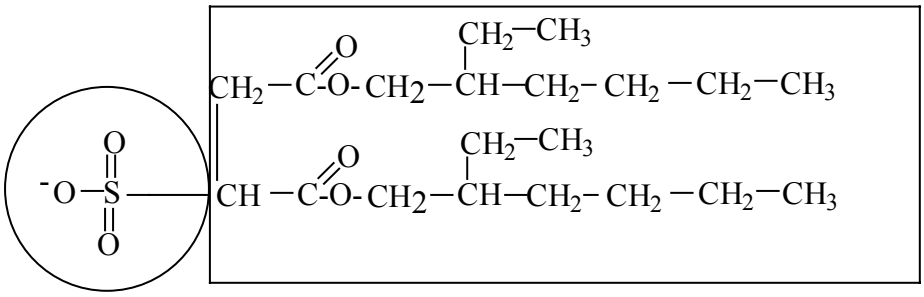


ii) Fe (-1) Fe (-1) 1+1 = 2 points

iii) The species added to S atom is CH_3^+ ; n= 0 .
1+1= 2 points

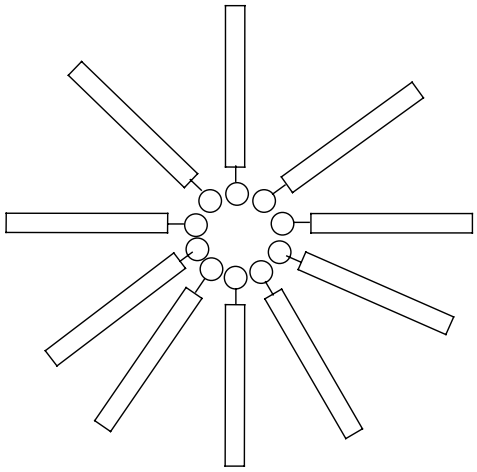
Problem 6 (total 13 points)

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



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

2. i)



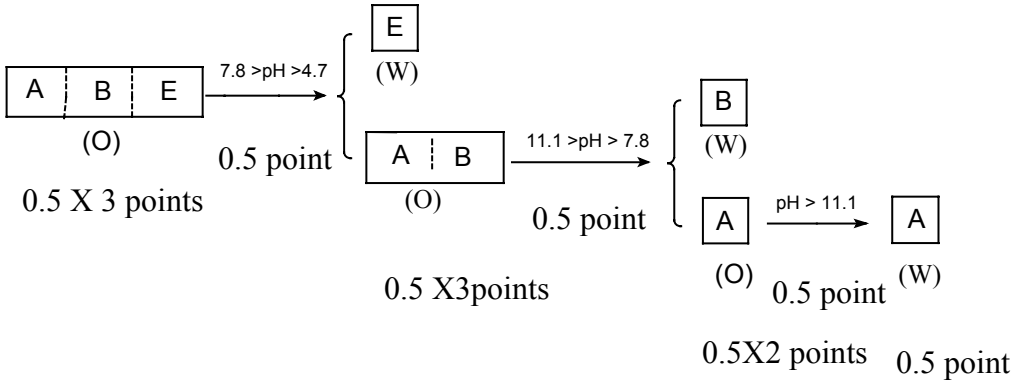
1 point for direction of the molecules

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)



0.5 X 3 points

0.5 point

0.5 X3points

0.5 point

0.5X2 points

0.5 point

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

Answer Sheet for the Theoretical Problems of the 27th IChO

Note: Write your code, which is marked at the right upper of your desk, at the right upper angle of each answer sheet!

Problem 1

1.

i) **ii)**

Reaction **chemical equation**

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

a) _____ _____

b) _____ _____

c) _____ _____

iii) Calculation:

Circle the correct answer:

A. → **B.** ←

2. i) Formula : _____

E_a = _____

ii) overall reaction order = _____ **(with Arabic figure)**

iii) rate v = _____

condition for the order of reaction (c) coincides with that in ii) is

when _____

3. i) Place a circle on one answer which is correct

(A) $E < 0$, **(B)** $E = 0$, **(C)** $E > 0$, **(D) not in affirmative**

ii) Process occurred in the cell: _____

Thermodynamic reason for choosing 3 (C) is

∵ _____ ∴ _____

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.

$CH_3COONa \longrightarrow$

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 LOMO of NO molecule is _____.

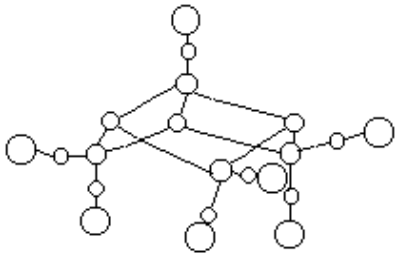
2. Choose the correct answer by circling the proper letter.

A. B. C.

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

A. B. C. D.

4.



Iron atom(s) _____ has $3d_{\square}$configuration;
Iron atom(s) _____ has $3d_{\square}$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.

