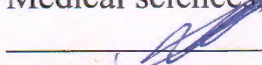


BELARUSIAN STATE MEDICAL UNIVERSITY

Exam on «Radiation Medicine
and Ecology» for students of the
Medical Faculty of Foreign
Students studying at the specialty:
7-07-0911-01 General Medicine

«APPROVED»
Head of the Department Radiation
Medicine and Ecology, PhD in
Medical sciences, Assoc. Prof

A.R. Avetisov
20.11. 2025

EXAM QUESTIONS

Section «Radiation medicine»

1. Radiation medicine: definition of the concept, goals, objectives, methods. Nucleon, isotope, radionuclide: definition of the concept, main characteristics.
2. Ionizing radiation: definition of the concept, classification, main characteristics. The mechanism of formation and characteristics of X-ray and gamma radiation, their interaction with matter.
3. Radioactivity: definition of the concept, main characteristics of the process. Activity as a characteristic of an ionizing radiation source: definition of the concept, types, units, ratio of systemic and non-systemic units.
4. The Law of Radioactive decay: definition, equation, graphical representation, practical use to justify measures to protect the public in case of accidents at nuclear facilities (nuclear power plant).
5. The mechanism of formation (types of radioactive transformations of nuclei) and the interaction of charged particles with matter. Linear energy transfer (LET): definition, unit of measurement, classification of radiation depending on the LET. Examples of elements undergoing the corresponding types of radioactive transformations.
6. The stages of formation of radiation damage. The scheme of oxidative stress.
7. Radiolysis of water, the main products of radiolysis. Direct and indirect effects of ionizing radiation on biomolecules. Oxygen effect: definition of the concept, connection with linear energy transfer (LET), practical use for controlling tissue radiosensitivity.
8. Radiation biochemistry of nucleic acids, proteins, lipids. The effect of ionizing radiation on cell membrane structures.
9. Types of cell reactions to radiation. Modern concepts of the mechanisms of interphase and mitotic cell death. The sequence of reactions leading to cell lysis.

10. Methods of registration of ionizing radiation, their characteristics, detectors and devices used.

11. Dosimetry. There are three types of quantities: physical, normalized, operational – definition of concepts, purpose.

12. Dosimetric quantities: absorbed dose, equivalent dose, effective dose – definition, formula, characteristics of weighing and tissue coefficients, dose units and their ratio, application features.

13. Radiation background: definition of the concept, structure, contribution of the main components to the formation of the annual effective radiation dose of the population.

14. Natural radiation background: sources of terrestrial and extraterrestrial origin, their contribution to the formation of effective radiation doses to the population.

15. Radioactive series: definition of the concept and types. The contribution of daughter decay products of Uranium-238 and Thorium-232 to the formation of effective doses of radiation to the population, possible biological effects of daughter decay products.

16. Radon and its decay products: characteristics, intake, distribution and excretion from the body, radiation levels of the population, possible biological effects. Optimization of the dose loads created by radon and its decay products.

17. Technogenically modified radiation background: definition of the concept, components and their contribution to the formation of effective doses of radiation to the population.

18. The nuclear fuel cycle: definition of the concept, stages and their contribution to the formation of the radiation dose of the population.

21. The accident at the Chernobyl nuclear power plant. Ways of formation of radiation doses among the population of the republic in the early, intermediate and recovery periods of the accident.

22. General patterns and characteristics of the routes of entry of radionuclides into the human body. Comparative characteristics of oral and inhaled routes of radionuclide intake into the body.

23. General patterns and characteristics of the distribution and excretion of radionuclides from the human body.

24. The main dose-forming radionuclides: Cs-137 and Sr-90 - characterization, intake, distribution and excretion from the body, possible biological effects.

