

Ім'я користувача:  
Оксана Сімонова

Дата перевірки:  
21.02.2020 14:01:07 EET

Дата звіту:  
07.04.2021 16:32:38 EEST

ID перевірки:  
1001177952

Тип перевірки:  
Doc vs Internet + Library

ID користувача:  
100002508

Назва документа: ПОСІБНИК ГБ

Кількість сторінок: 125 Кількість слів: 27765 Кількість символів: 172445 Розмір файлу: 714.50 KB ID файлу: 1001189246

## 35.2% Схожість

Найбільша схожість: 8.67% з Інтернет-джерелом (<http://www.123seminaronly.com/Seminar-Reports/029/59759661-GSM>).

35.2% Джерела з Інтернету

247

Сторінка 127

Не знайдено джерел з Бібліотеки

## 0% Цитат

Вилучення цитат вимкнене

Вилучення списку бібліографічних посилань вимкнене

## 0% Вилучень

Немає вилучених джерел

## Модифікації

Виявлено модифікації тексту. Детальна інформація доступна в онлайн-звіті.

Замінені символи

5

Міністерство освіти і науки України  
ДНУЗ «Херсонський державний аграрний університет»

*Кафедра іноземних мов*

## НАВЧАЛЬНИЙ ПОСІБНИК

для розвитку професійно-орієнтованої  
комунікативної компетенції зі спеціальності 194 «Гідротехнічне  
будівництво, водна інженерія та водні технології»

Херсон – 2020

УДК 372.8:811.11

Навчальний посібник розглянуто і затверджено на засіданні кафедри іноземних мов Херсонського державного аграрного університету (протокол № від 2020 року).

Навчальний посібник розглянуто і затверджено на засіданні методичної ради факультету водного господарства, будівництва та землеустрою Херсонського державного аграрного університету (протокол № від 20 року).

Рекомендовано до друку Вченою радою Херсонського державного аграрного університету (протокол № від 20 р.)

#### Упорядники:

кандидат філологічних наук, доцент Лебідь О.М.;  
кандидат філологічних наук, доцент Бокшань Г. І.;  
старший викладач Камінська М. О.;  
старший викладач Макухіна С.В.

#### Рецензенти:

кандидат сільськогосподарських наук, завідувач кафедри гідротехнічного будівництва Шапоринська Н.М..

кандидат педагогічних наук, доцент, зав. кафедри практики іноземних мов ХДУ Кіщенко Ю.В.

Лебідь О. М., Бокшань Г. І., Камінська М. О., Макухіна С.В. Навчальний посібник для розвитку професійно-орієнтованої комунікативної компетенції зі спеціальності 194 «Гідротехнічне будівництво, водна інженерія та водні технології»  
– Херсон: РВВ «Колос», 2020– 122 с.

Мета навчального посібника – формування і розвиток широкої професійно-орієнтованої комунікативної компетенції для здійснення спілкування у відповідних соціально-комунікативних ролях фахової сфери. Навчальний посібник призначений для аудиторної та самостійної роботи здобувачів вищої освіти першого «бакалаврського» та другого «магістерського» рівнів спеціальності 194 «Гідротехнічне будівництво, водна інженерія та водні технології»

## ЗМІСТ

Вступ .....	4	
Text 1. The use of water resources in land management.....	6	
Text 2. Water management in Ukraine .....	11	
Text 3. Earth water: Ground water.....	14	
Text 4. The advantages and disadvantages of ground water.....	18	
Text 5. Drainage.....	21	
Text 6. Current practices in drainage construction.....	25	
Text 7. Development of drainage and ways of its effective use.....	29	
Text 8. Types of dams.....	34	
Text 9. Concrete arch dams.....	38	
Text 10. The Kakhovka irrigation system .....	42	
Самостійна		робота
№1.....	45	
Самостійна		робота
№2.....	49	
Самостійна		робота
№3.....	52	
Самостійна		робота
№4.....	56	
Самостійна робота №5.....		
.....	59	
Самостійна		робота
№6.....	62	
Самостійна		робота
№7.....	66	
Самостійна		робота
№8.....	69	

Самостійна	робота
№9.....	73
Самостійна	робота
№10.....	76
Самостійна	робота
№11.....	79
Самостійна	робота
№12.....	82
Самостійна	робота
№13.....	85
Самостійна	робота
№14.....	88
Тести для самоконтролю.....	91
Ключі до тестів .....	121
Список використаних джерел .....	123

## Вступ

Упродовж тривалого часу невід’ємною частиною вивчення іноземних мов у системі вищої освіти є оволодіння професійно-орієнтованою комунікативною компетенцією. Молодий фахівець повинен уміти користуватися іноземною мовою не лише на побутовому рівні, а й у сфері трудових відносин. Мовленнєва компетенція як складова загальної професійної компетенції може стати запорукою встановлення й підтримання ділових стосунків із партнерами з закордону, виходу на перспективний шлях кар’єрного зростання й набуття статусу конкурентоздатного фахівця на сучасному ринку праці, що висуває дедалі вищі вимоги до потенційних кандидатів.

На даному етапі володіти іншомовною мовленнєвою компетенцією означає:

- коректно використовувати професійну лексику відповідно до граматичних норм іноземної мови у реальних комунікативних ситуаціях;

- володіти розмовними кліше, формулами спілкування й комунікативними паттернами;

- уміти працювати з науковою й фаховою літературою іноземною мовою з метою вилучення інформації для реалізації професійної діяльності.

Майбутній спеціаліст має усвідомити, що для успішного позиціонування себе у професійному середовищі володіння іншомовною комунікативною компетенцією часто є не стільки бажаним, скільки обов'язковим, адже від цього залежить установа ефективних партнерських контактів з іноземними колегами, що є особливо актуальним в умовах глобалізації.

Матеріал, запропонований у навчальному посібнику, може бути використаний як під час аудиторної, так і самостійної роботи здобувачів вищої освіти спеціальності 194 «Гідротехнічне будівництво, водна інженерія та водні технології»

Посібник призначено для засвоєння вузькогалузевих термінологічних одиниць, репрезентованих у контексті методично адаптованого фахового матеріалу, поданого у супроводі комплексу лексико-граматичних та умовно-комунікативних вправ.

У структурі навчального посібника витримано логічну послідовність текстів, підпорядковану принципу від простого до складного. Зміст представленого матеріалу охоплює найважливіші проблеми гідромеліорації та водного господарства. Підбір тематики текстів здійснювався відповідно до чинних робочих програм дисциплін профільних кафедр. Запропоновані післятекстові завдання пройшли апробацію на практичних заняттях у групах відповідної спеціальності й підтвердили доцільність та ефективність їх використання.

В навчальному посібнику представлені тексти і для самостійної роботи. Самостійна робота – це форма організації навчальної діяльності здобувачів вищої освіти, спрямована на засвоєння частини програмного матеріалу в позааудиторний час.

Мета самостійної роботи – сприяти формуванню самостійності як особистісної риси та важливої професійної якості молодшої людини, суть якої полягає в уміннях систематизувати, планувати, контролювати й регулювати свою діяльність без допомоги й контролю викладача. Самостійна робота дає можливість працювати без поспіху, користуватися довідковими матеріалами, а також обирати оптимальний темп роботи та умови її виконання.

#### **Text 1. THE USE OF WATER RESOURCES IN LAND MANAGEMENT**

1. Water management system provides water for various branches of national economy. Each year the amount of water taken from all sources to meet the requirements of national economy is in excess of 30 km<sup>3</sup>. The programme of reclamation development in Ukraine, and above all, land and pasture irrigation, timber floating, is part and parcel of water resources utilization. Approximately 50% of the total water supply is used for agriculture. At present, water used in agriculture amounts to 15 km<sup>3</sup>, in the future it will almost double.
2. Within the agriculture sector, irrigation is the major water consumer. Extensive reclamation activities being under way, the relationship between land reclamation and water resources development becomes ever so close.

3. The water for irrigation is diverted basically from the surface flow (98%), underground waters accounting only for 2%. Nevertheless in recent years underground waters have become increasingly be used for irrigation purposes.
4. Most of water reservoirs in the country are used comprehensively, that is for various needs of national economy: hydropower, water transport, fisheries, communal and industrial water supply including thermal and atomic power stations, irrigation varieties of agricultural crops, etc. For example, in the Dnieper cascade the Kremenchuk, Kakhovska and Kyiv reservoirs have the largest storage capacity.
5. There are also some single-purpose reservoirs, i.e. reservoirs used, for example, for purely irrigation purposes. These are located primarily in Crimea and some southern regions of Ukraine.
6. There are many ponds and large canals in Ukraine, serving irrigation purposes, the largest of which are Kakhovka main canal and the North Crimean canal.
7. In order to optimize the methods of water resources utilization in the course of land reclamation, the following measures are applied on a large scale:
  - a) construction of new and rehabilitation of existing irrigation systems on the basis of dynamic salt-water balance and economic calculations;
  - b) improvement of planning and operational control of water use on the basis of the forecast and available information about water content of the sources as well as on the basis of water use optimization. Water management computation techniques employed in designing reclamation projects are being improved.
8. Scientifically substantial record of the forecast changes of water resources is introduced; the dynamics of salt-water balance of different areas and its relationship with irrigation technology are studied closely.
9. As the control and planning of water use are improved, long-range forecasting of weather and sources' water content becomes increasingly important.
10. The work aimed at raising the efficiency of water use at reclamation projects proceeds in two main directions: modernization of presently applied technologies and introduction of operational system of water utilization. A great deal is being done to perfect irrigation technology and apply anti-filtration measures, which help to raise



substantially the efficiency of reclamation projects.

### Exercises

#### 1. Memorize the spelling, pronunciation and translation of the following words:

to provide water – забезпечувати водою

amount – кількість, в. дорівнювати, складати

source – джерело

in excess of – зверх, більш ніж

to be under way – проводити, вести

surface flow – поверхневий стік

storage capacity – водомісткість

to apply on a large scale – широко застосовувати

water management computations – водогосподарські розрахунки

to raise the efficiency – підвищувати ефективність

anti-filtration measures – протифільтраційні заходи

for irrigation purposes – з метою зрошення

water consumer – споживач води

relationship – відношення, зв'язок

improvement of planning – вдосконалення планування

pasture irrigation – обводнення пасовищ

timber floating – лісосплав

part and parcel – невід'ємна частина

to divert water – відводити воду

comprehensively – зі всіх сторін, всебічно

pond – водойма

forecast – прогноз, передбачення

to proceed – проходити, продовжуватись

a great deal of – багато

#### 2. Translate into Ukrainian the following words with common stem and word-

**combinations:**

- active, activable, activate, activation area, activator, actively, reclamation activities, activist, activated, activate;
- consume, water consumer, consumership, consumable goods, consumed energy, consumption, consumptive articles;
- filter (n), filter (v), filtering, filter-paper, filter-tipped cigarette, filtration system, filtrate; filtrable, filtrability, filter-press, anti-filtration measures;
- perfect, perfectible design, perfecting machine, perfectibility, attain perfection, perfective aspect, perfectionism, perfectly, perfector, perfecto, perfectionist, perfect irrigation technology;
- relate, related enterprise, international relations, relationship, relational, relative density, relatively useful device, theory of relativity, relator, relativism, relativistic electron;
- substantiate, substantial argument, substantiality, substantialize, raise substantially, substantials (n pl), substantiation.

**3. Match the words from the left-hand column to the corresponding translation from the right-hand column:**

задовольняти потреби	water supply
лісосплав	reclamation activities
водопостачання	to meet the requirements
меліоративна діяльність	long-range forecasting
головний споживач води	to raise substantially
складати	atomic power station
значно підвищувати	fisheries
галузі народного господарства	to account for
довгостроковий прогноз	timber floating
невід’ємна частина	pond
водні ресурси	major water consumer
водойма	water resources

атомна електростанція

branches of national economy

рибні промисли

part and parcel

**4. Give Ukrainian equivalents of the following words and word-combinations:**

efficiency of reclamation projects, responsive to irrigation crop, available information, water resources utilization, approximately, underground water, various needs, water transport, hydropower, communal water supply, thermal power station, storage capacity, purely irrigation purposes, rehabilitation of existing irrigation systems, on the basis, economic calculations, dynamic salt-water balance, operational control, water content of the sources.

**5. Find in the text and write down English equivalents of the following words:**

програма розвитку меліорації, вдосконалення планування, сільськогосподарський сектор, водогосподарські розрахунки, всебічно, на основі прогнозування, вживати заходи, широко застосовувати, більш ніж, Дніпровський каскад, науково обґрунтований облік, підвищити ефективність використання води, вдосконалювати зрошувальні технології, джерело, відводити воду, вибирати оптимальні методи використання водних ресурсів.

**6. Answer the questions:**

1. What is the annual amount of water taken from all sources to meet the requirements of national economy of our country?
2. What's the total water supply used for agriculture?
3. Why does the relationship between land reclamation and water resources development become ever so close?
4. What needs of national economy are most of water reservoirs in the country used for?
5. Where are the largest canals in Ukraine, serving irrigation purposes, located?
6. Are any measures applied in order to optimize the methods of water resources utilization?

7. Why do water management computation techniques require improvement?
8. What is scientifically substantial record of the forecast changes of water resources aimed at?
9. Why does the importance of long-range forecasting of weather and sources' water content increase?
10. What are the ways of raising the efficiency of water use at reclamation projects?

**7. Get ready to render the text.**

**Text 2. WATER MANAGEMENT IN UKRAINE**

1. Water management began to develop in Ukraine in ancient times. The development of waterways was linked with the Dnieper. The navigation on this river appeared over 2,000 years ago. But the first passenger ship line was opened on the Dnieper in 1850.

2. At the beginning of the twentieth century Ukraine had an inadequate water supply. Only a few large cities had water supply systems. The sewerage and water drainage systems were very limited.

3. In accordance with the plan of the electrification of the country, the problem of the all-round utilization of water resources was tackled in Ukraine. It began with the construction of the Hydroelectric Power Station on the Dnieper. At that time it was

the largest water power plant in Europe. The first ships passed through the Dniproges locks in May, 1933.

4. The reconstruction of farming created favourable conditions for the development of irrigation, the construction of large irrigation and flooding systems. Important work was carried out also for reclamation of swamped lands.

5. The water supply to industry, farms and public utilities considerably improved. Special attention was devoted to the water supply of the Donbas and Dnieper industrial areas.

6. Water management developed greatly in Ukraine after the war. New hydroelectric power plants and irrigation and drainage systems were constructed.

7. The Kakhovka hydropower station was put into service in 1956. Four years later the Kremenchuk hydropower plant was constructed and at the same time one of the largest artificial reservoirs on the Dnieper was created.

8. The construction of the two power stations made it possible to irrigate, flood and ensure water supply to the arid southern areas of the country.

9. The fourth stage of the Dnieper cascade of power stations – the Dniprodzerzhinsk HPS was completed in 1963. It was followed by the Kyiv and the Kaniv power stations. Altogether Dnieper cascade of power stations generate a total of 10,000 mln kw-hrs in the average year.

10. It must be said that the water economy of Ukraine has been considerably developed in the recent years. Water resources are used not only for power generation but also for navigation, land irrigation, industrial enterprises. They are a source of the water supply for the population. Many cities, industrial enterprises, state and private farms use underground water.

### Exercises

#### 1. Memorize the following words:

reclamation of swamped lands – меліорація заболочених земель

to be linked with – бути пов'язаним з...

inadequate water supply – недостатнє водопостачання

in accordance with – згідно з...  
water management – водне господарство  
to tackle – розглядати, розробляти  
to put into service – ввести в дію  
arid areas – засушливі землі  
in ancient times – давно, в давні часи  
to create favorable conditions – створювати сприятливі умови  
to ensure – забезпечити  
in recent years – за минулі роки, недавно  
lock – шлюз  
sewerage system – каналізаційна система  
public utilities – комунальні послуги  
in the average year – в середньому за рік  
all-round utilization – всебічне використання  
to devote special attention – приділяти особливу увагу  
industrial enterprises – промислові підприємства  
hydroelectric power station – ГЕС  
to be limited – бути обмеженим  
to generate – виробляти, генерувати

## 2. Find in Text B English equivalents of the following:

водні шляхи, будівництво, ГЕС, меліорація, значно, сільське господарство, зрошувальна система, створювати, забезпечити водопостачання, виробництво електроенергії, електрифікація, дренажна система, заболочені землі, сприятливі умови, в давні часи, в середньому за рік, промислові райони, згідно з ..., найбільші штучні водоймища, завершити, загалом, потрібно сказати, судноплавство, приватне селянське господарство.

## 3. Complete the sentences with the words given below:

1. The first ships passed through the Dniproges... in May, 1933.
2. The sewerage and water ... systems were very limited.

3. Special attention was devoted to the ... .. of the Donbas and Dnieper industrial areas.

4. The reconstruction of farming created favourable conditions for the development of irrigation, the construction of large irrigation and ... systems.

5. It should be said that the ... .. of Ukraine has been considerably developed in the recent years.

6. The Kremenchuk ... .. was constructed in 1960 and at the same time one of the largest artificial reservoirs on the Dnieper was created.

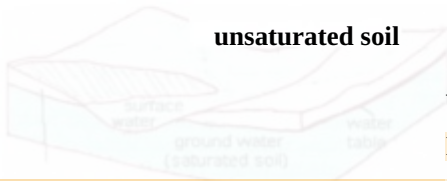
*(water economy, drainage, hydropower plant, locks, flooding, water supply).*

#### 4. Develop the situation.

You are a professor. You are examining one of your students. Ask him questions concerning the use of Water Resources in Land Reclamation and Water Management of Ukraine.

### Text 3. EARTH'S WATER: GROUND WATER

1. Ground water is the part of precipitation that seeps down through the soil until it reaches rock material that is saturated with water. Ground water slowly moves underground, generally at a downward angle (because of gravity), and may eventually seep into streams, lakes, and oceans.

2.  Here is a simplified diagram showing how the ground is saturated below the

water table. The ground above the water table may be wet to a certain degree, but it does not stay saturated. The dirt and rock in this unsaturated zone contain air and some water and support the vegetation on the Earth. The saturated zone below the water table has water that fills the tiny spaces (pores) between rock particles and the cracks (fractures) of the rocks.

3. A few important factors are responsible for the existence of ground water:

**(a) Gravity**

Nothing surprising here – gravity pulls water toward the center of the Earth. That means that water on the surface will try to seep into the ground below it.

**(b) The Rocks Below Our Feet**

The rock below the Earth's surface is the bedrock. If all bedrock consisted of a dense material like solid granite, then even gravity would have a hard time pulling water downward. But Earth's bedrock consists of many types of rock, such as sandstone, granite, and limestone. Bedrocks have varying amounts of void spaces in them where ground water accumulates. Bedrock can also become broken and fractured creating spaces that can fill with water. And some bedrock, such as limestone, are dissolved by water – which results in large cavities that fill with water.

4. In many places, you can see that rock is laid down in layers. Some layers have rocks that are more porous than others, and here water moves more freely (in a horizontal manner) through the earth.

5. So, gravity doesn't pull water all the way to the center of the Earth. Deep in the bedrock there are rock layers made of dense material, such as granite, or material that water has a hard time penetrating, such as clay. These layers are under the porous rock layers. Since it is more difficult for the water to go any deeper, it tends to pool in the porous layers and flow in a more horizontal direction across the aquifer toward a surface-water body, like a river.

## Exercises

**1. Memorize the spelling, pronunciation and translation of the following words:**

precipitation – опади



to seep – просочуватися  
rock material – скеляста порода  
to saturate – насичувати  
water table – рівень ґрунтових вод  
to support – підтримувати  
to fill – наповнювати  
to penetrate – проникати  
clay – глина  
particle – часточка  
crack – щілина, тріщина  
fracture – розлом, розрив  
bedrock – корінна, материнська порода (геол.)  
dense – щільний  
sandstone – піщаник  
limestone – вапняк  
to dissolve – розчиняти  
cavity – порожнина, пустота, щілина в породі  
to lay in layers – залягати шарами  
to pool – розливатися  
aquifer – водоносний горизонт

**2. Give Ukrainian equivalents of the following words and word-combinations:**

to fill tiny spaces, to be responsible for, to pull water downward, bedrock, to consist of a dense material, sandstone, limestone, varying amounts of void spaces, to be dissolved by water, eventually, to stay, to contain, to support, pore, crack, to exist, to penetrate, to pool, to be laid down in layers.

**3. Find in the text and write down English equivalents of the following words:**

існування ґрунтових вод, сила тяжіння, граніт, різні типи скелястої породи, було б важко, накопичувати ґрунтову воду, сягнути скелястої породи, призводити до,

великі порожнечі, рівень ґрунтових вод, вологий, наповнювати, часточки, розлом, вапняк, материкова порода, тягнути, накопичувати, глина, водоносний горизонт.

**4. Find in the text 10-12 word-combinations with prepositions and adverbs of place and direction, write them down and translate into Ukrainian.**

**5. Arrange the following words in pairs according to:**

1. *similar meaning*

2. *opposite meaning.*

vertical, to reach, cavities, downward, eventually, top, saturated, void spaces, to stay, slowly, to come to, dirt, below, quickly, at last, to remain, upward, above, ground, fracture, wet, porous, crack, dry, dense, horizontal, bottom.

**6. Complete the sentences filling in the words given below:**

1. Rain water ... through the soil until it comes to ... material.

2. The ground below the ... is saturated.

3. The dirt and rock in unsaturated zone support ... on the Earth.

4. This part of water cycle shows formation and movement of ... water.

5. Limestone is ... by water.

6. Granite is ... material.

7. Void spaces can ... with water.

8. Sandstone and limestone are ... than granite.

*(fill, water table, ground, seeps down, dissolved, dense, more porous, rock, vegetation)*

**7. Make up sentences with the following words given in a jumbled order:**

1. sandstone, many types, the Earth's bedrock, of, consists, limestone, such as, of rock, granite.

