МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ЖИТОМИРСЬКИЙ АГРОТЕХНІЧНИЙ КОЛЕДЖ

АНГЛІЙСЬКА МОВА

ЗА ПРОФЕСІЙНИМ СПРЯМУВАННЯМ

НАВЧАЛЬНИЙ ПОСІБНИК

ДЛЯ СТУДЕНТІВ

спеціальності **192 «Будівництво та цивільна інженерія»**
освітніх програм
«Монтаж, обслуговування устаткування і систем газопостачання»
«Обслуговування устаткування систем водопостачання і водовідведення»

Житомир
Видавець О. О. Євенок
2020

УДК [[811.111:651.4/.9]:[69+621]](075.8)

А 64

Рекомендовано методичною радою Житомирського агротехнічного коледжу (Протокол № 5 від 28.05.2020 р.)

Укладач: Лазаренко І. С. – викладач іноземної мови ЖАТК, спеціаліст вищої категорії, викладач-методист

Рецензенти:

Маліновський Е. Ф. – кандидат філологічних наук, доцент, заступник зав. кафедрою іноземних мов Житомирського військового інституту ім. С. П. Корольова

Пилипчук Н. В. – викладач дисципліни «Вступ до спеціальності», спеціаліст вищої категорії, викладач-методист, завідувач відділення Будівництва та цивільної інженерії

Англійська мова за професійним спрямуванням. Навчальний посібник для студентів спеціальності 192 «Будівництво та цивільна інженерія» освітніх програм «Монтаж, обслуговування устаткування і систем газопостачання», «Обслуговування устаткування систем водопостачання і водовідведення» / Житомир: Вид. О. О. Євенок, 2020. – 292 с.

А 64

Навчальний посібник створений для підвищення рівня володіння англійською мовою студентами спеціальності 192 «Будівництво та цивільна інженерія», освітньої програми «Монтаж, обслуговування устаткування і систем газопостачання» та «Обслуговування устаткування систем водопостачання і водовідведення».

Посібник містить ефективну систему засобів, зокрема вправ і завдань, які сприяють формуванню комунікативної компетентності як пріоритетної мети оволодіння студентами іншомовним спілкуванням за професійним спрямуванням. Підбір завдань відкриває широкі можливості як для використання посібника на заняттях, так і для самостійної роботи студентів.

Навчальний посібник знайомить студентів з професійними термінами освітньої програми «Монтаж, обслуговування устаткування і систем газопостачання» та «Обслуговування устаткування систем водопостачання і водовідведення», що дає змогу розуміти фахову літературу та спілкуватися за темами фахового напрямку.

Посібник розрахований на фахівців у галузі монтажу і обслуговування устаткування і систем газо- та водопостачання, наукових працівників, викладачів та студентів вищих навчальних закладів, технікумів і коледжів, що готують спеціалістів для технічної галузі.

УДК [[811.111:651.4/.9]:[69+621]](075.8)

© Лазаренко І. С., 2020

CONTENT

ВСТУП

В даний час в умовах все зростаючого потоку науково-технічної інформації перед фахівцями часто стоїть завдання швидкого пошуку, збору, переробки та обговорення інформації для прийняття рішень у виробничій діяльності. Цільовий пошук інформації розглядається в якості структурного компонента професійної діяльності спеціалісти у технічній галузі.

Навчальний посібник створений відповідно до нормативної програми з дисципліни «Іноземна мова за професійним спрямуванням» і освітньої програми «Монтаж, обслуговування устаткування і систем газопостачання» та «Обслуговування устаткування систем водопостачання і водовідведення» та змін, що відбулися в лінгвістичних та соціально-психологічних концепціях, які лежать в основі неспеціалізованої методики навчання іноземних мов.

Пропонований навчальний посібник має на меті розвиток навичок читання науково-популярної літератури з метою вилучення інформації та вдосконалення навичок професійно орієнтованого усного мовлення. Навчальний посібник відповідає вимогам програми з іноземної мови за професійним спрямуванням для навчальних закладів даного профілю і розраховане на студентів, що мають базову мовну підготовку.

Теоретичною основою навчального посібника є положення про те, що процес професійно орієнтованого читання являє собою складну, комплексну, інтелектуально-пізнавальну діяльність, здійснювану фахівцем в процесі орієнтування в інформаційних джерелах і текстах з поставленої проблеми. Це положення реалізується в посібнику в мовному та методичному аспектах.

Перший з них стосується насамперед текстового матеріалу. Пропоновані тексти відібрані на основі аналізу потенційних ситуацій читання і говоріння, в яких може опинитися майбутній фахівець, в процесі ознайомлення з англомовною літературою за фахом. У навчальний посібник включені оригінальні тексти, що висвітлюють різні проблеми монтажу, обслуговування устаткування і систем газо- та водопостачання. Студентам пропонується інформація, яка дозволяє по-новому подивитися процеси, з якими він зустрінеться на виробництві. Висвітлюються питання глобальних екологічних катастроф, екологічних проблем сучасності, забруднення води, повітря, грунту.

Що стосується методичного аспекту, то тут ставиться завдання максимально наблизити процес навчання до реальної стратегії

інтелектуальної обробки тексту і подальшого використання вилученої з тексту інформації. Ряд завдань направлений головним чином на формування у студентів умінь самостійно визначати цілі і завдання своєї діяльності, планувати її зміст і оцінювати результати.

Навчальний посібник складається з трьох основних розділів – Ділове мовлення, Будівництво та цивільна інженерія: Обслуговування систем водопостачання та водовідведення, Будівництво та цивільна інженерія: Обслуговування систем газопостачання, Навколишнє середовище: Проблеми та захист. Робота над перерахованими розділами представляє собою поетапне оволодіння різними стратегіями і тактиками читання оригінальної науково-популярної літератури з метою пошуку необхідної інформації і її можливого застосування в майбутній професійній діяльності. Навчання проводиться в умовах створення проблемних ситуацій, які організовують навчально-пізнавальну діяльність і вимагають від студентів самостійного пошуку, обговорення іноземною мовою узагальнень, висновків на основі закладеної в тексті інформації.

Посібник розрахований на фахівців у галузі монтажу і обслуговування устаткування і систем газо- та водопостачання, наукових працівників, викладачів та студентів вищих навчальних закладів, технікумів і коледжів, що готують спеціалістів для технічної галузі.

UNIT 1 JOBS AND PROFESSIONS
PART 1 CHOOSING JOBS AND PROFESSIONS

ACTIVITY 1. WHO WOULD YOU CONTACT OR CALL IN THE SITUATIONS GIVEN BELOW? MATCH THE SITUATIONS IN THE LEFT COLUMN WITH THE NAME OF THE JOB OR PROFESSION IN THE RIGHT COLUMN.

1) a filling has come out of one of your teeth	a) a surgeon
2) you need to have your hair cut	b) a lawyer
3)you need legal advice	c) a dentist
4)your house is on fire	d) a mechanic
5) your granny's knee needs an operation	e) a fireman
6)in the shop you want advice on what sort of coffee to buy	f) a psychologist
7)all the lights in your house have gone out	g) a barber/hairdresser
8)your neighbour's flat has been burgled	h) a shop assistant
9)you don't get on well with your parents	i) an accountant
10) you father needs somebody to help his firm with money problems	j) an electrician
	k) a policeman

ACTIVITY 2. FINISH THE FOLLOWING SENTENCES WITH THE NAMES OF JOBS OR PROFESSIONS GIVEN BELOW:

1. A person who deals with office correspondence and records is a ...
2. A person whose job is to treat sick animals is a ...
3. A person who checks in and out books and gives advice on what to read is a ...
4. A person who gets coal from under the ground is a...
5. A person who loads and unloads ships in a port is a ...
6. A person whose job is to cook in a restaurant is a ...
7. A person who sells newspapers and magazines is a ...
8. A person who works in a government office is a ...
9. A person whose job is to help people buy and sell houses is a ...
10. A person who designs buildings is an ...

ACTIVITY 3. CHECK THE MEANING OF THESE WORDS IN THE WORD LIST:

dangerous ……
excitement ……
bombs and rockets ……
adventure ……...
tornadoes ……...
lightning strikes ……..
travel …….
look for ……..

brave ……..
determined …….
hurricanes ……..
courage …….
proud ……
talented …….
patient ……
careful ……...

ACTIVITY 4. READ AND TRANSLATE THE TEXT BELOW. CHOOSE THE NECESSARY WORD AND PUT IN THE SENTENCES:

1) **desk job** – сидяча робота

There are people who don't like desk job. They prefer _____ and _____ Sometimes they even _____ a little danger.

2) **real-life storm chaser** – справжній ловець блискавок

Warren Faidley is a real-life chaser whose job is to photograph _____, _____ and _____. He is very _____ and _____. The _____, adventure and _____ are the things which he likes most about his job.

Jonathan Appley is a war photographer. Every day he wakes up in the middle of a war zone where _____are going off all the time. It's a _____ job which requires a lot of _____. Jonathan wants to show the word the horrors of war so that governments do more to stop them.

Joel Sartore is a _____ wildlife photographer who works with the national Geographic Society. "Photography is the key to the whole world," – he says. "You have to be _____ and _____, but when you see the pictures you have taken, then you feel really _____".

ACTIVITY 5. ADD THE NAMES OF THE PROFESSIONS THAT DEAL WITH THE THINGS LISTED IN THE SECOND COLUMN

JOBS	**1) Money**	bank clerk
	2) Medicine	dentist
	3) Transport	pilot
	4) the Arts	actor
	5) Law and Order	police officer
	6) Restaurant and Hotel	receptionist
	7) Sports	coach
	8) Media	reporter
	9) Education	teacher
	10) Agriculture	farmer
	11) Other	

ACTIVITY 6. WHAT IS MORE IMPORTANT IN A JOB: MAKING A LOT OF MONEY OR PERSONAL SATISFACTION? GIVE REASONS.

ACTIVITY 7. TRANSLATE THE WORDS. MATCH THE OPPOSITES.

1	brave	**a**	unfriendly
2	imaginative	**b**	lazy
3	friendly	**c**	unimaginative
4	sociable	**d**	cowardly
5	hardworking	**e**	unskilled
6	patient	**f**	dishonest
7	polite	**g**	careless
8	smart	**h**	impatient
9	honest	**i**	impolite
10	careful	**j**	shy
11	skillful	**k**	stupid

ACTIVITY 8. WHICH OF THE ADJECTIVES ABOVE BEST DESCRIBE THE PROFESSIONS:

1) A war reporter needs to be ……..
2) A fire fighter needs to be ……
3) A lawyer needs to be ……..
4) A waiter (waitress) needs to be ……
5) A storm chaser needs to be ……
6) A nursery teacher needs to be ……

7) A doctor needs to be ……
8) A mechanic needs to be ……
9) A builder needs to be ……

ACTIVITY 9. BEFORE YOU READ THE TEXT GIVEN BELOW MATCH THE WORDS IN THE LEFT COLUMN WITH THEIR SYNONYMS OR EXPLANATIONS IN THE RIGHT COLUMN:

Part I

1) to realize	a) to get money for some work
2) to rear	b) to give money
3) to apply to college	c) to be happy
4) to refuse	d) to give another job inside the company
5) to give financial support	e) to bring up children
6) to be unemployed	f) to come to classes
7) to be satisfied	g) to enter a college
8) to earn	h) to lose a job
9) to be sacked	i) to understand
10) to attend	j) to be out of work
11) to transfer	k) to say «no»

Part II

12) sales representative	l) someone who pays others to work for him
13) dole	m) someone learning a craft or trade from an employer, a beginner
14) a blue-collar worker	n) money paid for education
15) labourer	o) someone paid to work on a regular basis
16) fee	p) an unskilled worker
17) employer	q) money given to people who are out of work
18) employee	r) a salesman who sells while travelling
19) apprentice	s) a worker

ACTIVITY 10. LOOK AT THIS JOB AD: WHAT WOULD BE ITS ATTRACTIONS - WHAT MIGHT BE ITS DRAWBACKS? BASED ON THE INFORMATION FROM EXERCISE 5 WRITE A LETTER OF APPLICATION TO ACME ATLANTIC.

Work in Bermuda!

ACME Atlantic are a well-known and respected trading company. We handle imports directly from manufacturers in 35 different countries, often to our own specifications, and currently export to 46 different countries worldwide.

We are looking for enthusiastic people to work in our office in Bermuda on temporary 3- 6- and 9-month contracts. Applicants must be able to speak and write at least one foreign language fluently and can be nationals of any country.

Experience in import/export will be an advantage, but as special training will be available this is not essential. The main requirements are a willingness to work as a member of a team, to cope with pressure, to use the telephone in a foreign language and in English and to be prepared occasionally to work long hours when necessary.

There are several posts available and long-term prospects are good, though initially all successful applicants will be contracted for a maximum of 9 months.

The salary we will offer is excellent. We will pay for your return air fare and provide adequate accommodation at a nominal rent.

Please apply in your own handwriting, enclosing your resume, to Charles Fox,

European Sales Office, ACME Atlantic Ltd, 45 Pentonville Road, London EC2 4AC.

ACTIVITY 10. READ THE FOLLOWING INFORMATION ABOUT CV WRITING:

FORMAT FOR A CURRICULUM VITAE (CV)

A Curriculum Vitae, commonly referred to as CV, includes a summary of your educational and academic backgrounds as well as teaching and research experience, publications, presentations, awards, honors, and affiliations.

International employers often expect to read the type of personal information on a curriculum vitae that would not be included on a resume. When writing a CV for graduate school or academia the personal information included in this curriculum vitae template would be omitted.

The following curriculum vitae template will give you an example of what to include in your CV and show the appropriate format for curriculum vitae.

SAMPLE CURRICULUM VITAE TEMPLATE

CONTACT INFORMATION
Name
Address
Telephone
Cell Phone
Email

PERSONAL INFORMATION
Date of Birth
Place of Birth
Citizenship
Visa Status
Sex
Optional Personal information:
Marital Status
Spouse's Name
Children

EMPLOYMENT HISTORY
Work History
Academic Positions
Research and Training

EDUCATION
High School
University
Graduate School
Post-Doctoral Training

PROFESSIONAL QUALIFICATIONS
Certifications and Accreditations
Computer Skills
AWARDS
PUBLICATIONS
PROFESSIONAL MEMBERSHIPS
INTERESTS

ACTIVITY 11. BELOW YOU WILL SEE SOME COMMON EXPRESSIONS THAT YOU MIGHT FIND USEFUL. PUT EACH EXPRESSION INTO THE CORRECT BOX ACCORDING TO THE FUNCTION OF THAT EXPRESSION:

1. May I think about that for a moment? 2. In short, ... 3. What I'm trying to say is... 4. To sum up, ... 5. What are your views on...? 6. Would you mind repeating that? 7. How can I put this? 8. In other words... 9. Sorry to say but... 10. Well, as a matter of fact... 11. I'm not so sure about that 12. Pardon? 13. I can't help thinking the same 14. What are your feelings about...? 15. So in conclusion, ... 16. I see things rather differently myself 17. True enough 18. That's right	19. I don't entirely agree with you 20. Perhaps I should make that clearer by saying... 21. How can I best say this? 22. Could you repeat what you said? 23. I couldn't agree more 24. Actually... 25. To put it another way... 26. That's just what I was thinking 27. In brief, ... 28. Could I just say that ... 29. Well, my own opinion is that... 30. That's my view exactly 31. To summarize, ... 32. What was that? 33. I must take issue with you on that 34. Let me get this right 35. Sorry to interrupt, but... 36. I'm afraid I didn't catch that 37. What's your opinion?

Agreeing with somebody	***Disagreeing with somebody***
Example: Yes, I agree.	Example: I'm afraid I disagree.
Interrupting	***Asking for clarification or repetition***
Example: Excuse me for interrupting.	Example: I'm sorry
Asking somebody for their opinion	***Saying something in another way***
Example: What do you think about..?	Example: What I mean is
Giving yourself time to think	***Summing up***
Example: (in response to a question) Let me see.	Example: So basically.....

ACTIVITY 12. WORK IN GROUPS. THINK OF THE LAST INTERVIEW YOU ATTENDED AND DISCUSS THESE QUESTIONS:

- What was the worst thing about it?
- What difficult questions were you asked?
- Why do you think you were successful, or unsuccessful?
- If you could go through the interview again, what would you do differently?

- In an interview, do you always have to be completely honest?
- What impression do you try to give in an interview?

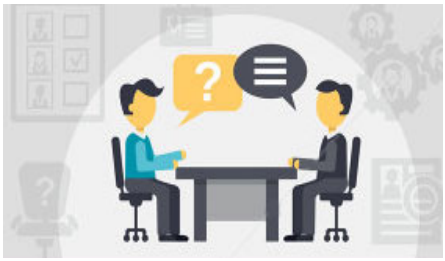
ACTIVITY 13. IMAGINE THAT A YOUNG FRIEND OF YOURS IS ABOUT TO ATTEND HIS OR HER FIRST INTERVIEW. NOTE DOWN SOME MORE ADVICE THAT YOU WOULD GIVE:

e.g. Do your homework: find out about the company, prepare some questions to ask about the company and what the job entails.

Wear smart, formal clothes, etc.

ACTIVITY 14. READ THE FOLLOWING INFORMATION ABOUT AN INTERVIEW, ITS TYPES AND METHODS OF SUCCESS. PREPARE A SHORT PRESENTATION ON EITHER OF THESE TOPICS:

JOB INTERVIEWING. GETTING DOWN TO BASICS



A job interview is your chance to show an employer what he or she will get if you're hired. That is why it is essential to be well prepared for the job interview. There exist five basic types of interviews:

The Screening Interview

This is usually an interview with someone in human resources. It may take place in person or on the telephone. He or she will have a copy of your resume in hand and will try to verify the information on it. The human resources representative will want to find out if you meet the minimum qualifications for the job and, if you do, you will be passed on to the next step.

The Selection Interview

The selection interview is the step in the process which makes people the most anxious.

The employer knows you are qualified to do the job. While you may have the skills to perform the tasks that are required by the job in question, the employer needs to know if you have the personality necessary to "fit in." Someone who can't interact well with management and co-workers may disrupt the functioning of an entire department. This ultimately can affect the company's bottom line.

The Group Interview

In the group interview, several job candidates are interviewed at once. The interviewer or interviewers are trying to separate the leaders from the followers. The interviewer may also be trying to find out if you are a "team player." The type of personality the employer is looking for determines the outcome of this interview. There is nothing more to do than act naturally.

The Panel Interview

The candidate is interviewed by several people at once. It can be quite intimidating as questions are fired at you. You should try to remain calm and establish rapport with each member of the panel. Make eye contact with each member of the panel as you answer his or her question.

The Stress Interview

It is not a very nice way to be introduced to the company that may end up being your future employer. It is, however, a technique sometimes used to weed out those that cannot handle adversity. The interviewer may try to artificially introduce stress into the interview by asking questions so quickly that the candidate doesn't have time to answer each one. The interviewer may also ask weird questions, not to determine what the job candidate answers, but how he or she answers.

Preparing for the Interview

Before you begin to think about how you will dress for the interview, or answer questions, you should gather as much information about the employer as you can. Not only will you appear informed and *intelligent*, it will also help you make a decision if a *job offer* is eventually made.

You might also want to prepare for answering questions by listing some of your *attributes*. Talk to former co-workers with whom you worked closely. Ask them to list some *traits* about you that they most admired - work related, of course.

You want to seem somewhat *spontaneous*, but you also want to appear *self-confident*.

The way to do that is to *rehearse*, not exactly what you will say, but how you will say it. A great method is to rehearse in front of a video camera. Study your *posture*, the way you make eye contact, and your *body language*.

Dressing for the Interview

Appearance is very important and whether we like it or not, it is the first thing people notice about us. You should match your dress to employees in the workplace in which you are interviewing and probably take it up a notch. If dress is very *casual*, those being interviewed should wear dress pants and dress

shirts or skirts and blouses. Don't choose a Friday, since many offices have "*casual Fridays*."

Your hair should be neat and stylish. Your nails should be well manicured and clean.

Men's nails should be short. Women's nails should be of a reasonable length and polished in a neutral color. Also, for women, makeup shouldn't be heavy. Perfume or cologne should be avoided as some people find certain scents offensive.

Establishing Rapport

Since the interviewer's job is to make sure that not only your skill, but your personality as well, is a good match, you must establish rapport with the person or persons interviewing you. That begins the instant you walk in the door. Let the interviewer set the tone. Nothing is as awkward as offering your hand and having the gesture not returned by the other person. Therefore, you should wait for the interviewer to offer his or her hand first, but be ready to offer your hand immediately.

Body Language

They say that body language gives more away about us than speech. Eye contact is very important but make sure it looks natural. A smiling, relaxed face is very inviting.

Hands resting casually in your lap rather than arms folded across your chest also is more inviting.

Answering Questions

When it comes down to it, isn't this the main point of the interview? Speak slowly and clearly. Pause before you answer a question. Your answers will seem less rehearsed and it will give you a chance to collect your thoughts.

Asking Questions

Usually toward the end of the interview, the person conducting it will ask you if you have any questions. You should have some. You should ask about what a typical day would entail. You could also ask what special projects you would be working on. As in every other aspect of the job search, you are trying to show the employer how you can fill their needs.

Illegal Questions

We have all heard horror stories of interviewers asking job candidates inappropriate questions, such as those about marital status, age, and family status. These questions should not be asked, but it is up to you whether to answer them.

Money Questions

Money is a very sensitive topic. The candidate shouldn't bring it up. However, the interviewer may bring it up first. He or she may ask what salary you hope to earn. You must prepare for this question before the interview. Find out what others in the same position are earning. Always give a range, not an exact number. This will help keep you from pricing yourself out of a job. You don't want the employer to think they can't afford you, but you also don't want them to think you are a cheap commodity.

After the Interview

This is something that is too often neglected. It's the thank you note or follow-up letter. It is your chance to reiterate something you mentioned on the interview or bring up something you forgot to mention. It is also a nice gesture and a simple

ACTIVITY 15. HERE ARE SOME TIPS RELATING TO YOUR APPEARANCE AND BODY LANGUAGE. FOR EACH ONE SELECT THE CORRECT MISSING WORD FROM THE OPTIONS BELOW:

1. Make sure your clothes are clean, but _____ wear obvious logos or designer names.

a. do **b.** don't **c**. must

2. Don't use _____ much deodorant or perfume!

a. to **b**. too **c.** two

3. Don't wear too much jewelry. Interviewers don't _____ like rings!

a. never **b.** sometimes **c.** usually

4. Wear _____ that are smart, but comfortable.

a. cloths **b.** clothes **c.** covers

5. Arrive well _____ the interview time.

a. before **b.** after **c.** later than

6. Make eye _____ with the interviewer when you are introduced.

a. contactation **b**. contiction **c.** contact

7. Give a firm handshake, and make sure you _____!

a. snarl **b**. smile **c**. snigger

8. Don't _____. This will distract the interviewer from what you're saying.

a. fidget **b**. figgit **c.** fijit

9. Don't appear over-confident, for example by leaning too far back in your chair, but do try to _____.

a. relax **b**. relapse **c.** collapse

ACTIVITY 16. MATCH THE COMMON INTERVIEW QUESTION ON THE LEFT WITH THE SUITABLE RESPONSE FROM THE LIST ON THE RIGHT:

1. Why did you choose this company? **2.** What are your strengths/weaknesses? **3.** How would your friends describe you? **4.** What is your greatest achievement? **5**. How well do you work in a team? **6.** Where will you be in 5 years?	**A.** People say I'm sociable, organized, and decisive. **B.** My aim is to have a position in the Management Team. **C.** I have excellent time management, but I can be impatient for results. **D.** Because I think I will find the work environment both challenging and rewarding. **E.** I always support my colleagues and believe we should work towards a common goal. **F.** Leading the University football team to the national Championships.

ACTIVITY 17.THE WORDS IN THE COLUMN ON THE RIGHT ARE PHRASES THAT USE THE WORD CAREER. FOR EACH DEFINITION ON THE LEFT, MATCH IT TO THE CORRECT PHRASE ON THE RIGHT:

1. Chances of future success in your career **2**. The direction you hope your career will take **3.** A change you make in order to progress **4.** Time when you are not employed, perhaps when travelling or looking after children **5.** A series of promotions towards more senior positions	**A.** career move **B**. career break **C.** career prospects **D.** career ladder **E.** career plan

ACTIVITY 18. READ THE TEXT BELOW WHICH ADVISES CANDIDATES HOW TO ANSWER DIFFICULT INTERVIEW QUESTIONS. FOR EACH QUESTION, MARK THE CORRECT ANSWER – **RIGHT**, **WRONG** OR **NOT GIVEN**:

Attending interviews

Good interviewers prepare their questions carefully in advance according to the candidate's application and CV. So candidates need to prepare just as carefully. Here are some useful tips on answering interview questions.

1. What don't you like about your current position?

No job is perfect; there's always something we don't like. Be honest but don't give a list of complaints. The important thing is to talk positively about how you deal with problems at work.

2. Where does your employer think you are today?

Be honest. If you lie to your current employer, you'll lie to your next employer. Don't phone in sick on the day of the interview. Take a day's holiday but don't say why.

3. What are your professional objectives?

Think about these before the interview. Your objectives should be relevant to the job you have applied for and achievable. If the new job can't offer you everything you want, the interviewer will think that you probably won't stay with the company very long.

4. What are your weaknesses?

Be honest; no-one is perfect. Think about this before the interview and choose your answer carefully. Talk about how you deal with a weakness; this is far more important than the weakness itself.

1. Interviewers ask every candidate the same questions.
2. You shouldn't mention problems with your current job.
3. You should arrange to have a day off for the interview.
4. You should give your personal objectives.
5. Your objectives should suit the position you apply for.
6. You should practice your answers at home.
7. You shouldn't discuss things you aren't good at.

ACTIVITY 19. WORK IN GROUPS. TAKE TURNS TO CARRY OUT THE INTERVIEW:

Student A:

You are applying for the position of a manager at a famous manufacturing company. You have exactly five minutes to find out if it is the right job for you. Prepare questions on the five features of character which you consider the most important.

Student B:

You are the chair of the manufacturing company. You have exactly five minutes to find out whether the candidate you are interviewing is the right person for the job. Prepare questions on the candidate's experience, character and qualifications.

ACTIVITY 20. READ THE TEXT BELOW. MATCH CHOICES **(F – H)** TO **(1 – 6)**. THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

HOW TO FIND A WELL-PAID BLUE-COLLAR JOB

Profitable blue-collar jobs are not as available as they used to be and the competition is stiff. These jobs involve labour and service to the community and include nurses, police offices and electricians among its rank. Use these steps to find the well-paid blue-collar job you want.

Instructions

1 _____ Though many consider blue-collar jobs nothing more than manual labour, many positions require workers with specialized skills. Physical labour and long work hours may be needed for certain jobs.

2 _____ Blue collar jobs that are continuing to experience growth have a desperate need for talented workers. "The Occupational Handbook" from the department of labour offers insight into top paying blue-collar careers as well as those which continue to suffer from shortages in available workers.

3 _____ Both trade schools and community colleges offer specialized programs that can give you the skills needed for certain blue-collar jobs. This training often allows you to substitute work experience for the certification or associate degree obtained.

4 _____ Internships show on the job training and may set you above other applicants with similar qualifications.

5 _____ Getting a well-paid blue-collar job may require you working your way up from the bottom. This approach provides insight and knowledge along the way that can't be taught.

6 _____ To find the best paying opportunities, travel to more remote destinations may be necessary. These types of positions often require specialized skills and years of training.

A – Get an internship

B – Go to school

C – Start at the bottom

D – Compare different types of blue-collar jobs

E – Travel to areas that have an abundance of blue-collar jobs openings

F – Show your dedication

G – Look for jobs experiencing growth

H – Be aggressive and make sacrifices

ACTIVITY 21. FILL IN THE GAPS WITH NECESSARY WORDS

1. Blue collar jobs that are continuing to experience growth have a desperate need for talented _____.
2. Internships show on the job training and may set you above other applicants with similar _____.
3. Getting a well-paid blue collar _____ may require you working your way up from the bottom.
4. To find the best paying _____ , travel to more remote destinations may be necessary.
5. Profitable _____ jobs are not as available as they used to be and the competition is stiff.

ACTIVITY 22. READ AND COMPLETE THE TEXT BELOW. FOR EACH OF THE EMPTY SPACES (**1 – 5**) CHOOSE THE CORRECT ANSWER (**A, B, C, D**).

A blue –collar worker is a working-class person who **1** _____ manual labour. Blue-collar work may involve skilled or unskilled manufacturing, mining, sanitation, custodian work, oil field, construction, mechanical, maintenance, and **2** _____ types of physical work. Blue-collar work **3** _____ hourly wage-labour, although some professionals may be paid by the project or salaried.

In contrast, the wite-colour worker typically performs work in an office environment and may involve **4** _____ at a computer or desk. **5** _____ type of work is a service worker (pink colour) whose labor is related to customer interaction, entertainment, sales or other service-oriented work.

1	**A**	performs	**B**	perform	**C**	performed	**D**	performing
2	**A**	many others	**B**	many the other	**C**	many the others	**D**	many other
3	**A**	is often pay	**B**	is often paid	**C**	is often paying	**D**	often paid
4	**A**	sitting	**B**	sit	**C**	sittings	**D**	sat
5	**A**	Threes	**B**	Three	**C**	A third	**D**	Third

ACTIVITY 23. IF YOU DECIDE TO APPLY FOR A JOB YOU WILL PROBABLY NEED TO GO THROUGH INTERVIEW. ANSWER THE FOLLOWING QUESTIONS:

1. Where and when were you born?
2. Are you married or single?
3. Have you got a family?
4. What is your family like?
5. How do your parents earn their living?

6. Will you tell me about education and any special training you have had?
7. Are you working now? What do you do? What is your occupation?
8. What kind of work experience have you had?
9. What kind of job are you looking for?
10. What kind of salary do you expect?
11. What are your spare-time interests?

ACTIVITY 24. READ THE FOLLOWING INFORMATION:

BUSINESS ETIQUETTE

Ethical behavior is doing things that are morally right. *Ethics (countable noun)* are moral beliefs about what is right or wrong. *Ethics (uncountable noun)* is the study of this. Ethically responsible companies want to do the right thing in areas such as:

- **employment and community**: they want to pay attention to things that affect all people, not just their employees, in the areas where the company has its offices, factories and activities.
- **the environment:** they want to conduct business in ways that protect the environment to ensure that the air, rivers etc. are not polluted and plant and animal life are not endangered.
- **winning new business**: they want to get business without engaging in corrupt behaviour, for example offering *bribes* - money given to someone so that they behave unethically.

Companies want to be seen as good corporate citizens, with activities that are beneficial not only for their *stakeholders* - their employees, *shareholders* and so on – but for the community and society as a whole.

Accountability and transparency

Ethical corporate behaviour includes *accountability* - the idea that companies are completely responsible for what they do and that people should be able to expect them to explain their actions.

Transparency is explaining this behaviour in a way that can be understood by outsiders, and not trying to hide anything. Companies may say that they demand high levels of *probity* and *integrity* - complete honesty - from their employees, and that they do not tolerate any form of *misconduct*.

Corporate social responsibility

Companies have long had *codes of ethics* and *codes of conduct* saying how their managers and employees should behave. Now they are looking at these issues in more systematic ways. They are designating executives to oversee the whole area of *corporate social responsibility* (CSR).

ACTIVITY 25. READ THE ARTICLE RELATING TO THE IDEAS IN **ACTIVITY 24**. THEN SAY IF THE STATEMENTS BELOW ARE **TRUE** OR **FALSE**, IDENTIFYING THE PHRASE OR SENTENCE FROM THE ARTICLE THAT CONFIRMS YOUR ANSWER:

HOW TO BECOME GOOD IN ALL AREAS

Few companies are clear about how to manage what can be an amorphous collection of internal initiatives and external relationships on social, environmental and ethical issues. Probity and responsibility must be embedded in a company's culture, strategy and operations from the top down. But how can this be done? A new guide from Business for Social Responsibility, a US non-profit research and advisory organization with 1,400 member companies and affiliates, attempts to answer this by taking the reader step by step through the process of designing a corporate social responsibility management system.

Only a handful of companies have a full CSR management system in place, says the organization, which advises its members on how to make responsible practices integral to their strategy and operations. Its combined annual revenues of nearly $2,000 bn

(£1,300bn) and employ 6m people. They include ABB, British Airways, Coca-Cola, Ikea, Unilever and Wal-Mart. The scandals in the US have underlined how “corporate responsibility taskforces” and codes of conduct are not enough on their own and can sometimes be a smokescreen.

Creating and building a successful CSR management system is a complex, long- term project for any company,” says the report. “It involves a shift in the way a company conducts business and can be likened to implementing other large- scale change initiatives such as total quality management.”

The guide runs through basics such as who currently has responsibility for CSR in the company, why a better management structure might improve things and what “hotbutton” issues (child labour, drug pricing) face different sectors. It encourages companies to think hard about their stakeholders, what their concerns are, how credible and influential they are and whether they are a potential long-term partner or liability.

1. Most companies have clear, coherent policies on social, environmental and ethical issues.
2. If a company behaves with probity, it has high ethical standards.
3. Business for Social Responsibility has a coherent approach to designing a corporate social responsibility management system.
4. It’s simple for a company to add a CSR management system to its day-to-day business.
5. Codes of conduct are enough to ensure ethical behaviour.
6. The guide says that a company’s stakeholders should all be kept happy so that they are all retained by the company over the long term.

ACTIVITY 26. COMPLETE THE SENTENCES, WITH EXPRESSIONS FROM THE TEXT ABOVE:

1. The company was accused of giving _____ to local officials in order to allow their products into the country more quickly.
2. The company has supported several projects in the local _____ where its factories are situated.
3. Voters demanded that there should be greater _____ in the election process so that they could understand it fully.
4. Following the scandals of Enron, WorldCom and others, there is greater emphasis in business schools on the teaching of _____ .

ACTIVITY 27. HOW ETHICAL ARE YOU IN YOUR BUSINESS DEALINGS? FIND OUT WITH THE QUESTIONNAIRE BELOW:

1. You do a lot of travelling on business. Your company pays your air fares and you have collected 'frequent flyer' miles from the airlines that you can exchange for free flights. If you use them for your own personal travel, nobody will know. Will you: **a.** use them for business trips and	2. You are the manager of a charming pub in the country a long way from the nearest town. The owner of the pub wants you to run an 'all you can drink' campaign where the customers can have as much beer as they want for a fixed price. It's bound to attract more customers and be very profitable. Will you:

save your company money? **b.** use them to upgrade your seat to first class on business trips? **c.** book that holiday in the Bahamas that you've always wanted?	**a.** refuse to do it, in case it encourages people to drink and drive? **b.** agree to do it, but put up posters warning against drink-driving and start selling black coffee as well as beer? **c.** refuse to do it unless you receive a profit related bonus?
3. You are the owner of a small business. One of your suppliers, an old friend, has asked you to pay them cash for an order so they can avoid paying VAT. There's no chance of you getting into trouble even if the tax office find out because it is your supplier's responsibility to declare it, not yours. Will you : **a.** refuse? **b.** warn your friend that they could get into trouble but agree if they insist? **c.** agree? (After all, what are friends for?)	4. You have run out of stationery at home and there's plenty of nice blank paper and envelopes in your desk at work. Will you: **a.** resist the temptation to take any home? **b**. take a little home to keep yourself going until you can buy some more? **c.** take plenty home so you don't run out again?
5. You work in the purchasing department of a large company. One of your suppliers has sent you a Christmas present - a case of wine. They know you shouldn't accept it because they also sent a note promising not to	6. You are a financial manager. Until last year, your company had an unbroken record of rising earnings per share, but last year's profits were down. Fortunately, you have received a very large order since the

tell any of your colleagues about it Will you: **a.** send the wine back and never buy anything from that supplier again? **b.** send the wine back and explain you can only accept gifts up to a certain value? **c.** send the wine back and say that you prefer fine malt whisky?	beginning of the present financial year. Your boss tells you to record the new order in last year's accounts, so you don't spoil the company's track record. Will you: **a.** explain it might mislead shareholders and refuse? **b.** refuse unless you can include a note about it in the small print in the annual report? **c.** agree and suggest some other 'legal' ways of making the figures look better this year?
7. You are friendly with someone in the strategic planning department of your company. One day, they give you some confidential information. They tell you about a company they are going to target for take-over. They are sure the share price will rise. You could make a lot of money if you buy shares now. Will you: **a**. tell your colleague they shouldn't pass on confidential information? **b.** thank your colleague but do nothing? **c.** tell your broker to buy as many shares as they can?	8. You are the owner of a small company. A friend offers you a free copy of a computer software program that you need at work. If you accept their offer, you won't have to pay the $700 licensing fee to the software company. Will you: **a**. turn down your friend's offer and buy your own copy? **b**. accept your friend's offer? **c.** accept their offer and charge the company $700 which you can pocket tax-free?

HOW DID YOU SCORE?

Mostly as You may not always be popular with your colleagues but your business contacts know they can trust you to play fair. If some people accuse you of being inflexible, it's because your strong principles make them feel uncomfortable. Your honest approach should bring you success in your career and, although it may be slow coming, it's bound to be long-lasting.	**Mostly bs** You like to do what's right if you can, but realize the world is not an honest place. You've probably noticed the person who tells the truth is not always the person who gets on fastest so you are prepared to make compromises, accepting the fact that in order to do business you sometimes have to bend the rules.	**Mostly cs** If the people around you are behaving dishonestly, you will do everything necessary to ensure they don't get your share. As you see it, if you can't beat them, join them. No doubt you will advance up the ladder of success at top speed because you are very good at telling people exactly what they want to hear. The trouble is, it is not always what they should hear, so your success will probably be short-lived.

ACTIVITY 28. READ THE FOLLOWING INFORMATION ABOUT DIFFERENT CULTURE MANNERS:

Alexandra Adler is an expert in doing business across cultures. She is talking to a group of British businesspeople.

‘Culture is the “way we do things here”. “Here” may be a country, an area, a social class or an organization such as a company or school. You often talk about:

- company or corporate culture: the way a particular company works, and the things it believes are important.
- canteen culture: the ways that people in an organization such as the police think and talk, not approved by the leaders of the organization.
- long-hours culture: where people are expected to work for a long time each day.
- macho culture: ideas typically associated with men: physical strength, aggressiveness, etc.

But you must be careful of stereotypes, fixed ideas that may not be true.’

Distance between managers and the people who work under them varies in different cultures. Look at these two companies.

In Country A, managers are usually easy to talk to - accessible and approachable – and there is a tradition of employees being involved in decision-making as part of a team of equals. This company is not very hierarchical, with only three management layers.

In Country B, managers are usually more distant and remote. Employees may feel quite distant from their managers and have a lot of deference for them: accepting decisions but not participating in them.

Companies in Country B tend to be more hierarchical than those in Country A, with more management layers.

Deference and distance may be shown in language. Some languages have many forms of address that you use to indicate how familiar you are with someone. English only has one form, ‘you’ but distance may be shown in other ways, for example, in whether first names or surnames are used.

ACTIVITY 29. LOOK AT **ACTIVITY 28.** WHICH WORD COMBINATION WITH ***'CULTURE'*** DESCRIBES EACH OF THE FOLLOWING?

1. The men really dominate in this company; they don't make life easy for women at all. All they talk about is football.
2. Among the management here we try to be fair to people from different minorities, but there are still elements of racism among the workforce.
3. Of course, the quality of the work you do after you've been at it for ten hours is not good.
4. There was a time when managers could only wear white shirts in this company – things are a bit less formal now.
5. Here the male managers talk about the market as if it was some kind of battlefield.
6. They say that if you go home at 5.30, you can't be doing your job properly, but I'm going anyway.

ACTIVITY 30. READ THIS INFORMATION AND DECIDE WHETHER THESE PIECES OF ADVICE ABOUT THE ENGLISH-SPEAKING BUSINESS WORLD ARE **TRUE** OR **FALSE:**

In the English-speaking business world, people use first names, even with people they do not know very well. But if you aren't sure, use Mr. and the family name for men, and Mrs. or Miss and the

family name for women, depending on whether they are married or not. Ms. often replaces Mrs. and Miss. You don't use Mr., Mrs., Miss or Ms. with only a first name (e.g. Mr. John) or by itself.

1. It's possible to introduce yourself by saying your family name then your first name.

2. It's possible to use Mr., Mrs. or Miss on its own, or with a first name.

3. British people use Sr. and Jr. to refer to a father and his son.

4. Americans often show their middle name with an initial.

5. You can always use someone's first name to talk to them, even if you don't know them very well.

6. Ms. is being used more and more as a title for women.

7. You can show your qualifications after your name on your business card.

ACTIVITY 31. READ THE FOLLOWING TEXT AND DO THE EXERCISES BELOW:

In Alphaland, businesspeople dress quite formally. The business suit is common, but for men, wearing non-matching jacket and trousers is also a possibility.

In Betatania, the dark business suit is obligatory for men. Some companies allow women to wear trouser suits.

In Gammaria, the business suit is almost as necessary as in Betatania, but with more variation in colours. Some companies require employees to wear formal clothes from Monday to Thursday, and allow less formal ones on what they call casual Fridays or dress-down Fridays. In some places, many banks and shops require people dealing with customers to wear uniforms so that they all dress the same.

In Deltatonia, people dress more casually at work than in the other countries. For men, suits and ties are less common than elsewhere. This is smart casual.

Alexandra Adler continues her seminar on cross-cultural issues. Entertaining and hospitality vary a lot in different cultures.

- In Alphaland, entertaining is important. There are long business lunches in restaurants, where deals are discussed. Professional and private lives are separate, and clients are never invited home.
- In Betatania, evenings are spent drinking and singing in bars with colleagues and clients.
- In Gammaria, lunch can be important, but less so than in Alphaland. Important contacts may be invited to dinner at home. Corporate hospitality is a big industry, with clients invited to big sports events.
- In Deltatonia, restaurants are rare outside the capital. Some entertainment takes place when important clients are invited to people's houses for dinner, or go sailing or to country houses for the weekend, etc.

Attitudes towards time can vary enormously.

In Busyville, people start work at eight, and officially finish at six, though many managers stay much longer. There is a culture of presenteeism: being at work when you don't need to be. There is a two-hour lunch break, and a lot of business is done over restaurant lunches. (Lunch is the main meal. The working breakfast is rare.) There are no snacks between meals, just coffee, so eat properly at meal times.

As for punctuality, you can arrive up to 15 minutes 'late' for meetings. If invited to someone's house (unusual in business), arrive 15-30 minutes after the time given.

Don’t phone people at home about work, and don’t phone them at all after 9 pm. There are a lot of public holidays (about 15) during the year. Busyville is empty in August, as many companies close completely for four weeks. Employees have five weeks’ holiday a year and they usually take four of them in August.

Here are some other areas of potential cultural misunderstanding:

a. distance when talking to people: what is comfortable?

b. eye contact: how much of the time do people look directly at each other?

c. gesture: people make lots of facial gestures? How much do they move their arms and hands?

d. greetings/goodbyes: do people shake hands every time? Are there fixed phrases to say?

e. humour: is this a good way of relaxing people? Or is it out of place in some contexts?

f. physical contact: how much do people touch each other?

g. presents: when should you give them? When should you open them? What should you say when you receive one?

h. rules of conversation and the role of silence: how long can people be silent before they feel uncomfortable? Is it acceptable to interrupt when others are speaking?

In which country might you hear these things:

1. How about a trip out tomorrow afternoon? We could see some horse racing and have a glass of champagne.

2. Do come out with us this evening! I know some great bars. How’s your singing?

3. What are you doing this weekend? You could come to our summer cottage. You’ll meet my family and we can take the boat out.

4. Let’s get out of the office to discuss the deal. I know a nice restaurant near here, with some very good local dishes.