25. Radionuclide I-131 – characterization, intake, distribution and excretion from the body, possible biological effects. Protection of the thyroid gland in the event of a radiation accident: indications and contraindications, doses and duration of taking stable iodine preparations.
26. Radiosensitivity: definition of the concept, evaluation criteria, determining factors at the cellular and tissue levels of the organization of living matter.
27. Radio sensitivity of human organs and systems.
28. Radiosensitivity at the population level. The effect of radiation on the embryo and fetus.
29. Bone marrow radiation syndrome: conditions of development, characteristics, relationship with radiation dose.
30. Gastrointestinal radiation syndrome and syndrome of damage to the cardiovascular and central nervous systems: conditions of development, characteristics, relationship with radiation dose.
31. Acute radiation sickness: classification (periods, phases, severity); clinical manifestations, principles of treatment.
32. Chronic radiation sickness (HRS): classification; conditions of development and features of various variants of HRS; changes in the main body systems in HRS; principles of treatment.
33. Deterministic effects of radiation: definition of the concept, types, characteristics, dependence of the effect on the dose.
34. Stochastic effects of radiation: definition of the concept, types, characteristics, dependence of the effect on the dose.
35. Comparative characteristics of deterministic and stochastic effects of irradiation.
36. Small doses of ionizing radiation: definition of the concept, types of dose-effect relationships. Radiation hormesis.
37. International and national regulatory and management in the field of radiation safety.
38. Source of ionizing radiation: definition of the concept, classification by type, purpose, degree of potential radiation hazard.
39. Sealed radionuclide sources of ionizing radiation. Methods of protection from external radiation.

40. Principles of radiation protection, practical application to reduce the dose burden on the population.
41. Unsealed radionuclide sources of ionizing radiation. Methods of protection from external and internal radiation.
42. International scale of nuclear events: general characteristics, criteria for event classification.

Section «Environmental medicine»

43. Biosphere: definition of the concept, characteristics of the main components. Ecosystem: definition of the concept, components (ecotope and biocenosis), their characteristics. Classification of ecosystems by energy sources, examples of ecosystems and their features.
44. Trophic levels and food chains. Producers, consumers, reducers. Patterns of energy and substance transfer within the food chain. Stepwise accumulation of foreign chemical substances, toxic compounds and radionuclides included, during their moving up the food chain.
45. Visible light: concept and profile. Biological clock: the diurnal cycle control mechanism. Seasonal affective (emotional) disorder: pathogenesis, signs, preventive measures.
46. Ultraviolet radiation (UVR): ranges, profiles, sources. Innate human protective mechanisms against adverse effects of UVR.
47. Types of the human skin sensitivity to ultraviolet radiation (UVR). Medicinal products compounds modifying human sensitivity to UVR.
48. The principal parameters to describe the effect of ultraviolet radiation exposure on the skin: erythema action spectrum (EAS), minimal erythema dose (MED), ultraviolet radiation index (UV index).
49. Human health implications of UVR exposure. Strategies to prevent the skin and the organ of vision adverse effects.
50. Oxidative stress and the principles of preventing its effects at the cellular level.
51. Chemicals (xenobiotics): definition of the concept, classification. Properties of xenobiotics that determine their toxicity. Mechanisms of toxic action.
52. Effectors of the endocrine system: definition, classification, metabolism and mechanism of action.

53. Characteristics of anthropogenic effectors of the endocrine system (EES), possible consequences of their prolonged intake into the human body. The protective effect of natural EES.

54. Environmental factors of biological origin. *Candida Albicans* and their significance in human pathology. Hypersensitivity pneumonia and legionnaires' disease.

55. The composition and structure of the Earth atmosphere. Sources and components of atmospheric pollution. Environmental and medical consequences of atmospheric pollution.

56. Features of the influence of atmospheric pollutants on the human body. Pulmonotoxicity and hematotoxicity of xenobiotics.

57. Carbon oxides: characteristics, sources of atmospheric entry, mechanism and clinical manifestations of toxic effects on the human body.

58. Greenhouse effect, sequence of changes in the biosphere during global warming, possible medical consequences of global warming.

