Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
of Higher Education
"St. Petersburg State University of Veterinary Medicine"

APPROVED BY
Vice-Rector for Educational
Work and Youth Policy
_____ Sukhinin A.A.
May 6, 2024

Department of veterinary hygiene and radiobiology

EDUCATIONAL WORK PROGRAM

for the discipline

«VETERINARY RADIOBIOLOGY»

The level of higher education
SPECIALIST COURSE

Specialty 36.05.01 Veterinary Medicine
Full-time education
Education starts in 2024

Reviewed and adopted
at the meeting of the department
on May 2, 2024.
Protocol No. 10

Head of the Department
of veterinary hygiene and radiobiology,
Doctor of Veterinary Medicine, Associate Professor
_____ Belopolsky A.E.

Saint Petersburg
2024

1. AIMS AND OBJECTIVES OF THE DISCIPLINE «VETERINARY RADIOBIOLOGY»

The purpose of the discipline is to give students theoretical knowledge, master methods and acquire practical skills necessary for the organization and conduct of radiological control in the field of agro-industrial complex.

Tasks:

a) the general educational task is to familiarize students in-depth with the physical foundations and methods of veterinary radiobiology, the laws of the phenomenon of radioactivity and the properties of radioactive radiation, radiation damage to farm animals, pathogenesis, diagnosis and treatment of radiation sickness.

b) the applied task highlights issues related to modern methods of radiation control of agricultural products to determine the levels of its radioactive contamination, the main patterns of migration of radionuclides in natural and agricultural ecosystems, their toxicological characteristics, the peculiarities of accumulation and excretion of waste products and methods of using livestock products and animals in radiation damage in different types of farm animals and creates a conceptual framework for the implementation of interdisciplinary structural and logical connections in order to develop medical thinking skills.

c) a special task is to familiarize students with modern trends and methodological approaches for predicting pollution of agricultural products and dose loads on the population in conditions of radioactive contamination to solve problems of animal husbandry and veterinary medicine, as well as existing achievements in this field.

2. THE LIST OF THE PLANNED RESULTS OF THE DISCIPLINE (MODULE), CORRELATED WITH THE PLANNED RESULTS OF THE REALISED EDUCATIONAL PROGRAM

As a result of mastering the discipline, the student prepares for the following types of activities, in accordance with the educational standard of the Federal State Educational Standard for Higher Education 36.05.01 "Veterinary Medicine".

Area of professional activity:

13 Agriculture

The student's competencies formed as a result of mastering the discipline.

The study of the discipline "**Veterinary radiobiology**" should form the following competencies:

A) Universal competencies:

UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations.

UC-8 ID-1 **To know:** the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services.

UC-8 ID-2 **To be able to:** identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations.

UC-8 ID-3 **To possess skills of:** the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergen-

cy situations; skills in maintaining safe living conditions, including those based on digital technologies.

GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body.

GPC-2 ID-1 **To know:** ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body.

GPC-2 ID-2 **To be able to:** use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors

GPC-2 ID-3 **To possess skills of:** the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.

GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.

GPC-4 ID-1 **To know:** the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

GPC-4 ID-2 **To be able to:** apply modern technologies and research methods in professional activities, interpret the results obtained.

GPC-4 ID-3 **To possess skills of:** the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

3. PLACE OF THE DISCIPLINE IN THE STRUCTURE OF MPEP

The discipline **B1. O. 29 "Veterinary radiobiology"** is a discipline of Block 1 of the mandatory part of the federal state educational standard of higher education in the specialty 36.05.01 "Veterinary Medicine" (specialty level).

Mastered: full-time-in the 5th semester; part – time-in the 6th semester; part-time in the 4th year.

When studying the discipline "Veterinary Radiobiology", the knowledge and skills acquired by students in the process of mastering the disciplines of civil defense and emergency response, radiobiology, chemistry, physics, biochemistry, physiology, pathophysiology, toxicology are used.

4. SCOPE OF THE DISCIPLINE "VETERINARY RADIOBIOLOGY" FOR FULL-TIME TRAINING

Type of academic work	Hours	Semesters
		5
Classroom sessions (total)	**68**	**68**
Including:		
Lectures, including interactive forms	34	34
Practical (PP), including interactive forms, including:	34	34
Practical training (PT)	8	8
Self-study (total)	**49**	**49**
Control	**27**	**27**
Type of intermediate certification (test, exam)	**exam**	**exam**
Total labor intensity hours / credits	**144/4**	**144/4**

5. CONTENT OF THE DISCIPLINE "VETERINARY RADIOBIOLOGY" FOR FULL-TIME EDUCATION

#	Name	Competencies being formed	Semester	Types of academic work, including independent work of students and labor intensity (in hours)			
				Lectures	Practical lessons	Practical training	Self-study
1.	Subject, objectives and history of radiobiology development	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 **To know:** the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services.	5	2	-		4
2.	Sources of ionizing radiation and fundamentals of radiation safety.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-2 **To be able to:** identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations.	5	-	2		2
3.	Fundamentals of nuclear physics.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-3 **To possess skills of:** the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies. GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-3 **To possess skills of:** the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	5	2	-		4

4.	Interaction of ionizing radiation with matter.	**UK-8: Is able to create and maintain safe living conditions, including cases of emergency situations.** UC-8 ID-2 **To be able to:** identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations. **GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body.** GPC-2 ID-1 **To know:** ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body. GPC-2 ID-2 **To be able to:** use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors GPC-2 ID-3 **To possess skills of:** the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.	5	2-4	-		4
5.	Dosimetry of ionizing radiation, calculation of doses and radiation dose rates.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-2 To be able to: identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations. GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	5	-	1	1	2

6.	Final lesson on converting non-system units of ionizing radiation doses and dose rates into a system of international units.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-2 To be able to: identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations. UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies. GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.	5	-	-	2	2
7.	Dosimetry of ionizing radiation.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies. GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	5	2	-		4
8.	Determination of radiation doses by calculation method under external radiation exposure.	UC-8: Is able to create and maintain safe living conditions, including cases of emergen-cy situations. UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situ-ations; skills in maintaining safe living conditions, including those based on digital technologies. GPC-4. Is able to use methods to solve problems, using modern equipment for the de-velopment of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in profes-sional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementa-tion of the set tasks for research and the development of new technologies, digital ones, as well.	5	-	1	1	2

9.	Natural radiation background and artificial sources of ionizing radiation.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. UC-8 ID-2 To be able to: identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations. UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies.	5	2-4	-		4
10.	Types of dosimetry. Methods, design and operation of dosimetric devices.	GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	5	-	2		2

11.	Colloquium on the section "Dosimetry of ionizing radiation"	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies. GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body. GPC-2 ID-2 To be able to: use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	5	-	2		2
12.	Radiometry of ionizing radiation.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	5	2	-		2

13.	Radiometry. Radioactivity and its measurement units.	GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	5	-	2		2
14.	Final lesson on calculating the activity of radioisotopes.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.	5	-	2		2
15.	Toxicology of radioactive substances.	GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body. GPC-2 ID-2 To be able to: use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors	5	2	-		2

16.	Calculation of radiation doses under internal radiation exposure, specific radioactivity of veterinary surveillance facilities in the external environment.	GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body. GPC-2 ID-2 To be able to: use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.	5	-	1	1	2
17.	Biological effect of ionizing radiation and factors affecting the degree of radiation damage.	GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body.	5	2	-		2
18.	Acute radiation sickness of animals.	GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body. GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.	5	2-2	-		2

19.	Chronic radiation sickness. Radiation burns and long-term consequences of radiation exposure.	GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body. GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.	5	2-2	-		2
20.	Fundamentals of agricultural radioecology.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body.	5	2	-		2
21.	Colloquium on the section "Radiation sickness"	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body. GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.	5-2	-	2		2

22.	Purpose, classification, and operation of radiometers.	GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	5	-	2		2
23.	Radiometric devices and their design characteristics.	GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	5-2	-	2	2	2
24	Colloquium on the section "Radiometry"	GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	5-2	-	2		2
25	Methods for determining the specific radioactivity of objects of veterinary supervision and the external environment.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies. GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body. GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.	5-2	-	2		2

26	Features of the course of radiation damage depending on the amount of radiation dose.	GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.	5-2	-	2		2
27	Migration, forecasting and rationing of the most dangerous radionuclides and features of their transition along feed chains.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies. GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.	5	2-2	-		2
28	Organization and management of animal husbandry in conditions of radioactive contamination.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies. GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.	5	2-2	-		2
29	Forecasting the content of radionuclides in agricultural products	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. UK-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies. GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.	5-1	-	1	1	2

30	Measures to reduce the content of radionuclides in feed and livestock products in conditions of radioactive contamination of the environment.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body. GPC-2 ID-2 To be able to: use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors	5	2-2	-		2
31	Radiation expertise and veterinary and environmental monitoring of objects of veterinary and sanitary supervision.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.	5	2-2	-		2
32	Fundamentals of radiation safety when working with radioactive substances and ionizing radiation.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies.	5	2-2	-		2

33	Use of ionizing radiation and radioactive isotopes in crop production, animal husbandry and veterinary medicine.	UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations. UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. UC-8 ID-2 To be able to: identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations. GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. GPC-2 ID-2 To be able to: use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors	5	2-2	-		2
			TOTAL	**34**	**26**	**8**	**76**

6. LIST OF EDUCATIONAL AND METHODOLOGICAL SUPPORT FOR INDEPENDENT WORK OF STUDENTS

6.1. Guidelines for independent work

1.Yugatova N. Yu., Tsyganov A.V., Ponomarenko N. P., Gaponova V. N. Methodological guidelines for performing control works on the discipline "Veterinary radiobiology". Saint Petersburg: SPbGAVM Publishing House, 2018, 24 p. https://clck.ru/VXk3k(in Russian). https://clck.ru/VXk3k (accessed on 27.04.2024). - Access mode: for authorization. users of the SPbGUVM Library.

6.2. Literature for independent work

1. Usha B. V., Seregin I. G. Veterinary supervision of animals and livestock products in emergency situations : [recommended by the UME] : textbook / B. V. Usha, I. G. Seregin. Saint-Petersburg: Kvadro Publ., 2013, 512 p. (in Russian)

2. Lysenko N. P., Pak V. V., Rogozhina L. V., Kusurova Z. G. Radiobiology : textbook; edited by N. P. Lysenko, Pak V. V. - 5th ed., ster. Saint Petersburg: Lan Publ., 2022, 572 phttps://e.lanbook.com/book/206792. (in Russian). https://e.lanbook.com/book/206792 (accessed: 27.04.2024). - Access mode: for authorization. users of EBS "Lan".