ACTIVITY 32. TICK (**V**) THE THINGS THIS VISITOR TO BUSYVILLE DOES RIGHT, AND PUT A CROSS (**X**) BY HER MISTAKES:

I phoned my contact in her office at 7.30 pm. **(1___)** I suggested a working breakfast the next morning. **(2___)** She wasn't keen, so I suggested lunch. **(3___)** We arranged to meet at her office at 12.30. I arrived at 12.45 **(4___)** and we went to a restaurant, where we had a very good discussion. That evening I wanted to check something, so I found her name in the phone book and phoned her at home. **(5 ___)** She was less friendly than at lunchtime. I said I would be back in Busyville in mid-August. **(6___)** Not a good time, she said, so I suggested September. **(7___)**

ACTIVITY 33. WHICH POINTS IN THE TEXT ABOVE **(ACTIVITY 31)** ARE REFERRED TO IN THIS STORY:

Sally, a student, is working for a company abroad for work experience. The company has employees from all over the world. The head of the company, Henrik, invites Sally to a barbecue for his employees at his home, at 3 pm on Saturday.

She is the first to arrive, at exactly 3 o'clock. When the others arrive, some shake hands with each other. Some kiss on one cheek, others on both cheeks. Others arrive and say hello without kissing or shaking hands. **(1_____)** Some bring wine or flowers, which the host does not open and puts to one side. Others bring nothing. **(2_____)** In conversations, some people move their arms around a lot and seem to make signs with their hands, others keep their hands by their sides. **(3_____)** Some people do not let others finish what they are saying, and others say almost nothing; the people with them seem upset and move away when they can. **(4_____).** Some people look directly at the person they are talking to. Others look away more. **(5_____)** Some touch the arm of the other person whenever they are speaking to them. **(6_____)** notices that some people seem to be slowly moving backwards across the garden as the

conversation goes on, while the person with them is moving forward. **(7_____)**

Later, somebody makes a joke but nobody laughs. Everyone goes quiet. **(8_____)** People start saying goodbye and leaving.

ACTIVITY 34. READ THIS ARTICLE AND CHOOSE ONE OF THESE TITLES FOR IT:

When in Rome ...
Problems that business people face
Travelling abroad
Good manners, good business
Doing business in Europe
I didn't mean to be rude!

Nobody actually wants to cause offence but, as business becomes ever more international, it is increasingly easy to get it wrong. There may be a single European market but it does not mean that managers behave the same in Greece as they do in Denmark.

In many European countries' handshaking is an automatic gesture. In France good manners require that on arriving at a business meeting a manager shakes hands with everyone present. This can be a demanding task and, in a crowded room, may require gymnastic ability if the farthest hand is to be reached.

Handshaking is almost as popular in other countries – including Germany, Belgium and Italy. But Northern Europeans, such as the British and Scandinavians, are not quite so fond of physical demonstrations of friendliness.

In Europe the most common challenge is not the content of the food, but the way you behave as you eat. Some things are just not done. In France it is not good manners to raise tricky questions of business over the main course. Business has its place: after the cheese course. Unless you are prepared to eat in silence you have to talk about something - something, that is, other than the business deal which you are continually chewing over in your head.

Italians give similar importance to the whole process of business entertaining. In fact, in Italy the biggest fear, as course after course appears, is that you entirely forget you are there on business. If you have the energy, you can always do the polite thing when the meal finally ends, and offer to pay. Then, after a lively discussion, you must remember the next polite thing to do - let your host pick up the bill.

In Germany, as you walk sadly back to your hotel room, you may wonder why your apparently friendly hosts have not invited you out for the evening. Don't worry, it is probably nothing personal. Germans do not entertain business people with quite the same enthusiasm as some of their European counterparts.

The Germans are also notable for the amount of formality they bring to business. As an outsider, it is often difficult to know whether colleagues have been working together for 30 years or have just met in the lift. If you are used to calling people by their first names this can be a little strange. To the Germans, titles are important. Forgetting that someone should be called *Herr Doktor* or *Frau Direktorin* might cause serious offence. It is equally offensive to call them by a title they do not possess.

In Italy the question of title is further confused by the fact that everyone with a university degree can be called *Dottore* - and engineers, lawyers and architects may also expect to be called by their professional titles.

These cultural challenges exist side by side with the problems of doing business in a foreign language. Language, of course, is full of difficulties - disaster may be only a syllable away. But the more you know of the culture of the country you are dealing with, the less likely you are to get into difficulties. It is worth the effort. It might be rather hard to explain that the reason you lost the contract was not the product or the price, but the fact that you offended your hosts in a light-hearted comment over an aperitif. Good manners are admired: they can also make or break the deal.

ACTIVITY 35. DECIDE IF THESE STATEMENTS ARE **TRUE** OR **FALSE**, ACCORDING TO THE WRITER:

1. In France you are expected to shake hands with everyone you meet.
2. People in Britain shake hands just as much as people in Germany.
3. In France people prefer talking about business during meals.
4. It is not polite to insist on paying for a meal if you are in Italy.
5. Visitors to Germany never get taken out for meals.
6. German business people don't like to be called by their surnames.
7. Make sure you know what the titles of the German people you meet are.
8. Italian professionals are usually addressed by their titles.
9. A humorous remark always goes down well all over the world.

ACTIVITY 36. DISCUSS THESE QUESTIONS:

1. Which of the ideas in the article do you disagree with?
2. What would you tell a foreign visitor about good manners in your country?
3. How much do you think international business is improved by knowing about foreign people's customs?

ACTIVITY 37. READ THE TEXT BELOW. MATCH CHOICES (**A – H**) TO (**1 – 5**). THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

HOW TO CREATE A FRIENDLY WORKSPACE ENVIRONMENT

Nobody likes to roll out of bed in the morning in dread of going to work. While you and your employer may not be able to reduce the workload that causes some of that dread, you may be able to reduce the stress that comes from working in an unpleasant

environment. Most of us have experience a workplace that was less than friendly. It's not that difficult to create a friendly workplace environment. It just takes a little creativity and initiative.

Instructions

1) _____. Nobody can be sunshine and cheer all the time, but employees who believe in the work they are doing and have confidence in their abilities are more likely to bring a positive attitude to the workplace.

2) _____ . That means trusting them to be accountable for their own time and decisions. While there need to be some parameters in which to work, most people are responsible enough to make sure work is done on time and well.

3) _____ . Consider replacing harsh fluorescent lights with softer lighting and providing workers with ergonomically correct furniture. Furthermore, allowing employees to enhance their workplaces seem more inviting.

4) _____ . Today's busy workers are often trying to juggle careers with family obligations. Provide employees the opportunity to take an hour off here and there to take care of appointments or child care issues or to see a school play. Willingness to be flexible will create a happier, more loyal and more productive workforce.

5) _____ . Don't hesitate to show appreciation for a coworker or employee when he's done something well or helped you complete a project. A friendly gesture of gratitude can go a long way.

A Try to reduce the stress

B Treat employees and coworkers like adults

C Say thank you

D Create a visually friendly and comfortable workplace

E Hire upbeat, positive people who are enthusiastic about their work

F Dismiss or address rumors about workplace changes

G Implement family-friendly and flexible work hours

ACTIVITY 38. READ THE DIALOGUE AND GUESS THE MEANING OF THE WORDS IN BOLD.

— Hello. Is that Mr. Smith? Sable is speaking.
— Hello. How are you?
— Fine. Thanks. Pretty busy. How are you?
— OK. Can't complain.
— Glad to hear it. There is something I'd like to talk over with you. How about having a chat early next week?
— It suits me OK. When and where do we make it?
— Let's make it Monday morning at my office.
— Just a moment... Let me consult my diary... Yes, I guess it'll be all right. Whattime do you suggest?
— Let's make it 10 a.m. Will that suit you?
— Yes, quiet.
— Fine. I'll be looking forward to seeing you.
— See you on Monday. Good-bye.
— Good-bye.

ACTIVITY 39. COMPLETE THE DIALOGUE WITH THE MISSING PARTS AND ACT IT OUT.

much, are, on, fine, invitation, dine, celebration, birthday, expect

— Hello, is that Mr. Snow?
— Yes, this is Snow.
— Mr. Snow, John Mitchell is speaking. Good evening!
— Good evening, Mr. Mitchell! How _____ you?
— Pretty _____ the same. Thanks. How are you?
— I am doing _____. Thanks. Are you engaged ___ Saturday?
— No, I am not. Why?
— Will you come and ____ with us? We shall be delighted.
— Thank you for the _____. What's the occasion?
— It'll be my wife's _____.
— The occasion calls for _____! I should be pleased to come.
— We _____ you and your wife at 7.00 p.m.
— Thank you. So till Saturday. Good-bye!
— Good-bye.

ACTIVITY 40. READ AND COMPLETE THE TEXT BELOW. FOR EACH EMPTY SPACES (1 – 8) CHOOSE THE CORRECT ANSWER (A, B, C, D)

A HOSTILE WORK ENVIRONMENT

The hostile work exist **1)** _____ an employee experiences workplace harassment and fears going to work **2)** _____ the offensive, intimidating, or oppressive atmosphere **3)** _____ by the harasser. A hostile work environment **4)** _____ also be created when management acts in a manner designed to make an employee **5)** _____ in retaliation for some action. For example, if an employee **6)** _____ safety violations at work, was injured, attempted to join a union, or reported regulatory violations by management then their response **7)** _____ to harass and pressure the employee to quit. Employers **8)** _____to force employees to quit by imposing unwarranted discipline, reducing hours, or cutting wages.

1	**a**	while	**b**	what	**c**	when	**d**	which
2	**a**	because	**b**	because of	**c**	so as	**d**	such as
3	**a**	generated	**b**	generate	**c**	generating	**d**	generates
4	**a**	must	**b**	ought	**c**	may	**d**	should
5	**a**	quit	**b**	to quit	**c**	quitted	**d**	quitting
6	**a**	report	**b**	reported	**c**	reports	**d**	reporting
7	**a**	might to be	**b**	might been	**c**	might have been	**d**	might be
8	**a**	trying	**b**	had tried	**c**	were trying	**d**	have tried

ACTIVITY 41. READ THE TEXT BELOW. MATCH CHOICES (A – H) TO (1 – 5). THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

BAD WORK HABITS – AND HOW TO BREAK THEM

When you are considering goals for yourself, don't forget to examine your work life. What changes could you make to become a more productive and pleasant colleague? Experts offer this list of common bad habits at work – and how to break them:

1 _____

Do you spend your first hour at work wondering what you should work on today? "So many people, when they leave their office at 4 to 6 p. m., really have no clue what they are going to do first thing the following morning ", says Glenn Davis, president of

the Next Step Group, which recruits sales and sales management professionals for software and other companies. It's more efficient to plan your next day before you leave work.

2 _____

Answering every email as it comes in may make you seem responsive, but it's not productive. "You feel like you are being a hero because you're dealing with all your email", says Valerie Frederickson, CEO and founder of Valerie Frederickson and Co., "But it has nothing to do with achieving your goals."

3 _____

"Yes, you save time when you work from home by not commuting. But too many people are easily sidetracked by the laundry, their kids or a quick errand." People like to say, "I get so much more done" working from home, David says. And some do – but not everyone. If you work from home, make sure you are putting in a full day's work – and that you are accessible to your colleagues during the workday.

4 _____

Everyone has emergencies from time to time. But it's annoying to have to fill in for the colleague who is late every morning because he's checking on his home-remodeling project, or who misses an entire afternoon because he scheduled a routine dentist appointment for 1:30 p.m .

5 _____

People like coworker who is enthusiastic about what they do. Show that you take pride in your job by presenting yourself well, communicating clearly and doing your best work.

A Being late for meeting
B Not taking care of health and hygiene
C Using inappropriate humour
D Spending the day in "email reaction mode"
E Planning poorly
F Abusing work-form-home privileges
G Not caring about your work
H Putting personal life before work

ACTIVITY 42. READ THE TEXT AGAIN AND DECIDE WHETHER THE STATEMENTS ARE **TRUE (T) OR FALSE (F)**

1. When you are considering goals for yourself, forget to examine your work life.

2. So many people, when they leave their office at 6 to 7 p. m., really have no clue what they are going to do first thing the following morning.

3. It is not more efficient to plan your next day before you leave work.

4. Answering every email as it comes in may make you seem responsive, and it's very productive.

5. You never save time when you work from home by not commuting.

6. Nobody has emergencies from time to time.

7. People like coworker who is enthusiastic about what they do.

8. It's not annoying to have to fill in for the colleague who is late every morning.

ACTIVITY 43. READ THE FOLLOWING TEXT AND DO **THE TRUE/FALSE ACTIVITY** THAT FOLLOWS IT.

CHOOSING YOUR WAY IN LIFE

Mary Glass is thirty-nine years old and she is a doctor. She chose the medical profession because she wanted to help people and at the same time to make good money. When Mary was younger her wish was to become a teacher or a nurse but she soon realized that there was not much money in either of those professions. Mary's parents were rather old-fashioned people and thought that a woman's place is at home. So, they wanted their daughter to become a secretary, marry a respectable young man, have several children and stay at home working about the house and bringing up the kids. When Mary applied to a medical college, her parents refused to give her any financial support and she had to work as a waitress in a restaurant to earn money for her college fees. She specialized as an optician, made a good career in the hospital she works, got married, had two children and is very much satisfied both with her family life and her business career.

Billy Blackthorn left school when he was sixteen. He didn't study well and had no qualifications. He just wanted to earn some money and got himself a job in a factory. He didn't mind being a blue-collar worker, all he wanted was enough money to take his girlfriend out on a Saturday night. But soon he and his fellow-workers were replaced by robots who could do their job and Bill was sacked. He was out of work for eighteen months and understood how terrible it was to be unemployed. The days seemed so long and the dole that he got was enough only for the cheapest food and second-hand clothes. Bill finally got a job as an unskilled labourer, working for a builder. He is twenty-five now and thinks that it is not too late to start attending night classes and get some extra training so that he can earn more money as a skilled worker.

John Rushton is a businessman. He is fifty years old and he has been working for the same company for twenty-seven years. He thinks that he has a very successful career. He started working for the company as a poorly paid clerk and was one of those nine-to-five white-collar office workers who spend all day with a pencil in one hand and a telephone in the other. He hated it and asked to be transferred to sales where he became one of the company's sales representatives. John travelled all over the country selling the company's products and eventually became the most successful salesperson on the stuff. In ten years, he was promoted to manager of the sales department. He has got a good salary and benefits. He might retire in another ten years and then his pension will allow him to live comfortably in his country house enjoying his hobbies that he has no time for now while he still works.

Joan Evans: This month I am leaving school to face the real world. My main ambition is to live and work abroad. I want to work with people and see the world. I hope to go to college and do a tourism course. When I'm in college, I will learn at least two foreign languages. I think that by the time I'm 30 I'll be married and have a baby. I don't want to be rich and famous, but I do want to enjoy life. That's all anybody can really ask.

Steve Taylor: My greatest wish is to be a manager for Rolls Royce. I will go to work for Rolls Royce as an apprentice, and after 2 or 4 years I will be an engineer. I'm not very ambitious but I'd like to become a manager in Rolls Royce. I'll get married in my mid-twenties because I want to have children and my mother says that you need to be young to cope with them.

ACTIVITY 44. READ THE FOLLOWING STATEMENTS ON THE TEXT AND DECIDE IF THEY ARE, **TRUE OR FALSE:**

1. Mary's parents didn't want their daughter to become a doctor because there was not much money in this profession.
2. Mary financially supported herself through the college by working as a secretary.
3. Mary's job is to test people's eyes.
4. To be a blue-collar worker means to work with a pencil in one hand and a telephone in the other.
5. Bill was rather ambitious about his career when he finished school.
6. Automatization of the factory was the reason of Bill's unemployment.
7. Bill enjoyed, his free time when he was out of work.
8. John didn't get much money when he started his career.
9. John's promotion followed his successful work as a sales representative.
10. John hopes that he will be able to find time for hobbies when he becomes a pensioner.
11. Both Joan and Steve are ambitious young people.

12. Both Joan and Steve want to work and live abroad.

ACTIVITY 45. ANSWER THE FOLLOWING QUESTIONS BY WRITING «YES» OR «NO» NEXT TO EACH OF THEM. THEN WRITE OUT THE NUMBERS OF YOUR «YES» ANSWERS AND LOOK IN THE KEY TO FIND OUT WHAT PROFESSION YOU ARE CUT OUT FOR.

1. Are you interested in the causes of different diseases and their cure?
2. Do you like to read critical articles after you've read a book?
3. Do you like to take responsibility in organizing things (e.g. parties)?
4. Do you like to read historical novels?
5. Do you ever go to listen to symphonies?
6. Do you like to explain to your classmates how to do a sum or write a grammatically correct sentence?
7. Can you say that your first impulse when you see somebody hurt is to give first aid?
8. Do you like to write poetry and prose?
9. Do you like to observe people's behavior?
10. Would you like to find out about the history of your family, the street you live in, your city, etc?
11. Do you enjoy spending time with kids, reading them books, playing with them, helping them, etc?
12. Are you irritated when your sick relatives ask you to help them?
13. Do you soon get tired when you work with dictionaries or reference books?
14. Can you quickly switch from one job to another?
15. Do you like to make reports on history?
16. Do your hobbies include playing musical instruments, drawing or wood carving?
17. Have you ever wanted to give a class instead of your teacher?
18. Are you interested in people's anatomy?

19. Do you like to discuss books with your friends?
20. Do you like to analyze the events that have happened in your or your friends' and relatives' lives?

ACTIVITY 46. CHOOSE THE NECESSARY WORD AND PUT IT INTO THE SENTENCE:

profession, career, a job, support, a manager, unemployed, languages, world, qualifications, salary

1. He didn't study well and had no _____ .
2. My greatest wish is to be _____ for Rolls Royce
3. He just wanted to earn some money and got himself _____ in a factory.
4. She chose the medical _____ because she wanted to help people.
5. Her parents refused to give her any financial _____ and she had to work as a waitress in a restaurant to earn money for her college fees.
6. He was out of work for eighteen months and understood how terrible it was to be _____.
7. John is a businessman. He thinks that he has a very successful _____.
8. He was promoted to manager of the sales department. He has got a good _____ and benefits.

9. This month I am leaving school to face the real _____.
10. When I'm in college, I will learn at least two foreign _____.

ACTIVITY 47. CHOOSE THE CORRECT ITEMS TO COMPLETE THE FOLLOWING DIALOGUE:

do you, introduce myself, with you, How, engineer

1. - Let me _____ _____ to you. I am George Scott.
- _____ do you do, Mr. Scott! My name is John Forest.
- How _____ do, Mr. Forest! I am a teacher of biology. What is your trade?
- I am an _____ from California.
- Pleased to get acquainted with you, Mr. Scott.

Allow, do you, to meet, like, help, much, be great

2. - _____ me to introduce Benjamin Larke to you, Mr. Flake.
- How _____ do, Mr. Flake! Glad _____ you.
- How do you do, Mr. Larke! Pleased to know you. How do you _____ our city?
- I like it very _____, though I haven`t seen much of it.
- I can _____ you. We`ll make a car tour of the city one of the days.
- It will _____!

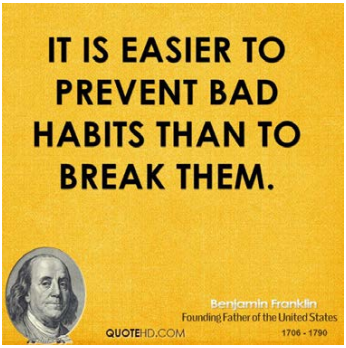
ACTIVITY 48. MAKE YOUR OWN DIALOGUE USING THE FOLLOWING EXPRESSIONS:

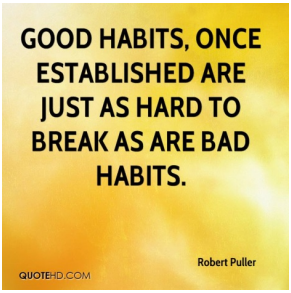
SPEECH PATTERNS:	**МОВНІ ЗРАЗКИ:**
Let me introduce myself to you.	Дозвольте представитися.
Let me introduce you to my aunt.	Дозвольте познайомити Вас з моєю тіткою.
Let me do it for you.	
Let me help you.	Давайте я зроблю це для вас.

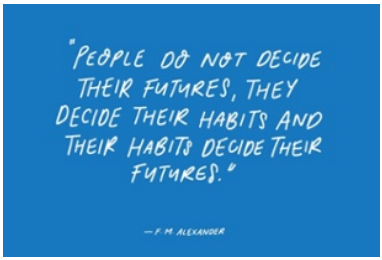
Let me know when you went to see me.	Давайте я допоможу вам. Дайте мені знати, коли захочете меня бачити.
What is your trade? – I am a designer. What is your profession? – I am an architect. What is your occupation? – I am an accountant. What is your? – I am a shop assistant. What is his business? – He is an artist.	Чим ви займаетесь? – Я - дизайнер. Кто ви за професією? – Я - архитектор. Ким ви працюєте? – Я - бухгалтер. Хто ви? – Я- продавець. Чим він займається? – Він - художник.

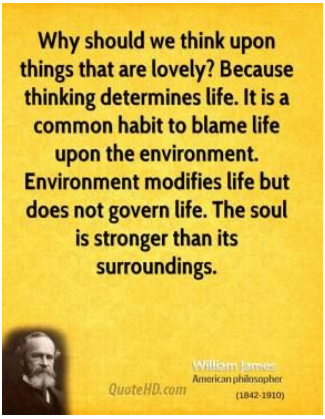
AFTER-READING ACTIVITY

ACTIVITY 1. WRITE RIGHT UKRAINIAN TRANSLATIONS OF ENGLISH SENTENCES:









ACTIVITY 2. LOOK AT THE PICTURE BELOW AND MAKE UP A MESSAGE ABOUT THE CORRECT DRESS CODE

PART 2
WRITING CV AND LETTER OF APPLICATION BUSINESS CORRESPONDENCES

ACTIVITY 1. READ THE FOLLOWING INFORMATION ABOUT WRITING LETTERS OF APPLICATION:

WRITING APPLICATION LETTER

A *letter of application* should create enough interest to make the potential employer want to look at your application in greater detail by reading your CV and hopefully invite you for an interview. Your application letter, however, should not contain too much detail about your *experience* and *qualifications* because that is the job of the CV.

Layout and style

The letter should be limited to one page and a few paragraphs will normally be sufficient. It is better to address a letter to a specific person, e.g. *Dear Miss Chan*, rather than to *Dear Sir or Madam*. However, in some job advertisements the name of the person you are writing to is not given. It is good practice to try to find out the following information before you write your letter:

- the full name of the person you are writing;
- their title - Mr., Mrs., Miss, Ms, Dr, Professor, etc, and;
- their position - Personnel Manager, Human Resources Manager, etc.

All this information can be obtained by a quick phone call to the company. Remember,

never write *Dear Miss W. Chan*. It should be *Dear Miss Chan*. Do not use the initial except in the address. If you start with **Dear Sir/Madam,** it is accepted practice to finish with **Yours faithfully**. Whereas, if you start with **Dear Miss Chan,** you may finish with **Yours sincerely.** Your letter should be neat and free from careless mistakes. You can follow the *blocked* and *open punctuation* style. Whichever layout style you choose to use, you should use it *consistently* throughout the letter.

Structure of the letter

Paragraph 1 It should state clearly **why** you are writing and **where** you saw the job advertised.

1. I would like to apply for the post of ... as advertised in today's issue of...

2. With reference to your advertisement in ... on ..., I am writing to apply for the position of...

Paragraph 2 It should give a little information about your qualifications and experience. Make sure the information you give is relevant to the job that you are applying for.

1. As you can see from my enclosed CV, I have worked in my present position for five years. During this time I have gained invaluable experience in...

2. I am currently a student at TPU studying..... I am due to graduate in.....

Although I have been studying full time, I have had a number of summer jobs which have helped me to gain experience in...

3. My experience over the past two years has been at the managerial level, where I have had responsibility for...

Paragraph 3 It should say **why** you believe you are suited to the job and **what** you can offer the company. Those currently employed can state the reason for wishing to change their present job. However, you should not sound critical of your present employer.

1. I am currently working as a receptionist in ...The reason for my seeking a new position is that I wish to pursue a secretarial career. Unfortunately, there are no openings for advancement in my present employment.

2. For the last two years I have been working as a receptionist in ...Unfortunately the company is moving its main offices overseas and I have therefore decided to look for a new position. I believe that the experience I have gained in ... has given me the qualities you are looking for ...

3. I believe I would be an asset to your company. I will be able to bring with me my experience of ... which I believe would be useful in this position.…

4. I feel that my ability to ... will help/enable me to ...

Paragraph 4 It should tell the reader **when** you are available for an interview and **how** to contact you.

1. I would like to have the opportunity to talk to you further about my application. I am available for interview at any time and I can be contacted at/on ...

2. I am available for an interview at any time but would appreciate two days' notice. I can be contacted on/at...

I look forward to hearing from/meeting you soon.

3. As requested in the advertisement, I enclose a copy of my resume together with a recent photograph.

I look forward to meeting with you to discuss my application further. I am available ... and can be contacted on/at...

Remember you might have to give a bit more detail than in the above examples. You can also combine the language in these examples. Also, it is sometimes useful to gather information about the company so that you know more about its background and policies.

This may help you present yourself in the best light.

ACTIVITY 2. READ AND DISCUSS THE TEXT.

"GOLDEN RULES" FOR WRITING BUSINESS LETTERS

- ✓ Give your letter a heading if it helps the reader to see at a glance what you are writing about.
- ✓ Decide what you are going to say before you start to write.
- ✓ Use short sentences.
- ✓ Put each separate idea in a separate paragraph.
- ✓ Use short words that everyone can understand.
- ✓ Think about your reader.

Your reader ...

... must be able to see exactly what you mean: your letters should be CLEAR;

... must be given all necessary information: your letters should be COMPLETE;

... is a busy person with no time to waste: your letters should be CONCISE;

... must be addressed to in a polite tone: your letters should be COURTEOUS;

... may get a bad impression if there are mistakes in grammar: your letters should be CORRECT.

Seven steps in planning a business letter:

- ✓ Write down your aim: Why are you writing this letter?
- ✓ Assemble all the relevant information and documents.
- ✓ Arrange the points in order of importance. Make rough notes.
- ✓ Write an outline and check it through, considering these questions:

- Have you left any important points out?
- Can the order of presentation be made clear?
- Have you included anything that is not relevant?

Write a first draft, leaving space for additions and changes.

Revise your first draft by considering these questions: Information:

- Does it cover all the essential points?
- Is it correct, relevant and complete?

English:

- Are the grammar, spelling and punctuation correct?

Style:

- Does it look attractive?
- Does it sound natural and sincere?
- Is it the kind of letter you would like to receive yourself?
- Is it clear, concise and courteous?
- Will it give the right impression?

Write, type or dictate your final version.

ACTIVITY 3. TRANSLATE THE FOLLOWING THE FOLLOWING WORD COMBINATIONS THAT ARE USED IN LETTERS AND REMEMBER THEM.

GREETINGS	
Hi! Hello!	
Hello everyone	
Hi there	
Greetings from sunny Spain!	
Dear ….. ,	
SING OFF AND SIGNATURE	
Bye for now, Emma	
See you soon,	
Best wishes,	
Love,	
With love,	
Hugs and kisses,	
Happy Holidays!	
INTRODUCTORY WORDS	
I consider	я вважаю
I think	я думаю

In my opinion	на мою думку
I suppose	я гадаю, я думаю
It seems to me	мені здається
In the very beginning of…	на самому початку …
As far as I understand	наскільки я розумію, як я розумію
As far I see	наскільки я бачу (розумію)
As far as I know	наскільки я знаю
From my personal experience	з мого особистого досвіду
What concerns me As far as I'm concerned	щодо мене
I'm afraid to be wrong but	боюсь помилитись, але
I'm not completely sure but	я не зовсім впевнений, але
Probably	ймовірно
I doubt	я сумніваюся
Even though	хоча
So to speak	так сказати
To say frankly	відверто говорячи
To say honestly	правду кажучи
Don't get offended, but	не ображайся, але
No offense, but	без образ, але
I'm absolutely sure	я абсолютно впевнений
It's clear	ясно. що
It's obvious	очевидно, що
First of all	перш за все (по-перше)
Firstly	по-перше
Secondly	по-друге
The second reason for	друга причина
To begin with	почнемо з того, що
The first thing that needs to be said is …	перше, що варто відмітити
As it's well known	як добре відомо
To make a long story short	коротше говорячи

First and foremost	в першу чергу
Eventually After all	в кінці кінців, в кінцевому рахунку
Finally	накінець
AGREEMENT	
You are right	ви маєте рацію
Yes, sure	так, звичайно
Very well	дуже добре
I believe so	думаю, що так
I agree with you	згоден (погоджуюся) з Вами
Naturally	звичайно
Maybe	можливо
Most likely	дуже схоже на те
Exactly so	саме так
INCOMPLIANCE	
I'm afraid so	боюсь, що це так
I doubt it	сумніваюся в цьому
It can hardly be so	навряд, що це так
Most unlikely	не схоже на те, що
Not a bit! No way!	ні в якому разі!
No go!	звичайно, ні!
Not for a moment!	нізащо в житті!
Nowhere near!	навіть і не близько!
What's the idea of..!	що за дурниця (дурня)!
PERSONAL PICTURE TIPS	
To my surprise	на моє здивування
Unfortunately	нажаль
Fortunately for us	на наше щастя

ACTIVITY 4. SCAN EXAMPLES OF WRITING LETTERS TO A FRIEND AND WRITE YOUR OWN ONES:

45/12, Vyshneva str.
Kyiv, Ukrain
12th January, 2017

Dear Maria,

Thank you for your letter. How are you?

Today I want to tell you about my family. So, my family is not very big. We are three in our family. My parents have one child besides me. Thus, I have my younger brother Sergey. He is 10. Sergey is schoolboy.

My parents are not old at all. My Daddy Alexander is forty, he is a taxi driver and my Mum is thirty-five, she is a nurse.

My grandparents are already pensioners, but they are full of life and energy. They live in the village. They have a big garden around their house. We like to have a rest there.

My family is very friendly. We go in for sports. We like playing football and basketball. Especially my father is good in football.

Write me, please, about your family. How are they?

Love,

Nina

38, Pokrovska str.,
Zhytomyr, Ukraine
17th February, 2018

Dear Anton,

Thank you for your letter. How are you now? I hope that you are OK. Are you still interested in English? Do you like your English lessons at college?

As for me, I like our English lessons at college. They are always very interesting. I like our teacher of English. She is very smart and intelligent. We read interesting texts, listen to dialogues, translate sentences and talk.

Sometimes we play different games and sing English songs. Also, we watch interesting films and cartoons in English. You know I want to have good command of the language. I'm sure if I work systematically as I do now, I will know the language very well. I try to do my best to master English as well as possible. I know that foreign languages are of great importance in our modern life.

And what do you usually do at your English lessons? Tell me about them.

Best wishes,

Tom

5, Svobody str.,
Chernivtsi, Ukraine

Dear David,

How are you? How is your family? You are still fond of sport?

As for me, I like sport very much. And now I am interested in tennis. It is very interesting kind of sport. Tennis helps me to stay fit. I go to the tennis club every Tuesday and Friday. To play tennis you need a racket and a ball.

Also I like football. It is a team kind of sport. There are 11 football players in one team. Players can't touch the ball with their hands. They can only kick it. Only the goalkeeper can touch the ball.

What about you? What is your favourite kind of sport? I'm waiting for your answer.

Best wishes,

Tom

ACTIVITY 5. SCAN AND REMEMBER TOPICAL WORDS:

heading	заголовок
irrelevant	недоречний
to include	містити (в собі)
draft	чернетка
essential	необхідний, обов'язковий
concise	короткий, стислий
courteous	ввічливий, чемний
letterhead	друкований бланк (установи)
addressee	адресат
range	низка, ряд
to enclose	вкладати (в пакет), прикладати до листа
up-to-date	сучасний
p.p. ("per procuretionem")	за дорученням
enc. ("enclosure")	вкладка, додаток
advertisement	оголошення, реклама
to cancel	анулювати, скасувати
quality	якість
commodity	товар
on the average	у середньому
to reduce	зменшувати, знижувати
concession	поступка
letter of intent	лист-забов'язання
execution	виконання
exclusive right	виключне право

ACTIVITY 6. NOTES ON LETTER WRITING:

STRUCTURE OF THE LETTER

1. Sender's address / Date.
2. Inside address (receiver's address).
3. Attention line.
4. Salutation.
5. Body of the letter.
6. Complimentary close.
7. Signature.

1.	GIMBEL& CO Ltd 21 High Street, Blackheath, London SE3B 5HY Tel: 01-564-8843 7th May 2002	***The address of the firm sending the letter (the letterhead) is often printed on the paper*** ***The date***
2.	M.Lawson Esq, Manager, Filbury & Johns, 20 Shaftsbury Avenue, London WlA 4WW	***The name, position, firm and address of the addressee***
3.	Our ref: DM/SK Dear Mr Lawson,	***The reference (the initials of the person writing the letter and the person who types it)***
4.	Thank you for your letter of 4th May enquiring about our range of office equipment.	***The first paragraph says why you are writing***
5	I enclose an up-to-date price list and our latest catalogue which I hope includes something of interest to you. You will notice that we offer very favourable terms of payment.	***The second paragraph says what you want or what you are doing (the real reason for writing the letter)***
6.	I look forward to hearing from you again.	***The final paragraph is a polite ending***

7.	Yours sincerely	***You write*** ‘Yours sincerely”, ***if you know the name of the addressee and*** ‘Yours faithfully" ***if you don’t***
8.	David Ripley Sales Manager	***The signature The person writing the letter His position in the firm***
9.	Ends	***Here the enclosures are the catalogue and price list***

ACTIVITY 7. SCAN AND REMEMBER WORDS AND WORD-COMBINATIONS:

Opening Phrases

•Dear Madam	Шановна пані
•Dear Sir	Шановний добродію
•Dear Mister Malforn	Шановний пане Малфорн
•Dear Sirs	Шановні панове
•We have received your letter of...	Ми отримали Вашого листа від ...
•We thank you for your letter of...	Дякуємо за лист від ...
•We have the pleasure to inform you	Ми раді повідомити Вас
•In reply to your letter of	У відповідь на ваш лист від ..
•To inform you	Повідомляємо вас
•We apologize for the delay in answering your letter	Просимо пробачення за затримку з відповіддю на ваш лист

Linking Phrases

•There is no doubt that	Безперечно
•It is necessary to note	Необхідно відзначити, що

•We'd like to draw your attention to the fact...	Звертаємо вашу увагу на той факт, що ...
•Considering the above said	Беручи до уваги сказане
•In this connection	У цьому зв'язку
•In connection with your request	У зв'язку з вашим проханням
•Otherwise we shall have	У противному разі ми будемо змушені
•As regards your request	Щодо вашого прохання
•Up till now we have received no reply	Дотепер ми не отримали відповіді
•In case of delay	У випадку затримки
•In case of your refusal	У випадку вашої відмови
•In case you fail to make payments	У випадку несплати

Closing Phrases

•We are looking forward to receiving your consent /approval / confirmation	Чекаємо вашої згоди / схвалення/ підтвердження
•Your prompt execution of our order would be appreciated	Будемо вам вдячні за швидке виконання нашого замовлення
•We wish to maintain cooperation with you	Сподіваємося підтримувати співробітництво
•Your early reply will be appreciated	Будемо вам вдячні за швидку відповідь
•We are looking forward to hearing from you	Сподіваємося отримати від Вас відповідь найближчим часом
•If we can be of any assistance,	Просимо звертатися

please do not hesitate to contact us	до нас, якщо ви потребуєте допомоги
•Yours faithfully	З повагою
•Yours sincerely	З повагою

ACTIVITY 8. READ AND DISCUSS THE LETTERS.

LETTER 1

London State University
24 Bonn str.,
London, NE,
England
15th May, 2017

Miss Nina Ivanenko
69, Nova str.,
Kyiv, 1421
Ukraine

Dear Miss Ivanenko,

If you want to take part in the competition, please send us your report and more detailrd description of your research results.

We also should be grateful if you would enclose references from your Chemistry teacher and fill in the questionnaire attached.

Thanks in advance.

Regards,
M. Davis, Secretary
London State University

LETTER 2

Eco Build Ltd.
26, Green Way,
London, SE10 8QY
14yh October, 2018

Mrs. Mary Need
75 Baker str.,
London, NW2 2LK
Dear Mrs. Need,

I have pleasure in inviting you to attend our special conference to be held at Benny Hotel, London on 11th December, 2018.

The seminar is organized by professional speakers who will give expert advice on many useful topics.

If you would like to join us, please complete the enclosed registration form and send in back to me before 30th October with your fee of £ 80 per person.

I look forward to your reply and to seeing you at our conference.

Regards,
Emily Smith,
President Eco Build Ltd.

LETTER 3

Mary Clifford
34 Chelsey str.,
Quantico, FU
22th January, 2017

Winter Brothers
25th Street,
Los Angeles, LA
Dear Sir,

I have seen your advertisement in the Sunny Days Journal, and will really appreciate if you send me more detailed description of your products. I would also like to know more about the discounts you provide for foreign students and special cooperation terms for distributers.

I am really interested in purchasing all the volumes of your reference book.

I am looking forward to your replay.

Yours faithfully,

Mary Clifford

P.S. Maybe there are some other books you have? I will really appreciate if you could share their titles.

LETTER 4

Emma Peters
Sale Consultant
Prime Time Ltd.
45 Somerset Lane
Salt lake City, UT, USA
12th May, 2017

Mr. Bill Hong
Managing Director EH Inc.
21 Lime str.,
London, E1 7D4
United Kingdom

Dear Mr. Hong,

Because Mr. Jones is out of the office for three weeks I am acknowledging receipt of your letter dated April 29, 2017. It will be brought to his attention immediately upon his return. If I may be of any assistance during Mr. Jons' absence, please do not hesitate to contact me.

Regards,
Emma Peters
Sale Consultant Prime Time Ltd.

LETTER 5

D. Clark,
Sales Manager,
Priston & Co Ltd,
28 Kolas Court,
North Middletown, NJ

07734 USA
5th March, 2018

Our ref: MP/NK

Dear Mr. Clark,

Thank you for your offer of 3d March.

We are favourably impressed by the quality of your commodity, but feel that the price is rather high. The prices quoted by other suppliers are, on the average, 10% lower. However, in view of the high quality of your commodity, we are ready to make a deal with you if you re-examine your prices.

If you reduce your price by 5% we will place an order for some 10.000 items. We trust that in view of the size of the order you will see your way of making this concession.

Your early reply will be appreciated.

Yours sincerely,

Mike Parson
Sales Manager

ACTIVITY 9. ANSWER THE QUESTIONS.

1. Who is sending the letter?
2. Who is receiving it?
3. What is the opening phrase?
4. The company is ready to purchase the commodity, isn't it?
5. What is its requirement?
6. What quantity is it ready to buy?
7. Do you think it is worth to make this concession?
8. What is the closing phrase?

ACTIVITY 10. TRANSLATE INTO ENGLISH.

1. Ми отримали вашого листа від 13 вересня 2018.
2. Дякуємо за лист-зобов'язання від 1 березня.
3. Я надсилаю вам цей лист з проханням надіслати каталог вашої продукції.
4. Ми готові співпрацювати з вами.
5. Ми хочемо закупити таку продукцію.
6. Компанія має виключне право на виготовлення цих товарів.

ACTIVITY 11. CHANGE THE FOLLOWING SENTENCES SO AS TO INTRODUCE "MAY".

1. It is possible that Mr. Jones will help us with the work.
2. Perhaps he will lend us some money.
3. It is possible that the manager will write the first draft.
4. Perhaps they will enclose an up-to-date price list.

5. Perhaps the manager will answer the letter himself.
6. It is possible that the prospective customer will enquire about the range of office equipment.
7. Perhaps we will receive the answer tomorrow.

ACTIVITY 12. ASK PERMISSION TO DO THE FOLLOWING.
MODEL: to use the typewriter

May I use the typewriter?
Yes, you may. (Yes, certainly)

1. to take a day-off tomorrow;
2. to come a bit later;
3. to smoke now;
4. to look through the documents;
5. to read the first draft;
6. to type the letter;
7. to use the telephone.

ACTIVITY 13. TRANSLATE INTO UKRAINIAN:

1. A heading can help a reader to see at a glance what you are writing about.
2. Can you decide what you are going to write about?
3. One can use short sentences.
4. We could not assemble all the relevant information.
5. Could you give us all the necessary information?
6. He could not revise your first draft. He had no time for it.
7. She can type the letter herself.

ACTIVITY 14. ANSWER THE QUESTIONS USING “CAN”.

1. Can you type?
2. Can you read and write English?
3. Could you speak English well last year?

4. Could you lend me some money?
5. Can you write this letter yourself?
6. Why couldn't you assemble all the necessary information?
7. Can you write the first draft yourself?

ACTIVITY 15. TRANSLATE INTO UKRAINIAN:

1. You must send the letter by airmail.
2. He must give us all the necessary information.
3. The reader must know exactly what you mean.
4. We have to think about our reader.
5. She has to assemble all the documents.
6. Information must cover all the essential points.
7. We have to consider these questions.
8. They have to make rough notes.
9. Your letters must be courteous.

ACTIVITY 16. REWRITE THIS LETTER IN A SUITABLY FORMAL STYLE. SOME SENTENCES MAY HAVE TO BE LEFT OUT ALTOGETHER. CHECK YOUR VERSION WITH ANOTHER STUDENT:

11 Oakwood Road
Stanhope, Birmingham
8th October

Dear Mr. Scott,

I am writing because you said you wanted a Service technician in The Evening Mail of 7th October. I've put my life story in with this letter. If you look at it you'll see I know a lot about engineering because I've been a maintenance engineer for six years. So I've learnt a lot about servicing manual and electrical systems. I took a conversion course the other day, all about pneumatic, hydraulic and electrical systems. It was pretty easy. Now I'm going to evening classes in the same things, and I hope I'll pass the exams at the end!

I liked your comment in the ad about "good prospects" because I'm not just in it for the money. I want a job that'll mean something. I'm sure you'll understand.

Get in touch if there's anything else you need to know. Give me a ring at work, it's 423419. In the evenings, you can always get me at my mother's in King Oak. I can come and see you at any time except Tuesdays, which are a bit awkward.

Best wishes,

Richard Walters

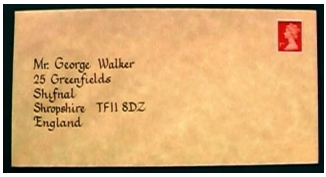
ACTIVITY 17. READ THE FOLLOWING EXTRACTS FROM TWO LETTERS ABOUT THE ADVERTISEMENT FOR ADMINISTRATIVE CLERK. FILL IN EACH BLANK WITH A WORD FROM THE FOLLOWING LIST:

as audio available consider enclose inquiries favourably for form further in opportunity position take to with

A. Dear Sir or Madam,

In reference **(1)…….**your advertisement in today's 'Morning News', I am interested **(2)…….**applying for the **(3)…….**of administrative clerk with your company.

Could you please send me **(4)…….**details and an application **(5)…….**



B. Dear Sir,

I would like to apply **(6)…….** the position of administrative clerk with your company. I **(7)…….** my application form. I am presently working **(8)…….** a secretary in the accounts office at TW Industries. My responsibilities include **(9)…….** and copy typing and dealing **(10)…….**correspondence and telephone **(11)…….** . Twice a week I have been going to evening classes in bookkeeping and I intend to **(12)…….** an examination in three month.

I am applying for the position because I would like an **(13)…….** to make more use of my training.

I would be **(14)…….** for an interview at any time. I hope that you will **(15)…….** my application **(16)…….**

UNIT II WATER AND EQUIPMENT OF WATER SUPPLY SYSTEMS

ACTIVITY 1. READ AND COMPLETE THE TEXT BELOW. FOR EACH OF THE EMPTY SPACES (1 – 10) CHOOSE THE CORRECT ANSWER (A, B, C, D).