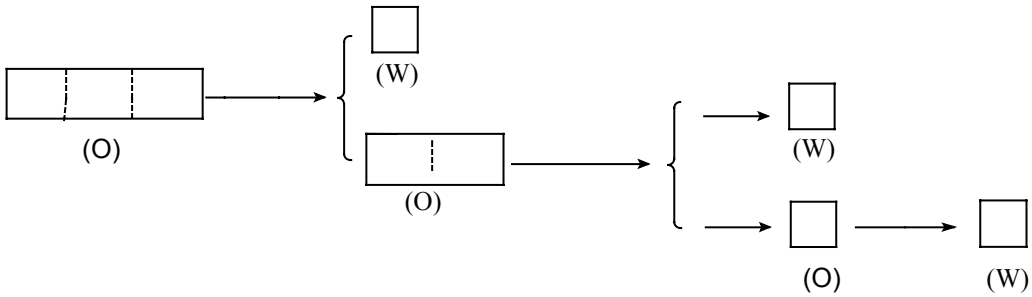
2. I) Draw a 10 molecule model for the given micelle:

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:


(W)
(O)
(O)
(W)
(O)
(W)

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 Repubic**	**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 Tchegaev	**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 Belemezova	**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**
2. Sebastian Klinke									
	6.111	**2.500**	**6.667**	**6.875**	**5.278**	**4.643**	**32.074**	**34.872**	**66.946**
3. Rodrigo M. Zapata-Zorza									
	2.778	**3.500**	**8.667**	**5.625**	**6.111**	**9.286**	**35.967**	**32.821**	**68.788**
4. Andres Zelcer									
	3.333	**4.500**	**7.333**	**8.750**	**2.778**	**5.357**	**32.051**	**33.846**	**65.897**
Australia									
1. Mark James Abraham									
	7.222	**1.500**	**2.667**	**8.750**	**8.333**	**9.286**	**37.758**	**30.769**	**68.527**
2. Matthew Gilbert Heaton									
	7.778	**3.000**	**6.000**	**10.00**	**5.000**	**6.786**	**38.567**	**35.897**	**74.464**
3. Julian Leon Huppert									
	8.333	**6.500**	**10.00**	**9.375**	**7.778**	**6.071**	**48.057**	**29.744**	**77.801**
4. Oliver Geoge Mailes									
	6.111	**4.000**	**10.00**	**6.250**	**5.556**	**7.143**	**39.060**	**30.769**	**69.829**
Austria									
1. Katharina GAMMER									
	8.333	**8.750**	**5.333**	**8.750**	**8.889**	**9.643**	**49.698**	**28.205**	**77.903**
2. Johannes SCHIMPL									
	7.222	**4.500**	**10.00**	**10.00**	**8.333**	**7.857**	**47.912**	**35.385**	**83.297**
3. Reinhard ULLRICH									
	8.333	**4.000**	**2.667**	**10.00**	**8.333**	**10.00**	**43.333**	**38.462**	**81.795**
4. Claudia ZIPPERLE									
	8.056	**7.500**	**8.000**	**6.875**	**5.556**	**5.357**	**41.344**	**33.846**	**75.190**
Belgium									
1. Bruno Bougard									
	1.111	**4.000**	**6.000**	**1.875**	**4.722**	**4.286**	**21.994**	**21.538**	**43.532**
2. Raphael Schmits									
	5.000	**2.000**	**0.667**	**1.250**	**4.444**	**2.500**	**15.861**	**30.769**	**46.630**
3. Raphael Robert Julia Bochlandt									
	2.500	**1.500**	**4.667**	**8.750**	**6.111**	**6.429**	**29.957**	**24.615**	**54.572**
4. Rachid Faouzi									
	1.111	**0.500**	**4.667**	**5.938**	**1.667**	**3.571**	**17.454**	**23.590**	**41.044**

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**
2. Boril Stefanov Tchernev									
	5.000	**1.500**	**3.333**	**8.125**	**5.000**	**3.214**	**26.172**	**29.487**	**65.659**
3. Jexandre Dimitrov Apostolov									
	3.889	**0.500**	**5.333**	**7.500**	**3.333**	**7.500**	**28.055**	**28.718**	**56.773**
4. Emilia Kirilova Belemezova									
	6.667	**1.500**	**3.333**	**6.875**	**5.000**	**1.071**	**24.446**	**34.872**	**59.318**
Canada									
Chun Fung Man									
	8.889	**10.000**	**4.000**	**8.750**	**7.222**	**2.857**	**41.718**	**30.256**	**71.974**
Christopher Mason									
	6.667	**5.000**	**2.667**	**6.875**	**6.111**	**6.785**	**34.106**	**29.231**	**63.337**
Hsu Fong									
	5.833	**5.000**	**4.000**	**8.438**	**5.556**	**4.286**	**33.113**	**23.590**	**56.703**
Brandon McDonald									
	6.667	**2.000**	**1.333**	**3.750**	**6.667**	**5.357**	**25.774**	**25.128**	**50.902**
China									
1. Chen Jingyang									
	9.722	**7.000**	**7.333**	**8.750**	**8.056**	**8.214**	**49.075**	**40.00**	**89.075**
2. Jiao Yuchen									
	9.444	**10.00**	**7.333**	**9.375**	**7.778**	**7.857**	**51.787**	**37.949**	**89.736**
3. Luo Hongpeng									
	10.00	**9.500**	**7.333**	**9.375**	**8.889**	**6.429**	**51.526**	**40.00**	**91.526**
4. Zhang Jianhui									
	10.00	**10.00**	**7.00**	**10.00**	**6.667**	**9.643**	**53.310**	**40.00**	**93.310**
Chinese Taipei									
WU Chia-Hung									
	6.111	**7.500**	**6.667**	**8.438**	**6.111**	**10.000**	**44.827**	**35.385**	**79.000**
YEH Kuo-Liang									
	7.222	**4.000**	**8.667**	**8.438**	**6.667**	**9.643**	**44.637**	**34.359**	**80.212**
Lin Chi-Wang									
	7.500	**4.000**	**4.000**	**6.250**	**6.111**	**7.143**	**35.004**	**32.821**	**67.825**
LIN Chih-Kai									
	6.389	**4.000**	**8.000**	**6.875**	**6.111**	**8.214**	**39.589**	**36.410**	**76.000**
Cuba									
Joel Torres Alacan									
	7.778	**3.500**	**4.667**	**6.250**	**3.333**	**0.714**	**26.242**	**31.795**	**58.037**