3. Zlobin V. S., Lysenko N. P. Radiobiological bases of radiation hygiene and veterinary and sanitary expertise. Saint-Petersburg: B. I., 2008, 359 p. (in Russian).

4. Lysenko N. P., Pasternak A.D., Rogozhina L. V., Pavlov A. G. Conducting animal husbandry in conditions of radioactive pollution of the environment. Saint Petersburg: Lan Publ., 2022, 240 phttps://e.lanbook.com/book/210131. (in Russian). https://e.lanbook.com/book/210131 (accessed: 27.04.2024). - Access mode: for authorization. users of EBS "Lan".

5. Yarmonenko S. P. Radiobiology of humans and animals: textbook. manual / S. P. Yarmonenko, A. A. Vainson; ed. by S. P. Yarmonenko. - Moscow: Higher School, 2004. - 549 p.: ill. - Text (visual): direct.

6. Belov A.D., Kirshin V. A., Lysenko N. P. Radiobiology : textbook; edited by A.D. Belov. - Moscow: Kolos Publ., 1999. - 384 p.: ill. - (Textbooks and textbooks. the manual. for students. higher level. study. 2.). - Text (visual): direct.

7. Grigoriev Yu. G.. Kosmicheskaya radiobiologiya [Space radiobiology]. Moscow: Energoizdat Publ., 1982, 175 p.: ill. Text (visual): direct.

8. Kirshin V. A., Belov A.D., Burdakov V. A. Veterinary radiobiology. - Moscow: Agropromizdat, 1986. - 175 p.: ill. - Text (visual): direct.

7. LIST OF BASIC AND ADDITIONAL LITERATURE REQUIRED FOR MASTERING THE DISCIPLINE

A) main literature:

1. Short course of veterinary radiobiology : textbook / comp.: E. I. Troshin [et al.]; Ministry of Agriculture of the Russian Federation, SPbGAVM. Saint Petersburg: SPbGAVM Publishing House, 2019, 184 p. URL: https://clck.ru/VXjjD (in Russian). https://clck.ru/VXjjD (accessed: 27.04.2024). - Access mode: for authorization. users of the SPbGUVM Library.

2.Troshin E. I., Vasiliev R. O., Yugatova N. Yu., Tsyganov A.V. Osnovy prakticheskoi radiobiologii : uchebnoe posobie dlya samostoyannoi raboty studentov veterinarnykh VUZov i fakultetov [Fundamentals of practical radiobiology: a textbook for independent work of students of veterinary universities and faculties]. Saint Petersburg: SPbGAVM Publishing House, 2018, 250 p. https://clck.ru/VXjve(in Russian). https://clck.ru/VXjve (accessed: 27.04.2024). - Access mode: for authorization. users of the SPbGUVM Library.

3. Stepanov V. G. Veterinary radiobiology : a textbook / V. G. Stepanov. Saint Petersburg: Lan Publ., 2022, 352 phttps://e.lanbook.com/book/212978. (in Russian).

https://e.lanbook.com/book/212978 (accessed: 27.04.2024). - Access mode: for authorization. users of EBS "Lan".

4. Stepanov V. G. Veterinary radiology : a textbook / V. G. Stepanov. - St. Petersburg: Lan, 2021. - URL: https://e.lanbook.com/book/169054 (accessed: 27.04.2024). - Access mode: for authorization. users of EBS "Lan".

5. Troshin, E. I. Tests in radiobiology : a textbook / E. I. Troshin, Yu. G. Vasiliev, I. S. Ivanov. Saint Petersburg: Lan Publ., 2022, 240 phttps://e.lanbook.com/book/211610. (in Russian). https://e.lanbook.com/book/211610 (accessed: 27.04.2024). - Access mode: for authorization. users of EBS "Lan".

B) additional literature:

1. Workshop on radiobiology: add. Lysenko N. P., Pak V. V.,Rogozhina L. V. [et al.], Moscow: KolosS Publ., 2008, 399 p.: ill. - Text (visual) : direct.

8. LIST OF RESOURCES OF THE INFORMATION AND TELECOMMUNICATIONS NETWORK "INTERNET" NECESSARY FOR MASTERING THE DISCIPLINE

To prepare for practical classes and perform independent work, students can use the following Internet resources:

https://meduniver.com -Medical information site.

https://www.rosatom.ru/ - information site about the nuclear industry

http://www.niirg.ru - information site of the NIIRG named after him. Ramzaeva

Electronic library systems:

1. EBS "SPBGUVM"
2. EBS "Lan Publishing House"
3. EBS "Student's consultant"
4. ConsultantPlus Legal Reference System
5. University information system "RUSSIA"
6. Full-text database POLPRED.COM
7. Scientific Electronic Library ELIBRARY.RU
8. Russian Scientific Network
9. IQlib Electronic Library System
10. Database of International Science Citation Indexes Web of Science
11. ProQuest AGRICULTURAL AND ENVIRONMENTAL SCIENCE DATABASE, a full-text interdisciplinary database for agricultural and environmental sciencesProQuest AGRICULTURAL AND ENVIRONMENTAL SCIENCE DATABASE
12. Electronic books published by Prospekt Nauki Publishing House http://prospektnauki.ru/ebooks/
13. KoCollection " Agriculture. Veterinary Medicine" by Kvadro Publishing House http://www.iprbookshop.ru/586.html

9. GUIDELINES FOR STUDENTS ON MASTERING THE DISCIPLINE "VETERINARY RADIOBIOLOGY "

Methodological recommendations for students are a set of recommendations and explanations that allow the student to optimally organize the process of studying this discipline.

The content of methodological recommendations, as a rule, may include:

- Tips for planning and organizing the time required to study the discipline. Description of the sequence of actions of the student, or "scenario of studying the discipline".

The morning time is the most productive for academic work (from 8-14 hours), followed by the afternoon time (from 16-19 hours) and the evening time (from 20-24 hours). The most difficult material is recommended to be studied at the beginning of each time interval after rest. After 1.5 hours of work, you need a break (10-15 minutes), after 4 hours of work, the break should be 1 hour. Mastering the technique of intellectual labor is part of the scientific organization of labor. Normally, a student should spend about 10 hours a day studying (6 hours at the university, 4 hours at home).

- Recommendations for working on the lecture material.

When preparing for a lecture, the student is recommended to:

1) view the recordings of the previous lecture and restore the previously studied material in memory;

2) it is also useful to review the upcoming material of a future lecture;

3) if an independent study of individual fragments of the topic of the previous lecture is set, then it should be completed without delay;

4) psychologically tune in to the lecture.

This work includes two main stages: taking notes of lectures and subsequent work on the lecture material.

Taking notes means making a summary, i.e. a brief written statement of the content of something (an oral presentation – a speech, lecture, report, etc., or a written source – a document, article, book, etc.).

The method of work when taking notes on oral presentations differs significantly from the method of work when taking notes on written sources.

By taking notes of written sources, the student has the opportunity to repeatedly read the desired passage of the text, reflect on it, highlight the main thoughts of the author, briefly formulate them, and then write them down. If necessary, they can also note their attitude to this point of view. While listening to the lecture, the student should postpone most of the complex of the above-mentioned works to another time, trying to use every minute to record the lecture, and not to comprehend it – there is no time left for this. Therefore, when taking notes on a lecture, it is recommended to separate the fields for subsequent entries on each page in addition to the summary.

After recording a lecture or making a summary of it, you should not leave work on the lecture material before preparing for the test. It is necessary to do as early as possible the work that accompanies taking notes on written sources and which was not possible to do during the recording of the lecture - read your notes, decipher individual abbreviations, analyze the text, establish logical connections between its elements, in some cases show them graphically, highlight the main thoughts, mark questions that require additional processing, in particular, teacher consultations.

When working on the text of the lecture, the student should pay special attention to the problematic issues raised by the teacher during the lecture, as well as to his tasks and recommendations.

For each lecture, practical lesson, and laboratory work, the number, topic, list of issues covered, length in hours, and references to recommended literature are provided. For classes held in interactive forms, you should indicate their organizational form: computer simulation, business or role-playing game, analysis of a specific situation, etc.

- Recommendations for preparing for practical classes.

Practical (seminar) classes are an important part of students ' professional training. The main purpose of conducting practical (seminar) classes is to form students ' analytical, creative thinking by acquiring practical skills. Practical classes are also held to deepen and consolidate the knowledge gained during lectures and in the process of independent work on regulatory documents, educational and scientific literature. When preparing for a practical lesson for students, it is necessary to study or repeat theoretical material on a given topic.

When preparing for a practical lesson, the student is recommended to follow the following algorithm:

1) get acquainted with the plan of the upcoming lesson;

2) study the literature sources that were recommended and read the introductory notes to the relevant sections.

Methodological guidelines for practical (seminar) classes in the discipline, along with the work program and schedule of the educational process, refer to methodological documents that determine the level of organization and quality of the educational process.

The content of practical (seminar) classes is recorded in the working curricula of disciplines in the sections "List of topics of practical (seminar) classes".

Tasks are the most important component of any form of practical training. The basis in the task is an example that is understood from the point of view of the theory developed in the lecture. As a rule, the main attention is paid to the formation of specific skills, which determines the content of students ' activities - problem solving, laboratory work, clarification of categories and concepts of science that are a prerequisite for correct thinking and speech.

Practical (seminar) classes perform the following tasks:

- encourage regular study of the recommended literature, as well as attentive attitude to the lecture course;
- consolidate the knowledge gained in the course of lecture training and independent work on literature;
- expand the scope of professionally relevant knowledge, skills and abilities;
- allow you to check the correctness of previously acquired knowledge.
- instill skills of independent thinking, oral presentation;
- promote free use of terminology;
- provide the teacher with the opportunity to systematically monitor the level of independent work of students.

Methodological guidelines for practical (seminar) classes in the discipline should be focused on modern business conditions, current regulatory documents, advanced technologies, the latest achievements of science, technology and practice, modern ideas about certain phenomena, the reality being studied.

* Recommendations for working with literature.

Working with literature is an important stage of a student's independent work on mastering the subject, which contributes not only to consolidating knowledge, but also to expanding their horizons, mental abilities, memory, the ability to think, express and confirm their hypotheses and ideas. In addition, research skills are developed that are necessary for further professional activities.