WATER

Water is our life source. It makes up 70 per cent of **(1)** ____ bodies, and the average person actually spends 18 months of his life **(2)** _____ the bath or shower.

But we are only now learning how to look **(3)** _____ water. Acid rain **(4)** _____ polluted as many as 18,000 lakes and our seas and rivers are polluted with waste products. It is now **(5**) _____ expensive to try to repair the damage which has been done. We have some hope for the future, though, **(6)** _____ new sources of water have been discovered. People **(7)** _____ in the Sahara Desert have **(8)** _____ fish swimming in deep underground streams.

Scientists also believe **(9)** _____ is a huge lake underneath London. If we have **(10)** _____ anything from our mistakes, we will try to keep these new areas of water clean.

1	A - the	B - their	C - our	D - these	E - them
2	A - in	B - to	C - on	D - at	E - of
3	A - over	B - on	C - after	D - to	E - above
4	A - will	B - has	C - would	D - is	E - are
5	A - very	B - such	C - more	D - much	E - most
6	A - which	B - because	C - so	D - even	E - ever
7	A - live	B - living	C - to live	D - lived	E - love
8	A - realised	B - put	C - looked	D - found	E - founded
9	A - it	B - here	C - that	D - there	E - what
10	A - taught	B -practised	C - known	D - learnt	E - earned

ACTIVITY 2. READ THE TEXT BELOW. MATCH CHOICES **(A – H)** TO **(1 – 4).** THERE ARE FOUR CHOICES YOU DO NOT NEED TO USE.

THE WATER CYCLE: STREAMFLOW

1 _____

When looking at the location of rivers and also the amount of streamflow in rivers, the key concept to know about is the river's "watershed". What is a watershed? Easy, if you are standing on ground right now, just look down. You're standing, and everyone is standing, in a watershed. A watershed is the area of land where all of the water that falls in it and drains off of it goes into the same place. Watersheds can be as small as a footprint in the mud or large enough to encompass all the land that drains water into the Mississippi River where it enters the Gulf of Mexico. Smaller watersheds are contained in bigger watersheds. It all depends of the outflow point — all of the land above that drains water that flows to the outflow point is the watershed for that outflow location. Watersheds are important because the streamflow and the water quality of a river are affected by things, human-induced or not, happening in the land area "above" the river-outflow point

2 _____

Charley River, Yukon, Alaska (USGS)

Streamflow is always changing, from day to day and even minute to minute. Of course, the main influence on streamflow is precipitation runoff in the watershed. Rainfall causes rivers to rise, and a river can even rise if it only rains very far up in the watershed—remember that water that falls in a watershed will eventually drain by the outflow point. The size of a river is highly dependent on the size of its watershed.

Large rivers have watersheds with lots of surface area; small rivers have smaller watersheds. Likewise, different size rivers react differently to storms and rainfall. Large rivers rise and fall slower and at a slower rate than small rivers. In a small watershed, a storm can cause 100 times as much water to flow by each minute as during baseflow periods, but the river will rise and fall possibly in a matter of minutes and hours. Large rivers may take days to rise and fall, and flooding can last for a number of days. After all, it can take days for all the water that fell hundreds of miles upstream to drain past an outflow point.

3 _____

Rivers are invaluable to not only people, but to life everywhere. Not only are rivers a great place for people (and their dogs) to play, but people use river water for drinking-water supplies and irrigation water, to produce electricity, to flush away wastes (hopefully, but not always, treated wastes), to transport merchandise, and to obtain food. Rivers are major aquatic landscapes for all manners of plants and animals. Rivers even help keep the aquifers underground full of water by discharging water downward through their streambeds. And, we've already mentioned that the oceans stay full of water because rivers and runoff continually refresh them.

One word can explain why any river exists on Earth – gravity. You've heard that "water seeks its own level," but really water is seeking the center of the Earth, just like everything else. In practical terms, water generally seeks to flow to the oceans, which are at sea level. So, no matter where on Earth water is, it tries to flow downhill. With the Earth being a very unlevel place, water ends up occupying the valleys and depressions in the landscape as rivers and lakes.

When looking at the location of rivers and the amount of streamflow in rivers, the key concept is the river's "watershed". What is a watershed? Easy, if you are standing on the ground right now, just look down. You're standing, and everyone is standing, in a watershed. A watershed is the area of land where all of the water

that falls in it and drains off of it goes to the same place. Watersheds can be as small as a footprint or large enough to encompass all the land that drains water into rivers that drain into Chesapeake Bay, where it enters the Atlantic Ocean. Larger watersheds contain many smaller watersheds. It all depends on the outflow point; all of the land that drains water to the outflow point is the watershed for that outflow location. Watersheds are important because the streamflow and the water quality of a river are affected by things, human-induced or not, happening in the land area "above" the river-outflow point.

4 _____

Even though the water flowing in rivers is tremendously valuable to not only people but also to much of life on Earth, it makes up just a miniscule amount of Earth's water. Considering just the freshwater on Earth, streamflow in rivers only accounts for about six-one thousands of one percent (0.006%)! The first table below shows that about 0.002 percent of all Earth's water is contained in rivers, and only 0.006 percent of the world's freshwater is in rivers.

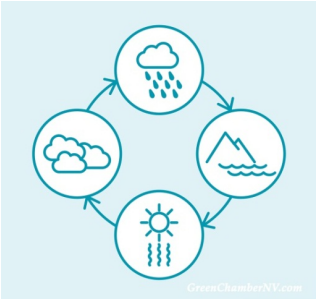
A – Streamflow and global water distribution
B – Watersheds and rivers
C – Importance of rivers
D – The world's freshwater
E – Streamflow is always changing
F – A miniscule amount of Earth's water
G – Large rivers have watersheds
H – The water quality

ACTIVITY 3. LOOK THROUGH THE TEXTS AND FIND THE TITLE AMONG THE EXAMPLES BELOW

TEXT 1.

Large amounts of water are stored in the ground. The water is still moving, possibly very slowly, and it is a part of the water cycle. Most of the water in the ground comes from precipitation that infiltrates downward from the land surface. The upper layer of the soil is the unsaturated zone, where water is present in varying amounts that change over time, but does not saturate the soil. Below this layer is the saturated zone, where all of the pores, cracks, and spaces between rock particles are saturated with water. The term ground water is used to describe this area. Another term for ground water is "aquifer," although this term is usually used to describe water-bearing formations capable of yielding enough water to supply peoples' uses. Aquifers are a huge storehouse of Earth's water and people all over the world depend on ground water in their daily lives.

A – The pumping of wells
B – The breaking waves of the ocean
C – Water existing for long periods below the Earth's surface
D – The term ground water



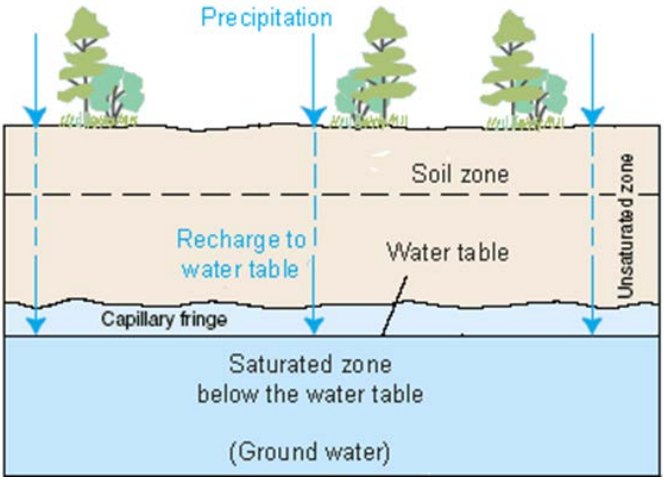
TEXT 2.

GROUNDWATER STORAGE

Large amounts of water are stored in the ground. The water is still moving, possibly very slowly, and it is still part of the water cycle. Most of the water in the ground comes from precipitation that infiltrates downward from the land surface. The upper layer of the soil is the unsaturated zone, where water is present in varying amounts that change over time, but does not saturate the soil. Below this layer is the saturated zone, where all of the pores, cracks, and spaces between rock particles are saturated with water. The term groundwater is used to describe this area. Another term for groundwater is "aquifer," although this term is usually used to describe water-bearing formations capable of yielding enough water to supply peoples' uses. Aquifers are a huge storehouse of Earth's water and people all over the world depend on groundwater in their daily lives.

The top of the surface where groundwater occurs is called the water table. In the diagram, you can see how the ground below the water table is saturated with water (the saturated zone). Aquifers are replenished by the seepage of precipitation that falls on the land, but there are many geologic, meteorologic, topographic, and human factors that determine the extent and rate to which aquifers are refilled with water. Rocks have different porosity and permeability characteristics, which means that water does not move around the same way in all rocks. Thus, the characteristics of groundwater recharge vary all over the world.

A – Water is the part of the water cycle
B – The saturated zone
C – The characteristics of groundwater
D – Groundwater storage



ACTIVITY 4. READ AND COMPLETE THE TEXT BELOW. FOR EACH OF THE EMPTY SPACES (**1 – 6**) CHOOSE THE CORRECT ANSWER (**A, B, C** or **D**).

TO FIND WATER, LOOK UNDER THE TABLE ... THE WATER TABLE

A hole dug at the beach is **(1)** _____ to illustrate the concept of how at a certain **(2)** _____ the ground, if it is permeable enough to hold water, is saturated with water. The top of the pool of water in this hole is the water table. The water level in the hole is the same as the level of the ocean. Of course, the water level at the beach changes by the minute due to the movement of the tides, and as the tide goes up and down, the water level in the hole moves, too.

In a way, the hole is like a dug well used to access (**3) _____**, albeit saline in this case. But, if this was freshwater, people could grab a bucket an supply themselves with the water they need to live their daily lives. You know that at the beach if you took a bucket and tried to empty the hole, it would refill immediately because the sand is so permeable that water flows easily through it, meaning our "well" is very "high-yielding" (too bad the water is saline). To access freshwater, people have to drill wells deep enough to tap into an aquifer. The well might have to be dozens or thousands of feet **(4) _____**. But the concept is the same as our well at the beach — access the water in the saturated zone where the voids in the rock are full of water.

I hope you appreciate my spending an hour in the blazing sun to dig this hole at the beach. It is a great way to illustrate the concept of how at a certain depth the ground, if it is permeable enough to allow water to move through it, is saturated with water. The top of the **(5) _____** in this hole is the water table. The breaking waves of the ocean are just to the right of this hole, and the water level in the hole is the same as the level of the ocean. Of course, the water level here changes by the minute due to the movement of the tides, and as the tide goes up and down, the water level in the hole moves, too. Just as with this hole, the level of the water table is affected by other environmental (**6) _____**.

1	**A**	a great way	**B**	a very big way	**C**	way is great	**D**	any way
2	**A**	high	**B**	long	**C**	small	**D**	depth
3	**A**	table water	**B**	speed water	**C**	ground water	**D**	dinner water
4	**A**	depth	**B**	deep	**C**	high	**D**	far
5	**A**	pool of water	**B**	level of water	**C**	pump of water	**D**	allow of water
6	**A**	people	**B**	conditions	**C**	saturated zone	**D**	ground water

ACTIVITY 5. CIRCLE THE CORRECT ITEM:

1. The top of the pool of water **in/on** this hole is the water table.

2. If this was freshwater, people **could /can** grab a bucket an supply themselves with the water they need to live their daily lives.

3. It is a great way to illustrate the concept of how at a certain depth the ground, if it is permeable enough to allow water to move **through / to** it, is saturated with water.

4. The top of the pool **in /of** water in this hole is the water table.

5. The water level here changes by the minute **due / thanks** to the movement of the tides, and as the tide goes up and down, the water level in the hole moves, too.

6. Just as with this hole, the level of the water table is affected by other **environmental / surrounding** conditions.

ACTIVITY 5. MATCH THE FOLLOWING WORDS AND WORD COMBINATIONS WITH THEIR UKRAINIAN EQUIVALENTS.

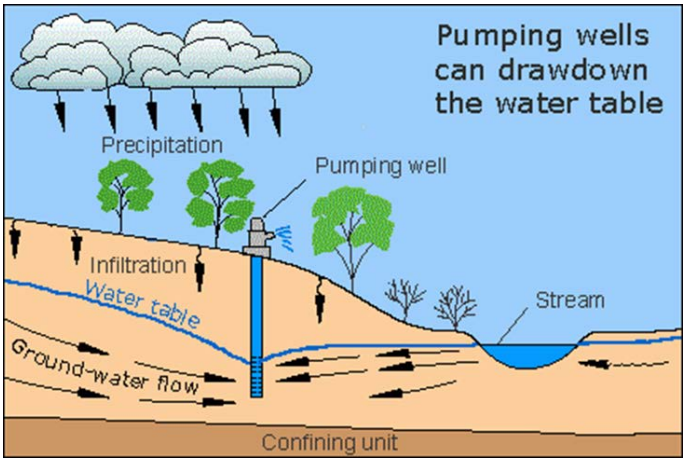
1) saturated zone	a) грунтові води
2) ground water	b) насичена зона
3) hole	c) басейн, калюжа
4) to hold	d) копати, рити
5) to dig	e) тримати, вміщати, зберігати
6) empty	f) спорожняти, висипати, виливати
7) pool	g) яма, діра, дупло
8) to empty	h) порожній, пустий
9) environment	i) навколишнє середовище, стихія

ACTIVITY 6. FILL IN THE GAPS IN THE FOLLOWING SENTENCES WITH THE WORDS GIVEN IN THE BOX.

waves, well, deep, to empty, to move, the top

1. You know that at the beach if you took a bucket and tried _____ the hole, it would refill immediately.
2. The well might have to be dozens or thousands of feet _____.
3. The concept is the same as our _____at the beach — accesses the water in the saturated zone where the voids in the rock are full of water.
4. It is a great way to illustrate the concept of how at a certain depth the ground, if it is permeable enough to allow water _____ through it, is saturated with water.
5. _____ of the pool of water in this hole is the water table.
6. The breaking _____ of the ocean are just to the right of this hole, and the water level in the hole is the same as the level of the ocean.

ACTIVITY 7. READ THE TEXT AND DO THE ACTIVITY WHICH FOLLOWS IT.



PUMPING CAN AFFECT THE LEVEL OF THE WATER TABLE

In an aquifer, the soil and rock are saturated with water. If the aquifer is shallow enough and permeable enough to allow water to move through it at a rapid-enough rate, then people can drill wells into it and withdraw water. The level of the water table can naturally change over time due to changes in weather cycles and precipitation patterns, streamflow and geologic changes, and even human-induced changes, such as the increase in impervious surfaces, such as roads and paved areas, on the landscape.

The pumping of wells can have a great deal of influence on water levels below ground, especially in the vicinity of the well, as this diagram shows. Depending on geologic and hydrologic conditions of the aquifer, the impact on the level of the water table can be short-lived or last for decades, and the water level can fall a small amount or many hundreds of feet. Excessive pumping can lower the water table so much that the wells no longer supply water — they can "go dry."

A) MAKE THE SENTENCES NEGATIVE AND INTERROGATIVE.

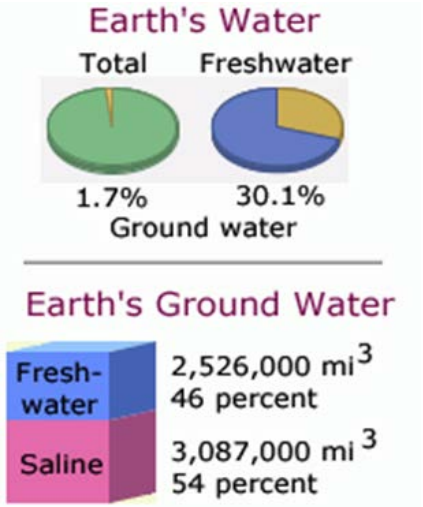
1) The soil and rock is saturated with water.
2) The level of the water table can naturally change over time.
3) The pumping of wells can have a great deal of influence on water levels below ground.
4) Excessive pumping can lower the water table.
5) People can drill wells into it and withdraw water.

B) FIND THE UKRAINIAN EQUIVALENTS OF THE ENGLISH WORDS AND WORD COMBINATION:

immediately	
empty	
below ground	
the level of the water	
to change	
a great deal	
go dry	
pumping	
soil	
rock	
landscape	

ACTIVITY 8. READ THE TEXT AND DO THE ACTIVITY WHICH FOLLOWS IT.

GROUNDWATER AND GLOBAL WATER DISTRIBUTION



As these charts show, even though the amount of water locked up in groundwater is a small percentage of all of Earth's water, it represents a large percentage of total freshwater on Earth. The pie chart shows that about 1.7 percent of all of Earth's water is groundwater and about 30.1 percent of freshwater on Earth occurs as groundwater. As the bar chart shows, about 5,614,000 cubic miles (mi3), or

23,400,000 cubic kilometers (km3), of groundwater exist on Earth. About 54 percent is saline, with the remaining 2,526,000 mi3 (10,530,000 km3) , about 46 percent, being freshwater.

Water in aquifers below the oceans is generally saline, while the water below the land surfaces (where freshwater, which fell as precipitation, infiltrates into the ground) is generally freshwater. There is a stable transition zone that separates saline water and freshwater below ground. It is fortunate for us that the relatively shallow aquifers that people tap with wells contain freshwater, since if we tried to irrigate corn fields with saline water, I suspect the stalks would refuse to grow.

A) DECIDE WHETHER THE FOLLOWING STATEMENTS ARE **TRUE** OR **FALSE**

1. Water in aquifers below the oceans is generally sweet.
2. Even though the amount of water locked up in groundwater is a great percentage of all of Earth's water, it represents a large percentage of total freshwater on Earth.
3. There is a stable transition zone that separates saline water.
4. It is fortunate for us that the relatively shallow aquifers that animals tap with wells contain freshwater.

B) FIND THE UKRAINIAN EQUIVALENTS OF THE ENGLISH WORDS AND WORD COMBINATION:

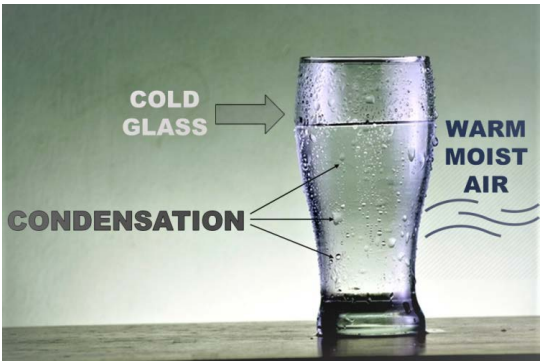
the land surfaces	
Earth's water	
to show	
below the oceans	
stable transition zone	
to suspect	
groundwater	
freshwate	

C) MAKE YOUR OWN SENTENCES WITH THE WORDS FROM THE TABLE

ACTIVITY 9. READ THE TEXT BELOW AND MATCH CHOICES **(A – H)** TO **(1 – 3)**. THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

THE WATER CYCLE: CONDENSATION

(1) _____



Condensation is the process in which water vapor in the air is changed into liquid water. Condensation is crucial to the water cycle because it is responsible for the formation of clouds. These clouds may produce precipitation, which is the primary route for water to return to the Earth's surface within the water cycle. Condensation is the opposite of evaporation.

You don't have to look at something as far away as a cloud to notice condensation, though. Condensation is responsible for ground-level fog, for your glasses fogging up when you go from a cold room to the outdoors on a hot, humid day, for the water that drips off the outside of your glass of iced tea, and for the water on the inside of your home windows on a cold day.

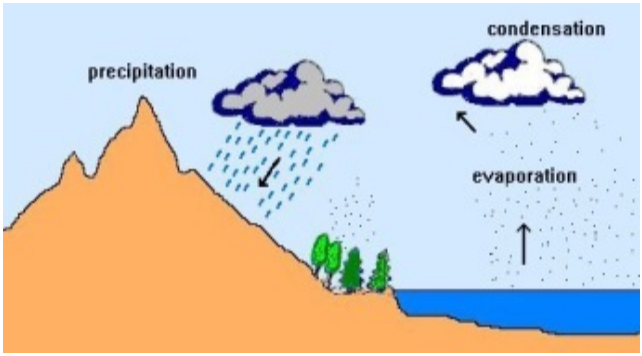
(2) _____

Even though clouds are absent in a crystal-clear blue sky, water is still present in the form of water vapor and droplets which are too small to be seen. Depending on meteorological conditions, water molecules will combine with tiny particles of dust, salt, and smoke

in the air to form cloud droplets, which grow and develop into clouds, a form of water we can see. Cloud droplets can vary greatly in size, from 10 microns (millionths of a meter) to 1 millimeter (mm), and even as large as 5 mm. This process occurs higher in the sky where the air is cooler and more condensation occurs relative to evaporation. As water droplets combine (also known as coalescence) with each other, and grow in size, clouds not only develop, but precipitation may also occur. Precipitation is essentially water cloud in its liquid or solid form falling form the base of a cloud. This seems to happen too often during picnics or large groups of people gather at swimming pools.

(3) _____

As we said, clouds form in the atmosphere because air containing water vapor rises and cools. The key to this process is that air near the Earth's surface is warmed by solar radiation. But, do you know why the atmosphere cools above the Earth's surface? Generally, air pressure, is the reason. Air has mass (and, because of gravity on Earth, weight) and at sea level the weight of a column of air pressing down on your head is about 14 ½ pounds (6.6 kilograms) per square inch. The pressure (weight), called barometric pressure, which results is a consequence of the density of the air above. At higher altitudes, there is less air above, and, thus, less air pressure pressing down. The barometric pressure is lower, and lower barometric pressure is associated with fewer molecules per unit volume. Therefore, the air at higher altitudes is less dense. Since fewer air molecules exist in a certain volume of air, there are fewer molecules colliding with each other, and as a result, there will be less heat produced. This means cooler air. Do you find this confusing? Just think, clouds form all day long without having to understand any of this.



A – Clouds form in the atmosphere
B – You might ask: why is it colder higher up?
C – The barometric pressure
D – Condensation in the air
E – The water cycle

ACTIVITY 10. READ AND COMPLETE THE TEXT BELOW. FOR EACH OF THE EMPTY SPACES **(1 – 7)** CHOOSE THE CORRECT ANSWER **(A, B, C or D).**

WHY DO CLOUDS FORM AND WHY DOES IT RAIN?

Air, even "clear air," contains **(1)** _____. Clouds exist in the atmosphere because of rising air. As air rises and cools the water in it can "condense out", forming clouds. Since clouds drift over the landscape, they are one of the ways that water moves geographically around the globe in the water cycle. A common myth is that clouds form because cooler air can hold less water than warmer air — but this is not true.

As Alistair Fraser explains in his Web page "Bad Meteorology", "What appears to be **(2)** _____ (virtually) always contains sub microscopic drops, but as evaporation exceeds condensation, the drops do not survive long after an initial chance clumping of molecules. As air is cooled, the evaporation rate decreases more rapidly than does the condensation rate with the result that there comes a temperature (the dew point temperature)

where the evaporation is less than the condensation and a droplet can grow into a cloud drop. When the temperature **(3) _____** below the dew-point temperature, there is a net condensation and a cloud forms." (accessed on Sep. 12, 2003).

You've seen the cloud-like trails that high-flying airplanes leave behind and you probably know they are called contrails. Maybe you didn't **(4) _____** they were called that because they are actually condensation trails and, in fact, are not much different than natural clouds. If the exhaust from the airplane contains water vapor, and if the air is very cold (which it often is at high altitudes), then the water vapor in the exhaust will condense out into what is essentially a cirrus cloud.

As a matter of **(5) _____,** sailors have known for some time to look specifically at the patterns and persistence of jet contrails for weather forecasting. On days where the contrails disappear **(6) _____** or don't even form, they can expect continuing good weather, while on days where they persist, a change in the weather pattern may be expected. Contrails are a concern in climate studies as increased jet traffic may result in an increase in cloud cover. Several scientific studies are being conducted with respect to contrail formation and their impact on climates. Cirrus clouds affect **(7) _____**climate by reflecting incoming sunlight and inhibiting heat loss from the surface of the planet. It has been estimated that in certain heavy air-traffic corridors, cloud cover has increased by as much as 20 percent.

1	**A**	water molecules	**B**	water parts	**C**	water drops	**D**	water point
2	**A**	cloud-free sea	**B**	cloud-free air	**C**	cloud-free ground	**D**	cloud-free well
3	**A**	droped	**B**	not drop	**C**	drops	**D**	dropping
4	**A**	known	**B**	unknown	**C**	knew	**D**	know
5	**A**	fact	**B**	point	**C**	mind	**D**	affect
6	**A**	slowely	**B**	quick	**C**	quickly	**D**	bright
7	**A**	Moon	**B**	Earth's	**C**	Earth'	**D**	Moon light

ACTIVITY 11. FIND THE UKRAINIAN EQUIVALENTS OF THE ENGLISH WORDS AND WORD COMBINATION. MAKE YOUR OWN SENTENCES WITH THE WORDS FROM THE TABLE:

to contain	
common myth	
to look at	
heat loss	
weather pattern	
to leave	
high-flying airplanes	
microscopic drops	

ACTIVITY 12. DECIDE WHETHER THE FOLLOWING STATEMENTS ARE **TRUE** OR **FALSE**

1. The clouds form because cooler air can hold less water than warmer air.
2. Clouds exist in the atmosphere because of rising air.
3. If the exhaust from the airplane contains water vapor, and if the air is very cold (which it often is at high altitudes), then the water vapor in the exhaust will condense out into what is essentially a cirrus sky.
4. Sailors have not known for some time to look specifically at the patterns and persistence of jet contrails for weather forecasting.
5. No scientific studies are being conducted with respect to contrail formation and their impact on climates.
6. It has been estimated that in certain heavy air-traffic corridors, cloud cover has increased by as much as 60 percent.

ACTIVITY 13. READ THE TEXT BELOW AND MATCH CHOICES **(A – F)** TO **(1 – 4)**. THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

THE WATER CYCLE: EVAPORATION

(1) _____

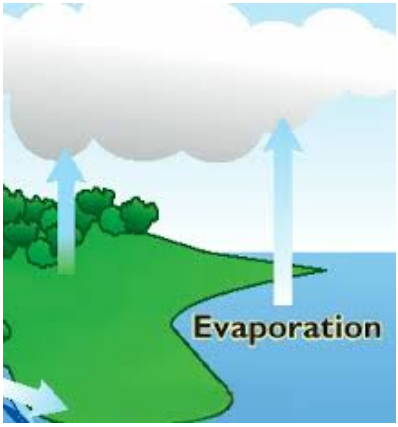
Evaporation is the process by which water changes from a liquid to a gas or vapor. Evaporation is the primary pathway that water moves from the liquid state back into the water cycle as atmospheric water vapor. Studies have shown that the oceans, seas, lakes, and rivers provide nearly 90 percent of the moisture in the atmosphere via evaporation, with the remaining 10 percent being contributed by plant.

A very small amount of water vapor enters the atmosphere through sublimation, the process by which water changes from a solid (ice or snow) to a gas, bypassing the liquid phase. This often happens in the Rocky Mountains as dry and warm Chinook winds blow in from the Pacific in late winter and early spring. When a Chinook takes effect local temperatures rise dramatically in a matter of hours. When the dry air hits the snow, it changes the snow directly into water vapor, bypassing the liquid phase. Sublimation is a common way for snow to disappear quickly in arid climates.

(2) _____

Heat (energy) is necessary for evaporation to occur. Energy is used to break the bonds that hold water molecules together, which is why water easily evaporates at the boiling point (212° F, 100° C) but evaporates much more slowly at the freezing point. Net evaporation occurs when the rate of evaporation exceeds the rate of

condensation. A state of saturation exists when these two process rates are equal, at which point the relative humidity of the air is 100 percent. Condensation, the opposite of evaporation, occurs when saturated air is cooled below the dew point (the temperature to which air must be cooled at a constant pressure for it to become fully saturated with water), such as on the outside of a glass of ice water. In fact, the process of evaporation removes heat from the environment, which is why water evaporating from your skin cools you.



Evaporation from the oceans is the primary mechanism supporting the surface-to-atmosphere portion of the water cycle. After all, the large surface area of the oceans (over 70 percent of the Earth's surface is covered by the oceans) provides the opportunity for large-scale evaporation to occur. On a global scale, the amount of water evaporating is about the same as the amount of water delivered to the Earth as precipitation. This does vary geographically, though. Evaporation is more prevalent over the oceans than precipitation, while over the land, precipitation routinely exceeds evaporation. Most of the water that evaporates from the oceans falls back into the oceans as precipitation. Only about 10 percent of the water evaporated from the oceans is transported over land and falls as precipitation. Once evaporated, a water molecule spends about 10 days in the air. The process of evaporation is so great that without precipitation runoff, and groundwater discharge from aquifers, oceans would become nearly empty.

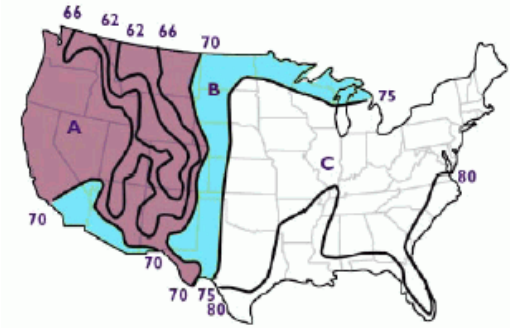
(3) _____

If you ever find yourself stranded on an island in need of some salt, just grab a bowl, add some seawater, and wait for the sun to

evaporate the water. In fact, one way to produce table salt is to evaporate saline water in evaporation ponds, a technique used by people for thousands of years.

Seawater contains other valuable minerals that are easily obtained by evaporation. The Dead Sea is located in the Middle East within a closed watershed and without any means of outflow, which is abnormal for most lakes. The primary mechanism for water to leave the lake is by evaporation, which can be quite high in a desert—upwards of 1,300 - 1,600 millimeters per year. The result is that the waters of the Dead Sea have the highest salinity and density (which is why you float “higher”; when you lay in the water) of any sea in the world, too high to support life. The water is ideal for locating evaporation ponds for the extraction of not only table salt, but also magnesium, potash, and bromine.

We said earlier that heat is removed from the environment during evaporation, leading to a net cooling; notice how cold your arm gets when a physician rubs it with alcohol before pulling out a syringe with that scary-looking needle attached. In climates where the humidity is low and the temperatures are hot, an evaporator cooler, such as a "swamp cooler" can lower the air temperature by 20 degrees F., while it increases humidity.



(4) _____

As this map shows, evaporative coolers work best in the dry areas of the United States (red areas marked A) and can work somewhat in the blue areas marked B. In the humid eastern U.S., normal air conditioners must be used.

Yes, swamp coolers aren't just for homes anymore. After all, the evaporative process is just as happy keeping a dog cool as it is keeping a house cool. Evaporative coolers are really quite simple devices, at least compared to air conditioners. Swamp coolers pull in the dry, hot outdoor air and pass it through an evaporative pad that is kept wet by a supply of water. In a home device, a fan draws the air through the pad, the water in the pad evaporates, resulting in cooler air which is pumped through the house. Much less energy is used as compared to an air conditioner.

A – the process of evaporation
B – Evaporative coolers are quite devices
C – Why evaporation occurs?
D – People make use of evaporation
E – The mechanism supporting the surface-to-atmosphere portion of the water cycle
F – Evaporative coolers work

ACTIVITY 14. READ THE SENTENCES BELOW, TRANSLATE THEM INTO UKRAINIAN. MAKE THE SENTENCES NEGATIVE AND INTERROGATIVE.

1. Only about 10 percent of the water evaporated from the oceans is transported over land.
2. Much less energy is used as compared to an air conditioner.
3. Only about 10 percent of the water evaporated from the oceans falls as precipitation.
4. Evaporation from the oceans is the primary mechanism supporting the surface-to-atmosphere portion of the water cycle.
5. Heat (energy) is necessary for evaporation to occur.
6. A very small amount of water vapor enters the atmosphere through sublimation.

ACTIVITY 15. FILL IN THE GAPS IN THE FOLLOWING SENTENCES WITH THE WORDS GIVEN IN THE BOX.

Condensation, air, evaporation, East, minerals, process, together, water

1. Seawater contains other valuable _____ that are easily obtained by evaporation.
2. The Dead Sea is located in the Middle _____ within a closed watershed and without any means of outflow, which is abnormal for most lakes.
3. The process of _____ is so great that without precipitation runoff.
4. Energy is used to break the bonds that hold water molecules _____.
5. Evaporation is the _____ by which water changes from a liquid to a gas or vapor.
6. A very small amount of _____ vapor enters the atmosphere through sublimation.
7. When the dry _____ hits the snow, it changes the snow directly into water vapor.
8. _____, the opposite of evaporation, occurs when saturated air is cooled below the dew point.

ACTIVITY 16. MATCH THE FOLLOWING WORDS AND WORD COMBINATIONS WITH THEIR UKRAINIAN EQUIVALENTS.

1) seawater	a) випаровування
2) evaporation	b) морська вода
3) primary mechanism	c) паротворні охолоджувачі
4) evaporative coolers	d) первинний механізм
5) swamp coolers	e) опади
6) precipitation	f) точка замерзання
7) freezing point	g) точка кипіння
8) boiling point	h) повітряний кондиціонер
9) air conditioner	i) болотні осушувачі

ACTIVITY 17. READ AND TRANSLATE THE FOLLOWING TEXT:

WATER

Water is a chemical compound of oxygen and hydrogen, the latter gas forming two thirds of its volume. It is the most abundant of all chemical compounds, five seventh of the earth's surface being covered with water. As we know, water does not burn, on the contrary, it is generally used for putting out the fire. Therefore it seems remarkable that the two gases which it is composed of act in the opposite way: one of them – hydrogen – burns, the second – oxygen – making things burn much faster than does air. Hydrogen is the lightest gas known, oxygen being slightly heavier than air. Now, although these two gases, when taken separately, can be compressed

into a much smaller space by pressure, water is one of the most incompressible substances known, properties of a compound being unlike the properties of the elements of which it is made. By means of hydraulic accumulators water can be subjected to a tremendous pressure without appreciably reducing its volume. But in spite of its resistance to compression, it has been calculated that at ocean depths water is compressed to such an extent that the average sea level is 35.6 meters lower than it would be if water were absolutely incompressible.

Water like air is never found quite pure in nature but contains various salts and minerals in solution. Salt water being heavier, some things will float in it which would sink in fresh water; hence it is easier to swim in salt water. When sea water freezes the salt separates from it, ice being quite pure.

The almost endless applications of water are such that without it all life would cease. Water is necessary for the existence of man, animals and plants, every living thing containing large amounts of water. Being a solvent of most substances it is indispensable in chemistry and medicine. When used in engineering its great resistance to compression enables it to transmit enormous power. When we drink water it is almost immediately coursing through our system, the body being purified of poison which is carried off in solution. When heated, water changes into an invisible gas, freezing it we get a solid block of crystals. When evaporated it forms clouds from where it falls on the earth as rain or snow, the soil absorbing the water which appears on the surface again in the form of streams to begin a new cycle of evaporation. In its various changes it is indestructible disappearing only to appear again in another form. It goes round and round, the total amount of water on the earth never changing.

ACTIVITY 18. FIND OUT AND READ THE ANSWERS TO THE QUESTIONS:

1. What is water composed of?
2. What gases does it contain?
3. What are the properties of oxygen and hydrogen?
4. What is generally used for putting out the fire?
5. What gas does things make burn?
6. At what temperature does water become solid?
7. What is the freezing point of water?
8. How do we make ice liquid?
9. How do we distinguish water from ice?
10. What may be compressed easier: a gas or a liquid?
11. What can reduce the volume of a gas?
12. Why must water be purified?

ACTIVITY 19. REPLACE THE INDEPENDENT PARTICIPIAL PHRASE WITH AN INDEPENDENT OR SUBORDINATE SENTENCE:

EXEMPLE: *Rain falling on the ground, the soil absorbs the water.*
When rain falls on the ground the soil absorbs the water.

1. The salt separates from freezing water, the ice being quite pure.
2. Water is never absolutely pure in nature, the amount of impurities depending upon the locality.
3. Chemical industry produces large quantities of synthetic materials, plastics being largely used in everyday life.
4. Polymers losing their properties from atmospheric changes, their manufacture requires special care.
5. An engineer builds houses and cities, an architect planning their construction.

ACTIVITY 20. REPLACE EVERY SECOND SENTENCE WITH THE INDEPENDENT PARTICIPIAL PHRASE IN EVERY EXEMPLE:

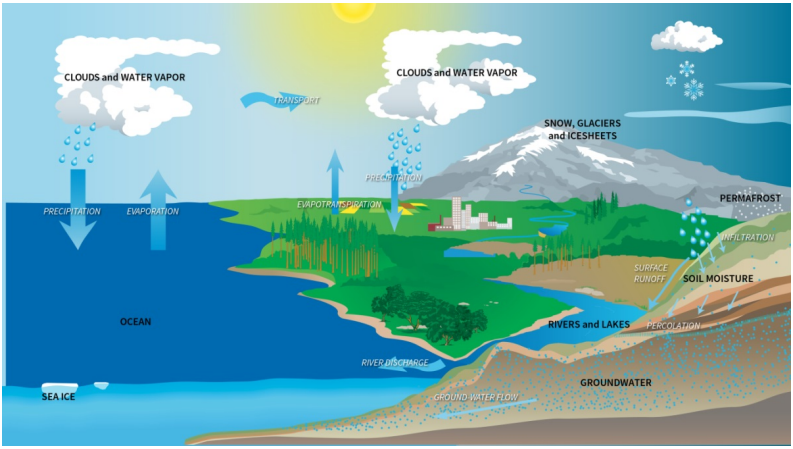
EXEMPLE: *Asbestos doesn't conduct heat, whereas a metal is a good heat conductor.*

Asbestos doesn't conduct heat, a metal being a good heat conductor.

1. Aluminum is a light metal, whereas (but) copper is much heavier.
2. Metals are seldom used in their pure form as alloys have better properties for industrial purposes.
3. Water can be produced in the laboratory if the chemist mixes oxygen and hydrogen.
4. An engineer uses new materials in industry while a chemist studies their properties.

ACTIVITY 21. READ THE TEXT BELOW AND MATCH CHOICES **(A – F)** TO **(1 – 4).** THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

THE MOVEMENT OF WATER OUT OF THE GROUND



1) _____

You see water all around you every day as lakes, rivers, ice, rain and snow. There are also vast amounts of water that are unseen—water existing in the ground. And even though ground water is unseen, it is moving below your feet right now. As part of the water cycle, ground water is a major contributor to flow in many streams and rivers and has a strong influence on river and wetland habitats for plants and animals. People have been using ground water for thousands of years and continue to use it today, largely for drinking water and irrigation. Life on Earth depends on ground water just as it does on surface water.

(2) _____

Some of the precipitation that falls onto the land infiltrates into the ground to become ground water. Once in the ground, some of this water travels close to the land surface and emerges very quickly as discharge into streambeds, but, because of gravity, much of it continues to sink deeper into the ground. If the water meets the water table (below which the soil is saturated), it can move both vertically and horizontally. Water moving downward can also meet more dense and water-resistant non-porous rock and soil, which causes it to flow in a more horizontal fashion, generally towards streams, the ocean, or deeper into the ground.

(3) _____

The direction and speed of groundwater movement is determined by the various characteristics of aquifers and confining layers (which water has a difficult time penetrating) in the ground. Water moving below ground depends on the permeability (how easy or difficult it is for water to move) and on the porosity (the amount of open space in the material) of the subsurface rock. If the rock has characteristics that allow water to move relatively freely through it, then ground water can move significant distances in a number of days. But ground water can also sink into deep aquifers where it takes thousands of years to move back into the environment, or even

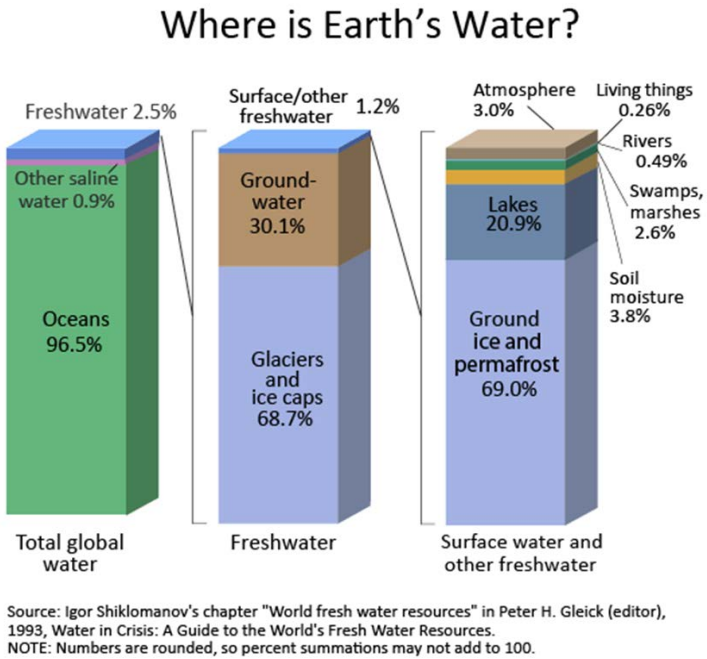
go into deep groundwater storage, where it might stay for much longer periods.

(4) _____

For an estimated explanation of where Earth's water exists, look at the chart below. By now, you know that the water cycle describes the movement of Earth's water, so realize that the chart and table below represent the presence of Earth's water at a single point in time. If you check back in a thousand or million years, no doubt these numbers will be different!

Notice how of the world's total water supply of about 332.5 million cubic miles of water, over 96 percent is saline. And, of the total freshwater, over 68 percent is locked up in ice and glaciers. Another 30 percent of freshwater is in the ground. Fresh surface-water sources, such as rivers and lakes, only constitute about 22,300 cubic miles (93,100 cubic kilometers), which is about 1/150th of one percent of total water. Yet, rivers and lakes are the sources of most of the water people use every day.

A – Groundwater flows underground
B – Groundwater movement
C – Using ground water for thousands of years
D – There's more water than just what you can see
E – Global water distribution
F – How of the world's total water supply



ACTIVITY 23. FILL IN THE GAPS IN THE FOLLOWING SENTENCES WITH THE WORDS GIVEN IN THE BOX.

water, all around, characteristics, water supply, falls, ground water

1. Notice how of the world's total _____ of about 332.5 million cubic miles of water.
2. The direction and speed of groundwater movement is determined by the various _____.
3. Some of the precipitation that _____ onto the land infiltrates into the ground to become ground water.
4. You see water _____ you every day as lakes, rivers, ice, rain and snow.
5. _____ can also sink into deep aquifers where it takes thousands of years to move back into the environment.

6. _____ moving downward can also meet more dense and water-resistant non-porous rock and soil.

ACTIVITY 24. COMPLETE THE FOLLOWING SENTENCES WITH THE CORRECT WORDS.

1. Water is a chemical compound **1** _____ oxygen and hydrogen, the latter gas forming two thirds of its volume.
2. There **2** _____ vast amounts of water that are unseen—water existing in the ground.
3. **3** _____ we know, water does not burn, on the contrary, it is generally used for putting out the fire.
4. Some of the precipitation **4** _____ falls onto the land infiltrates into the ground to become ground water.
5. Water like air is never found quite pure in nature **5** _____ contains various salts and minerals in solution.
6. The direction and speed of groundwater movement is determined **6** _____ the various characteristics of aquifers.
7. Salt water being heavier, some things will float **7** _____ it which would sink in fresh water.

