

Fields of advanced difficulty

Theoretical

1. *Thermodynamics*: relation between equilibrium constants and standard reaction Gibbs free energy, relation between thermodynamic and electrochemical data.
2. *Kinetics*: orders of reaction, half-life, rates defined as time derivatives of concentrations, use of integrated rate laws, classic approximations.
3. *Basic quantum chemistry*: notion of wavefunction, expression of simple molecular orbitals, electronic energy levels, crystal field theory.
4. *Spectroscopy*: simple IR spectroscopy (identification of chemical groups only), ^1H NMR spectroscopy (chemical shifts, integrals, couplings and multiplicity).
5. *Polymers*: block copolymers, polymerization, polydispersity, simple size exclusion chromatography (SEC).
6. *Stereochemistry*: stereoisomers in organic and inorganic chemistry, stereoselectivity in organic synthesis.

Practical

1. Techniques in organic synthesis (drying of a precipitate, recrystallization, TLC).
2. Use of a spectrophotometer (mono-wavelength measurements).

Important notes

Theoretical: the following advanced skills or knowledge WILL NOT appear in the exam set:

- Solid state structures;
- Specific notions about catalysis;
- Specific notions about enzymes;
- Specific carbohydrates chemistry (reactivity at the anomeric position, nomenclature, representation);
- Stereochemical aspects associated with the Diels-Alder reaction (supra-supra and endo approaches);
- Hückel theory;
- Calculus (differentiation and integration).

Practical: the following techniques WILL NOT be required during the competition:

- Use of a separatory funnel and extraction using immiscible solvents;
- Use of a rotary evaporator;
- Sublimation;
- Use of a melting point apparatus;
- Use of a pH-meter.