When starting to study the literature on the topic, it is necessary to make notes, extracts, notes. It is mandatory to take notes on the works of theorists that allow us to understand the theoretical basis of the study. Otherwise, you can limit yourself to extracts from the studied sources. All extracts and citations must have an exact "return address" (author, title of the work, year of publication, page, etc.). It is advisable to write an abbreviated title of the question to which the extract or quote relates. In addition, it is necessary to learn how to immediately make a file of special literature and publications of sources, both proposed by the teacher and identified independently, as well as refer to bibliographic reference books, annals of journal articles, book chronicles, and abstract journals. At the same time, write publications of sources (articles, book titles, etc.) on separate cards, which must be filled in according to the rules of bibliographic description (last name, initials of the author, title of the work. Place of publication, publisher, year of publication, number of pages, and for journal articles – the name of the journal, year of publication, page numbers). On each card, it is advisable to record the idea of the author of the book or a fact from this book only on one specific issue. If the work, even in the same paragraph or phrase, contains other judgments or facts on another issue, then they should be written out on a separate card. The presentation should be concise, accurate, and free of subjective evaluations.

On the back of the card, you can make your own notes about this book or article, its content, structure, what sources it is written in, and so on.

* Explanations about working with control and test materials for the course, recommendations for completing homework.

Testing allows you to determine whether the actual behavior of the program corresponds to the expected one by performing a specially selected set of tests. A test is the fulfillment of certain conditions and actions necessary to verify the operation of the function under test or part of it. Each question in the discipline must be answered correctly by selecting one option.

10. EDUCATIONAL WORK

As part of the implementation of the discipline, educational work is carried out to form a modern scientific worldview and a system of basic values, to form and develop spiritual and moral, civil and patriotic values, a system of aesthetic and ethical knowledge and values, attitudes of tolerant consciousness in society, to form students ' needs for work as the first vital necessity, the highest value and the main success in life, to realize the social significance of your future profession.

11. LIST OF INFORMATION TECHNOLOGIES USED IN THE IMPLEMENTATION OF THE EDUCATIONAL PROCESS

11.1. In the educational process of the discipline, the use of information technologies is provided:

✓ conducting practical classes using multimedia;

✓ interactive technologies (conducting dialogues, collective discussion of various approaches to solving a particular educational and professional task);

✓ interaction with students via e-mail;

✓ joint work in the Electronic information and Educational environment of St. Petersburg State University of Internal Affairs: https://spbguvm.ru/academy/eios/

11.2. Software

List of licensed and freely distributed software, including those produced in Russia

Non /	a Name of technical and computer training tools recommended by sections and topics	License
1	MS PowerPoint	67580828
2	LibreOffice	free software
3	OS Alt Education 8	free SOFTWARE
4	ABIS "MARK-SQL"	02102014155
5	MS Windows 10	67580828
6	System ConsultantPlus	503 / CL
7	Android OS	free software

12. MATERIAL AND TECHNICAL BASE NECESSARY FOR THE IMPLEMENTATION OF THE EDUCATIONAL PROCESS IN THE DISCIPLINE

Name of the discipline (module), practices in accordance with the curriculum	**Name of special rooms and rooms for independent work**	**Equipment of special rooms and rooms for independent work**
Veterinary radiobiology	015 (196084, Saint Petersburg, Moskovsky Prospekt, 99) Classroom for conducting seminar-type classes, group and individual consultations, current monitoring and	Specialized furniture: desks, chairs, stools, blackboard. Technical training facilities: multimedia projector, screen, computer.

	intermediate certification.	Visual aids and training materials: specialized stands for the discipline program, devices.
	011 (196084, Saint Petersburg, Moskovsky Prospekt, 99) Training room for conducting seminar-type classes, group and individual consultations, current control and intermediate certification	Specialized furniture: tables, chairs, whiteboard, visual visual aids Technical training tools: projector, screen, computer with Internet connection"and access to the electronic information and educational environment
	016 (99 Moskovsky Prospekt, Saint Petersburg, 196084). Training room for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification.	Specialized furniture: desks, chairs, stools, blackboard. Technical training facilities: computer, TV. Visual aids and training materials:. specialized stands for the discipline program, devices.
	017 (99 Moskovsky Prospekt, Saint Petersburg, 196084). Training room for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification.	Specialized furniture: desks, chairs, stools, blackboard. Technical training facilities: multimedia projector, screen, computer. Visual aids and training materials: specialized stands for the discipline program, devices.
	206 Large reading room (5 Chernigovskaya St., Saint Petersburg, 196084) Room for independent work.	Specialized furniture: tables, chairs Technical training facilities: computers with Internet connection and access to the electronic information and educational environment.
	214 Small Reading Room (5 Chernigovskaya St., Saint Petersburg, 196084) Room for independent work.	Specialized furniture: tables, chairs Technical training facilities: computers with Internet connection and access to the electronic information and educational environment
	324 Department of Information Technologies (5 Chernigovskaya St., 196084, Saint Petersburg) Storage and preventive maintenance of educational equipment.	Specialized furniture: tables, chairs, special equipment, materials and spare parts for preventive maintenance of technical training equipment.
	Box No. 3 Carpentry workshop (5 Chernigovskaya St., Saint Petersburg, 196084) A room for storage and preventive maintenance of educational equip-	Specialized furniture: tables, chairs, special equipment, materials for preventive maintenance of furniture.

	ment.	

Developers:

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Candidate of Biological Sciences **R. O. Vasilev**

Annex 1

Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
of higher education
«Saint Petersburg State University of Veterinary Medicine

Department of veterinary hygiene and radiobiology

FUND OF ASSESMENT TOOLS
for the discipline
"VETERINARY RADIOBIOLOGY "

Level of higher education
SPECIALIST COURSE

Specialty 36.05.01 Veterinary Medicine
Full-time education

Education starts in 2024

Saint Petersburg
2024

1. PASSPORT OF THE APPRAISAL FUND

Table 1

#	Formed competencies	Controlled sections (topics) of the discipline	Assessment tool
1.	**UC-8:** Is able to create and maintain safe living conditions, including cases of emergency situations. **UC-8 ID-1** To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services. **UC-8 ID-2** To be able to: identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations. **UC-8 ID-3** To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies. **GPC-2.** Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body. **GPC-2 ID-1** To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body. **GPC-2 ID-2** To be able to: use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors	Section 1. Physical bases of radiobiology.	Colloquium, abstract, tests
2.		Section 2. Dosimetry.	Colloquium, abstract, tests
3.		Section 3. Radiometry.	Colloquium, abstract, tests
4.		Section 4. Radiation injuries of animals.	Colloquium, Abstract
5.		Section 5. Biological effect of AI	Colloquium, abstract, tests
6.		Radel 6. Toxicology of RV	Colloquium, abstract, tests
7.		Section 7. Radioecology	Colloquium, abstract, tests
8.		Section 8. Forecasting and rationing of raw material input to crop and livestock production	Colloquium, abstract, tests

	GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well. **GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. **GPC-4 ID-1** To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. **GPC-4 ID-2** To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. **GPC-4 ID-3** To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.		

2. SAMPLE LIST OF EVALUATION TOOLS

Table 2

#	Name of the valuation tool	Brief description of the valuation tool	Presentation of the valuation tool in the fund
1.	Colloquium	is a means of controlling the assimilation of educational material of a topic, section or sections of a discipline, organized as a training session in the form of a teacher's interview with training	questions on topics/sections of the discipline
2.	Test	A system of standardized tasks that allows you to automate the procedure for measuring the level of knowledge and skills of the student	Fund of test tasks
3.	Abstract	is a product of independent work of the student, which is a summary in writing of the results of theoretical analysis of a certain scientific(educational and research) topic, where the author reveals the essence of the problem under study, gives various points of view, as well as his own views on it	Topics of research papers

3. INDICATORS AND CRITERIA FOR ASSESSING COMPETENCIES AT VARIOUS STAGES OF THEIR FORMATION, DESCRIPTION OF ASSESSMENT SCALES

Table 3

Planned results of competence	The level of development				Assessment tool
	Unsatisfactory	Satisfactory	Good	Excellent	
Is able to create and maintain safe living conditions, including cases of emergency situations **(UC-8).**					
UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services.	The level of knowledge is below the minimum requirements, there were gross mistakes	The minimum acceptable level of knowledge, many minor errors have been made	The level of knowledge corresponds to the training program, several minor errors have been made	The level of knowledge corresponds to the training program, no errors have been made	Colloquium, tests, summary
UC-8 ID-2 To be able to: identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations..	Basic skills were not demonstrated in solving standard tasks, and gross errors occurred	Basic skills have been demonstrated, typical problems have been solved with minor errors, all tasks have been completed, but not in full	All the basic skills have been demonstrated, all the main tasks have been solved with minor errors,. all the tasks have been completed in full, but some with flaws	All basic skills have been demonstrated, all main tasks have been solved with some minor flaws, all tasks have been completed in full	Colloquium, tests, summary
UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies	When solving standard problems basic skills were not demonstrated, gross errors occurred	There is a minimum set of skills to solve standard tasks with some shortcomings	When solving standard problems basic skills were not demonstrated with some flaws	Skills were demonstrated in solving non-standard tasks without errors and flaws	Colloquium, tests, abstract

. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body **(GPC-2)**					
GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body..	The level of knowledge is below the minimum requirements, there were gross mistakes	The minimum acceptable level of knowledge, many minor errors have been made	The level of knowledge corresponds to the training program, several minor errors have been made	The level of knowledge corresponds to the training program, no errors have been made	Colloquium, tests, summary
GPC-2 ID-2 To be able to: use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors.	Basic skills were not demonstrated in solving standard tasks, and gross errors occurred	Basic skills have been demonstrated, typical problems have been solved with minor errors, all tasks have been completed, but not in full	All the basic skills have been demonstrated, all the main tasks have been solved with minor errors, all the tasks have been completed in full, but some with flaws	All basic skills have been demonstrated, all main tasks have been solved with some minor flaws, all tasks have been completed in full	Colloquium, tests, abstract
GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the	When solving standard problems basic skills were not demonstrated, gross errors occurred	There is a minimum set of skills to solve standard tasks with some shortcomings	When solving standard problems basic skills were not demonstrated with some flaws	Skills were demonstrated in solving non-standard tasks without errors and flaws	Colloquium, tests, abstract

laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.					
Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. **(GPC-4.)**					
GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.	The level of knowledge is below the minimum requirements, there were gross mistakes	The minimum acceptable level of knowledge, many minor errors have been made	The level of knowledge corresponds to the training program, several minor errors have been made	The level of knowledge corresponds to the training program, no errors have been made	Colloquium, tests, abstract
GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.	Basic skills were not demonstrated in solving standard tasks, and gross errors occurred	Basic skills have been demonstrated, typical problems have been solved with minor errors, all tasks have been completed, but not in full	All the basic skills have been demonstrated, all the main tasks have been solved with minor errors, all the tasks have been completed in full, but some with flaws	All basic skills have been demonstrated, all main tasks have been solved with some minor flaws, all tasks have been completed in full	Colloquium, tests, abstract
GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	When solving standard problems basic skills were not demonstrated, gross errors occurred	There is a minimum set of skills to solve standard tasks with some shortcomings	When solving standard problems basic skills were not demonstrated with some flaws	Skills were demonstrated in solving non-standard tasks without errors and flaws	Colloquium, tests, abstract

4. LIST OF CONTROL TASKS AND OTHER MATERIALS NECESSARY FOR ASSESSING KNOWLEDGE, SKILLS, ABILITIES AND EXPERIENCE OF ACTIVITIES

4.1. Typical tasks for the current control of academic progress

4.1.1. Questions for the Colloquium

Questions for assessing competence

UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations.

UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services.

1. Radiobiology and veterinary radiobiology-definition, objectives, history and prospects of development.
2. The structure of the atom, elementary particles.
3. The phenomenon of radioactivity. Isotopes. Natural and artificial radioisotopes.
4. Types of ionizing radiation and their characteristics.
5. Radioactive decay and its types (alpha decay, beta electron decay, beta positron decay).
6. Interaction of gamma radiation with matter.
7. Nuclear reactions. Activation response and its practical significance.
8. The fission reaction of heavy nuclei and its use.
9 The reaction of light nuclear synthesis and its significance.
10. General regularities of movement of radioactive substances in the biosphere.
11. Subject and tasks of radiotoxicology.

UC-8 ID-2 To be able to: identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations.

12. The effect of small doses of ionizing radiation on living organisms.
13. Intake and methods for predicting the intake of RV in agricultural plants and animals.
14. Veterinary and sanitary expertise of slaughter products of irradiated animals.
15. Radiometry, its tasks and goals.
16. The use of RV and ionizing radiation in biology, animal husbandry, medicine and veterinary medicine.

UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies.

17. Principles of animal husbandry in the period of "iodine" danger.
18. The law of radioactive decay.
19. Organization of veterinary activities on the trail of a radioactive cloud.
20. Subject and tasks of radioecology of farm animals.
21. Radiometric studies and drawing up a conclusion.
22. Preparation and processing of samples for radiometry.
23. Procedure for sampling for radiometry.
24. Animal husbandry during the period of surface contamination and root intake of ditches.

Questions for assessing competence

GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal

body.

GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body

25. Mechanism of biological action of ionizing radiation.
26. Influence of ionizing radiation on hematopoietic organs and blood.
27. Factors affecting the degree of radiation damage to the body during internal exposure to radiation.
28. The effect of ionizing radiation on the digestive system.
29. The effect of ionizing radiation on the reproductive organs and offspring of animals.
30. The effect of ionizing radiation on the nervous system, endocrine glands, and sensory organs.
31. Influence of ionizing radiation on the cardiovascular system and respiratory organs.
32. The effect of ionizing radiation on various tissues (skin, connective tissue, bones, cartilage, muscles).

GPC-2 ID-2 To be able to: use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors

33. Natural and artificial sources of ionizing radiation and their impact on the animal body.
34. Natural radioactive background and its effect on the animal body.
35. The concept of ionizing radiation and its effect on various objects.
36. The concept of radiation doses and radiation dose rates, units of measurement.
37. Purpose and classification of dosimetric devices.
38. Maximum permissible doses of external and internal radiation to the population in peacetime
39. Metabolism and toxicology of strontium-90 and caesium-137.
40. Metabolism and toxicology of young fission products.
41. Accumulation and elimination of radionuclides from the body. Effective elimination half-life.

GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.

42. Classification of radiation injuries in animals.
43. Pathways of RV ingestion in animals.
44. Radiometric expertise of agricultural products and environmental objects.
45. Organization of animal husbandry in the territory polluted by RV.
46. Types of distribution of radionuclides in the body. The concept of a critical organ.
47. Acute radiation sickness of animals.
48. Chronic radiation sickness of animals. Features of the development and course of the disease.
49. Radiation burns of animals (etiology, pathogenesis, clinic, course and outcome, pre-

vention and treatment).

50. Prevention and treatment of radiation sickness.

51. Genetic effect of ionizing radiation.

52. Somatic effect of ionizing radiation (leukemias, tumors, cataracts of the lens of the eye, reduction of life expectancy).

53. Acute radiation sickness of horses.

54. Acute radiation sickness of K. R. S.

55. Acute radiation sickness of pigs.

56. Acute radiation sickness of sheep.

57. Acute radiation sickness of goats.

58. Acute radiation sickness of fur-bearing animals.

59. Acute radiation sickness of chickens.

60. Diagnosis and path picture of radiation sickness.

Questions for assessing competence

GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.

GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

61. Purpose, operating principle and device of the KID-2 dosimeter.

62. Purpose, operating principle and device of dosimeters DK-02, DP-24, ID-1.

63. Units of measurement of the equivalent radiation dose (basic, fractional, multiple).

64. Units of measurement of the absorbed radiation dose (basic, fractional, multiple).

65. Units of measurement of the exposure dose of radiation (basic, fractional, multiple).

GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.

66. The radioisotope activity is 1 Ci, 1 mcCi, and 5 mcCi; express this activity in Becquerels (Bc).

67. Procedure for determining radiation doses by calculation method under external radiation exposure.

68. Calculate the equivalent radiation dose if the absorbed dose from fast neurons is 5 rad.

69 Dosimetry, its tasks and goals.

70. Units of measurement of radiation dose rate (basic, fractional, multiple).

71. Radiometric expertise of agricultural products and environmental objects.

72. Relative biological efficiency of radiation and equivalent (biological) radiation dose.

73. Calculate the absorbed radiation dose in Gy if the dose measured in air is 1000 rubles.

74. Calculate the equivalent radiation dose in Sieverts (SV) if the exposure dose of gamma radiation is 300 rubles.

75. The level of radiation on the ground is 10 P/hour. Determine what absorbed radiation dose the animals will receive when they are in this area for 3 and 12 hours.

GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

76. The concept of specific radioactivity and stages of its determination.

77. Purpose, design and operation of radiometers.

78. Activity measurement units – the number of RVs (basic, fractional, and multiples).

79. Express methods for determining specific radioactivity.

80. Individual dosimetric control using condenser-type dosimeters. Principle of operation of the ionization chamber.

81. Methods of dosimetric control.

82. Calculate the maximum absorbed dose (rad) of internal alpha radiation that a professional can receive within one year.

83. Basic methods for determining radioactivity.

84. Gas-discharge and scintillation meters, device and principle of their operation.

4.1.2. Abstract topics

Topics of abstracts for competency assessment

UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations.

UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services.

UC-8 ID-2 To be able to: identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations.

UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies.

GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body.

GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body.

GPC-2 ID-2 To be able to: use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors

GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.

GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.

GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.

GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

1. The effect of radiation on the sex glands, pregnancy, fetus and offspring.
2. Molecular aspects of the action of ionizing radiation at the cell level.

3. The effect of ionizing radiation on the blood and hematopoietic organs.
4. Features of radiation damage to plants.
5. History of radiobiology development.
6. Main types of ionizing radiation and their characteristics.
7. Natural sources of decay.
8. The main sources of radioactive contamination of the environment.
9. Biological effects of ionizing radiation.
10. Radiosensitivity of organisms.
11. Ecology of radiation pollution.
12. Metabolism and toxicology of the main fission products of uranium and the most dangerous radionuclides (I-131, Sr-90, Cs-137).
13. The peculiarity of animal husbandry in areas with different levels of radioactive contamination.
14. Radionuclide migration along biological chains.
15. Use of ionizing radiation and radioactive substances in agricultural production.
16. Radiation and hygienic expertise of objects of veterinary supervision and the external environment.
17. Dosimetry and assessment of the impact of radiation exposure on the environment.
18 Methods and instruments used to determine radiation doses and quantities of radioactive substances.
19. Interaction of ionizing radiation with matter and fundamentals of dosimetry.
20. Prevention of entry and accumulation of radioactive substances in agricultural products.
21. Keeping animals in case of radioactive contamination of the environment.
22. Long-term effects of radiation on animals.
23. Fundamentals of radiation safety and organization of work with ionizing radiation sources.
24. Radiation rationing and radiation safety
25. Radiation sickness of farm animals.
26. Radiation burns of farm animals.
27. Diagnostics, prevention and treatment of animals exposed to radiation.
28. Combined radioactive damage.

4.1.3. Tests

UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations.

UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services.

1. What does Radiobiology study?

a) features of the existence of animals and patterns occurring in their natural populations and biogeocenoses when exposed to radiation factors of the environment;

b) the effect of all types of ionizing radiation on living organisms, their communities and the biosphere as a whole;

c) ways of entering radioactive isotopes into the body, patterns of distribution in it and inclusion in the molecular structures of tissues, features of accumulation in various organs and their removal from the body;

d) patterns of environmental contamination by radioactive substances, their migration along food chains in the biogeocenosis and their impact on living organisms.

2. What discoveries gave rise to the development of radiobiology?

a) V. K. Roentgen discovered x-rays, E. Rutherford proposed a planetary model of the structure of the atom, J. Chadwick discovered the neutron;

b) V. K. Roentgen discovered x-rays, A. Becquerel discovered the natural radioactivity of uranium, I. Curie and F. Joliot-Curie discovered artificial radioactivity;

c) V. K. Roentgen discovered x-rays, M. Skladovskaya and P. Curie discovered the radioactive properties of polonium and radium, and I. Curie and F. Joliot-Curie discovered artificial radioactivity;

d) V. K. Roentgen discovered x-rays, A. Becquerel discovered the natural radioactivity of uranium, M. Skladovskaya and P. Curie discovered the radioactive properties of polonium and radium.

3. What is the name of the smallest particle of a chemical element that retains all its chemical properties?

a) a molecule;

b) an atom.

c) corpuscle;

d) a quasar.

4. What elementary particles does the nucleus of an atom consist of?

a) electrons, protons;

b) electrons, neutrons;

c) protons and neutrons;

d) positrons, neutrons.

5. What types of ionizing radiation doses are distinguished in radiobiology?

a) medium-lethal ($LD_{50/30}$), exposure, biological;

b) absorbed, absolutely lethal ($LD_{100/30}$), medium lethal ($LD_{50/30}$);

c) exposure, equivalent, absorbed;

d) equivalent, absorbed, biological.

6. What is the name of the increment in the dose of ionizing radiation attributed to the unit of time during which this increase occurred?

a) kerma;

b) ionization;

c) radiation dose rate;

d) ionization density.

