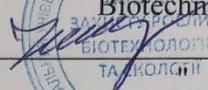


**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF
UKRAINE**

**AGROBIOLOGICAL FACULTY
DEPARTMENT OF ANALYTICAL AND BIOINORGANIC CHEMISTRY &
WATER QUALITY**

“APPROVED”

Dean of the Faculty of Plant Protection,
Biotechnology and Ecology

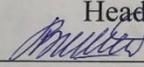
Dr.Agr.Sc., Prof.  Yu.V. Kolomiets
_ 2021

REVIEWED AND APPROVED

At the meeting of the department
of Analytical and Bioinorganic
Chemistry & Water Quality

Protocol # 10 “20” May 2021

Head of the Department

Dr.Chem.Sc., Prof.  V.A. Kopilevich

WORKING PROGRAM

**Academic Discipline “Hydrology”
For Specialty – 102 “Ecology”**

**Working Program compiled by : Associate Professor N. Prokopchuk, PhD in
Chemistry**

Kyiv, 2021

The Working Program Hydrology

for students specialty 102 “Ecology”

Syllabus compiled by: Associate Professor N. Prokopchuk, PhD in Chemistry

The Working Program was approved at the meeting of the Department of Analytical and Inorganic Chemistry and Water Quality

Protocol # 10 “ 20” May 2021

**Head of the Department
Dr.Chem.Sc., Prof.**

_____ **V.A. Kopilevich**

**APPROVED by Scientific Council of the Faculty of Plant Protection,
Biotechnology and Ecology**

Protocol # “ ” 2021

Head _____

(_____)

1. Discipline Description

HIDROLOGY

Branch of knowledge, training direction, specialty, education and qualification level		
Branch of knowledge	10 – Natural Sciences	
Specialty	101 – “Ecology”	
Education and qualification level	bachelor	
Characteristics of the discipline		
Kind	Selective	
Total number of hours	132 hours	
Number of credits ECTS	4,5	
Number of content modules	2	
Course project (paper) (if there is any)	no	
Form of control	exam	
Indicators of discipline for full-time and distance learning		
	full-time learning	distance learning
Year of training	2	_____
Semester	4	_____
Lectures	30 hours	_____ hours
Practical classes, seminars	30 hours	_____ hours
Laboratory classes	-	_____ hours
Individual work	72 hours	_____ hours
Individual tasks	-	_____ hours
Number of weekly hours for full-time study: auditorium independent student work –	2.5 hours 5 hours	

2. The aims and objectives of the discipline

The purpose of the discipline is to form a theoretical understanding, knowledge and some practical skills of future professionals-ecologists in the field of use, conservation and restoration of water resources and water bodies, understanding of the place and role of water in nature and society.

The main objectives of the course are:

- make a picture of the most common patterns of hydrological processes on Earth;
- show the role, place and significance of natural waters in the geographical envelope (biosphere);
- familiarize students with the basic geographical, hydrological and ecological features of different types of water bodies;
- reveal the nature of hydrological processes from the standpoint of the fundamental laws of physics and other sciences;
- show the importance of hydrological knowledge to deal with issues of use and protection of water;
- form students' ability to apply their knowledge in solving important practical issues of describing water bodies and analysis of the processes occurring in them.

3. Discipline Program

CONTENT MODULE 1. *Hydrology as a science. Hydrosphere. World Ocean.*

CHAPTER 1. *Hydrosphere integrity and discretization*

Hydrosphere - water envelope of the Earth. Formation and evolution of the Earth's hydrosphere. The most important properties of natural waters: thermal, optical, chemical. Water - the solvent, the surface tension of water. Geographic effects of physical and chemical properties of natural waters.

Parts of the hydrosphere. Combining integrity in the hydrosphere World water cycle. Large, small and inland circles of water cycling. World water balance.

World Ocean and its parts. Limits of Oceans. Classification of seas. Types of bays. Straits of World Ocean. Modern methods of Ocean investigation. Layered surface of oceans and seas. The reasons for its oscillation.

CHAPTER 2. *World Ocean*

Physical and chemical properties of oceanic water. The chemical composition of oceanic water. Constancy of salt content oceanic water. Formation of modern composition of waters of the World Ocean. The salinity of oceanic water, the patterns of distribution in the surface layer and depth. Differences in salinity of seas.