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
	Prodromos Philippou	7.222	1.250	2.667	8.750	2.222	3.214	25.325	21.026	46.351
	Panayiotis Kyzas	4.444	1.500	3.333	6.250	1.944	6.071	23.542	22.051	45.593
	Nasos Charalanbides	6.667	0.500	0.000	3.125	5.000	2.857	18.149	23.590	42.739
Czech Republic										
	Jiri JANECEK	8.056	7.500	10.000	8.125	7.222	4.643	45.546	37.949	83.495
	Jiri Franta	5.278	4.000	3.333	6.875	5.000	3.571	28.057	37.436	65.493
	Petr Matousek	5.000	2.500	4.000	8.125	2.778	3.571	25.974	36.410	62.384
	Ludek MECA	7.500	9.500	10.000	8.438	8.333	4.286	48.057	40.000	88.057
Denmark										
	Brian Schou RASMUSSEN	7.222	6.000	8.667	7.500	8.333	7.143	44.865	33.333	78.198
	Per Hindborg Hemmingsen	8.056	7.250	2.333	7.500	8.333	6.429	39.901	30.256	70.157
	Christian Ingemann Mikkelsen	7.500	7.500	4.000	8.125	3.333	2.500	32.958	31.795	64.753
	Mikkel Hindkaer Dahl	6.389	5.500	6.000	5.625	8.333	3.214	35.061	27.179	62.240
Estonia										
	Ain Uustare	6.667	7.500	7.333	9.375	4.444	6.429	41.748	29.744	71.492
	Jaak Suurpere	6.667	7.500	9.333	9.063	7.222	7.857	47.642	23.077	70.719
	Alexei Lulia	6.111	4.500	2.667	2.500	2.222	0.714	18.714	34.872	53.586
	Arthur Jogi	3.056	0.500	6.667	3.750	2.222	3.214	19.409	29.744	49.153

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**
Nagymate Emese	**6.389**	**0.500**	**4.000**	**6.875**	**4.444**	**5.714**	**27.922**	**40.000**	**67.922**
BUNKOCZI Gabor	**5.833**	**3.500**	**3.333**	**10.000**	**8.333**	**5.714**	**36.713**	**36.410**	**73.123**
Szekeres Zsolt	**7.222**	**3.500**	**5.333**	**7.500**	**5.000**	**5.357**	**33.912**	**36.923**	**70.835**
Iran									
SHAHAKBARI	**9.722**	**2.000**	**8.667**	**10.000**	**8.333**	**3.929**	**42.651**	**39.487**	**82.138**
KIANI Roozbeh	**9.167**	**10.000**	**10.000**	**10.000**	**10.000**	**7.500**	**56.667**	**38.974**	**95.641**
JALALI Ali	**10.000**	**6.000**	**10.000**	**10.000**	**8.889**	**7.500**	**52.389**	**40.000**	**92.389**
RAZZGHI Mehdi	**8.333**	**7.000**	**10.000**	**9.375**	**7.222**	**8.571**	**50.501**	**40.000**	**90.501**
Italy									
Gaetano Mangiapia	**6.111**	**9.000**	**4.667**	**5.000**	**5.000**	**2.500**	**32.278**	**32.308**	**64.586**
Luca ARGENTI	**6.667**	**10.000**	**10.000**	**9.375**	**7.778**	**10.000**	**53.820**	**35.385**	**89.205**
Giovanni GIULIANO	**9.444**	**5.500**	**4.667**	**9.375**	**7.222**	**6.429**	**42.637**	**36.410**	**79.047**
Andrea Magro	**8.333**	**4.000**	**4.000**	**6.875**	**7.778**	**3.929**	**34.915**	**33.846**	**68.761**
Korea Republic									
BAE Seung-Bin	**9.444**	**5.500**	**6.667**	**6.250**	**8.889**	**5.714**	**42.464**	**31.795**	**74.259**
Lim Sangmin	**8.056**	**4.000**	**3.000**	**6.875**	**6.111**	**7.857**	**35.899**	**30.256**	**66.155**
Park Kihyun	**5.833**	**3.500**	**5.333**	**6.875**	**7.222**	**7.143**	**35.906**	**29.744**	**65.650**
Cho Chang-Ho	**6.944**	**3.000**	**5.333**	**6.875**	**5.000**	**8.571**	**35.723**	**24.103**	**59.826**