7. In what units is the exposure dose of radiation measured?

a) Gr, rad;

b) P, Kl/kg;

c) Zv, rem;

d) Ci, A/kg.

8. In what units is the absorbed radiation dose measured?

a) Gr, rad;

b) P, Kl/kg;

c) Zv, rem;

d) Ci, A/kg.

9. In what units is the biological radiation dose measured?

a) Gr, rad;

b) P, Kl/kg;
c) Zv, rem;
d) Ci, A/kg.

10. In what units is the exposure dose rate measured?
a) Ci/kg, Cl/kg;
b) A / kg, P / s;
c) rad / s, Gr/s;
d) Sv/s, rem/s.

11. In what units is the absorbed dose rate measured?
a) Ci/kg, Cl/kg;
b) A / kg, P / s;
c) rad / s, Gr/s;
d) Sv/s, rem/s.

12. In what units is the equivalent dose rate measured?
a) Ci/kg, Cl/kg;
b) A / kg, P / s;
c) rad / s, Gr/s;
d) Sv/s, rem/s.

13. what is the ratio of absorbed doses of various types of radiation causing the same biological effect?
a) the dose change factor;
b) kerma:
c) relative biological efficiency;
d) the maximum allowable dose.

14. Which radiation has the highest quality factor?
a) gamma rays;
b) alpha particles;
c) x-ray radiation;
d) heavy recoil cores.

15. What radiation has the highest damaging effect under external influence and the same absorbed dose?
a) gamma rays;
b) alpha particles;
c) x-ray radiation;
d) beta radiation.

16. Which radiation with the same absorbed dose of internal radiation has the highest damaging effect?
a) gamma rays;
b) alpha particles;
c) fast neutrons;
d) beta radiation.

17. What are the types of corpuscular ionizing radiation?
a) alpha radiation, beta radiation;
b) neutron, gamma-ray quanta;

c) proton, x-ray;
d) gamma-quanta, X-ray radiation.

18. What types of electromagnetic ionizing radiation do you know?
a) alpha radiation, beta radiation;
b) neutron, gamma-ray quanta;
c) proton, x-ray;
d) gamma-quanta, X-ray radiation.

UC-8 ID-2 To be able to: identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations.

19. What are radiation safety standards (NRB-99/2009)?
a) the main dose limits of animal exposure and the permissible level of radionuclide content in animal and plant products;
b) maximum doses of external and internal radiation to biological objects, at which somatic and genetic changes do not occur;
c) regulatory requirements of laws in the form of the basic dose limit, the permissible level of exposure to ionizing radiation and other requirements for limiting human exposure;
d) pollution of the environment, including water and food products, regulated by hygienic standards and safe for humans.

20. What is the main purpose of radiation safety?
a) eliminating the occurrence of genetic effects and limiting the occurrence of stochastic ones, while maintaining conditions for human production activities;
b) not exceeding the permissible limit of individual radiation doses from all sources of ionizing radiation;
c) prohibition of all types of activities involving the use of radiation sources, in which the benefits received for a person and society do not exceed the risk of possible harm caused by additional radiation to the natural background;
d) maintaining individual radiation doses and the number of people exposed to radiation at the lowest possible and achievable level, taking into account environmental and social factors, when using any source of ionizing radiation.

21. What are the main principles of radiation safety laid down in NRB99 / 2009?
a) justification, declaration, optimization;
b) transparency, rationing, declaration;
c) rationing, justification, optimization;
d) collegiality, rationing, justification.

22. How many categories according to NRB99 / 2009 are the entire population of the state divided according to the permissible level of exposure?
b) three;
c) four;
d) five.

23. What is the basis of the principle of radiation safety justification?
a) eliminating the occurrence of genetic effects and limiting the occurrence of stochastic ones, while maintaining conditions for human production activities;
b) not exceeding the permissible limit of individual radiation doses from all sources of ionizing radiation;

c) prohibition of all types of activities involving the use of radiation sources, in which the benefits received for a person and society do not exceed the risk of possible harm caused by additional radiation to the natural background;
d) maintaining individual radiation doses and the number of people exposed to radiation at the lowest possible and achievable level, taking into account environmental and social factors, when using any source of ionizing radiation.

24. What is the essence of the principle of radiation safety regulation?
a) eliminating the occurrence of genetic effects and limiting the occurrence of stochastic ones, while maintaining conditions for human production activities;
b) not exceeding the permissible limit of individual radiation doses from all sources of ionizing radiation;
c) prohibition of all types of activities involving the use of radiation sources, in which the benefits received for a person and society do not exceed the risk of possible harm caused by additional exposure to the natural radiation background of exposure;
d) maintaining individual radiation doses and the number of people exposed to radiation using any source of ionizing radiation at the lowest possible and achievable level, taking into account environmental and social factors.

25. Who is classified in category" A " according to NRB99 / 2009 for the permissible level of human exposure?
a) people who permanently or temporarily work with man-made sources of ionizing radiation;
b) people living in the vicinity of sanitary protection zones of institutions and enterprises using ionizing radiation sources;
c) people living on the territory of the trace of a radioactive cloud of a nuclear explosion;
d) the population of a region, territory, republic, or country that is not included in group "B".

26. Who belongs to category " B " according to NRB99 / 2009 on the permissible level of human exposure?
a) people who permanently or temporarily work with man-made sources of ionizing radiation;
b) people living in the vicinity of sanitary protection zones of institutions and enterprises using ionizing radiation sources;
c) people living on the territory of the trace of a radioactive cloud of a nuclear explosion;
d) the population of a region, territory, republic, or country that is not included in the first two groups.

27. What is the basis of the principle of radiation safety optimization?
a) eliminating the occurrence of genetic effects and limiting the occurrence of stochastic ones, while maintaining conditions for human production activities;
b) not exceeding the permissible limit of individual radiation doses from all sources of ionizing radiation;
c) prohibition of all types of activities involving the use of radiation sources, in which the benefits received for a person and society do not exceed the risk of possible harm caused by additional exposure to the natural radiation background of exposure;
d) maintaining individual radiation doses and the number of people exposed to radiation using any source of ionizing radiation at the lowest possible and achievable level, taking into account environmental and social factors.

28. Who is included in the third category of the population, according to NRB99 / 2009, according to the permissible level of human exposure?
a) people who permanently or temporarily work with man-made sources of ionizing radiation;

b) people living in the vicinity of sanitary protection zones of institutions and enterprises using ionizing radiation sources;
c) people living on the territory of the trace of a radioactive cloud of a nuclear explosion;
d) the population of a region, territory, republic, or country that is not included in the first two groups.

UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies.

29. What are the main dose limits for category "A" individuals?
a) maximum permissible dose, limit of annual intake of radioactive substances;
b) the limit of annual intake of RV, the limit of external radiation dose intake;
c) the maximum permissible dose of radiation, the dose limit of internal damage;
d) the dose limit of external and internal radiation.

30. What are the main dose limits for exposure of category "B" individuals?
a) maximum permissible dose, limit of annual intake of radioactive substances;
b) the limit of annual intake of RV, the limit of external radiation dose intake;
c) the maximum permissible dose of radiation, the dose limit of internal damage;
d) the dose limit of external and internal radiation.

31. Which groups of critical organs and tissues are regulated by the radiation safety standards NRB99 / 2009?
a) highly sensitive, medium sensitivity, practically non-sensitive;
b) medium sensitivity, low sensitivity, least sensitive;
c) highly sensitive, medium sensitivity, less sensitive;
d) extremely high sensitivity, medium sensitivity, practically non-sensitive.

32. What group of critical organs and tissues are classified according to NRB99 / 2009?
a) gonads, red bone marrow, thyroid gland;
b) the brain, heart, and gonads.
c) the whole body, gonads, red bone marrow;
d) the brain, thyroid, and entire body.

33. What group of critical organs and tissues are classified according to NRB99 / 2009?
a) gastrointestinal tract, muscle and bone tissue, skin, hands, ankles, feet;
b) bones, skin, forearm, hands, ankles, feet;
c) adipose tissue, skin, bones, forearm, hands, feet;
d) muscle and bone tissue, eye lens, skin, hands, feet.

34. How many groups of critical organs are regulated by the radiation safety standards NRB99 / 2009?
a) two;
b) three;
c) four;
d) five.

35. What value should not exceed the dose of a single exposure of people in wartime?
a) 5 X-rays;
b) 50 X-rays;
c) 100 X-rays;
d) 200 X-rays.

36. How much is the permissible dose of repeated exposure of people in wartime for three months?

a) 50 X-rays;
b) 100 X-rays;
c) 200 X-rays;
d) 300 X-rays.

37. What value should not exceed the total annual radiation dose of people in wartime?

a) 50 X-rays;
b) 100 X-rays;
c) 200 X-rays;
d) 300 X-rays.

38. Where should first-class open source facilities be located?

a) in a separate part of the building, isolated from other premises, there should be a sanitary pass, a shower room, a radiation control point at the exit;

b) in a separate building with a separate entrance only through the sanitary pass and divided into three zones;

c) there are no special requirements, it is recommended to set up a shower room and rooms for storing and packing solutions;

d) work is carried out in specialized laboratories.

39. What should equipment, containers, packages, vehicles, apparatuses, mobile installations, premises for working with ionizing radiation sources have in accordance with OSPORB-99/2010?

a) reliable shut-off valves;
b) a structure made of durable material;
c) a sign of radiation hazard;
d) special slightly absorbent coatings that are resistant to detergents.

40. Under what conditions is the planned increase in exposure of Group A personnel permitted under NRB-99/2009?

a) a nuclear explosion;
b) radioactive fallout;
c) elimination of radiation accidents;
d) conducting experiments.

GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body.

GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body.

1. What does radiotoxicology study?

a) routes of entry of radionuclides into the body, their distribution accumulation and elimination from the body; establishment of acceptable levels of radionuclide content in the environment, food and the human body; search for effective means to prevent damage by radionuclides; development of means and methods that accelerate the elimination of radioactive substances from the body.

b) the effect of all types of ionizing radiation on living organisms and their communities

and the biosphere as a whole, methods of using ionizing radiation as a radiobiological technology in agriculture;

c) features of the existence of animals and patterns occurring in their natural populations and biogeocenoses when exposed to radiation factors of the environment;

d) patterns of environmental contamination by radioactive substances, their migration along food chains in the biogeocenosis and their impact on living organisms.