2. accumulates, in pores, in, and, rock particles, water, between, the cracks, of rock, in the saturated zone.

3. the movement, important factors, gravity, and of bedrocks, are responsible for,

various kinds, of ground water.

4. seeps down, reaches, precipitation, through the soil, rock material, water, until, it, saturated with.

5. above the water table, does not, long, the ground, stay saturated.

6. pools, gravity, of the Earth, water, the center, towards.

7. flows, of bedrocks, in a horizontal manner, in porous layers, water, sideways.

#### **Text 4. THE ADVANTAGES AND DISADVANTAGES OF GROUND WATER**

Ground water serves a great many people who live in rural areas and have a water-supply system of one type or another. The reason is that, among the various sources of supply, ground-water is by far the most practical and safe in nature. Even in a highly industrialized country such as the USA, municipal ground-water installations far outnumber surface-water supplies. It is very probable that, for a long time to come, ground water will be the most important source of supply for most rural communities of the world.

The advantages of ground water are:

1. It is likely to be free of pathogenic bacteria;
2. Generally, it may be used without further treatment;
3. In many instances it can be found in the close vicinity of rural communities;
4. It is often most practical and economical to obtain and distribute;
5. The water-bearing stratum from which it is drawn usually provides a natural storage at the point of intake.

The disadvantages are:

1. Ground water is often high in mineral content;
2. It usually requires pumping.

Get two sponges and lay one on top of the other. Pour water (precipitation) on top and it will seep through the top sponge downward into the bottom sponge. If you stopped adding water, the top sponge would dry up and then the bottom sponge would dry up too. Now, put a piece of plastic between the sponges (making the bottom sponge an impermeable rock layer that is too dense to allow water to flow through it). Now when you pour water on the top sponge, the water will seep downward until it reaches the plastic. The top sponge will become saturated, and when the water comes to the plastic it won't be able to seep into the second sponge. Instead, it will start flowing sideways and come out at the edges of the sponge (horizontal flow of ground water). This happens in the earth all the time – and it is an important part of the water cycle.

### Exercises

#### 1. Memorize the following words.

rural area – сільська місцевість  
supply – постачати, постачання  
a water-supply system – система водопостачання  
municipal – міський  
outnumber – переважати за кількістю  
advantage – перевага  
disadvantage – недолік  
treatment – обробка, очистка  
in the close vicinity – дуже близько від  
to obtain – отримати, добути  
to distribute – розподіляти  
water-bearing stratum – водоносний пласт  
to draw – відводити, добувати

to store – наповнювати, запасати

to provide – забезпечувати, надавати

intake – водозабір

## 2. Translate into English:

1. Багато людей у сільській місцевості використовують ґрунтові води.

2. Ґрунтові води більш корисні і безпечні.

3. У майбутньому ґрунтові води стануть найважливішим джерелом водопостачання в сільських місцевостях.

4. Можна назвати щонайменше 5 переваг ґрунтових вод над поверхневими водами.

5. У ґрунтових водах немає патогенних бактерій.

6. Ґрунтові води можна використовувати без очищення.

7. Водонесний шар забезпечує природне поповнення в точці водозабору.

8. Ґрунтова вода містить багато мінеральних речовин.

9. Для добування ґрунтових вод зазвичай потрібні насоси.

## 3. Define the main idea of the text.

4. Divide the text into parts, state the microtopics of each part. Render the contents of each part in 1-2 sentences.

5. Speak about advantages and disadvantages of ground water.

#### Text 5. DRAINAGE

1. Drainage is the natural or artificial removal of surface and sub-surface water from a given area. Many agricultural soils need drainage to improve production or to manage water supplies.
2. Agricultural drainage is the use of surface ditches, subsurface permeable pipes, or both, to remove standing or excess water from poorly drained lands. During the late 1800s, European settlers in the Upper Midwest began making drainage ditches and channelizing (straightening and reshaping) streams to carry water from the wet areas of their farms to nearby streams and rivers. Later, farmers increased drainage by installing subsurface drainage pipes generally at a depth of three to six feet. Until the 1970s, most subsurface drainage pipes were made from short, cylindrical sections of concrete or clay called "tile," That is why terms like tile, tile drainage, and tiling are still used, even though most drainage pipe today is perforated polyethylene tubing. When installing a subsurface drainage system, pipes are either strategically placed in

a field to remove water from isolated wet areas or installed in a pattern to drain an entire field.

3. Many soils in the world have poor natural internal drainage and would remain waterlogged for several days after excess rain without artificial drainage. This prolonged wetness prevents timely fieldwork and causes stress to growing crops because saturated soils do not provide sufficient aeration for crop root development. The roots of most crops cannot tolerate excessively wet conditions for more than a couple of days. Soil conditions that make drainage a necessity for some agricultural lands include those with slow water permeability or dense soil layers that restrict water movement, flat or depression topography and, in some areas, high levels of salts at the soil surface. Large areas of Minnesota would not reliably produce crops if artificial drainage systems had not been installed. Subsurface drainage pipes are typically placed at depths of 3 to 4 feet in poorly drained soils.

### Exercises

#### 1. Match the words from the left-hand column to the corresponding translation from the right-hand column:

permeable – канава

restrict water – відведення води природним шляхом

flat / depressional topography – керувати запасами води

to produce crops – високий рівень солей

to install drainage system – перфорована труба

ditch – (водо)проникний

subsurface drainage pipes – вчасне проведення польових робіт

natural removal of water – гончарний дренаж

tile drainage – погане (слабке) осушення

excessively wet conditions – підземні дренажні труби

perforated tubing – обмежувати рух води

to manage water supplies – умови перезволоження  
poor drainage – вирощувати врожаї  
high levels of salts – рівнинний рельєф / місцевість з лощинами  
timely fieldwork – встановити (збудувати) дренажну систему

## 2. Give Ukrainian equivalents of the following words and word-combinations

excess surface water, ditch, permeable pipes, settlers, straightening and reshaping, to carry water, cylindrical sections of concrete or clay, in a pattern, entire field, poor natural internal drainage, prolonged wetness, crop root development, to tolerate wet conditions, slow water permeability, to reliably produce crops.

## 3. Find in the text and write down English equivalents of the following words:

побудувати дренажну систему, стояча вода, погано осушені землі, вологі території, на глибині 3-6 футів, гончарна труба, хоча, оперативно, спричиняти (створювати) навантаження (тиск), забезпечити достатній доступ повітря, декілька днів, щільний пласт (шар) ґрунту, рельєф з лощинами.

## 4. Arrange the words in pairs according to:

a) *similar meaning*

b) *opposite meaning*.

natural, slow, subsurface water, tube, to restrict, trench, artificial, ground water, permeable, impervious, fast, to limit, contamination, surface, impermeable, wet, subsurface, pollution, dry, environmental, pipe, ditch, ecological, pervious.

## 5. Make up sentences with the following words given in a jumbled order.

1. may be adequate for, in moist climates, soils, cropping.
2. from snow melt, become, waterlogged, each year, from heavy rains, or, some soils, for brief periods.
3. passes, very slowly, water, clay, downward.
4. around the roots, air movement, the excessive water, eliminates, through the soil.
5. of mineralized soil, may, some soils, have, an, layer, impervious.



6. fruit trees, is, a week, enough, to kill, the soil

**6. Answer the questions:**

1. What is drainage?
2. Is drainage needed only in agriculture?
3. What is agricultural drainage?
4. When did draining of soils begin in the USA?
5. What were the first steps of European settlers?
6. What are the meanings of the term “channelizing”?
7. Why was channelizing carried out in the Midwest of the USA?
8. How was drainage increased later?
9. What is tiling?
10. In what ways is a subsurface drainage system installed?
11. On what soils is agricultural drainage needed?
12. Is prolonged soil wetness a favorable phenomenon for farmers? Why?
13. Name 4 kinds of soil conditions that make drainage a necessity.
14. What depth are drainage pipes placed at?

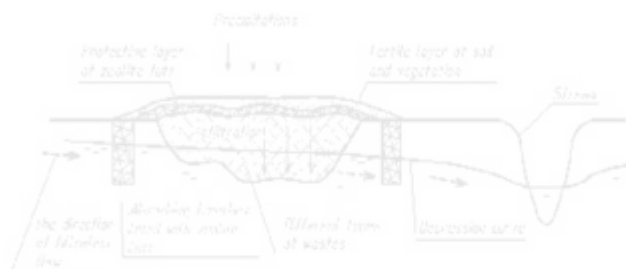
**Text 6. CURRENT PRACTICES IN DRAINAGE CONSTRUCTION.**

1. Modern drainage systems have geotextile filters – synthetic textile fabrics. They retain and prevent fine grains of soil from passing into and clogging the drain. In a typical drainage system they can be laid along a trench which is then filled with coarse granular material: gravel, seashells, rock. The geotextile is then folded over the top of granular material and the trench is then covered by soil. Ground water seeps through the geotextile and flows within the granular material to an outfall. In high groundwater conditions a perforated plastic (PVC or PE) pipe is laid along the base of the drain to increase the volume of water transported in the drain.

2. A new technology of application of drainage trenches has been developed by Rocoichinsky A. and Gromachenko S., scholars of National University of Water Management and Nature Resources Use. It is aimed at protection of water bodies from local pollutants of different origin – biological, chemical, radiological, etc.

Figure given below shows how the filtration flow is treated with the help of drainage absorbing trenches filled with zeolite tuff, natural sorbent material.

3. Precipitation penetrates through the fertile layer of soil and vegetation covering the landfill, interacts with different types of wastes and



*Figure. 1. Application of engineering land reclamation measures to protect water bodies from local pollutants. forms the toxic filtrate. To neutralize the*

negative impact of the filtrate, it is necessary to make a trench along the perimeter of the landfill and fill it with sorbent material, for example, with zeolite tuff. As a result, the infiltrate will be purified, surface air layer will be deodorized and ground water sipping into the stream will be clean.

### Exercises

#### 1. Memorize the following words.

fabrics – матеріал, тканина, виріб

to retain – затримувати

fine grains – маленькі часточки

to clog – засмічувати, закупорювати

coarse – крупний, великий

gravel – гравій

seashells – морські ракушки, мушлі

to fold over – обгортати

to cover – покривати

outfall – водовідвід

water body – водний об'єкт

to protect – захищати  
to treat the filtration flow – очищати фільтраційний потік  
drainage absorbing trench – дренажна траншея-поглинач  
zeolite tuff – цеолітовий туф  
landfill – сміттєзвалище  
wastes – (тверді) відходи  
negative impact – негативний вплив  
to purify – очищати  
land reclamation – меліорація земель  
land improvement  
land amelioration

## 2. Complete the sentences according to the information from Text 6

1. Geotextile filters retain ... .
2. For a typical drainage system, the filling may be ... .
3. Above, the trench is covered ... .
4. A new technology developed at National University of Water Management and Nature Resources Use is designed to ... .
5. The filtrate is the result of ... .
6. Zeolite tuff is natural ... .
7. The surface air layer around the landfill ... .
8. The trench along the perimeter of a landfill is filled with ... .
9. The filtrate flowing through the drainage absorbing trench is ... and surface air is ... .
10. As a result of these engineering land reclamation measures, ground water sipping into the stream ... .

## 3. Translate into English:

1. Одним із найважливіших завдань меліорації є охорона водних об'єктів.
2. Учені розробили комплекс інженерно-меліоративних заходів для захисту

річок від локальних забруднювачів.

3. На цій схемі зображено технологію очищення фільтраційного потоку, який рухається від сміттєзвалища.

4. Очищення відбувається за допомогою дренажних траншей-поглиначів, вистелених цеолітовим туфом.

5. У якості фільтраційного матеріалу традиційно застосовують гравій, мушлі, каміння.

6. Токсичний фільтрат утворюється від взаємодії опадів з різними видами відходів.

7. Дана технологія ґрунтується на застосуванні дренажних траншей-поглиначів у поєднанні з природним сорбентом – цеолітовим туфом.

8. Ця технологія дозволяє локалізувати та нейтралізувати шкідливі речовини.

9. У результаті цих заходів відбувається очищення інфільтрату та дезодорація приземного шару повітря.

**4. Divide the text into parts, state the microtopics of each part. Render the contents of each part in 2-4 sentences.**

**5. Answer the questions:**

1. What is one of the largest consumers of water?
2. Does a site use water from one source only?
3. What water sources can you name?
4. What does the choice of a source depend on?
5. What must be done with the abstracted water before drinking it?
6. What treatment processes do you know?
7. What is water disposal?
8. Where is industrial wastewater discharged to?
9. Is wastewater always treated on site?

**6. Work in pairs. Ask your groupmate questions in English about the following matters and let him / her answer them:**

- чи споживає промисловість велику кількість води;
- скільки є способів постачання води для промислових та комерційних підприємств; у чому вони полягають;
- яким чином здійснюється водовідведення на промислових підприємствах;
- чи завжди промислові стічні води очищаються.

#### **Text 7. DEVELOPMENT OF DRAINAGE AND WAYS OF ITS EFFECTIVE USE.**

1. Drainage is, besides flood control on watersheds, the oldest measure in land consolidation and water management, and of vital importance for the development of agricultural production and for the entire economy.
2. The development of farming raises urgent demands for hydro-technical melioration, varying from accumulating excess water in depressions to its evacuation into recipients by means of ditches (either by gravity or pumping), and the present control by pipe drainage, aided by modern cultivation measures.
3. Nowadays, a substantial part of the agricultural areas is provided with drainage. The majority of these areas are directly connected with the drainage systems. The rest, either due to their position or to the prevailing conditions, is provided with partial drainage or drains by gravity towards the recipients.

4. Drainage of heavy clay soils and areas where soil water regimes have been changed due to artificial influences, is of vital concern for water management specialists and land users. The considerable area of salty lands in many countries, mainly state-owned property, is also gaining importance as the need for their melioration and exploitation increases.

5. This need to drain agricultural land may arise from one of three phenomena: high groundwater level, impermeable layer in the soil profile and local springs. Very often the phenomenon of an impermeable layer prevails, impeding natural drainage, and provoking stagnation of water in the field during critical periods of the year (autumn and spring) when the soil must be prepared for sowing or when the main crops (wheat, corn) have to be sown.

6. In recent years studies were conducted on soils as to the optimum way of drainage: bedding, mole drainage, pipe drainage and combined drainage. The conclusions were that in the European climate each of the investigated methods achieved some improvements, while the best and most appropriate results were achieved by combined drainage. This method differs from the standard type of drainage so far that drain pipes are installed at a depth 0,8-1 m with gravel backfill which enables better evacuation of excess water from the surface into drain pipes and protects the drain pipe from clogging.

7. Mole drainage and subsoiling should not be implemented in a wet soil and should be executed in summer, following the harvest of the second crop. For drainage of these soils, it is of great importance to improve the soil stability. After the implementation of the drainage system the tillage and the selection of suitable crops have to be ascertained.

8. The construction of a pipe drainage system is primarily done by trenching machines, although trenchless draining machines are also used. Land consolidation is a part of the measures aiming at increasing crop production. Melioration work represents an immense social wealth that greatly obliges the agricultural organizations to regular maintenance of the constructed facilities. Evaluation and control of the drainage efficiency give an insight in the actual state of melioration

systems. To ensure successful drainage operation, prompt discharge of drain water is needed, which in turn necessitates appropriate execution of the drainage recipients.

9. Numerous drainage outflows are clogged or covered due to side-slope sliding or are blocked due to ochre clogging, resulting in non-functioning of the system. On heavy clay soil, only a drainage system is not a sufficient measure to improve air-water properties of that soil which needs additional treatment, namely: mechanical subsoiling or vibration subsoiling.

### Exercises

#### 1. Match the words from the left-hand column to the corresponding translation from the right-hand column:

землерийна машина	gravity ditch
оранка	pipe drainage
розпушення підґрунтя	prevailing conditions
підвищити врожайність	artificial influence
дренажна система	ground water level
швидке витікання	covered drainage network
переважаючі умови	subsoiling
рівень ґрунтової води	drainage system
трубчастий дренаж	clogging
самотічний водовід	mole drainage
закрита дренажна мережа	tillage
котовий дренаж	trenching machine
штучний вплив	to increase crop production
засмічення	prompt discharge

#### 2. Give Ukrainian equivalents of the following words and word-combinations:

development of agricultural production, vital importance, urgent demand, pumping ditch, water management specialist, considerable area of salty land, local springs, main crops sowing, optimum way of drainage, bedding, to achieve some



improvements, permeability of the drain trench, total efficiency, implementation of the drainage system, open ditch drains, costly maintenance, small plots, construction of a pipe drainage system, areas with non-functioning drainage, insufficient measure, mechanical subsoiling, to practise on a regular basis.

**3. Find in the text and write down English equivalents of the following expressions:**

безпосередньо сполучатись з системами дренажу, дренаж важких глинистих ґрунтів, землекористувач, державна власність, осушати сільськогосподарські землі, непроникний шар в профілі ґрунту, перешкоджати природному дренажу, викликати застій води, гравійна обсіпка, проводити дослідження, комбінований дренаж, відведення надлишкової води від поверхні в дренажні труби, стійкість ґрунту, підвищити ефективність дренажу, с/г техніка, регулярне обслуговування споруджених засобів, засмічувати канали, призводити до сповзання укосів каналу.

**4. Translate into Ukrainian the following words with common stem and word-combinations:**

– agriculture (n), agricultural, agrarian, agriculturist, agrobiological, agrobiology, agrology, agronomical, agronomist, agrostology, agronomy, agronomist, agronomics, agrotype;

– flow (n), flow (v), flowage, flowability, flow-chart, inflow, inflowing, outflow;

– meliorate (v), melioration, meliorative, meliorator, meliorism, meliority, amelioration, ameliorator, ameliorative, ameliorable;

– measure (n), measure (v), measurable, measurability, measurably, measured, measurement, measurer, measuring, measuring-tape;

– operate (v), operation, operator, remotely operated, operating load, operating-table, operative, operational task;

– special (n), special (adj), specialism, specialist, speciality, specially, specialization, specialize, speciation, especial, especially.

#### 5. Answer the questions:

1. What is of vital importance for the development of agricultural production and for the entire economy?
2. Why is the considerable area of salty land gaining also importance?
3. Which phenomena may the need to drain agricultural land arise from?
4. What kind of studies were conducted in recent years? What conclusions have they resulted in?
5. What are the peculiarities of the combined drainage? Why does it differ from the standard type of drainage?
6. What multiple function does the gravel backfill fulfill in the combined drainage?
7. Why shouldn't mole drainage and subsoiling be implemented in a wet soil?
8. Land consolidation is a part of measures aiming at increasing crop production, isn't it?
9. What should be done to ensure successful drainage operation?
10. Why isn't only a drainage system sufficient measure to improve air-water properties of the heavy clay soils?

#### 6. Ask your groupmates questions in English about:

- які заходи є життєво важливими для розвитку сільськогосподарського виробництва і для всієї економіки в цілому в наш час;
- яким видом дренажу було досягнуто найкращих результатів за останні роки в наших кліматичних умовах згідно з проведеними дослідженнями;
- на яку глибину встановлюються дренажні труби з гравійним обсіпанням при застосуванні комбінованого дренажу;
- за допомогою чого переважно здійснюється будівництво системи трубчастого дренажу;

- які негативні фактори часто призводять до збоїв у функціонуванні дренажної системи;
- у чому полягає застосування додаткових заходів на важких глинистих ґрунтах.

### Text 8. TYPES OF DAMS

1. Dams may be classified into a number of different categories depending upon the purpose of the classification. It is convenient to consider 3 broad classifications: according to materials comprising the structure, use and hydraulic design.
2. The most common way of classifying the dams is based upon choosing the materials comprising the structure. This classification also usually recognizes the basic type of design such as, for example, concrete gravity dam or concrete arch dam.
3. In discussing the diversity of dams, the specialists point out that earthfill dams are the most widespread among them, principally because their construction involves utilization of materials in the natural state requiring a minimum of processing. Moreover, the foundation requirements for earthfill dams are less stringent than for constructing other types.

4. The classification of earthfill dams includes several types-semi-hydraulic-fill, hydraulic-fill and rolled-fill types – the latter being most economical.
5. Earth fill dams require supplementary structures to serve as spillways. The principal disadvantage of an earthfill dam is that its damaging or even destroying may be possible under the erosive action of water flowing over it if sufficient spillway capacity is not provided. It is also subject to undergoing serious damage or even failure due to animals' burrowing unless being taken special precautions.
6. It is important to find a way of eliminating the possibility of ruining the dam. To be safe, an earth dam must satisfy four basic requirements: it must not be overtopped by flooding which most certainly cut right through it, seepage under the dam must not be allowed to undermine it, seepage through the embankment must not wash it away and the slopes of the embankment must be so constructed that they will not slip.
7. The rockfill dam has two basic structural components – an impervious membrane and an embankment which supports the membrane. The embankment usually consists of an upstream section of dry rubble masonry and a downstream section of loose rockfill.
8. The impervious membrane is most commonly constructed of concrete: a concrete slab, asphaltic concrete paving or steel plates; or it may be an interior thin core of impervious soil.
9. Like the earth embankments, the rockfill dam is subject to damaging or destructing by water overflowing and so must be provided with a spillway of adequate capacity to prevent overflowing of the dam. The only suitable foundation for rockfill dams are rock or compact sand and gravel.
10. Rockfill dams have enjoyed a fine safety record and up to 2008 none had failed as a result of any structural defects.
11. In addition to improving existing construction technologies, a research is being conducted in Ukraine and abroad for developing fundamentally different types of dams.