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**
	Amenah Al-Yousef	**2.500**	**0.000**	**0.000**	**0.000**	**2.778**	**2.500**	**7.778**	**10.769**	**18.547**
	Mutlaq Al-Sihan	**1.667**	**2.000**	**1.333**	**0.313**	**1.111**	**1.786**	**8.210**	**9.231**	**17.441**
	Maha Al-Shmmari	**0.833**	**0.000**	**0.000**	**0.000**	**1.111**	**0.000**	**1.944**	**1.538**	**3.482**
Latvia										
	Juris Fotins	**3.889**	**2.000**	**6.667**	**6.250**	**5.000**	**2.857**	**26.663**	**36.410**	**63.073**
	Janis Garancs	**2.500**	**2.000**	**8.000**	**4.375**	**3.889**	**1.786**	**22.550**	**27.179**	**49.729**
	Edgars Liepins	**1.111**	**2.000**	**4.000**	**5.313**	**4.714**	**0.714**	**17.860**	**31.795**	**49.655**
	Helmars Smits	**3.611**	**1.500**	**5.333**	**5.938**	**4.167**	**1.429**	**21.978**	**21.026**	**43.004**
Lithuania										
	Eduardas GAIDAMAUSKAS	**8.889**	**9.500**	**8.000**	**7.000**	**8.889**	**4.643**	**46.921**	**34.872**	**81.793**
	Vilius PIGAGA	**8.056**	**7.500**	**10.000**	**8.750**	**6.667**	**1.786**	**42.759**	**36.923**	**79.682**
	Laurynas Riauba	**2.778**	**1.000**	**3.333**	**7.500**	**8.889**	**2.857**	**26.357**	**21.539**	**47.896**
	Pranas Japertas	**4.167**	**5.000**	**2.667**	**7.500**	**5.000**	**2.143**	**26.477**	**26.154**	**52.631**
Mexico										
	Luis Ivan TUBERT-BROHMAN	**5.833**	**9.000**	**5.333**	**8.125**	**5.556**	**6.071**	**39.918**	**39.487**	**79.405**
	Jose Luis Garcia-Ojeda	**3.611**	**1.250**	**6.667**	**6.875**	**4.444**	**4.643**	**27.490**	**28.205**	**55.695**
	Carlos Armando Quevedo-Lerma	**3.889**	**2.000**	**3.333**	**5.000**	**2.222**	**5.714**	**22.158**	**29.231**	**51.389**
	Emmanuel Trevino-Garza	**3.333**	**1.000**	**1.333**	**5.625**	**4.167**	**2.143**	**17.601**	**20.000**	**37.601**

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
	Delegation									
	The Netherlands									
	Paul PEIJZEL									
		4.167	**2.000**	**7.333**	**7.500**	**4.444**	**10.000**	**35.444**	**38.974**	**74.418**
	Chirs Dams									
		8.056	**0.750**	**5.333**	**10.000**	**5.000**	**9.643**	**38.782**	**27.179**	**65.961**
	Ruth Deboer									
		4.722	**0.000**	**8.000**	**8.750**	**6.387**	**5.357**	**33.218**	**25.641**	**58.859**
	Hetly Jolink									
		1.944	**0.500**	**6.000**	**5.625**	**3.889**	**5.357**	**23.315**	**30.769**	**54.084**
	New Zealand									
	Irine Peng									
		7.778	**5.000**	**3.333**	**8.125**	**6.111**	**6.786**	**37.133**	**31.282**	**68.415**
	Hayden Callow									
		5.278	**4.750**	**2.667**	**1.875**	**6.667**	**8.929**	**30.166**	**28.205**	**58.639**
	Andrew Baldwin									
		6.111	**4.500**	**2.667**	**5.000**	**6.667**	**3.929**	**28.874**	**24.103**	**52.977**
	Ben Clark									
		6.944	**4.250**	**2.000**	**7.500**	**5.556**	**5.357**	**31.607**	**33.333**	**64.940**
	Norway									
	Tore August Kro									
		3.611	**7.500**	**5.667**	**1.250**	**7.222**	**0.000**	**25.250**	**34.872**	**60.122**
	Martin Lersch									
		1.944	**3.500**	**6.667**	**5.000**	**5.000**	**3.571**	**25.682**	**31.795**	**57.477**
	Bjarte Hitland									
		4.444	**2.000**	**3.333**	**1.250**	**7.222**	**2.875**	**21.106**	**33.333**	**54.439**
	Ole Kristian Holen									
		1.944	**2.750**	**0.000**	**3.125**	**4.444**	**5.000**	**17.263**	**33.333**	**50.596**
	Poland									
	Piotr LIPIEC									
		5.278	**8.500**	**5.333**	**6.250**	**5.000**	**7.143**	**37.504**	**30.769**	**68.273**
	Tomasz Zielinski									
		8.889	**5.000**	**5.333**	**7.813**	**8.333**	**6.429**	**41.797**	**36.923**	**78.720**
	Adam Sikora									
		6.667	**4.500**	**9.333**	**3.125**	**7.778**	**8.571**	**39.974**	**28.205**	**68.179**
	Bartosz Dybowski									
		5.556	**6.500**	**2.667**	**8.125**	**2.778**	**5.714**	**31.340**	**31.795**	**63.135**