The content of oxygen in the ocean water, the source of its income, the patterns of distribution in the surface layers and depth. The content of carbon dioxide, nitrogen, hydrogen sulfide in the ocean water.

The density of ocean water and the factors of its study. The pressure of ocean water and its variation with depth. Water clarity in the ocean. Color waters of the oceans and seas.

The thermal regime of the oceans. Heat balance of ocean water. Patterns of diurnal and annual variations in the temperature of the surface layers of water. The change in temperature with depth in the ocean. Temperature distribution on the surface of the oceans.

Ice in the ocean. The formation of ice in salt water. Ice crystals, fat, glasses, nilas, pancake ice, fresh, pack ice. Distribution of oceanic ice.

Dynamics of the waters of the oceans. Churning of water. Wave elements. Classification of waves according to origin. Wind waves, their size, power and movement. Seismic waves and their impact on the coast. Anemobakic waves.

Tidal movements of ocean water. Inequality of tides. Springs and quadrature tides. Internal waves.

Flows of the oceans. Classification of waves according to the origin. Friction and gradient flows. Classification of flows according to depth, duration, temperature. Ekman laws. Generalized scheme of surface flows of World Ocean. Circulation of flows in the Atlantic, Pacific, Indian and Arctic Oceans.

Surface and deep water masses. Zonal types of surface water masses. Upwelling and downwelling.

The ocean as a place of life. Separation of ocean organic world to the benthos, plankton, nekton. Productivity of the oceans in different latitudes. The natural resources of the oceans: biological, chemical, mineral, fuel, energy, water desalination and recreational resources.

CONTENT MODULE 2. Water Bodies

CHAPTER 3. *Upland surface waters*

Classification of upland waters. The concept of a river, its parts. The river system, river net, hydrographic net. River basin and watershed. Major upland river basins. The areas of seepage flow. World watershed divide of the Earth.

Live and dead water of the river cross-sections. Morphometric characteristics of the cross-section of the river. Longitudinal profile of the river, falls and slope of the river. The velocity of the river flow.

River runoff, its performance. Factors that affect the magnitude of streamflow. Sources of river supply. Water regime of rivers, its phases (flood, high water, low-water period). Catastrophic flooding. Classification of river water regime according to M.Lvovych. Zonal types of water regime of rivers.

The chemical composition of river water. The thermal regime of rivers. Ice on rivers, ice drift. Biota in rivers. Commercial use and protection of rivers.

The term "lake". Classification of lake basins according to origin. Basins of endogenous and exogenous origin. Morphometric characteristics of the lake. Water

balance of the lake water. Differences of water balance of flow and drainage lakes. Classification of lakes by water regime.

The chemical composition of lake waters. Classification of lakes by salinity. The relationship between chemical composition and salinity of lake water. Gas content in lake waters. The heat balance of lakes. Direct and inverse thermal stratification of lake waters. The concept of thermocline. Types of thermal regime of lakes. Dynamics of lake waters. Wind waves and seiches. Life in lakes. The value of the lakes in life and activity of people.

The term "bog". The formation of bogs. Classification of bogs according to mineral nutrition: eutrophic, mesotrophic, oligotrophic. The use of bogs. The term "genesis of bog soil".

Artificial water bodies. Reservoirs and ponds. Irrigation, water-supply, shipping, integrated canals.

CHAPTER 4. *Groundwater. Glaciers. Permafrost.*

The term "groundwater". The properties of rocks (porosity, moisture content, permeability). Forms of water in the soil. Classification of groundwater in terms of occurrence. Water aeration zone, groundwater, between formation waters. Zonal types of ground water. Artesian basins. The chemical composition of the groundwater according to temperature. Springs, geysers. Use and protection of groundwater.

The concept of "glaciers." Hionosphere, the snow line. Formation and development of glaciers. Morphological types of glaciers. Alpine glaciers. Mountain-cover and ice cover.

The term "permafrost". Formation and distribution of permafrost. Ground water in permafrost.

