International Chemistry Olympiad

Moscow, 15-24 July 2007

Report of the IChO-2007 Science Committee

Motivations

- To get pleasure (and fun) from mental work
- To learn something new about chemistry
- To suggest creative problems
- To introduce modern chemistry to the students

Chemistry

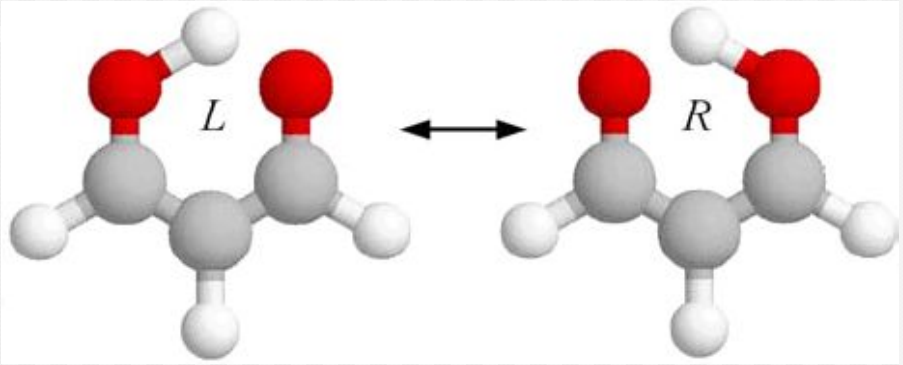
- is in line with the IChO slogan
  “Chemistry – art, science, fun”
- reflects some modern trends in science
- stresses the interdisciplinary character of science
- gives numerous possibilities for students
  to reveal their creativity
- promotes achievements of Russian chemists
  (mainly in prep problems)

Total Set of Problems

	Theory								Exp.	
No.	1	2	3	4	5	6	7	8	1	2
Max	7	8	7	8	7.5	7	7.5	8	20	20
Avg	4.65	3.23	3.94	3.57	2.29	3.49	1.84	2.13	6.23	7.15
%	66	40	56	43	31	50	25	26	31	36

Problem 1. Proton Tunneling

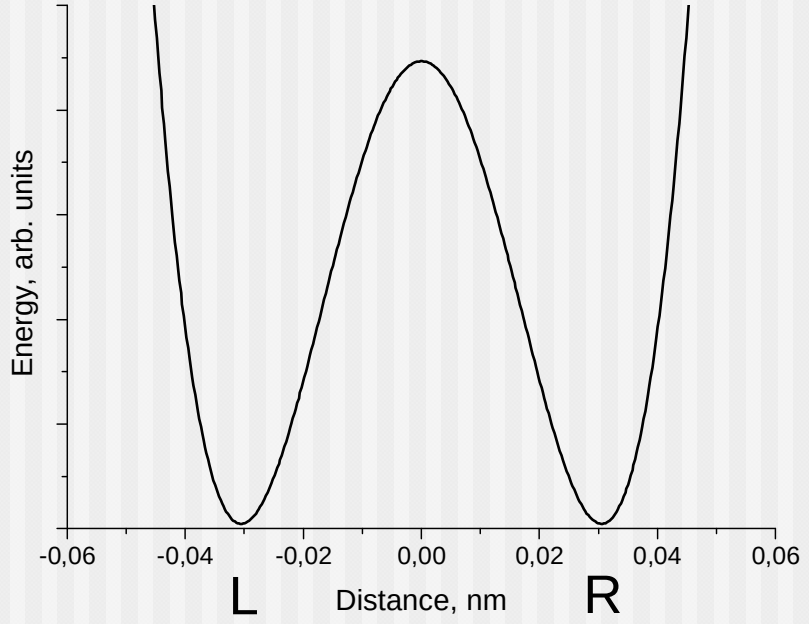
Avg. 66%



Main ideas:

Quantum mechanics is everywhere in chemistry.