### Exercises

35

**1. Match the words from the left-hand column to the corresponding translation from the right-hand column:**

переливатися через край	slopes
фільтрація	dry rubble masonry
відкоси греблі	disadvantage
недолік	foundation requirements
пошкоджувати	to overflow
задовольняти вимоги	seepage
ємкість водозливної споруди	loose rock fill
вкатана земля	to undergo serious damage
скидати	to satisfy requirements
суха будова кладка	construction technologies
вільно насипана порода	to dump
облицювання	rolled earth
будівельні технології	to damage
вимоги до основи	spillway capacity
заснавати серйозних пошкоджень	paving

**2. Give Ukrainian equivalents of the following words and word-combinations:**

hydraulic design, rockfill dam, utilization of materials, natural state, minimum of processing, semi-hydraulic-fill dam, embankment, erosive action of water, to be subject to, burrowing of animals, special precautions, to eliminate the possibility, earth dam, to undermine the dam, structural components, to support the membrane, upstream section, concrete slab, steel plates, interior thin core.

**3. Find in the text and write down English equivalents of the following words:**

навивна гребля, додаткова споруда, низовий відкіс, показник надійності, забезпечити водозливні споруди достатньої ємкості, водостійкий ґрунт, гірська порода, перевага, найбільш поширений тип греблі, обов'язкова вимога, достатнє постачання якісного каменю, занадто коштовний, запобігати

переливанню води через край, бути надійним, земляна вкатана гребля, проводити дослідження, гравій, щільно укладений пісок.

#### 4. Translate into Ukrainian the following words with common stem and word-combinations:

– design (n), design (v), hydraulic design, basic type of design, designable, designed, designedly, designer, designful, designing;

– eliminate, elimination of the possibility of ruining the dam, eliminant, eliminable, eliminative, eliminator, eliminatory;

– found (n), found (v), suitable foundation, to be founded on alluvial foundations, founder, foundation-member, foundation-stone, foundational, foundering, founderous road, foundress, foundry;

– materialize, materials composing the structure, raw materials, materialism, materialist, materialistical, materiality, materially, materialization, materia medica;

– pave (n), pave (v), asphaltic concrete paving, paved, pavage, pavement, pavement-breaker, paver, paving-tile, paviour, paving-stone;

– stream (n), stream (v), upstream section, downstream base, overflowing stream, streaming, stream-ice, streamer, streamless, streamlet, stream-line, streamy, streamliner.

#### 5. Answer the questions:

1. What are the most common dam classifications?
2. In what way are the dams classified according to the materials comprising the structure?
3. Why are the earthfill dams considered to be most widespread?
4. What are the foundation requirements for earthfill dams?
5. What types does the classification of earthfill dams include?
6. Are earthfill dams subject to serious damage?
7. What requirements must an earth dam satisfy to be safe?
8. What are the basic structural components of the rockfill dam?

9. What is the impervious membrane most commonly constructed of?

10. What is the only suitable foundation for rockfill dams?

**6. Ask your groupmates questions in English about:**

- які найбільш поширені класифікації гребель;
- які причини зумовлюють аварії земляних гребель;
- як забезпечується надійність земляних гребель;
- в чому полягає основне призначення водозливів;
- яким є показник надійності кам'яно-накидних гребель.

### Text 9. CONCRETE ARCH DAMS

1. Arch dam is a dam curved in plan and dependent on arch action for its strength. Arch dams are thin structures and require less material than any other type. So cost often is the basic reason for the choice of slender arch dams. Despite the weakness of the cylinder theory in the second half of the 19th century, the thin arch dams were a success. They showed that arch dams of unprecedented slenderness were perfectly feasible.

2. In the 17th century Spanish civil engineers had reached the point where they adapted the form of their dams to the topography of the sites. Gravity dams were used at sites which were wide and shallow, arch dams were built in narrow emplacement where the foundations were good hard rock.

3. An arch dam carries most of the water load horizontally to the abutments by arch

action. The thrust thus developed makes it essential that the sidewalls of the canon be capable of resisting the arch forces.

4. In principle, an arch dam is visualized as consisting of a series of horizontal arches transmitting thrust to the abutments or a series of vertical cantilevers fixed at the foundations.

5. The horizontal component of the water load is resisted jointly by the arch and cantilever action. Near the bottom of the dam most of the load is carried by the cantilevers, while near the top the arches take more of the load.

6. It is necessary to mention that few arch dams have failed, in comparison with the more numerous failures of other types of dams.

7. The arched dam is defined as essentially gravity dam which in plan view is curved. The name arch-gravity dam is an alternative. So the term “arched dam” is taken to mean any dam which in plan view is curved, generally to a circular shape, but which at the same time resists the water pressure by its weight. In short, an arched dam is curved gravity dam.

8. Buttress dams comprise flat deck and multiple arch structures. They require about 60 per cent less concrete than gravity dams, but the increased formwork and reinforcement steel required usually offset the savings in concrete. This type of construction is not competitive with other types of dams when labour costs are high.

9. A buttress dam consists of sloping membrane which transmits the water load to series of buttresses at right angles to the axis of the dam.

10. There are several types of buttress dams. They fall into: round head buttress dams, diamond head buttress dams, multiple dome buttress dams.

### Exercises

#### 1. Memorize the following words:

concrete dam – бетонна гребля

gravity dam – гравітаційна гребля

arch dam – аркова гребля

arched (arch-gravity) dam – арково-гравітаційна гребля



buttress dam – контрфорсна гребля  
alluvial foundation – алювіальна основа  
cutoff – зуб, зачіпка в основі  
to resist – чинити опір  
to exert force upon – діяти силою на ...  
maintenance – експлуатація, догляд  
sound rock foundation – міцна скельна основа  
may be either straight or curved – може бути або прямолінійною або вигнутою  
hard rock – тверда порода  
abutments – устої греблі  
to transmit thrust – подавати напір  
cantilever – консоль  
slenderness – стрункість  
feasible – можливий; той, що можна здійснити  
narrow emplacement – вузьке місце  
the thrust thus developed – напір, який виникає таким чином  
to visualize – розглядати  
buttress – контрфорс, підпорка, устій  
flat slab – плоска плита  
diamond head buttress dam – контрфорсна гребля з багатограними оголовками  
formwork – опалубка  
reinforcement steel – арматурна сталь  
to offset the saving – компенсувати економію  
ratio – відношення  
wider spacing – більш широке розташування

## 2. Find in Text 9 English equivalents of the following:

глибока ущелина, арково-гравітаційна гребля, вигнутий у горизонтальній проекції, означати, дуговий, чинити опір тиску води, плоска плита, багатоаркова споруда, багатокупольна гребля, вартість праці, конкурувати, вісь, консоль,

устої греблі, контрфорсна гребля з круглими оголовками, підпорка, арматурна сталь, тверда порода, розглядати, аварія, компенсувати економію, напір води.

### 3. Add two or three sentences to the given statements using the material of text B

1. The arched dam is defined as essentially gravity dam which in plan view is curved.
2. Buttress dams comprise flat deck and multiple arch structures.
3. Arch dams are thin structures and require less material than any other type.
4. The horizontal component of the water load is resisted jointly by the arch and cantilever action.

### 4. Complete the sentences matching the words from the column to the sentence gaps:

1. Arch dams are built in ... ..	a) buttresses
2. The sidewalls of the canon are capable of ... the arch forces.	b) increased formwork
3. The water load is transmitted to series of ... at right angles to the axis of the dam.	c) gravity dams
4. In principle, ... .. aren't used at sites which are narrow and deep.	d) resisting
5. The arch and ... .. resist jointly the horizontal component of the water load.	e) narrow emplacement
6. Buttress dams require ... .. and reinforcement steel.	f) cantilever action

### 5. Translate into English:

1. Існують чотири основних типи бетонних гребель: гравітаційні, аркові, арково-гравітаційні та контрфорсні греблі.
2. Бетонна гравітаційна гребля – це споруда, спроектована таким чином, що її власна вага спроможна чинити опір силам, які діють на неї. Якщо міцну

бетонну греблю спорудити на адекватній основі, то така гребля буде довгочасною будівлею, яка не потребуватиме пильного догляду.

3. Отже, гравітаційні греблі будують на місцевості з досить міцною скельною основою, хоча невисокі греблі можна зводити на алювіальній основі при наявності надійних зачіпок.

4. На початку минулого століття будівельним матеріалом при спорудженні гравітаційних гребель слугував камінь, що вимагало величезних витрат фізичної праці. У сучасних умовах при зведенні гравітаційних гребель застосовують виключно бетон.

5. Залежно від проекту, гравітаційна гребля може бути або прямолінійною, або вигнутою. Греблі з вигнутою формою мають певні переваги як з погляду вартості, так і безпеки їх експлуатації.

#### Text 10. THE KAKHOVKA IRRIGATION SESTEM

The Kakhovka Irrigation System has been constructed in the steppes of Tavria, spread over the territory of Kherson and Zaporizhya regions, between the rivers of Dnipro and Molochna.

1. The canals of the System water the vast region of fertile steppe with the total area of 1,100 000 ha.

2. The lands are irrigated by the Dnipro-river waters. Water intake from the Kakhovka reservoir is accomplished by the largest in the world pumping station. Every second the Main Pumping Station pumps from the Dnipro-river 530 cu. m. of water at a height of 24 m., and then it delivers the volume into Main Canal which is central waterway of the System.

3. Water is distributed over the irrigated area by three main canals: the 130 km long Kakhovka Main Canal, the 114 km long Serogozsky Canal and 41 km long

Kalantchaksky Canal as well as by the interfarm distributing canal system with the total length of 998 km.

4. The construction of the System's first stage with the irrigated area of 260 thous. km<sup>2</sup> was over in 1981.

5. The crops irrigation is executed by the wide-coverage "Fregaf" sprinklers. The sprinklers are supplied with water by means of 200 pumping stations and high pressure stationary pipelines.

6. The water distribution and the crops irrigation is fully automated. The water discharge and the water level in the main canal and interfarm distributaries are adjusted by upstream-downstream cascade regulation. Soil-film screens, concrete-film screens and polyethylene films due to their waterproofing properties help to improve efficiency of the open irrigation canals.

7. In the first days of July 1973 the Dnipro waters were brought to the main pumping station and the first pump units delivered the water into the irrigating system.

8. The fertile steppe watered by the artificial rain gives high yields of cereals, forage and vegetables. The yield of winter wheat reaches 5 t/ha, maize for corn – 6 t/ha, fodder root crops – 52 t/ha, vegetables – 21.5 t/ha.

9. As a result of the first stage construction of the Kakhovka Irrigation System, the farms of the irrigated zone additionally receive on the average 333 thous. tons of cereals, 938 thous. tons of forage (in fodder units), 58.9 thous. tons of meat and 293 thous. tons of milk annually.

### Exercises

**1. Match the words from the left-hand column to the corresponding translation from the right-hand column:**

рівень води	interfarm distributary canal
зрошувальна система	wide-coverage
стаціонарний трубопровід	water level
родючий степ	irrigation system
широкозахватний	to supply water
обводнювати	water intake
подавати воду	water discharge

водозабір	to water
міжгосподарський розподільний канал	stationary pipeline
витрати води	fertile steppe

**2. Translate into Ukrainian the following words with common stem and word-combinations:**

– water (n), water (v), water intake, waterway, waterproofing properties, water discharge, water level;

– pump (n), pump (v), pump unit, pumping station, the Main Pumping Station;

– distribute, distribution, distributing canal, distributary;

– irrigate, irrigation, irrigator, irrigating canal, irrigated lands.

**3. Give Ukrainian equivalents of the following words and word-combinations:**

waterproofing properties, to improve efficiency, reservoir, to pump, to be over, high-pressure pipeline, to adjust, upstream, downstream, pump unit, high yields, forage, to justify, agricultural development of irrigated lands.

**4. Find in the text and write down English equivalents of the following words:**

завдяки чомусь, здійснювати, розподіляти воду, розподільний канал, ґрунтоплівковий екран, зернові культури, багаторічні трави, високі врожаї, щорічний приріст валової продукції, початкові капіталовкладення, сільськогосподарське освоєння земель, головна насосна станція.

**5. Answer the questions:**

1. Where has the Kakhovka Irrigation System been constructed?
2. The lands are irrigated by the Dnipro-river waters, aren't they?
3. What are the main components of the System?
4. What are the largest canals of Kakhovka Irrigation System?
5. Is crop irrigation executed by Fregat or Volzhanka sprinklers?
6. Is water distribution automated?
7. What helps to improve efficiency of the open irrigation canals?

**6. Work in pairs. Ask your groupmate questions in English about:**

- які області зрошує Каховська зрошувальна система;
- яку площу обводнюють канали Каховської системи;
- коли закінчилось будівництво першої черги системи;
- чи в системі передбачено міжб'єфне регулювання витрат та рівнів води;
- чи дають зрошувані землі високі врожаї.

**Самостійна робота №1****Masonry Dams**

In the arch dam, stability is obtained by a combination of arch and gravity action. If the upstream face is vertical the entire weight of the dam must be carried to the foundation by gravity, while the distribution of the normal hydrostatic pressure between vertical cantilever and arch action will depend upon the stiffness of the dam in a vertical and horizontal direction. When the upstream face is sloped the distribution is more complicated. The normal component of the weight of the arch ring may be taken by the arch action, while the normal hydrostatic pressure will be distributed as described above. For this type of dam, firm reliable supports at the abutments (either buttress or canyon side wall) are more important. The most desirable place for an arch dam is a narrow canyon with steep side walls composed of sound rock. The safety of an arch dam is dependent on the strength of the side wall abutments, hence not only should the arch be well seated on the side walls but also the character of the rock should be carefully inspected.

Two types of single-arch dams are in use, namely the constant-angle and the constant-radius dam. The constant-radius type employs the same face radius at all elevations of the dam, which means that as the channel grows narrower towards the

bottom of the dam the central angle subtended by the face of the dam becomes smaller. Jones Falls Dam, in Canada, is a constant radius dam. In a constant-angle dam, also known as a variable radius dam, this subtended angle is kept a constant and the variation in distance between the abutments at various levels are taken care of by varying the radii. Constant-radius dams are much less common than constant-angle dams. Parker Dam is a constant-angle arch dam.

A similar type is the double-curvature or thin-shell dam. Wildhorse Dam near Mountain City, Nevada in the United States is an example of the type. This method of construction minimizes the amount of concrete necessary for construction but transmits large loads to the foundation and abutments. The appearance is similar to a single-arch dam but with a distinct vertical curvature to it as well lending it the vague appearance of a concave lens as viewed from downstream.

The multiple-arch dam consists of a number of single-arch dams with concrete buttresses as the supporting abutments. The multiple-arch dam does not require as many buttresses as the hollow gravity type, but requires good rock foundation because the buttress loads are heavy.

### Vocabulary:

upstream face – напірна грань греблі

cantilever – консоль, кронштейн; укіс

arch action – розпір

arch ring – архивольт арки

abutment – контрфорс, опора

buttress wall – стіна з контрфорсами

constant-angle (arch) dam – арочна гребля змінного радіусу

curvature – вигин, скривлення

concave lens – увігнута лінза

downstream – низовий бік греблі

multiple-arch dam – багатоарочна гребля

hollow gravity dam – масивно-контрфорсна гребля

## EXERCISES

**1. Find the English equivalents of the words and word-combinations:**

Гідростатичний напір; сила архивольта арки; крута бокова стінка; протилежний кут; кількість бетону; перекласти вантаж на основу та контрфорси.

**2. True or false?**

1. The distribution of the normal hydrostatic pressure between vertical cantilever and arch action will depend upon the stiffness of the dam in a vertical and horizontal direction.
2. The most desirable place for an arch dam is a wide canyon with steep side walls composed of concrete.
3. The character of the rock should not be carefully inspected for an arch dam construction.
4. Constant-radius dams are much less common than constant-angle dams.

**3. Match the parts of the sentences:**

- |  |  |
|--|--|
| 1. If the upstream face is vertical the entire weight of the dam must be carried to ...                | 1. ... that as the abutments channel grows narrower toward the bottom of the dam the central angle subtended by the face of the dam becomes smaller. |
| 2. The safety of an arch dam is dependent on ...   | 2. ... transmits large loads to the foundation and abutments.  |
| 3. The constant-radius type employs the same face radius at all elevations of the dam, which means ... | 3. ... the strength of the side wall abutments.  |
| 4. This method of double-curvature dam construction minimizes the amount of                            | 4. ... a number of single-arch dams with concrete buttresses as the supporting abutments.  |

47



concrete necessary for  
construction but ...

5. The multiple-arch dam consists of ...
5. ... the foundation by gravity.

**4. Complete the sentences with suitable words and word-combinations:**

1. The normal component of the weight of the arch ring may be taken by ... ..
2. The most desirable place for an arch dam is ... .. with ... side walls composed of ... rock.
3. The constant-radius type employs the same face radius at all ... of the dam.
4. ... .. are much less common than constant-angle dams.
5. The multiple-arch dam requires ... .. because the buttress loads are heavy.

**5. Answer the following questions:**

1. How is stability obtained in the arch dam?
2. What must the entire weight of the dam be carried to if the upstream face is vertical?
3. What is important for a masonry dam?
4. What is the most desirable place for an arch dam?
5. What does the safety of an arch dam depend on?
6. What are the two types of single-arch dams? Describe them.
7. What are the peculiarities of a double-curvature dam construction?
8. How is a multiple-arch dam constructed?

**Самостійна робота №2****Gravity Dams**

In a gravity dam, stability is secured by making it of such a size and shape that it will resist overturning, sliding and crushing at the toe. The dam will not overturn provided that the moment around the turning point, caused by the water pressure is smaller than the moment caused by the weight of the dam. This is the case if the resultant force of water pressure and weight falls within the base of the dam. However, in order to prevent tensile stress at the upstream face and excessive compressive stress at the downstream face, the dam cross section is usually designed so that the resultant falls within the middle at all elevations of the cross section (the core). For this type of dam, impervious foundations with high *bearing* strength are essential.

When situated on a suitable site, a gravity dam inspires more confidence in the layman than any other type; it has mass that lends an atmosphere of permanence, stability, and safety. When built on a carefully studied foundation with stresses calculated from completely evaluated loads, the gravity dam probably represents the best developed example of the art of dam building. This is significant because the fear of flood is a strong motivator in many regions, and has resulted in gravity dams being built in some instances where an arch dam would have been more economical.

Gravity dams are classified as "solid" or "hollow." The solid form is the more widely used of the two, though the hollow dam is frequently more economical to construct. Gravity dams can also be classified as "overflow" (spillway) and "non-overflow." A gravity dam can be combined with an arch dam, an arch-gravity dam, for areas with massive amounts of water flow but less material available for a purely gravity dam.

### Vocabulary:

gravity dam – гравітаційна гребля

turning point – поворотний пункт; критична точка; рішучий момент

resultant force – рівнодіюча сила

tensile stress – напруга при розтягненні

upstream face – напірна грань греблі

downstream face – низова грань греблі

compressive stress – стискаюча напруга

cross section – поперечний переріз

bearing strength – несуча здатність

hollow gravity dam – масивно-контрфорсна гребля

solid gravity dam – глуха гравітаційна гребля

overflow dam – водоскидна гребля

### EXERCISES

#### 1. Find the English equivalents of the words and word-combinations:

Стійкість (сталість); перекидати; рівнодіюча сила; тиск води; основа греблі; масивно-контрфорсна гребля; безпека; водоскид; водоскидна гребля.

#### 2. Choose the words from the list to fill in gaps:

bearing, section, stress, resultant, turning

1. a \_\_\_\_\_ point

2. \_\_\_\_\_ force

3. tensile \_\_\_\_\_

4. cross \_\_\_\_\_  
5. \_\_\_\_\_ strength

**3. Match the parts of the sentences:**

- |   |  |
|---|--|
| 1. In a gravity dam, stability is secured by ...  | 1. ... the moment around the turning point, caused by the water pressure is smaller than the moment caused by the weight of the dam.   |
| 2. The dam will not overturn provided that ...  | 2. ... frequently more economical to construct.  |
| 3. In order to prevent tensile stress at the upstream face and excessive compressive stress at the downstream face, ... | 3. ... lends an atmosphere of permanence, stability, and safety.   |
| 4. A gravity dam has mass that ...  | 4. ... the dam cross section is usually designed so that the resultant falls within the middle at all elevations of the cross section. |
| 5. A hollow gravity dam is ...  | 5. ... making it of such a size and shape that it will resist overturning, sliding, and crushing at the toe.                           |

**4. Complete the sentences making the right choice:**

1. Stability is secured by making a gravity dam of such a size and shape that it will resist *overturning/building*.
2. Impervious foundations with high bearing strength are *unnecessary/essential*.

3. The fear of tensile *stress/flood* is a strong motivator in many regions.
4. A *solid gravity dam/a hollow gravity dam* is the more widely used of the two.
5. A *gravity dam* can be combined with an *arch dam* for areas with *frequent/massive* amounts of water.

**5. Answer the following questions:**

1. How is stability secured in a gravity dam?
2. In what case won't the dam overturn?
3. How is the dam cross section usually designed?

### Самостійна робота №3

#### Embankment Dams

Embankment dams are made from compacted earth, and have two main types, rock-fill and earth-fill dams. Embankment dams rely on their weight to hold back the force of water, like the gravity dams made from concrete.

##### Rock-fill dams

Rock-fill dams are embankments of compacted free-draining granular earth with an impervious zone. The earth utilized often contains a large percentage of large particles hence the term *rock-fill*. The impervious zone may be on the upstream face and made of masonry, concrete, plastic membrane, steel sheet piles, timber or other material. The impervious zone may also be within the embankment in which case it is referred to as a *core*. In the instances where clay is utilized as the impervious material the dam is referred to as a *composite* dam. Rock-fill dams are resistant to damage from earthquakes. However, inadequate quality control during construction can lead to poor compaction and sand in the embankment which can lead to liquefaction of the rock-fill during an earthquake. Liquefaction potential can be reduced by keeping susceptible material from being saturated, and by providing adequate compaction during construction.