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
	Delegation									
	Romania									
	Alexandru Ioan POPA	**8.333**	**10.000**	**4.667**	**10.000**	**10.000**	**7.143**	**50.143**	**36.410**	**86.553**
	Liviu MIRICA	**8.889**	**9.000**	**10.000**	**9.375**	**8.056**	**10.000**	**55.320**	**23.590**	**78.910**
	Stefan Alexandru CARP	**6.389**	**6.500**	**6.000**	**8.750**	**8.333**	**6.071**	**42.043**	**38.974**	**81.017**
	Leonard MADA	**7.778**	**7.500**	**10.000**	**9.063**	**8.333**	**5.000**	**47.674**	**38.462**	**86.136**
	Russian Federation									
	Mikhail SEREBRIAKOV	**9.444**	**7.000**	**4.000**	**10.000**	**6.667**	**6.071**	**43.182**	**40.000**	**83.182**
	Viatchislav Chtcherban	**5.833**	**9.000**	**2.667**	**5.000**	**6.111**	**2.500**	**31.111**	**29.231**	**60.342**
	Igor A GARIEV	**9.722**	**8.500**	**10.000**	**8.750**	**6.667**	**5.714**	**49.353**	**38.974**	**88.327**
	Konstantine Yurievich Tchegaev	**6.667**	**4.250**	**4.667**	**9.063**	**6.667**	**6.071**	**37.385**	**28.205**	**65.590**
	Singapore									
1.	**Choy Dawen**	**10.000**	**7.500**	**5.333**	**10.000**	**7.222**	**7.500**	**47.555**	**37.436**	**84.991**
2.	**Ho Wai-Luen Terence**	**6.944**	**3.000**	**3.333**	**8.750**	**5.556**	**4.286**	**31.869**	**28.205**	**60.074**
3.	**Tan Say Lock**	**8.056**	**7.000**	**7.000**	**8.125**	**7.222**	**6.071**	**43.474**	**29.231**	**72.705**
4.	**Tan Wei-Tze Shawn**	**8.611**	**2.000**	**5.333**	**4.688**	**3.889**	**9.643**	**34.164**	**36.923**	**71.087**
	Slovakia									
1.	**Martin WALKO**	**6.111**	**3.500**	**7.333**	**7.500**	**6.667**	**9.643**	**40.754**	**36.410**	**77.164**
2.	**Lubomir Flak**	**4.444**	**3.500**	**4.667**	**8.750**	**5.556**	**4.643**	**31.560**	**35.385**	**66.945**
3.	**Ladislav KISS**	**6.389**	**9.000**	**4.667**	**8.125**	**6.944**	**9.643**	**44.768**	**39.487**	**84.255**
4.	**Vladimir VEGH**	**6.389**	**4.500**	**6.667**	**8.438**	**5.556**	**9.643**	**41.193**	**35.385**	**76.578**

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

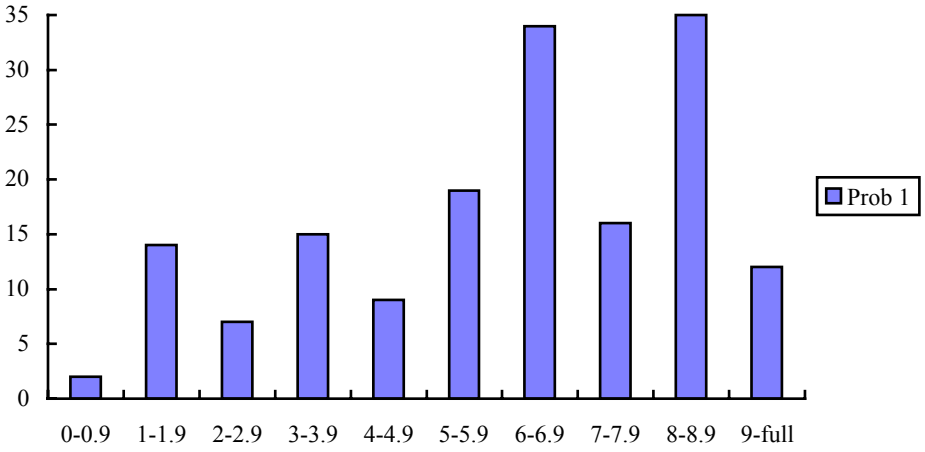
5.278	**2.000**	**4.667**	**6.250**	**6.667**	**1.786**	**26.647**	**25.128**	**51.775**

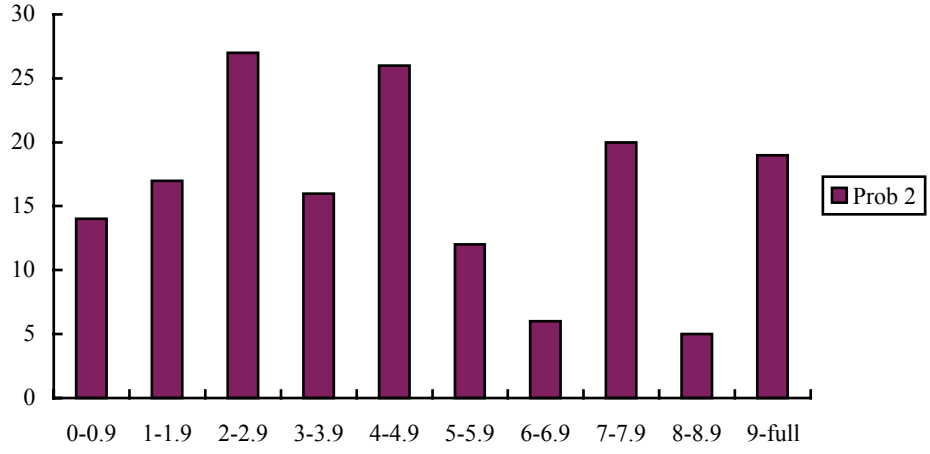
Camilo Contreras

2.222	**1.500**	**7.333**	**8.125**	**2.778**	**6.429**	**28.387**	**12.308**	**40.695**