2. What determines the toxicity of radionuclides?

a) the half-life of the isotope, the type and energy of radiation, the physicochemical properties of the radionuclide, the type of distribution and the rate of elimination from the body.

b) the half-life of the isotope, the physical and chemical properties of the substance in which the radionuclide enters the body, the routes of entry, the type of distribution and elimination from the body;

c) the value of linear energy transfer, the half-life of the isotope, the routes of entry and the type of distribution in the body;

d) the value of linear energy transfer, the presence of a stable analog, the half-life, the physicochemical properties of the radionuclide, and the rate of elimination from the body.

3. What causes linear energy transfer (LPE)?

a) specific ionization;

b) half-life;

c) the path length of the particle;

d) the total amount of energy.

4. What influences the degree of biological action of Sr90 when administered internally?

a) K;

b) Na;

c) Ca;

d) Fe.

5. How many groups are provided for in the classification of radionuclides by their toxicity to humans and animals?

a) three;

b) four;

c) five;

d) six.

6. What radioisotopes are included in the first group of radiotoxicity by biological effect on the body?

a) high toxicity;

b) the lowest toxicity;

c) particularly high toxicity;

d) excessively high toxicity.

7. What radionuclides are included in the fifth group of toxicity?

a) moderate toxicity;

b) the lowest toxicity;

c) tritium and its chemical compounds;

d) carbon and its chemical compounds.

8. Which radioisotopes from the fission products of heavy nuclei are most important for agricultural animals?

a) Cs137, Y90, I131;

b) Ce144, Sr90, Co60;

c) Pu239, Y90, Cs137;

d) Sr90, I131, Cs137.

9. How can radioactive substances enter the animal body?

a) gastrointestinal tract, lungs, skin, mucous membranes, wounds;
b) lungs, skin, mucous membranes, natural openings, sexually transmitted diseases;
c) gastrointestinal tract, natural openings, lungs, wounds;
d) lungs, skin, gastrointestinal tract, wounds, natural openings.

GPC-2 ID-2 To be able to: use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assessment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors.

10. What determines the degree of penetration of radioactive aerosol and its retention in the lungs?
a) particle size and isotope half-life;
b) solubility of radionuclides and particle charge;
c) the charge of the particles and their size;
d) solubility of radionuclides and half-life.

11. What are the main routes of radionuclide ingestion in agricultural animals?
a) skin and mucous membranes;
b) respiratory organs;
c) organs of the gastrointestinal tract;
d) natural openings.

12. What mainly determines the nature of absorption of radioactive substances in the gastrointestinal tract?
a) routes of entry, physical and chemical properties of radionuclides, type, age, physiological state of the body;
b) the activity, pathway and multiplicity of isotope intake, age, and physiological state of the body;
c) multiplicity of intake, age, gender, physiological state of the body, half-life;
d) physical and chemical properties of radionuclides, frequency of entry, age, routes of entry.

13. Where is the most intensive absorption of most radionuclides?
a) stomach, jejunum, colon, ileum and duodenum;
b) duodenum, jejunum, colon and ileum, stomach;
c) stomach, duodenum, jejunum, colon and ileum;
d) stomach, duodenum, colon, ileum and jejunum.

14. In what ascending order, depending on the site of administration, all other things being equal, is the intensity of absorption of radionuclides into the blood distributed?
a) oral, subcutaneous, intramuscular, inhaled, intraperitoneal;
b) subcutaneous, intramuscular, oral, intraperitoneal, inhalation;
c) inhalation, oral, subcutaneous, intramuscular, intraperitoneal;
d) intraperitoneal, intramuscular, subcutaneous, inhaled, oral.

15. How many groups of radionuclides are released depending on their distribution in the body?
a) three;
b) four;
c) five;
d) six.

16. What is the name of the organ in which the selective concentration of radionuclide occurs and as a result of which it is exposed to a large amount of radiation?

a) vulnerable;
b) critical.
c) tropic;
d) selective.

17. Which organs will be critical for all radionuclides?
a) gastrointestinal tract, bones;
b) hematopoietic system, gastrointestinal tract;
c) thyroid gland, sex glands;
d) sexual glands, hematopoietic system.

18. What are the main four types of radionuclide distribution?
a) skeletal, hepatic, uniform, renal;
b) renal, osteotropic, thyrotropic, uniform;
c) pancreatic, theriotropic, skeletal, uniform;
d) renal, hepatic, pancreatic, skeletal.

19. What is the name of the period during which half of the received amount of radionuclide is removed from the body?
a) the effective half-life;
b) biological half-life;
c) chemical half-life;
d) the physical half-life.

20. What is the term used to describe the actual loss of radionuclides from the human body?
a) effective elimination half-life;
b) biological half-life;
c) chemical half-life;
d) physical half-life.

21. What is the ratio of the activity of radionuclides in organs and tissues to their daily intake in the body?
a) specific radioactivity in organs and tissues;
b) multiplicity of accumulation;
c) coefficient-discrimination;
d) the state of equilibrium.

22. What is the name of a mixture of short-lived radionuclides 10 hours old?
a) young products of nuclear fission;
b) fresh products of nuclear fission;
c) noble gases;
d) induced radioactivity.

GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.

23. Which isotopes have the greatest biological significance in a mixture of young fission products?
a) I125, I132, I133, I135, Sr89, Mo99, Te132, Ba140, Ce143;
b) I125, I131, I132, I133, Sr90, Mo99, Te132, Ba140, Ce143;
c) I131, I132, I133, I129, Sr90, Mo99, Te132, Ba140, Ce143;
d) I131, I132, I133, I135, Sr89, Mo99, Te132, Ba140, Ce143.

24. In the development of what is the toxic effect of radioactive iodine?
a) thyroid cancer, anemia, radiation sickness, leukemia;

b) leukopenia, anemia, leukemia, osteosarcoma;
c) leukopenia, radiation sickness, malignant neoplasms;
d) hyperthyroidism, hypothyroidism, arteriosis, thyroid cancer.

25. In the development of what is the toxic effect of caesium-137?
a) thyroid cancer, anemia, radiation sickness, leukemia;
b) leukopenia, anemia, leukemia, osteosarcoma;
c) leukopenia, radiation sickness, malignant neoplasms;
d) hyperthyroidism, hypothyroidism, arteriosis, thyroid cancer.

26. What diseases arise from the toxicological action of strontium-90?
a) thyroid cancer, anemia, radiation sickness, leukemia;
b) leukopenia, anemia, leukemia, osteosarcoma;
c) leukopenia, radiation sickness, malignant neoplasms;
d) hyperthyroidism, hypothyroidism, arteriosis, thyroid cancer.

27. What series of organs and tissues of animals form according to the degree of accumulation of young nuclear fission products?
a) thyroid > liver > blood > muscle > skeleton;
b) blood > liver > muscle > thyroid gland > skeleton;
c) liver > thyroid > muscle > blood > skeleton;
d) blood > muscle > thyroid > liver > skeleton.

28. What are the isotopes of young nuclear fission products (10 hours old)? do they make the main contribution to the radioactive contamination of the thyroid gland, muscles and blood when ingested with food in the body of a cow?
a) I125, I131, I132, I133;
b) I131, I132, I133, I135,
c) I132, I133, Ba140, Ce143;
d) Mo99, Ba140, La140, I135.

29. Which isotopes of young nuclear fission products make the main contribution to the radioactive contamination of the skeleton and liver when ingested in animals?
a) Sr89, Te132, I125;
b) Sr89, Ba140, Ce143;
c) Mo99, Ba140, La140;
d) Mo99, La140, Sr89.

30. What is the name of the period when the amount of radionuclide received is equal to the amount of output per unit of time?
a) the discrimination coefficient;
b) the accumulation coefficient;
c) the state of equilibrium;
d) biological mobility.

31. Which radionuclides are most important in the case of chronic ingestion of radioactive substances that have accumulated in the Earth's biosphere?
a) U235, Ra226;
b) K40, Co60;
c) Na22, Ca45;
d) Cs137, Sr90.

32. What isotopes are released in all animals with milk in large quantities?
a) tritium, iodine isotopes, strontium isotopes, caesium isotopes;
b) K40, tritium, isotopes of iodine, isotopes of caesium;
c) Zn65, iodine isotopes, caesium isotopes, strontium isotopes;
d) K40, Zn65, Cs137, Sr90.

33. What is the type of distribution of radionuclides-beryllium, calcium, barium, radium, and zirconium?
a) uniform;

b) renal;
c) hepatic;
d) skeletal.

34. What is the type of distribution of radionuclides-sodium, potassium, rubidium, ruthenium?

a) uniform;
b) renal;
c) hepatic;
d) skeletal.

35. Which radionuclides with a high accumulation rate are most dangerous for animals?

a) isotopes of caesium, isotopes of strontium, isotopes of uranium;
b) isotopes of iodine, isotopes of caesium, isotopes of rubidium;
c) strontium isotopes, iodine isotopes, caesium isotopes;
d) isotopes of potassium, isotopes of iodine, isotopes of rubidium.

36. What is the rate of resorption of radionuclides in the gastrointestinal tract in animals with a single-chamber stomach compared to ruminants?

a) below;
b) higher;
c) has no differences;
d) depends on the composition of the radioactive mixture.

37. What is the intensity of radionuclide absorption in newborns and growing animals compared to adults?

a) slower.
b) has no differences;
c) depends on the composition of the radionuclide mixture;
d) be more active.

38. What significantly affects the amount and rate of absorption of radionuclides?

a) in what form radionuclides enter the body;
b) the presence of stable elements in the diet;
c) the number of radionuclides received;
d) physical and chemical composition of radionuclides.

39. What qualitative concept is used to assess accumulated radionuclides in organs and tissues?

a) multiplicity of accumulation;
b) content;
c) concentration;
d) resorption coefficient.

40. Which isotopes have a high accumulation rate?

a) iodine, strontium, caesium;
b) caesium, cobalt, cerium;
c) ruthenium, polonium, uranium;
d) iodine, polonium, and caesium.

GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.

GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

1. What is the name of the process of measuring the amount of radioactive substances and determining their concentration in various research objects?

a) dosimetry;

b) radiometry;
c) determination of specific radioactivity;
d) determination of the molecular weight of radionuclides.