##### Earth-fill dams

Earth-fill dams, also called earthen, rolled-earth or simply earth dams, are

constructed as a simple embankment of well compacted earth. A homogeneous rolled-earth dam is entirely constructed of one type of material but may contain a drain layer to collect seep water. A zoned-earth dam has distinct parts or zones of dissimilar material, typically a locally plentiful shell with a watertight clay core. Modern zoned-earth embankments employ filter and drain zones to collect and remove seep water and preserve the integrity of the downstream shell zone. An outdated method of zoned earth dam construction utilized a hydraulic fill to produce a watertight core. Rolled-earth dams may also employ a watertight facing or core in the manner of a rock-fill dam. An interesting type of temporary earth dam occasionally used in high latitudes is the frozen-core dam, in which a coolant is circulated through pipes inside the dam to maintain a watertight region of permafrost within it.

#### Asphalt-Concrete Core

A third type of embankment dam is built with asphalt concrete core. The majority of such dams are built with rock and/or gravel as the main fill material. The type of asphalt used is a viscoelastic-plastic material that can adjust to the movements and deformations imposed on the embankment as a whole, and to settlements in the foundation. The flexible properties of the asphalt make such dams especially suited in earthquake regions.

#### Vocabulary:

embankment dam – земляна гребля; кам'яно-накидна гребля

rock-fill dam – кам'яна гребля

earth-fill dam – земляна гребля

sheet pile – шпунтова стінка

composite dam – неоднорідна (земляна) гребля

liquefaction – зрідження

rolled earth – ґрунт, затвердіння укоченням

drain layer – плоский фільтр

zoned-earth dam – неоднорідна земляна гребля

shell – каркас, обшивка

hydraulic fill – наливна насипка

coolant – мастильно-охолоджувальна емульсія

concrete core – залізобетонний каркас

viscoelastic – в'язкопружний, в'язкоеластичний

## EXERCISES

### 1. Find the English equivalents of the words and word-combinations:

Затверділий ґрунт; той, що не пропускає вологу; кам'яна кладка; використовувати; вода, що просмоктується; водонепроникне глиняне ядро; тимчасова земляна дамба; наповнювач (наповнююча речовина).

### 2. Choose the words from the list to fill in gaps:

*zone, flexible, compacted, control, watertight*

1. \_\_\_\_\_ earth

2. impervious \_\_\_\_\_

3. quality \_\_\_\_\_

4. \_\_\_\_\_ core

5. \_\_\_\_\_ properties

### 3. True or false?

1. The impervious zone may be made of masonry, concrete, plastic membrane, steel sheet piles, timber or other material.

2. Rock-fill dams are resistant to damage from sliding.

3. A zoned-earth dam has distinct parts or zones of dissimilar material.

4. An outdated method of zoned earth dam construction utilized a hydraulic fill to hold back a watertight core.

5. The type of asphalt used is a timber material.

### 4. Complete the sentences making the right choice:

1. Embankment dams rely on their ... to hold back the force of water.

2. The earth utilized often contains a large percentage of large particles hence the

term... ..

3. Liquefaction potential can be reduced by keeping ... .. from being saturated, and by providing ... .. during construction.
4. A homogeneous rolled-earth dam is entirely constructed of one type of material but may contain ... .. to collect seep water.
5. A third type of embankment dam is built with ... .. .

**5. Answer the following questions:**

1. What are embankment dams made from?
2. What are the two types of them?
3. How is a rock-fill dam characterized?
4. What is a composite dam?
5. What can inadequate quality control during construction lead to?
6. How are earth-fill dams constructed?
7. Describe a zoned-earth dam.
8. What is a frozen-core dam?
9. What are embankment dams with asphalt concrete core built with?
10. How can the type of asphalt be characterised?



#### Самостійна робота №4

### Timber and Steel Dams

Timber dams were widely used in the early part of the industrial revolution and in frontier areas due to ease and speed of construction. Rarely built in modern times by humans due to relatively short lifespan and limited height to which they can be built, timber dams must be kept constantly wet in order to maintain their water retention properties and limit deterioration by rot, similar to a barrel. The locations where timber dams are most economical to build are those where timber is plentiful, cement is costly or difficult to transport, and either a low head diversion dam is required or longevity is not an issue. Two common variations of timber dams were the *crib* and the *plank*.

*Timber crib dams* were erected of heavy timbers or dressed logs in the manner of a log house and the interior filled with earth or rubble. The heavy crib structure supported the dam's face and the weight of the water.

*Timber plank dams* were more elegant structures that employed a variety of construction methods utilizing heavy timbers to support a water retaining arrangement of planks.

A steel dam is a type of dam briefly experimented with in around the turn of the 19th-20th century which uses steel plating (at an angle) and load bearing beams as the structure. Intended as permanent structures, steel dams were an (arguably failed) experiment to determine if a construction technique could be devised that was

cheaper than masonry, concrete or earthworks, but sturdier than timber crib dams.

**Vocabulary:**

water retention – вологозатримання

low head – малий натиск води

crib – несуча конструкція

crib dam – ряжева гребля

plank dam – шандорне загородження

diversion dam – водозабірна (водопідйомна) гребля

dam face – грань греблі; укіс земляної греблі

water retaining – водопідпирний

frangement – механізм, прилад

steel plating – облицювання сталевими листами

load beam – опорна балка

earthwork – земляне укріплення

**EXERCISES****1. Find the English equivalents of the words and word-combinations:**

Обмежена висота; властивості вологозатримання; оброблені колоди (деревини); бутовий камінь; водопідпирний прилад; дошка; балка; земляне укріплення.

**2. Choose the words from the list to fill in gaps:**

*structures, load, low head, face, plating, crib, timbers, construction*

1. \_\_\_\_\_ diversion dam

2. heavy \_\_\_\_\_

3. dam's \_\_\_\_\_

4. \_\_\_\_\_ methods

5. permanent \_\_\_\_\_

6. \_\_\_\_\_ beam

7. \_\_\_\_\_ dam

8. steel \_\_\_\_\_

**3. Match the parts of the sentences:**

- |  |   |
|--|---|
| 1. Timber dams were widely used in ...   | 1. ... heavy timbers or dressed logs in the manner of a log house and the interior filled with earth or rubble. |
| 2. Rarely built in modern times by humans due to ...                               | 2. ... if a construction technique could be devised.  |
| 3. The location where timber dams are most economical to built are those where ... | 3. ... the early part of the industrial revolution.   |
| 4. Timber crib dams were erected of ...  | 4. ... timber is plentiful, cement is costly or difficult to support.   |
| 5. Steel dams were an experiment to determine ...                                  | 5. ... relatively short lifespan and limited height to which they can be built.                                 |

**4. Complete the sentences making the right choice:**

1. Timber dams were widely used in frontier areas due to ... and ... of construction.
2. Timber dams must be kept constantly ... in order to maintain ... properties.
3. Timber crib dams were erected of ... or ... .
4. The heavy crib structure supported ... and ... of ... .
5. A steel dam uses ... and ... as the structure.

**5. Answer the following questions:**

1. When and where were timber dams widely used?
2. Why are timber dams rarely built in modern times?
3. In what condition must they be kept?
4. What were two common variations of timber dams? Describe them.

5. What is used in steel dams constructions

### Самостійна робота №5 Environmental Impact

Dams affect many ecological aspects of a river. Rivers depend on the constant disturbance of a certain tolerance. Dams slow the river and this disturbance may damage or destroy this pattern of ecology. Temperature is also another problem that dams create. Rivers tend to have fairly homogeneous temperatures. Reservoirs have layered temperatures, warm on the top and cold on the bottom; in addition often it is water from the colder (lower) layer which is released downstream, and this may have a different dissolved oxygen content than before. Organisms depending upon a regular cycle of temperatures may be unable to adapt; the balance of other fauna (especially plant life and microscopic fauna) may be affected by the change of oxygen content.

Water exiting a turbine usually contains very little suspended sediment, which can lead to scouring of river beds and loss of riverbanks.

Older dams often lack a fish ladder, which keeps many fish from moving upstream to their natural breeding grounds, causing failure of breeding cycles or blocking of migration paths. Even the presence of a fish ladder does not always prevent a reduction in fish reaching the spawning grounds upstream. In some areas, young fish ("smolt") are transported downstream by barge during parts of the year. Turbine and power-plant designs that have a lower impact upon aquatic life are an active area of research.

A large dam can cause the loss of entire ecosystem, including endangered and undiscovered species in the area, and the replacement of the original environment by a new inland lake.

**Vocabulary:**

dissolved oxygen – розчинений кисень  
water turbine – гідротурбіна  
suspended sediments – зважені (важені) насоси  
fish ladder – рибопідйомник (греблі ГЕС)  
breeding ground – місце розмноження  
spawning – нерест  
power-plant – силова установка

**EXERCISES****1. Find the English equivalents of the words and word-combinations:**

Вплив; постійна температура; розшаровувати; вміст кисню; захисна пробка;  
русло річки; нерест; наражати на небезпеку.

**2. Choose the words from the list to fill in gaps:**

*life, tolerance, suspended, cycles, ecological, dissolved, species, power-plant, homogeneous, fish*

1. \_\_\_\_\_ aspects
2. certain \_\_\_\_\_
3. \_\_\_\_\_ temperatures
4. \_\_\_\_\_ oxygen content
5. plant \_\_\_\_\_
6. \_\_\_\_\_ sediment
7. \_\_\_\_\_ ladder
8. breeding \_\_\_\_\_
9. \_\_\_\_\_ designs
10. endangered and undiscovered \_\_\_\_\_

60

**3. Match the parts of the sentences:**

- |  |   |
|--|---|
| 1. Temperature is a problem ...  | 1. ... warm on the top and cold on the bottom.  |
| 2. Reservoirs have layered temperatures, ...                           | 2. ... the original environment by a new inland lake.   |
| 3. The balance of plant life and microscopic fauna may be affected ... | 3. ... their natural breeding grounds, causing failure of breeding cycles or blocking of migration paths. |
| 4. In some areas, young fish are transported downstream to ...         | 4. ... that dams create.  |
| 5. A large dam can cause the replacement of ...                        | 5. ... by change of oxygen content.   |

**4. Complete the sentences making the right choice:**

1. Rivers depend on the constant disturbance of ... .
2. Dams slow the river and this disturbance may ... or ... this pattern of ecology.
3. Organisms depending upon a regular cycle of temperatures may be unable ... .
4. Water exiting a turbine usually contains very little ... .
5. Even the presence of ... does not always prevent ... in fish reaching the spawning grounds upstream.

**5. Answer the following questions:**

1. What do dams affect?
2. How do dams influence ecological aspects of a river?
3. What does the absence of a fish ladder cause?
4. What is an active area of research?
5. What damage can a large dam cause?

## Самостійна робота №6

### Artificial Drainage

#### Reasons for artificial drainage

Wetland soils may need drainage to be used for agriculture. In the northern USA and Europe, glaciation created numerous small lakes which gradually filled with humus to make marshes. Some of these were drained using open ditches and trenches to make mucklands, which are primarily used for high value crops such as vegetables.

The largest project of this type in the world has been in process for centuries in the Netherlands. Turf cutting (peat mining), subsidence and shoreline erosion gradually caused the formation of one large lake, the Haarlemmermeer, or lake of Haarlem. The invention of wind powered pumping engines in the 15<sup>th</sup> century permitted drainage of some of the marginal land, but the final drainage of the lake had to await the design of large, steam powered pumps and agreements between regional authorities. The elimination of the lake occurred between 1849 and 1852, creating thousands of km<sup>2</sup> of new land.

Coastal plains and river deltas may have seasonally or permanently high water tables and must have drainage improvements if they are to be used for agriculture. An example is the flatwoods citrus-growing region of Florida. After periods of high rainfall, drainage pumps are employed to prevent damage to the citrus groves from overly wet soils. Rice production requires complete control of water, as fields need to be flooded or drained at different stages of the crop cycle. In moist climates, soils

may be adequate for cropping with the exception that they become waterlogged for brief periods each year, from snow melt or from heavy rains. Soils that are predominantly clay will pass water very slowly downward, meanwhile plant roots suffocate because the excessive water around the roots eliminates air movement through the soil. Other soils may have an impervious layer of mineralized soil, called a hardpan or relatively impervious rock layers may underlie shallow soils. In each of these cases appropriate drainage is used to carry off temporary flushes of water to prevent damage to annual or perennial crops.

In farming drier areas, irrigation is often used, and one would not consider drainage necessary. However, irrigation water always contains minerals and salts, and these can be concentrated to toxic levels by evapotranspiration. Irrigated land may need periodic flushes with excessive irrigation water and drainage to remove these toxic minerals.

### **Vocabulary:**

artificial – штучний

subsurface water – підземні води

humus – перегній, чорнозем

turf cutting (peat) mining – добування торфу

subsidence – осідання ґрунту

steam pump – парова помпа

steam power – парова тяга

water table – горизонт ґрунтової води

drainage pump – дренажна помпа

impervious layer – водонепроникливий шар

hardpan – рудяк

evapotranspiration – сумарне випаровування

## **EXERCISES**

### **1. Find the English equivalents of the words and word-combinations:**

Водопостачання; заболочений; осушувати; руйнування берегової лінії;



зникнення озера; повний контроль води; рух повітря; повінь; токсичні мінерали.

**2. Choose the words from the list to fill in gaps:**

*marginal, water, table, toxic, layer, mining, drainage, periodic*

1. \_\_\_\_\_ supplies
2. artificial \_\_\_\_\_
3. peat \_\_\_\_\_
4. \_\_\_\_\_ land
5. water \_\_\_\_\_
6. impervious \_\_\_\_\_
7. \_\_\_\_\_ flushes
8. \_\_\_\_\_ minerals

**3. True or false?**

1. Many agricultural soils need drainage to eliminate air movement.
2. Turf cutting, subsidence and shoreline erosion gradually caused the formation of one large lake, lake of Haarlem.
3. In moist climates, soils may be adequate for cropping with the exception that they become waterlogged for brief periods each year, from snow melt or from heavy rains.
4. Appropriate drainage is not used to carry off temporary flushes of water to prevent damage to annual or perennial crops.
5. Irrigated land may need periodic flushes with excessive irrigation water and drainage to remove toxic minerals.

**4. Match the parts of the sentences:**

- |                               |                                      |
|-------------------------------|--------------------------------------|
| 1. Wetland soils may need ... | 1. ... complete control of water, as |
|                               | fields need to be flooded or         |
|                               | drained at different stages of the   |
|                               | crop cycle.                          |
| 2. The invention of wind      | 2. ... can be concentrated to toxic  |

64

- powered pumping engines  
in the 15<sup>th</sup> century ...
3. Coastal plains and river deltas  
may have seasonally or  
permanently high water tables  
and must have ...
4. Rice production requires ...
5. Irrigation water always contains  
minerals and salt, and these ...
- levels by evapotranspiration.
3. ... drainage to be used for  
agriculture.
4. ... permitted drainage of some  
of the marginal land.
5. ... drainage improvements if  
they are to be used for  
agriculture.

**5. Answer the following questions:**

1. What is drainage?
2. Why do many agricultural soils need drainage?
3. What project has been in process for centuries in the Netherlands?
4. When and where are drainage improvements used?
5. What may irrigated land need?

## Самостійна робота №7

### Irrigation

**Irrigation** is the artificial application of water to the soil usually for assisting in growing crops. In crop production it is mainly used in dry areas and in periods of rainfall shortfalls, but also to protect plants against frost. Additionally irrigation helps to suppress weed growing in rice fields. In contrast, agriculture that relies only on direct rainfall is sometimes referred to as dry-land farming or as rain fed farming. It is often studied together with drainage, which is the natural or artificial removal of surface and sub-surface water from a given area.

### Types of irrigation

Various types of irrigation techniques differ in how the water obtained from the source is distributed within the field. In general, the goal is to supply the entire field uniformly with water, so that each plant has the amount of water it needs, neither too much nor too little.

#### Surface irrigation

In surface irrigation systems water moves over and across the land by simple gravity flow in order to wet it and to infiltrate into the soil. Surface irrigation can be subdivided into furrow, borderstrip or basin irrigation. It is often called **flood irrigation** when the irrigation results in flooding or near flooding of the cultivated land. Historically, this has been the most common method of irrigating agricultural land.

#### Localized irrigation

Localized irrigation is a system where water is distributed under low pressure through a piped network, in a pre-determined pattern, and applied as a small discharge to each

plant or adjacent to it. Drip irrigation, spray or micro-sprinkler irrigation and bubbler irrigation belong to this category of irrigation methods.

### **Drip Irrigation**

Drip irrigation, also known as trickle irrigation, functions as its name suggests. Water is delivered at or near the root zone of plants, drop by drop. This method can be the most water-efficient method of irrigation, if managed properly, since evaporation and runoff are minimized.<sup>1</sup> In modern agriculture, drip irrigation is often combined with plastic mulch, further reducing evaporation, and is also the means of delivery of fertilizer. The process is known as fertigation.

### **Vocabulary:**

surface irrigation – поверхнєве зрошування

furrow irrigation – поливання по борознах

basin irrigation – лиманне зрошування

flood irrigation – лиманне зрошування

ripped network – система трубопроводів

discharge – виливати, зливати, випускати

drip irrigation – крапельне зрошування

bubbler irrigation – фонтанне зрошування

trickle irrigation – крапельне зрошування

evaporation – випаровування

runoff – стікання

## **EXERCISES**

### **1. Answer the following questions:**

1. What is irrigation?
2. What are the main types of irrigation?
3. Has flood irrigation been the most common method of irrigating agricultural land?
4. How does localized irrigation work?
5. Why is drip irrigation the most water-efficient method of irrigation?

**2. Match the words:**

- |                |                |
|----------------|----------------|
| 1. artificial  | 1. flow        |
| 2. gravity     | 2. zone        |
| 3. root        | 3. water       |
| 4. dry-land    | 4. application |
| 5. sub-surface | 5. farming     |

**3. Find the equivalents of the following words and word combinations:**

Нестача опадів, захищати рослини, стримувати ріст бур'янів, прийоми зрошування, розподіляти, постачати воду, зволожувати ґрунт, низький тиск, зменшувати випаровування, стікання, подача добрива.

**4. Odd one out:**

1. crops, weed, rice, trickle, plant
2. drip, removal, spray, micro-sprinkler, bubbler
3. apply, deliver, distribute, drainage, supply
4. evaporation, furrow, borderstrip, basin
5. land, network, soil, field

**5. Complete the sentences with a suitable word or word combination:**

1. .... is used to protect plants against frost.
2. .... is the natural or artificial removal of surface and sub-surface water from a given area.
3. .... has been the most common method of irrigating agricultural land.
4. Drip irrigation, spray or micro-sprinkler irrigation and bubbler irrigation belong to the category of .... irrigation.
5. In .... irrigation water is delivered at or near the root zone of plants, drop by drop.

**Самостійна робота №8****Drip Irrigation Layout and its parts**

Deep percolation, where water moves below the root zone, can occur if a drip system is operated for too long of a duration or if the delivery rate is too high. Drip irrigation methods range from very high-tech and computerized to low-tech and relatively labor-intensive. Lower water pressures are usually needed than for most other types of systems, with the exception of low energy center pivot systems and surface irrigation systems, and the system can be designed for uniformity throughout a field or for precise water delivery to individual plants in a landscape containing a mix of plant species. Although it is difficult to regulate pressure on steep slopes, pressure compensating emitters are available, so the field does not have to be level. High-tech solutions involve precisely calibrated emitters located along lines of tubing that extend from a computerized set of valves. Both pressure regulation and filtration to remove particles are important. The tubes are usually black (or buried under soil or mulch) to prevent the growth of algae and to protect the polyethylene from degradation due to ultraviolet light. But drip irrigation can also be as low-tech as a porous clay vessel sunk into the soil and occasionally filled from a hose or bucket. Subsurface drip irrigation has been used successfully on lawns, but it is more expensive than a more traditional sprinkler system. Surface drip systems are not cost-effective (or aesthetically pleasing) for lawns and golf courses. In the past one of the main disadvantages of the subsurface drip irrigation (SDI) systems, when used for turf, was the fact of having to install the plastic lines very close to each other in the ground, therefore disrupting the turfgrass area.

### Sprinkler Irrigation

In sprinkler or overhead irrigation, water is piped to one or more central locations within the field and distributed by overhead high-pressure sprinklers or guns. A system utilizing sprinklers, sprays, or guns mounted overhead on permanently installed risers is often referred to as a *solid-set* irrigation system. Higher pressure sprinklers that rotate are called *rotors* and are driven by a ball drive, gear drive, or impact mechanism. Rotors can be designed to rotate in a full or partial circle.

Sprinklers may also be mounted on moving platforms connected to the water source by a hose. Automatically moving wheeled systems known as *traveling sprinklers* may irrigate areas such as small farms, sports fields, parks, pastures, and cemeteries unattended. Most of these utilize a length of polyethylene tubing wound on a steel drum. As the tubing is wound on the drum powered by the irrigation water or a small gas engine, the sprinkler is pulled across the field. When the sprinkler arrives back at the reel the system shuts off. This type of system is known to most people as a "waterreel" traveling irrigation sprinkler and they are used extensively for dust suppression, irrigation, and land application of waste water. Other travelers use a flat rubber hose that is dragged along behind while the sprinkler platform is pulled by a cable. These cable-type travelers are definitely old technology and their use is limited in today's modern irrigation projects.