1	**A**	at	**B**	off	**C**	in	**D**	of
2	**A**	was	**B**	will be	**C**	are	**D**	is
3	**A**	Not	**B**	As	**C**	Is	**D**	At
4	**A**	that	**B**	then	**C**	this	**D**	the
5	**A**	and	**B**	or	**C**	that	**D**	but
6	**A**	from	**B**	which	**C**	by	**D**	which
7	**A**	on	**B**	in	**C**	at	**D**	near

ACTIVITY 25. READ AND TRANSLATE THE TEXT BELOW IN UKRAINIAN. COMPLETE THE FOLLOWING TASKS:

a) MAKE A PLAN OF THE TEXT

WATER DISTRIBUTION SYSTEM CHALLENGES AND SOLUTIONS

Providing sufficient water of appropriate quality and quantity has been one of the most important issues in human history. Most ancient civilizations were initiated near water sources. As populations grew, the challenge to meet user demands also increased.

People began to transport water from other locations to their communities. For example, the Romans constructed aqueducts to deliver water from distant sources to their communities.

Today, a water supply system consists of infrastructure that collects, treats, stores, and distributes water between water sources and consumers. Limited new natural water sources, especially in the southwest region of the USA, and rapidly increasing population has led to the need for innovative methods to manage a water supply system. For example, reclaimed water has become an essential water resource for potable and nonpotable uses. Structural system additions including new conveyance systems and treatment and recharge facilities and operation decisions, such as allocating flow and implementing conservation practices, are made with the present and future demands in minds. As additional components and linkages between sources and users are developed, the complexity of the water supply system and the difficulty in understanding how the system will react to changes grows.

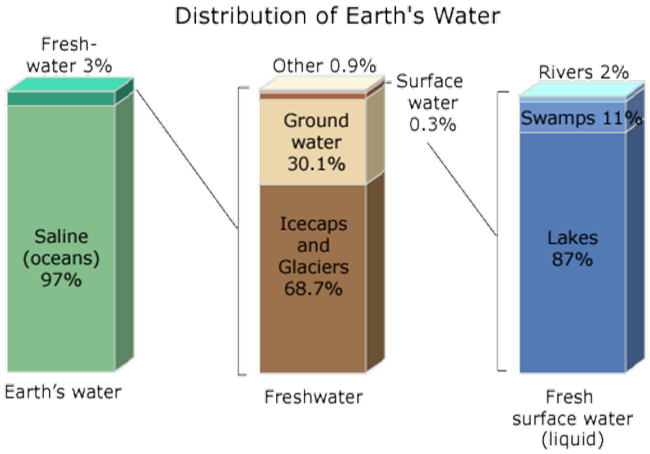
Many efforts on the development of a water supply system have been made through for sustainable water supply. However, the complexity of system limited the site specific application at the first era. As water demands pressures raise increasingly on the existing

water supply system, many studies attempted to develop a general water supply system to assist decision makers to design more reliable systems for a long range operation period. These attempts also include the optimization of total system construction and operation cost. Under given situations such as pipeline maintenance, non-revenue water, advanced metering infrastructure, the ultimate goal of this paper is to ensure water distribution system challenges are overcome and supply water sources to users reliably in a more sustainable and timely manner as a long-term plan.

b) ANSWER THE QUESTIONS

1. What has been of the most important issues in human history?
2. What were most ancient civilizations initiated?
3. What did the Romans construct to deliver water from distant sources to their communities?
3. What does a water supply system consist of?
4. When did the complexity of system limite the site specific application?

c) LOOK AT THE PICTURES BELOW AND MAKE A STORY ABOUT DISTRIBUTION OF EARTH'S WATER.



ACTIVITY 26. READ AND TRANSLATE THE TEXT BELOW IN UKRAINIAN. CHOOSE RIGHT VARIANT OF ADVANTAGES AND DISADVANTAGES FOR EACH TYPE OF PIPE NETWORKS

WATER DISTRIBUTION SYSTEMS

The purpose of distribution system is to deliver water to consumer with appropriate quality, quantity and pressure. Distribution system is used to describe collectively the facilities used to supply water from its source to the point of usage.

Requirements of Good Distribution System

1. Water quality should not get deteriorated in the distribution pipes.
2. It should be capable of supplying water at all the intended places with sufficient pressure head.
3. It should be capable of supplying the requisite amount of water during firefighting.
4. The layout should be such that no consumer would be without water supply, during the repair of any section of the system.
5. All the distribution pipes should be preferably laid one metre away or above the sewer lines.
6. It should be fairly water-tight as to keep losses due to leakage to the minimum.

Layouts of Distribution Network

The distribution pipes are generally laid below the road pavements, and as such their layouts generally follow the layouts of roads. There are, in general, four different types of pipe networks; any one of which either singly or in combinations, can be used for a particular place. They are: Grid, Ring, Radial and Dead End System.

Grid Iron System:

It is suitable for cities with rectangular layout, where the water mains and branches are laid in rectangles.

Advantages	*Disadvantages*

- Water is kept in good circulation due to the absence of dead ends.
- In the cases of a breakdown in some section, water is available from some other direction.
- Exact calculation of sizes of pipes is not possible due to provision of valves on all branches.

Ring System:

The supply main is laid all along the peripheral roads and sub mains branch out from the mains. Thus, this system also follows the grid iron system with the flow pattern similar in character to that of dead end system. So, determination of the size of pipes is easy.

Advantages	*Disadvantages*

- Water can be supplied to any point from at least two directions.

Radial System:

The area is divided into different zones. The water is pumped into the distribution reservoir kept in the middle of each zone and the supply pipes are laid radially ending towards the periphery.

Advantages	*Disadvantages*

- It gives quick service.
- Calculation of pipe sizes is easy.

Dead End System:

It is suitable for old towns and cities having no definite pattern of roads.

Advantages	*Disadvantages*

- Relatively cheap.
- Determination of discharges and pressure easier due to less number of valves.
- Due to many dead ends, stagnation of water occurs in pipes.

ACTIVITY 27. READ THE TEXT BELOW AND MATCH CHOICES **(A – H)** TO **(1 – 4).** THERE ARE FOUR CHOICES YOU DO NOT NEED TO USE.

PIPELINE MAINTENANCE

1 _____

Many water utilities in Asia practice passive leakage control, meaning that they repair only those leaks that are visible. This is clearly not enough since 90% of the leaks are usually not visible on the surface. This means it takes far too long, often many years, until the utility is even aware that there is a leak. Since awareness time largely determines the volume of water lost from a pipe burst, utilities need a strategy to reduce awareness time.

2 _____

The most traditional and basic method is to have a team of leak detection specialists who check all pipes on a regular basis. Since leak noise can be detected, this work is done with a wide range of listening devices, ranging from simple mechanical listening sticks to electronic ground microphones or even leak noise correlators. Leakage inspectors use this equipment to listen to the network and identify problems, much like doctors use stethoscopes. If every part of the network is surveyed once a year, the average leak run time (awareness time) is 6 months. To reduce awareness time, the survey frequency can be increased. However, leak detection efforts will still not be well targeted. To be able to determine how much water

is lost in specific parts of the network, the network must be split in hydraulically discrete zones and the inflow to these zones must then be measured. By computing the volume of leakage in each zone, leak detection specialists can better target their efforts. Clearly, the smaller the zone, the better the information and the efficiency of leak detection. The smallest zones are called District Metered Areas (DMAs). A DMA is hydraulically discrete and ideally has only a single inflow point. The inflow and corresponding pressure is measured and monitored on a continuous basis.

3 _____

Ideally, when the entire distribution network is split into DMAs, the utility has several advantages. For instance:

•The volume of NRW (the difference between DMA inflow and billed volume) can be calculated on a monthly basis.

•The components of NRW (physical and commercial losses) can be quantified by analysing flow and pressure data.

•Leak detection works can be prioritized.

•New pipe bursts can be identified immediately by monitoring the minimum night flow, and therefore awareness time will be reduced from several months to several days (or even less).

•When leakage is eliminated, utilities can better gauge the existence of illegal connections or other forms of water theft and can take action.

Furthermore, DMAs (District Metered Area) can be helpful in managing pressure. At the inflow to the DMAs, pressure reducing valves can be installed, and the pressure in every DMA can be adjusted to the required level. There is no ideal size for a DMA. The size, whether it is 500 or 5,000 service connections, is always a tradeoff. The decision has to be made on a case-by-case basis and depends on a number of factors (e.g., hydraulic, topographic, practical and economic).

Topography and network layout also play an important role in DMA design and size. Therefore, there will always be DMAs of different sizes in a distribution network. An important influencing

factor is the condition of the infrastructure. If mains and service connections are fragile, then bursts will be more frequent and the optimal DMA will be relatively small. On the other hand, in areas with brand new infrastructure, DMAs can be larger and still manageable.

4 _____

According to the recommendations of the International Water Association's (IWA) Water Loss Task Force, if a DMA is larger than 5,000 connections, it becomes difficult to discriminate small bursts (e.g., service connection bursts) from variations in customer night use. In networks with very poor infrastructure conditions, DMAs as small as 500 service connections might be warranted. A calibrated hydraulic model should always be used for DMA design irrespective of the size of the DMAs.

Water losses from larger diameter pipes can be quite significant, especially in the Asian context with predominantly low-pressure systems, where leaks will not come to the surface and remain unnoticed for many years. Leaks on large diameter pipes are always difficult to detect and often specialized equipment is required (e.g., inside pipe inspection and leak detection). These techniques are costly but might be economically well justified where water availability is limited and every cubic meter of water recovered can be sold to existing or new customers.

A – Advantages of the entire distribution network
B – Water availability
C – The entire distribution network
D – Water losses
E – Leaks on large diameter pipes
F – The volume of water lost from a pipe burst
G – The most traditional and basic method
H – Water utilities in Asia

ACTIVITY 28. CHOOSE THE WORDS THAT BEST COMPLETE THE PHRASE.

1. Since awareness time largely determines the volume of _____ lost from a pipe burst, utilities need a strategy to reduce awareness time. (pipe, equipment, water)
2. The most traditional and basic _____ is to have a team of leak detection specialists who check all pipes on a regular basis. (inspection, method, model)
3. The network must be split in hydraulically discrete _____and the inflow to these zones must then be measured. (zones, losses, network)
4. The smaller the zone, the better the _____ and the efficiency of leak detection. (detection, information, location)
5. Topography and network layout also play an important _____ in DMA design and size. (variation, role, tunnel)
6. Water _____ from larger diameter pipes can be quite significant. (methods, size, losses)
7. Leaks on large diameter pipes are always difficult to detect and often specialized _____ is required. (systems, equipment, existence)

ACTIVITY 30. MATCH THE FOLLOWING WORDS AND WORD COMBINATIONS WITH THEIR UKRAINIAN EQUIVALENTS.

1) recommendations	a) поверхня
2) leakage control	b) рекомендації
3) visible	c) фахівці з виявлення витоків
4) surface	d) електронні наземні мікрофони
5) leak detection specialists	e) корелятори шуму витоку
6) electronic ground microphones	f) споживач
7) leak noise correlators	g) мережа, сітка
8) network	h) видимий
9) customer	i) контроль витоків

ACTIVITY 31. READ THE TEXT BELOW AND MATCH CHOICES **(A – H)** TO **(1 – 6).** THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

WATER REQUIREMENTS

Municipal water supply systems include facilities for storage, transmission, treatment, and distribution. The design of these facilities depends on the quality of the water, on the particular needs of the user or consumer, and on the quantities of water that must be processed.

1 _____

Water has such a strong tendency to dissolve other substances that it is rarely found in nature in a pure condition. When it falls as

rain, small amounts of gases such as oxygen and carbon dioxide become dissolved in it; raindrops also carry tiny dust particles and other substances. As it flows over the ground, water picks up fine soil particles, microbes, organic material, and soluble minerals. In lakes, bogs, and swamps, water may gain colour, taste, and odour from decaying vegetation and other natural organic matter. Groundwater usually acquires more dissolved minerals than does surface runoff because of its longer direct contact with soil and rock. It may also absorb gases such as hydrogen sulfide and methane. In populated areas the quality of surface water as well as groundwater is directly influenced by land use and by human activities. For example, stormwater runoff contaminated with agricultural or lawn pesticides and fertilizers, as well as with road deicing chemicals, can flow into streams and lakes. In addition, effluent from malfunctioning septic tanks and subsurface leaching fields can seep into groundwater.

2 _____

Five general types of impurities are of public health concern. These are organic chemicals, inorganic chemicals, turbidity, microorganisms, and radioactive substances. Organic contaminants include various pesticides, industrial solvents, and trihalomethanes such as chloroform. Inorganic contaminants of major concern include arsenic, nitrate, fluoride, and toxic metals such as lead and mercury. All these substances can harm human health when present above certain concentrations in drinking water. A low concentration of fluoride, however, has been proved to promote dental health. Some communities add fluoride to their water for this purpose.

Turbidity refers to cloudiness caused by very small particles of silt, clay, and other substances suspended in water. Even a slight degree of turbidity in drinking water is objectionable to most people. Turbidity also interferes with disinfection by creating a possible shield for pathogenic organisms. Groundwater normally has very low turbidity, because of the natural filtration that occurs

as it percolates through the soil. Surface waters, though, are often high in turbidity.

The most important microbiological measure of drinking-water quality is a group of bacteria called coliforms. Coliform bacteria normally are not pathogenic, but they are always present in the intestinal tract of humans and are excreted in very large numbers with human waste. Water contaminated with human waste always contains coliforms, and it is also likely to contain pathogens excreted by infected individuals in the community. Since it is easier to test for the presence of coliforms rather than for specific types of pathogens, coliforms are used as indicator organisms for measuring the biological quality of water. If coliforms are not found in the water, it can be assumed that the water is also free of pathogens. The coliform count thus reflects the chance of pathogens being present; the lower the coliform count, the less likely it is that pathogens are in the water.

Radioactive materials from natural as well as industrial sources can be harmful water contaminants. Wastes from uranium mining, nuclear power plants, and medical research are possible pollutants. Strontium-90 and tritium are radioactive contaminants that have been found in water as a result of nuclear weapons testing. Naturally occurring substances such as radium and radon gas are found in some groundwater sources. The danger from dissolved radon gas arises not from drinking the water but from breathing the gas after it is released into the air.

3 _____

Colour, taste, and odour are physical characteristics of drinking water that are important for aesthetic reasons rather than for health reasons. Colour in water may be caused by decaying leaves or by algae, giving it a brownish yellow hue. Taste and odour may be

caused by naturally occurring dissolved organics or gases. Some well-water supplies, for example, have a rotten-egg odour that is caused by hydrogen sulfidegas. Chemical impurities associated with the aesthetic quality of drinking water include iron, manganese, copper, zinc, and chloride. Dissolved metals impart a bitter taste to water and may stain laundry and plumbing fixtures. Excessive chlorides give the water an objectionable salty taste.

4 _____

Another parameter of water quality is hardness. This is a term used to describe the effect of dissolved minerals (mostly calcium and magnesium). Minerals cause deposits of scale in hot water pipes, and they also interfere with the lathering action of soap. Hard water does not harm human health, but the economic problems it causes make it objectionable to most people.

5 _____

Water quality standards set limits on the concentrations of impurities allowed in water. Standards also affect the selection of raw water sources and the choice of treatment processes. The development of water quality standards began in the United States in the early 20th century. Since that time, the total number of regulated contaminants has increased as toxicological knowledge and analytical measurement techniques have improved. Modern testing methods now allow the detection of contaminants in extremely low concentrations—as low as one part contaminant per one billion parts water or even, in some cases, per one trillion parts water. Water quality standards are continually evolving, usually becoming more stringent. As a result, the number of regulated

contaminants increases over time, and their allowable concentrations in water are lowered.

Drinking-water regulations in the United States include two types of standards: primary and secondary. Primary standards are designed to protect public health, whereas secondary standards are based on aesthetic factors rather than on health effects. Primary standards specify maximum contaminant levels for many chemical, microbiological, and radiological parameters of water quality. They reflect the best available scientific and engineering judgment and take into account exposure from other sources in the environment and from foods. Turbidity is also included in the primary standards because of its tendency to interfere with disinfection. Secondary standards are guidelines or suggested maximum levels of colour, taste, odour, hardness, corrosiveness, and certain other factors.

6 _____

Water consumption in a community is characterized by several types of demand, including domestic, public, commercial, and industrial uses. Domestic demand includes water for drinking, cooking, washing, laundering, and other household functions. Public demand includes water for fire protection, street cleaning, and use in schools and other public buildings. Commercial and industrial demands include water for stores, offices, hotels, laundries, restaurants, and most manufacturing plants. There is usually a wide variation in total water demand among different communities. This variation depends on population, geographic location, climate, the extent of local commercial and industrial activity, and the cost of water.

Water use or demand is expressed numerically by average daily consumption per capita (per person). In the United States the average is approximately 380 litres (100 gallons) per capita per day for domestic and public needs. Overall, the average total demand is about 680 litres (180 gallons) per capita per day, when commercial and industrial water uses are included. (These figures do not include withdrawals from freshwater sources for such purposes as crop

irrigation or cooling operations at electric power-generating facilities.) Water consumption in some developing countries may average as little as 15 litres (4 gallons) per capita per day. The world average is estimated to be approximately 60 litres (16 gallons) per person per day.

A – Hardness
B – Drinking-water quality
C – Environmental engineers
D – Health concerns
E – Modern testing methods
F – Aesthetic concerns
G – Municipal water consumption
H – Standards

ACTIVITY 32. COMPLETE THE FOLLOWING SENTENCES WITH THE CORRECT WORDS.

WATER REQUIREMENTS

1 _____ any community, water demand varies on a seasonal, daily, and hourly basis. **2** _____ a hot summer day, for example, it is not unusual for total water consumption to be as much as 200 percent of the **3** _____ demand. The **4** _____ demands in residential areas usually occur in the morning and early evening hours (just before and after the normal workday). **5** _____ demands in commercial and industrial districts, though, are usually uniform during the work day. **6** _____ water demands typically occur in the very early or predawn morning hours. Civil and environmental **7** _____ must carefully study each community's water use patterns in order to design efficient pumping and distribution systems.

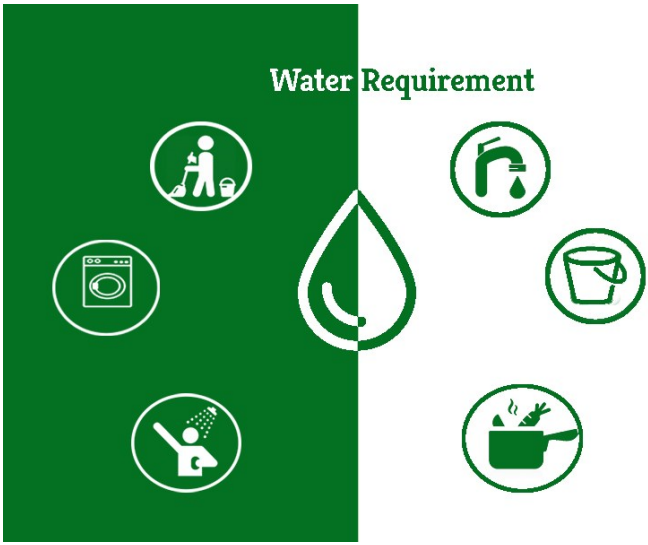
1	**A**	In	**B**	At	**C**	Under	**D**	Off
2	**A**	Between	**B**	On	**C**	Near	**D**	In
3	**A**	general	**B**	common	**C**	average	**D**	corporate
4	**A**	lower	**B**	nether	**C**	under	**D**	peak
5	**A**	Water	**B**	liquid	**C**	aqua	**D**	fluid
6	**A**	Less	**B**	Minimum	**C**	Lowest	**D**	Soft
7	**A**	workers	**B**	mechanics	**C**	engineers	**D**	standards

ACTIVITY 33. FILL IN THE GAPS IN THE FOLLOWING SENTENCES WITH THE WORDS GIVEN IN THE BOX.

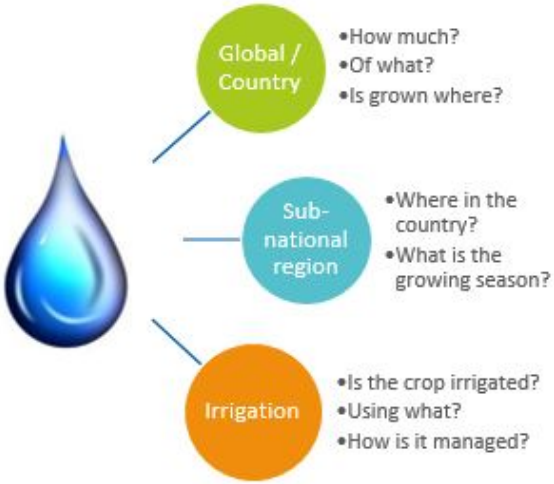
characteristics, development, standards, household, natural, condition, buildings, plants

1. Water quality _____ set limits on the concentrations of impurities allowed in water.
2. The _____ of water quality standards began in the United States in the early 20th century.
3. Colour, taste, and odour are physical _____ of drinking water that are important for aesthetic reasons rather than for health reasons.
4. Water has such a strong tendency to dissolve other substances that it is rarely found in nature in a pure _____.
5. In lakes, bogs, and swamps, water may gain colour, taste, and odour from decaying vegetation and other _____ organic matter.
6. Domestic demand includes water for drinking, cooking, washing, laundering, and other _____ functions.
7. Public demand includes water for fire protection, street cleaning, and use in schools and other public _____.
8. Commercial and industrial demands include water for stores, offices, hotels, laundries, restaurants, and most manufacturing _____.

ACTIVITY 34. LOOK THROUGH THE PICTURE BELOW. MAKE A STORY ABOUT WATER REQUIREMENTS IN DOMESTIC USE.



ACTIVITY 35. LOOK THROUGH THE PICTURE BELOW. MAKE A STORY ABOUT GLOBAL DEMAND OF WATER. FOR MAKING IT ANSWER THE FOLLOWING QUESTIONS: WHAT IS WATER REQUIREMENT IN YOUR COUNTRY? WHAT IS THE GROWING SEASON IN YOUR COUNTRY? IS THE CROP IRRIGATED IN YOUR COUNTRY? WHAT DOES THE IRRIGATION SYSTEM USE? HOW IT IS MANAGED?



ACTIVITY 36. LOOK THROUGH THE TEXT "WATER REQUIREMENTS" AGAIN (**ACTIVITY 31**). ANSWER THE QUESTIONS:

1. What do municipal water supply systems include?
2. What strong tendency has water?
3. What are the general types of impurities of public health?
4. What radioactive materials from natural sources can be harmful?
5. What average volume of water is the world estimated per person per day?

ACTIVITY 37. READ AND TRANSLATE THE TEXT INTO UKRAINIAN. READ THE TEXT '**WATER TREATMENT'** IN **EXTENSIVE READING PART** AND TELL WHAT IS SEDIMENTATION, DISINFECTION, COAGULATION AND FLOCCULATION OF WATER.

WATER TREATMENT

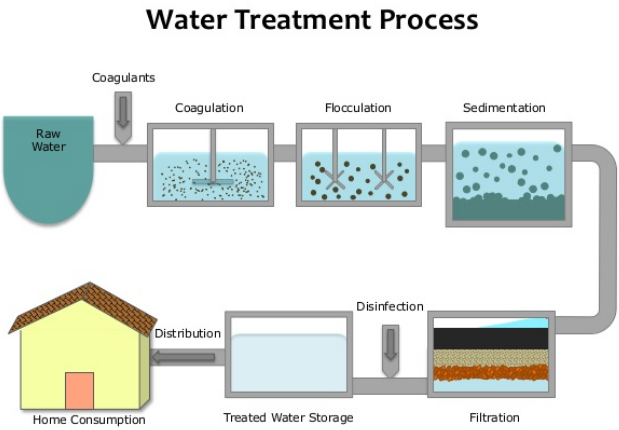
Water in rivers or lakes is rarely clean enough for human consumption if it is not first treated or purified. Groundwater, too, often needs some level of treatment to render it potable. The primary objective of water treatment is to protect the health of the community. Potable water must, of course, be free of harmful microorganisms and chemicals, but public supplies should also be aesthetically desirable so that consumers will not be tempted to use water from another, more attractive but unprotected source. The water should be crystal clear, with almost no turbidity, and it should be free of objectionable colour, odour, and taste. For domestic supplies, water should not be corrosive, nor should it deposit troublesome amounts of scale and stains on plumbing fixtures. Industrial requirements may be even more stringent; many industries provide special treatment on their own premises.

Water purification plant in Japan. Mayuno

The type and extent of treatment required to obtain potable water depends on the quality of the source. The better the quality, the less treatment is needed. Surface water usually needs more extensive treatment than does groundwater, because most streams, rivers, and lakes are polluted to some extent. Even in areas remote

from human populations, surface water contains suspended silt, organic material, decaying vegetation, and microbes from animal wastes. Groundwater, on the other hand, is usually free of microbes and suspended solids because of natural filtration as the water moves through soil, though it often contains relatively high concentrations of dissolved minerals from its direct contact with soil and rock.

Water is treated in a variety of physical and chemical methods. Treatment of surface water begins with intake screens to prevent fish and debris from entering the plant and damaging pumps and other components. Conventional treatment of water primarily involves clarification and disinfection. Clarification removes most of the turbidity, making the water crystal clear. Disinfection, usually the final step in the treatment of drinking water, destroys pathogenic microbes. Groundwater does not often need clarification, but it should be disinfected as a precaution to protect public health. In addition to clarification and disinfection, the processes of softening, aeration, carbon adsorption, and fluoridation may be used for certain public water sources. Desalination processes are used in areas where freshwater supplies are not readily available.



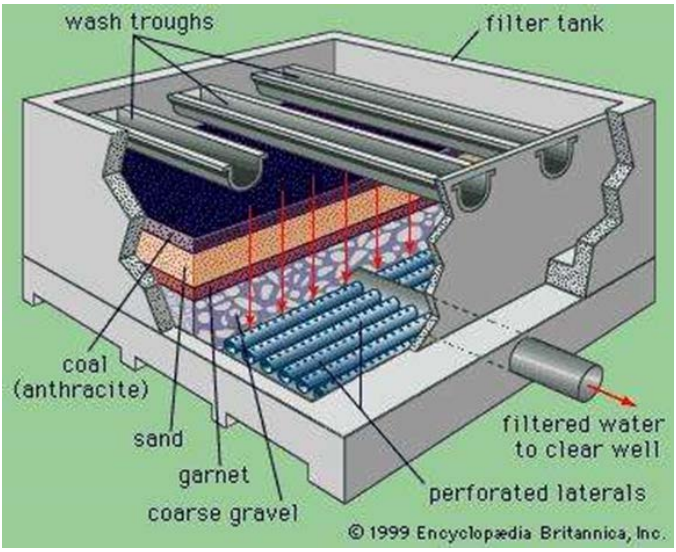
1 _____

Even after coagulation and flocculation, sedimentation does not remove enough suspended impurities from water to make it crystal clear. The remaining nonsettling floc causes noticeable turbidity in the water and can shield microbes from disinfection. Filtration is a physical process that removes these impurities from water by percolating it downward through a layer or bed of porous, granular material such as sand. Suspended particles become trapped within the pore spaces of the filter media, which also remove harmful protozoa and natural colour. Most surface water supplies require filtration after the coagulation and sedimentation steps. For surface waters with low turbidity and colour, however, a process of direct filtration, which is not preceded by sedimentation, may be used.

Two types of sand filters are in use: slow and rapid. Slow filters require much more surface area than rapid filters and are difficult to clean. Most modern water-treatment plants now use rapid dual-media filters following coagulation and sedimentation. A dual-media filter consists of a layer of anthracite coal above a layer of fine sand. The upper layer of coal traps most of the large floc, and the finer sand grains in the lower layer trap smaller impurities. This process is called in-depth filtration, as the impurities are not simply screened out or removed at the surface of the filter bed, as is the case in slow sand filters. In order to enhance in-depth filtration, so-called mixed-media filters are used in some treatment plants. These have a third layer, consisting of a fine-grained dense mineral called garnet, at the bottom of the bed.

Rapid filters are housed in boxlike concrete structures, with multiple boxes arranged on both sides of a piping gallery. A large tank called a clear well is usually built under the filters to hold the clarified water temporarily. A layer of coarse gravel usually supports the filter media. When clogged by particles removed from the water, the filter bed must be cleaned by backwashing. In the backwash process, the direction of flow through the filter is reversed. Clean water is forced upward through the media,

expanding the filter bed slightly and carrying away the impurities in wash troughs. The backwash water is distributed uniformly across the filter bottom by an underdrain system of perforated pipes or porous tile blocks.



Schematic diagram of a rapid-filter water treatment facility.
Encyclopædia Britannica, Inc.

Because of its reliability, the rapid filter is the most common type of filter used to treat public water supplies. However, other types of filters may be used, including pressure filters, diatomaceous earth filters, and microstrainers. A pressure filter has a granular media bed, but, instead of being open at the top like a gravity-flow rapid filter, it is enclosed in a cylindrical steel tank. Water is pumped through the filter under pressure. In diatomaceous earth filters, a natural powderlike material composed of the shells of microscopic organisms called diatoms is used as a filter media. The powder is supported in a thin layer on a metal screen or fabric, and water is pumped through the layer. Pressure filters and diatomaceous earth filters are used most often for industrial applications or for public swimming pools.

Microstrainers consist of a finely woven stainless-steel wire cloth mounted on a revolving drum that is partially submerged in

the water. Water enters through an open end of the drum and flows out through the screen, leaving suspended solids behind. Captured solids are washed into a hopper when they are carried up out of the water by the rotating drum. Microstrainers are used mainly to remove algae from surface water supplies before conventional gravity-flow filtration. (They can also be employed in advanced wastewater treatment.)

2 _____

The addition of chlorine or chlorine compounds to drinking water is called chlorination. Chlorine compounds may be applied in liquid and solid forms—for instance, liquid sodium hypochlorite or calcium hypochlorite in tablet or granular form. However, the direct application of gaseous chlorine from pressurized steel containers is usually the most economical method for disinfecting large volumes of water.

Taste or odour problems are minimized with proper dosages of chlorine at the treatment plant, and a residual concentration can be maintained throughout the distribution system to ensure a safe level at the points of use. Chlorine can combine with certain naturally occurring organic compounds in water to produce chloroform and other potentially harmful by-products (trihalomethanes). The risk of this is small, however, when chlorine is applied after coagulation, sedimentation, and filtration.

The use of chlorine compounds called chloramines (chlorine combined with ammonia) for disinfecting public water supplies has been increasing since the beginning of the 21st century. This disinfection method is often called chloramination. The disinfecting effect of chloramines lasts longer than that of chlorine alone, further protecting water quality throughout the distribution system. Also, chloramines further reduce taste and odour problems and produce lower levels of harmful by-products, compared with the use of chlorine alone.

3 _____

Softening is the process of removing the dissolved calcium and magnesium salts that cause hardness in water. It is achieved either by adding chemicals that form insoluble precipitates or by ion exchange. Chemicals used for softening include calcium hydroxide (slaked lime) and sodium carbonate (soda ash). The lime-soda method of water softening must be followed by sedimentation and filtration in order to remove the precipitates. Ion exchange is accomplished by passing the water through columns of a natural or synthetic resin that trades sodium ions for calcium and magnesium ions. Ion-exchange columns must eventually be regenerated by washing with a sodium chloride solution.

4 _____

An effective method for removing dissolved organic substances that cause tastes, odours, or colours is adsorption by activated carbon. Adsorption is the capacity of a solid particle to attract molecules to its surface. Powdered carbon mixed with water can adsorb and hold many different organic impurities. When the carbon is saturated with impurities, it is cleaned or reactivated by heating to a high temperature in a special furnace.

5 _____

Desalination, or desalting, is the separation of fresh water from salt water or brackish water. Major advances in desalination technology have taken place since the 1950s, as the need for supplies of fresh water has grown in arid and densely populated areas of the world. Desalted water is the main source of municipal supply in areas of the Caribbean, the Middle East, and North Africa, and its use is increasing in the southeastern United States. Although it is relatively expensive to produce, desalted water can be more economical than the alternative of transporting large quantities of fresh water over long distances.

ACTIVITY 38. FIND RIGHT TITLE FOR EACH PART OF THE TEXT BEFORE. MATCH CHOICES **(A – G)** TO **(1 – 5).** THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

A – Chlorination
B – Carbon adsorption
C – Rapid filter
D – Organic material
E – Desalination
F – Water softening
G – Filtration

ACTIVITY 39. FILL IN THE GAPS IN THE FOLLOWING SENTENCES WITH THE WORDS GIVEN IN THE BOX.

water, clear, water, under, behind, needed, filter, before

1. A large tank called a clear well is usually built (**1**) _____ the filters to hold the clarified water temporarily.
2. The better the quality, the less treatment is **(2)** _____.
3. The water should be crystal **(3)** _____, with almost no turbidity, and it should be free of objectionable colour, odour, and taste.

4. For domestic supplies, **(4) _____** should not be corrosive, nor should it deposit troublesome amounts of scale and stains on plumbing fixtures.
5. The backwash water is distributed uniformly across the **(5) _____** bottom by an underdrain system of perforated pipes or porous tile blocks.
6. Microstrainers consist of a finely woven stainless-steel wire cloth mounted on a revolving drum that is partially submerged in the **(6) _____**.
7. Water enters through an open end of the drum and flows out through the screen, leaving suspended solids **(7) _____**.
8. Microstrainers are used mainly to remove algae from surface water supplies **(8) _____** conventional gravity-flow filtration.

ACTIVITY 40. COMPLETE THE FOLLOWING SENTENCES WITH THE CORRECT WORDS.

DISINFECTION AND AERATION OF WATER

Disinfection destroys pathogenic **(1)** _____ and is essential to prevent the spread of waterborne disease. Typically, the final process in drinking-water **(2) _____**, it is accomplished by applying either chlorine or chlorine compounds, ozone, or ultraviolet radiation to clarified **(3) _____**.

Aeration is a physical treatment **(4) _____** used for taste and odour control and for removal of dissolved iron and manganese. It **(5) _____** of spraying water into the air or cascading it downward through stacks of perforated trays. Dissolved gases that cause tastes and odours are transferred from the water to the **(6) _____**. **(7) _____** from the air, meanwhile, reacts with any iron and manganese in the water, forming a precipitate that is removed by sedimentation and filtration.

1	**A**	bacteria	**B**	nature	**C**	chlorine	**D**	microstrainer
2	**A**	distillation	**B**	treatment	**C**	adsorption	**D**	softening
3	**A**	distance	**B**	temperature	**C**	water	**D**	type
4	**A**	fixture	**B**	surface	**C**	process	**D**	treatment
5	**A**	consists	**B**	improve	**C**	treat	**D**	remove
6	**A**	liquide	**B**	air	**C**	water	**D**	gas
7	**A**	Gas	**B**	Vapour	**C**	Oxygen	**D**	Carbon

ACTIVITY 41. DECIDE WHETHER THE FOLLOWING STATEMENTS ARE **TRUE** OR **FALSE**

1. Microstrainers consist of a finely woven stainless-steel wire cloth mounted on a revolving drum that is not partially submerged in the water.
2. Water enters through an open end of the drum and flows out through the screen, leaving suspended solids behind.
3. A small tank called a clear well is usually built under the filters to hold the clarified water temporarily.
4. The primary objective of water treatment is to provide the health of the community.
5. Water in rivers or lakes is rarely clean enough for human consumption if it is not first treated or purified.
6. Most modern water-treatment plants now use rapid dual-media filters following coagulation and sedimentation.

ACTIVITY 42. FIND THE UKRAINIAN EQUIVALENTS OF THE ENGLISH WORDS AND WORD COMBINATION. MAKE YOUR OWN SENTENCES WITH THE WORDS FROM THE TABLE:

to provide	
to protect	
to consist of	
colour	

odour	
taste	
domestic supplies	
under pressure	
the filter bottom	

ACTIVITY 43. FIND RIGHT TITLE FOR EACH PART OF THE TEXT BEFORE. MATCH CHOICES **(A – F)** TO **(1 – 4).** THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

WATER TREATMENT: BASIC TYPES OF DESALTING TECHNIQUES

There are two basic types of desalting techniques: thermal processes and membrane processes. Both types consume considerable amounts of energy. Thermal methods involve heat transfer and a phase change of the water from liquid into vapour or ice. Membrane methods use very thin sheets of special plastic that act as selective barriers, allowing pure water to be separated from the salt.

1 _____

Distillation, a thermal process that includes heating, evaporation, and condensation, is the oldest and most widely used of desalination technologies. Modern methods for the distillation of large quantities of salt water rely on the fact that the boiling temperature of water is lowered as air pressure drops, significantly reducing the amount of energy needed to vaporize the water. Systems that utilize this principle include multistage flash distillation, multiple-effect distillation, and vapour-compression distillation.

Multistage flash distillation plants account for more than half of the world production of desalted water. The process is carried out in a series of closed vessels (stages) set at progressively lower internal pressures. Heat is added to the system from a boiler. When preheated salt water enters a low-pressure chamber, some of it rapidly boils, or flashes, into water vapour. The vapour is condensed into fresh water on heat-exchange tubes that run through each stage. These tubes carry incoming seawater, thereby reducing the heat required from the boiler. Fresh water collects in trays under the tubes. The remaining brine flows into the next stage at even lower pressure, where some of it again flashes into vapour. A multistage flash plant may have as many as 40 stages, permitting salt water to boil repeatedly without supplying additional heat.

Multiple-effect distillation also takes place in a series of low-pressure vessels (effects), but it differs from multistage distillation in that preheated salt water is sprayed onto evaporator tubes in order to promote rapid evaporation in each vessel. This process requires pumping the salt water from one effect to the next.

In the vapour-compression system, heat is provided by the compression of vapour rather than by direct heat input from a boiler. When the vapour is rapidly compressed, its temperature rises. Some of the compressed and heated vapour is then recycled through a series of tubes passing through a reduced-pressure chamber, where evaporation of salt water occurs. Electricity is the main source of energy for this process. It is used for small-scale desalting applications—for example, at coastal resorts.

Two other thermal processes are solar humidification and freezing. In solar humidification, salt water is collected in shallow

basins in a “still,” a structure similar to a greenhouse. The water is warmed as sunlight enters through inclined glass or plastic covers. Water vapour rises, condenses on the cooler covers, and trickles down to a collecting trough. Thermal energy from the sun is free, but a solar still is expensive to build, requires a large land area, and needs additional energy for pumping water to and from the facility. Solar humidification units are suitable for providing desalted water to individual families or for very small villages where sunlight is abundant.

The freezing process, also called crystallization, involves cooling salt water to form crystals of pure ice. The ice crystals are separated from the unfrozen brine, rinsed to remove residual salt, and then melted to produce fresh water. Freezing is theoretically more efficient than distillation, and scaling as well as corrosion problems are lessened at the lower operating temperatures, but the mechanical difficulties of handling mixtures of ice and water prevent the construction of large-scale commercial plants. In hot climates, heat leakage into the facility is also a significant problem.

2 _____

Two commercially important membrane processes used for desalination are electrodialysis and reverse osmosis. They are used mainly to desalt brackish or highly mineralized water supplies rather than much saltier seawater. In both methods, thin plastic sheets act as selective barriers, allowing fresh water but not salt to flow through.

Most salts dissolved in water exist in the form of electrically charged particles called ions. Half are positively charged (e.g., sodium), and half are negatively charged (e.g., chloride). In electrodialysis an electric voltage is applied across the saline

solution. This causes ions to migrate toward the electrode that has a charge opposite to that of their own. In a typical electrodialysis unit, several hundred plastic membranes that are selectively permeable to either positive ions or negative ions, but not both, are closely spaced in alternation and bound together with electrodes on the outside. Incoming salt water flows between the membrane sheets. Under the applied voltage the ions move in opposite directions through the membranes, but they are trapped by the next membrane in the stack. This forms alternate cells of dilute salt water and brine. The more-dilute solution is recycled back through the stack until it reaches freshwater quality.

When a semipermeable membrane separates two solutions of different concentrations, there is a natural tendency for the concentrations to become equalized. Water flows from the dilute side to the concentrated side. This process is called osmosis. However, a high pressure applied to the concentrated side can reverse the direction of this flow. In reverse osmosis, salty water is pumped into a vessel and pressurized against the membrane. Fresh water diffuses through the membrane, leaving a more concentrated salt solution behind.

Next to multistage flash distillation, reverse osmosis is the second-ranking desalting process. It will play a greater role in the desalting of seawater and brackish water as more-durable membranes are developed. It can also be applied to the advanced treatment of municipal sewage and industrial wastewater.

3 _____

Desalting costs are reduced by using cogeneration and hybrid processes. Cogeneration (or dual-purpose) desalination plants are large-scale facilities that produce both electric power and desalted

seawater. Distillation methods in particular are suitable for cogeneration. The high-pressure steam that runs electric generators can be recycled in the distillation unit's brine heater. This significantly reduces fuel consumption compared with what is required if separate facilities are built. Cogeneration is very common in the Middle East and North Africa.

Hybrid systems are units that operate with two or more different desalting processes (e.g., distillation and reverse osmosis). They offer further economic benefits when employed in cogeneration plants, productively combining the operation of each process.

4 _____

Desalination produces fresh water but also a significant volume of waste effluent, called brine. Since the primary pollutant in the brine is salt, disposal in the ocean is generally not a problem for facilities located near a coastline. At inland desalination facilities, care must be taken to prevent pollution of groundwater or surface waters. Methods of brine disposal include dilution, evaporation, injection into a saline aquifer, and pipeline transport to a suitable disposal point.

A – Membrane processes
B – Effluent disposal
C – Economic benefits
D – Hybrid systems
E – Cogeneration and hybrid processes
F – Thermal processes

ACTIVITY 44. DECIDE WHETHER THE FOLLOWING STATEMENTS ARE **TRUE** OR **FALSE**

1. Cogeneration (or dual-purpose) desalination plants are small-scale facilities that produce both electric power and desalted seawater.

2. Distillation methods in particular are not suitable for cogeneration.
3. Most salts dissolved in water exist in the form of electrically charged particles called ions.
4. In the vapour-compression system, heat is provided by the compression of vapour rather than by direct heat output from a boiler.
5. Modern methods for the distillation of large quantities of salt water rely on the fact that the boiling temperature of water is lowered as air pressure drops.

ACTIVITY 45. FIND THE UKRAINIAN EQUIVALENTS OF THE ENGLISH WORDS AND WORD COMBINATION. MAKE YOUR OWN SENTENCES WITH THE WORDS FROM THE TABLE:

industrial wastewater	
primary pollutant	
thermal processes	
cogeneration	
desalination	
brackish water	
seawater	
to diffuse	
to separate	
to reduce	

ACTIVITY 46. ANSWER THE QUESTIONS:

1. What contaminants may be found in drinking water?
2. Where does drinking water come from?
3. How is drinking water treated?
4. What if I have special health needs?
5. Who is a violation of a drinking water standard?

6. How can we help to protect drinking water?

ACTIVITY 47. FIND RIGHT TITLE FOR EACH PART OF THE TEXT BEFORE. MATCH CHOICES **(A – H)** TO **(1 – 6).** THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

WATER DISTRIBUTION

A water distribution system is a network of pumps, pipelines, storage tanks, and other appurtenances. It must deliver adequate quantities of water at pressures sufficient for operating plumbing fixtures and firefighting equipment, yet it must not deliver water at pressures high enough to increase the occurrence of leaks and pipeline breaks. Pressure-regulating valves may be installed to reduce pressure levels in low-lying service areas. More than half the cost of a municipal water supply system is for the distribution network.

1 _____

The pipeline system of a municipal water distribution network consists of arterial water mains or primary feeders, which convey water from the treatment plant to areas of major water use in the community, and smaller-diameter pipelines called secondary feeders, which tie in to the mains. Usually not less than 150 mm (6 inches) in diameter, these pipelines are placed within the public right-of-way so that service connections can be made for all

potential water users. The pipelines are usually arranged in a gridiron pattern that allows water to circulate in interconnected loops; this permits any broken sections of pipe to be isolated for repair without disrupting service to large areas of the community.