2. What is the name of the process of studying the quantities that characterize the effect of ionizing radiation on various objects, as well as methods and devices for their quantitative and qualitative measurement?
a) dosimetry;
b) radiometry;
c) determination of specific radioactivity;
d) determination of the molecular weight of radionuclides.
3. What is the name of the amount of radiation energy acting on the irradiated object during its stay in the radiation exposure zone or in an area contaminated with radioactive substances?
a) specific radioactivity;
b) radiation dose;
c) linear energy transfer;
d) relative biological efficiency.
4. What types of ionizing radiation doses are distinguished in radiobiology?
a) medium-lethal (LD50 / 30), exposure, biological;
b) absorbed, absolutely lethal (LD100 / 30), medium lethal (LD50 / 30);
c) exposure, equivalent, absorbed;
d) equivalent, absorbed, biological.
5. What is the name of the dose that characterizes the ionizing ability of X-ray and gamma radiation in the air?
a) equivalent;
b) absorbed;
c) exposition;
d) moderate-lethal (LD50/30).
6. What is the name of the dose that characterizes the amount of energy of any type of radiation absorbed per unit mass of the irradiated biological tissue?
a) equivalent;
b) absorbed;
c) exposition;
d) moderate-lethal (LD50/30).
7. What is the name of the dose that determines the amount of absorbed energy of any type of ionizing radiation, taking into account the biological effect characteristic of each type of radiation?
a) equivalent;
b) absorbed;
c) exposition;
d) moderate-lethal (LD50/30).
8. What is the name of the increment in the dose of ionizing radiation attributed to the unit of time during which this increase occurred?
a) kerma;
b) ionization;
c) radiation dose rate;
d) ionization density.
9. What units are used to measure the exposure dose of radiation?
a) Gr, rad;
b) P, Kl/kg;
c) Zv, rem;

d) Ci, A/kg.

10. What units are used to measure the absorbed radiation dose?

a) Gr, rad;

b) P, Kl/kg;

c) Zv, rem;

d) Ci, A/kg.

11. What units are used to measure the biological radiation dose?

a) Gr, rad;

b) P, Kl/kg;

c) Zv, rem;

d) Ci, A/kg.

12. What units are used to express the exposure dose rate?

b) A / kg, P / s;

c) rad / s, Gr/s;

d) Sv/s, rem/s.

13. What units are used to express the absorbed dose rate?

a) Ci/kg, Cl/kg;

b) A / kg, P / s;

c) rad / s, Gr/s;

d) Sv/s, rem/s.

14. What units are used to express the equivalent dose rate?

a) Ci/kg, Cl/kg;

b) A / kg, P / s;

c) rad / s, Gr/s;

d) Sv/s, rem/s.

GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.

15. What is the ratio of absorbed doses of various types of radiation causing the same biological effect?

a) the dose change factor;

b) kerma:

c) relative biological efficiency;

d) the maximum allowable dose.

16. Which of the radiations has the highest quality factor?

a) gamma rays;

b) alpha particles;

c) x-ray radiation;

d) heavy recoil cores.

17. What radiation causes the highest damaging effect with external exposure and the same absorbed dose?

a) gamma rays;

b) alpha particles;

c) x-ray radiation;

d) beta radiation.

18. Which radiation, with the same absorbed dose of internal radiation, has the highest damaging effect?

a) gamma rays;

b) alpha particles;

c) fast neutrons;

d) beta radiation.

19. Which ionizing radiation is considered corpuscular?

a) alpha radiation, beta radiation;
b) neutron, gamma-ray quanta;
c) proton, x-ray;
d) gamma-quanta, X-ray radiation.

20. Which of the listed ionizing radiations are electromagnetic?
a) alpha radiation, beta radiation;
b) neutron, gamma-ray quanta;
c) proton, x-ray;
d) gamma-quanta, X-ray radiation.

21. What formula is used to calculate the total absorbed dose (rad) accumulated from the initial moment of time to the complete decay of the isotope and in any organ with a gamma emitter deposited in it?
a) Dy∞ = 0.032 Ky With Opq Teff;
b) Dy(t) = 0.032 Cu With Opq Teff (1st);
c) Dß (t) = 73.8 Co ĒB Teff;
d) Dß (t) = 73.8 Co ĒB Teff (1st).

22. What formula is used to calculate the absorbed dose (rad) at any time after the gamma-emitting radionuclide enters the body?
a) Dy∞ = 0.032 Ky With Opq Teff;
b) Dy(t) = 0.032 Cu With Opq Teff (1st);
c) Dß (t) = 73.8 Co ĒB Teff;
d) Dß (t) = 73.8 Co ĒB Teff (1st).

23. What formula is used to calculate the absorbed dose (rad) for short-lived beta-emitting radionuclides with a short half-life (up to one week) after ingestion?
a) Dy∞ = 0.032 Ky With Opq Teff;
b) Dy(t) = 0.032 Cu With Opq Teff (1st);
c) Dß (t) = 73.8 Co ĒB Teff;
d) Dß (t) = 73.8 Co ĒB Teff (1st).

24. What formula is used to calculate the absorbed dose (rad) of beta-emitting isotopes at any point in time after ingestion?
a) Dy∞ = 0.032 Ky With Opq Teff;
b) Dy(t) = 0.032 Cu With Opq Teff (1st);
c) Dß (t) = 73.8 Co ĒB Teff;
d) Dß (t) = 73.8 Co ĒB Teff (1st).

GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

25. Which of the listed processes that occur during the interaction of radiation with matter and are used to detect and measure ionizing radiation are considered primary?
a) photochemical reactions, luminescence;
b) changes in the physical and chemical properties of the substance, ionization;
c) luminescence, ionization;
d) photochemical reactions, changes in the physical and chemical properties of a substance.

26. Which of the listed processes that occur during the interaction of radiation with matter, which are the basis for detecting and measuring ionizing radiation, are secondary?
a) photochemical reactions, luminescence;
b) changes in the physical and chemical properties of the substance, ionization;
c) luminescence, ionization;
d) photochemical reactions, changes in the physical and chemical properties of a substance.

27. Which of the listed methods of dosimetric control indication are based on the primary processes of interaction of ionizing radiation with a substance?
a) photographic, scintillation, chemical;

b) ionization, luminescent, calorimetric;
c) scintillation, luminescent, ionization;
d) photographic, chemical, and calorimetric analysis.

28. Which of the listed methods of dosimetric control indication are based on secondary processes of interaction of ionizing radiation with a substance?

a) photographic, scintillation, chemical;
b) ionization, luminescent, calorimetric;
c) scintillation, luminescent, ionization;
d) photographic, chemical, and calorimetric analysis.

29. What are the names of devices designed to measure the activity of radioactive substances, the flux density of ionizing radiation, specific and volumetric activity?

a) dosimeters;
b) spectrometers;
c) radiometers;
d) radiation generators.

30. What are the names of devices designed to measure the exposure and absorbed radiation dose, their power and intensity of ionizing radiation?

a) dosimeters;
b) spectrometers;
c) radiometers;
d) radiation generators.

31. What are the names of devices designed to measure the distribution of radiation by energy, charge and mass, as well as spatial and temporal distributions and radiation?

a) dosimeters;
b) spectrometers;
c) radiometers;
d) radiation generators.

32. What groups can radiometers be divided into according to their intended purpose?

a) stationary, portable, for conducting radionuclide composition analyses, for special research in biology and medicine;
b) for conducting radionuclide composition analyses, stationary, direct-pointing, portable;
c) portable, non-directly indicating, stationary devices for conducting special studies in biology and medicine;
d) direct-pointing, indirect-pointing, stationary, portable.

33. Which of the listed individual dosimeters are directly indicative?

a) KID-2, DC-0,2, DP-22-V, DP-24, ID-11;
b) DC-02, DP-24, DP-22V, ID-1, DKP-50;
c) KID-2, ID-11, KDT-02, IFC, KID-1;
d) DP-22-V, DP-24, ID-11, ID-1, KDT-02.

34. Which of the listed individual dosimeters are not directly indicative?

a) KID-2, DC-0,2, DP-22-V, DP-24, ID-11;
b) DC-02, DP-24, DP-22V, ID-1, DKP-50;
c) KID-2, ID-11, KDT-02, IFC, KID-1;
d) DP-22-V, DP-24, ID-11, ID-1, KDT-02.

35. Which of the listed methods of measuring radioactivity are the main ones?

a) calculated, absolute, spectrometric;
b) spectrometric, absolute, relative;
c) relative, calculated, absolute;
d) calculated, spectrometric, relative.

36. Which method of determining the radioactivity of samples is most widely used in practice?

a) absolute;
b) relative;
c) settlement;
d) spectrometric.

37. Which of the listed methods for determining the radioactivity of samples is the most accurate?

a) absolute;
b) relative;
c) settlement;
d) spectrometric.

38. Which of the listed radiation detectors is the most common?

a) proportional counters;
b) Geiger-Muller counters;
c) scintillation counters;
d) ionization chambers.

39. What is the name of the time during which the meter cannot register the ionizing radiation that has entered it?

a) absorbed;
b) dead.
c) deferred;
d) not effective.

40. How long is the dead time of the gas discharge meter?

a) $10\text{-}4^{-4}$ seconds;
b) $5\text{-}4^{-4}$ seconds.
c) $20\text{-}4^{-4}$ seconds;
d) $15\text{-}4^{-4}$ s.

4.2. Standard tasks for intermediate certification

4.2.1. exam questions

Emerging competence: UC-8: Is able to create and maintain safe living conditions, including cases of emergency situations.

UC-8 ID-1 To know: the consequences of harmful and dangerous factors exposure on the body of animals, humans and the natural environment, methods of protection from emergencies and military conflicts; fundamentals of life safety, telephone numbers of rescue services.

1. Radiobiology and veterinary radiobiology - definition, goals, tasks.
2. History and prospects of radiobiology development.
1. Atomic structure, elementary particles, nuclear mass defect.
2. The phenomenon of radioactivity. Isotopes, isobars, isotones, and spectra. Natural and artificial radioisotopes.
3. Types of ionizing radiation and their characteristics.
4. Radioactive decay and its types (alpha-decay, beta-decay).
5. Interaction of gamma radiation with matter (elastic scattering, photoelectric effect, Compton effect, electron-positron pair formation).
6. Nuclear reactions. Activation response and its practical significance.
7. The fission reaction of heavy nuclei and its use.
8. The synthesis reaction of light nuclei and its significance.

UC-8 ID-2 To be able to: identify the signs, causes and conditions of emergencies and military conflicts; assess the likelihood of a potential danger to the student and take measures to prevent it in an educational institution; provide first aid in emergency situations.

9. The main limits of radiation doses for personnel and the public in peacetime.
10. Permissible doses of radiation to people during wartime and radiation accidents.
11. Natural radioactive background and its effect on the body of animals and humans.