#### Vocabulary:

**percolation** – просочування, проникнення  
**pivot** – вісь, стрижень  
**surface irrigation** – поверхнєве зрошування  
**emitter** – «випускач», емітер  
**tubing** – трубопровід  
**valve** – клапан, вентиль  
**hose** – шланг  
**sprinkler system** – дощувальна система  
**overhead irrigation** – дощування  
**ball drive** – кульковий привод  
**gear drive** – зубчастий привод  
**drum** – барабан



## EXERCISES

1. Answer the following questions :

1. When can deep percolation occur?
2. Are drip irrigation methods high-tech or low-tech?
3. What was the main disadvantage of the subsurface drip irrigation in the past?
4. How does sprinkler irrigation work?
5. What is a “waterreel” traveling irrigation sprinkler?

2. Match the words:

- |             |               |
|-------------|---------------|
| 1. delivery | 1. water      |
| 2. plant    | 2. irrigation |
| 3. steep    | 3. species    |
| 4. overhead | 4. rate       |
| 5. waste    | 5. slopes     |

3. Find the English equivalents of the following words and word-combinations:

Коренева зона, нижчий тиск води, точна доставка води, традиційна дощувальна система, головний недолік, пускати по трубах, установлювати (монтувати), пасовиська, гумовий шланг, сучасні проекти зрошення.

4. Odd one out:

1. surface irrigation, irrigation water, subsurface irrigation, sprinkler irrigation
2. tubing, emitters, valves, soil
3. lawns, sprays, parks, pastures, fields
4. clay vessel, steel drum, tubing, gas engine
5. cost-effective, labour-intensive, ultraviolet, expensive

5. Complete the sentences with a suitable word or word-combination:

1. It is difficult to regulate ..... on steep slopes.

2. .... are located along lines of tubing that extend from a computerized set of valves.
3. .... are usually black to prevent the growth of algae.
4. .... are driven by a ball drive, gear drive or impact mechanism.
5. The tubing is wound on the .... powered by the irrigation water or a small gas engine.

### Самостійна робота №9

## Center Pivot Irrigation

Center pivot is a form of sprinkler irrigation consisting of several segments of pipe (usually galvanized steel or aluminum) joined together and supported by trusses, mounted on wheeled towers with sprinklers positioned along its length. The system moves in a circular pattern and is fed with water from the pivot point at the center of the arc. These systems are common in parts of the United States where terrain is flat.

Most center pivot systems now have drops hanging from a u-shaped pipe called a *gooseneck* attached at the top of the pipe with sprinkler heads that are positioned a few feet (at most) above the crop, thus limiting evaporative losses. Drops can also be used with drag hoses or bubblers that deposit the water directly on the ground between crops. The crops are planted in a circle to conform to the center pivot. This type of system is known as LEPA (Low Energy Precision Application). Originally, most center pivots were water powered. These were replaced by hydraulic systems (T-L irrigation) and electric motor driven systems (*Lindsay, Reinke, Valley, Zimmatic, Pierce*). Most systems today are driven by an electric motor mounted low on each span. This drives a reduction gearbox and transverse driveshafts transmit power to another reduction gearbox mounted behind each wheel. Precision controls, some with GPS location and remote computer monitoring, are now available.

### Lateral Move (Side Roll, Wheel Line) Irrigation

A series of pipes, each with a wheel of about 1.5 m diameter permanently affixed to its midpoint and sprinklers along its length, are coupled together at one edge of a field. Water is supplied at one end using a large hose. After sufficient water has been applied, the hose is removed and the remaining assembly rotated either by hand or with a purpose-built mechanism, so that the sprinklers move 10 m across the field. The hose is reconnected. The process is repeated until the opposite edge of the field is reached. This system is less expensive to install than a center pivot, but much more labor intensive to operate, and it is limited in the amount of water it can carry. Most systems utilize 4 or 5-inch (130 mm) diameter aluminum pipe. One feature of a lateral move system is that it consists of sections that can be easily disconnected.

They are most often used for small or oddly-shaped fields, such as those found in hilly or mountainous regions, or in regions where labor is inexpensive.

### Vocabulary:

centre pivot irrigation – центрально-стрижневе зрошування

wheeled towers – колісні опори

sprinkler – розбризкувач

terrain – територія, ґрунт

bubblers – фонтани

reduction gearbox – редукційна коробка передач

transverse drive-shafts – поперечний ведучий вал

lateral move – бічний рух

pipe – труба, трубопровід

hose – шланг

### EXERCISES

#### 1. Answer the following questions:

1. What does centre pivot consists of?
2. Where are centre pivot systems used?
3. How are the crops planted in the areas where the centre pivot is used?
4. What are the parts of lateral move systems?
5. What are the advantages of a lateral move system?

#### 2. Match the words:

- |                |               |
|----------------|---------------|
| 1. circular    | 1. monitoring |
| 2. evaporative | 2. regions    |
| 3. computer    | 3. pattern    |
| 4. mountainous | 4. gearbox    |
| 5. reduction   | 5. loss       |

**3. Find the equivalents of the following words and word-combinations:**

Труба (трубопровід), розбризкувач, краплі, прикріплений, керувати, передавати потужність, колесо, постачати, достатня кількість води, установлювати, роз'єднувати, робоча сила.

**4. Odd one out:**

1. trusses, pipes, labour, wheeled towers
2. losses, sprinkler heads, drag hoses, bubblers
3. reduction gear box, transverse drive shafts, mountainous regions
4. sprinkler, drop, hose, pipe
5. affix, apply, connect, available

**5. Complete the sentences with a suitable word or word-combination:**

1. .... consists of several segments of pipe joined together.
2. A centre pivot system moves in a circular .....
3. .... or .....deposit the water directly on the ground between crops.
4. Most systems today are driven by an ..... mounted low on each span.
5. .... system is less expensive to install than a centre pivot

**Самостійна робота №10****Sub-irrigation**

Sub-irrigation also sometimes called *seepage irrigation* has been used for many years in field crops in areas with high water tables. It is a method of artificially raising the water table to allow the soil to be moistened from below the plants' root zone. Often those systems are located on permanent grasslands in lowlands or river valleys and combined with drainage infrastructure. A system of pumping stations, canals, weirs and gates allows it to increase or decrease the water level in a network of ditches and the control the water table thereby.

Sub-irrigation is also used in commercial greenhouses production, usually for potted plants. Water is delivered from below, absorbed upwards, and the excess collected for recycling. Typically, a solution of water and nutrients floods a container or flows through a trough for a short period of time, 10-20 minutes, and is then pumped back into a holding tank for reuse. Sub-irrigation in greenhouses requires fairly sophisticated, expensive equipment and management. Advantages are water and nutrient conservation, and labor-saving through lowered system maintenance and automation. It is similar in principle and action to subsurface drip irrigation.

**Manual Irrigation Using Buckets or Watering Cans**

These systems have low requirements for infrastructure and technical equipment but need high labor inputs. Irrigation using watering cans is to be found for example in peri-urban agriculture around large cities in some African countries.

**Automatic, Non-electric Irrigation Using Buckets and Ropes**

Besides the common manual watering by bucket, an automated, natural version of this also exist. Using plain polyester ropes combined with a prepared ground mixture can be used to water plants from a vessel filled with water. The ground mixture would need to be made depending on the plant itself, yet would mostly consist of black potting soil, vermiculite and perlite. This system would (with certain crops) allow you to save expenses as it does not consume any electricity and only little water (unlike sprinklers, water timers). However, it may only be used with

certain crops (probably mostly larger crops that do not need a humid environment; perhaps e.g. paprika's).

### **Irrigation Using Stones to Catch Water from Humid Air**

In countries where at night, humid air sweeps the countryside, stones are used to catch water from the humid air by transpiration. This is for example practiced in the vineyards at Lanzarote.

#### **Vocabulary:**

**sub-irrigation** – підґрунтове зрошення

**seepage** – просочування, витік

**water table** – рівень ґрунтових вод

**moisten** – зволожувати, змочувати

**pumping station** – насосна станція

**weir** – гребля, загата, водорозлив

**gates** – шлюзні ворота

**network of ditches** – мережа каналів

**manual irrigation** – ручне зрошування

**vermiculite** – вермикуліт

**perlite** – перліт

**transpiration** – просочування, транспірація

#### **EXERCISES**

*1. Answer the following questions:*

1. Where has sub-irrigation been used?
2. What are the advantages of sub-irrigation?
3. Why is manual irrigation ineffective?
4. How is automatic irrigation used?
5. Where are stones used in irrigation?

**2. Match the words:**

- |              |                 |
|--------------|-----------------|
| 1. seepage   | 1. table        |
| 2. water     | 2. ropes        |
| 3. nutrient  | 3. environment  |
| 4. humid     | 4. irrigation   |
| 5. polyester | 5. conservation |

**3. Find the equivalents of the following words and word-combinations:**

Польові культури, штучне підняття рівня ґрунтових вод, зволожувати, долина річки, осушування, поглинати, викачувати (насосом), заощаджуючий працю (раціоналізаторський), земляна суміш, дощувальна установка, вологе повітря.

**4. Odd one out:**

1. pumps, plants, canals, weirs, gates
2. crop, tank, can, vessel, bucket
3. ground, soil, land, rope
4. save, consume, deliver, humid
5. plants, ditches, crops, green houses

**5. Complete the sentences with a suitable word or word-combination:**

1. .... is a method of artificially raising the water table to allow the soil to be moistened from below the plants root zone.
2. Sub-irrigation is used in commercial greenhouse production for growing .....
3. .... has low requirements for infrastructure and technical equipment but needs high labour inputs.
4. .... allows you to save expenses as it does not consume any electricity and only little water.
5. In some countries stones are used to catch water from the humid air by .....



### Самостійна робота №11

#### Dry Terrasses for Irrigation and Water Distribution

In subtropical countries as Mali and Senegal, a special type of terrassing (without flood irrigation or intent to flatten farming ground) is used. Here, a 'stairs' is made through the use of ground level differences which helps to decrease water evaporation and also distributes the water to all patches (sort of irrigation).

#### Sources of Irrigation Water

Sources of irrigation water can be groundwater extracted from springs or by using wells, surface water withdrawn from rivers, lakes or reservoirs or non-conventional sources like treated wastewater, desalinated water or drainage water. A special form of irrigation using surface water is spate irrigation, also called flood water harvesting. In case of a flood (spate) water is diverted to normally dry river beds (wadi's) using a network of dams, gates and channels and spread over large areas. The moisture stored in the soil will be used thereafter to grow crops. Spate irrigation areas are in particular located in semi-arid or arid, mountainous regions. While floodwater harvesting belongs to the accepted irrigation methods, rainwater harvesting is usually not considered as a form of irrigation. Rainwater harvesting is the collection of runoff water from roofs or unused land and the concentration of this water on cultivated land. Therefore this method is considered as a water concentration method.

#### How an In-ground Irrigation System Works

Most commercial and residential irrigation systems are "in ground" systems, which means that everything is buried in the ground. With the pipes, sprinkles, and irrigation valves being hidden, it makes for a cleaner, more presentable landscape without garden hoses or other items having to be moved around manually.

#### Water Source and Piping

The beginning of a sprinkler system is the water source. This is usually a tap into an existing (city) water line or a pump that pulls water out of a well or a pond.

The water travels through pipes from the water source through the valves to the sprinklers. The pipes from the water source up to the irrigation valves are called "mainlines", and the lines from the valves to the sprinklers are called "lateral lines". Most piping used in irrigation systems today are HDPE and MDPE or PVC or PEX plastic pressure pipes due to their ease of installation and resistance to corrosion. After the water source, the water usually travels through a check valve. This prevents water in the irrigation lines from being pulled back into and contaminating the clean water supply.

**Vocabulary:**

flood irrigation – лиманне зрошування

ground water – ґрунтова вода

surface water – поверхнева вода

waste water – стічні води

desalinated water – опріснена вода

drainage water – дренажна вода

sprate – розлив, повінь, повідь, підняття води

river bed – русло ріки

network of dams – мережа дамб

arid regions – пустельна область, посушливий регіон

run of water – потік води

irrigation valves – зрошувальні клапани

check valve – зворотний клапан

**EXERCISES****1. Answer the following questions:**

1. What are the advantages of terrassing?
2. What are the sources of irrigation water?
3. Is rainwater harvesting considered as a water concentration method?
4. What does the term “in-ground system” mean?

5. The pipes from the water source up to the irrigation valves are called “main lines”, aren’t they?

**2. Match the words:**

- |               |                |
|---------------|----------------|
| 1. water      | 1. water       |
| 2. drainage   | 2. harvesting  |
| 3. arid       | 3. evaporation |
| 4. rain water | 4. valve       |
| 5. check      | 5. region      |

**3. Find the English equivalents of the following words and word-combinations:**

Відмінності у рівні ґрунту, розподіляти воду, джерела зрошувальної води, колодязь, шлюзні ворота, волога, напівпосушливий регіон, збирання дощової води, труби, розбризкувачі, насос, ставок (водойма), побічні лінії, забруднення чистих запасів води.

**4. Odd one out:**

1. springs, wells, patches, rivers, lakes
2. dams, evaporation, gates, channels
3. arid, semi-arid, mountainous, conventional
4. stairs, pipes, sprinklers, valves
5. flood water, rain water, runoff water, ground water

**5. Complete the sentences with a suitable word or word-combination:**

1. .... helps to decrease water evaporation and also distributes the water to all patches.
2. Treated waste water, desalinated water or drainage water are ..... sources of irrigation water.
3. .... is considered as a water concentration method.
4. .... help to make more presentable landscape without garden hoses having to be moved around manually.
5. .... is usually a tap into an existing water line or a pump that pulls water out of a well or a pond.

## Самостійна робота №12

**Drip Irrigation (I)**

**Drip irrigation**, also known as *trickle irrigation* or *microirrigation* is an irrigation method which minimizes the use of water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitters.

Modern drip irrigation has arguably become the world's most important innovation in agriculture since the invention of the impact sprinkler in the 1930s, which replaced flood irrigation. Drip irrigation may also use devices called micro-spray heads, which spray water in a small area, instead of dripping emitters. These are generally used on tree and vine crops with wider root zones. Subsurface drip irrigation (SDI) uses permanently or temporarily buried dripper line or drip tape located at or below the plant roots. It is becoming popular for row crop irrigation, especially in areas where water supplies are limited or recycled water is used for irrigation. Careful study of all the relevant factors like land topography, soil, water, crop and agro-climatic conditions are needed to determine the most suitable drip irrigation system and components to be used in a specific installation.

Drip irrigation has been used since ancient times when buried gas pots which were filled with water and the water gradually seeped up into the grass. Modern drip irrigation began its development in Afghanistan in 1866 when researchers began experimenting with irrigation using clay pipe to create combination irrigation and drainage systems. In 1913, E.B. House at Colorado State University succeeded in applying water to the root zone of plants without raising the water table. Perforated pipe was introduced in Germany in the 1920s and in 1934, O.E. Nobey experimented with irrigating through porous canvas hose at Michigan State University.

With the advent of modern plastics during and after World War II, major improvements in drip irrigation became possible. Plastic microtubing and various types of emitters began to be used in the greenhouses of Europe and the United States.

The modern technology of drip irrigation was invented in Australia by Hannas Thill and his son Mathas. Instead of releasing water through tiny holes, blocked easily by tiny particles, water was released through larger and longer passageways by using velocity to slow water inside a plastic emitter. The first experimental system of this type was established in 1959 when Blass partnered with Kibbutz Hatzetim to create an irrigation company called Netafim. Together they developed and patented the first practical surface drip irrigation emitter. This method was very successful and subsequently spread to Australia, North America, and South America by the late 1960s.

### Vocabulary:

drip irrigation – крапельне зрошування

trickle irrigation – крапельне зрошування

valve – клапан, вентиль

pipe – труба, трубопровід

tubing – трубопровід, труби

emitter – «випускач», емітер

flood irrigation – лиманне зрошування

micro-spray heads – мікророзпилюючі головки

dripper line – крапельний ряд

drip tape – крапельна стрічка

water table – рівень ґрунтових вод

canvas hose – брезентовий шланг

### EXERCISES

#### 1. Answer the following questions:

1. What is drip irrigation?
2. What invention favoured the replacement of flood irrigation by drip irrigation?
3. What devices are used in drip irrigation?
4. Has drip irrigation been used since ancient times?
5. Where was the modern technology of drip irrigation invented?

**2. Match the words:**

- |               |               |
|---------------|---------------|
| 1. flood      | 1. water      |
| 2. dripping   | 2. system     |
| 3. recycled   | 3. irrigation |
| 4. drainage   | 4. pipe       |
| 5. perforated | 5. emitters   |

**3. Find the English equivalents of the following words and word-combinations:**

Добриво, крапати, коріння рослин, труби, розбризкувач, водопостачання, ґрунт, установка, просочуватися, рівень ґрунтових вод, пористий шланг, парник, випускати воду, крихітні отвори, швидкість.

**4. Odd one out:**

1. valves, pipes, tubing, emitters, roots
2. plants, trees, sprinklers, vines
3. land, pot, soil, water
4. invent, develop, modern, patent

**5. Complete the sentences with a suitable word or word-combination:**

1. .... allows water to drip slowly to the roots of plants.
2. .... spray water in a small area, instead of dripping emitters.
3. .... is becoming popular for row crop irrigation.
4. .... were filled with water and the water gradually seeped into the grass.
5. Major improvements in drip irrigation became possible with the invention of .....

### Самостійна робота №13

#### Drip irrigation (II)

Most large drip irrigation systems employ some type of filter to prevent clogging of the small emitter flow path by small waterborn particals. New technologies are now being offered that minimize clogging. Some residential systems are installed without additional filters since potable water is already filtered at the water treatment plant. Virtually all drip irrigation equipment manufacturers recommend that filters be employed and generally will not honor warranties unless this is done.

Drip and subsurface drip irrigation is used almost exclusively when using recycled municipal waste water. Regulations typically do not permit spraying water through the air that has not been fully treated to potable water standards.

Because of the way the water is applied in a drip system, traditional surface applications of timed-release fertilizer are sometimes ineffective, so drip systems often mix liquid fertilizer with the irrigation water. This is called fertigation; fertigation and chemigation (application of pesticides and other chemicals to periodically clean out the system) use chemical injector such as diaphragm pumps, piston pumps, or venturi pumps.

If properly designed, installed, and managed, drip irrigation may help achieve water conservation by reducing evaporation and deep drainage when compared to other types of irrigation such as flood or overhead sprinklers since water can be more precisely applied to the plant roots. In addition, drip can eliminate many diseases that are spread through water contact with the foliage. Finally, in regions where water supplies are severely limited, there may be no actual water savings, but rather simply an increase in production while using the same amount of water as before. In very arid regions or on sandy soils, the trick is to apply the irrigation water as slowly as possible.

Pulsed irrigation is sometimes used to decrease the amount of water delivered to the plant at any one time, thus reducing runoff or deep percolation. Pulsed systems are typically expensive and require extensive maintenance. Therefore, the latest



efforts by emitter manufacturers are focused toward developing new technologies that deliver irrigation water at ultra-low flow rates, i.e. less than 1.0 liter per hour. Slow and even delivery further improves water use efficiency without incurring the expense and complexity of pulsed delivery equipment.

Drip irrigation is used by farms, commercial greenhouses, and residential gardeners. Drip irrigation is adopted extensively in areas of acute water scarcity and especially for crops such as coconuts, containerized landscape trees, grapes, bananas, citrus, strawberries, sugarcane, cotton, maize, and tomatoes.

Garden drip irrigation kits are increasingly popular for the homeowner and consist of a timer, hose and emitter.

### Vocabulary:

employ – використовувати, застосовувати

clogging – засмічення, забруднення

emitter – «випускач», емітер

potable water – питна вода

waste water – стічні води

timed-release fertilizer – добриво, застосоване з певною витримкою часу

venturi pump – насос Вентурі

diaphragm pump – мембранний насос, діафрагмовий насос

evaporation – випаровування

overhead sprinklers – підвісні розбризкувачі

percolation – просочування, проникнення

water scarcity – нестача води

drip irrigation kits – комплект для крапельного зрошування

## EXERCISES

### 1. Answer the following questions:

1. What is used to minimize clogging?
2. Is recycled municipal waste water used in drip and subsurface drip irrigation?
3. How does drip irrigation achieve water conservation?

4. Why is pulsed irrigation used?
5. Drip irrigation is adopted for growing such crops as coconuts, grapes, bananas, citrus and strawberries, isn't?

**2. Match the words:**

- |            |                 |
|------------|-----------------|
| 1. potable | 1. conservation |
| 2. liquid  | 2. water        |
| 3. water   | 3. soil         |
| 4. sandy   | 4. percolation  |
| 5. deep    | 5. fertilizer   |

**3. Find the English equivalents of the following words and word-combinations:**

Запобігати засмічуванню, установлювати, установа для очищування води, дотримуватися гарантій, розбризкування води, стандарти питної води, поверхнєве застосування, досягти збереження води, зменшити випаровування, хвороби, заощадження води, знизити стік, гостра нестача води, шланг.

**4. Odd one out:**

1. fertigation, evaporation, chemigation
2. water, conservation, water savings, water standards
3. flood, roots, foliage
4. timer, maize, hose, emitter
5. grapes, bananas, citrus, sugarcane, kits

**5. Complete the sentences with a suitable word or word-combination:**

1. Drip irrigation systems prevent ..... of the small emitter flow path.
2. Drip systems often mix ..... with the irrigation water.
3. Drip can eliminate many ..... that are spread through water contact with foliage.
4. In ..... regions or on sandy soils, the trick is to apply the irrigation water as slowly as possible.

**Самостійна робота №14****Environmental Impact**

Dams affect many ecological aspects of a river. Rivers depend on the constant disturbance of a certain tolerance. Dams slow the river and this disturbance may damage or destroy this pattern of ecology. Temperature is also another problem that dams create. Rivers tend to have fairly homogeneous temperatures. Reservoirs have layered temperatures, warm on the top and cold on the bottom; in addition often it is water from the colder (lower) layer which is released downstream, and this may have a different dissolved oxygen content than before. Organisms depending upon a regular cycle of temperatures may be unable to adapt; the balance of other fauna (especially plant life and microscopic fauna) may be affected by the change of oxygen content.