4. Structure of the discipline

Назви змістових модулів і тем	Number of hours											
	full-time learning						distance learning					
	total	including					total	including				
		l	p	lab	ind	i.w.		l	p	lab	ind	i.w.
1	2	3	4	5	6	7	8	9	10	11	12	13
Theme module 1. Hydrology as a science. Hydrosphere. World Ocean												
Chapter 1. Hydrology as a science. Water cycle.	18	4		4		10						
Chapter 2. Structure of the World Ocean. The properties of oceanic water. Dynamics of water masses.	20	4		4		12						
Chapter 3. The Water Resources and Water Budget.	18	4		4		10						
Total for the content module 1	56	12		12		32						
Theme module 2. Water Bodies												
Chapter 1. Surface Hydrology. General characteristics of streams and river flow. Composition of river water.	16	4		4		8						
Chapter 2. Wetland Hydrology.	16	4		4		8						
Chapter 3. Limnology (Hydrology of Lakes)	12	4		2		8						
Chapter 4. Groundwater Hydrology	16	3		6		8						
Chapter 5. Permafrost. Glaciers Hydrology	11	3		2		8						
Total for the content module 2	76	18		18		40						
Total hours	132	30		30		72						
Course project (paper) in _____ (if there is any)		-	-	-		-		-	-	-		-
Total hours	132	30		30		72						

5. Laboratory topics

№ з/п	Title of the topic	Number of hours
1	Introduction to Hydrology. Hydrology and its branches	2
2	Main Types of Water Bodies	2
3	Determination of groundwater classes and groups	2
4	Chemical and physical properties of natural water	2
5.1	Investigating the Vertical Salinity Structure: Salinity vs Depth at Equatorial, Tropical, Subtropical, Moderate, Subpolar and Polar Waters.	2
5.2	Control test "Salinity. Marcet's Principle (Dittmar's law).	1
6	Investigating the Vertical Thermal Structure: Temperature vs Depth at at Equatorial, Tropical, Subtropical, Moderate, Subpolar and Polar Waters.	2
7	Hydrograph for the water year on the river	4
8.1	Streamflow (Discharge)	2
8.2	Control Work: The Hydrologic Cycle	1
9	Determination of groundwater classes and groups by their composition. Description of the composition by the Kurlovs' formula.	2
10	River Watershed Water Budget (Balance)	2
11	Biotesting	2
12	Direction and filtration rate of groundwater	2
13	Plotting a graph of groundwater level fluctuations	2
	Total	30

6. Individual work

№ з/п	Title of the topic	Number of hours
1	Hydrosphere of the Earth. Circulation of water, hydrological cycle. The main hydrological terms and concepts.	8
2	Statistical properties of water levels.	8
3	The chemical properties of natural waters.	8
4	The Earth Cryosphere.	8
5	Underground hydrosphere.	8
6	Hydrology of the reservoir.	8
7	River sediments.	8
8	The geographical range of lakes in Europe and North America.	4

9	The geographical range of lakes in Asia, Africa, South America and Australia.	4
10	Wetland Hydrology	4
11	Water types and water masses	4
	Total	72

7. Teaching Methods

A **teaching method** comprises the principles and methods used for teaching. Commonly used teaching methods for studying subject Water Resources Management include class participation, demonstration, recitation, memorization, or combinations of these. The choice of teaching method or methods to be used depends largely on the information or skill that is being taught, and it may also be influenced by the aptitude and enthusiasm of the students.

Explaining, or lecturing, is the process of teaching by giving spoken explanations of the subject that is to be learned. Lecturing is often accompanied by visual aids to help students visualize an object or problem.

Demonstrating is the process of teaching through examples or experiments. For example, a science teacher may teach an idea by performing an experiment for students. A demonstration may be used to prove a fact through a combination of visual evidence and associated reasoning.

Demonstrations are similar to written storytelling and examples in that they allow students to personally relate to the presented information. Memorization of a list of facts is a detached and impersonal experience, whereas the same information, conveyed through demonstration, becomes personally relatable. Demonstrations help to raise student interest and reinforce memory retention because they provide connections between facts and real-world applications of those facts. Lectures, on the other hand, are often geared more towards factual presentation than connective learning.

Collaboration allows students to actively participate in the learning process by talking with each other and listening to other points of view. Collaboration establishes a personal connection between students and the topic of study and it helps students think in a less personally biased way. Group projects and discussions are examples of this teaching method. Teachers may employ collaboration to assess student's abilities to work as a team, leadership skills, or presentation abilities.