"Dead-end" patterns may also be used, but they do not permit circulation, and the water they provide is more susceptible to taste and odour problems because of stagnation.

A water distribution pipeline must be able to resist internal and external forces, as well as corrosion. Pipes are placed under stress by internal water pressure, by the weight of the overlying soil, and by vehicles passing above. They may have to withstand water-hammer forces; these occur when valves are closed too rapidly, causing pressure waves to surge through the system. In addition, metal pipes may rust internally if the water supply is corrosive or externally because of corrosive soil conditions.

2 _____

Distribution pipes are made of asbestos cement, cast iron, ductile iron, plastic, reinforced concrete, or steel. Although not as strong as iron, asbestos cement, because of its corrosion resistance and ease of installation, is a desirable material for secondary feeders up to 41 cm (16 inches) in diameter. Pipe sections are easily joined with a coupling sleeve and rubber-ring gasket. Cast iron has an excellent record of service, with many installations still functioning after 100 years. Ductile iron, a stronger and more elastic type of cast iron, is used in newer installations. Iron pipes are provided in diameters up to 122 cm (48 inches) and are usually coated to prevent corrosion. Underground sections are connected with bell-and-spigot joints, the spigot end of one pipe section being pushed

into the bell end of an adjacent section. A rubber-ring gasket in the bell end is compressed when the two sections are joined, creating a watertight, flexible connection. Flanged and bolted joints are used for aboveground installations.

Plastic pipes are available in diameters up to 61 cm (24 inches). They are lightweight, easily installed, and corrosion-resistant, and their smoothness provides good hydraulic characteristics. Plastic pipes are connected either by a bell-and-spigot compression-type joint or by threaded screw couplings.

Precast reinforced concrete pipe sections up to 366 cm (12 feet) in diameter are used for arterial mains. Reinforced concrete pipes are strong and durable. They are joined using a bell-and-spigot-type connection that is sealed with cement mortar. Steel pipe is sometimes used for arterial mains in aboveground installations. It is very strong and lighter than concrete pipe, but it must be protected against corrosion with lining of the interior and with painting and wrapping of the exterior. Sections of steel pipe are joined by welding or with mechanical coupling devices.

3 _____

In order to function properly, a water distribution system requires several types of fittings, including hydrants, shutoff valves, and other appurtenances. The main purpose of hydrants is to provide water for firefighting. They also are used for flushing water mains, pressure testing, water sampling, and washing debris off public streets.

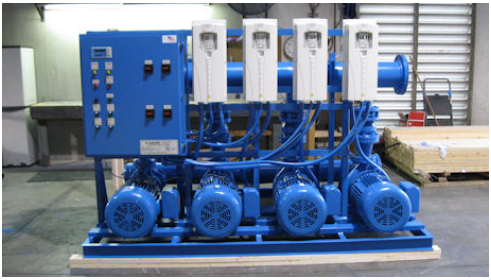
Many types of valves are used to control the quantity and direction of water flow. Gate valves are usually installed throughout the pipe network. They allow sections to be shut off and isolated during the repair of broken mains, pumps, or hydrants. A type of valve commonly used for throttling and controlling the rate of flow is the butterfly valve. Other valves used in water distribution systems include pressure-reducing valves, check valves, and air-release valves.

4 _____

Water mains must be placed roughly 1 to 2 metres (3 to 6 feet) below the ground surface in order to protect against traffic loads and to prevent freezing. Since the water in a distribution system is under pressure, pipelines can follow the shape of the land, uphill as well as downhill. They must be installed with proper bedding and backfill. Compaction of soil layers under the pipe (bedding) as well as above the pipe (backfill) is necessary to provide proper support. A water main should never be installed in the same trench with a sewer line. Where the two must cross, the water main should be placed above the sewer line.

5 _____

Many kinds of pumps are used in distribution systems. Pumps that lift surface water and move it to a nearby treatment plant are



called low-lift pumps. These move large volumes of water at relatively low discharge pressures. Pumps that discharge treated water into arterial mains are called high-lift pumps. These operate under higher pressures. Pumps that increase the pressure within the distribution system or raise water into an elevated storage tank are called booster pumps. Well pumps lift water from underground and discharge it directly into a distribution system.

Most water distribution pumps are of the centrifugal type, in which a rapidly rotating impeller adds energy to the water and raises the pressure inside the pump casing. The flow rate through a centrifugal pump depends on the pressure against which it operates. The higher the pressure, the lower the flow or discharge. Another kind of pump is the positive-displacement type. This pump delivers a fixed quantity of water with each cycle of a piston or rotor. The water is literally pushed or displaced from the pump casing. The

flow capacity of a positive-displacement pump is unaffected by the pressure of the system in which it operates.

6 _____

Distribution storage tanks, familiar sights in many communities, serve two basic purposes: equalizing storage and emergency storage. Equalizing storage is the volume of water needed to satisfy peak hourly demands in the community. During the late night and very early morning hours, when water demand is lower, high-lift pumps fill the tank. During the day, when water demand is higher, water flows out of the tank to help satisfy the peak hourly water needs. This allows for a uniform flow rate at the treatment plant and pumping station. Water in a distribution storage tank may also be needed for fighting fires, cleaning up accidental spills of hazardous materials, or other community emergencies. The capacity of a distribution storage tank is designed to be about equal to the average daily water demand of the community.

A – Water cycle
B – Pipelines
C – Pumps
D – Fittings
E – Water distribution
F – Materials
G – Installation
H – Storage tanks

ACTIVITY 48. CHOOSE THE WORDS THAT BEST COMPLETE THE PHRASE.

1. Distribution storage tanks serve two basic _____: equalizing storage and emergency storage. (purposes, devices, activities)
2. Many types of valves are used to control the quantity and direction of _____. (water supply, water flow, water distribution)

3. Plastic _____ are connected either by a bell-and-spigot compression-type joint or by threaded screw couplings. (pipes, cycles, tanks)
4. A water _____ pipeline must be able to resist internal and external forces, as well as corrosion. (distribution, flow, installation)
5. The _____ system of a municipal water distribution network consists of arterial water mains or primary feeders. (tank, pipeline, uniform)
6. A water distribution system is a _____ of pumps, pipelines, storage tanks, and other appurtenances. (section, network, system)
7. More than half the cost of a municipal water supply _____is for the distribution network. (device, system, network)

ACTIVITY 49. COMPLETE THE FOLLOWING SENTENCES WITH THE CORRECT WORDS.

WATER DISTRIBUTION SYSTEM

Water distribution **1** _____ should be based on a pipe layout that is suitable and have no or less water stagnation within the pipe to avoid tuberculation, encrustation and sediment deposits

Through a wealth of specialized publications and software development is now well understood that water distribution system management is technically **2** _____, but with current technologies, software systems, and highly specialized equipment (flushing and scraper), this is simply not the case anymore.

Water utilities will also need to practice appropriate **3** _____ of system expansions/distribution and use higher quality works, materials, and equipment. In addition, regulators and policy makers should require water **4** _____ to do periodic water audits and regularly publish detailed water distribution system data, which can then be independently audited.

Again, water **5** _____ system management should not be a one-time activity. Although an intense and comprehensive water

distribution system reduction program is suitable to **6** _____ the backlog of required water distribution system reduction measures, it should not lead to a sustainable low level of water distribution system unless water distribution system management becomes part of the normal day-to-day **7** _____ of the water utility.

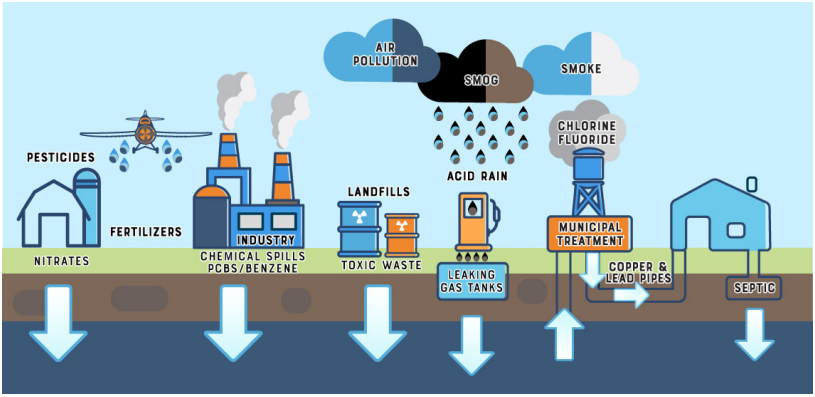
1	**a**	cycle	**b**	type	**c**	network	**d**	system
2	**a**	easy	**b**	complex	**c**	difficult	**d**	strong
3	**a**	pressure	**b**	design	**c**	welding	**d**	coupling
4	**a**	utilities	**b**	sections	**c**	cycles	**d**	pistons
5	**a**	installation	**b**	distribution	**c**	characteristic	**d**	compression
6	**a**	resist	**b**	serve	**c**	reduce	**d**	cost
7	**a**	devices	**b**	practices	**c**	capacities	**d**	activities

ACTIVITY 50. DECIDE WHETHER THE FOLLOWING STATEMENTS ARE **TRUE** OR **FALSE**

1. Distribution storage tanks, familiar sights in many communities, serve three basic purposes: equalizing storage and emergency storage.
2. During the late night and very early morning hours, when water demand is lower, high-lift pumps fill the tank.
3. During the day, when water demand is lower, water flows out of the tank to help satisfy the peak hourly water needs.
4. Pipe sections are easily joined with a coupling sleeve and rubber-ring gasket.
5. A water distribution pipeline must be able to provide internal and external forces, as well as corrosion.

AFTER READING ACTIVITY

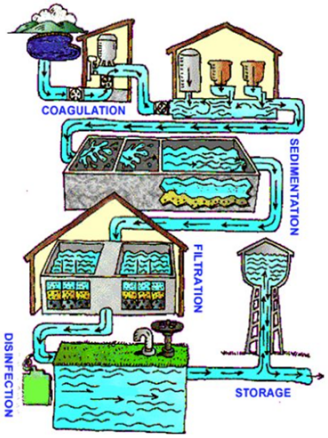
ACTIVITY 1. LOOK AT THE PICTURE BELOW AND MAKE UP SENTENCES ABOUT WELL WATER CONTAMINATION SOURCES



ACTIVITY 2. LOOK AT THE PICTURE BELOW AND TELL WHAT DOES WATER CONSIST OF. MAKE UP A STORY ABOUT DRINKING WATER QUALITY.

ACTIVITY 3. LOOK AT THE PICTURE BELOW AND TELL ABOUT THE WATER TREATMENT PROCESS

The water treatment process generally uses the steps below:



1. **Pre-treatment:** controls algae and arrests any biological growth

2. **Aeration:** along with pre-chlorination, removes dissolved iron and manganese

3. **Coagulation:** prepares for flocculation

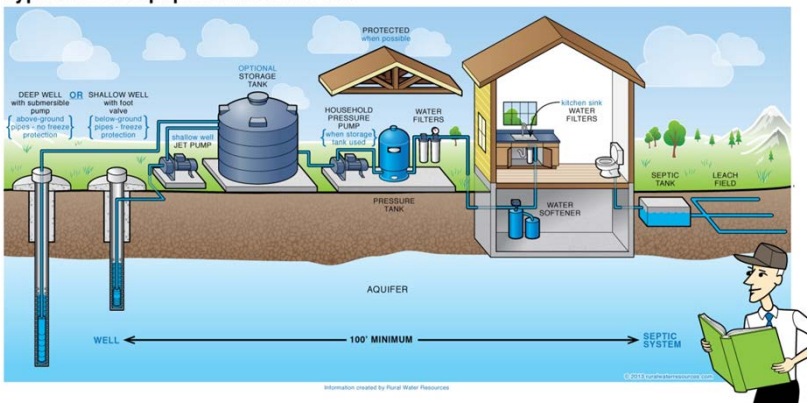
4. **Sedimentation:** for solids separation, that is, removal of suspended solids trapped in the floc

5. **Filtration:** removing particles from water

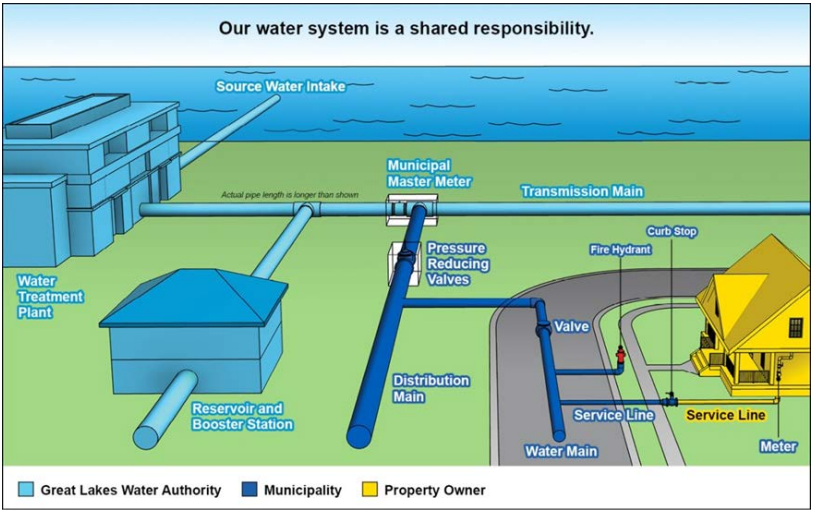
6. **Disinfection:** for killing bacteria

ACTIVITY 4. LOOK AT THE PICTURE BELOW AND TELL WHAT IS THE TYPICAL WELL EQUIPMENT CONNECTION. MAKE UP 7 – 8 SENTENCES.

Typical Well Equipment Connection



ACTIVITY 5. LOOK AT THE PICTURE BELOW AND MAKE UP SENTENCES ABOUT OUR WATER SYSTEM



EXTENSIVE READING

TEXT 1. FRESHWATER STORAGE: FRESHWATER EXISTING ON THE EARTH'S SURFACE

One part of the water cycle that is obviously essential to all life on Earth is the freshwater existing on the land surface. Just ask your neighbor, a tomato plant, a trout, or that pesky mosquito. Surface water includes the streams (of all sizes, from large rivers to small creeks), ponds, lakes, reservoirs (man-made lakes), and freshwater wetlands. The definition of freshwater is water containing less than 1,000 milligrams per liter of dissolved solids, most often salt.

The amount of water in our rivers and lakes is always changing due to inflows and outflows. Inflows to these water bodies will be from precipitation, overland runoff, groundwater seepage, or tributary inflows. Outflows from lakes and rivers include evaporation and discharge to ground water. Humans get into the act also, as people make great use of diverted surface water for their needs. So, the amount and location of surface water changes over time and space, whether naturally or with human help. Certainly during the last ice age when glaciers and snowpacks covered much more land surface than today, life on Earth had to adapt to different hydrologic conditions than those which took place both before and after. And the layout of the landscape certainly was different before and after the last ice age, which influenced the topographical layout of many surface-water bodies today. Glaciers are what made the Great Lakes not only "great," but also such a huge storehouse of freshwater

Surface water keeps life going

From space, the Nile Delta in Egypt appears green, showing that life can even bloom in the desert if there is a supply of surface water (or ground water) available. Water on the land surface really does sustain life, and this is as true today as it was millions of years ago. I'm sure dinosaurs held their meetings at the local watering hole 100 million years ago, just as antelopes in Africa do today.

And, since ground water is supplied by the downward percolation of surface water, even aquifers are happy for water on the Earth's surface. You might think that fish living in the saline oceans aren't affected by freshwater, but, without freshwater to replenish the oceans they would eventually evaporate and become too saline for even the fish to survive.

Usable freshwater is relatively scarce

Freshwater represents only about three percent of all water on Earth and freshwater lakes and swamps account for a mere 0.29 percent of the Earth's freshwater. Twenty percent of all fresh surface water is in one lake, Lake Baikal in Asia. Another twenty percent is stored in the Great Lakes (Huron, Michigan, and Superior). Rivers hold only about 0.006 percent of total freshwater reserves. You can see that life on Earth survives on what is essentially only a "drop in the bucket" of Earth’s total water supply!

One part of the water cycle that is obviously essential to all life on Earth is the freshwater existing on the land surface. Just ask your neighbor, a tomato plant, a trout, or that pesky mosquito. Surface water includes the streams (of all sizes, from large rivers to small creeks), ponds, lakes, reservoirs and canals (man-made lakes and streams), and freshwater wetlands. The definition of freshwater is water containing less than 1,000 milligrams per liter of dissolved solids, most often salt.

As a part of the water cycle, Earth's surface-water bodies are generally thought of as renewable resources, although they are very dependent on other parts of the water cycle. The amount of water in rivers and lakes is always changing due to inflows and outflows.

Inflows to these water bodies will be from precipitation, overland runoff, groundwater seepage, and tributary inflows. Outflows from lakes and rivers include evaporation, movement of water into groundwater, and withdrawals by people. Humans get into the act also, as people make great use of surface water for their needs.

So, the amount and location of surface water changes over time and space, whether naturally or with human help. Certainly during the last ice age when glaciers and snowpacks covered much more land surface than today, life on Earth had to adapt to different hydrologic conditions than those which took place both before and after. And the layout of the landscape certainly was different before and after the last ice age, which influenced the topographical layout of many surface-water bodies today. Glaciers are what made the Great Lakes not only "great" but also such a huge storehouse of freshwater.

Surface water keeps life going

As this picture of the Nile Delta in Egypt shows, life can even bloom in the desert if there is a supply of surface water (or groundwater) available. Water on the land surface really does sustain life, and this is as true today as it was millions of years ago. I'm sure dinosaurs held their meetings at the local watering hole 100 million years ago, just as antelopes in Africa do today. And, since groundwater is supplied by the downward percolation of surface water, even aquifers are happy for water on the Earth's surface. You might think that fish living in the saline oceans aren't affected by freshwater, but, without freshwater to replenish the oceans they would eventually evaporate and become too saline for even the fish to survive.

As we said, everybody and every living thing congregates and lives where they can gain access to water, especially freshwater. Just ask the 6 billion people living on Earth! Here's a satellite picture of the Mediterranean region during night (the full picture of the Earth is available from NASA). The most obvious thing you can see is that people live near the coasts, which, of course, is where water, albeit saline, is located. But the interesting thing in this picture are the lights following the Nile River and Nile Delta in Egypt (the circled area). In this dry part of the world, surface-water supplies are essential for human communities. And if you check the price of lakefront property in your part of the world, it probably sells for much more than other land.

To many people, streams and lakes are the most visible part of the water cycle. Not only do they supply the human population, animals, and plants with the freshwater they need to survive, but they are great places for people to have fun. You might be surprised at how little of Earth's water supply is stored as freshwater on the land surface, as shown in the diagram and table below. Freshwater represents only about three percent of all water on Earth and freshwater lakes and swamps account for a mere 0.29 percent of the Earth's freshwater. Twenty percent of all fresh surface water is in one lake, Lake Baikal in Asia. Another twenty percent (about 5,500 cubic miles (about 23,000 cubic kilometers)) is stored in the Great Lakes. Rivers hold only about 0.006 percent of total freshwater reserves. You can see that life on Earth survives on what is essentially only a "drop in the bucket" of Earth's total water supply! People have built systems, such as large reservoirs and small water

towers (like this one in South Carolina, created to blend in with the peach trees surrounding it) to store water for when they need it. These systems allow people to live in places where nature doesn't always supply enough water or where water is not available at the time of year it is needed.

TEXT 2. NON-WATER REVENUE

Until the early 1990s, there were no reliable and standardized methods for accounting for water losses. Leakage management performance was measured in terms of “unaccounted-for water.” Since this term had no generally accepted definition, there was wide room for interpretation. Unaccounted-for water was typically expressed as a percentage of system input, which is already problematic.

Given this situation, utility performance could not be measured or compared, realistic targets could not be defined, and performance against targets could not be tracked reliably.

While this situation still exists in many countries, significant progress has been made to address these past shortcomings. Over the last 20 years, a number of organizations from around the world have developed a suite of tools and methodologies to help utilities evaluate and manage water losses in an effective manner.

One recommendation of the WLTF (Water Loss Task Force) was to use the term “non-revenue water” instead of “unaccounted-for water.” NRW (non-revenue water) has a precise and simple definition. It is the difference between the volume of water put into a water distribution system and the volume that is billed to customers. NRW comprises three components as follows:

Physical (or real): losses comprise leakage from all parts of the system and overflows at the utility's reservoirs. They are caused by poor operations and maintenance, the lack of active leakage control, and poor quality of underground assets.

Commercial (or apparent): losses are caused by customer meter under registration, data handling errors, and theft of water in various forms.

Unbilled authorized consumption: includes water used by the utility for operational purposes, water used for firefighting, and water provided for free to certain consumer groups.

Although it is widely acknowledged that NRW levels in developing countries are often high, actual figures are elusive. Most water utilities do not have adequate monitoring systems for assessing water losses, and many countries lack national reporting systems that collect and consolidate information on water utility performance. The result is that data on NRW is usually not readily available. Even when data is available, it is not always reliable, as some poorly performing utilities are known to practice "window dressing" in an attempt to conceal the extent of their own inefficiency.

The volume of water lost from an individual pipe burst does not only depend on the flow rate of the event, but is also a function of run time. This is often overlooked. The leak run time consists of three components:

- Awareness time: time until the utility becomes aware that there is a leak
- Location time: time spent to precisely locate the leak so that a repair job order can be issued
- Repair time: time between issuing of repair job order and completion of the repair.

TEXT 3. ADVANCED METERING INFRASTRUCTURE

Commercial losses are nearly always less in volume than physical losses, but this does not mean that commercial loss reduction is any less important. Commercial loss reduction has the shortest possible payback time, as any action immediately results in an increase in billed volume and an increase in revenues. Commercial losses consist of three main elements:

- customer meter under-registration;
- illegal connections and all other forms of water theft; and
- problems and errors in metering, data handling, and billing.

Metering: Minimizing customer meter under-registration requires substantial technical expertise, managerial skills, and upfront funding. Customer meter management should be undertaken holistically, best described by the term “integrated meter management.”

In this effort, utilities should seek to select appropriate meter types and prepare tailored specifications. This can prove difficult, especially where procurement laws and regulations encourage purchasing the cheapest products on the market.

A number of meter manufacturers produce meters that “on paper” meet the specifications but deteriorate at an amazing rate in the field. This is one of the major obstacles for sustained improvement of customer meter accuracy. Contributing to this problem is the lack of good quality meter testing facilities, especially when it comes to larger diameter meters, and the lack of experience in how to best utilize such facilities. This makes it easy for manufacturers to supply meters from second class quality manufacturing batches with little risk that the utility would ever find out.

Another common problem is the reluctance to invest in high quality but more costly meters for large customers. Normally, the top accounts of a utility generate such a large portion of their revenues that any investment in more advanced meters can be economically justified. The payback time is often just a matter of months. Yet, many

water utilities opt to maintain and calibrate old meters over and over again instead of taking appropriate action and installing new meters.

Billing system issues: The billing system is the only source of metered consumption data that can help determine the volume of NRW through an annual water audit. However, most billing systems are not designed to retain the integrity of consumption data. Rather, they are designed to deliver accurate bills to customers and correctly account for the bills. However, there are many day-to-day processes in operating a billing system that have the potential to corrupt the integrity of the consumption data, depending on the design of the particular system. Issues that can affect consumption volumes include

- meter reading practices
- handling of reversals of over-estimation
- processes used for dealing with complaints about high bills
- customer leaks
- estimation of consumption
- meter change-outs
- tracking inactive accounts, and
- the processes for the identification and rectification of stuck meters.

Water theft: While meter under-registration is more of a technical problem, water theft is a political and social issue. Reducing this part of commercial losses is neither technically difficult nor costly, but it requires making difficult and unpleasant managerial decisions that may be politically unpopular. The reason is that illegal connections are nearly always wrongly associated with only the urban poor and informal settlements. However, water theft by high-income households and commercial users, sometimes even large corporations,

often accounts for sizable volumes of water lost and even higher losses of revenue.

In addition to illegal connections, other forms of water theft include meter tampering and meter bypasses, meter reader corruption, and illegal hydrant use. Another common problem is “inactive accounts.” In cases where a customer’s contract has been terminated, the physical service connection, or at least the tapping point on the main, still exists and is easy to re connect illegally. A stringent inactive account management and verification program can easily solve this problem.

CONCLUSION

Water distribution system should be based on a pipe layout that is suitable and have no or less water stagnation within the pipe to avoid tuberculation, encrustation and sediment deposits

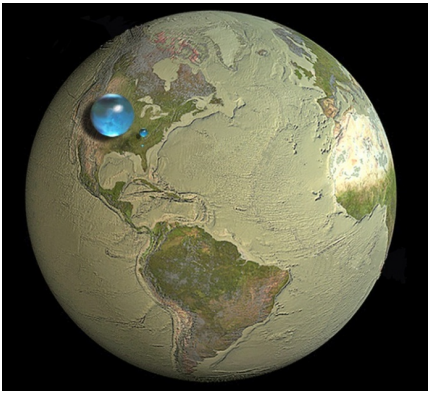
Through a wealth of specialized publications and software development is now well understood that water distribution system management is technically difficult, but with current technologies, software systems, and highly specialized equipment (flushing and scraper), this is simply not the case anymore.

Water utilities will also need to practice appropriate design of system expansions/distribution (e.g., new network parts already constructed as DMAs) and use higher quality works, materials, and equipment. In addition, regulators and policy makers should require water utilities to do periodic water audits and regularly publish detailed water distribution system data, which can then be independently audited.

Again, water distribution system management should not be a one-time activity. Although an intense and comprehensive water distribution system reduction program is suitable to reduce the backlog of required water distribution system reduction measures, it should not lead to a sustainable low level of water distribution system unless water distribution system management becomes part of the normal day-to-day activities of the water utility.

TEXT 4. WATER SOURCES

Global distribution



Water is present in abundant quantities on and under the Earth's surface, but less than 1 percent of it is liquid fresh water. Most of Earth's estimated 1.4 billion cubic km (326 million cubic miles) of water is in the oceans or frozen in polar ice caps and glaciers. Ocean water contains about 35 grams per litre (4.5 ounces per gallon) of dissolved minerals or salts, making it unfit for drinking and for most industrial or agricultural uses.

There is ample fresh water—water containing less than 3 grams of salts per litre, or less than one-eighth ounce of salts per gallon—to satisfy all human needs. It is not always available, though, at the times and places it is needed, and it is not uniformly distributed over the Earth. In many locations the availability of good-quality water is further reduced because of urban development, industrial growth, and environmental pollution.

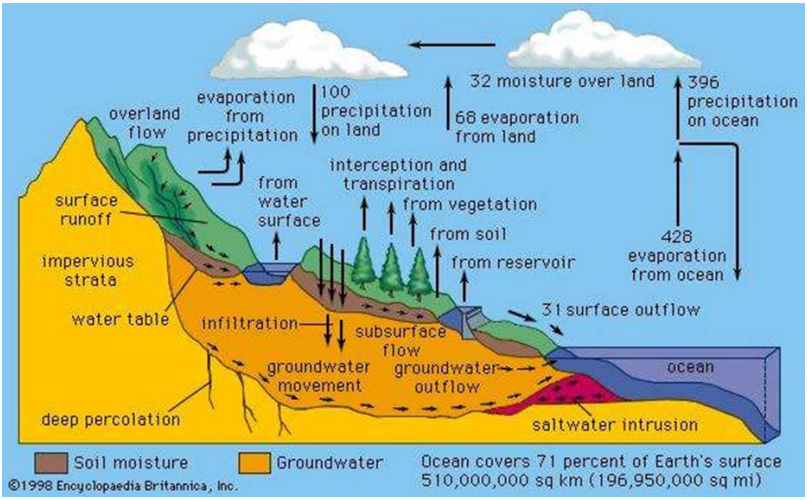
Surface water and groundwater

Surface water and groundwater are both important sources for community water supply needs. Groundwater is a common source for single homes and small towns, and rivers and lakes are the usual sources for large cities. Although approximately 98 percent of liquid fresh water exists as groundwater, much of it occurs very deep in the Earth. This makes pumping very expensive, preventing the full development and use of all groundwater resources.

The hydrologic cycle

Water is in constant circulation, powered by the energy from sunlightand gravity in a natural process called the hydrologic cycle.

Water evaporates from the ocean and land surfaces, is held temporarily as vapour in the atmosphere, and falls back to the Earth's surface as precipitation. Surface water is the residue of precipitation and melted snow, called runoff. Where the average rate of precipitation exceeds the rate at which runoff seeps into the soil, evaporates, or is absorbed by vegetation, bodies of surface water such as streams, rivers, and lakes are formed. Water that infiltrates the Earth's surface becomes groundwater, slowly seeping downward into extensive layers of porous soil and rock called aquifers. Under the pull of gravity, groundwater flows slowly and steadily through the aquifer. In low areas it emerges in springs and streams. Both surface water and groundwater eventually return to the ocean, where evaporation replenishes the supply of atmospheric water vapour. Winds carry the moist air over land, precipitation occurs, and the hydrologic cycle continues.



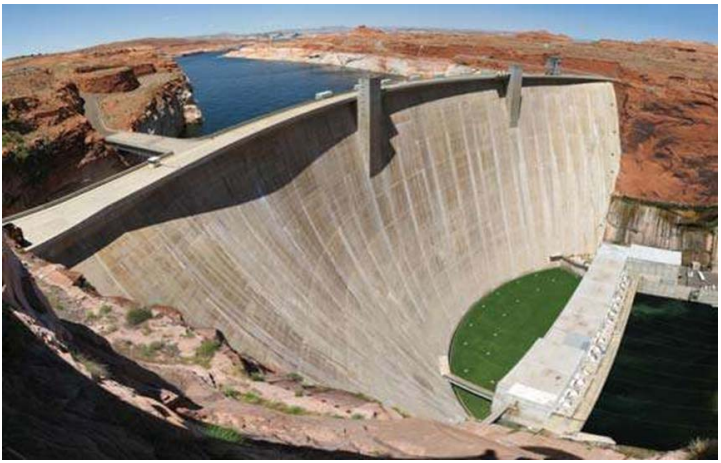
In the hydrologic cycle, water is transferred between the land surface, the ocean, and the atmosphere.
The numbers on the arrows indicate relative water fluxes.
Encyclopædia Britannica, Inc.

Surface water sources

The total land area that contributes surface runoff to a river or lake is called a watershed, drainage basin, or catchment area. The

volume of water available for municipal supply depends mostly on the amount of rainfall. It also depends on the size of the watershed, the slope of the ground, the type of soil and vegetation, and the type of land use.

The flow rate or discharge of a river varies with time. Higher flow rates typically occur in the spring, and lower flow rates occur in the winter. When the average discharge of a river is not enough for a dependable supply of water, a conservation reservoir may be built. The flow of water is blocked by a dam, allowing an artificial lake to be formed. Conservation reservoirs store water from wet weather periods for use during times of drought and low streamflow. A water intake structure is built within the reservoir, with inlet ports and valves at several depths. Since the quality of water in a reservoir varies seasonally with depth, a multilevel intake allows water of best quality to be withdrawn. Sometimes it is advisable, for economic reasons, to provide a multipurpose reservoir. A multipurpose reservoir is designed to satisfy a combination of community water needs. In addition to drinking water, the reservoir may also provide flood control, hydroelectric power, and recreation.



Glen Canyon DamConstruction of the Glen Canyon Dam on the Colorado River formed Lake Powell in Arizona.

Groundwater sources

The value of an aquifer as a source of groundwater is a function of the porosity of the geologic stratum, or layer, of which it is formed. Water is withdrawn from an aquifer by pumping it out of a well or infiltration gallery. An infiltration gallery typically includes several horizontal perforated pipes radiating outward from the bottom of a large-diameter vertical shaft. Wells are constructed in several ways, depending on the depth and nature of the aquifer. Wells used for public water supplies, usually more than 30 metres (100 feet) deep and from 10 to 30 cm (4 to 12 inches) in diameter, must penetrate large aquifers that can provide dependable yields of good-quality water. They are drilled using impact or rotary techniques and are usually lined with a metal pipe or casing to prevent contamination. The annular space around the outside of the upper portion of the casing is filled with cement grout, and a special sanitary seal is installed at the top to provide further protection. At the bottom of the casing, a slotted screen is attached to strain silt and sand out of the groundwater. A submersible pump driven by an electric motorcan be used to raise the water to the surface. Sometimes a deep well may penetrate a confined artesian aquifer, in which case natural hydrostatic pressure can raise the water to the surface.

TEXT 5. WATER SUPPLY SYSTEM

Water supply system, infrastructure for the collection, transmission, treatment, storage, and distribution of water for homes, commercial establishments, industry, and irrigation, as well as for such public needs as firefighting and street flushing. Of all municipal services, provision of potable water is perhaps the most vital. People depend on water for drinking, cooking, washing, carrying away wastes, and other domestic needs. Water supply systems must also meet requirements for public, commercial, and industrial activities. In all cases, the water must fulfill both quality and quantity requirements.

Historical Background

Developments in supply systems

Water was an important factor in the location of the earliest settled communities, and the evolution of public water supply systems is tied directly to the growth of cities. In the development of water resources beyond their natural condition in rivers, lakes, and springs, the digging of shallow wells was probably the earliest innovation. As the need for water increased and tools were developed, wells were made deeper. Brick-lined wells were built by city dwellers in the Indus River basin as early as 2500 BCE, and wells almost 500 metres (more than 1,600 feet) deep are known to have been used in ancient China.

Construction of qanāts, slightly sloping tunnels driven into hillsides that contained groundwater, probably originated in ancient Persia about 700 BCE. From the hillsides the water was conveyed by gravity in open channels to nearby towns or cities. The use of qanāts became widespread throughout the region, and some are still in existence. Until 1933 the Iranian capital city, Tehrān, drew its entire water supply from a system of qanāts.

A qanāt at the National Library of Iran, Tehran. Zereshk

The need to channel water supplies from distant sources was an outcome of the growth of urban communities. Among the most

notable of ancient water-conveyance systems are the aqueducts built between 312 BCE and 455 CE throughout the Roman Empire. Some of these impressive works are still in existence. The writings of Sextus Julius Frontinus (who was appointed superintendent of Roman aqueducts in 97 CE) provide information about the design and construction of the 11 major aqueducts that supplied Rome itself. Extending from a distant spring-fed area, a lake, or a river, a typical Roman aqueduct included a series of underground and aboveground channels. The longest was the Aqua Marcia, built in 144 BCE. Its source was about 37 km (23 miles) from Rome. The aqueduct itself was 92 km (57 miles) long, however, because it had to meander along land contours in order to maintain a steady flow of water. For about 80 km (50 miles) the aqueduct was underground in a covered trench, and only for the last 11 km (7 miles) was it carried aboveground on an arcade. In fact, most of the combined length of the aqueducts supplying Rome (about 420 km [260 miles]) was built as covered trenches or tunnels. When crossing a valley, aqueducts were supported by arcades comprising one or more levels of massive granite piers and impressive arches.

The aqueducts ended in Rome at distribution reservoirs, from which the water was conveyed to public baths or fountains. A few very wealthy or privileged citizens had water piped directly into their homes, but most of the people carried water in containers from a public fountain. Water was running constantly; the excess being used to clean the streets and flush the sewers.

Ancient aqueducts and pipelines were not capable of withstanding much pressure. Channels were constructed of cut stone, brick, rubble, or rough concrete. Pipes were typically made of drilled stone or of hollowed wooden logs, although clay and lead pipes were also used. During the Middle Ages there was no notable progress in the methods or materials used to convey and distribute water.

Cast-iron pipes with joints capable of withstanding high pressures were not used very much until the early 19th century. The steam engine was first applied to water-pumping operations at about that

time, making it possible for all but the smallest communities to have drinking water supplied directly to individual homes. Asbestos cement, ductile iron, reinforced concrete, and steel came into use as materials for water supply pipelines in the 20th century.

Developments in water treatment

In addition to quantity of supply, water quality is also of concern. Even the ancients had an appreciation for the importance of water purity. Sanskrit writings from as early as 2000 BCE tell how to purify foul water by boiling and filtering. But it was not until the middle of the 19th century that a direct link between polluted water and disease (cholera) was proved, and it was not until the end of that same century that the German bacteriologist Robert Koch proved the germ theory of disease, establishing a scientific basis for the treatment and sanitation of drinking water.

Water treatment is the alteration of a water source in order to achieve a quality that meets specified goals. At the end of the 19th century and the beginning of the 20th, the main goal was elimination of deadly waterborne diseases. The treatment of public drinking water to remove pathogenic, or disease-causing, microorganisms began about that time. Treatment methods included sand filtration as well as the use of chlorine for disinfection. The virtual elimination of diseases such as cholera and typhoid in developed countries proved the success of this water-treatment technology. In developing countries, waterborne disease is still the principal water quality concern.

In industrialized countries, concern has shifted to the chronic health effects related to chemical contamination. For example, trace amounts of certain synthetic organic substances in drinking water are suspected of causing cancer in humans. The added goal of reducing such health risks is seen in the continually increasing number of factors included in drinking-water standards.

TEXT 6. WATER TREATMENT

Clarification

Sedimentation

Impurities in water are either dissolved or suspended. The suspended material reduces clarity, and the easiest way to remove it is to rely on gravity. Under quiescent (still) conditions, suspended particles that are denser than water gradually settle to the bottom of a basin or tank. This is called plain sedimentation. Long-term water storage (for more than one month) in reservoirs reduces the amount of suspended sediment and bacteria. Nevertheless, additional clarification is usually needed. In a treatment plant, sedimentation (settling) tanks are built to provide a few hours of storage or detention time as the water slowly flows from tank inlet to outlet. It is impractical to keep water in the tanks for longer periods, because of the large volumes that must be treated.

Sedimentation tanks may be rectangular or circular in shape and are typically about 3 metres (10 feet) deep. Several tanks are usually provided and arranged for parallel (side-by-side) operation. Influent (water flowing in) is uniformly distributed as it enters a tank. Clarified effluent (water flowing out) is skimmed from the surface as it flows over special baffles called weirs. The layer of concentrated solids that collects at the bottom of the tank is called sludge. Modern sedimentation tanks are equipped with mechanical scrapers that continuously push the sludge toward a collection hopper, where it is pumped out.

The efficiency of a sedimentation tank for removing suspended solids depends more on its surface area than on its depth or volume. A relatively shallow tank with a large surface area will be more effective than a very deep tank that holds the same volume but has a smaller surface area. Most sedimentation tanks, though, are not less than 3 metres deep, in order to provide enough room for a sludge layer and a scraper mechanism.

A technique called shallow-depth sedimentation is often applied in modern treatment plants. In this method, several prefabricated units or modules of “tube settlers” are installed near the tops of tanks in order to increase their effective surface area.

Coagulation and flocculation

Suspended particles cannot be removed completely by plain settling. Large, heavy particles settle out readily, but smaller and lighter particles settle very slowly or in some cases do not settle at all. Because of this, the sedimentation step is usually preceded by a chemical process known as coagulation. Chemicals (coagulants) are added to the water to bring the nonsettling particles together into larger, heavier masses of solids called floc. Aluminum sulfate (alum) is the most common coagulant used for water purification. Other chemicals, such as ferric sulfate or sodium aluminate, may also be used.

Coagulation is usually accomplished in two stages: rapid mixing and slow mixing. Rapid mixing serves to disperse the coagulants evenly throughout the water and to ensure a complete chemical reaction. Sometimes this is accomplished by adding the chemicals just before the pumps, allowing the pump impellers to do the mixing. Usually, though, a small flash-mix tank provides about one minute of detention time. After the flash mix, a longer period of gentle agitation is needed to promote particle collisions and enhance the growth of floc. This gentle agitation, or slow mixing, is called flocculation; it is accomplished in a tank that provides at least a half hour of detention time. The flocculation tank has wooden paddle-type mixers that slowly rotate on a horizontal motor-driven shaft. After flocculation the water flows into the sedimentation tanks. Some small water-treatment plants combine coagulation and sedimentation in a single prefabricated steel unit called a solids-contact tank.

Disinfection

Disinfection destroys pathogenic bacteria and is essential to prevent the spread of waterborne disease. Typically the final process in drinking-water treatment, it is accomplished by applying either

chlorine or chlorine compounds, ozone, or ultraviolet radiation to clarified water.

Ozone

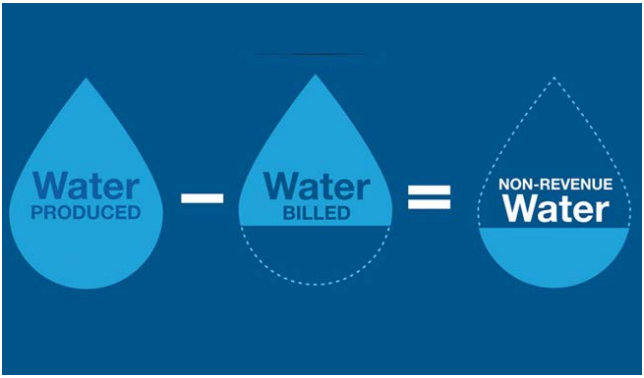
Ozone gas may be used for disinfection of drinking water. However, since ozone is unstable, it cannot be stored and must be produced on-site, making the process more expensive than chlorination. Ozone has the advantage of not causing taste or odour problems; it leaves no residual in the disinfected water. The lack of an ozone residual, however, makes it difficult to monitor its continued effectiveness as water flows through the distribution system.

Ultraviolet radiation

Ultraviolet radiation destroys pathogens, and its use as a disinfecting agent eliminates the need to handle chemicals. It leaves no residual, and it does not cause taste or odour problems. But the high cost of its application makes it a poor competitor with either chlorine or ozone as a disinfectant.

Additional treatment

Clarification and disinfection are the conventional processes for purifying surface water supplies. Other techniques may be used in addition, or separately, to remove certain impurities, depending on the quality of the raw water.



UNIT III NATURAL GAS AND EQUIPMENT OF GAS SUPPLY SYSTEMS

ACTIVITY 1. MATCH THE FOLLOWING WORDS AND WORD COMBINATIONS WITH THEIR UKRAINIAN EQUIVALENTS.

1) natural gas	a) рідина
2) gas	b) джерело, ключ
3) methane	c) шипіти, виділятись у вигляді газу
4) fossil fuels	d) резервуар, запас, джерело
5) coal bed	e) виробництво нафти
6) methanogenic	f) азот
7) bog	g) гелій
8) fertilizer	h) сірка
9) greenhouse gas	i) вуглеводень
10) processing	j) пентан
11) ethane	k) бутан
12) propane	l) пропан
13) butane	m) етан
14) pentane	n) обробка
15) hydrocarbon	o) тепличний газ
16) sulfur	p) болото, трясовина
17) helium	q) добриво
18) nitrogen	r) метаногенний
19) oil producing	s) вугільний пласт
20) reservoir	t) мінеральне паливо
21) effervesce	u) метан
22) wellhead	v) газ
23) liquid	w) природний газ

ACTIVITY 2. READ AND TRANSLATE THE FOLLOWING TEXT INTO UKRAINIAN

NATURAL GAS

Natural gas is a gas consisting primarily of methane. It is found associated with fossil fuels, in coal beds, as methane clathrates, and is created by methanogenic organisms in marshes, bogs, and landfills. It is an important fuel source, a major feedstock for fertilizers, and a potent greenhouse gas.

Natural gas is often informally referred to as simply gas, especially when compared to other energy sources such as electricity. Before natural gas can be used as a fuel, it must undergo extensive processing to remove almost all materials other than methane. The by-products of that processing include ethane, propane, butane, pentane and higher molecular weight hydrocarbon, elemental sulfur, and sometimes helium and nitrogen.