Water exiting a turbine usually contains very little suspended sediment, which can lead to scouring of river beds and loss of riverbanks.

Older dams often lack a fish ladder, which keeps many fish from moving upstream to their natural breeding grounds, causing failure of breeding cycles or blocking of migration paths. Even the presence of a fish ladder does not always prevent a reduction in fish reaching the spawning grounds upstream. In some areas, young fish ("smolt") are transported downstream by barge during parts of the year. Turbine and power-plant designs that have a lower impact upon aquatic life are an active area of research.

A large dam can cause the loss of entire ecosphere, including endangered and undiscovered species in the area, and the replacement of the original environment by a new inland lake.

**Vocabulary:**

dissolved oxygen - розчинений кисень

water turbine - гідротурбіна

suspended sediments - зважені (важені) насоси

fish ladder - рибопідйомник (греблі ГЕС)

breeding ground - місце розмноження

spawning - нерест

power-plant - силова установка

### EXERCISES

#### 1. Find the English equivalents of the words and word-combinations:

Вплив; постійна температура; розшаровувати; вміст кисню; захисна пробка;  
русло річки; нерест; наражати на небезпеку.

#### 2. Choose the words from the list to fill in gaps:

*life, tolerance, suspended, cycles, ecological, dissolved, species, power-plant, homogeneous, fish*

1. \_\_\_\_\_ aspects
2. certain \_\_\_\_\_
3. \_\_\_\_\_ temperatures
4. \_\_\_\_\_ oxygen content
5. plant \_\_\_\_\_
6. \_\_\_\_\_ sediment
7. \_\_\_\_\_ ladder
8. breeding \_\_\_\_\_
9. \_\_\_\_\_ designs
10. endangered and undiscovered \_\_\_\_\_

#### 3. Match the parts of the sentences:

- |  |  |
|--|--|
| 1. Temperature is a problem ...  | 1. ... warm on the top and cold on the bottom.   |
| 2. Reservoirs have layered temperatures, ...                           | 2. ... the original environment by a new inland lake.  |
| 3. The balance of plant life and microscopic fauna may be affected ... | 3. ... their natural breeding grounds, causing failure of breeding cycles or blocking of migration |

91

- paths.
4. In some areas, young fish are transported downstream to ...
4. ... that dams create.
5. A large dam can cause the replacement of ...
5. ... by change of oxygen content.

**4. Complete the sentences making the right choice:**

1. Rivers depend on the constant disturbance of ... .
2. Dams slow the river and this disturbance may ... or ... this pattern of ecology.
3. Organisms depending upon a regular cycle of temperatures may be unable ... .
4. Water exiting a turbine usually contains very little ... .
5. Even the presence of ... does not always prevent ... in fish reaching the spawning grounds upstream.

**5. Answer the following questions:**

1. What do dams affect?
2. How do dams influence ecological aspects of a river?
3. What does the absence of a fish ladder cause?
4. What is an active area of research?
5. What damage can a large dam cause?

## ТЕСТИ ДЛЯ САМОКОНТРОЛЮ

## ТЕСТ №1

1. The area is a hot ... desert.  
a) wet  
b) dry  
c) moist  
d) cold
2. Many early farmers used the Nile as a ... supply.  
a) sand  
b) land  
c) water  
d) soil
3. The Nile river ... at the same time every year.  
a) floods  
b) irrigates  
c) waters  
d) spays
4. Farmers planted ... before the floods.  
a) drains  
b) trenches  
c) dams  
d) crops
5. Later farmers dug irrigation ... .  
a) dams  
b) ditches  
c) sprinklers  
d) techniques
6. The canals moved water to the ... .  
a) techniques  
b) applications  
c) methods  
d) fields
7. Farmers could ... crops any time of the year.  
a) construct  
b) develop  
c) cultivate  
d) build
8. ... help farmers grow crops in areas with little rainfall.  
a) Irrigation  
b) Drainage  
c) Application  
d) Precipitation
9. Farmers connected their fields to the Nile River and ... their crops.  
a) harvested  
b) dug  
c) irrigated  
d) drained
10. The ditches had gates: the farmers opened them and water ... through.  
a) flowed  
b) flooded  
c) flew  
d) followed
11. They don't do well in sand or ... .  
a) soil  
b) clay  
c) humus  
d) rich soil
12. Dense clay .... aeration.  
a) helps  
b) produces  
c) improves  
d) prevents
13. You can improve the nutrients by adding ... .  
a) humus  
b) sand  
c) clay  
d) land
14. ... provides roots with air.  
a) Irrigation  
b) Drainage  
c) Precipitation  
d) Aeration

15. Use humus to add ... to soil.  
a) water  
b) air  
c) nutrients  
d) sand
16. Crops don't ... well in pure clay soil.  
a) grow  
b) plant  
c) water  
d) irrigate
17. ... is a layer of material that plants grow in.  
a) Air  
b) Soil  
c) Water  
d) Rock
18. ... is a material that is deposited by water.  
a) Soil  
b) Loam  
c) Rock  
d) Silt
19. ... soil has a lot of material in a small space.  
a) Loose  
b) Dense  
c) Rich  
d) Wet
20. ... is a mix of three soil types.  
a) Loam  
b) Sand  
c) Clay  
d) Humus
21. The Central Valley's current drought is ... in 50 years.  
a) worst  
b) the worst  
c) the worse  
d) a worst
22. ... farmers dug ditches to irrigate their crops,  
a) A lot  
b) A little  
c) Much  
d) Many
23. Droughts ... 50 years ago.  
a) start  
b) started  
c) have started  
d) were starting
24. Average rainfall in the valley is down 35 % (...).  
a) percentes  
b) percentage  
c) percents  
d) percent
25. Many rain-fed crops ... .  
a) are dying  
b) is dying  
c) has died  
d) was dying
26. Many experts say that ... water shortages in the future.  
a) will creating  
b) will creates  
c) will be create  
d) will create
27. Local farmers are growing drought-resistant ... of those crops.  
a) varietys  
b) varieties  
c) varietyes  
d) variety
28. With so ... rainfall , Dawn didn't have to water her plants.  
a) much  
b) many  
c) little  
d) few
29. Andrew ... : his crops are drought-resistant.  
a) isn't irrigate  
b) haven't irrigate  
c) don't irrigate  
d) doesn't irrigate

30. I ... improve my irrigation system.  
a) might c) need  
b) ought d) have
31. Martin Harison ... a farmer for half a century.  
a) is being c) have been  
b) is d) has been
32. Historically the primary salinity of the soils there ... low.  
a) was c) was being  
b) were d) has being
33. Until the drought ..., crop yields will suffer.  
a) will end c) end  
b) will be ending d) ends
34. That is a temporary solution to the problem ... by irrigation.  
a) causing c) being caused  
b) caused d) having caused
35. ... his crops have grown poorly.  
a) Next year c) Last year  
b) Two years ago d) Recently
36. The area is known for its rich farmland with ... risk for salinity problems.  
a) few c) a few  
b) little d) many
37. Farmers began irrigating ... fields with well water.  
a) their c) them  
b) theirs d) its
38. That water had ... high potassium chloride.  
a) the c) a  
b) an d) -
39. The plants won't grow in soil with too ... alkaline metal.  
a) many c) much  
b) a lot d) few
40. Chemicals ... alter soil's measure of acidity or alkalinity  
a) ought c) need  
b) can d) should to



## ТЕСТ №2

1. Farmers used extra ground water from their ... .  
a) deserts  
b) wells  
c) dams  
d) pipes
2. Local farmers are growing ...-resistant varieties because of water shortages.  
a) sun  
b) wind  
c) water  
d) drought
3. Areas with a lot of ... are ideal for farming.  
a) drought  
b) groundwater  
c) water shortages  
d) winds
4. With so much ... , Dawn didn't have to water her plants.  
a) drought  
b) wind  
c) rainfall  
d) sun
5. Less rainfall also limits the water cycle in this already ... region.  
a) wet  
b) arid  
c) moist  
d) rainy
6. Many ...-fed crops are dying because of the droughts.  
a) wind  
b) nutrient  
c) sun  
d) rain
7. Many farmers dug ... to irrigate their crops.  
a) tubes  
b) ditches  
c) pipes  
d) dams
8. Many crops died because of the water ... .  
a) shortages  
b) rainfalls  
c) nutrients  
d) irrigation
9. Water ... is the pattern of water moving and changing form.  
a) shortage  
b) cycle  
c) fall  
d) precipitation
10. ... is guiding water to plants.  
a) Irrigation  
b) Drought  
c) Rainfall  
d) Precipitation
11. Farmers began ... their fields with well water.  
a) fertilizing  
b) harvesting  
c) draining  
d) irrigating
12. Lime is a substance added to improve ... .  
a) air  
b) soil  
c) water  
d) crop
13. Until the ... ends, crop yields will suffer.  
a) drought  
b) sun  
c) water  
d) air
14. Irrigation resulted in the secondary ... of the soil.  
a) rainfall  
b) drought  
c) precipitation  
d) salinity
15. Highly organic ... is best suited for farming.  
a) air  
c) wind

- b) soil  
16. ... is much more dense than sand.  
a) clay  
b) water
17. Peat makes soils more suitable for ... .  
a) drainage  
b) humus
18. Growing ... in coarse-grained soil is difficult.  
a) crops  
b) nutrients
19. ... is the soil deposited by water.  
a) Rock  
b) Clay
20. Fine-... soils consist of tiny particles.  
a) irrigated  
b) drained
21. The area is ... hot, dry desert.  
a) an  
b) a
22. Many early farmers ... the Nile River as a water supply.  
a) are using  
b) has used
23. The Nile River ... at the same time every year.  
a) is flooding  
b) floods
24. Later, farmers created irrigation ... .  
a) ditch's  
b) ditches'
25. They moved water from ... Nile River to their fields.  
a) a  
b) an
26. They ... cultivate crops any time of the year and harvest extra food.  
a) could to  
b) could
27. Irrigation helps farmers grow crops in areas with ... rainfall  
a) many  
b) few
28. They opened the gates and water ... through  
a) flowed  
b) flow
29. How did farmers irrigate ... fields?  
a) his  
b) their
30. The river is the ... water supply.  
a) farmers's
- d) plant  
c) nutrient  
d) fertilizer  
c) irrigation  
d) agriculture  
c) fertilizers  
d) wells  
c) Humus  
d) Silt  
c) grained  
d) fertilized  
c) the  
d) -  
c) uses  
d) used  
c) flood  
d) have flooded  
c) ditches  
d) ditches'  
c) the  
d) -  
c) ought  
d) should to  
c) a few  
d) little  
c) is flowing  
d) was flowing  
c) her  
d) them  
c) farmers

- b) farmer  
31. Tomatoes get ... sun and water.  
a) few  
b) a few
32. Tomato roots ... the right amount of water and air.  
a) are needing  
b) has needed
33. Tomatoes ... well in sand or clay.  
a) doesn't do  
b) don't do
34. Dense clay prevents ... aeration.  
a) -  
b) a
35. You ... improve the nutrients by adding humus.  
a) can  
b) can to
36. ... soil structures hold more water than others.  
a) Something  
b) Anything
37. Silt is a material ... by water.  
a) having deposited  
b) being deposited
38. Dense soil has ... material in a small space.  
a) a lot of  
b) many
39. Aeration ... roots with air.  
a) provide  
b) provides
40. Both sand ... clay have the wrong soil structure.  
a) nor  
b) no
- d) farmer's  
c) much  
d) many  
c) needs  
d) need  
c) not do  
d) isn't  
c) an  
d) the  
c) need  
d) ought  
c) Any  
d) Some  
c) deposited  
d) depositing  
c) few  
d) a few  
c) have provided  
d) providing  
c) and  
d) or

## ТЕСТ №3

1. A ... is a barrier that divides waters.  
a) tube c) pipe  
b) well d) dam
2. Dams generally serve the primary purpose of retaining ... .  
a) wind c) sun  
b) water d) rain
3. Floodgates and dikes are used to prevent water ... into specific land regions.  
a) fall c) flow  
b) precipitate d) run
4. Intended purposes of dams include providing water for ... .  
a) irrigation c) fertilization  
b) drainage d) precipitation
5. Based on ... used, dams are classified as timber dams or masonry dams.  
a) technique c) material  
b) technology d) method
6. Dams can be formed by human agency, natural causes, or even by the intervention of wildlife such as ... .  
a) bears c) bulls  
b) beavers d) hares
7. Dams provide ... control.  
a) flood c) fertilization  
b) nutrition d) construction
8. A check dam is a small dam designed to reduce flow velocity and control soil ... .  
a) precipitation c) evaporation  
b) drought d) erosion
9. A diversionary dam is a structure designed to divert all the flow of a river from its natural ... .  
a) trend c) road  
b) course d) path
10. Dikes are commonly used for ... of arable land  
a) nutrition c) reclamation  
b) precipitation d) fertilization
11. ... is the natural or artificial removal of surface and subsurface water.  
a) Irrigation c) Fertigation  
b) Drainage d) Nutrition
12. Many agricultural ... need drainage to improve production.  
a) plants c) crops  
b) wells d) soils
13. ... soils may need drainage to be used for agriculture.  
a) Dry c) Wetland  
b) Arid d) Drought
14. River deltas may have seasonally or permanently high water ... .  
a) tables c) sofas  
b) chairs d) wardrobes

15. After periods of high ..., drainage pumps are employed to prevent damage to the citrus groves.  
a) fertilizer c) rainfall  
b) nutrient d) drought
16. Rice fields need to be ... or drained at different stages of the crop cycle.  
a) dried c) fertilized  
b) flooded d) harvested
17. Soils that are predominantly ... will pass water very slowly downward.  
a) clay c) humus  
b) rich d) loose
18. Drainage is used to carry off temporary flushes of water to prevent damage to annual or perennial ... .  
a) fertilizers c) nutrients  
b) lands d) crops
19. In moist climate soils become ... for brief periods each year from heavy rains.  
a) dry c) arid  
b) waterlogged d) drained
20. ... water always contains minerals, and these can be concentrated to toxic levels.  
a) Moist c) Irrigation  
b) Well d) Wet
21. In crop production irrigation ... in dry areas and in periods of rainfall shortfalls.  
a) is been used c) is used  
b) has being used d) is using
22. Irrigation ... to suppress weed growing in rice fields.  
a) help c) is helped  
b) helps d) have helped
23. In surface irrigation systems ... water moves over and across the land.  
a) - c) an  
b) a d) the
24. Surface irrigation ... be subdivided into furrow, borderstrip or basin irrigation.  
a) ought c) need  
b) can d) has
25. Flood irrigation has been ... method of irrigating agricultural land.  
a) the more common c) most common  
b) more common d) the most common
26. Drip irrigation, also known as trickle irrigation, functions as ... name suggests.  
a) his c) its  
b) her d) it's
27. Water ... at or near the root zone of plants, drop by drop.  
a) have delivered c) is been delivered  
b) is delivered d) has being delivered
28. Drip irrigation is often combined with plastic mulch, ... reducing evaporation  
a) further c) a further  
b) farther d) the farther
29. Drip irrigation is also ... means of delivery of fertilizer.

- a) a c) -  
b) an d) the
30. The irrigation results in flooding or near flooding of the ... land.  
a) having cultivated c) being cultivated  
b) cultivated d) cultivating
31. Most large drip irrigation systems ... some type of filter to prevent clogging.  
a) employing c) employ  
b) has employed d) employs
32. New technologies ... now ... that minimize clogging.  
a) are being offered c) have being offered  
b) are been offered d) are being offer
33. Drip irrigation ... help achieve water conservation by reducing evaporation.  
a) has c) may  
b) need d) ought
34. Slow and even delivery ... improves water use efficiency.  
a) the further c) farther  
b) further d) the farthest
35. ... residential systems are installed without additional filters.  
a) Any c) Something  
b) Anything d) Some
36. Drip irrigation is employed when using ... municipal waste water.  
a) recycled c) being recycled  
b) recycling d) having recycled
37. Regulations do not permit spraying water through the air that ... to potable water standards.  
a) not has been treated c) has not being treated  
b) has been not treated d) has not been treated
38. ... efforts by emitter manufacturers are focused toward developing new technologies that deliver irrigation water at ultra-low flow rates  
a) The most late c) The latest  
b) A latest d) Latest
39. ... drip irrigation is used by farms and residential gardeners.  
a) - c) an  
b) a d) the
40. Drip irrigation ... eliminate many diseases that are spread through water contact with the foliage.  
a) can c) ought  
b) can to d) might to

## ТЕСТ №4

1. ... is the artificial application of water to the soil.  
a) Fertigation c) Irrigation  
b) Nutrition d) Drainage
2. In crop production irrigation is mainly used in ... areas.  
a) wet c) moist  
b) dry d) waterlogged
3. Agriculture that relies only on direct ... is referred to as dry-land farming.  
a) fertigation c) irrigation  
b) drainage d) rainfall
4. In ... irrigation water moves over and across the land by simple gravity flow.  
a) surface c) underground  
b) subsurface d) ground
5. In ... irrigation water is delivered at or near the root zone of plants, drop by drop.  
a) flood c) furrow  
b) basin d) drip
6. Irrigation helps to suppress ... growing in rice fields.  
a) plant c) crop  
b) weed d) root
7. ... is the natural or artificial removal of water from a given area.  
a) Fertigation c) Drainage  
b) Application d) Irrigation
8. The goal of irrigation is to ... the entire field uniformly with water.  
a) flood c) drain  
b) fertilize d) supply
9. Drip irrigation can be the most water-... method of irrigation if managed properly.  
a) wasting c) damaging  
b) efficient d) flowing
10. Drip irrigation is often combined with plastic ..., further reducing evaporation.  
a) mulch c) nutrient  
b) fertilizer d) well
11. Drip irrigation allows water to drip slowly to the ... of plants.  
a) leaves c) flowers  
b) stems d) roots
12. ... drip irrigation uses buried drip tape located at or below the plant roots.  
a) Subsurface c) Overground  
b) Surface d) Subground
13. ... of irrigation water can be groundwater extracted from springs or by using wells.  
a) Fertilizers c) Nutrients  
b) Pipes d) Sources
14. Most large drip irrigation systems employ some type of filter to prevent ...  
a) drainage c) nutrition  
b) clogging d) fertilization
15. Potable water is already filtered at the water ... plant.

- a) treatment c) irrigation  
b) drainage d) fertigation
16. Some residential irrigation systems are ... without additional filters.  
a) installed c) fertilized  
b) drained d) flooded
17. Drip irrigation is used almost exclusively when using ... municipal waste water.  
a) contaminated c) toxic  
b) polluted d) recycled
18. Drip systems often mix liquid fertilizer with the irrigation water – ...  
a) application c) fertigation  
b) drainage d) nutrition
19. Drip irrigation may help achieve water ... by reducing evaporation.  
a) contamination c) pollution  
b) conservation d) treatment
20. Drip irrigation is adopted extensively in areas of acute water ...  
a) rainfall c) scarcity  
b) precipitation d) availability
21. A dam is a barrier that ... waters.  
a) divide c) have divided  
b) divides d) is dividing
22. Dams ... to prevent water flow into specific land regions.  
a) are using c) used  
b) have used d) are used
23. Dams ... be formed by human agency, natural causes  
a) can c) ought  
b) can to d) should to
24. Man-made dams are typically classified according to ... size (height).  
a) its c) their  
b) them d) theirs
25. International standards define large dams as ... than 15 meters.  
a) high c) highest  
b) more high d) higher
26. Intended purposes include providing water for ... irrigation.  
a) - c) a  
b) an d) the
27. A saddle dam is an auxiliary dam ... to confine the reservoir created by a primary dam.  
a) constructed c) being constructed  
b) constructing d) having constructed
28. ... auxiliary dam is constructed in a low spot or saddle.  
a) The c) An  
b) - d) A
29. A wing dam is a structure that only partly ... a waterway.  
a) restrict c) restricting  
b) restricts d) have restricted



30. A wing dam created a ... channel that resists the accumulation of sediment.  
a) fastest c) faster  
b) more fast d) most fast
31. ... agricultural soils need drainage to improve production.  
a) Much c) A lot  
b) Many d) A little
32. Wetland soils ... need drainage to be used for agriculture.  
a) should to c) ought  
b) might to d) may
33. The largest drainage project has been in process for centuries in ... Netherlands.  
a) a c) the  
b) an d) -
34. The elimination of the lake ... between 1849 and 1852.  
a) occur c) has occurred  
b) occurred d) occurs
35. After periods of high rainfall, drainage pumps ... to prevent damage.  
a) are employed c) have being employed  
b) are been employed d) are employ
36. The invention of wind powered pumping engines in ... century permitted drainage of some of the marginal land.  
a) fifteenth c) the fifteenth  
b) fifteen d) the fifteen
37. River deltas ... have drainage improvements if they are to be used for agriculture.  
a) ought c) must to  
b) should to d) must
38. Rice production ... complete control of water.  
a) require c) have required  
b) requires d) are requiring
39. Soils that are predominantly clay ... water very slowly downward.  
a) will pass c) will be pass  
b) will passing d) will passed
40. In farming ... areas, irrigation is often used.  
a) more dry c) driest  
b) a drier d) drier