Collaborative discussions can take a variety of forms, such as fishbowl discussions. After some preparation and with clearly defined roles, a discussion may constitute most of a lesson, with the teacher only giving short feedback at the end or in the following lesson.

Learning by teaching is the method, when students assume the role of teacher and teach their peers. Students who teach others as a group or as individuals must study and understand a topic well enough to teach it to their peers. By having students participate in the teaching process, they gain self-confidence and strengthen their speaking and communication skills.

8. Forms of Knowledge Control

The main forms of knowledge control are control at the lectures at seminars and workshops, outside the classroom, at the consultations, tests and exams. I. Control of the lectures can be conducted as a selective oral questioning of students or tests using the previously laid material, particularly in sections of the course that are necessary for the understanding of the lecture topics, read, or to establish a degree of mastery of the material lectures (held by the manner of the late first or early second hour lectures).

Testing during lectures designed to teach students to systematic elaboration covered material and prepare for the upcoming lectures, establish the degree of assimilation theory to identify the most difficult students to read chapters from the following explanation of them. Control of the lectures has to subtract time. By spending time to control oral examination yields control, programmable for cards. II. Current control on practical, seminar and laboratory studies conducted to elucidate ready students for employment in the following forms:

1. Writing (45 min.) Control work.

2. Colloquium on separate sections of theoretical courses (modules or themes).

III. Credits. Some subjects (theoretical courses, practical training) is applied differential test of performance appraisal on a five point scale. In a lecture course or its individual parts, which are not accompanied by laboratory or practical classes, the teacher may conduct interviews or colloquium, offer oral or written (with tickets) questions. Teacher Useful browse the students' notes. Often, students are subject to crediting as minor, insignificant and do not give enough time to prepare for it. Of the major courses before credit of Colloquium useful.

Term papers are the product of many days of work. They include elements of scientific research. Protecting course work - a special form of offset in the commission of two or three teachers. Best of coursework submitted for scientific student conference.

IV. Examinations. Exam is the final step in the study of the whole or part of the discipline and are designed to test students' knowledge on the theory and identify the skills apply the acquired knowledge in solving practical problems, as well as independent work skills with educational and scientific literature.

9. Distribution points

In the curricula include courses in one semester lecture - 30 hours of laboratory classes - 30 hours, for a total is 72 hours (3.0 ECTS credits). After studying the discipline scheduled test.

Evaluation and grading Grading system: National and ECTS

National grade	Grade according to national system	Percentage score
passed	Excellent	90 – 100
	Good	74-89
	Satisfactory	60-73
Not-passed	Unsatisfactory	0-59

11. Recommended literature

Basic

1. Гідрологія. Теоретичні відомості та практичні роботи для студентів спеціальності -101 “Екологія” / Д.А. Савченко, Н.М. Прокопчук, Л.В. Войтенко. – К.: «Експо-Друк», 2020. – 214 с.
2. Гідроекологія та методи гідроекологічних досліджень. Навчальний посібник / В.А. Копілевич, В.Є. Косматий, Д.А. Савченко, Л.М. Абарбарчук, К.О. Чеботько. – К.: «Аграр Медіа Груп», 2012. – 174 с.
3. Groundwater Hydrology / David Keith Todd, Larry W. Mays.- U.S.: Argosy Publishing, 2005. - 652 p.
4. Фоменко А.П., Хихлуха В.И. Общая физическая география и геоморфология. — М.: Наука, 373 с.
5. Ратобыльский Н.С., Лярский П.А. Землеведение и краеведение. — М.: Высшая школа, 1987. — 215 с.
6. Михайлов В.Н. Общая гидрология. — М.: Просвещение, 2019. — 368 с.