Statistic Figures of the 27th IChO Competitors' Response Results

Theoretical Problems:





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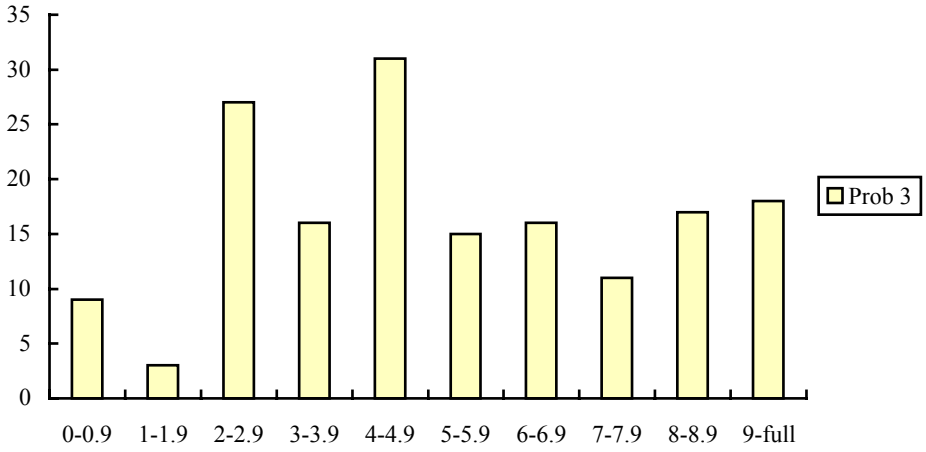
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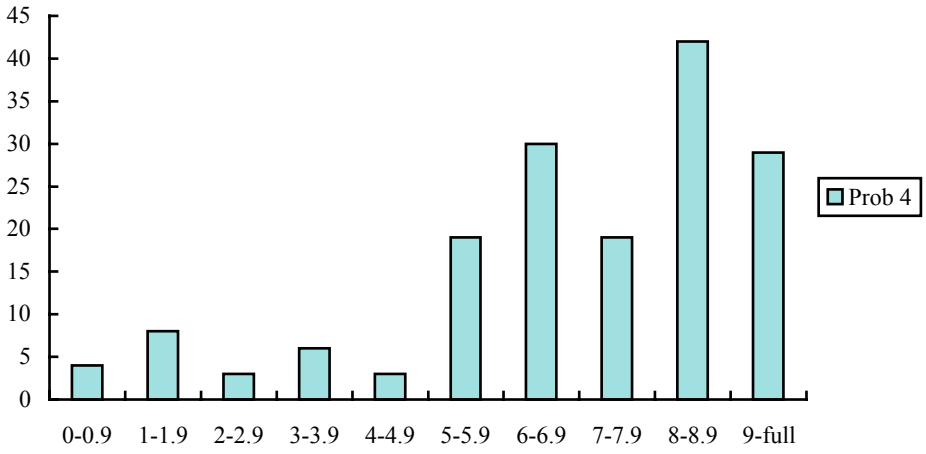
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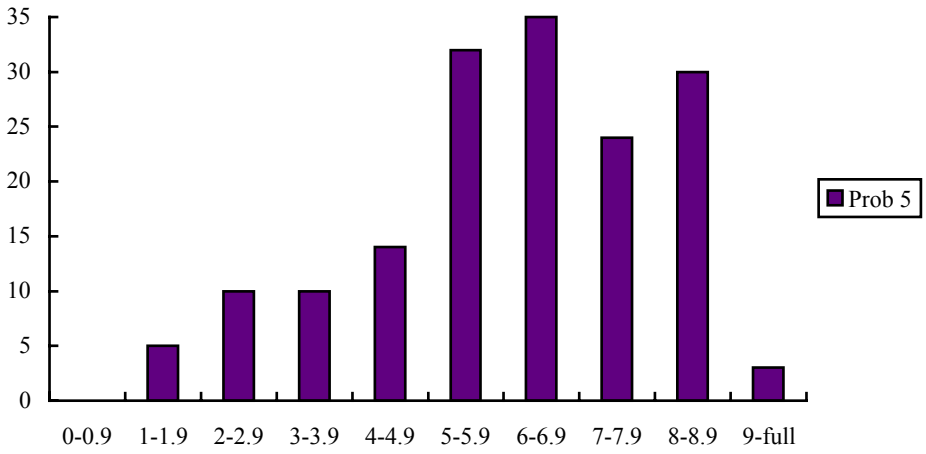
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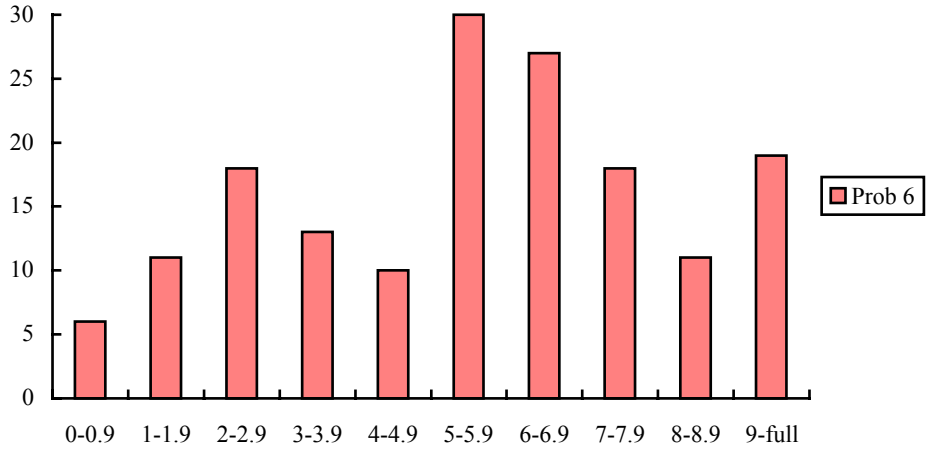