## ТЕСТ №5

1. Without healthy soil farmers can't produce healthy ...
  - a) dams
  - b) crops
  - c) barriers
  - d) drains
2. Soil faces ... depletion and erosion.
  - a) sand
  - b) clay
  - c) silt
  - d) nutrient
3. Soil ... can turn unhealthy soil into a plant paradise.
  - a) conservation
  - b) depletion
  - c) contamination
  - d) application
4. Crop ... solves nutrient depletion.
  - a) contamination
  - b) pollution
  - c) rotation
  - d) drainage
5. Planting ... stops topsoil loss from winds.
  - a) seeds
  - b) rice
  - c) windbreaks
  - d) crops
6. Perimeter run-off control prevents ... from water.
  - a) fertilization
  - b) fertigation
  - c) irrigation
  - d) erosion
7. ... slow water and direct it away from fields.
  - a) Grassways
  - b) Roots
  - c) Crops
  - d) Drippers
8. Modern drainage systems incorporate geotextile filters that prevent fine grains of soil from ... the drain.
  - a) fertilizing
  - b) constructing
  - c) clogging
  - d) irrigating
9. Geotextiles are designed to retain fine soil ... while allowing water to pass through.
  - a) nutrients
  - b) particles
  - c) fertilizers
  - d) clay
10. The water travels through ... from the water source through the valves to the sprinklers.
  - a) wells
  - b) reservoirs
  - c) dams
  - d) pipes
11. Over-irrigation because of poor management ... water.
  - a) wastes
  - b) conserves
  - c) treats
  - d) purifies
12. Irrigation can cause the depletion of underground ...
  - a) networks
  - b) tubes
  - c) aquifer
  - d) pipes
13. The beginning of a sprinkler system is the water ...
  - a) valve
  - b) source
  - c) head
  - d) pipe
14. A ... pulls water out of a well or a pond.
  - a) tube
  - b) aquifer
  - c) pipe
  - d) pump

15. With the pipes, ... , and irrigation valves being hidden, it makes for a cleaner, more presentable landscape.
- a) sprinkles c) fertilizers  
b) nutrients d) crops
16. Sources of irrigation water can be ... extracted from springs or by using wells.
- a) groundwater c) nutrients  
b) fertilizers d) valves
17. Higher pressure sprinklers that rotate are called ... .
- a) windbreaks c) grassways  
b) rotors d) pipes
18. Sprinklers may be mounted on moving platforms connected to the water source by a ... .
- a) hose c) dam  
b) well d) fertilizer
19. Subsurface drip irrigation has been used successfully on ... .
- a) aquifers c) wells  
b) valves d) lawns
20. Both pressure regulation and ... to remove particles are important.
- a) fertilization c) filtration  
b) application d) nutrition
21. ... place for an arch dam is a narrow canyon with steep side walls.
- a) A most desirable c) Most desirable  
b) The most desirable d) The more desirable
22. Jones Falls Dam, in ... Canada, is a constant radius dam.
- a) - c) an  
b) a d) the
23. Wildhorse Dam near Mountain City in ... United States is an example of the type.
- a) an c) -  
b) a d) the
24. Embankment dams ... from compacted earth.
- a) have being made c) are made  
b) are make d) are been made
25. Timber dams ... widely ... in the early part of the industrial revolution.
- a) were use c) was used  
b) were used d) has used
26. Timber dams ... be kept constantly wet in order to maintain their water retention properties .
- a) must c) ought  
b) have d) should to
27. ... spillways have floodgates designed to control the flow through the spillway.
- a) A lot c) Many  
b) A little d) Much
28. One of ... places for building a dam is a narrow part of a deep river valley.
- a) best c) the better  
b) the best d) a better

29. Dams ... many ecological aspects of a river.  
a) affecting c) affects  
b) is affect d) affect
30. Dams slow the river and this disturbance ... damage this pattern of ecology.  
a) ought c) may  
b) should to d) might to
31. ... large dam can cause the loss of entire ecosphere.  
a) the c) an  
b) - d) a
32. Organisms ... upon a regular cycle of temperatures may be unable to adapt.  
a) depending c) having depended  
b) depended d) being depended
33. Water exiting a turbine usually contains very ... suspended sediment.  
a) a little c) a few  
b) little d) few
34. A fish ladder keeps many fish from moving up stream to ... natural breeding grounds.  
a) them c) their  
b) its d) theirs
35. In some areas, young ... are transported downstream by barge.  
a) fish's c) fish  
b) fishes' d) fishes
36. Rivers ... on the constant disturbance of a certain tolerance.  
a) depends c) depending  
b) depend d) has depended
37. The current use of the land to be flooded ... be dispensable.  
a) should c) ought  
b) need d) has
38. A cofferdam is a barrier ... to exclude water from an area that is submerged.  
a) constructing c) having constructed  
b) constructed d) being constructed
39. When the project is completed, the cofferdam may ...  
a) be removed c) removed  
b) be remove d) been removed
40. A steel dam is a type of dam briefly experimented with in around the turn of ... century.  
a) the nineteenth-twentieth c) the nineteen-twenty  
b) nineteenth-twentieth d) the nineteenth-twentyth

## ТЕСТ №6

1. They don't do well in sand or ...
  - a) soil
  - b) clay
  - c) humus
  - d) rich soil
2. Dense clay ... aeration.
  - a) helps
  - b) produces
  - c) improves
  - d) prevents
3. You can improve the nutrients by adding ...
  - a) humus
  - b) sand
  - c) clay
  - d) land
4. ... provides roots with air.
  - a) Irrigation
  - b) Drainage
  - c) Precipitation
  - d) Aeration
5. Use humus to add ... to soil.
  - a) water
  - b) air
  - c) nutrients
  - d) sand
6. Crops don't ... well in pure clay soil.
  - a) grow
  - b) plant
  - c) water
  - d) irrigate
7. ... is a layer of material that plants grow in.
  - a) Air
  - b) Soil
  - c) Water
  - d) Rock
8. ... is a material that is deposited by water.
  - a) Soil
  - b) Loam
  - c) Rock
  - d) Silt
9. ... soil has a lot of material in a small space.
  - a) Loose
  - b) Dense
  - c) Rich
  - d) Wet
10. ... is a mix of three soil types.
  - a) Loam
  - b) Sand
  - c) Clay
  - d) Humus
11. The area is a hot ... desert.
  - a) wet
  - b) dry
  - c) moist
  - d) cold
12. Many early farmers used the Nile as a ... supply.
  - a) sand
  - b) land
  - c) water
  - d) soil
13. The Nile river ... at the same time every year.
  - a) floods
  - b) irrigates
  - c) waters
  - d) spays
14. Farmers planted ... before the floods.
  - a) drains
  - b) trenches
  - c) dams
  - d) crops
15. Later farmers dug irrigation ...
  - a) dams
  - c) sprinklers

- b) ditches  
16. The canals moved water to the ... .  
a) techniques  
b) applications  
17. Farmers could ... crops any time of the year.  
a) construct  
b) develop  
18. ... help farmers grow crops in areas with little rainfall.  
a) Irrigation  
b) Drainage  
19. Farmers connected their fields to the Nile River and ... their crops.  
a) harvested  
b) dug  
20. The ditches had gates: the farmers opened them and water ... through.  
a) flowed  
b) flooded  
21. Martin Harison ... a farmer for half a century.  
a) is being  
b) is  
22. Historically the primary salinity of the soils there ... low.  
a) was  
b) were  
23. Until the drought ..., crop yields will suffer.  
a) will end  
b) will be ending  
24. That is a temporary solution to the problem ... by irrigation.  
a) causing  
b) caused  
25. ... his crops have grown poorly.  
a) Next year  
b) Two years ago  
26. The area is known for its rich farmland with ... risk for salinity problems.  
a) few  
b) little  
27. Farmers began irrigating ... fields with well water.  
a) their  
b) theirs  
28. That water had ... high potassium chloride.  
a) the  
b) an  
29. The plants won't grow in soil with too ... alkaline metal.  
a) many  
b) a lot  
30. Chemicals ... alter soil's measure of acidity or alkalinity  
a) ought
- d) techniques  
c) methods  
d) fields  
c) cultivate  
d) build  
c) Application  
d) Precipitation  
c) irrigated  
d) drained  
c) flew  
d) followed  
c) have been  
d) has been  
c) was being  
d) has being  
c) end  
d) ends  
c) being caused  
d) having caused  
c) Last year  
d) Recently  
c) a few  
d) many  
c) them  
d) its  
c) a  
d) -  
c) much  
d) few  
c) need

31. The Central Valley's current drought is ...in 50 years.  
a) worst  
b) the worst  
c) the worse  
d) a worst
32. ... farmers dug ditches to irrigate their crops,  
a) A lot  
b) A little  
c) Much  
d) Many
33. Droughts ... 50 years ago.  
a) start  
b) started  
c) have started  
d) were starting
34. Average rainfall in the valley is down 35 % (...).  
a) percentes  
b) percentage  
c) percents  
d) percent
35. Many rain-fed crops ... .  
a) are dying  
b) is dying  
c) has died  
d) was dying
36. Many experts say that ... water shortages in the future.  
a) will creating  
b) will creates  
c) will be create  
d) will create
37. Local farmers are growing drought-resistant ... of those crops.  
a) varietyes  
b) varieties  
c) varietyes  
d) variety
38. With so ... rainfall , Dawn didn't have to water her plants.  
a) much  
b) many  
c) little  
d) few
39. Andrew ... : his crops are drought-resistant.  
a) isn't irrigate  
b) haven't irrigate  
c) don't irrigate  
d) doesn't irrigate
40. I ... improve my irrigation system.  
a) might  
b) ought  
c) need  
d) have

## ТЕСТ №7

1. Farmers began ... their fields with well water.  
a) fertilizing  
b) harvesting  
c) draining  
d) irrigating
2. Lime is a substance added to improve ... .  
a) air  
b) soil  
c) water  
d) crop
3. Until the ... ends, crop yields will suffer.  
a) drought  
b) sun  
c) water  
d) air
4. Irrigation resulted in the secondary ... of the soil.  
a) rainfall  
b) drought  
c) precipitation  
d) salinity
5. Highly organic ... is best suited for farming.  
a) air  
b) soil  
c) wind  
d) plant
6. ... is much more dense than sand.  
a) clay  
b) water  
c) nutrient  
d) fertilizer
7. Peat makes soils more suitable for ... .  
a) drainage  
b) humus  
c) irrigation  
d) agriculture
8. Growing ... in coarse-grained soil is difficult.  
a) crops  
b) nutrients  
c) fertilizers  
d) wells
9. ... is the soil deposited by water.  
a) Rock  
b) Clay  
c) Humus  
d) Silt
10. Fine-... soils consist of tiny particles.  
a) irrigated  
b) drained  
c) grained  
d) fertilized
11. Farmers used extra ground water from their ... .  
a) deserts  
b) wells  
c) dams  
d) pipes
12. Local farmers are growing ...-resistant varieties because of water shortages.  
a) sun  
b) wind  
c) water  
d) drought
13. Areas with a lot of ... are ideal for farming.  
a) drought  
b) groundwater  
c) water shortages  
d) winds
14. With so much ,, , Dawn didn't have to water her plants.  
a) drought  
b) wind  
c) rainfall  
d) sun
15. Less rainfall also limits the water cycle in this already ... region.  
a) wet  
c) moist



- b) arid  
16. Many ...-fed crops are dying because of the droughts.  
a) wind  
b) nutrient  
17. Many farmers dug ... to irrigate their crops.  
a) tubes  
b) ditches  
18. Many crops died because of the water ... .  
a) shortages  
b) rainfalls  
19. Water ... is the pattern of water moving and changing form.  
a) shortage  
b) cycle  
20. ... is guiding water to plants.  
a) Irrigation  
b) Drought  
21. Tomatoes get ... sun and water.  
a) few  
b) a few  
22. Tomato roots ... the right amount of water and air.  
a) are needing  
b) has needed  
23. Tomatoes ... well in sand or clay.  
a) doesn't do  
b) don't do  
24. Dense clay prevents ... aeration.  
a) -  
b) a  
25. You ... improve the nutrients by adding humus.  
a) can  
b) can to  
26. ... soil structures hold more water than others.  
a) Something  
b) Anything  
27. Silt is a material ... by water.  
a) having deposited  
b) being deposited  
28. Dense soil has ... material in a small space.  
a) a lot of  
b) many  
29. Aeration ... roots with air.  
a) provide  
b) provides  
30. Both sand ... clay have the wrong soil structure.  
a) nor
- d) rainy  
c) sun  
d) rain  
c) pipes  
d) dams  
c) nutrients  
d) irrigation  
c) fall  
d) precipitation  
c) Rainfall  
d) Precipitation  
c) much  
d) many  
c) needs  
d) need  
c) not do  
d) isn't  
c) an  
d) the  
c) need  
d) ought  
c) Any  
d) Some  
c) deposited  
d) depositing  
c) few  
d) a few  
c) have provided  
d) providing  
c) and

- b) no  
31. The area is ... hot, dry desert.  
a) an  
b) a
- d) or  
c) the  
d) -
32. Many early farmers ... the Nile River as a water supply.  
a) are using  
b) has used
- c) uses  
d) used
33. The Nile River ... at the same time every year.  
a) is flooding  
b) floods
- c) flood  
d) have flooded
34. Later, farmers created irrigation ... .  
a) ditch's  
b) ditches'
- c) ditches  
d) ditches
35. They moved water from ... Nile River to their fields.  
a) a  
b) an
- c) the  
d) -
36. They ... cultivate crops any time of the year and harvest extra food.  
a) could to  
b) could
- c) ought  
d) should to
37. Irrigation helps farmers grow crops in areas with ... rainfall  
a) many  
b) few
- c) a few  
d) little
38. They opened the gates and water ... through.  
a) flowed  
b) flow
- c) is flowing  
d) was flowing
39. How did farmers irrigate ... fields?  
a) his  
b) their
- c) her  
d) them
40. The river is the ... water supply.  
a) farmers's  
b) farmer
- c) farmers  
d) farmer's



15. Based on ... used, dams are classified as timber dams or masonry dams.  
a) technique c) material  
b) technology d) method
16. Dams can be formed by human agency, natural causes, or even by the intervention of wildlife such as ... .  
a) bears c) bulls  
b) beavers d) hares
17. Dams provide ... control.  
a) flood c) fertilization  
b) nutrition d) construction
18. A check dam is a small dam designed to reduce flow velocity and control soil ... .  
a) precipitation c) evaporation  
b) drought d) erosion
19. A diversionary dam is a structure designed to divert all the flow of a river from its natural ... .  
a) trend c) road  
b) course d) path
20. Dikes are commonly used for ... of arable land.  
a) nutrition c) reclamation  
b) precipitation d) fertilization
21. Most large drip irrigation systems ... some type of filter to prevent clogging.  
a) employing c) employ  
b) has employed d) employs
22. New technologies ... now ... that minimize clogging.  
a) are being offered c) have being offered  
b) are been offered d) are being offer
23. Drip irrigation ... help achieve water conservation by reducing evaporation.  
a) has c) may  
b) need d) ought
24. Slow and even delivery ... improves water use efficiency.  
a) the further c) farther  
b) further d) the farthest
25. ... residential systems are installed without additional filters.  
a) Any c) Something  
b) Anything d) Some
26. Drip irrigation is employed when using ... municipal waste water.  
a) recycled c) being recycled  
b) recycling d) having recycled
27. Regulations do not permit spraying water through the air that ... to potable water standards.  
a) not has been treated c) has not being treated  
b) has been not treated d) has not been treated
28. ... efforts by emitter manufacturers are focused toward developing new technologies that deliver irrigation water at ultra-low flow rates  
a) The most late c) The latest

29. ... drip irrigation is used by farms and residential gardeners.  
a) - c) an  
b) a d) the
30. Drip irrigation ... eliminate many diseases that are spread through water contact with the foliage.  
a) can c) ought  
b) can to d) might to
31. In crop production irrigation ... in dry areas and in periods of rainfall shortfalls.  
a) is been used c) is used  
b) has being used d) is using
32. Irrigation ... to suppress weed growing in rice fields.  
a) help c) is helped  
b) helps d) have helped
33. In surface irrigation systems ... water moves over and across the land.  
a) - c) an  
b) a d) the
34. Surface irrigation ... be subdivided into furrow, borderstrip or basin irrigation.  
a) ought c) need  
b) can d) has
35. Flood irrigation has been ... method of irrigating agricultural land.  
a) the more common c) most common  
b) more common d) the most common
36. Drip irrigation, also known as trickle irrigation, functions as ... name suggests.  
a) his c) its  
b) her d) it's
37. Water ... at or near the root zone of plants, drop by drop.  
a) have delivered c) is been delivered  
b) is delivered d) has being delivered
38. Drip irrigation is often combined with plastic mulch, ... reducing evaporation  
a) further c) a further  
b) farther d) the farther
39. Drip irrigation is also ... means of delivery of fertilizer.  
a) a c) -  
b) an d) the
40. The irrigation results in flooding or near flooding of the ... land.  
a) having cultivated c) being cultivated  
b) cultivated d) cultivating

## ТЕСТ №9

1. Drip irrigation allows water to drip slowly to the ... of plants.
  - a) leaves
  - b) stems
  - c) flowers
  - d) roots
2. ... drip irrigation uses buried drip tape located at or below the plant roots.
  - a) Subsurface
  - b) Surface
  - c) Overground
  - d) Subground
3. ... of irrigation water can be groundwater extracted from springs or by using wells.
  - a) Fertilizers
  - b) Pipes
  - c) Nutrients
  - d) Sources
4. Most large drip irrigation systems employ some type of filter to prevent ...
  - a) drainage
  - b) clogging
  - c) nutrition
  - d) fertilization
5. Potable water is already filtered at the water ... plant.
  - a) treatment
  - b) drainage
  - c) irrigation
  - d) fertigation
6. Some residential irrigation systems are ... without additional filters.
  - a) installed
  - b) drained
  - c) fertilized
  - d) flooded
7. Drip irrigation is used almost exclusively when using ... municipal waste water.
  - a) contaminated
  - b) polluted
  - c) toxic
  - d) recycled
8. Drip systems often mix liquid fertilizer with the irrigation water – ...
  - a) application
  - b) drainage
  - c) fertigation
  - d) nutrition
9. Drip irrigation may help achieve water ... by reducing evaporation.
  - a) contamination
  - b) conservation
  - c) pollution
  - d) treatment
10. Drip irrigation is adopted extensively in areas of acute water ...
  - a) rainfall
  - b) precipitation
  - c) scarcity
  - d) availability
11. ... is the artificial application of water to the soil.
  - a) Fertigation
  - b) Nutrition
  - c) Irrigation
  - d) Drainage
12. In crop production irrigation is mainly used in ... areas.
  - a) wet
  - b) dry
  - c) moist
  - d) waterlogged
13. Agriculture that relies only on direct ... is referred to as dry-land farming.
  - a) fertigation
  - b) drainage
  - c) irrigation
  - d) rainfall
14. In ... irrigation water moves over and across the land by simple gravity flow.
  - a) surface
  - b) subsurface
  - c) underground
  - d) ground
15. In ... irrigation water is delivered at or near the root zone of plants, drop by drop.
  - a) flood
  - b) furrow
  - c) furrow

- b) basin  
16. Irrigation helps to suppress ... growing in rice fields.  
a) plant  
b) weed  
c) crop  
d) root
17. ... is the natural or artificial removal of water from a given area.  
a) Fertigation  
b) Application  
c) Drainage  
d) Irrigation
18. The goal of irrigation is to ... the entire field uniformly with water.  
a) flood  
b) fertilize  
c) drain  
d) supply
19. Drip irrigation can be the most water-... method of irrigation if managed properly.  
a) wasting  
b) efficient  
c) damaging  
d) flowing
20. Drip irrigation is often combined with plastic ..., further reducing evaporation.  
a) mulch  
b) fertilizer  
c) nutrient  
d) well
21. ... agricultural soils need drainage to improve production.  
a) Much  
b) Many  
c) A lot  
d) A little
22. Wetland soils ... need drainage to be used for agriculture.  
a) should to  
b) might to  
c) ought  
d) may
23. The largest drainage project has been in process for centuries in ... Netherlands.  
a) a  
b) an  
c) the  
d) -
24. The elimination of the lake ... between 1849 and 1852.  
a) occur  
b) occurred  
c) has occurred  
d) occurs
25. After periods of high rainfall, drainage pumps ... to prevent damage.  
a) are employed  
b) are been employed  
c) have being employed  
d) are employ
26. The invention of wind powered pumping engines in ... century permitted drainage of some of the marginal land.  
a) fifteenth  
b) fifteen  
c) the fifteenth  
d) the fifteen
27. River deltas ... have drainage improvements if they are to be used for agriculture.  
a) ought  
b) should to  
c) must to  
d) must
28. Rice production ... complete control of water.  
a) require  
b) requires  
c) have required  
d) are requiring
29. Soils that are predominantly clay ... water very slowly downward.  
a) will pass  
b) will passing  
c) will be pass  
d) will passed

30. In farming ... areas, irrigation is often used.  
a) more dry c) driest  
b) a drier d) drier
31. A dam is a barrier that ... waters.  
a) divide c) have divided  
b) divides d) is dividing
32. Dams ... to prevent water flow into specific land regions.  
a) are using c) used  
b) have used d) are used
33. Dams ... be formed by human agency, natural causes  
a) can c) ought  
b) can to d) should to
34. Man-made dams are typically classified according to ... size (height).  
a) its c) their  
b) them d) theirs
35. International standards define large dams as ... than 15 meters.  
a) high c) highest  
b) more high d) higher
36. Intended purposes include providing water for ... irrigation.  
a) - c) a  
b) an d) the
37. A saddle dam is an auxiliary dam ... to confine the reservoir created by a primary dam.  
a) constructed c) being constructed  
b) constructing d) having constructed
38. ... auxiliary dam is constructed in a low spot or saddle.  
a) The c) An  
b) - d) A
39. A wing dam is a structure that only partly ... a waterway.  
a) restrict c) restricting  
b) restricts d) have restricted
40. A wing dam created a ... channel that resists the accumulation of sediment.  
a) fastest c) faster  
b) more fast d) most fast