Supplemental

1. Textbook on Hydrology. Analyses and synoptic tables of contents of selected textbooks. - France, 2020. - 358 p.
2. Cousteau J.Jean-Michel Cousteau's World. Cities under the Sea: Coral Reefs. – Jean-Michel Cousteau's Productions Inc., 2019. – Disk 1. *Низинные болота, верховные болота..* Н/а
3. Авакян А.Б. Водні проблеми: міфи і реальність. – М.: Знання, 2001. – 48 с. – (Новое в жизни , науке , технике.Сер."Науки о Земле".; №9 (Н/а))
4. Авакян А.Б. Водохранилища/ А.Б.Авакян, В.П.Салтанкин, В.А.Шарапов. – М.: Мысль, 1987. – 325 с.: ил. – (Природа мира). – Библиогр.: с.319-323. ЧЗ№1
5. Антипчук А.Ф. Водна мікробіологія: Навч. посібник для студ. вищих навч. закладів/ А.Ф.Антипчук, І.Ю.Кіреєва. – К.: Кондор, 2005. – 256 с. ЧЗ№1
6. Басейновий принцип управління водними ресурсами// Екологічний вісник. – 2007. – №2. – С.31.
7. Бевзюк В. Мертве море: міфи та реальність// Краєзнавство.Географія.Туризм. – 2009. – №1. – С.18-19.
8. Брукс Ф. Моря и океаны: Энциклопедия окружающего мира: Пер. с англ. – М.: Росмэн, 1988. – 32 с. ЧЗ№1
9. Вершинин А. Тайны Черного моря// В мире животных. – 2006. – №10. – С.2-9.
10. Волков А. Льды, зной и числа Миланковича// Знание-сила. – 2006. – №8. – С.75-81.
11. Вронский В.А. Биологические ресурсы мирового океана// Биология в школе. – 2005. – №8. – С.13-16.

12. Вронский В.А. Экологическое состояние южных морей России// География и экология в школе XXI века. – 2007. – №1. – С.21-25.
13. Галалюк Н.А. Океани. 7 клас// Географія : науково-методичний журнал. – 2006. – №18. – С.9-20.
14. Гвоздев Ю.А. Агония Черного моря. Новые проекты спасения экосистемы региона// Экология и жизнь. – 2004. – №4. – С.53-54.
15. Гвоздяк П. Біологічні аномалії води, або чотири запитання для обміркування// Вісник НАН України. – 2005. – №4. – С.45-52.
16. Гвоздяк П. Біохімія води як перспективний науковий напрям// Вісник НАН України. – 2006. – №9. – С.21-23. *Яким чином біота впливає на воду.*
17. Гельман З.Е. Сибиряк и Мертвое море// Химия и жизнь. – 2006. – №11. – С.52-53. *Новомейский М.А. занимался разработкой минеральных богатств Мертвого моря.*
18. Гожик П. Вивчення Південного океану в 7 класі/ П.Гожик, В.Корнеєв// Краєзнавство.Географія.Туризм. – 2004. – №38. – С.4-8.

Normative literature

1. ISO 6353-2:1983 Reagents for chemical analysis -- Part 2: Specifications -- First series.
2. ISO 6058:1984, Water quality - Determination of calcium content - EDTA titrimetric method ISO 6058:1984, Water quality - Determination of calcium content - EDTA titrimetric method.
3. ISO 6059 – 1984 Water quality – Determination of the sum of calcium and magnesium – EDTA titrimetric method.

15. IT resources

1. <https://elearn.nubip.edu.ua/course/view.php?id=400>
2. <http://www.national-geog-rahpic-news.info>
3. <http://www.geoportat.narod.ru>
4. <http://www/open/web.ru>
5. <http://dir.yahoo.com/Science/Geography>
6. <https://www.usbr.gov/tsc/techreferences/mands/mands-dfs/FloodHyd.pdf>
7. <http://www.fondriest.com/environmental-measurements/parameters/hydrology/>
8. <http://www.mdpi.com/journal/hydrology>
9. http://iswm.nctcog.org/Documents/technical_manual/Hydrology_4-2010.pdf
10. https://www.mdt.mt.gov/other/webdata/external/hydraulics/manuals/chapter_7_hydrology.pdf

Study question bank in bioinorganic chemistry for students of the shortened period of study