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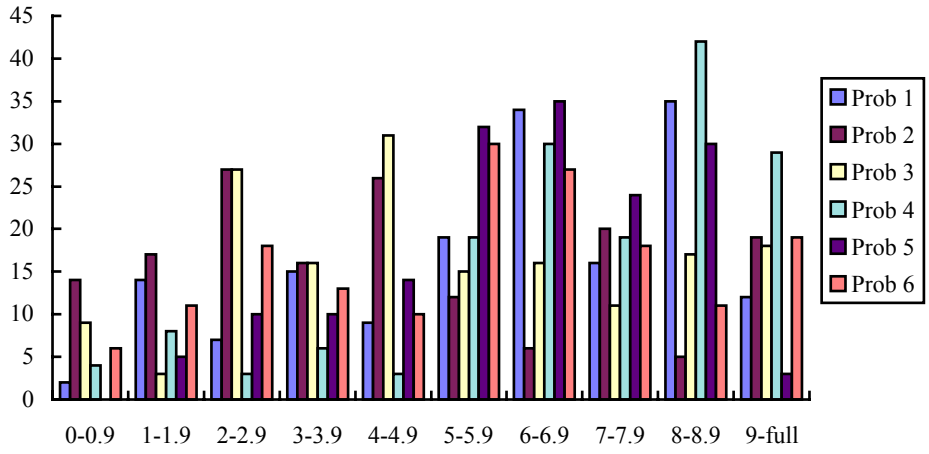
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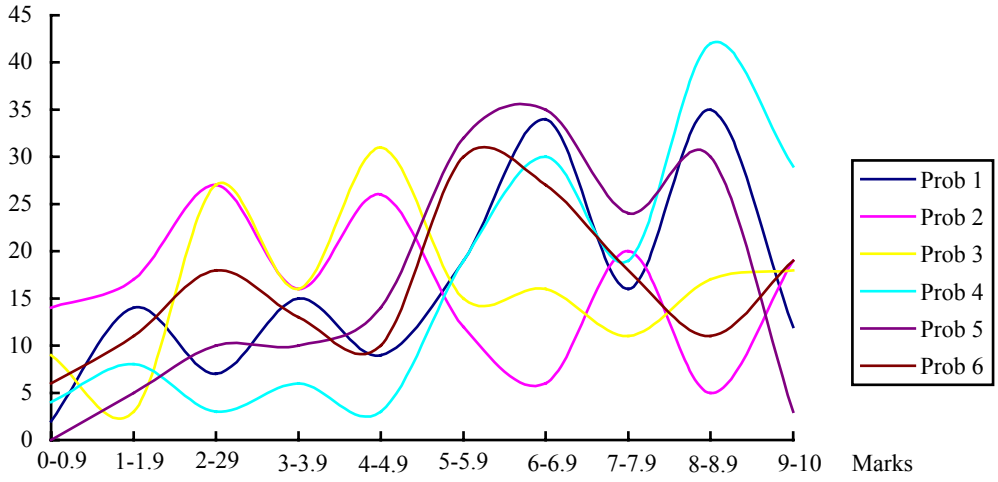
Prob 1
Prob 2
Prob 3
Prob 4
Prob 5
Prob 6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Prob 3
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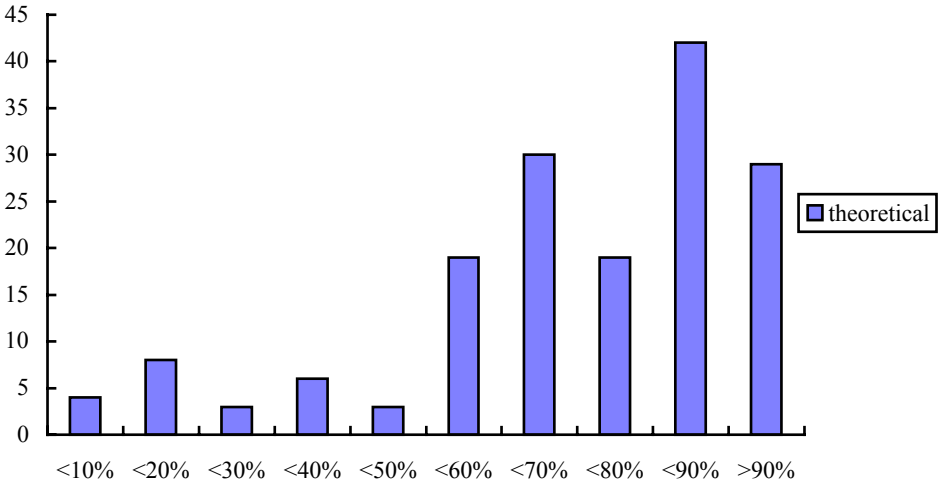
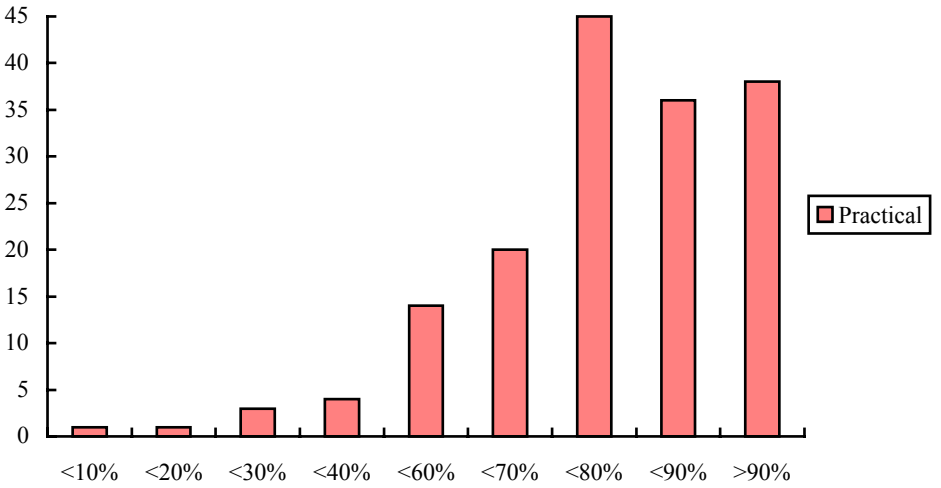