UC-8 ID-3 To possess skills of: the ways to ensure safety in the human-animal-habitat system. Possess methods of forecasting the occurrence of dangerous or emergency situations; skills in maintaining safe living conditions, including those based on digital technologies

12. Methods for predicting the supply of RV to agricultural plants (the seedling method, using the Klechkovsky complex indicator, the proportionality coefficient, etc.).
13. A method for predicting the supply of radioactive substances to livestock products.
14. Veterinary and sanitary expertise of slaughter products of irradiated animals (for external and internal irradiation).
15. Principles of animal husbandry in the period of "iodine" danger.
16. The principle of animal husbandry in the period of surface pollution.
17. The principle of animal husbandry during the root intake of radionuclides.
18. Organization of veterinary and agrotechnological activities on the trail of a radioactive cloud.
19. Effect of ionizing radiation on the digestive system.
20. The effect of ionizing radiation on the reproductive organs and offspring of animals.
21. The effect of ionizing radiation on the nervous system, endocrine glands, and sensory organs.
22. Influence of ionizing radiation on the cardiovascular system and respiratory organs.
23. The effect of ionizing radiation on various tissues (skin, connective tissue, bones, cartilage, muscles).
24. Division of territory in a nuclear explosion.

Formed competence: GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body.

GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body

25. Pathways of RV ingestion in animals. The concept of the concentration and content of radioactive substances in the organ and body.
26. Natural sources of ionizing radiation and their impact on the animal body.
27. Artificial sources of ionizing radiation and their impact on the animal body.
28. Genetic effects of ionizing radiation.
29. Factors affecting the degree of radiation damage to the body during internal exposure to radiation.
30. Somatic effect of ionizing radiation (leukemias, tumors, cataracts of the eye lens, shortening of life expectancy).
31. Types of radionuclide distribution in the body. The concept of a critical organ.

GPC-2 ID-2 To be able to: use environmental factors and environmental laws in agricultural manufacture; apply the achievements of modern microbiology and ecology of microorganisms in animal husbandry and veterinary medicine in order to prevent infectious and invasive diseases and treat animals; use environmental monitoring methods in the environmental assess-

ment of agricultural facilities and the production of agricultural products; assess the impact on the animal body, anthropogenic and economic factors.

32. General patterns of movement of radioactive substances in the biosphere (biotic and abiotic cycles).

33. Mechanism of biological action of ionizing radiation (theories of primary direct and indirect action).

34. Mechanism of biological action of ionizing radiation (theories of primary indirect action, oxygen effect and water radiolysis).

35. Influence of ionizing radiation on hematopoietic organs and blood.

36. Subject and tasks of radiotoxicology. Classification of radionuclides by their degree of toxicity.

37. The effect of small doses of ionizing radiation on living organisms.

38. The law of radioactive decay.

39. Metabolism and toxicology of strontium-90 and caesium-137.

GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well

40. Metabolism and toxicology of young fission products (iodine isotopes, etc.).

41. Ways of removing radionuclides from the body. Effective and biological half-lives.

42. Subject and tasks of agricultural radioecology.

43. Acute radiation sickness of animals (definitions, etiology, pathogenesis, syndromes).

44. Chronic radiation sickness of animals. Features of the development and course of the disease.

45. Radiation burns of animals (etiology, pathogenesis, clinic, course and outcome, prevention and treatment).

46. Prevention and treatment of acute radiation sickness in animals.

47. Features of the clinical manifestation of acute radiation sickness in horses.

48. Features of the clinical manifestation of acute radiation sickness in cattle.

49. Features of the clinical manifestation of acute radiation sickness in pigs.

50. Clinical features of acute radiation sickness in sheep and goats.

51. Clinical features of acute radiation sickness in fur-bearing animals (sable, mink, fox).

52. Features of the clinical manifestation of acute radiation sickness in chickens.

53. Pathoanatomical changes in acute radiation sickness and differential diagnosis of acute radiation sickness.

Emerging competence: GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.

GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

54. The system of state veterinary control over radioactive contamination of objects of veterinary supervision.

55. The first and second stages (sampling and preparation of samples) of determining the specific radioactivity of objects of veterinary supervision.

56. The third and fourth stages (proper radiometric research and drawing up a conclusion) determine the specific radioactivity of veterinary surveillance facilities.

57. Dosimetry, its types, goals and objectives.

58. Units of measurement of radiation dose rate (basic, fractional, multiple).

59. Sorting and economic use of farm animals against the background of exposure to ionizing radiation.

60. Radiometry, its tasks and goals.

61. The use of RV and ionizing radiation in biology, animal husbandry, medicine and veterinary medicine.

GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.

62. Methods of dosimetric control (photo control).

63. Methods of dosimetric control (luminescent control).

64. Methods of dosimetric control (with condenser-type dosimeters).

65. Methods of dosimetric control (colorometric, calorimetric, chemical, biological, neutron activation).

66. Relative biological efficiency of radiation and equivalent (biological) radiation dose.

67. Purpose, operating principle and device of the dosimeter KID-2, ID-11.

68. Purpose, operating principle, and device of the DP-22V, DP-24, and ID-1 dosimeters.

69. Procedure for determining radiation doses by calculation method under external radiation exposure.

70. Activity measurement units – the number of RVs (basic, subdivided, and multiples).

71. Purpose, operating principle and device of the SRP-68-01 (SRP – 88N), DP-5.

72. Rapid methods for determining specific radioactivity using SRP-68-01 and DP-5.

GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

73. The concept of radiation doses, units of measurement (basic, fractional, multiples).

74. Methods of radiometric examination of agricultural products and environmental objects (absolute, relative, calculated).

75. Units of measurement of the equivalent and effective radiation dose (basic, fractional, multiple).

76. Units of measurement of absorbed radiation (basic, fractional, multiple).

77. Gas-discharge detectors, their design and principle of operation.

78. Scintillation detectors, device and principle of their operation.

79. Units of measurement of the exposure dose of radiation (basic, fractional, multiple).

80. The concept of specific radioactivity and the stages of its determination.

81. Purpose, design and operation of radiometers.

82. Purpose, design and operation of spectrometers.

5. METHODOLOGICAL MATERIALS DEFINING PROCEDURES FOR ASSESSING KNOWLEDGE, SKILLS AND ABILITIES AND EXPERIENCE OF ACTIVITIES THAT CHARACTERIZE THE STAGES OF COMPETENCE FORMATION

Criteria for evaluating students ' knowledge during the colloquium:

• **Mark "excellent"**- the student clearly expresses their point of view on the issues under consideration, giving appropriate examples.

• **Mark "good"** - the student makes some errors in the answer

• **Mark "satisfactory"**- the student discovers gaps in knowledge of the main educational and regulatory material.

• **Mark "unsatisfactory"**- the student discovers significant gaps in knowledge of the main provisions of the discipline, the inability to get the correct solution to a specific practical problem with the help of the teacher.

Criteria for evaluating students ' knowledge during testing:

The test result is evaluated on a percentage rating scale. Each student is offered a set of test tasks consisting of 25 questions:

• **The mark "excellent"** – 25-22 correct answers.

• **Mark "good"** – 21-18-correct answers.

• **Mark "satisfactory"** –17-13 correct answers.

• **"Unsatisfactory" mark** – less than 13 correct answers

Criteria for evaluating students ' knowledge when conducting research papers:

• **Mark "excellent"** - the problem is identified and its relevance is justified; an analysis of various points of view on the problem under consideration is made and one's own position is logically stated; conclusions are formulated, the topic is fully disclosed, the volume is maintained; external design requirements are met, the main requirements for the abstract are met

• **Mark "good"**- there are some mistakes made. In particular, there are inaccuracies in the presentation of the material; there is no logical sequence in the judgments; the volume of the abstract is not maintained; there are omissions in the design, there are significant deviations from the requirements for referencing.

• **Mark "satisfactory"**- the topic is only partially covered; factual errors were made in the content of the abstract; there are no conclusions, the topic of the abstract is not disclosed

• **Mark "unsatisfactory"** - there is a significant misunderstanding of the problem or the abstract is not presented at all.

Knowledge criteria for the exam:

• **Mark "excellent"** – completed all types of academic work provided for in the curriculum. The student demonstrates the correspondence of knowledge, skills and abilities to the indicators given in the tables, operates with the acquired knowledge, skills and abilities, and applies them in various situations of increased complexity. At the same time, there may be inaccuracies, difficulties in analytical operations, and the transfer of knowledge and skills to new, non-standard situations. –

• **Mark "good"** – all types of academic work provided for in the curriculum are completed. The student demonstrates the correspondence of knowledge, skills and abilities to the indicators given in the tables, operates with the acquired knowledge, skills and abilities, and applies them in standard situations. However, minor errors, inaccuracies, difficulties in analytical operations, and the transfer of knowledge and skills to new, non-standard situations may occur.

• **Mark "satisfactory"** – one or more types of academic work provided for in the curriculum were not completed. The student demonstrates incomplete compliance of knowledge, skills, and abilities with the indicators shown in the tables, significant errors are made, a partial lack of knowledge, skills, and abilities is manifested in a number of indicators, and the student has significant difficulties in operating with knowledge and skills when transferring them to new situations. –

• **Mark "unsatisfactory"** – the types of academic work provided for in the curriculum were not completed. demonstrates incomplete correspondence of knowledge, skills, and abilities to those listed in the tables of indicators, significant errors are made, the lack of knowledge, skills, and abilities is manifested in a larger number of indicators, and the student has significant difficulties in operating with knowledge and skills when transferring them to new situations.

6. ACCESSIBILITY AND QUALITY OF EDUCATION FOR DISABLED PEOPLE

If necessary, persons with disabilities and persons with disabilities are given additional time to prepare a response to the test.

When carrying out the procedure for evaluating the results of training of disabled people and persons with disabilities, their own technical means can be used.

The procedure for evaluating the results of training of disabled people and persons with disabilities in the discipline provides for the provision of information in forms adapted to the limitations of their health and perception of information:

For people with visual impairments:	- in printed form with an enlarged font, – in the form of an electronic document.
For people with hearing impairments:	– in printed form, – in the form of an electronic document.
For persons with musculoskeletal disorders–	– in printed form, but: - in the form of an electronic document.

When conducting the procedure for evaluating the results of training of disabled people and persons with disabilities in the discipline, it ensures that the following additional requirements are met, depending on the individual characteristics of students:

a) instructions on the procedure for conducting the assessment procedure are provided in an accessible form (orally, in writing);

b) an accessible form of providing tasks with assessment tools (in printed form, in printed form in an enlarged font, in the form of an electronic document, tasks are read out by the teacher);

c) an accessible form of providing answers to tasks (written on paper, a set of answers on a computer, orally).

If necessary, for students with disabilities and disabled people, the procedure for evaluating the results of training in a discipline can be carried out in several stages.

The procedure for evaluating the learning outcomes of disabled people and persons with disabilities is allowed using distance learning technologies.