1. Formation and evolution of the Earth's hydrosphere.
2. Thermal properties of natural waters.
3. The chemical properties of natural waters. Classification of natural waters by salinity.
4. Physical properties of natural water (except thermal ones).
5. Geographic effects of physical and chemical properties of natural waters.
6. The structure and integrity of the hydrosphere.
7. Global water cycle.
8. World water balance.
9. Parts of the World Ocean.
10. Classification of seas.
11. Modern methods of investigation of World Ocean waters.
12. Layered surface of oceans and seas.
13. The chemical composition of oceanic water and consistency of salt content.
14. Patterns of distribution of the oceanic water salinity in the surface layer and by depth.
15. The content of oxygen in the ocean water and patterns of its distribution.
16. Density, pressure, transparency and color of oceanic water.
17. The heat balance of the ocean and its differences at different latitudes.
18. Temperature distribution on the surface of the World Ocean.
19. The change in water temperature World Ocean by depth.
20. Types of ice formations in the ocean and their distribution.
21. Classification of waves according to the origin.
22. Seismic, anemobaric and internal waves.
23. Tidewater in oceans and seas.
24. Classification of ocean currents according to depth and origin.
25. Ekman laws. Classification of currents according to temperature and duration.
26. Generalized scheme of surface currents of the World Ocean.
27. Zonal types of surface water masses.
28. The ocean as a place of life. Productivity of the ocean at different latitudes.
29. Biological and energy resources of the Worlds Ocean.
30. Chemical, mineral and fuel resources of the World Ocean.
31. Circulation of surface currents of the Indian Ocean.
32. The term "river", its parts and speed.
33. Similar and different in terms of "river", "river system" river net. Quantitative indicators describing these concepts.
34. The term "river basin". Major river basins of uplands. World watershed of the Earth.
35. Morphometric characteristics of the cross-section of the river.
36. Grade line of the river and its indices.
37. River flow and its indices.

- 38.Sources of feed of rivers.
- 39.Water regime of rivers, its phases.
- 40.Classification of water regime of rivers by M.Lvovych.
- 41.Zonal types of water regime.
- 42.Biota in rivers. Use and protection of rivers.
- 43.Classification of lake basins in origin.
- 44.Differences of water balance of flowage and not open lakes.
- 45.Classification of lakes by water regime.
- 46.Classification of lakes by salinity. The dependence of the chemical composition of the salinity of the lake water.
- 47.Types of thermal regime of lakes.
- 48.The chemical composition of the lake waters. The content of gases in lakes.
- 49.Morphometric characteristics of lakes (with examples of records).
- 50.Formation and spread of bogs.
- 51.Classification of bogs according to mineral nutrition.
- 52.Artificial water bodies.
- 53.Water properties of rocks.
- 54.Forms of water in the soil.
- 55.Classification of groundwater in terms of occurrence.
- 56.Sources and geysers.
- 57.Formation and spread of permafrost.
- 58.The term "hionosphere" and "snow line".
- 59.Formation and feed of glaciers.
- 60.The movement of glaciers. Pulsing glaciers.
- 61.Types of mountain glaciers.
- 62.Types of mountain covering glaciers.
- 63.Types of covering glaciers.
- 64.Patterns of spread of different types of glaciers

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL
SCIENCES OF UKRAINE**

FACULTY _____

Direction of training
(specialty) _____

Form of study
Semester ____ **Course** _____

EQL «Bachelor»

Department of Analytical and bioinorganic chemistry and water quality

Discipline _____

Lecturer (Associate Professor N.M. Prokopchuk)

«Approved»

Acting Head of Department _____ (V.A. Kopilevich)

«_» _____ 21 _____

Question 1. Chemically bound water:	
1	In the vapor state, along with the air fills the spaces
2	In the liquid state fills all the spaces of rocks
3	Is a part of minerals, is there in the form of ions OH , H , H O
4	Is a part of crystallization lattice of minerals in the form of molecules H O
Question 2. The hydrological regime of water body is:	
1	Regular changes of water facilities in time occurred under the influence of climatic conditions
2	Relationship between hydrological, hydrochemical and hydrobiological processes in water body
3	Phenomena and processes occurring in water body and affecting the livelihoods of organisms
4	The combination of hydrological characteristics of water body at any given time
Question 3. The major ions (macroelements) in the chemical composition of natural waters are:	
1	SO ₄ ²⁻ , SiO ₃ ²⁻ , NO ₃ ⁻ , SO ₃ ²⁻ ; Al ³⁺ , Ca ²⁺ , K ⁺
2	SO ₄ ²⁻ , HCO ₃ ²⁻ , SiO ₃ ²⁻ , NO ₃ ⁻ ; Ba ²⁺ , Ca ²⁺ , K ⁺ , Na ⁺
3	Cl ⁻ , SO ₄ ²⁻ , HCO ₃ ²⁻ , CO ₃ ²⁻ ; Na ⁺ , K ⁺ , Mg ²⁺ , Ca ²⁺
4	CO ₃ ²⁻ , SiO ₃ ²⁻ , NO ₃ ⁻ , Cl ⁻ ; Ca ²⁺ , K ⁺ , Fe ²⁺ , Ca ²⁺
Question 4. The great circulation of water includes:	
1	DRY LAND AND ATMOSPHERE
2	LITHOGENIC, SOIL, LAKE, GLACIAL, BIOLOGICAL AND ECONOMIC COMPONENTS
3	The World Ocean, the Earth's atmosphere and dry land
4	The ocean and atmosphere
Question 5. Methods of field hydrological research are:	
1	Chemical, physical and chemical
2	Stationary, expeditionary
3	Experimental, physical and chemical
4	Stationary, experimental