Practical Problem:



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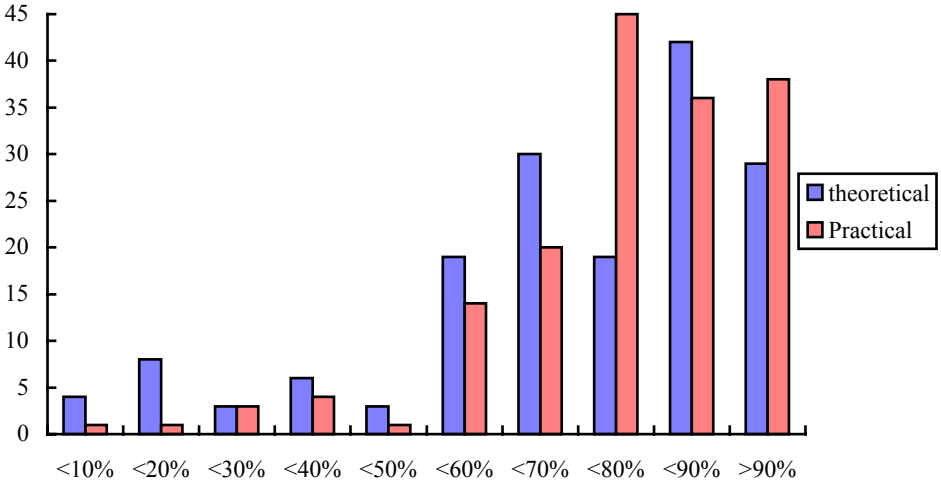

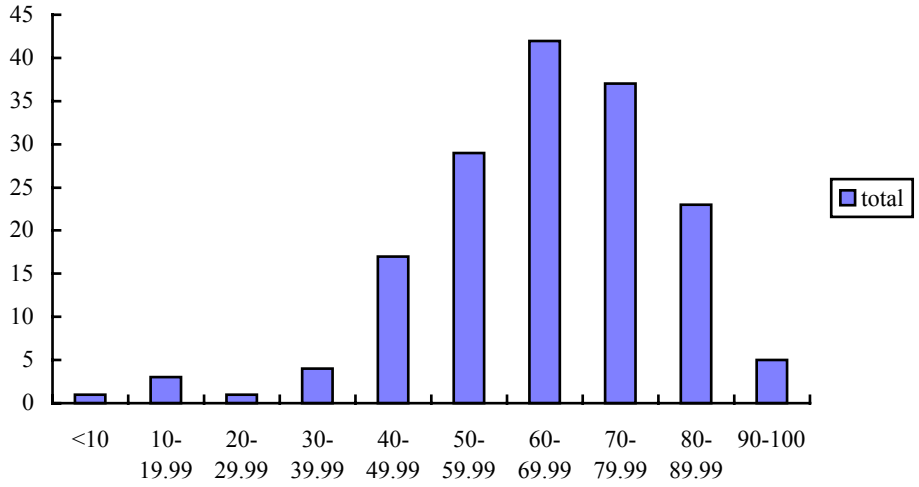

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Dec. 1995.