ACTIVITY 3. FILL IN THE GAPS IN THE FOLLOWING SENTENCES WITH THE VERBS GIVEN IN THE BOX.

methane, organisms, sources, gas, coal

1. Natural gas is often informally referred to as simply _____, especially when compared to other energy _____ such as electricity.
2. Natural gas is a gas consisting primarily of _____.
3. Natural gas is found associated with fossil fuels, in _____beds.
4. Natural gas is created by methanogenic _____ in marshes, bogs, and landfills.

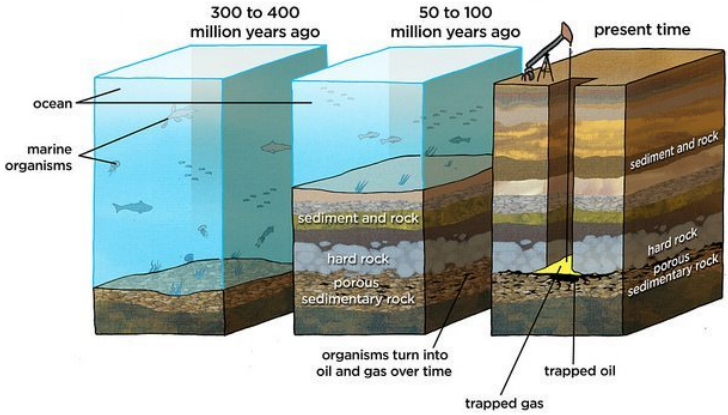
ACTIVITY 4. MATCH THE FOLLOWING WORDS AND WORD COMBINATIONS WITH THEIR UKRAINIAN EQUIVALENTS.

1) Fischer-Tropsch process	a) анаеробний розпад
2) end consumer	b) кам'яновугільний дьоготь
3) natural gas field	c) органічний
4) coal bed methane	d) окис вуглецю
5) carbon dioxide	e) побутовий газ
6) hydrogen sulfide	f) ретроградна конденсація
7) oil field	g) Персидська затока
8) shale gas	h) ГазПром
9) Gazprom	i) сланцевий газ
10) Persian Gulf	j) нафтове родовище
11) retrograde condensation	k) гідроокис, гідрат
12) town gas	l) двоокис вуглецю
13) carbon monoxide	m) болото
14) organic	n) метан, що виділяється з вугільних пластів
15) coal tar	o) бітум
16) bitumen	p) джерело природного газу
17) anaerobic decay	q) кінцевий споживач
18) swamp	r) процес Фішера-Тропша

ACTIVITY 5. READ THE TEXT BELOW. MATCH CHOICES **(A – H)** TO **(1 – 6).** THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

WHAT IS NATURAL GAS?

Natural gas is the earth's cleanest fossil fuel and is colorless and odorless in its natural state. It is composed of four hydrocarbon atoms and one carbon atom (CH4 or methane).



1 _____

Much of the natural gas we find and use today began as microscopic plants and animals living in shallow marine environments millions of years ago. As living organisms, they absorbed energy from the sun, which was stored as carbon molecules in their bodies. When they died, they sank to the bottom of the sea and were covered by layer after layer of sediment. As this organic feedstock became buried deeper in the earth, heat, combined with the pressure of compaction, converted some of the biomaterial into natural gas.

2 _____

Once natural gas has been generated in nature, it tends to migrate within the sediments and rocks in which it was created, using the pore space, fractures and fissures that occur naturally in the subsurface. Some natural gas actually makes it to the surface and shows up in seeps, while other gas molecules travel until they are trapped or impeded by impermeable layers of rock, shale, salt or clay. These trapped deposits are the reservoirs where we find natural gas today.

3 _____

Natural gas is composed of four hydrogen atoms and one carbon atom (CH4 or methane). Colorless and odorless in its natural state, natural gas is the cleanest burning fossil fuel. When it burns,

natural gas produces mostly carbon dioxide, water vapor and small amounts of nitrogen oxides.

4 _____

Technological advances, an accessible and abundant domestic resource, and the world's most extensive and reliable delivery infrastructure have created a fundamental shift in the natural gas marketplace, providing an opportunity to satisfy significant new demand at affordable prices well into the future. In 2017, the Potential Gas Committee (Colorado School of Mines) in coordination with the American Gas Association (AGA), released a year-end 2016 biennial report: Potential Gas Supply of Natural Gas in the United States, which found thatthe United States possesses a technically recoverable natural gas resource base of 2,817 trillion cubic feet (Tcf) yet to be discovered. This is the highest resource evaluation in the Committee's 52-year history—a 12 percent increase from the previous high assessment from year-end 2014.

5_____

The first use of gas energy in the United States occurred in 1816, when gaslights illuminated the streets of Baltimore, Md. By 1900, natural gas had been discovered in 17 states. During the years following World War II, expansion of the extensive interstate pipeline network occurred, bringing natural gas service to customers all over the country.

Today, natural gas is used extensively in residential, commercial and industrial applications. It is the main energy used for home heating: slightly more than half of American homes use gas. Increasingly, natural gas is being used for electric power generation as well.

6_____

Natural gas, like other forms of heat energy, is measured in British thermal units or Btu. One Btu is equivalent to the heat needed to raise the temperature of one pound of water by one degree Fahrenheit. A cubic foot of natural gas holds a lot of power, about 1,032 Btu. The unit you see on your heating bill holds even more

power: most natural gas bills measure gas in therms, which is a unit of heating equal to 103,200 Btu. That's a lot of hot water! In fact, a therm is enough to provide almost 2.5 days of hot water for your household; and two therms can warm your home for a day.

A – Migration
B – A Little Goes a Long Way
C – A Long History of Many Uses
D – Origins
E – What can warm your home
F – Commercial and industrial applications
G – The Earth's Cleanest Fossil Fuel
H – Where Do We Find It?

ACTIVITY 6. FILL IN THE GAPS IN THE FOLLOWING SENTENCES WITH THE VERBS GIVEN IN THE BOX. USE THE APPROPRIATE GRAMMAR FORM

to be, occure, can, to hold, to be composed, make, advance, begin

1. A cubic foot of natural gas _____ a lot of power, about 1,032 Btu.
2. Two therms _____ warm your home for a day.
3. The first use of gas energy in the United States _____ in 1816.
4. Technological _____ and the world's most extensive and reliable delivery infrastructure have created a fundamental shift in the natural gas marketplace.
5. Natural gas _____ of four hydrogen atoms and one carbon atom.
6. Some natural gas actually _____ it to the surface and shows up in seeps.
7. Much of the natural gas we find and use today _____as microscopic plants and animals living in shallow marine environments millions of years ago.
8. Natural gas _____ the earth's cleanest fossil fuel.

ACTIVITY 7. COMPLETE THE FOLLOWING SENTENCES WITH THE CORRECT WORDS. READ THE TEXT BELOW AND TRANSLATE IT INTO UKRAINIAN

FOSSIL NATURAL GAS

In the past, natural gas was almost always a byproduct of producing **1** ____, since the small, light gas carbon chains come out of solution as it undergoes pressure reduction from the reservoir to the surface, similar to uncapping a bottle of soda pop where the carbon dioxide effervesces. Unwanted natural gas can be a disposal problem at the well site. If there is not a market for natural gas near the wellhead it is virtually valueless since it must be piped to the end user. Until recently, such unwanted **2** _____ was burned off at the well site, but due to environmental concerns this practice is becoming less common. Often, unwanted (or "stranded" gas without a market) gas is pumped back into the reservoir with an "injection" well for disposal or depressurizing the producing formation. Another solution is to export the natural gas as a liquid. Gas-to-liquid, (GTL) is a developing technology that converts stranded natural gas into synthetic gasoline, diesel or jet fuel through the Fischer-Tropsch process developed in World War II Germany. Such fuels can be transported through conventional pipelines and tankers to users. Proponents claim GTL fuels burn cleaner than comparable petroleum fuels. Most major international oil companies are in advanced development stages of GTL production, with a world-scale (140,000 bbl. /day) GTL plant in Qatar scheduled to come online before 2010. In locations **3** _____ as the United States with

a high natural gas demand, pipelines are constructed to take the gas from the well site to the end consumer.

Fossil **4** _____ gas can be "associated" (found in oil fields) or "non-associated" (isolated in natural gas fields), and is also found in coal beds (as coal bed methane). It sometimes contains significant quantities of ethane, propane, butane, and pentane—heavier hydrocarbons removed prior to use as a consumer fuel—as well as carbon dioxide, nitrogen, helium and hydrogen sulfide. Natural gas is commercially produced **5** _____ oil fields and natural gas fields. Gas produced from oil wells is called casing head gas or associated gas. The natural gas **6** _____ is producing gas from increasingly more challenging resource types: sour gas, tight gas, and shale gas and coal bed methane.

The world's largest proven gas reserves are **7** _____ in Russia, with 4.757 × 1013 m^3 (1.6 × 1015 cu ft). Russia is also the world's largest natural gas producer, through the Gazprom Company. Major proven resources (with year of estimate) (in billion cubic meters) are world 175,400 (2006), Russia 47,570 (2006), Iran 26,370 (2006), Qatar 25,790 (2007), Saudi Arabia 6,568 (2006) and United Arab Emirates 5,823 (2006).

The world's largest gas field is Qatar's offshore North Field, estimated to have 25 trillion cubic meters (9.0 × 1014 cu ft.) of gas in place - enough to last more than 200 years at optimum production levels. The second largest natural gas field is the South Pars Gas Field in Iranian waters in the Persian Gulf. Connected to Qatar's North Field, it has estimated reserves of 8 to 14 trillion cubic meters (2.8 × 1014 to 5.0 × 1014 cu ft) of gas.

Because natural gas is not a pure **8** _____, when non-associated gas is extracted from a field under supercritical (pressure/temperature) conditions, it may partially condense upon exothermic depressurizing – an effect called retrograde condensation. The liquids thus formed may get trapped by depositing in the pores of the gas reservoir. One method to deal with this problem is to reinject dried gas free of condensate to maintain

the underground pressure and to allow reevaporation and extraction of condensates.

1	**A**	oil	**B**	power	**C**	coal	**D**	energy
2	**A**	coal	**B**	gas	**C**	water	**D**	well
3	**A**	many	**B**	some	**C**	such	**D**	much
4	**A**	through	**B**	behind	**C**	out of	**D**	from
5	**A**	out of	**B**	from	**C**	after	**D**	through
6	**A**	agriculture	**B**	formation	**C**	industry	**D**	reservoir
7	**A**	located	**B**	unwanted	**C**	extracted	**D**	founded
8	**A**	meter	**B**	resource	**C**	level	**D**	product

ACTIVITY 8. DECIDE WHETHER THE FOLLOWING STATEMENTS ARE **TRUE** OR **FALSE**

1. The world's largest gas field is Qatar's offshore South Field.
2. Natural gas is commercially produced from oil fields and natural coal fields.
3. Gas produced from oil wells is called casing head gas or associated gas.
4. In the past, natural gas was almost always a byproduct of producing oil.

5. The natural gas industry is producing gas from increasingly more challenging resource types: sour gas, tight gas, and shale gas and coal bed methane.
6. The liquids thus formed may get trapped by depositing in the pores of the gas formation.
7. The second largest natural gas field is the South Pars Gas Field in Iranian waters in the Persian Gulf.

ACTIVITY 9. ANSWER THE QUESTIONS BASED ON THE CONTENT OF THE TEXT '**FOSSIL NATURAL GAS'**

1. What was the gas in the past?
2. Can natural gas be a disposal problem at the well site?
3. Where fossil natural gas can be found?
4. What natural gas is commercially produced from?
5. What is the world's largest gas field?
6. Is natural gas a pure product?
7. Where the world's largest proven gas reserves are located?
8. What is the second largest natural gas field?

ACTIVITY 10. MAKE SENTENCES FROM THE FOLLOWING WORDS:
1. natural gas, In the past, was, producing oil, a byproduct of, almost always.
2. such as, In locations, constructed, the United States, pipelines, are, to take the gas, to the end consumer, from the well site.
3. Qatar's offshore North Field, The world's, is, largest, gas field.
4. natural gas, Because, a pure product, is not, it may, upon, partially condense, exothermic depressurizing.
5. largest natural gas field, The second, Iranian waters, is in, in the Persian Gulf.
6. commercially produced, and, Natural gas, from, oil fields, natural gas fields, is.

ACTIVITY 11. MATCH THE FOLLOWING WORDS AND WORD COMBINATIONS WITH THEIR UKRAINIAN EQUIVALENTS

1) sewage sludge	a) вічна мерзлота
2) manure	b) органічні матеріали
3) anaerobic digester	c) с/г відходи
4) enteric fermentation	d) норми викидів
5) termites	e) двоокис вуглецю
6) biomass	f) водяна пара
7) biogas	g) Гетвордське графство
8) ruminant	h) забрудник
9) pollutant	i) жуйна тварина
10) Hertfordshire	j) біогаз
11) water vapor	k) біомаса
12) emission standards	l) терміти
13) agricultural waste	m) ферментація
14) organic materials	n) анаеробний реактор
15) anaerobic lagoon	o) перегній, добриво, удобрювати
16) permafrost	p) анаеробні лагуни
17) carbon dioxide	q) осад стічних вод

ACTIVITY 12. TRY TO MATCH UP THE ADJECTIVES IN COLUMN A WITH THE NOUNS IN COLUMN B TO FORM MEANINGFUL PHRASES

A	B
natural	organism
fossil	weigh
methanogenic	fuels
molecular	gas
extensive	sulfur
elemental	processing

ACTIVITY 13. READ THE TEXT BELOW AND TRANSLATE IT INTO UKRAINIAN

TOWN GAS

Town gas is a mixture of methane and other gases, mainly the highly toxic carbon monoxide that can be used in a similar way to natural gas and can be produced by treating coal chemically. This is a historic technology, still used as “best solution” in some local circumstances, although coal gasification is not usually economic at current gas prices. However, depending upon infrastructure considerations, it remains a future possibility.

Most town “gashouses” located in the eastern United States in the late nineteenth and early twentieth centuries were simple by-product coke ovens which heated bituminous coal in air-tight chambers. The gas driven off from the coal was collected and

distributed through town-wide networks of pipes to residences and other buildings where it was used for cooking and lighting purposes. (Gas heating did not come into widespread use until the last half of the twentieth century.) The coal tar that collected in the bottoms of the gashouse ovens was often used for roofing and other water-proofing purposes, and also, when mixed with sand and gravel, was used for creating Bitumen for the surfacing of local streets.

ACTIVITY 14. COMPLETE THE SENTENCES WITH THE MISSING WORDS

1. The coal tar was often used for _____ and other water-proofing purposes, and also was used for creating Bitumen for the surfacing of local streets. (**collecting, roofing, cooking**)
2. The gas driven off from the _____was collected and distributed through town-wide networks of pipes to residences and other buildings. (**coal, gas, wood**)
3. Town _____ is a mixture of methane and other gases. (**coal, gas, wood**)
4. Coal gasification is not usually economic at current gas _____. (**considerations, residences, prices**)
5. Most town "gashouses" located in the eastern United States in the late nineteenth and early twentieth _____ were simple by-product coke ovens which heated bituminous coal in air-tight chambers. (**centuries, bituminous**, **purposes**)

6. Gas _____ did not come into widespread use until the last half of the twentieth century. (**heating, cooking, lighting**)

ACTIVITY 15. QUOTE THE SENTENCES IN WHICH THESE WORDS AND WORD COMBINATIONS AND USED IN THE TEXTS

Carbon chains, disposal problem, unwanted gas, environmental concerns, synthetic gasoline, conventional pipelines, significant quantities, casing head gas, pure product, supercritical conditions, historic technology, bituminous coal, widespread use, biological sources, symbiotic relationship, pollutant, principal component, landfill gas, organic materials, unpleasant odor, experimental systems

ACTIVITY 16. FILL IN THE GAPS WITH THE MISSING WORDS IN THE FOLLOWING SENTENCES, THE FIRST LETTER OF EACH WORD HAS BEEN GIVEN TO HELP YOU

1. Natural gas is a gas consisting primarily of **m**_____ .
2. Natural gas is an important **f**_____ today.
3. In the past natural gas was almost always a **b** _____ of producing oil.
4. Unwanted natural gas can be a **d**_____ problem at the **w**_____ .
5. Another solution is to export the natural gas as a **l**_____.
6. Gas produced from oil **w**_____ is called gasinghead gas or associated gas.
7. **T**_____ gas is a mixture of methane and other gases, mainly the highly toxic **c**_____ **m**_____ gases.
8. Methane released directly into the atmosphere would be considered a **p**_____ .

9. Future sources of methane, the **p**_____ **c**_____ of natural gas, include landfill gas, biogas and methane hydrate.
10. **L**_____ gas is created from the decomposition of waste in landfills.

ACTIVITY 17. PUT THE WORDS OF THE FOLLOWING SENTENCES IN ORDER, THE FIRST WORD IN EACH SENTENCE IS IN ITALICS.

1. of, is other, a mixture, gases, methane, Town gas, and.
2. United States, in, the, located, are, eastern town “gashouses”, Most.
3. a pollutant, is, released, into, directly, Methane, the atmosphere, considered.
4. in, the atmosphere, oxidized, is, Methane, producing, and, water, dioxide, carbon.
5. gas, Landfill, is, from, created, decomposition, waste, of, in landfills.
6. can, The gas, be, to the atmosphere, vented, flared, burned, or, electricity, to, produce, or, heat.
7. gas Fossil, natural, be, can, or “associated”, “non-associated”.
8. largest, world’s, The, proven, gas reserves, in, Russia, located, are.
9. from, produced, Gas, oil wells, called, is, associated gas.
10. Russia, gas, natural, producer, is, also, world’s, largest, the.

ACTIVITY 18. MAKE UP GENERAL AND DISJUNCTIVE QUESTIONS AND GIVE THE SHORT ANSWERS ON THEM.

1. In the past natural gas was almost always a byproduct.
2. Unwanted natural gas can be a disposal problem at the well site.
3. Until recently unwanted gas was burned off at the well site.
4. Another solution is to export the natural gas as a liquid.
5. Natural gas is often informally referred to as simply gas.

6. Future sources of methane, the principal component of natural gas, include landfill gas, biogas and methane hydrate.

ACTIVITY 19. ANSWER THE FOLLOWING QUESTIONS.

1. What does natural gas consist of?
2. What is natural gas used for?
3. Which by-products of natural gas processing are there?
4. What was natural gas used for in the past?
5. What is gas-to-liquid?
6. How is gas produced from oil wells called?
7. Where are most town “gashouses” located?
8. What does town gas consist of?
9. Where are the world’s largest proven gas reserves located?
10. How long does methane live in the atmosphere?

ACTIVITY 20. READ THE TEXT BELOW. MATCH CHOICES **(A – F)** TO **(1 – 8).** THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

NATURAL GAS IN YOUR HOME

1 _____

Homebuyers consistently rate fireplaces as a must have in consumer preference surveys. However, many homeowners do not often use wood-burning fireplaces, because it can be time-consuming and messy to collect wood, build a fire, tend it, cool it down and clean up the ashes.

It is no surprise that gas hearth product shipments zoomed up 600 percent between 1992-2000, while sales of traditional cordwood appliances rose only 11 percent during the same time period, according to the Hearth, Patio and Barbecue Association.

Families who already have a masonry fireplace and a chimney in good shape can easily upgrade to a gas fireplace. And new manufactured gas fireplaces can be installed without a conventional chimney making some gas hearth products appropriate even for high-rise apartments.

Natural gas fireplaces, stoves, fireplace inserts and gas log sets burn more cleanly than wood fireplaces. This means no ash build-up, no creosote in chimneys and no sparks or flying embers that could burn holes in carpets or furniture. Natural gas hearth products are so clean, in fact, that they can be used anytime in areas of the country that have no burn regulations for wood fireplaces and stoves in an effort to reduce air pollution.

2 _____

Gas fireplaces are complete, prefabricated units that contain a gas fire within a prefabricated metal firebox. They come in a variety

of sizes and styles, including see-through, three-sided and traditional fireplace configurations. The size of the firebox, the interior where the fire burns, typically varies from 32 to 45 inches in width. The fireplace can be placed along inside or outside walls, under windows, as a peninsula between rooms, in bookcases and media centers or in corners. These units can be vented up through the roof or through a side wall, or can be unvented. Some models use a fan or blower to circulate warm air from the fire into the room. Because no masonry work is needed, natural gas fireplaces are economical to install.

All natural gas fireplaces feature realistic gas logs with burning flames, and some can be used as supplemental heat. Gas fireplaces that are classified as decorative appliances are designed primarily for their appearance and the radiant heat they provide to a room. Some of these fireplaces can be equipped with blower assemblies that increase the amount of supplemental heat available.

Some types of fireplaces are classified as vented space heaters and are given efficiency ratings like furnaces and other types of vented space heaters. The efficiency rating is called its Annual Fuel Utilization Efficiency or AFUE. The AFUE for a fireplace takes into consideration the energy used while the fireplace is operating, any energy lost in start-up and shut down, and any fuel used in a standing pilot light.

Fireplaces classified as space heaters contain a heat exchanger, a metal box used to transfer heat from the burner to the air to be circulated, and a blower or fan to move the warmed air through the room, usually through a decorative grill on the front of the fireplace.

3 _____

Gas fireplace logs are constructed of ceramic fiber or concrete with a gas burner underneath. They are available in a variety of designs crafted to resemble real wood. The gas burner assembly creates a pleasant effect that suggests lively glowing embers.

There are two types of fireplace log sets:

1. Vented decorative gas fireplace log sets require leaving the fireplace damper open during operation. These sets are used primarily for ambience, since only about 10 percent of the log appliance s heat is retained in the room. Building codes usually require that the fireplace damper (the metal flap at the top of the firebox, leading to the chimney) be opened permanently with vented gas logs. As a result, glass doors are recommended for the firebox opening in order to keep heat in the room when the fireplace is not in use.

2. Vent-free log heaters can contribute to heating a room, and can be used with the fireplace damper closed. A sensor in the unit monitors the percentage of oxygen in the room and automatically shuts the log set off if the level drops beneath its set point. Local building codes vary on installation of these units.

4 _____

Another option for an existing fireplace is a gas fireplace insert. These units can upgrade an inefficient wood fireplace into a good source of extra heat.

An insert is composed of a set of gas logs built into a steel or cast iron box, usually with a fan or blower to move heat into the room. Inserts can fit into almost any existing fireplace and come in

a wide variety of styles and sizes. Vented decorative models come in an airtight metal cabinet with sealed glass door. They sometimes require a chimney liner to ensure proper venting. Vent-free heater models do not require sealed glass doors since all of the heat produced goes into the room. Units can be controlled by a switch, remote control or thermostat.

5 _____

Country, rustic or western-style homes are particularly well suited to gas stoves, which provide warmth with the look of a blazing fire. Gas stoves are good substitutes for more polluting wood-burning stoves. These units are freestanding, come in traditional and contemporary styles, and are available in vented and vent-free models. The stoves offer realistic flames, good heating capacity, high efficiency and an attractive appearance.

The heat output of gas stoves can be adjusted by turning the burner up or down, by linking the unit to a thermostat or by using a remote control. During power outages, gas stoves can provide heat as long as the pilot light is on.

6 _____

Builders know that a kitchen can sell a house. But smart builders know that natural gas appliances can sell the kitchen. Just as most professional chefs insist on cooking with natural gas, everyday cooks recognize that natural gas offers even heat, excellent temperature control and instant on/off settings for cooking and baking.

Today's natural gas ranges, ovens, cooktops and grills feature high efficiency, easy cleaning and the reliability that natural gas equipment is known for.

Cooking with natural gas is economical it costs about half as much to cook with a natural gas range as with a similar electric range. Many of the new models of natural gas cooking equipment use an electronic spark ignition, rather than a continuously burning pilot. This saves as much as 30 percent on energy costs.

7 _____

The wide variety of natural gas appliances on the market enables kitchen design to dictate appliance choice, rather than the other way around. Natural gas cooking equipment comes in many sizes and shapes. Most familiar is the traditional freestanding range, which includes a cooktop and an oven. Built-in ranges can either slide or drop into a space between cabinets. The drop-in style sits on a low cabinet base and doesn t have a lower storage drawer, like freestanding or slide-in ranges do.

In many kitchens today, the cooktop and the oven are separated. This means greater flexibility for installation and greater flexibility and convenience for a two-cook kitchen. An indoor gas grill can also be added either as part of the range or as a free-standing unit.

Many new gas ranges and cooktops come with special high-Btu burners, for rapid heating, and/or low-Btu burners for simmering.

Commercial-style ranges are becoming increasingly popular for home installation. They have chrome or stainless-steel finishes, and multiple burners and ovens. These ranges are built especially for homes, with extra safety measures and insulation added.

8 _____

Water heaters are the second biggest energy users in a typical home, next to the heating and cooling system. Natural gas water heaters cost less to operate than electric water heaters, on average, and can heat water twice as fast. In fact, consumers can enjoy two bathtubs full of water with natural gas for the same cost of a single tub full of water heated with electricity, on average.

A – Gas Logs
B – Design Options
C – Gas Stoves
D – Basking In the Comfort Of Natural Gas Hearth Products
E – Gas Fireplace Inserts
F – A variety of sizes and styles
G – Gas Fireplaces
H – Cooking with Natural Gas: Precise Control in a Stylish Package
I – Natural Gas Water Heaters
F – Convenience for a two-cook kitchen

ACTIVITY 21. READ THE TEXT '**NATURAL GAS IN YOUR HOME'** AND DO THE ACTIVITIES BELOW

A) DECIDE WHETHER THE FOLLOWING STATEMENTS ARE **TRUE** OR **FALSE**

1. Builders know that a kitchen can sell a house.
2. Cooking with natural gas isn't economical it costs about half as much to cook with a natural gas range as with a similar electric range.
3. The wide variety of natural gas appliances on the market enables kitchen design to dictate appliance choice, rather than the other way around.
4. In many kitchens today, the cooktop and the oven aren't separated.
5. During power outages, gas stoves can provide heat as long as the pilot light is on.
6. Families who already have a masonry fireplace and a chimney in good shape can easily upgrade to a gas fireplace.
7. Natural gas fireplaces, stoves, fireplace inserts and gas log sets burn more cleanly than coal fireplaces.

B) FIND THE UKRAINIAN EQUIVALENTS OF THE ENGLISH WORDS AND WORD COMBINATION:

a single tub	
water heaters	
gas cooking equipment	
consumers	
cooktop	
convenience	
to be separated	
an electronic spark ignition	
high efficiency	
temperature control	

C) MAKE YOUR OWN SENTENCES WITH THE WORDS FROM THE TABLE

ACTIVITY 22. CHOOSE THE PROPER WORDS AND FILL THEM IN THE BLANKS:

1. Natural gas cooking _____ comes in many sizes and shapes.

A convenience ***B*** storage ***C*** appliance ***D*** equipment

2. Cooking with natural gas is _____ it costs about half as much to cook with a natural gas range as with a similar electric range.

A widespread ***B*** adapted ***C*** economical ***D*** natural

3. Families who already have a masonry fireplace and a chimney in good shape can easily upgrade to a gas _____.

A range ***B*** fireplace ***C*** cooktop ***D*** furnace

4. Natural _____ fireplaces, stoves, fireplace inserts and gas log sets burn more cleanly than wood fireplaces.

A gas ***B*** coal ***C*** oil ***D*** water

5. Natural gas hearth products are so _____, in fact, that they can be used anytime in areas of the country that have no burn regulations for wood fireplaces and stoves in an effort to reduce air pollution.

A dirty ***B*** clean ***C*** neat ***D*** messy

6. The fireplace can be placed along inside or outside _____, under windows, as a peninsula between rooms, in bookcases and media centers or in corners.

A fence ***B*** balconet ***C*** walls ***D*** barrier

7. Most _____is the traditional freestanding range, which includes a cooktop and an oven.

A united ***B*** homelike ***C*** intimate ***D*** familiar

ACTIVITY 23. ANSWER THESE MULTIPLE-CHOICE QUESTIONS ABOUT NATURAL GAS IN YOUR HOME:

1. What is option for an existing fireplace?
   A – a gas fireplace invest
   B – a gas fireplace insert
   C – a gas fireplace gusset
2. What do the new models of natural gas cooking equipment use?
   A – an electronic spark ignition
   B – an electronic spark self-ignition
   C – an electronic spark lighting
3. Where did new gas ranges and cooktops come with?
   A – special average high-Btu burners
   B – special low level Btu burners
   C – special high-Btu burners (спеціальні пальники високого рівня)
4. What are gas fireplace logs constructed of?
   A – ceramic fiber
   B – artificial fiber
   C – chemical fiber
5. What do some fireplaces can be equipped with?

A – funnel pipe
B – blower assemblies (повітродувки)
C – chimney stack

ACTIVITY 24. READ AND TRANSLATE THE TEXT BELOW INTO UKRAINIAN. MAKE UP THE PLAN OF IT.

NATURAL GAS PROCESSING

Natural gas, as it is used by consumers, is much different from the natural gas that is brought from underground up to the wellhead. Although the processing of natural gas is in many respects less complicated than the processing and refining of crude oil, it is equally as necessary before its use by end users.

The natural gas used by consumers is composed almost entirely of methane. However, natural gas found at the wellhead, although still composed primarily of methane, is by no means as pure. Raw natural gas comes from three types of wells: oil wells, gas wells, and condensate wells. Natural gas that comes from oil wells is typically termed ‘associated gas’. This gas can exist separate from oil in the formation (free gas), or dissolved in the crude oil (dissolved gas). Natural gas from gas and condensate wells, in which there is little or no crude oil, is termed ‘nonassociated gas’. Gas wells typically produce raw natural gas by itself, while condensate wells produce free natural gas along with a semi-liquid hydrocarbon condensate. Whatever the source of the natural gas, once separated from crude oil (if present) it commonly exists in mixtures with other hydrocarbons; principally ethane, propane, butane, and pentanes. In addition, raw natural gas contains water

vapor, hydrogen sulfide (H2S), carbon dioxide, helium, nitrogen, and other compounds.

Natural gas processing consists of separating all of the various hydrocarbons and fluids from the pure natural gas, to produce what is known as ‘pipeline quality’ dry natural gas. Major transportation pipelines usually impose restrictions on the make-up of the natural gas that is allowed into the pipeline. That means that before the natural gas can be transported it must be purified. While the ethane, propane, butane, and pentanes must be removed from natural gas, this does not mean that they are all ‘waste products’.

In fact, associated hydrocarbons, known as ‘natural gas liquids’ (NGLs) can be very valuable by-products of natural gas processing. NGLs include ethane, propane, butane, iso-butane, and natural gasoline. These NGLs are sold separately and have a variety of different uses; including enhancing oil recovery in oil wells, providing raw materials for oil refineries or petrochemical plants, and as sources of energy.

A Natural Gas Processing Plant

In addition to processing done at the wellhead and at centralized processing plants, some final processing is also sometimes accomplished at ‘straddle extraction plants’. These plants are located on major pipeline systems. Although the natural

gas that arrives at these straddle extraction plants is already of pipeline quality, in certain instances there still exist small quantities of NGLs, which are extracted at the straddle plants.

The actual practice of processing natural gas to pipeline dry gas quality levels can be quite complex, but usually involves four main processes to remove the various impurities:

- Oil and Condensate Removal
- Water Removal
- Separation of Natural Gas Liquids
- Sulfur and Carbon Dioxide Removal

In addition to the four processes above, heaters and scrubbers are installed, usually at or near the wellhead. The scrubbers serve primarily to remove sand and other large-particle impurities. The heaters ensure that the temperature of the gas does not drop too low. With natural gas that contains even low quantities of water, natural gas hydrates have a tendency to form when temperatures drop. These hydrates are solid or semi-solid compounds, resembling ice like crystals. Should these hydrates accumulate, they can impede the passage of natural gas through valves and gathering systems. To reduce the occurrence of hydrates, small natural gas-fired heating units are typically installed along the gathering pipe wherever it is likely that hydrates may form.

ACTIVITY 25. ANSWER THESE MULTIPLE-CHOICE QUESTIONS ABOUT NATURAL GAS PROCESSING

1. What is the natural gas used by consumers composed of?
   A – methane
   B – carbon dioxide
   C – carbonic acid
2. What does raw natural gas come from?
   A – oil wells, condensate wells
   B – gas wells, oil wells
   C – oil wells, gas wells, and condensate wells

3. What does natural gas contain?

A – hydrogen sulfide, carbon dioxide

B – water vapor, hydrogen sulfide, carbon dioxide, helium, nitrogen

C – water vapor, hydrogen sulfide

4. What does natural gas processing consist of?

A – fluids from the pure natural gas

B – separating all of the various hydrocarbons and fluids from the pure natural gas

C – separating all of the various hydrocarbons

5. What is hydrocarbons known as?

A – natural gas processing

B – natural gas liquids

C – natural gas processing and hydrocarbons

ACTIVITY 26. COMPLETE THE FOLLOWING SENTENCES WITH THE CORRECT WORDS.

While some of the needed processing can be accomplished at or near the wellhead (field processing), the complete processing of **1** _____ gas takes place at a processing plant, usually located in a natural gas producing **2** _____. The extracted natural gas is **3** _____ to these processing plants through a network of gathering pipelines, which are small-diameter, low pressure **4** _____. A complex gathering **5** _____ can consist of thousands of miles of pipes, interconnecting the processing **6** _____ to upwards of 100 wells in the area. According to the American Gas Association's Gas Facts 2000, **7** _____ was an estimated 36,100 miles of gathering system pipelines in the U.S. in 1999.

1	**a**	natural	**b**	artificial	**c**	factitious	**d**	synthetic
2	**a**	district	**b**	region	**c**	circuit	**d**	zone
3	**a**	shipped	**b**	delivered	**c**	transported	**d**	brought
4	**a**	trench	**b**	aqueduct	**c**	tube	**d**	pipes
5	**a**	system	**b**	scheme	**c**	method	**d**	chain
6	**a**	construction	**b**	plant	**c**	activity	**d**	works
7	**a**	here	**b**	therein	**c**	there	**d**	then

ACTIVITY 27. COMPLETE THE SENTENCES WITH THE MISSING WORDS

1. Natural gas found at the wellhead, although still composed primarily of _____, is by no means as pure. (**methane, carbon dioxide, carbonic acid**)
2. Natural gas that comes from oil _____ is typically termed 'associated gas'. **(source, wells, spring)**
3. Natural gas from gas and condensate wells, in which there is little or no crude oil, is termed '_____gas'. **(nonassociated, unsatisfactory, appropriate)**
4. Major transportation pipelines usually impose restrictions on the make-up of the natural gas that is allowed into the _____. (**trunk, pipeline, artery**)

5. With natural gas that contains even low quantities of water, natural gas hydrates have a _____ to form when temperatures drop. **(tendency, trend, proclivity)**

6. To reduce the occurrence of hydrates, small natural gas-fired heating units are typically installed _____ the gathering pipe wherever it is likely that hydrates may form. **(above, down, along)**

ACTIVITY 28. READ THE TEXT BELOW. MATCH CHOICES **(A – E)** TO **(1 – 3).** THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

PROCESSING AND TRANSPORTATION OF NATURAL GAS

1 _____

In order to process and transport associated dissolved natural gas, it must be separated from the oil in which it is dissolved. This separation of natural gas from oil is most often done using equipment installed at or near the wellhead.

The actual process used to separate oil from natural gas, as well as the equipment that is used, can vary widely. Although dry pipeline quality natural gas is virtually identical across different geographic areas, raw natural gas from different regions may have different compositions and separation requirements. In many instances, natural gas is dissolved in oil underground primarily due to the pressure that the formation is under. When this natural gas and oil is produced, it is possible that it will separate on its own, simply due to decreased pressure; much like opening a can of soda pop allows the release of dissolved carbon dioxide. In these cases, separation of oil and gas is relatively easy, and the two hydrocarbons are sent separate ways for further processing. The most basic type of

separator is known as a conventional separator. It consists of a simple closed tank, where the force of gravity serves to separate the heavier liquids like oil, and the lighter gases, like natural gas.

2 _____

Natural gas coming directly from a well contains many natural gas liquids that are commonly removed. In most instances, natural gas liquids (NGLs) have a higher value as separate products, and it is thus economical to remove them from the gas stream. The removal of natural gas liquids usually takes place in a relatively centralized processing plant, and uses techniques similar to those used to dehydrate natural gas.

There are two basic steps to the treatment of natural gas liquids in the natural gas stream. First, the liquids must be extracted from the natural gas. Second, these natural gas liquids must be separated themselves, down to their base components.

3 _____

In addition to water, oil, and NGL removal, one of the most important parts of gas processing involves the removal of sulfur and carbon dioxide. Natural gas from some wells contains significant amounts of sulfur and carbon dioxide. This natural gas, because of the rotten smell provided by its sulfur content, is commonly called ‘sour gas’. Sour gas is undesirable because the sulfur compounds it contains can be extremely harmful, even lethal, to breathe. Sour gas can also be extremely corrosive. In addition, the sulfur that exists in the natural gas stream can be extracted and marketed on its own. In fact, according to the USGS, U.S. sulfur production from gas processing plants accounts for about 15 percent of the total U.S. production of sulfur. For information on the production of sulfur in the United States.

Sulfur exists in natural gas as hydrogen sulfide (H2S), and the gas is usually considered sour if the hydrogen sulfide content exceeds 5.7 milligrams of H2S per cubic meter of natural gas. The process for removing hydrogen sulfide from sour gas is commonly referred to as ‘sweetening’ the gas.

The primary process for sweetening sour natural gas is quite similar to the processes of glycol dehydration and NGL absorption. In this case, however, amine solutions are used to remove the hydrogen sulfide. This process is known simply as the ‘amine process’, or alternatively as the Girdler process, and is used in 95 percent of U.S. gas sweetening operations. The sour gas is run through a tower, which contains the amine solution. This solution has an affinity for sulfur, and absorbs it much like glycol absorbing water. There are two principle amine solutions used, monoethanolamine (MEA) and diethanolamine (DEA). Either of these compounds, in liquid form, will absorb sulfur compounds from natural gas as it passes through. The effluent gas is virtually free of sulfur compounds, and thus loses its sour gas status. Like the process for NGL extraction and glycol dehydration, the amine solution used can be regenerated (that is, the absorbed sulfur is removed), allowing it to be reused to treat more sour gas.

Although most sour gas sweetening involves the amine absorption process, it is also possible to use solid desiccants like iron sponges to remove the sulfide and carbon dioxide.

Sulfur can be sold and used if reduced to its elemental form. Elemental sulfur is a bright yellow powder like material, and can often be seen in large piles near gas treatment plants, as is shown. In order to recover elemental sulfur from the gas processing plant, the sulfur containing discharge from a gas sweetening process must be further treated. The process used to recover sulfur is known as the Claus process, and involves using thermal and catalytic reactions to extract the elemental sulfur from the hydrogen sulfide solution.

Gas processing is an instrumental piece of the natural gas value chain. It is instrumental in ensuring that the natural gas intended for use is as clean and pure as possible, making it the clean burning and environmentally sound energy choice. Once the natural gas has been fully processed, and is ready to be consumed, it must be transported from those areas that produce natural gas, to those areas that require it.

Elemental Sulfur Production in a Gas Treatment Plant

A – Sulfur and Carbon Dioxide Removal
B – Oil and Condensate Removal
C – Thermal and catalytic reactions
D – Separation of Natural Gas Liquids
E – Natural gas value chain

ACTIVITY 29. READ THE TEXT AND COMPLETE THE SENTENCES WITH THE MISSING WORDS

gas, liquid, example, separator, equipment, possible, pressure, use, temperature, can

OIL AND CONDENSATE REMOVAL

In certain instances, however, specialized _____ **(1)** is necessary to separate oil and natural gas. An _____ **(2)** of this type of equipment is the Low-Temperature Separator (LTX). This is most often used for wells producing high _____ **(3)** gas along with

light crude oil or condensate. These separators _____ **(4)** pressure differentials to cool the wet natural gas and separate the oil and condensate. Wet gas enters the separator, being cooled slightly by a heat exchanger. The gas then travels through a high pressure _____ **(5)** 'knockout', which serves to remove any liquids into a low-temperature separator. The gas then flows into this low-temperature _____ **(6)** through a choke mechanism, which expands the gas as it enters the separator. This rapid expansion of the gas allows for the lowering of the _____ **(7)** in the separator. After liquid removal, the dry gas then travels back through the heat exchanger and is warmed by the incoming wet gas. By varying the pressure of the gas in various sections of the separator, it is _____ **(8)** to vary the temperature, which causes the oil and some water to be condensed out of the wet gas stream. This basic pressure-temperature relationship _____ **(9)** work in reverse as well, to extract _____ **(10)** from a liquid oil stream.

ACTIVITY 30. COMPLETE THE FOLLOWING SENTENCES WITH THE CORRECT WORDS.

WATER REMOVAL

In addition to separating **1** _____ and some condensate from the wet gas **2** _____**,** it is necessary to remove most of the associated water. Most of the **3** _____**,** free water associated with extracted **4** _____ gas is removed by simple separation **5** _____ at or near the wellhead. However, the removal of the water **6** _____ that exists in solution in natural gas requires a more complex treatment. This treatment consists of 'dehydrating' the natural gas, which usually involves one of two **7** _____ : either absorption, or adsorption.

Absorption occurs when the water vapor is taken out by a dehydrating agent. **8** _____ occurs when the water vapor is condensed and collected on the surface.

1	**a**	oil	**b**	butter	**c**	petrol	**d**	mineral oil
2	**a**	flow	**b**	stream	**c**	current	**d**	spring
3	**a**	aqua	**b**	liquor	**c**	liquid	**d**	dip
4	**a**	native	**b**	organic	**c**	easy	**d**	natural
5	**a**	methods	**b**	routine	**c**	strategy	**d**	procedure
6	**a**	fallow	**b**	vapor	**c**	exhalation	**d**	fume
7	**a**	mode	**b**	way	**c**	processes	**d**	operation
8	**a**	Soak	**b**	Draught	**c**	Uptake	**d**	Adsorption

ACTIVITY 31. READ THE TEXT '**PROCESSING AND TRANSPORTATION OF NATURAL GAS**' AND DO THE ACTIVITIES BELOW

A) DECIDE WHETHER THE FOLLOWING STATEMENTS ARE **TRUE** OR **FALSE**

1. Gas processing is an instrumental piece of the natural water value chain.
2. Natural gas coming directly from a well contains many natural gas liquids that are commonly removed.
3. The actual process used to evoid oil from natural gas, as well as the equipment that is used, can vary widely.
4. There are two basic steps to the treatment of natural gas liquids in the natural gas stream.
5. The sour gas is run through a belfry, which contains the amine solution.

B) FIND THE UKRAINIAN EQUIVALENTS OF THE ENGLISH WORDS AND WORD COMBINATION:

1) equipment	a)
2) liquids	b)
3) gas stream	c)
4) adsorption	d)
5) to require	e)
6) to exist	f)
7) to contain	g)
8) to come	h)
9) to remove	i)
10) to separate	j)

C) MAKE YOUR OWN SENTENCES WITH THE WORDS FROM THE TABLE

adsorption, equipment, to separate, gas processing, value chain, to intend, to use

ACTIVITY 32. READ THE TEXT **'THE TRANSPORTATION OF NATURAL GAS'** AND DO THE ACTIVITIES BELOW

THE TRANSPORTATION OF NATURAL GAS

The efficient and effective movement of natural gas from producing regions to consumption regions requires an extensive and elaborate transportation system. In many instances, natural gas produced from a particular well will have to travel a great distance to reach its point of use. The transportation system for natural gas consists of a complex network of pipelines, designed to quickly and efficiently transport natural gas from its origin, to areas of high natural gas demand. Transportation of natural gas is closely linked to its storage: should the natural gas being transported not be immediately required; it can be put into storage facilities for when it is needed.

There are three major types of pipelines along the transportation route: the gathering system, the interstate pipeline system, and the distribution system. The gathering system consists of low pressure, small diameter pipelines that transport raw natural gas from the wellhead to the processing plant. Should natural gas from a particular well have high sulfur and carbon dioxide contents (sour gas), a specialized sour gas gathering pipe must be installed. Sour gas is corrosive, thus its transportation from the wellhead to the sweetening plant must be done carefully. Review the treatment and processing of natural gas.

