

LIST OF EXAMINATION QUESTIONS

Master's program 18.04.02

"Industrial Ecology and Cleaner Production"

1. Theories on the origin of life. Differences between living and non-living things. Evolution of life.
2. Balancing mechanisms in natural ecosystems. Homeostasis and succession. Types of successions. Emergence.
3. Biogeocenosis and ecological ecosystems. Simplified man-made ecosystems.
4. Global and regional ecological problems.
5. Origins of the environmental crisis. Scenarios of overcoming the environmental crisis. Sustainable biosphere.
6. Main stages of technogenesis. Technosphere as the final stage of technogenesis. Key evidence of the expansion of technosphere.
7. Interaction of facilities used for human economic activity with the environment. Environmental pollution classification
8. General environmental protection regulations for enterprises. Industrial environmental monitoring.
9. Emission inventory. Types and key stages of emission inventory.
10. Basic terms and concepts: pollutant, pollutant source, emission source. Classification of emission sources.
11. Standardization of pollutants into the atmosphere. TLV, SRLI. Types of TLV. The concept of separated standardization of pollutants. Key regulatory documents. Types of combined effects of pollutants on a human organism. Ambient concentration. Sources of information on ambient concentration values.
12. Pollutant ventilation in the atmospheric air. Key factors affecting pollutant ventilation. Changes in pollutant concentration depending on the height of emission source and in the ground level of atmospheric air with distance from the emission source.
13. MPE, TAE. Conditions for establishing MPE's, TAE mitigation measures. Establishing an enterprise's MPE. Key development stages. Structure and synopsis of sections of an MPE book..
14. Accounting management of water consumption at an enterprise. Procedure of establishing pollution standards.
15. Environmental safety issues of waste management. Hazardous waste classification procedure.
16. Strategies and tasks of monitoring atmospheric air and natural waters.
17. Control of contamination of soil by human-made hazardous substances. Rules for selecting and preparing soil samples for analysis. Complex classification of soil contamination levels.
18. Environmental resource management. The ecological mission, policy and objectives of an industrial enterprise. Planning of an enterprise's activities in the field of environmental resource management.
19. International system of standards in the field of environmental management. ISO 14000 family of standards.
20. Audit requirements for quality management systems and environment management systems according to the GOST R ISO 19011 international standard. Audit of an environment management system.
21. Types of environmental audits. Environmental audit as an element of the environmental management system of an enterprise. Requirements for education and work experience when training a specialist to work as an environmental auditor.

22. Environmental projects' feasibility studies.
23. Procedure of establishing pollution fees.
24. Fundamentals of environmental management in the Russian Federation.
25. Facilities, equipment and machines for separating particulate pollutants from waste waters.
26. Physical and chemical approaches to wastewater treatment and the associated equipment.
27. Aerobic biological wastewater treatment; basic principles. External influences on the process of biological treatment.
28. Anaerobic biological wastewater treatment; basic principles. External influences on the process of biological treatment.
29. Purification of industrial gaseous discharge from hazardous vapours and gaseous components. Adsorption technique.
30. Ion exchange: the gist of the approach, natural and synthetic ionites, exchange capacity of ion exchangers. Process designs of ion-exchange systems for purifying natural and waste waters, and the associated equipment.
31. Specifics and field of application of the processes of baromembrane separation of contaminated liquids. Mechanisms of hyper- and ultrafiltration separation.
32. Membrane technology for water purification: process flow diagram.
33. Destructive wastewater treatment methods: treatment with various oxidants, liquid-phase oxidation, electrochemical destruction. Associated instrumentation.
34. Wastewater sludge treatment: associated instrumentation and sludge properties, general methods of sludge utilization, general sludge processing processes with the application of the aforementioned equipment.
35. Disposal and recycling of solid industrial and domestic waste: properties of industrial and domestic waste, industrial and solid domestic waste dumping grounds.
36. Waste recycling and waste burning plants, basic equipment of such facilities.
37. Reverse waste collection of valuable components from solid industrial and domestic waste: basic methods and the associated equipment.
38. Plants and equipment for dry and wet removal of dust particles from gases.
39. Purification of industrial gaseous discharge from hazardous vapours and gaseous components. Thermal method.
40. Basics of low-waste and cleaner production engineering: key concepts, requirements for technical processes, instrumentation, resource base.