Theoreticians think in terms of numbers, functions and energy curves



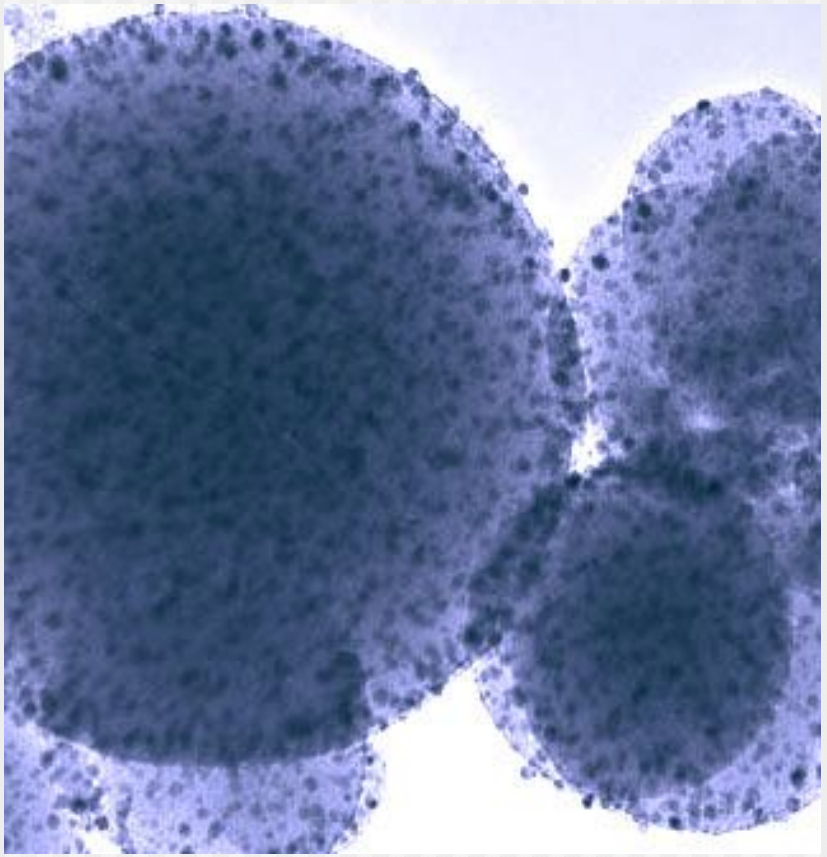
Problem 2. Nanochemistry

Avg. 40%

Main ideas:

Thermodynamic functions are size-dependent.

Change of the particle size can be in favor of both desirable and undesirable reactions



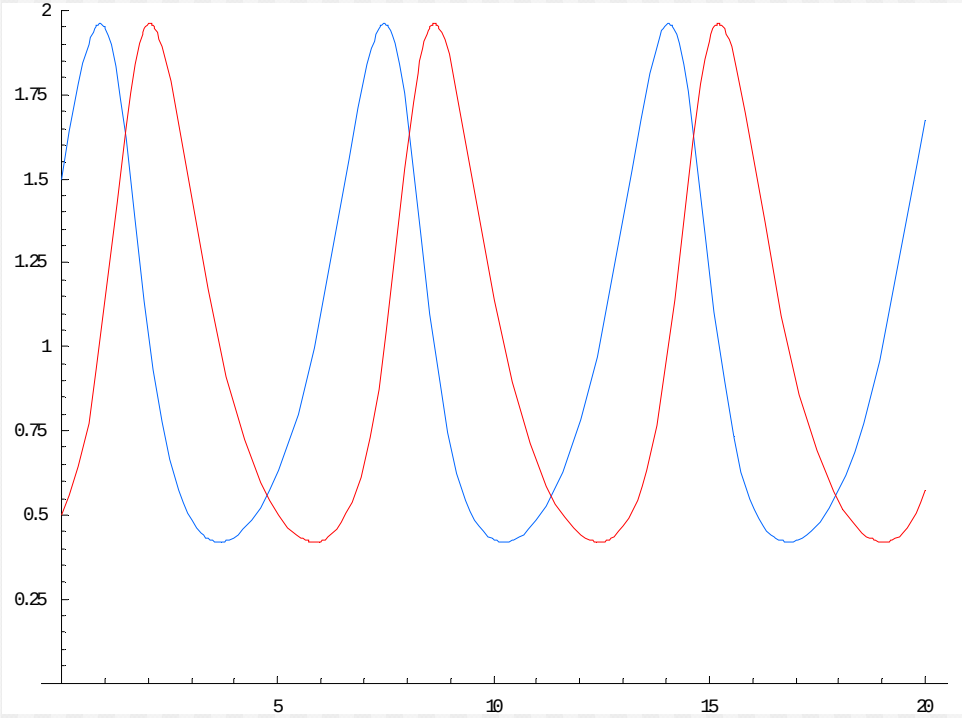
Problem 3. Unstable Reactions

Avg. 56%

Main ideas:

In an open system autocatalytic steps can lead to an oscillatory behavior

Changing the initial concentrations or the rate constants can result in the different kinetic curves



Problem 4. Determination of Water by Fischer Titration

Avg. 43%

Main ideas:

Fischer method was discovered 100 years ago but still is the best method for the determination of water