Pipelines can be characterized as interstate or intrastate. Interstate pipelines are similar to in the interstate highway system: they carry natural gas across state boundaries, in some cases clear across the country. Intrastate pipelines, on the other hand, transport natural gas within a particular state. This section will cover only the fundamentals of interstate natural gas pipelines, however the technical and operational details discussed are essentially the same for intrastate pipelines.

A) ANSWER THESE MULTIPLE-CHOICE QUESTIONS ABOUT THE TRANSPORTATION OF NATURAL GAS

1) What does the efficient and effective movement of natural gas from producing regions to consumption regions require?

A – an extensive transportation system

B – an elaborate transportation system

C – an extensive and elaborate transportation system

2) What does the transportation system for natural gas consist of?

A – a complex network of pipelines

B – an efficient transport

C – pipelines

3) Is transportation of natural gas linked to its storage?

A – Yes, it is

B – It doesn't say

C – No, it is not

4) How many are there types of pipelines along the transportation route?

A – three major types

B – three types

C – four major types

5) What is a sour gas?

A – caustic

B – particular

C – corrosive

B) MAKE UP GENERAL, SPECIAL AND DISJUNCTIVE QUESTIONS AND GIVE THE SHORT ANSWERS ON THEM.

1) There are three major types of pipelines along the transportation route.
2) Pipelines can be characterized as interstate or intrastate.
3) Natural gas produced from a particular well will have to travel a great distance to reach its point of use.
4) The transportation system for natural gas consists of a complex network of pipelines.
5) Transportation of natural gas is closely linked to its storage.

C) COMPLETE THE SENTENCES WITH THE MISSING WORDS:

storage, pipelines, put, consists, types, distance, transportation

1) _____ can be characterized as interstate or intrastate.
2) There are three major _____ of pipelines along the transportation route
3) Sour gas is corrosive, thus its _____ from the wellhead to the sweetening plant must be done carefully.
4) Natural gas produced from a particular well will have to travel a great _____ to reach its point of use.
5) The transportation system for natural gas _____ of a complex network of pipelines.
6) Transportation of natural gas is closely linked to its _____.
7) Natural gas can be _____ into storage facilities for when it is needed.

ACTIVITY 33. READ THE TEXT BELOW. MATCH CHOICES **(A – F)** TO **(1 – 8).** THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

1 _____ The interstate natural gas pipeline network transports processed natural gas from processing plants in producing regions to those areas with high natural gas requirements, particularly large, populated urban areas. As can be seen, the pipeline network extends across the entire country.

Interstate pipelines are the 'highways' of natural gas transmission. Natural gas that is transported through interstate pipelines travels at high pressure in the pipeline, at pressures anywhere from 200 to 1500 pounds per square inch (psi). This reduces the volume of the natural gas being transported (by up to 600 times), as well as propelling natural gas through the pipeline.

This section will cover the components of the interstate pipeline system, the construction of pipelines, and pipeline inspection and safety. For more information on interstate pipelines in general, click here to visit the website of the Interstate Natural Gas Association of Amerca.

2_____ Interstate pipelines consist of a number of components that ensure the efficiency and reliability of a system that delivers such an important energy source year-round, twenty four hours a day, and includes a number of different components.

3 _____ Transmission pipes can measure anywhere from 6 to 48 inches in diameter, depending on their function. Certain component pipe sections can even consist of small diameter pipe, as small as 0.5 inches in diameter. However, this small diameter pipe is usually used only in gathering and distribution systems. Mainline transmission pipes, the principle pipeline in a given system, are usually between 16 and 48 inches in diameter. Lateral pipelines, which deliver natural gas to or from the mainline, are typically between 6 and 16 inches in diameter. Most major

interstate pipelines are between 24 and 36 inches in diameter. The actual pipeline itself, commonly called 'line pipe', consists of a strong carbon steel material, engineered to meet standards set by the American Petroleum Institute (API). In contrast, some distribution pipe is made of highly advanced plastic, because of the need for flexibility, versatility and the ease of replacement.

Transmission pipelines are produced in steel mills, which are sometimes specialized to produce only pipeline. There are two different production techniques, one for small diameter pipes and one for large diameter pipes. For large diameter pipes, from 20 to 42 inches in diameter, the pipes are produced from sheets of metal which are folded into a tube shape, with the ends welded together to form a pipe section. Small diameter pipe, on the other hand, can be produced seamlessly. This involves heating a metal bar to very high temperatures, then punching a hole through the middle of the bar to produce a hollow tube. In either case, the pipe is tested before being shipped from the steel mill, to ensure that it can meet the pressure and strength standards for transporting natural gas.

Line pipe is also covered with a specialized coating to ensure that it does not corrode once placed in the ground. The purpose of the coating is to protect the pipe from moisture, which causes corrosion and rusting. There are a number of different coating techniques. In the past, pipelines were coated with specialized coal tar enamel. Today, pipes are often protected with what is known as a fusion bond epoxy, which gives the pipe a noticeable light blue color. In addition, cathodic protection is often used; which is a technique of running an electric current through the pipe to ward off corrosion and rusting.

4 _____ Compressor Stations

As mentioned, natural gas is highly pressurized as it travels through an interstate pipeline. To ensure that the natural gas flowing through any one pipeline remains pressurized, compression of this natural gas is required periodically along the pipe. This is accomplished by compressor stations, usually placed at 40 to 100

mile intervals along the pipeline. The natural gas enters the compressor station, where it is compressed by either a turbine, motor, or engine.

Turbine compressors gain their energy by using up a small proportion of the natural gas that they compress. The turbine itself serves to operate a centrifugal compressor, which contains a type of fan that compresses and pumps the natural gas through the pipeline. Some compressor stations are operated by using an electric motor to turn the same type of centrifugal compressor. This type of compression does not require the use of any of the natural gas from the pipe, however it does require a reliable source of electricity nearby. Reciprocating natural gas engines are also used to power some compressor stations. These engines resemble a very large automobile engine, and are powered by natural gas from the pipeline. The combustion of the natural gas powers pistons on the outside of the engine, which serves to compress the natural gas.

In addition to compressing natural gas, compressor stations also usually contain some type of liquid separator, much like the ones used to dehydrate natural gas during its processing. Usually, these separators consist of scrubbers and filters that capture any liquids or other unwanted particles from the natural gas in the pipeline. Although natural gas in pipelines is considered ‘dry’ gas, it is not uncommon for a certain amount of water and hydrocarbons to condense out of the gas stream while in transit. The liquid separators at compressor stations ensure that the natural gas in the pipeline is as pure as possible, and usually filter the gas prior to compression.

5 _____ In addition to compressing natural gas to reduce its volume and push it through the pipe, metering stations are placed

periodically along interstate natural gas pipelines. These stations allow pipeline companies to monitor the natural gas in their pipes. Essentially, these metering stations measure the flow of gas along the pipeline, and allow pipeline companies to 'track' natural gas as it flows along the pipeline. These metering stations employ specialized meters to measure the natural gas as it flows through the pipeline, without impeding its movement.

6 _____ Interstate pipelines include a great number of valves along their entire length. These valves work like gateways; they are usually open and allow natural gas to flow freely, or they can be used to stop gas flow along a certain section of pipe. There are many reasons why a pipeline may need to restrict gas flow in certain areas. For example, if a section of pipe requires replacement or maintenance, valves on either end of that section of pipe can be closed to allow engineers and work crews safe access. These large valves can be placed every 5 to 20 miles along the pipeline, and are subject to regulation by safety codes.

A – Valves
B – Metering Stations
C – Compressor Stations
D – Impeding gas movement
E – Safety codes
F – Transmission Pipes
G – Pipeline Components
H – Interstate Natural Gas Pipelines

ACTIVITY 34. READ AND COMPLETE THE TEXTE BELOW. FOR EACH OF THE EMPTY SPACES **(1 – 5)** CHOOSE THE CORRECT ANSWER **(A, B, C** OR **D)**.

CONTROL STATIONS AND SCADA SYSTEMS

Natural gas **(1) _____** companies have customers on both ends of the pipeline – the producers and processors that input gas into the pipeline, and the consumers and local gas utilities that take gas out of the pipeline. In order to manage the **(2) _____** that enters the pipeline, and to ensure that all customers receive timely delivery of their portion of this gas, sophisticated control systems are required to monitor the gas as it travels through all sections of what could be a very lengthy pipeline network. To accomplish this task of monitoring and controlling the natural gas that is **(3) _____** through the pipeline, centralized gas control stations collect, assimilate, and manage data received from monitoring and compressor stations all along the pipe.

Most of the data that is received by a **(4) _____** is provided by Supervisory Control and Data Acquisition (SCADA) systems. These systems are essentially sophisticated communications systems that take measurements and collect data along the pipeline (usually in a metering or compressor stations and valves) and transmit it to the centralized control station. Flow rate through the pipeline, operational status, pressure, and temperature readings may all be used to assess the status of the pipeline at any one time. These systems also work in real time, meaning that there is little lag time between the measurements taken along the pipeline and their transmission to the control station.

The data is relayed to a centralized control station, allowing pipeline **(5) _____** to know exactly what is happening along the pipeline at all times. This enables quick reactions to equipment

malfunctions, leaks, or any other unusual activity along the pipeline. Some SCADA systems also incorporate the ability to remotely operate certain equipment along the pipeline, including compressor stations, allowing engineers in a centralized control center to immediately and easily adjust flow rates in the pipeline.

1	**a**	systems	**b**	center	**c**	station	**d**	pipeline
2	**a**	little lag time	**b**	certain equipment	**c**	natural gas	**d**	manage data
3	**a**	accomplishing	**b**	traveling	**c**	monitoring	**d**	controlling
4	**a**	control station	**b**	control systems	**c**	compressor stations	**d**	collect stations
5	**a**	compressors	**b**	stations	**c**	measurements	**d**	engineers

ACTIVITY 35. FIND THE UKRAINIAN EQUIVALENTS OF THE ENGLISH WORDS AND WORD COMBINATION:

measurement	
pipeline	
equipment	
real time	
little lag time	
accomplish	
ensure	
monitor	
monitoring	
control	
controlling	
assess	
customer	

ACTIVITY 36. DECIDE WHETHER THE FOLLOWING STATEMENTS ARE **TRUE** OR **FALSE**

1. Natural gas pipeline companies have not customers on both ends of the pipeline.
2. All customers don't receive timely delivery of their portion of this gas.
3. To accomplish this task of monitoring and controlling the natural gas that is traveling through the control systems.
4. This enables quick reactions to equipment malfunctions, leaks, or any other unusual activity along the pipeline.
5. Most of the data that is received by a control station is provided by SCADA systems.
6. Flow rate through the pipeline, operational status, pressure, and temperature readings may all be used to assess the status of the pipeline all time.
7. The enables quick reactions to equipment malfunctions, leaks, or any other unusual activity along the pipeline.
8. All SCADA systems also incorporate the ability to remotely operate certain equipment along the pipeline.

ACTIVITY 37. READ THE TEXT **'PIPELINE CONSTRUCTION'** AND DO THE ACTIVITIES BELOW

PIPELINE CONSTRUCTION

Constructing natural gas pipelines requires a great deal of **planning and preparation**. In addition to actually building the pipeline, several permitting and regulatory processes must be completed. In many cases, prior to beginning the permitting and land access processes, natural gas pipeline

companies prepare a feasibility analysis to ensure that an acceptable route for the pipeline exists that provides the least impact to the environment and public infrastructure already in place.

Assuming a pipeline company obtains all the required permits and satisfies all of the regulatory requirements, construction of the pipe may begin. Extensive surveying of the intended route is completed, both aerial and land based, to ensure that no surprises pop up during actual assembly of the pipeline.

Installing a pipeline is much like an assembly line process, with sections of the pipeline being completed in stages. First, the path of the pipeline is cleared of all removable impediments, including trees, boulders, brush, and anything else that may prohibit the construction. Once the pipeline's path has been cleared sufficiently to allow construction equipment to gain access, sections of pipes are laid out along the intended path, a process called 'stringing' the pipe. These pipe sections are commonly from 40 to 80 feet long, and are specific to their destination. That is, certain areas have different requirements for coating material and pipe thickness.

Once the pipe is in place, trenches are dug alongside the laid out pipe. These trenches are typically five to six feet deep, as the regulations require the pipe to be at least 30 inches below the surface. In certain areas, however, including road crossings and bodies of water, the pipe is buried even deeper. Once the trenches are dug, the pipe is assembled and contoured. This includes welding the sections of pipe together into one continuous pipeline, and bending it slightly, if needed, to fit the contour of the pipeline's path. Coating is applied to the ends of the pipes. The coating applied at a coating mill typically leaves the ends of the pipe clean,

so as not to interfere with welding. Finally, the entire coating of the pipe is inspected to ensure that it is free from defects.

Once the pipe is welded, bent, coated, and inspected it can be lowered into the previously-dug trenches. This is done with specialized construction equipment acting to lift the pipe in a level manner and lower it into the trench. Once lowered into the ground, the trench is filled in carefully, to ensure that the pipe and its coating retain their integrity. The last step in pipeline construction is the hydrostatic test. This consists of running water, at pressures higher than will be needed for natural gas transportation, through the entire length of the pipe. This serves as a test to ensure that the pipeline is strong enough, and absent of any leaks of fissures, before natural gas is pumped through the pipeline.

Laying pipe across streams or rivers can be accomplished in one of two ways. Open cut crossing involves the digging of trenches on the floor of the river to house the pipe. When this is done, the pipe itself is usually fitted with a concrete casing, which both ensures that the pipe stays on the bottom of the river and adds an extra protective coating to prevent any natural gas leaks into the water. Alternatively, a form of directional drilling may be employed, in which a ‘tunnel’ is drilled under the river through which the pipe may be passed. The same techniques are used for road crossings – either an open trench is excavated across the road and replaced once the pipe is installed, or a tunnel may be drilled underneath the road.

Once the pipeline has been installed and covered, extensive efforts are taken to restore the pipeline’s pathway to its original state, or to mitigate any environmental or other impacts that may have occurred during the construction process. These steps often

include replacing topsoil, fences, irrigation canals, and anything else that may have been removed or upset during the construction process. For more information on natural gas pipeline construction, visit the website of the Interstate Natural Gas Association of America. (INGAA)

A) ANSWER THESE MULTIPLE-CHOICE QUESTIONS ABOUT THE TRANSPORTATION OF NATURAL GAS

1) What deal do constructing natural gas pipelines require?
   A – planning and preparation
   B – drill and cover
   C – a concrete casing
2) What permits and satisfies does a pipeline company obtain?
   A – all removable impediments
   B – regulatory requirements
   C – surprises pop up
3) What installing a pipeline is like?
   A – the same techniques
   B – the intended route
   C – an assembly line process
4) Where is coating applied to?
   A – the sections of pipe
   B – to the ends of the pipes
   C – to the coating of the pipe
5) What is the last step in pipeline construction?
   A – the hydrostatic test
   B – the coating applied
   C – the coating mill

C) COMPLETE THE SENTENCES WITH THE MISSING WORDS:

can be, pipeline, construction, across, pipe

1. Once the _____ has been installed and covered, extensive efforts are taken to restore the pipeline's pathway to its original state.
2. The last step in pipeline _____ is the hydrostatic test.
3. Once the pipe is welded, bent, coated, and inspected it _____ lowered into the previously-dug trenches.
4. Laying pipe _____ streams or rivers can be accomplished in one of two ways.
5. Open cut crossing involves the digging of trenches on the floor of the river to house the _____.

C) COMPLETE THE FOLLOWING SENTENCES WITH THE CORRECT WORDS

As natural gas use increases, so does the need to have **1)** _____ infrastructure in place to supply the increased demand. This means that pipeline **2)** _____ are constantly assessing the flow of natural gas across the U.S., and building pipelines to allow **3)** _____ of natural gas to those areas that are underserved.

Installing a pipeline is much like an assembly line **4)** _____, with sections of the pipeline being completed in stages. First, the path of the **5)** _____ is cleared of all removable impediments, including trees, boulders, brush, and anything else that may prohibit the **6)** _____.

1	**a**	transportation	**b**	shipping	**c**	traffic	**d**	carriage
2	**a**	partnership	**b**	companies	**c**	community	**d**	concern
3	**a**	ferry	**b**	crossing	**c**	transportation	**d**	transit
4	**a**	operation	**b**	procedure	**c**	means	**d**	process
5	**a**	conduit	**b**	commutator	**c**	pipeline	**d**	manifold
6	**a**	building	**b**	construction	**c**	design	**d**	installation

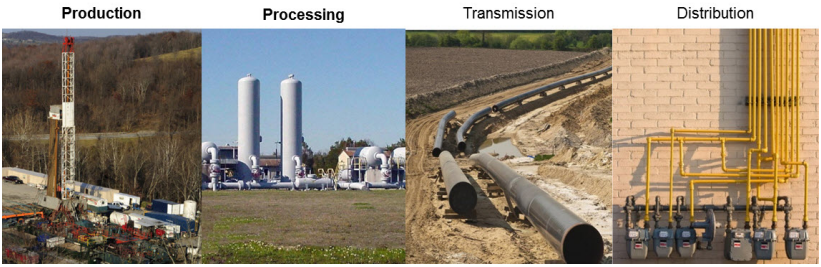
ACTIVITY 38. MATCH THE FOLLOWING WORDS AND WORD COMBINATIONS WITH THEIR UKRAINIAN EQUIVALENTS

1) the trenches	a) проточна вода
2) pipeline’s path	b) зварювання
3) to include	c) гідростатичний тест, випробування
4) to increase	d) збільшувати
5) the digging of trenches	e) копання траншей
6) the floor of the river	f) містити в собі, включати до складу
7) running water	g) траншеї
8) welding	h) дно річки
9) a coating mill	i) фреза для нанесення покриття
10) the hydrostatic test	j) шлях трубопроводу

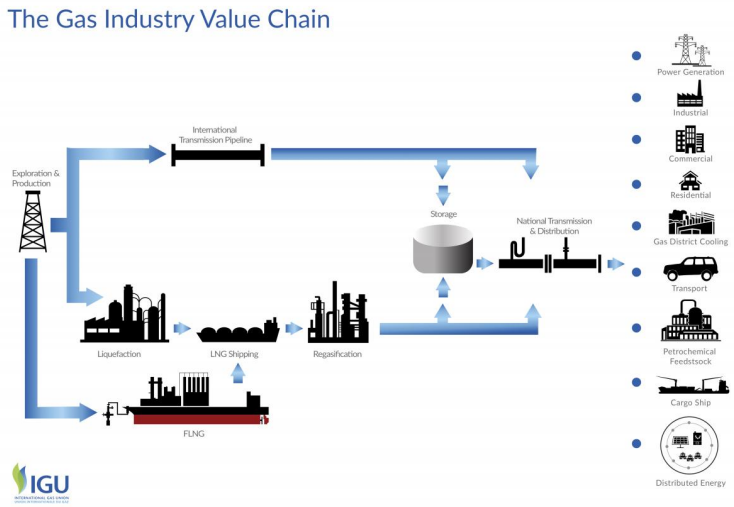
AFTER-READING ACTIVITY

ACTIVITY 1. LOOK AT THE PICTURES. DESCRIBE THE PROCESSES OF EXTRACTION, PROCESSING, SUPPLY AND USE OF NATURAL GAS.

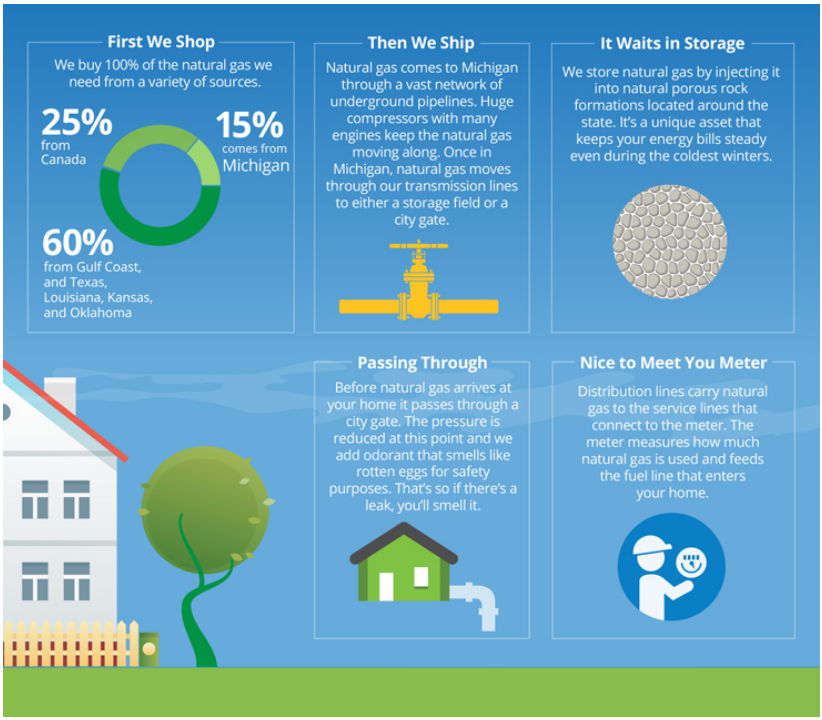
A)



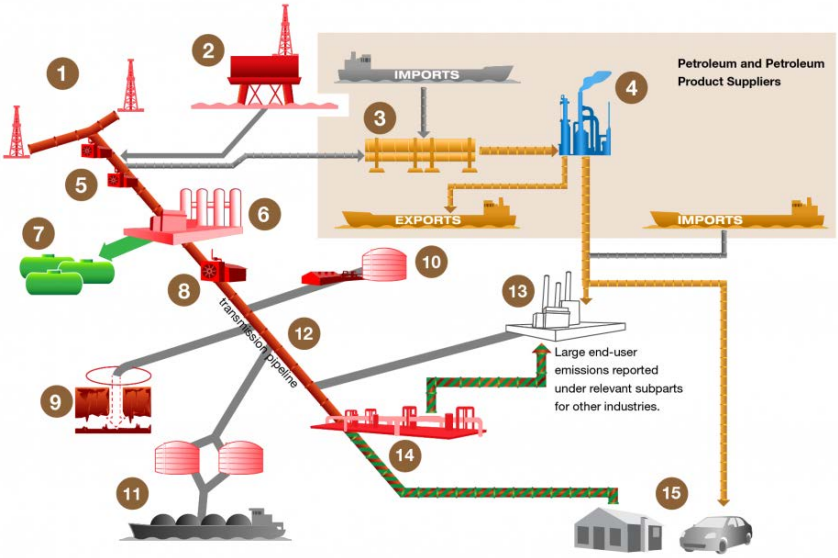
B)



ACTIVITY 2. READ THE SHORT FRAGMENTS OF THE TEXT AND COMPOSE YOUR OWN TEXT ABOUT NATURAL GAS USING



ACTIVITY 3. LOOK AT THE PICTURE. MAKE UP THE REPORT ABOUT PRODUCTION, PROCESSING, TRANSMISSION AND STORAGE OF NATURAL GAS



Production & Processing

1. Onshore Petroleum & Natural Gas Production
2. Offshore Petroleum & Natural Gas Production
3. Total Crude Oil to Refineries
4. Petroleum Refining
5. Gathering and Boosting
   *Data collection began in RY 2016
6. Gas Processing Plant
   *May contain NGL Fractionation equipment
7. Natural Gas Liquids (NGL) Supply

Natural Gas Transmission & Storage

8. Transmission Compressor Stations
9. Underground Storage
10. Liquified Natural Gas (LNG) Storage
11. LNG Import-Export Equipment
12. Natural Gas Transmission Pipeline
    *Data collection began in RY 2016

Distribution

13. Large End Users
14. Natural Gas Distribution
15. Natural Gas & Petroleum Supply to Small End Users

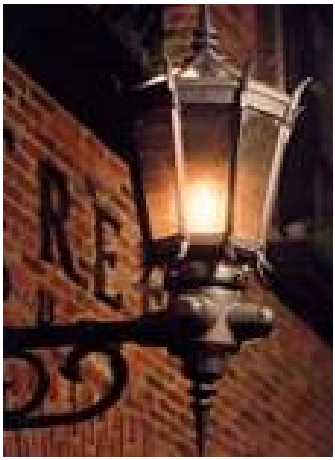
- Subpart W: Emissions from petroleum & natural gas systems
- Subpart Y: Emissions from petroleum refineries
- Subpart MM: CO_2 associated with supplies of petroleum products
- Subpart NN: CO_2 associated with supplies of natural gas & natural gas liquids
- Not reported under GHGRP

EXTENSIVE READING

TEXT 1. NATURAL GAS. HISTORY

Natural gas is nothing new. In fact, most of the natural gas that is brought out from under the ground is millions and millions of years old. However, it was not until recently that methods for obtaining this gas, bringing it to the surface, and putting it to use were developed.

Before there was an understanding of what natural gas was, it posed a mystery to man. Sometimes, lightning strikes would ignite natural gas that was escaping from under the earth's crust. This would create a fire coming from the earth, burning the natural gas as it seeped out from underground. These fires puzzled most early civilizations, and were the root of myth and superstition. One of the most famous of these flames was found in ancient Greece, on Mount Parnassus around 1000 B.C. A goat herdsman came across what looked like a 'burning spring', a flame rising from a fissure in the rock. The Greeks, believing it to be of divine origin, built a temple on the flame. This temple housed a priestess who was known as the Oracle of Delphi, giving out prophecies she claimed were inspired by the flame.



These types of springs became prominent in the religions of India, Greece, and Persia. Unable to explain where these fires came from, they were often regarded as divine, or supernatural. It wasn't until about 500 B.C. that the Chinese discovered the potential to use these fires to their advantage. Finding places where gas was seeping to the surface, the Chinese formed crude pipelines out of bamboo shoots to transport the gas, where it was

used to boil sea water, separating the salt and making it palatable.

Britain was the first country to commercialize the use of natural gas. Around 1785, natural gas produced from coal was used to light houses, as well as streetlights.

Manufactured natural gas of this type (as opposed to naturally occurring gas) was first brought to the United States in 1816, when it was used to light the streets of Baltimore, Maryland. However, this manufactured gas was much less efficient, and less environmentally friendly, than modern natural gas that comes from underground.

Naturally occurring natural gas was discovered and identified in America as early as 1626, when French explorers discovered Native Americans igniting gases that were seeping into and around Lake Erie. The American natural gas industry got its beginnings in this area. In 1859, Colonel Edwin Drake (a former railroad conductor who adopted the title 'Colonel' to impress the townspeople) dug the first well. Drake hit oil and natural gas at 69 feet below the surface of the earth. (***A Reconstruction of 'Colonel' Drake's First Well in Titusville)***

Most historians characterize this well as the beginning of the natural gas industry in America. A two-inch diameter pipeline was built, running 5 and ½ miles from the well to the village of Titusville, Pennsylvania. The construction of this pipeline proved that natural gas could be brought safely and relatively easily from its underground source to be used for practical purposes.

In 1821, the first well specifically intended to obtain natural gas was dug in Fredonia, New York by William Hart. After noticing gas bubbles rising to the surface of a creek, Hart dug a 27-foot well to try and obtain a larger flow of gas to the surface. Hart is regarded by

many as the ‘father of natural gas’ in America. Expanding on Hart’s work, the Fredonia Gas Light Companywas eventually formed, becoming being the first American natural gas company.

During most of the 19th century, natural gas was used almost exclusively as a source of light. Without a pipeline infrastructure, it was difficult to transport the gas very far, or into homes to be used for heating or cooking. Most of the natural gas produced in this era was manufactured from coal, rather than coming from a well. Near the end of the 19th century, with the advent of electricity, natural gas lights were converted to electric lights. This led producers of natural gas to look for new uses for their product.

In 1885, Robert Bunsen invented what is now known as the Bunsen burner. He managed to create a device that mixed natural gas with air in the right proportions, creating a flame that could be safely used for cooking and heating. The invention of the Bunsen burner opened up new opportunities for the use of natural gas in America, and throughout the world. The invention of temperature-regulating thermostatic devices allowed for better use of the heating potential of natural gas, allowing the temperature of the flame to be adjusted and monitored.

Without any way to transport it effectively, natural gas discovered pre-WWII was usually just allowed to vent into the atmosphere, or burnt, when found alongside coal and oil, or simply left in the ground when found alone.

One of the first major pipelines was constructed in 1891. This pipeline was 120 miles long, and carried natural gas from wells in central Indiana to the city of Chicago. However, this early pipeline was not very efficient at transporting natural gas. It wasn’t until the 1920s that significant effort was put into building a pipeline infrastructure. After World War

II, new welding techniques, along with advances in pipe rolling and metallurgy, further improved pipeline reliability. This post-war pipeline construction boom lasted well into the ‘60s, and allowed for the construction of thousands of miles of pipeline in America.

Once the transportation of natural gas was possible, new uses for natural gas were discovered. These included using natural gas to heat homes and operate appliances such as water heaters, ovens, and cooktops. Industry began to use natural gas in manufacturing and processing plants. Also, natural gas was used to heat boilers used to generate electricity. The expanded transportation infrastructure had made natural gas easy to obtain, and it was becoming an increasingly popular energy choice. Find additional detail on modern methods of natural gas exploration, extraction, and transportation as well as more information on the many uses of natural gas today.

TEXT 2. A BRIEF HISTORY OF REGULATION

In 1938, the U.S. government first regulated the natural gas industry. At the time, members of the government believed the natural gas industry to be a ‘natural monopoly’. Because of the fear of possible abuses, such as charging unreasonably high prices, and given the rising importance of natural gas nationwide, the Natural Gas Act was passed. This Act imposed regulations and restrictions on the price of natural gas to protect consumers. Find more information on this Act, and legislation and regulation that affect the natural gas industry.

In the 1970s and 1980s, a number of gas shortages and price irregularities indicated that a regulated market was not best for consumers or the natural gas industry. Into the 1980s and early 1990s, the industry gradually moved toward less regulation, allowing for healthy competition and market-based prices. These moves led to a strengthening of the natural gas market, lowering prices for consumers and allowing for more natural gas to be

discovered. Although not as active as the 1990s, the beginning of the 21st Century has brought with it significant regulation concerning gas quality, standards of conduct for interstate pipelines, and price reporting.

Today, the natural gas industry is regulated by the Federal Energy Regulatory Commission (FERC). While FERC does not deal exclusively with natural gas issues, it is the primary rule making body with respect to the regulation of the natural gas industry.

Competition characterizes the natural gas industry as it is known today. The restructuring of the industry, and the move away from strict regulation, has allowed for increased efficiency and technological improvements. Natural gas is now being obtained more efficiently, cheaply, and easily than ever before. However, the search for more natural gas to serve our ever growing demand requires new techniques and knowledge to obtain it from hard-to-reach places. Learn more about the business side of natural gas.

The the natural gas industry has existed in this country for more than 150 years, and it continues to grow. Restructuring and the move toward cleaner-burning fuels have created an enormous market for natural gas across the country. Technologies are continually being developed that allow Americans to use natural gas in new and exciting ways. And new production techniques now allow us to produce natural gas from shale formations. With all of the advantages of natural gas, it is no wonder that it has become the fuel of choice in this country, and throughout the world.

UNIT IV ENVIRONMENT, ITS PROBLEMS AND PROTECTION

ACTIVITY 1. READ AND TRANSLATE THE TEXT BELOW AND DO EXERCICES AFTER IT:

NATURAL ENVIRONMENT

An environment is the set of surrounding conditions that acts on a place or person and gives it a certain character. A body of air, for example, receives energy from the sun and Earth's surface and water from the oceans, lakes, soils, and plants over which it passes. Bodies of air from contrasting environrments have different characteristics of temperature and rnoisture.

Earth's natural environment is the set of physical and biologic conditions that surround humaп beings at Earth's surface.

Issues that arise from humaп activities in the natural environment occur at a raпge of spatial scales and chaпge rapidly over time. Because physical geographers understand the complex processes that link together Earth's major environments, they can contribute to current political and scientific debates about environmental issues.

Earth's natural environment caп be divided into four major parts. Each major Earth environmerrt has unique characteristics, but they all overlap and interact to create dynamic and living systems at all geographic scales.

In the atmosphere and oceans are inextricably linked by exchanges of heat and materials. The atmosphere is a thin blanket that both traps energy from the sun's rays and protects Earth, particularly plants and animals, from the harmful elements of those rays. The oceans act as a giant store of water and heat. Exchanges between the atmosphere and oceans help to maintain the composition of the atmosphere. The atmosphere-ocean environment transports energy from the sun around the globe and creates weather and climate.

The solid-earth environment is very different. It consists of rocks that are hot and fluid near Earth's center and relatively cool and rigid near the surface. Gravity and the heat that keeps rocks melted inside our planet are the sources of energy for moving surface rocks.activity in the solid-earth environment is most apparent in volcanic eruptions and earthquakes. Such sporadic surface events are a powerful reminder of continuous activity deep within Earth.

The atmosphere-ocean environment interacts on the surfaces of continents to form the hills, plains, and valleys – or land forms – of the surface-relief environment. The solid-earth environment forms the broad features of continents and mountain chains, while the reactions of different rocks to atmospheric agent such as wild, ice, and running water control the detailed appearance of land surfaces.

The living-organism environment is shaped by the other three Earth environments. Plants and animals need water and the sun's energy from the atmosphere-ocean environment; plant nutrients come from the rock minerals of the solid-earth environment. The distribution of plants and animals around the world depends on how water and nutrients are delivered to the organisms by processes in the surface-relief environment.

These four major Earth environments create a dynamic and living planet as they constantly interact and adjust to each other.

A) COMPLETE THE FOLLOWING SENTENCES WITH THE CORRECT WORDS:

An environment is the set of surrounding **1) _____** that acts on a place or person and gives it a certain character.

Farmers are partly **2) _____** in choosing their crops by the farrn's environrnrent: the temperature and humidity of the **3) _____** air, the amount of rain or snow that falls, the character of the underlying soil, and the steepness of the terrain.

Earth's natural environment is the set of physical and biologic conditions that surround humarı beings at Earth's **4) _____.**

1	**a**	surroundings	**b**	circumstances	**c**	situations	**d**	conditions
2	**a**	affected	**b**	operated	**c**	influenced	**d**	manipulated
3	**a**	superficies	**b**	surrounding	**c**	neighbor	**d**	outward
4	**a**	surface	**b**	superficies	**c**	position	**d**	upside

B) COMPLETE THE SENTENCES WITH THE MISSING WORDS:

Earth, surfaces, environment, living-organism, atmosphere

1) Earth's natural **_____** is the set of physical and biologic conditions that surround humarı beings at Earth's surface.

2) The atmosphere-ocean environment interacts on the _____ of continents to form the hills, plains, and valleys – or land forms – of the surface-relief environment.
3) In the _____ and oceans are inextricably linked by exchanges of heat and materials.
4) The _____ environment is shaped by the other three Earth environments.
5) The atmosphere is a thin blanket that both traps energy from the sun's rays and protects _____.

C) DECIDE WHETHER THE FOLLOWING STATEMENTS ARE **TRUE** OR **FALSE**

1. Four major Earth environments don't create a dynamic and living planet as they constantly interact and adjust to each other.
2. The living-organism environment is shaped by the other five Earth environments.
3. The oceans act as a giant store of water and cold.
4. Earth's natural environment can be divided into four major parts.
5. Plants and animals need water and the sun's energy from the air-ocean environment

ACTIVITY 2. READ AND TRANSLATE THE TEXT BELOW AND DO EXERCICES AFTER IT:

WEATHER AND CLIMATE: THE GREENHOUSE EFFECT AND AGRICULTURE

Agricultural yields are very dependent on weather. Recent examples are frost and drought damage to Soviet grain crops, the recent drought in the USA and frost damage to Brazilian coffee. There are indications that extreme weather conditions now occur more frequently than in the past. If true, this instability will influence agriculture and increase the need for food reserves.

Unfortunately, accurate long-term weather forecasts are probably impossible. Some compensation for weather vagaries is possible by irrigation, but apart from this little else can be done with weather.

One aspect of the climate now attracting political attention is the problem increase in the earth's average surface temperature due to the "greenhouse effect". The heat balance of the atmosphere is influenced by some of the components of the air that are present in only small amounts: carbon dioxide, methane, nitrous oxide and the chlorofluorocarbons. These gases absorb infra-red (heat) radiation from the earth. The concentration of these gases in the air is increasing and thus the capacity of the atmosphere to retain heat. It is feared that this will give a global temperature rise and thus influence climate.

The increasing atmospheric concentration of these gases is due to human, domestic and industrial activities. The increase appears to have started with industrialization and became especially noticeable after the Second World War.

The influence of these gases on global temperature and climate is very complex. Other factors are also involved, such as regional pollutants (e.g., ozone), water vapour and clouds, and changes in the earth surface reflectance due to deforestation and other land use changes.

There is a growing consensus that the increase in the concentration of greenhouse gases gives cause for concern. The observed trends must eventually change the global surface temperature or the atmospheric circulation pattern, or both, but the size and timing of any effects are a matter for current debate.

In principle the emissions of chlorofluorocarbons should be those easiest to reduce or eliminate. These are man-made industrial chemicals. There is now international agreement that their use should be greatly reduced and preferably eliminated.

The main concern is increasing concentration of carbon dioxide. Burning of fossil fuel emits carbon dioxide to air.

Forests contain carbon. When trees are replaced by grassland or crops with less standing biomass, carbon is liberated as carbon dioxide. The present rate of decline in forest area results in a substantial input of carbon dioxide to the atmosphere, though somewhat less in magnitude than the burning of fossil fuels.

Soil also contains much carbon as humus. Increased conversion of grasslands to croplands liberates some carbon from this source too.

The main contribution of agriculture to abating the carbon dioxide problem must be to maintain soil humus and to increase the productivity of arable land and thus reduce the need for using forested areas for crop production.

Agricultural practices mainly water management and animal husbandry, are believed to be major factors in the current noticeable increase in methane production.

Sources of methane are mostly anaerobic fermentation of organic matter by ruminant cattle, and also in wetlands such us rice fields. Increasing rice-paddy areas could be a major cause for the increased emissions. Much of atmospheric methane seems to be derived from fossil sources.

Nitrous oxide comes mainly from the soil. Nitrous oxide is a greenhouse gas and also reacts with ozone in the ozone layer, where it is decomposed.

Higher fertile cultivated land in temperate and tropical regions together with tropical forests and grasslands are regarded as the major sources of nitrous oxide, but the relative importance of the individual sources and processes is largely unknown. Combustion was believed to be a major source, but this contribution seems to have been overestimated.

Nitrous oxide is formed in the soil during the natural biological processes of nitrification and denitrification. The end-product of denitrification is usually nitrogen gas but under some conditions nitrous oxide is also formed.

The emission of nitrous oxide from the fields is uneven, it depends on competing reactions and varies with the conditions.

Agricultural practices such us tillage, fertilization, manuring, crop residue management and drainage all influence nitrogen transformation processes in the soil and may therefore influence nitrous oxide emissions. Knowledge required to give guidelines on how to minimize such emissions is largely lacking. Nitrate application on excessively wet or waterlogged fields can increase nitrous oxide emissions from the soil, but it is not usual to fertilize under such conditions. Research on the influence of agriculture on nitrous oxide formation is now being undertaken in many institutions, but improved measurement methods for field emissions are needed.

A) SCAN THE TEXT AGAIN AND ANSWER THE FOLLOWING QUESTIONS:

1) What indications are there that extreme weather conditions?

2) How does the production of fertilizers influence the global warming?

3) Which components affect the heat balance of the atmosphere?

4) Does soil containe carbon? What is its name?

5) What do agriculturral practices management and and drainage?

B) MATCH THE FOLLOWING WORDS AND WORD COMBINATIONS WITH THEIR UKRAINIAN EQUIVALENTS

1) soil	a) вміщувати, містити в собі
2) to contain	b) тваринництво
3) international agreement	c) джерело
4) to reduce	d) сільськогосподарський
5) industrial	e) зменшувати, знижувати
6) agricultural	f) міжнародні угоди
7) source	g) промисловий
8) crop production	h)виробництво сільськогосподарської продукції
9) animal husbandry	i) територія, площа лісу
10) forest area	j) грунт

C) ANSWER THESE MULTIPLE-CHOICE QUESTIONS ABOUT ENVIRONMENTAL POLLUTION:

1. What does the term “environmental pollution“ mean?
   A polluted air
   B all the ways of polluting surroundings
   C rubbish and litter
2. Why is environmental pollution a serious problem?
   A because it can cause disastrous processes
   B because people dirty the air with gases and smoke
   C because motor vehicles fill the air with the noise
3. Why is environmental pollution a complicated problem?
   A because people ruin naturally beautiful world
   B because much pollution is caused by things that benefit people
   C because exhaust from cars causes a large percentage of all air pollution
4. How can we reduce environmental pollution?

A Governments should enforce laws which ban the pollution of the environment

B We should work hard

C We should stop using many things that benefit us

D) REFER TO THE TEXT ONCE AGAIN AND FIND OUT NEW INFORMATION ABOUT THE WAYS OF REJECTING THE GREENHOUSE EFFECT.

ACTIVITY 3. CHOOSE THE PROPER WORDS AND FILL THEM IN THE BLANKS:

1. Agricultural yields are very dependent on _____ .

A weather **B** processes **C** sculpture **D** disintegration

2. There are indications that extreme weather _____ now occur more frequently than in the past.

A circumstances **B** conditions **C** considerations **D** occasions

3. The increasing atmospheric concentration of gases is due to _____, domestic and industrial activities.

A personage **B** individual **C** human **D** person

4. The main concern is increasing concentration of carbon dioxide.

A consistence **B** thickness **C** density **D** concentration

5. Nitrous oxide comes mainly from the soil.

A soil **B** property **C** land **D** stead

ACTIVITY 4. READ THE TEXT BELOW AND TRANSLATE IT INTO UKRAINIAN.

ENVIRONMENTAL POLLUTION

Environmental pollution is a term that refers to all the ways by which people pollute their surroundings. People dirty the air with gases and smoke, poison the water with chemicals and other substances, damage the soil with too many fertilizers and pesticides. People also pollute their surroundings in various other ways. They ruin natural beauty by scattering rubbish and litter on the land and in the water. They operate motor vehicles that fill the air with the noise.

Environmental pollution is one of the most serious problems facing humanity today. It causes global warming, destruction of ozone layer, and other disastrous processes. Air, water, and soil – all harmed by pollution- are necessary to the survival of all living things. Badly polluted air can cause illness, and even death. Polluted water kills fish and other marine life. Pollution of soil reduces the amount of land available for growing crops. Environmental pollution also brings ugliness to our beautiful world.

The pollution problem is as complicated as it is serious. It is complicated because much pollution is caused by things that benefit people. Exhaust from cars causes a large percentage of all air pollution, but the car provides transportation for millions of people. Factories discharge much of material that pollutes air and water, but factories provide jobs for people and produce goods that people want. Too many fertilizers or pesticides can ruin our soil, but they are important aids for the growing crops.

Thus, to end or greatly reduce pollution immediately, people would have to stop using many things that benefit them. But pollution can be gradually reduced. Scientists and engineers should work hard to find the ways to lessen the amount of pollution that such things as cars and factories cause. Governments should enforce laws that require enterprises or individuals to stop or to reduce certain polluting activities.

ACTIVITY 5. READ AND GIVE A SUMMARY OF THE TEXT.

SCIENCE AND TECHNOLOGY

Technology means the use of people's inventions and discoveries to satisfy their needs. Since people have appeared on the earth, they have had to get food, clothes, and shelter. Thought the ages, people have invented tools, machines, and materials to make work easier.

