

# Chemistry

## National Research Lobachevsky State University of Nizhni Novgorod (Lobachevsky University)

Degree or qualification is awarded: **Bachelor's degree in Chemistry**

Language of study: **Russian**

Mode of study: **full-time, part-time**

Duration: **4/4,5 years**

Availability of free education: **yes**

Price: **137 000 RUB per year/ 50 000 per year**

Programme webpage at the university website:

<http://www.chem.unn.ru/courses/fizicheskaya-kultura-dlya-lits-s-otkloneniymi-v-sostoyanii-zdorovya-adaptivnaya-fizicheskaya-kultura/>

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Students studying at the Faculty of Chemistry become highly qualified specialists. Graduates from the Faculty of Chemistry get employed at academic and industrial scientific research institutions, leading enterprises of petrochemical and chemical industry in Russia and the Nizhny Novgorod region, analytical control laboratories (ecological control, customs, forensic laboratories, sanitary and epidemiological service), enterprises of radio-electronic, pharmaceutical, food, wood processing and other industries, as well as teachers at higher educational establishments, schools and other sectors of national economy.

Students of the Faculty of Chemistry actively participate in scientific work, which is an integral element of the educational process. A lot of students are winners of Russian scientific student's conferences and competitions. After graduation the most talented students improve their scientific qualification by studying under postgraduate training programmes under the guidance of leading professors of the Faculty.

### Specializations within this programme

#### Inorganic Chemistry

While studying under this programme students will learn principles of technological and scientific research thinking, get to know key actual problems of chemical engineering and means of their solutions, as well as methods of solving high-tech industries problems with the use of new scientific developments in the sphere of high-purity substances, understand the relationship between specific technological solutions and progress in chemical engineering, acquire skills for alternative technological solutions comparison.

#### Analytical Chemistry

Studying under the programme a student will acquire knowledge in the sphere of basic methods of analytical chemistry and usage of analytical equipment and instruments. Within the framework of the programme students will also learn theoretical background of analytical chemistry, classical chemical and modern instrumental methods, develop skills of performing basic analytical operations, compare various

methods of analysis, select best solutions for specific analytical tasks, use equipment and devices of analytical laboratories (UV, IR, NMR, gas, liquid, thin layer and paper chromatography), perform tests according to known formulas.

### **Organic Chemistry**

In the course of training Bachelor's degree students acquire knowledge on the production process, structure, properties and usage of organic compounds of major classes, hydrocarbons and their derivatives. Students receive basic knowledge on substances, their composition, structure, stability, reactivity, as well as spheres of their application in national economy, new technologies and materials that form the basis for the educational trajectory.

The essential condition for Bachelor's degree students is the formation of skills for working with up-to-date information bases of synthesis and analysis of the organic compounds structure. Organic chemistry is the theoretical basis of the most important industries associated not only with organic substances, but also with other spheres of knowledge: agriculture, medicine, biology, etc. The organic chemistry specialization is a fundamental one in the system of the University chemical education and is closely connected with other profiles as being realized by the Faculty.

### **Physical Chemistry**

Graduates of the Physical Chemistry specialization understand relations and interdependence of physical and chemical phenomena (processes), based on which there are being formulated common patterns of chemical transformation that allow to predict possible reaction pathways and the resulting effects of chemical interaction.

The most important task of physical chemistry is the research and determination of parameters defining chemical processes pathways and their rate as depending upon conditions - temperature, pressure, concentration. The key task of a research chemist and a chemical engineer is to define whether the chemical reaction will take place, determine its rate and product yield.

The physical chemistry educational goal is the study of laws describing chemical processes behavior, introduction to methods and instruments used in physical-chemical research, as well as methods of mathematical processing of experimental measurement results.

### **Macromolecular Compounds Chemistry**

The objective of the programme is to brief students on the fundamental principles of polymer science and its practical value. Thus, in accordance with this, the introduction reflects the pre-history of the science, which was formed from branches of organic and physical chemistry and physics in the middle of the twentieth century that were related to the study of polymers, and its relation to modern scientific disciplines, particularly to molecular biology.

The objective basis for this independent fundamental profile formation is provided for by the fact that polymer substances differ from low molecular weight substances by physical and chemical properties in a quality manner, thus the polymer state is a specific state of matter. The latter is emphasized, in particular, by the evidence that polymers have specific characteristics, for example, high elasticity and ability for film formation, that are of exceptional importance in molecular biology.

### **Petrochemistry**

The course is aimed at the profound study of chemical composition of oil and oil products, technologies and methods of analysis in petrochemistry. Detailed approach is applied to the methods of analysis that are currently used for oil products quality control, including methods based on gas chromatography, X-ray

radiography, IR, UV, NMR spectroscopy. Special attention is paid to the analysis according to "State standard" (GOST) methodology.

During the course students acquire knowledge of chemical composition of oil and oil products, analysis of their physical-chemical, thermal, mechanical and other characteristics.

At the same time, thermal, catalytic processes of oil processing, fuel blending, influence of additives on the quality of fuels and oil get also under consideration. It is important to provide for the understanding of particular qualities of chemical composition and properties of different types of oil and oil products, methods of analysis of their physical-chemical, thermal, mechanical and other characteristics, to navigate in normative documentation covering objects of analysis and test techniques.

### **Solid State Chemistry**

During the course students acquire theoretical knowledge and practical skills as applicable to the most important physical and physical-chemical research in the solid state chemistry (X-ray radiography, vibrational spectroscopy, thermal analysis, X-ray fluorescence analysis, electron probe microanalysis). Bachelor's degree students are to master fundamentals of research methods - theories and models applied to objects of study description, setup of research instruments (devices), theory and practice of analytical response, types and techniques of solving research tasks as based on studied methods.

### **Photochemistry**

During the course students get acquainted with photochemistry - the science of chemical reactions under the influence of light (at that the "light" notion is included into ultraviolet and infrared radiation). As the sun is the most ancient and the most powerful source of radiation, and the emergence and maintenance of life on earth is considered as its merit, the photosynthesis reactions, the radiation effect and the ecosystem transformation phenomena, including the light influence effect, are carefully studied. Photochemical reactions are used in industrial synthesis, in the processes of recording, reading and transmitting of information, as well as technologies of producing corresponding devices. In some cases photochemical reactions are the only means of unique chemical compounds synthesis.

Bachelor's degree graduates know characteristics of various types of radiation, fundamentals and principles of photochemistry, key physical processes occurring in the substance that has absorbed certain amount of radiation, mechanisms of absorbed energy degradation; can determine the quantum yield of different physical and chemical processes and know typical photochemical reactions of diverse chemical compounds classes.

### **Spectroscopy**

During the course students study spectral analysis methods, in particular, atomic emission, atomic absorption and x-ray fluorescence methods, which are widely used in modern industry and research. These methods are applied in the analysis of metals and alloys, ores and minerals, powders and solutions, high-purity substances and semiconductor materials; and are also used for the environmental pollution control (water, air, soil, agricultural products, etc.). Therefore a future analytical chemist is to know and to apply these methods.

Bachelor's degree students learn theoretical fundamentals of spectral methods of analysis, key spectral instruments and sources of spectra excitation, methods of qualitative and quantitative spectral analysis, techniques of qualitative and quantitative analysis of various materials, metrological characteristics of analysis methodology. Based on theoretical and practical knowledge students can analyze metals and alloys, solutions, powders and other substances with the use of visual, photographic and photoelectric spectrum registration devices and process the respective results. Students become theoretically and

practically prepared for a thesis in the sphere of spectral analysis.