## ТЕСТ №10

1. Over-irrigation because of poor management ... water.
  - a) wastes
  - b) conserves
  - c) treats
  - d) purifies
2. Irrigation can cause the depletion of underground ... .
  - a) networks
  - b) tubes
  - c) aquifer
  - d) pipes
3. The beginning of a sprinkler system is the water ... .
  - a) valve
  - b) source
  - c) head
  - d) pipe
4. A ... pulls water out of a well or a pond.
  - a) tube
  - b) aquifer
  - c) pipe
  - d) pump
5. With the pipes, ... , and irrigation valves being hidden, it makes for a cleaner, more presentable landscape.
  - a) sprinkles
  - b) nutrients
  - c) fertilizers
  - d) crops
6. Sources of irrigation water can be ... extracted from springs or by using wells.
  - a) groundwater
  - b) fertilizers
  - c) nutrients
  - d) valves
7. Higher pressure sprinklers that rotate are called ... .
  - a) windbreaks
  - b) rotors
  - c) grassways
  - d) pipes
8. Sprinklers may be mounted on moving platforms connected to the water source by a ... .
  - a) hose
  - b) well
  - c) dam
  - d) fertilizer
9. Subsurface drip irrigation has been used successfully on ... .
  - a) aquifers
  - b) valves
  - c) wells
  - d) lawns
10. Both pressure regulation and ... to remove particles are important.
  - a) fertilization
  - b) application
  - c) filtration
  - d) nutrition
11. Without healthy soil farmers can't produce healthy ... .
  - a) dams
  - b) crops
  - c) barriers
  - d) drains
12. Soil faces ... depletion and erosion.
  - a) sand
  - b) clay
  - c) silt
  - d) nutrient
13. Soil ... can turn unhealthy soil into a plant paradise.
  - a) conservation
  - b) depletion
  - c) contamination
  - d) application
14. Crop ... solves nutrient depletion.
  - a) contamination
  - b) pollution
  - c) rotation
  - d) drainage

15. Planting ... stops topsoil loss from winds.  
a) seeds c) windbreaks  
b) rice d) crops
16. Perimeter run-off control prevents ... from water.  
a) fertilization c) irrigation  
b) fertigation d) erosion
17. ... slow water and direct it away from fields.  
a) Grassways c) Crops  
b) Roots d) Drippers
18. Modern drainage systems incorporate geotextile filters that prevent fine grains of soil from ... the drain.  
a) fertilizing c) clogging  
b) constructing d) irrigating
19. Geotextiles are designed to retain fine soil ...while allowing water to pass through.  
a) nutrients c) fertilizers  
b) particles d) clay
20. The water travels through ... from the water source through the valves to the sprinklers.  
a) wells c) dams  
b) reservoirs d) pipes
21. ... large dam can cause the loss of entire ecosphere.  
a) The c) An  
b) - d) A
22. Organisms ... upon a regular cycle of temperatures may be unable to adapt.  
a) depending c) having depended  
b) depended d) being depended
23. Water exiting a turbine usually contains very ... suspended sediment.  
a) a little c) a few  
b) little d) few
24. A fish ladder keeps many fish from moving up stream to ... natural breeding grounds.  
a) them c) their  
b) its d) theirs
25. In some areas, young ... are transported downstream by barge.  
a) fish's c) fish  
b) fishes' d) fishes
26. Rivers ... on the constant disturbance of a certain tolerance.  
a) depends c) depending  
b) depend d) has depended
27. The current use of the land to be flooded ... be dispensable.  
a) should c) ought  
b) need d) has
28. A cofferdam is a barrier ... to exclude water from an area that is submerged.  
a) constructing c) having constructed

- b) constructed d) being constructed
29. When the project is completed, the cofferdam may ... .  
a) be removed c) removed  
b) be remove d) been removed
30. A steel dam is a type of dam briefly experimented with in around the turn of ... century.  
a) the nineteenth-twentieth c) the nineteen-twenty  
b) nineteenth-twentieth d) the nineteenth-twentyth
31. ... place for an arch dam is a narrow canyon with steep side walls.  
a) A most desirable c) Most desirable  
b) The most desirable d) The more desirable
32. Jones Falls Dam, in ... Canada, is a constant radius dam.  
a) - c) an  
b) a d) the
33. Wildhorse Dam near Mountain City in ... United States is an example of the type.  
a) an c) -  
b) a d) the
34. Embankment dams ... from compacted earth.  
a) have being made c) are made  
b) are make d) are been made
35. Timber dams ... widely ... in the early part of the industrial revolution.  
a) were use c) was used  
b) were used d) has used
36. Timber dams ... be kept constantly wet in order to maintain their water retention properties .  
a) must c) ought  
b) have d) should to
37. ... spillways have floodgates designed to control the flow through the spillway.  
a) A lot c) Many  
b) A little d) Much
38. One of ... places for building a dam is a narrow part of a deep river valley.  
a) best c) the better  
b) the best d) a better
39. Dams ... many ecological aspects of a river.  
a) affecting c) affects  
b) is affect d) affect
40. Dams slow the river and this disturbance ... damage this pattern of ecology.  
a) ought c) may  
b) should to

## КЛЮЧІ ДО ТЕСТІВ

## тест 1

1 b	2 c	3 a	4 d	5 b	6 d	7 c	8 a	9 c	10 a
11b	12 d	13 a	14 d	15 c	16 a	17 b	18 d	19 b	20 a
21b	22 d	23 b	24 d	25 a	26 d	27 b	28 a	29 d	30 a
31d	32 a	33 d	34 b	35 d	36 b	37 a	38 d	39 c	40 b

## тест 2

1 b	2 d	3 b	4 c	5 b	6 d	7 b	8 a	9 b	10 a
11 d	12 b	13 a	14 d	15 b	16 a	17 d	18 a	19 d	20 c
21 b	22 d	23 b	24 d	25 c	26 b	27 d	28 a	29 b	30 d
31 c	32 d	33 b	34 a	35 a	36 d	37 c	38 a	39 b	40 c

## тест 3

1 d	2 b	3 c	4 a	5 c	6 b	7 a	8 d	9 b	10 c
11 b	12 d	13 c	14 a	15 c	16 b	17 a	18 d	19 b	20 c
21 c	22 b	23 a	24 b	25 d	26 c	27 b	28 a	29 d	30 b
31 c	32 a	33 c	34 b	35 d	36 a	37 d	38 c	39 a	40 a

## тест 4

1 c	2 b	3 d	4 a	5 d	6 b	7 c	8 d	9 b	10 a
11 d	12 a	13 d	14 b	15 a	16 a	17 d	18 c	19 b	20 c
21 b	22 d	23 a	24 c	25 d	26 a	27 a	28 c	29 b	30 c
31 b	32 d	33 c	34 b	35 a	36 c	37 d	38 b	39 a	40 d

## тест 5

1 b	2 d	3 a	4 c	5 c	6 d	7 a	8 c	9 b	10 d
11 a	12 c	13 b	14 d	15 a	16 a	17 b	18 a	19 d	20 c
21 b	22 a	23 d	24 c	25 b	26 a	27 c	28 b	29 d	30 c
31 a	32 a	33 b	34 c	35 c	36 b	37 a	38 b	39 a	40 a

## тест 6

1 b	2 d	3 a	4 d	5 c	6 a	7 b	8 d	9 b	10 a
11 b	12 c	13 a	14 d	15 b	16 d	17 c	18 a	19 c	20 a
21 d	22 a	23 d	24 b	25 d	26 b	27 a	28 d	29 c	30 b
31 b	32 d	33 b	34 d	35 a	36 d	37 b	38 a	39 d	40 a

## тест 7

1 d	2 b	3 a	4 d	5 b	6 a	7 d	8 a	9 d	10 c
11 b	12 d	13 b	14 c	15 b	16 d	17 b	18 a	19 b	20 a
21 c	22 d	23 b	24 a	25 a	26 d	27 c	28 a	29 b	30 c
31 b	32 d	33 b	34 d	35 c	36 b	37 d	38 a	39 b	40 d

## тест 8

1 b	2 d	3 c	4 a	5 c	6 b	7 a	8 d	9 b	10 c
11 d	12 b	13 c	14 a	15 c	16 b	17 a	18 d	19 b	20 c
21 c	22 a	23 c	24 b	25 d	26 a	27 d	28 c	29 a	30 a
31 c	32 b	33 a	34 b	35 d	36 c	37 b	38 a	39 d	40 b
тест 9									
1 d	2 a	3 d	4 b	5 a	6 a	7 d	8 c	9 b	10 c
11 c	12 b	13 d	14 a	15 d	16 b	17 c	18 d	19 b	20 a
21 b	22 d	23 c	24 b	25 a	26 c	27 d	28 b	29 a	30 d
31 b	32 d	33 a	34 c	35 d	36 a	37 a	38 c	39 b	40 c
тест 10									
1 a	2 c	3 b	4 d	5 a	6 a	7 b	8 a	9 d	10 c
11 b	12 d	13 a	14 c	15 c	16 d	17 a	18 c	19 b	20 d
21 d	22 a	23 b	24 c	25 c	26 b	27 a	28 b	29 a	30 a
31 b	32 a	33 d	34 c	35 b	36 a	37 c	38 b	39 d	40 c

## Список використаних джерел

1. Лебідь О. М., Морозов В. В., Камінська М. О. Англійська мова в геоінформаційних системах: навч. посібник. Херсон: Вид-во ХДУ, 2007. 198 с.
2. Морозов В. В. Ландшафтні меліорації: навч. посібник. Херсон: Вид-во ХДУ, 2007. 224 с.
3. Морозов В. В. Основи системного аналізу в гідромеліорації: навч. посібник. Херсон: Вид-во ХДУ, 2008. 64 с.
4. Управління водними і земельними ресурсами на базі ГІС-технологій: навч. посібник. Херсон: Вид-во ХДУ, 2007. 288 с.
5. Гамаюнов В. Е. Почвоведение: учеб. пособие. Херсон, 1997. 292 с.
6. Гнатенко О. Ф., Капштик М. В., Петренко Л. Р., Вітвицький С. В. Ґрунтознавство з основами геології: навч. посібник. Київ: Оранта, 2005. 648 с.
7. Гордієнко В. П., Недвига М. В., Осадчий О. С., Осінній М. Г. Основи ґрунтознавства і землеробства: підручник. Київ, 2000. 390 с.
8. Крикунов В. Г. Ґрунти і їх родючість: підручник. Київ: Вища школа, 1993. 287 с.
9. Купчик В. І., Іваніна В. В., Нестеров Г. І. та ін. Ґрунти України: властивості, генезис, менеджмент родючості: навч. посібник. Київ: Кондор, 2007. 414 с.
10. Морозов В. В. Земельний кадастр: навч. посібник. Херсон: Вид-во Херсонського державного університету, 2004. – 84 с.
11. Назаренко І. І., Польчина С. М., Нікорич В. А. Ґрунтознавство: підручник. Чернівці, 2003. 400 с.
12. Панас Р. М. Ґрунтознавство: навч. посібник. Львів: Новий Світ. 2000, 2006. 372 с.
13. Тихоненко Д. Г., Горін М. О., Лактіонов М. І. та ін. Ґрунтознавство: підручник. Київ: Вища освіта, 2005. 703 с.
14. Третяк А. М. Земельний кадастр ХХІ століття. Зарубіжні і вітчизняні погляди на розвиток земельного кадастру. Київ, 1999. 115 с.
15. Формування ринку землі в Україні. Київ: Урожай, 2002. 280 с.

## Схожість

Джерела з Інтернету

247

1	<a href="http://www.123seminaronly.com/Seminar-Reports/029/59759661-GSM-Based-Irrigation-System.doc">http://www.123seminaronly.com/Seminar-Reports/029/59759661-GSM-Based-Irrigation-System.doc</a>	2 джерела	8.67%
2	<a href="https://en.wikibooks.org/wiki/Horticulture/Irrigation">https://en.wikibooks.org/wiki/Horticulture/Irrigation</a>		7.84%
3	<a href="https://kids.kiddle.co/Dam">https://kids.kiddle.co/Dam</a>	6 джерел	7.02%
4	<a href="https://www.cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/d/Dam.htm">https://www.cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/d/Dam.htm</a>	2 джерела	6.48%
5	<a href="https://damsandpower.blogspot.com">https://damsandpower.blogspot.com</a>	2 джерела	5.06%
6	<a href="https://en.wikipedia.org/wiki/Irrigation">https://en.wikipedia.org/wiki/Irrigation</a>		4.65%
7	<a href="https://chinajersey13.blogspot.com">https://chinajersey13.blogspot.com</a>		3.33%
8	<a href="https://www.zdamsam.ru/b57784.html">https://www.zdamsam.ru/b57784.html</a>		3.04%
9	<a href="https://www.eijkelkamp.com/files/media/downloads/p050eirrigationmanagement.pdf">https://www.eijkelkamp.com/files/media/downloads/p050eirrigationmanagement.pdf</a>		2.89%
10	<a href="https://en.wikipedia.org/wiki/Drip_irrigation">https://en.wikipedia.org/wiki/Drip_irrigation</a>		2.76%
11	<a href="https://en.wikipedia.org/wiki/Subsurface_drainage">https://en.wikipedia.org/wiki/Subsurface_drainage</a>	3 джерела	2.28%
12	<a href="https://zdamsam.ru/b57790.html">https://zdamsam.ru/b57790.html</a>	8 джерел	2.24%
13	<a href="https://www.usgs.gov/special-topic/water-science-school/science/groundwater-what-groundwater?qt-science_center">https://www.usgs.gov/special-topic/water-science-school/science/groundwater-what-groundwater?qt-science_center</a>	4 джерела	1.65%
14	<a href="http://content.alterra.wur.nl/Internet/webdocs/ilri-publicaties/publicaties/Pub42/pub42-h11.pdf">http://content.alterra.wur.nl/Internet/webdocs/ilri-publicaties/publicaties/Pub42/pub42-h11.pdf</a>	20 джерел	1.61%
15	<a href="http://www.tmacog.org/Environment/Portage%20meetings/2010/7_15_10/07740%20Agricultural%20Drainage.pdf">http://www.tmacog.org/Environment/Portage%20meetings/2010/7_15_10/07740%20Agricultural%20Drainage.pdf</a>	3 джерела	1.04%
16	<a href="http://nuwm.edu.ua/library/text/095.doc">http://nuwm.edu.ua/library/text/095.doc</a>	31 джерело	0.6%
17	<a href="https://www.who.int/water_sanitation_health/dwq/monograph42_chapter3.pdf">https://www.who.int/water_sanitation_health/dwq/monograph42_chapter3.pdf</a>		0.59%
18	<a href="http://www.scert.kerala.gov.in/images/2016/vhse/humanities/agro%20machinery.pdf">http://www.scert.kerala.gov.in/images/2016/vhse/humanities/agro%20machinery.pdf</a>		0.34%
19	<a href="https://www.usbr.gov/tsc/techreferences/designstandards-datacollectionguides/finals-pdfs/DS13-1.pdf">https://www.usbr.gov/tsc/techreferences/designstandards-datacollectionguides/finals-pdfs/DS13-1.pdf</a>		0.23%
20	<a href="https://www.dreamstime.com/stock-video-construction-site-water-drainage-concrete-pipe-near-railway-train-natural">https://www.dreamstime.com/stock-video-construction-site-water-drainage-concrete-pipe-near-railway-train-natural</a>	2 джерела	0.2%





43	<a href="https://www.nap.edu/read/289/chapter/8">https://www.nap.edu/read/289/chapter/8</a>	0.04%
44	<a href="https://knote.edu.ua/file/NjY4NQ==/5dc23d5c71b4002f0d98a84c7c6c4876.pdf">https://knote.edu.ua/file/NjY4NQ==/5dc23d5c71b4002f0d98a84c7c6c4876.pdf</a>	0.03%
45	<a href="https://infourok.ru/testi-po-grammatike-nastoyaschie-vremena-606181.html">https://infourok.ru/testi-po-grammatike-nastoyaschie-vremena-606181.html</a>	0.03%
46	<a href="https://opentextbc.ca/introductiontosociology2ndedition/chapter/chapter-9-social-inequality-in-canada">https://opentextbc.ca/introductiontosociology2ndedition/chapter/chapter-9-social-inequality-in-canada</a>	0.03%
47	<a href="http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/irrigation/about-irrigation">http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/irrigation/about-irrigation</a>	2 джерела 0.03%
48	<a href="http://www.jufnaomi.nl/verkeer.doc">http://www.jufnaomi.nl/verkeer.doc</a>	3 джерела 0.03%
49	<a href="http://web.mnstate.edu/jasperse/Chem210/Extra%20Practice%20Sets%20Chem%20210/Test4%20210%20Nuclear%20">http://web.mnstate.edu/jasperse/Chem210/Extra%20Practice%20Sets%20Chem%20210/Test4%20210%20Nuclear%20</a>	2 джерела 0.03%
50	<a href="https://irondale.weebly.com/uploads/2/4/2/5/24252776/le_chateliers_principle_and_equilibrium__print_-_quizizz.pdf">https://irondale.weebly.com/uploads/2/4/2/5/24252776/le_chateliers_principle_and_equilibrium__print_-_quizizz.pdf</a>	0.03%
51	<a href="https://www.covseindhoven.nl/images/COVS/Arbitraal/Arbitraalnummer_1_2017.pdf">https://www.covseindhoven.nl/images/COVS/Arbitraal/Arbitraalnummer_1_2017.pdf</a>	0.03%
52	<a href="http://dspace.zsmu.edu.ua/bitstream/123456789/2305/1/14Pytannya%20imunoprofilaktyky.pdf">http://dspace.zsmu.edu.ua/bitstream/123456789/2305/1/14Pytannya%20imunoprofilaktyky.pdf</a>	2 джерела 0.03%
53	<a href="http://www.osmu.odessa.ua/ua/vodnotransportnikh-i-shelfovikh-sporud/spec-bud-bach/gidroteh-bud.html">http://www.osmu.odessa.ua/ua/vodnotransportnikh-i-shelfovikh-sporud/spec-bud-bach/gidroteh-bud.html</a>	11 джерел 0.03%
54	<a href="https://en.wikipedia.org/wiki?search=Bach">https://en.wikipedia.org/wiki?search=Bach</a>	29 джерел 0.03%
55	<a href="https://www.slideshare.net/gauravhtandon1/arch-and-buttress-dams">https://www.slideshare.net/gauravhtandon1/arch-and-buttress-dams</a>	4 джерела 0.03%
56	<a href="https://www.tutorialspoint.com/data_structures_algorithms/data_structures_algorithms_mock_test.htm?min=51&amp;max=75">https://www.tutorialspoint.com/data_structures_algorithms/data_structures_algorithms_mock_test.htm?min=51&amp;max=75</a>	0.03%
57	<a href="http://elartu.tntu.edu.ua/bitstream/lib/20887/1/fkztims2009.pdf">http://elartu.tntu.edu.ua/bitstream/lib/20887/1/fkztims2009.pdf</a>	0.03%
58	<a href="https://infopedia.su/20x529a.html">https://infopedia.su/20x529a.html</a>	0.03%
59	<a href="https://www.softwaretestinghelp.com/istqb-exam-questions-equivalence-partitioning-boundary-value-analysis">https://www.softwaretestinghelp.com/istqb-exam-questions-equivalence-partitioning-boundary-value-analysis</a>	0.03%
60	<a href="https://lektsii.net/4-24055.html">https://lektsii.net/4-24055.html</a>	0.03%
61	<a href="https://docplayer.net/82566655-Zbirnik-navchalnih-program-fakultetu-biologiyi-geografiyi-i-ekologiyi.html">https://docplayer.net/82566655-Zbirnik-navchalnih-program-fakultetu-biologiyi-geografiyi-i-ekologiyi.html</a>	0.03%
62	<a href="https://bbresources.s3.amazonaws.com/sites/3/Grammar-PresentPastPerfectContinuous_2672.pdf">https://bbresources.s3.amazonaws.com/sites/3/Grammar-PresentPastPerfectContinuous_2672.pdf</a>	0.03%
63	<a href="https://www.tutorialspoint.com/sap_testing/sap_testing_mock_test.htm">https://www.tutorialspoint.com/sap_testing/sap_testing_mock_test.htm</a>	0.03%
64	<a href="http://docplayer.nl/17753056-Viseon-volginstrument-voor-sociaal-emotionele-ontwikkeling.html">http://docplayer.nl/17753056-Viseon-volginstrument-voor-sociaal-emotionele-ontwikkeling.html</a>	0.03%

65	<a href="https://www.entsoe.eu/fileadmin/user_upload/_library/resources/LCFR/130628-NC_LFCR-Issue1.pdf">https://www.entsoe.eu/fileadmin/user_upload/_library/resources/LCFR/130628-NC_LFCR-Issue1.pdf</a>	0.03%
66	<a href="https://studopedia.org/6-90042.html">https://studopedia.org/6-90042.html</a>	0.03%
67	<a href="https://dspace.library.uu.nl/bitstream/handle/1874/295616/BACHELORSCRIPTIE%20Het%20effect%20van%20woordmoeilijkh...">https://dspace.library.uu.nl/bitstream/handle/1874/295616/BACHELORSCRIPTIE%20Het%20effect%20van%20woordmoeilijkh...</a>	0.03%
68	<a href="https://www.scholieren.com/verslag/antwoorden-biologie-thema-1-tm-7">https://www.scholieren.com/verslag/antwoorden-biologie-thema-1-tm-7</a>	0.03%
69	<a href="https://docplayer.nl/13492245-Beste-leerling-we-wensen-je-heel-veel-succes-vandaag-en-op-je-examen-straks-namens-het-tea...">https://docplayer.nl/13492245-Beste-leerling-we-wensen-je-heel-veel-succes-vandaag-en-op-je-examen-straks-namens-het-tea...</a>	0.03%