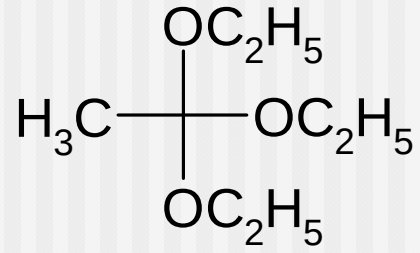
The problems involves complicated stoichiometric calculations which vary from substance to substance

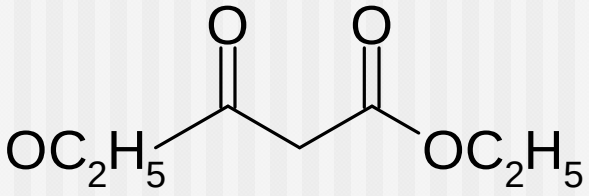
Problem 5. A Mysterious Mixture (Organic Hide-and-seek Game)

Avg. 31%

Main idea:

There are some “hidden forms” of acetic acid.





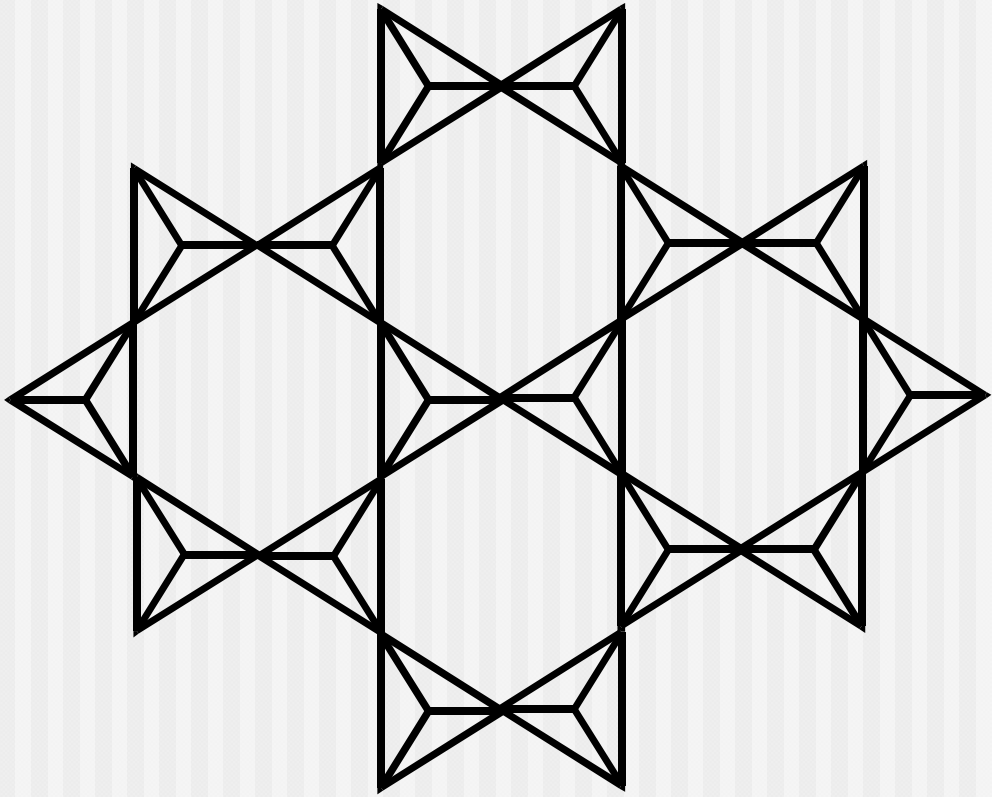
Problem 6. Silicates as the Base of the Earth Crust

Avg. 50%

Main ideas:

Chemistry (even of silicon) is not boring at all

Chemistry is not only formulas and equations but also nice pictures

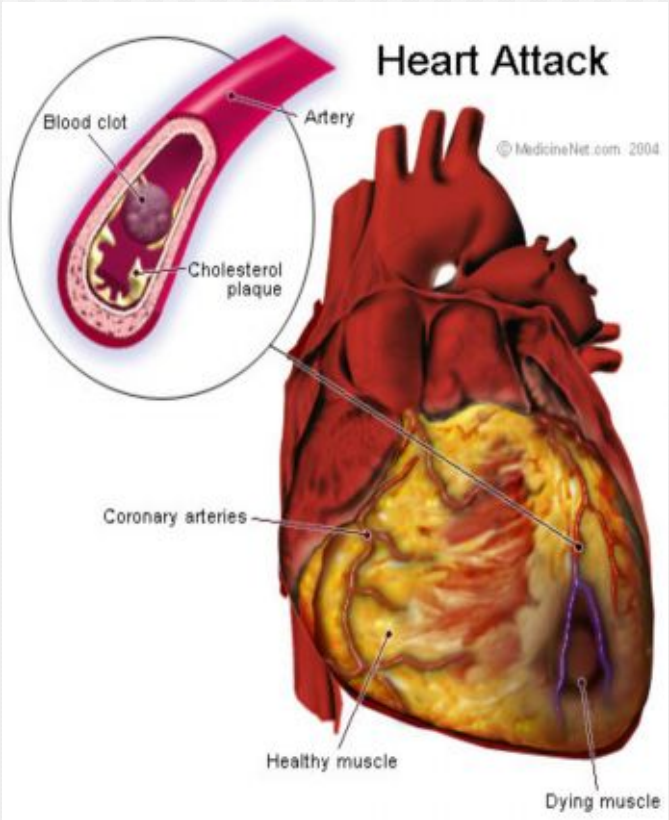


Problem 7. Atherosclerosis and Intermediates of Cholesterol Biosynthesis

Avg. 25%

Main idea:

Understanding the cholesterol metabolism is crucial for the treatment and prevention of cardiovascular diseases

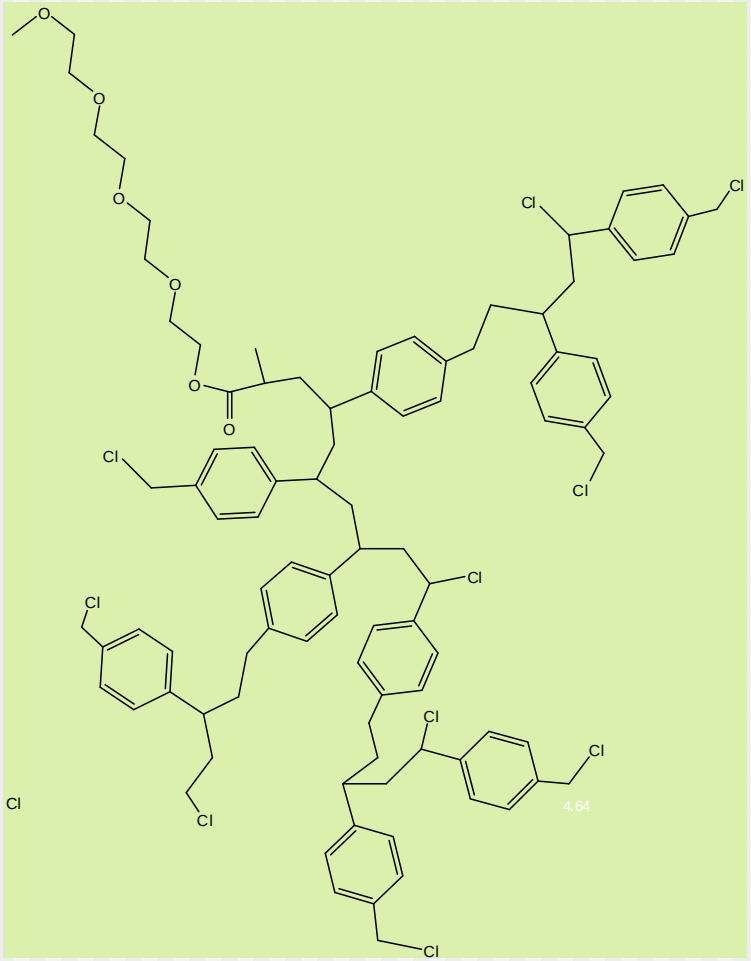


Problem 8. ATRP Allows New Polymers

Avg. 26%

Main idea:

Atom transfer radical polymerization (ATRP) is an important novel approach for the controlled radical polymerization

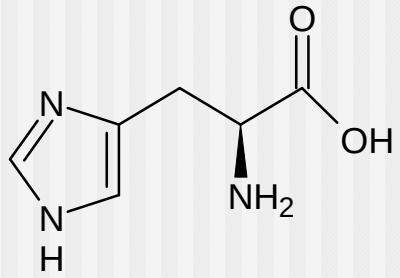


Experimental Problem 1. Ion-exchange chromatography of amino acids

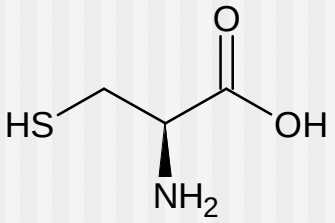
Avg. 31%

Main idea and steps:

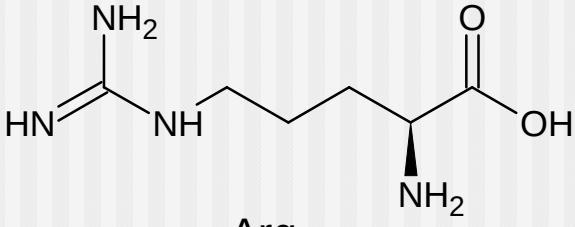
Separation of a mixture of three amino acids with subsequent qualitative and quantitative analysis



His



Cys



Arg

Experimental Problem 2. Determination of carbonate and hydrogen phosphate in an abrasive sample

Avg. 36%

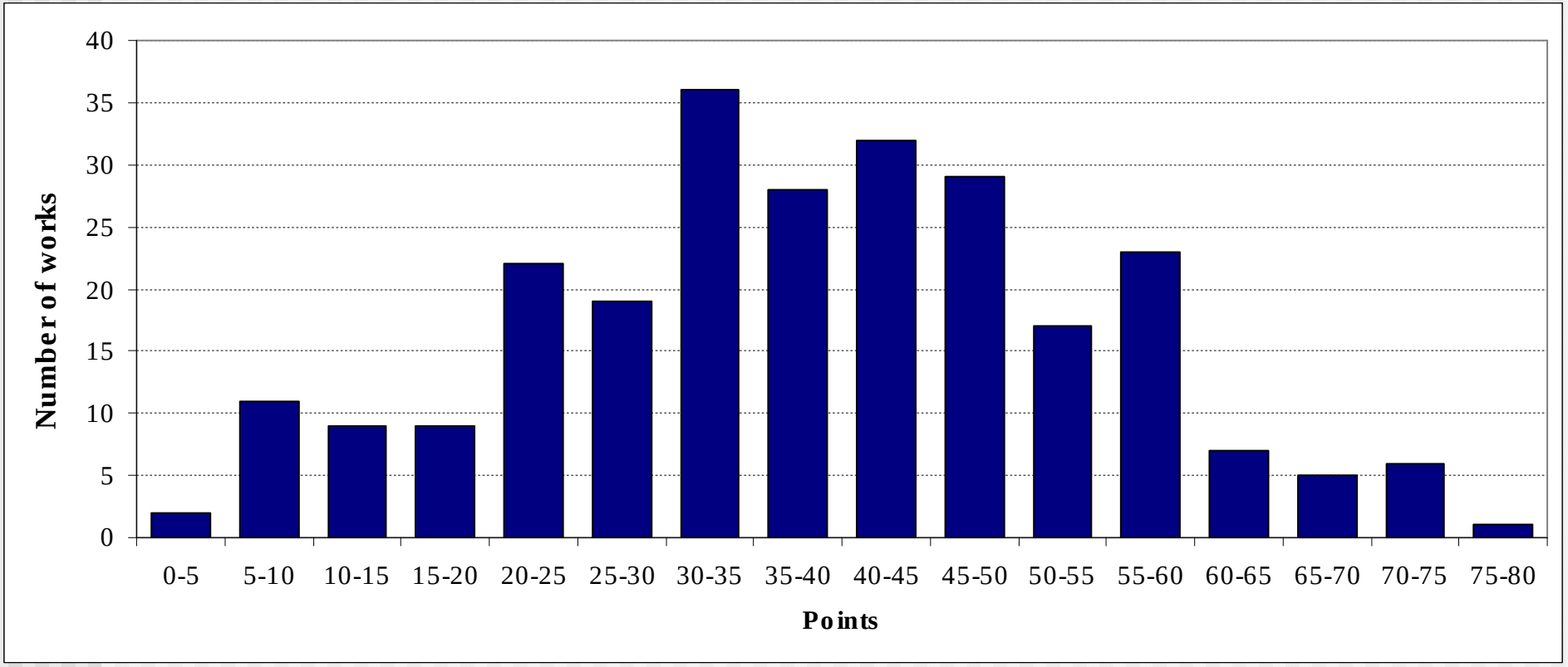
Main idea:

Determination of two ions in a mixture by acid-base titration. The procedure involves all basic analytical techniques: dissolution, precipitation, filtering, titration, calculations

$$Ca^{2+} + H_2PO_4^- \rightarrow CaHPO_4 + H^+$$

$$3Ca^{2+} + 2HPO_4^{2-} \rightarrow Ca_3(PO_4)_2 + 2H^+$$

Distribution of points



Staff

Permanent staff

- 3 professors
- 16 associate professors, postdocs and researchers

Occupation

- MSU Chemistry Department (mostly)
- Russian Academy of Sciences
- Bashkir State University (Ufa)
- Kazan' State University
- University of Maryland

Mean age – 34 years (oldest – 54)