

## Applied Geology

1. Forms of occurrence of substances in water (true and colloidal solutions, suspensions, ions, complexes, ion pairs, organic complexes). Carbonate system. Acid-base reactions (water dissociation, pH, mass balance, electroneutrality condition, proton condition, acidity and alkalinity, determination methods). Oxidation-reduction processes (electrochemical potentials, Nernst equation, redox potential, mixed potentials, electron activity, electrodes, Eh/pH diagrams). Organic and radioactive substances and isotopes in groundwater (division, structure, fractionation, geochronology, etc.).
2. Methods of obtaining hydraulic parameters - laboratory tests, empirical formulas, hydrodynamic tests. Boundary conditions. Pumping tests in conditions of steady flow (free and stressed level). Pumping tests under steady flow conditions (Theis, Jacob). Climbing tests and their meaning.
3. Groundwater protection and remediation (causes and types of groundwater contamination, protection methods, pollution remediation methods, sanitary protection zones). Pollutants in waters. Form of occurrence, methods of determination. Groundwater and seepage water treatment technology.
4. Basic legislation in hydrogeology, protection of underground and surface water. Basic legislative principles of HG survey management. Expertise in carrying out of HG survey.
5. Problematics of standards relating to classes of bedrock and foundation soils, workability, calculated bearing capacity, physical-mechanical properties of soils and solid rock. Documentation in engineering geology. Improving the properties of the geological environment.
6. Problematics of engineering-geological investigation and works in the field of slope deformations, environment, mining and urban planning.
7. Problematics of engineering geological investigation of ground, underground and line structures (transportation structures, underground transmission lines)
8. Problematics of engineering geological investigation of water management structures (especially dams), nuclear power plants and waste disposal.
9. Types of geothermal systems and methods of their utilization
10. Drilling and completion of geothermal boreholes
11. Design of the primary borehole exchangers, thermal response test, EED software
12. Underground thermal energy storage