Question 6. Biogenic substances in the chemical composition of natural waters are:	
1	SO ₄ ²⁻ , SiO ₃ ²⁻ , Cl ⁻ , CO ₃ ²⁻
2	NO ₃ ⁻ , NO ₂ ⁻ , NH ₄ ⁺ , PO ₄ ³⁻
3	HCO ₃ ²⁻ , CO ₃ ²⁻ , NO ₃ ⁻ , Cl ⁻
4	NH ₄ ⁺ , PO ₄ ³⁻ , HCO ₃ ²⁻ , CO ₃ ²⁻
Question 7. Natural waters contain dissolved gases:	
1	Oxygen, carbon dioxide, hydrogen sulfide, methane, nitrogen
2	Oxygen, ammonia, moisture, carbon dioxide
3	Oxygen, ozone, carbon dioxide, hydrogen
4	Oxygen, hydrogen sulfide, chlorine, carbon dioxide
Question 8. Moisture content of rocks is:	
1	Humidity of rocks, determined by the ratio between the mass of water in the rock and the weight of dry rock
2	The ability of rocks absorb and retain a certain amount of water
3	Maximum water content in the rock at full saturation of its interscites
4	The ability of water-saturated rocks to give back moisture
Question 9. Depth to groundwater is called:	
1	The distance from the Earth's surface to the water table
2	The distance from the aeration zone to the groundwater level
3	The distance between the water table and impermeable horizon
4	The distance from the Earth's surface to the zone of saturation
Question 10. Mineralization of natural water include:	
1	The total mass of cations of calcium and magnesium, which are in one liter of water
2	The total mass of the major macroelements that are in one liter of water
3	The total mass of all inorganic components that are in one liter of water
4	The total mass of carbonate, hydrocarbonate, sulfate and chloride ions, which are in one liter of water
Question 11. Flooding is:	
1	The process that leads to the formation of excessively wet lands and bogs
2	Prevalence of atmospheric precipitation over evaporation in the absence of drainage
3	Increased groundwater after the construction of dams on rivers due to excessive irrigation of large areas
4	The process of overgrowing water and waterlogging of land
Question 12. The active layer of the bog is:	
1	Horizon with a constant amount of water throughout the year
2	A layer of increased access of air into the intercises of peat and the general increase in the number of microorganisms
3	Waterlogged plots of marsh land masses that have a high water level
4	Layer of intense moisture with the atmosphere and the surrounding marsh areas.
Question 13. Valley reservoirs are reservoirs:	
1	HAVING FLOODED RIVERBEDS AND HIGH FLOODPLAINS
2	The bed of which is part of the river valley
3	Located in cavities and the lower area, and separated from the riverbed
4	Located within the bed of the river and low floodplain
Question 14. By chemical composition of water lakes are divided into:	
1	Carbonate, nitrate and chloride
2	Sulfate, chloride and nitrate
3	Chloride, carbonate and nitrate