59. Nitrogen oxides: characteristics, sources of atmospheric entry, mechanism and clinical manifestations of toxic effects on the human body.

60. Photochemical smog: conditions of formation, components, including the formation of products of photochemical reactions, their effect on the human body.

61. Sulfur oxides: characteristics, sources of atmospheric entry, mechanism and clinical manifestations of toxic effects on the human body.

62. Stratospheric ozone: characteristics, mechanism of formation and destruction. Factors affecting ozone concentration in the stratosphere, biological and medical consequences of ozone depletion.

63. The Earth water origin and destination. Contamination of aquatic environment associated with natural events and human activities: factors and sources. Hydrosphere pollution environmental and human health effects.

64. Water-associated diseases caused by living in water organisms: WHO epidemiological classification.

65. Neurotoxicity and nephrotoxicity concepts. Health effects of waterborne xenobiotics, including neurotoxic and nephrotoxic effects.

66. Diseases mediated by chemical pollutants of drinking water. Environmental significance and health effects of chlorine compounds in water.

67. Environment-dependent morbidity of humans. Drinking water qualitative criteria: epidemiological safety, chemical safety, favorable organoleptic properties, radiation safety.

68. Lithosphere, soil: definition of concepts, characteristics. Natural and anthropogenic geochemical province, the relationship with the development of endemic pathology.

69. Conditions and factors contributing to the development of endemic goiter, the effect of xenobiotics on thyroid function. Nonspecific and specific prevention of endemic goiter. The WHO recommended daily intake of iodine.

70. Detoxification of xenobiotics: concept, sequential stages. Chemical modification of xenobiotics.

71. Food components. Classification of xenobiotics in foods. Harmful chemicals of natural origin in food; toxic compounds formed under certain conditions in food and the human body.

72. Genetically modified organisms and food products: definition of the concept, use, risks to human health and the environment, ensuring biosafety (rationing and legal regulation).

73. Mercury (Hg) as a toxic contaminant of food and water: characteristics; sources of entry into water, food and the human body, mechanisms and consequences of its effects on the human body. Conducting demercurization.

74. Lead (Pb) as a toxic contaminant of food and water: characteristics; sources of entry into water, food and the human body, mechanisms and consequences of exposure to the human body.

75. Aluminum (Al) as toxic contaminants of food and water: characteristics; sources of their entry into water, food and the human body, mechanisms and consequences of their effects on the human body.


76. Polychlorinated biphenyls and dioxins: characteristics, sources, routes of entry, distribution features in the human body, their impact on public health and the human environment.

77. Nitrites and nitrates: the main sources of entry into the human body, the conversion of nitrates in water, soil and food, regulation of the content of nitrites and nitrates in food and water, the effect of nitrites and nitrates on the human body, medical care for poisoning with nitrites and nitrates.

78. Tobacco smoke: characteristics of the main components, the toxic effect of tobacco combustion products on the human body under various exposure options.

79. "Sick building" syndrome: definition of the concept, factors contributing to its development, clinical manifestations, prevention.
80. Multiple chemical sensitivity: definition of the concept, factors contributing to its development; direct chemical inducers; characteristic features.
81. Non-ionizing electromagnetic radiation (NIER): definition of the concept, classification, mechanisms of biological action depending on the physical characteristics of NIER and exposure conditions.
82. Mobile communication: definition of the concept, features. The effect of pulsating microwave radiation on humans. Minimizing human exposure.
83. Assessment of the risk to human health caused by environmental factors: definition of the concept; stages of assessment of health risks associated with environmental factors. Assessment of risk acceptability.
84. Environmental monitoring: definition of concepts, types, methods.

The present question list for the exam in the discipline «Radiation Medicine and Ecology» for the 3-nd year English medium students studying at the specialty 7-07-0911-01 «General Medicine» was reviewed and approved at the Department of Radiation Medicine and Ecology meeting. Minutes No 4 of November 20, 2025

PhD in Medical sciences, Associate Professor  L.M. Sheuchuk