4	Hydrocarbon, chloride and sulfate
Question 15. Eutrophic lakes are lakes which:	
1	Poor in nutrients with low salinity water and low oxygen
2	Poor in plant plankton and nutrients, with minor mineralization and equal distribution of oxygen throughout the year
3	Have a high content of nutrients, organic matter and are well-heated in summer
4	Have an average nutrient content, high salinity and medium oxygen content
Question 16. Organogenic lakes are formed:	
1	In peat bogs
2	In areas of extension of limestone, gypsum
3	As a result of groundwater washout of clay particles
4	In double bottom cavity
Question 17. The length of river net is:	
1	THE EARTH'S SURFACE, WHICH INCLUDES THE RIVER SYSTEM
2	The total length of all rivers within the basin
3	The ratio of the length of the river to the length of the line between the endpoints of the river
4	This is the distance from the source of the river to the mouth
Question 18. Colloidal solutions are those, which:	
1	Contain substances in the form of molecules and ions
2	Contain particles of matter larger than 10 ⁻⁵ mm
3	Along with molecules and ions include their groups
4	Contain material particles larger than 10 ⁻² mm
Question 19. River basin is:	
1	The earth's surface, which includes the river system and is separated from other river systems by watersheds
2	Land surface from which the river collects water
3	Parts of the earth's surface, limiting the Valley or the sides
4	Some bulk limited by water surface and the bottom of the river
Question 20. Water regime of rivers is:	
1	Prolonged standing of levels and water consumption
2	The types and extent of river feeding
3	Logical alternation of periods of high and low water level of rivers during the year
4	Logical changes in time of flow, flow velocity, water level and sloping of water surface
Question 21. Water level is:	
1	The height of the water surface, which is measured relative to the bottom of the river
2	The height of the water surface, which is determined by the measured depth
3	Relative horizontal plane of the river
4	The height of the water surface, which is measured relative to some conventional horizontal constant plane
Question 22. Runoff is:	
1	The amount of water that flows down from any area and flows in the river
2	The movement of water on the surface, deep in the soil and rocks in hydrological cycle
3	The amount of water that flows per unit of catchment area per unit of time
4	The movement of river water in the direction of flow
Question 23. The zonation of groundwater is:	
1	Distribution of groundwater in vertical section

2	The movement of ground water due to the general geological and structural features of the region
3	The territory of distribution of groundwater
4	A certain regularity in the spread of groundwater in the Earth crust with characteristics of each landscape
Question 24. Aeration zone is:	
1	The extreme upper part of the crust with the presence of air and water vapor in the cavities of rocks
2	Groundwater, which lie close to the earth's surface
3	Accumulation of free and capillary water deep in the soil
4	Part of earth crust, where lie artesian water
Question 25. Saturation zone is:	
1	Part of earth crust between water-impermeable horizons
2	The pores, cracks and other interstices of rocks completely filled with gravitational water.
3	Part of earth crust, where it is concentrated the largest number of capillary water
4	Accumulation of free and capillary water deep in the soil
Question 26. Groundwater regime is:	
1	Change of their levels, temperature and chemical composition in space and time under the influence of meteorological, hydrological, geological, geomorphological, biogenic factors and human activities.
2	Distribution of groundwater in the earth's crust in vertical section
3	Seasonal variations in temperature and volume of groundwater
4	Change of temperature and chemical composition of groundwater as a result of human activities
Question 27. Chemogenic sediments in the seas and oceans are:	
1	The result of biochemical processes at the bottom and bottom waters
2	Suspended and bottom sediments, which are carried by rivers and coast debris
3	Deep-sea biogenic siliceous sediments
4	Sediments associated with entering into the ocean of lava, ash, volcanic dust from volcanoes, both at the bottom of the ocean and on land
Question 28. Biogenic sediments in the oceans and seas:	
1	They are suspended and bottom sediments, which are carried by rivers
2	These are clayey silts that occur at depths greater than 4 km
3	These are deposits, brought by winds from land
4	These are deposits, formed from the remains of dead planktonic organisms
Question 29. The heat balance of the sea is:	
1	The amount of heat that enters the water, or is spent by it as a result of all thermal processes
2	NATURAL FLUCTUATIONS OF TEMPERATURE OF SEAWATER DURING THE YEAR
3	The redistribution of heat in the sea, heating and cooling of the water mass
4	The magnitude of both diurnal and seasonal variations in temperature of sea water
Question 30. Water resources are:	
1	The volume of surface fresh water used for drinking water production
2	Amount of water used for domestic and industrial water use
3	Rivers, lakes, bogs and other forms of water on the land surface
4	The volume of surface water and groundwater that are used or could be used in the process of material production