Nowadays, when people speak of technology, they generally mean industrial technology. Industrial technology began about 200 years ago witch the development of the steam engine, the growth of factories, and the mass production of goods. It influenced different aspects of people's lives. The development of the car influenced where people lived and worked. Radio and television changed their leisure time. The telephone revolutionized communication.

Science has contributed much into modern technology. Science attempts to explain how and why things happen. Technology makes things happen. But not all technology is based on science. For example, people had made different objects from iron for centuries before they learnt the structure of the metal. But some modern technologies, such as nuclear power production and space travel, depend heavily on science.

ACTIVITY 6. COMPLETE THE SENTENCES WITH THE MISSING WORDS:

science, means, technology, makes, modern

1. When people speak of technology, they generally mean industrial _____.
2. Technology _____ the use of people's inventions and discoveries to satisfy their needs.
3. _____attempts to explain how and why things happen.
4. Technology _____ things happen.
5. Some _____technologies, such as nuclear power production and space travel, depend heavily on science.

ACTIVITY 7. SCAN THE TEXT '**SCIENCE AND TECHNOLOGY'** AGAIN AND ANSWER THE FOLLOWING QUESTIONS:

1. Which things are technologies based on?
2. When did industrial technology begin?
3. What does technology mean?

ACTIVITY 8. READ THE TEXT, TRY TO FOCUS ON ITS ESSENTIAL FACTS AND CHOOSE THE MOST SUITABLE HEADING BELOW FOR EACH PARAGRAPH.

1. The Fields of Scientific Research
2. Different Groups of Sciences
3. The Importance of Science
4. What is Science?
5. Methods of Scientific Research

SCIENCE AND SCIENTISTS

The world ‘science’ comes from the Latin word ‘scientia’, which means ‘knowledge’. Science covers the broad field of knowledge that deals facts and the relationship among these facts.

Scientists study a wide variety of subjects. Some scientists search for clues to the origin of the universe and examine the structure of the cells of living plants and animals. Other researchers investigate why we act the way we do, or try to solve complicated mathematical problems.

Scientists use systematic methods of study to make observations and collect facts. They develop theories that help them order and unity facts. Scientific theories consist of general principles or laws that attempt to explain how and why something happens or has happened. A theory is considered to become a part of scientific knowledge if it has been tested experimentally and proved to be true.

Scientific study can be divided into three major groups: the natural, social, and technical sciences. As scientific knowledge has grown and become more complicated, many new fields of science

have appeared. At the same time, the boundaries between scientific fields have become less and less clear. Numerous areas of science overlap each other and it is often hard to tell where one science ends and other begins. All sciences are closely interconnected.

Science has great influence on our lives. It provides the basis of modern technology – the tools and machines that make our life and work easier. The discoveries and inventions of scientists also help shape our view about ourselves and our place in the universe.

ACTIVITY 9. DIVIDE THE FOLLOWING WORDS INTO THREE GROUPS, THOSE WHICH DESCRIBE:
A) SCIENCE, **B)** TECHNOLOGY, **C)** COMPUTERS

Communication, nuclear power production, tools, scientific fields, steam engine, knowledge, systematic methods, a theory, analog, digital, natural sciences, discoveries, to explain, a printer, a mouse, television, radio, numbers, researchers, scientists, social sciences, complicated, space travel, machines, materials

ACTIVITY 10. COMPLETE THE FOLLOWING SENTENCES WITH THE MISSING WORDS:

1. The word “science” comes from the Latin word, which means _____
2. Science deals with facts and _____
3. Scientists study a wide variety of _____
4. Some scientists search for clues to _____
5. Other researches solve complicated _____
6. Scientific theories consist of general principles or _____
7. A theory becomes part of _____
8. Scientific study can be divided into three major groups: _____
9.The boundaries between scientific fields have become _____

10. Science provides the basis of _____
11. Technology means the use of _____
12. Industrial technology began 200 years ago with _____
13. Technology influenced different aspects of _____
14. Science attempts to explain how and why _____
15. Technology makes things _____

ACTIVITY 11. MAKE UP GENERAL AND DISJUNCTIVE QUESTIONS, AND GIVE THE SHORT ANSWERS ON THEM.

1. Science deals with the facts and relationship among these facts.
2. A theory becomes a part of scientific knowledge.
3. Science attempts to explain how and why things happen.
4. Technology makes things happen.
5. Technology influences different aspects of people's lives.
6. Some scientists search for clues to the origin of the universe.
7. Scientists examine the structure of the cells of living plants and animals.
8. They use systematic methods of study.

ACTIVITY 12. ANSWER THE FOLLOWING QUESTIONS ABOUT SCIENCE AND TECHNOLOGY

1. What is science?
2. What is technology?
3. Are they interconnected?
4. Is all technology based on science?
5. What modern technologies depend heavily on science?
6. When did industrial technology begin?
7. When was a steam engine invented?
8. Who invented a steam engine?
9. When was radio invented?
10. Who invented the radio?
11. When was the television invented?

12. Who invented the television?
13. When was the telephone invented?
14. Who invented the telephone?
15. When was the first car invented?
16. When was the first digital computer invented?
17. Who invented the first digital computer?
18. What famous scientists do you know?
19. What famous inventors do you know?
20. What scientific field are you interested in? Why?

ACTIVITY 13. READ THE TEXT BELOW. MATCH CHOICES **(A – F)** TO **(1 – 8).** THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

ENERGY PRODUCTION: PROSPECTS AND PROBLEMS

The nation's need for reliable energy supplies has helped move forward a major new farm policy objective: conversion of biomass from the nation's farms and forests to liquid fuels. The most promising application of biomass technologies is the production of ethyl alcohol (ethanol) from corn. When mixed with gasoline in a1:9 ethanol to gasoline ratio, this product yields the popular new fuel, gasohol. Although attention is focused on farm crops as major biomass feedstocks, any plant material-crops, trees, water plants, even algae and seaweed — could be used in biomass conversion.

1 _____

A coalition of farmers, citizens and politicians advocates rapid expansion of the nation's gasohol production capacity as farmers perceive several advantages in gasohol production: by production energy directly from grain, crop

residues, or animal wastes, gasohol offers rural communities a degree of independence from the spiralling costs and unreliable supply of gasoline (also contributing positively to national efforts to solve serious energy supply problems), and, once gasohol production capacity expands, it is a potential positive influence on farm income. The wait for expansion may be relatively short.

2 _____

Many observers question the economic and environmental effects of a massive and rapid change in the use of major farm crops. An important environmental problem associated with energy production from crop residues is that of maintaining soil fertility and preventing excessive soil loss. World nutrition may also be affected if the food needs of the hungry compete with the demand for liquid fuels derived from grain crops.

3 _____

The full costs of maintaining soil fertility when crop residues are removed for ethanol production are poorly understood and quantified. Nutrients removed by and contained in the crop, including any residues (such as corn stocks or grain straw) removed from the farm, must be supplied again by some means if soil productivity is to be maintained. The quantity of nutrients removed in the grain and residue of major crops is large. The amount of nitrogen in crop residues alone is about 1 per cent of the nitrogen applied in commercial fertilizer to primary crops in Illinois, a major farm state.

The biological process by which crop residues decompose in the soil, providing nutrients to a growing crop, is complex. It is also highly sensitive to a number of natural and human factors.

Although the exact exchange between residue removal and use of fertilizers can be determined only under specific conditions, farmers would have to increase fertilizer applications greatly in order to maintain soil fertility if crop residues are removed regularly.

4 _____

Removal of crop residues alters the plant nutrient cycle through a second, less direct mechanism. In nearly all regions, removal of crop residues would aggravate soil erosion by exposing the soil surface which would then be more easily affected by wind and water erosion. Scientists have demonstrated that, when crop residues cover one-half the soil surface, the annual rate of erosion on most soils is about 32 per cent less than when the soil is bare. Many widely used conservation tillage practices reach or exceed this degree of soil cover. For common midwestern soils, researchers have demonstrated that no-tillage practices maintain up to 95 per cent of the soil covered from harvest to corn-planting time the following spring. It has been estimated that, when optimal conservation practices are applied an average 58 per cent of agricultural residues can be removed without causing erosion over *5* tons per cent.

The nutrient loss through erosion is difficult to quantify precisely. Many factors affect the amounts of nutrients lost from a given field. The timing and methods of fertilizer application affect the portion of applied nutrients that are either used by the crop or carried off the field by eroding sediment or runoff. Soil scientists believe that, on the average, *a* pound of nutrients lost through erosion or residue removal must fundamentally he replaced by a pound from commercial or other sources if production levels are to be maintained.

5 _____

The factors which determine how much residue could be made available for biomass conversion are the same as those which determine the rate of erosion — degree and length of slope, soil texture and the intensity of rainfall. Natural soil erodibility in turn determines the importance of crop residue management to the control of erosion, except perhaps where other conservation measures (terracing, for example) are in place. More extreme alternative to control erosion – generally less intensive cropping patterns or reduction in length or steepness of the slope through

land reformation – are economically workable choices for only a small portion of the cultivated land base subject to serious erosion.

A – Loss through erosion
B – Nation's gasohol production
C – Biomass conversion
D – The economic and environmental effects
E – Nutrients
F – Removal of crop residues
G – Capacity and organic content

ACTIVITY 14. COMPLETE THE FOLLOWING SENTENCES WITH THE CORRECT WORDS

Biomass **1)** _____ using crop residues would aggravate nonpoint water pollution stemming from agriculture and could aggravate nutrient loss and soil erosion. Streams, rivers, canals, reservoirs, and lakes could be subject to **2)** _____ sediment loads. Beneficial **3)** _____ characteristics such as tilt, water holding capacity and organic content could also be damaged. Yet, because the environmental **4)** _____ of biomass conversion are not concentrated, are indirect, and occur over time, it is **5)** _____ to place a monetary value on them.

1	**a**	conversion	**b**	exposition	**c**	transformation	**d**	turning
2	**a**	elevated	**b**	increased	**c**	upraised	**d**	overhead
3	**a**	property	**b**	land	**c**	soil	**d**	earth
4	**a**	realizes	**b**	exercises	**c**	performs	**d**	effects
5	**a**	heavy	**b**	serious	**c**	difficult	**d**	hard

ACTIVITY 15. ANSWER THE FOLLOWING QUESTIONS ABOUT ENERGY PRODUCTION:

1. How do farmers contribute to energy production?

2. What are the economic effects of the nation's gasohol production?
3. What are the environmental effects of the nation's gasohol production?
4. How does removal of crops residues alter the plant nutrients cycle?
5. What are the factors which determine the amount of residue possibly available for biomass conversion?

ACTIVITY 16. TRY TO MATCH THE ADJECTIVES IN COLUMN **A** WITH THE NOUNS IN COLUMN **B** TO FORM MEANINGFUL PHRASES

A	**B**
various	ways
environmental	beauty
serious	warming
radioactive	world
disastrous	processes
nuclear	pollutant
natural	pollution
global	weapons
dangerous	substance
beautiful	world

ACTIVITY 17. DECIDE WHICH OF THE VERBS **ON THE LEFT COLUMN** GO WITH THE NOUNS **ON THE RIGHT COLUMN**

to pollute	the soil
to poison	the vehicle
to damage	pollution
to kill	the air
to ruin	the water
to cause	crops
to grow	the distraction
to operate	fish
to provide	jobs
to reduce	the beauty

ACTIVITY 18. TRANSLATE THE FOLLOWING WORD COMBINATIONS. PAY ATTENTION TO THE PREPOSITIONS:

to dirty the air with gases, to poison the water with chemicals,
in various ways, on the land, in the water, to fill the air with noise,
one of the problems, destruction of ozone layer,
harmed by pollution, pollution of soil, for growing crops,
to bring ugliness to our beautiful world, from cars,
for millions of people, job for people,
for the growing crops, the amount of pollution,
from radioactive substances, from nuclear weapons,
are produced by variety of electronic devices,
exposure to large amounts, in reproductive cells,
in the atmosphere

ACTIVITY 19. MATCH THE FOLLOWING WORDS AND WORD COMBINATIONS WITH THEIR UKRAINIAN EQUIVALENTS.

1) to pollute	a) відходи
2) environmental pollution	b) невидимий
3) smoke	c) нав'язувати
4) to poison	d) зменшувати
5) to damage	e) поступово
6) fertilizer	f) випускати, розряджати
7) to scatter rubbish and litter	g) вичерпувати, виснажувати
8) to cause	h) потворність
9) disastrous	i) знижувати
10) to reduce	j) руйнівний
11) ugliness	k) спричиняти
12) exhaust	l) забруднювати
13) to discharge	m) забруднення навколишнього середовища
14) gradually	n) дим
15) to lessen	o) отруювати
16) to enforce	p) завдавати шкоди
17) invisible	q) добрива
18) waste	r) викидати сміття та відходи

ACTIVITY 20. DIVIDE THE FOLLOWING WORDS AND WORD COMBINATIONS INTO THREE GROUPS, THOSE, WHICH DESCRIBE:

a) environmental pollution	**b) radiation**	**c) drugs addiction**

gases, smoke, chemical , X-ray machines, nuclear, drug, dependence, drug user,
pleasurable change, computers, reproductive cells, lasers, fertilizers, pesticides, rubbish, litter

ACTIVITY 21. A) DECIDE WHICH WORLD IS THE ODD ONE OUT IN EACH OF THE FOLLOWING GROUPS OF WORDS.

1. to pollute, to dirty, to damage, to cause
2. air, pollution, water soil
3. to reduce, to increase, to lessen, to decrease
4. rubbish, weapons, litter, to eliminate, waste
5. to ban, to ruin, to eliminate, do destruct

B) FIND THE NAMES FOR THE GROUPS OF WORDS. FILL IN EACH OF THE SPACES:

1. the soil, the water, the air : _____
2. fertilizers, pesticides, chemicals : _____
3. fish, animals, birds : _____
4. a car, a bicycle, a bus : _____
5. scientist, engineers, ranchers : _____

ACTIVITY 22. READ THE TEXT BELOW. MATCH CHOICES **(A – H) TO (1 – 5).** THERE ARE TWO CHOICES YOU DO NOT NEED TO USE.

POLLUTION

Pollution is **1)** _____ by external substances introduced directly or indirectly. Human health, ecosystem quality and aquatic and terrestrial biodiversity may be affected and altered permanently by pollution. Pollution occurs when ecosystems can not get rid of **2)** _____. The critical threshold of its ability to naturally eliminate substances is compromised and the balance of the ecosystem is broken.

The sources of pollution are numerous. The identification of these different pollutants and their effects on ecosystems is complex. They can come from natural disasters or **3)** _____, such as oil spills, chemical spills, nuclear accidents… These can have **4)** _____where they live: destruction of the biodiversity, increased mortality of the human and animal species, destruction of natural habitat, damage caused to the quality of soil, water and air …

Preventing pollution and protecting the environment necessitate the application of the principles of sustainable development. We have to consider to satisfy the needs of today without **5)** _____.

A – the degradation of natural environment
B – compromising the ability of future generations to meet their needs
C – substances introduced into the environment
D – the result of human activity
E – terrible consequences on people and the planet
F – inside the ecosystem
G – by helping plants and animals

ACTIVITY 23. MATCH THE FOLLOWING WORDS AND WORD COMBINATIONS WITH THEIR UKRAINIAN EQUIVALENTS.

1) weapons	a) виживання
2) nuclear weapons	b) одорант, духмяний
3) to determine	c) зловживати
4) to influence	d) сприйняття
5) exposure	e) окрім, за винятком
6) a cell	f) присвячувати
7) to ban	g) знищувати, очищати, виділяти
8) to eliminate	h) ядерна зброя
9) to devote	i) забороняти
10) except	j) зброя
11) perception	k) визначати
12) abuse	l) впливати
13) odorant	m) клітина
14) the survival	n) піддавання зовнішньому впливу

ACTIVITY 24. PUT QUESTIONS ON THE UNDERLINED WORDS.

1. As a rule they pollute the surroundings.
2. They are constantly reducing the pollution.
3. This is a very complex problem.
4. They have various problems.
5. They are destroying the surroundings.

ACTIVITY 25. FILL IN THE BLANKS WITH THE VERBS ***TO BE, TO HAVE***

Legal drugs ____considered to _____ a serious problem in both the US and UK. Drugs like heroin, cocaine _____ often described as hard drugs. Hard drugs cause a lot of crime because their users

become very dependent on them and constantly need money to have more drugs. Drugs like cannabis, ecstasy, and LSD _____ often described as soft drugs because many young people believe that they _____ not seriously _____ not seriously harmful. But they _____ mistaken. To _____such drugs _____ considered to _____ a crime.

ACTIVITY 26. READ AND STATE THE FUNCTION OF THE VERBS ***TO BE, TO HAVE***

It is illegal to drive in the US and UK if you have drunk more than the legal limit of alcohol. If the people stop you when you are driving and believe that you may have drunk too much alcohol, they will usually test your breath using a special device. In the US and UK, drink-driving is considered to be a very serious crime, for which you can be put in prison and lose your legal right to drive.

ACTIVITY 27. FILL IN THE BLANKS WITH THE ARTICLES **A, AN, THE** WHERE NECESSARY

Since more and more _____ people in _____ UK and US worry now about _____ environment, they are demanding more _____ products, _____machines that are not _____ harmful to _____ environment. These products and _____ methods are advertised as environmentally friendly.

ACTIVITY 28. READ AND GIVE THE SUMMERY OF THE TEXT

RADIATION

Radiation is an invisible pollutant that can be highly dangerous. Nuclear radiation comes from radioactive substances, including waste from nuclear weapons testing and from nuclear power plants. Small amounts of electromagnetic radiation are produced by a variety of electronic devices including computers, lasers, microwave ovens, TV-sets and X-ray machines.

Scientists have not determined exactly what effects small amounts of radiation influence people. But exposure to large amounts can cause cancer and harmful changes in reproductive cells.

International agreements ban most testing of nuclear weapons in the atmosphere. Such regulations have helped to eliminate the major sources of radiation. However, the amount of radioactive waste is constantly increasing.

Scientists are studying the ways to eliminate these wastes safely and permanently.

ACTIVITY 29. FILL IN THE GAPS WITH THE MISSING WORDS IN THE FOLLOWING SENTENCES, THE FIRST LETTER OF EACH WORD HAS BEEN GIVEN TO HELP YOU.

1) People often **p** …… their surroundings.
2) People **d**……. the soil with too many **f**……..
3) People **s**…… rubbish and litter on the land.
4) Cars fill the air with the **n**……..
5) Environmental pollution **c** …… disastrous processes.
6) The pollution problem is **c**…….
7) Factories **d**…… much of the material that pollutes air and water.
8) Pollution can be **r**…….
9) **E**…… to large amounts of radiation can cause cancer.
10) International agreements **b**…… most testing of nuclear weapons.

ACTIVITY 30. CHOOSE THE PROPER WORDS AND FILL IN THE BLANKS:

1. People _____ their surroundings.
A pollute **B** face **C** kill **D** operate
2. Environmental pollution _____ the ozone layer.
A poison **B** destruct **C** cause **D** produce
3. Fertilizers are necessary for growing _____ .
A fish **B** rubbish **C** crops **D** land
4. Factories _____ gases and smoke.
A dirty **B** harm **C** provide **D** discharge
5. We should _____ radioactive wastes safely.
A increase **B** study **C** eliminate **D** ban
6. Many _____ users turn to crime.
A computer **B** drug **C** addiction **D** habit
7. There is a lot of advertising against drugs _____ .
A survival **B** users **C** dependence **D** mind

8. Environmental pollution causes _____ processes.

A survival **B** disastrous **C** gradual **D** invisible

9. Air, water and soil are necessary to the _____ of all living things.

A pollution **B** people **C** humanity **D** survival

10. They scatter rubbish and _____ everywhere.

A pesticides **B** litter **C** fertilizers **D** weapons

ACTIVITY 31. ANSWER THESE MULTIPLE-CHOICE QUESTIONS ABOUT ENVIRONMENTAL POLLUTION:

1. What does the term “environmental pollution “mean?

A polluted air

B all the ways of polluting surroundings

C rubbish and litter

2. Why is environmental pollution a serious problem?

A because it can cause disastrous processes

B because people dirty the air with gases and smoke

C because motor vehicles fill the air with the noise

3. Why is environmental pollution a complicated problem?

A because people ruin naturally beautiful world

B because much pollution is caused by things that benefit people

C because exhaust from cars causes a large percentage of all air pollution

4. How can we reduce environmental pollution?

A Governments should enforce laws which ban the pollution of the environment

B we should work hard

C we should stop using many things that benefit us

ACTIVITY 24. READ THE TEXT AND ANSWER THE QUESTION ON IT BELOW

ENVIRONMENTAL EFFECTS

CO2 emissions

Natural gas is often described as the cleanest fossil fuel, producing less carbon dioxide per joule delivered than either coal or oil and far fewer pollutants than other hydrocarbon fuels. However, in absolute terms, it does contribute substantially to global carbon emissions, and this contribution is projected to grow. According to the IPCC Fourth Assessment Report (Working Group III Report, chapter 4), in 2004, natural gas produced about 5.3 billion tons a year of CO2 emissions, while coal and oil produced 10.6 and 10.2 billion tons respectively.

According to an updated version of the SRES B2 emissions scenario, however, by the year 2030, natural gas would be the source of 11 billion tons a year, with coal and oil now 8.4 and 17.2 billion respectively because demand is increasing 1.9% a year (Total global emissions for 2004 were estimated at over 27,200 million tons)

In addition, natural gas itself is a greenhouse gas more potent than carbon dioxide when released into the atmosphere, although natural gas is released in much smaller quantities. However, methane is oxidized in the atmosphere, and hence natural gas has a residence lifetime in the atmosphere for approximately 12 years, compared to CO2, which is already oxidized, and has an effect for 100 to 500 years.

Natural gas is mainly composed of methane, which has a radioactive forcing twenty times greater than carbon dioxide. Based on such composition, a ton of methane in the atmosphere traps in as much radiation as 20 tons of carbon dioxide; however, it remains in the atmosphere for a 8–40 times shorter time. Carbon dioxide still receives the lion's share of attention over greenhouse gases because

it is released in much larger amounts. Still, it is inevitable when natural gas is used on a large scale that some of it will leak into the atmosphere. (Coal methane not captured by coal bed methane extraction techniques is simply lost into the atmosphere; however, most methane in the atmosphere is currently from animals and bacteria, not from industrial leaks.) Current estimates by the EPA place global emissions of methane at 3 trillion cubic feet (85 km3) annually, or 3.2% of global production. Direct emissions of methane represented 14.3% of all global anthropogenic greenhouse gas emissions in 2004.

1)Is natural gas the cleanest fossil fuel?
2) How many tons of gas a year would be extracted by the 2030?
3)What is done with methane in the atmosphere?
4)What is natural gas composed of?
5)Why does the carbon dioxide receive the lion's share of attention?

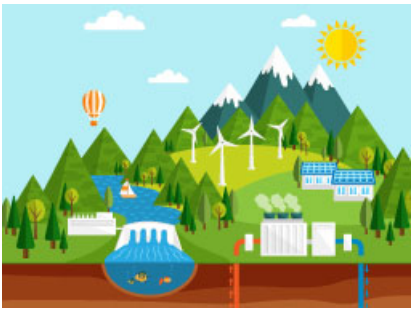
ACTIVITY 25. TRY TO MATCH THE ADJECTIVES IN **COLUMN A** WITH THE NOUNS IN **COLUMN B** TO FORM MEANINGFUL PHRASES

A	B
to pollute	the soil
to poison	the vehicle
to damage	pollution
to kill	the air
to ruin	the water
to cause	crops
to grow	the distraction
to operate	fish
to provide	jobs
to reduce	the beauty

ACTIVITY 26. READ THE SENTENCES AND MAKE THEM NEGATIVE AND INTERROGATIVE

1) Natural gas produces far lower amounts of sulfur dioxide and nitrous oxides than any other hydrocarbon fuel.
2) Carbon dioxide produced is 117,000 ppm vs. 208,000 for burning coal.
3) Particulates are also a major contribution to global warming.
4) Natural gas has 7ppm vs. coal's 2,744ppm.
5) In mines, where methane seeping from rock formations has no odor, sensors are used.
6) Mining apparatus such as the Davy lamp has been specifically developed to avoid ignition sources. The untreated gas hydrogen sulfide (H2S) is toxic.
7) Amine gas treating is often used to remove hydrogen sulfide from natural gas.
8) Extraction of natural gas (or oil) leads to decrease in pressure in the reservoir.
9) Such decrease in pressure in turn may result in subsidence, sinking of the ground above.
10) Subsidence may affect ecosystems, waterways, sewer and water supply systems, foundations, and so on.

ACTIVITY 27. COMPLETE THE FOLLOWING SENTENCES WITH THE CORRECT WORDS



Many **1)** _____ suggest turning to renewable energy, which means **2)** _____ of energy that will never run out. It can be produced using the **3)** _____, the sun, waves or hot springs. The wind can turn large **4)** _____ to produce electricity, while energy from the sun can be collected in panels and stored in batteries. The movement of the sea can also be changed into electrical **5)** _____ by using wave machines and, in parts of the world where there is volcanic activity, hot springs can produce geothermal energy. Unlike nuclear power, these are safe sources of energy that don't pollute the **6)** _____.

1	**a**	naturalist	**b**	academic	**c**	scholar	**d**	scientists
2	**a**	origin	**b**	headspring	**c**	sources	**d**	spring
3	**a**	air	**b**	wind	**c**	noise	**d**	breeze
4	**a**	turbines	**b**	machines	**c**	powers	**d**	flows
5	**a**	power	**b**	force	**c**	might	**d**	energy
6	**a**	surroundings	**b**	atmosphere	**c**	environment	**d**	setting

ACTIVITY 28. SUPPLY THE MISSING **PREPOSITIONS** IN THE FOLLOWING CONTEXT

People who live **1** ____ California have every reason to be afraid of earthquakes. No one has ever forgotten the great quake that destroyed San Francisco **2** _____ 1906. **3** _____ May, 1988, the people of Los Angeles panicked. According to a prophecy made **4** _____ the 16th century by a prophet called Nostradamus the city would be destroyed early **5** _____ 1988. During the panic, the

parents didn't send their children **6** _____ school and people didn't go **7** _____ work. No one stayed **8** _____ home, either. The airlines did great business carrying people who fled **9** _____ their 'doomed city'. Which is more puzzling: how Nostradamus knew that a city which didn't even exist **10** _____ his time would be destroyed **11** _____ the 20th century, or the behavior of the people who believed 'the prophecy'?

ACTIVITY 29. READ THE TEXT AND CHOOSE THE BEST ANSWER **(A–D)** TO COMPLETE THE SENTENCES **(1–5).**

A record -breaking snowstorm has brought chaos to much of the north -eastern United States. Much of the region now lies covered in some two feet or more of snow and trans¬port systems are at a standstill. Thousands of homes are without electrical power.

The United States National Weather Service says that this huge winter storm has dumped some 68.3 centimetres of snow in Central Park, making it the worst blizzard to hit New York since records began in 1869.

To add to the problems facing the entire north- eastern seaboard, winds across the region have been gusting at up to 96 kilometres an hour, causing serious localised drifting1. The road network in many places is impassable. Most of the airports in the region have been closed, with hundreds of flights cancelled. Passengers on Transatlantic flights heading into New York have, in some cases, found themselves diverted to alternative destinations.

Here in Manhattan, snowploughs worked non- stop on Sunday in an effort to keep the streets and avenues open to traffic. But much of the city was quiet. Even the no¬toriously busy Times Square was all but deserted for much of the day. Some who did venture2 out into the snow were rewarded with the memorable sight of people making their way down Broadway on skis.

1. Because of the large amount of snow…

A people walked out on strike for higher pay.

B transport systems were closed and many homes were without power.

C the New York City government gave away coats to keep people warm.

D New York City ordered all stores closed for the day.

2. This was the most snowfall New York has seen since…

A 1969.

B the record breaking storm of 1899.

C records began in 1869.

D the blizzard of 1989.

3. The phrase "localised drifting" most likely means…

A snow is being blown into large piles is some areas.

B snowploughs cannot plough the roads clear.

C people are lost in the blizzard.

D people stayed home from work.

4. What was the notoriously busy Times Square missing?

A people **B** snow **C** policemen **D** skis

5. What was a remarkable sight to see on this day?

A Central Park Zoo's penguins

B people skiing on Broadway

C Transatlantic flights landing in Times Square

D the deserted theatres on Broadway

1	2	3	4	5

ACTIVITY 29. READ THE TEXT. FIVE SENTENCES HAVE BEEN TAKEN OUT OF IT. COMPLETE THE TEXT WITH APPROPRIATIVE SENTENCES **(A-G)** GIVEN BELOW. AN EXAMPLE **(0)** HAS BEEN DONE FOR YOU AT THE BEGINNING. THERE ARE TWO EXTRA SENTENCES WHICH YOU DON'T NEED.

POLLUTANTS

In any form, a minute amount of odorant such as t-butyl mercaptan, with a rotting-cabbage-like smell, is added to the otherwise colorless and almost odorless gas, so that leaks can be detected before a fire or explosion occurs. **(0)**_____. Sometimes a related compound, theophany is used, with a rotten-egg smell. Adding odorant to natural gas began in the United States after the 1937 New London School explosion. **(1)** _____. Odorants are considered non-toxic in the extremely low concentrations occurring in natural gas delivered to the end user. **(2)** _____.

Explosions caused by natural gas leaks occur a few times each year. Individual homes, small businesses and boats are most frequently affected when an internal leak builds up gas inside the structure. **(3)**_____. In these cases, the people inside tend to have minor to moderate injuries. Occasionally, the gas can collect in high enough quantities to cause a deadly explosion, disintegrating one or more buildings in the process. The gas usually dissipates readily outdoors, but can sometimes collect in dangerous quantities if weather conditions are right.

(4) _____. Some gas fields yield sour gas containing hydrogen sulfide (H2S). This untreated gas is toxic. Amine gas treating, an

industrial scale process which removes acidic gaseous components, is often used to remove hydrogen sulfide from natural gas.

Extraction of natural gas (or oil) leads to decrease in pressure in the reservoir. **(5)** _____. Natural gas heating systems are a minor source of carbon monoxide deaths in the United States. According to the US Consumer Product Safety Commission (2008), 56% of unintentional deaths from non-fire CO poisoning were associated with engine-driven tools like gas-powered generators and lawn mowers. Natural gas heating systems accounted for 4% of these deaths. Improvements in natural gas furnace designs have greatly reduced CO poisoning concerns. Detectors are also available that warn of carbon monoxide and/or explosive gas (methane, propane, etc.)

A Carbon dioxide produced is 117,000 ppm vs. 208,000 for burning coal.

B Frequently, the blast will be enough to significantly damage a building but leave it standing.

C In mines, where methane seeping from rock formations has no odor, sensors are used.

D However, considering the tens of millions of structures that use the fuel, the individual risk of using natural gas is very low.

E Such decrease in pressure in turn may result in subsidence, sinking of the ground above.

F This in turn may lead to subsidence at ground level. Subsidence may affect ecosystems, waterways, sewer and water supply systems, foundations, etc.

G The buildup of gas in the school went unnoticed, killing three hundred students and faculty when it ignited.

EXTENSIVE READING

TEXT 1. IMPORTANT RESOURCE

We may take it for granted, but water is the most important resource on Earth. It covers 80 % of the Earth's surface and it's the only substance that can be found naturally in three forms: solid, liquid and gas. Water also makes up 66 % of the human body and without it we can't live for more than a week.

Although water is the most common substance on Earth, we should use it carefully because only 1% is drinkable and 1/3 of all the people in the world can't get enough clean water. Today, we use 3 times more water than in 1950, and people in rich countries use 10 times more than those in poor ones. So where does it all go? Well, a single dripping tap can waste up to 7,600 litres of water in a year and a leaking toilet can waste about 260 litres in a day.

At home, we can help by fixing broken taps and toilets. Having showers instead of baths could save about 300 litres of water a week. We should also avoid using chemicals that pollute the water supply, because we can't increase the amount of fresh water in the world. We can only change the way we use it.

TEXT 2. SURFACE WATER STORAGE

One of the most important features of planet Earth as a home for living things is the presence of Water on its surface. Water circulates from surface storage areas into the atmosphere, moves through the atmosphere, and then returns to Earth's surface as part of the hydrologic cycle. The proceses that drive the hydrologic cycle include the tiansformations and transfer of solar energy in the atmosphere-ocean environment and the patterns of global winds.

The oceans cover 71 percent of Earth's surface and contain 97.2 percent of Earth 's water.

The remaining 2.8 percent exists as fresh water or ice on the continents and as water vapor in the atmosphere. The ice sheets of Antarctica and Greenland and the glaciers of high mountains store nearly three- fourths of the continental water, and rocks contain the rest below ground.

Only small amounts of Earth's total water circulate through the hydrologic cycle at any one moment. The average amount of water in Earth's atmosphere would be sufficient for only ten days of rain or snow if no water was added from the ocean surface. Most of Earth's water is storied, often for several thousand years, before moving through the hydrologic cycle. The water moving through the hydrologic cycle greatly influences weather and climate and is also important in carving surface landforms and sustaining living organisms.

TEXT 3. FROM SURFACE WATER TO ATMOSPHERIC GAS

Water begins its journey through the atmosphere when evaporation or transpiration converts it from liquid to gas. Evaporation is the change from a liquid (e.g. water) to the gaseous form (e.g. water vapor). Transpiration is the process by which plants pass water vapor into the atmosphere through the pores in their leaves.

Evaporation occurs where water surfaces are exposed to the air. It requires a lot of energy to break apart the bonds linking the water molecules and so release each molecule into the atmosphere as a free gas molecule, the evaporation of 1 g of water requires the same amount of energy as the heating of 6 g of water from freezing to boiling point (5 g fill a teaspoon). There is usually sufficient heat energy in the atmosphere for evaporation to occur continuously from water surfaces.

Transpiration occurs in plants. Plants draw water through their roots and use it to manufacture and transport their own foods. The

water passes up the steam and into the leaves, which transpire it as vapor into the atmosphere. A plant may transpire up to 98 percent of the water absorbed by its roots.

Evaporation and transpiration over land are difficult to measure separately and are commonly referred to collectively as evapotranspiration.

Water vapor entering the air adds to the molecules of other gases already there but acts separately. The amount of water vapor that can coexist with the other atmospheric gases depends on the temperature of the atmosphere. As temperature rises molecules become increasingly excited until water molecules escape from water surfaces and become water vapor in the atmosphere.

The atmospheric temperature limits the amount of water vapor the air can hold. When as much water vapor is changing back to water droplets as is being evaporated, the air is said to be saturated. Air that is not saturated, in which evaporation exceeds the formation of water droplets, is known as “dry” air. Winds help to maintain evaporation rates by moving saturated air away from a water or vegetated surface.

TEXT 4. THERMAL WARMING

The world’s oceans have warmed 50 percent faster over the last 40 years than previously thought due to climate change, Australian and US climate researchers reported on Wednesday. Higher ocean temperatures expand the volume of water, contributing to a rise in sea levels that is submerging small island nations and threatening to flooding in low-lying, densely-populated delta regions around the globe.

The study, published in the British journal *Nature*, adds to a growing scientific chorus of warnings about the consequences rising oceans. It also serves as a corrective to a massive report issued last year by the Nobel-winning UN Intergovernmental Panel on Climate Change (IPCC), according to the authors.

Rising sea levels are driven by two things: the thermal expansion of sea water, and additional water from melting sources of ice. Both processes are caused by global warming. The ice sheet that sits atop Greenland, for example, contains enough water to raise world ocean levels by seven metres (23 feet), which would bury sea-level cities from Dhaka to Shanghai.

Trying to figure out how much each of these factors contributes to rising sea levels is critically important to understanding climate change, and forecasting future temperature rises, scientists say. But up to now, there has been a perplexing gap between the projections of computer-based climate models, and the observations of scientists gathering data from the oceans.

The new study, led by Catia Domingues of the Centre for Australian Weather and Climate Research, is the first to reconcile the models with observed data. Using new techniques to assess ocean temperatures to a depth of 700 metres (2,300 feet) from 1961 to 2003, it shows that thermal warming contributed to a 0.53 millimetre-per-year rise in sea levels rather than the 0.32 mm rise reported by the IPCC.

TEXT 5. ENERGY

In the 21st century, our need for energy is greater than it has ever been. Fossil fuels like coal, oil and gas were formed millions of years ago, and when power stations burn them to create electricity, they release harmful gases into the atmosphere. There may be enough coal to last for a few hundred years, but known oil and gas

reserves will run out in less than 50 years – and then what will we do?

Many scientists suggest turning to renewable energy, which means sources of energy that will never run out. It can be produced using the wind, the sun, waves or hot springs. The wind can turn large turbines to produce electricity, while energy from the sun can be collected in panels and stored in batteries. The movement of the sea can also be changed into electrical energy by using wave machines and, in parts of the world where there is volcanic activity; hot springs can produce geothermal energy. Unlike nuclear power, these are safe sources of energy that don't pollute the environment.

Our dependence on fossil fuels has to end soon. Let's hope that by the time all the reserves are gone, there will be enough alternative sources of efficient energy available. In the meantime, why don't we try to reduce the amount of energy that we use?

TEXT 6. THE DARK SIDE – MAKING WAR ON LIGHT POLLUTION

In 1610, Galileo Galilei published a small book describing astronomical observations that he had made of the skies above Padua, Italy. His homemade telescopes had less magnifying and resolving power than most beginners' telescopes sold today, yet with them he made astonishing discoveries: that the moon has mountains and other topo¬graphical features, that Jupiter is orbited by satellites which he called planets, and that the Milky Way is made up of individual stars. It may seem strange that this last observa¬tion could have surprised anyone, but in Galileo's time

people assumed that the Milky Way must be some kind of continuous substance. It truly resembled a streak of spilled liquid and it was so bright that it cast shadows on the ground (as did Jupiter and Venus). Today, by contrast, most Americans are unable to see the Milky Way in the sky above the place where they live, and those who can see it are sometimes baffled by its name.

The stars have not become dimmer; rather, the Earth has become vastly brighter, so that celestial objects are harder to see. Air pollution has made the atmosphere less transparent and more reflective, and high levels of terrestrial illumination have washed out the stars overhead – a phenomenon called “sky glow.” Anyone who has flown across the country on a clear night has seen the landscape ablaze with artificial lights, especially in urban areas. Today, a person standing on the observation deck of the Empire State Building on a cloudless night would be unable to discern much more than the moon, the brighter planets and a handful of very bright stars – less than one percent of what Galileo would have been able to see without a telescope.

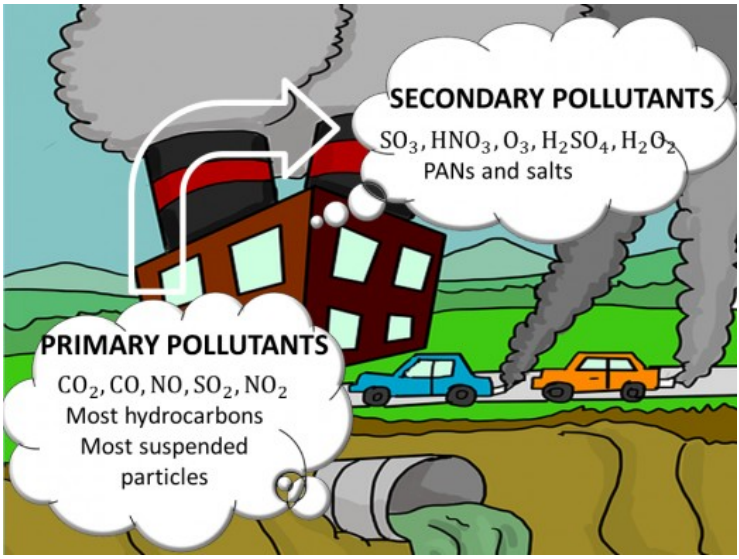
Today, the very darkest places in the United States are increasingly threatened. For someone standing on the rim1 of the Grand Canyon on a moonless night, the brightest feature of the sky is not the Milky Way but the glow of Las Vegas, a hundred and seventy five miles away. To see skies truly comparable to those which Galileo knew, you would have to travel to such places as the Australian Outback and the mountains of Peru.

AFTER - READING ACTIVITY

ACTIVITY 1. READ THE STATEMENTS AND COMPOSE YOUR OWN STORY ABOUT CURRENT ENVIRONMENTAL PROBLEMS

ACTIVITY 2. LOOK AT THE PICTURE AND MAKE UP THE LIST OF ENVIRONMENTAL POLLUTANTS

ACTIVITY 3. LOOK AT THE PICTURE AND TELL ABOUT THE SOURCES OF ENVIRONMENTAL POLLUTION



VOCABULARY FOLDER

UNIT 1 JOBS AND PROFESSIONS

PART 1 CHOOSING JOBS AND PROFESSIONS	
to advance up	просуватися вперед
ambitions	амбіції, мета, прагнення
to apply to college	подати заяву до коледжу
apprentice	початківець, учень, підмайстер
to be employed	бути прийнятим на роботу
to be sacked	бути звільненим
to be out of work	бути без роботи
beneficial	вигідний, корисний
benefits	переваги, користь, благодійність
behavior	поведінка, ставлення
blue-collar jobs	«синій комірець», робітник
chance	щасливий випадок, шанс
company’s bottom line	останній у списку компанії
company's representative	представник компанії
to cope with	впоратися з
corporate culture	корпоративна культура
coworker	колега, співробітник
current job	поточні робочі місця,
Curriculum Vitae (CV)	автобіографія
to deal with	мати справу з…
dedication	відданість
desk job	сидяча робота
to earn	заробляти
employee	працівник, службовець
employer	роботодавець
to enjoy life	насолоджуватися життям

to establish	встановлювати, засновувати
to face the real world	стикатися з реальним світом
to fit in	підходити
flexible work hours	гнучкі робочі години
friendliness	дружелюбність
to get money for some work	щоб отримати гроші за якусь роботу
to give advice	давати поради
to give financial support	надати фінансову підтримку
good work habits	хороші робочі звички
human resources	людські ресурси
interviewer	інтерв'юер
to offer	пропонувати, намагатися
positive attitude	позитивне ставлення
provide adequate accommodation	забезпечити належне розміщення, проживання
social responsibility	соціальна відповідальність
skilled worker	кваліфікований працівник
successful applicant	успішний претендент
unskilled laborer	некваліфікований робітник
unsuccessful	невдалий, неуспішний, безуспішний
well-paid	добре оплачуваний
PART 2 WRITING CV AND LETTER OF APPLICATION BUSINESS CORRESPONDENCES	
advertisement	реклама, оголошення
to arrange	організувати, пристосовувати
to assemble	зібрати, збирати
attractive	привабливий
essential points	істотні моменти
letter of application	лист-заява
right impression	гарне, правильне враження

separate idea	окрема ідея
sincere	щирий, чесний, відвертий
final version	фінальна версія
first draft	перший проект

UNIT II WATER. EQUIPMENT OF WATER SUPPLY SYSTEMS

air pressure	тиск повітря
to affect	впливати
to allow water	щоб дозволити воді
altitude	висота, вершина
appreciate	цінувати, брати до уваги
aquifer	водоносний горизонт
baseflow period	період базового потоку
blazing sun	палаюче сонце
breaking waves	хвилі, що розбиваються
certain volume of air	певний об'єм повітря
cirrus clouds	перисті хмари
condensation	конденсація, згущення
crystal-clear blue sky	кришталево чисте блакитне небо
daily life	повсякденне життя
distribution	розповсюдження, розподіл
dew point temperature	точка температури роси
excessive pumping	надмірне перекачування
expect	очікувати, сподіватися
evaporation	випаровування
to float	плавати
footprint	слід
to grab	хапати, захоплювати, привласнювати
ground-level fog	туман на рівні землі
hole dug	викопана яма

to impact	ущільнювати, міцно закріпляти
influence	вплив, впливати
initial chance	первинний, початковий шанс
to be invaluable	бути неоціненним, дорогоцінним
life source	джерело життя
location of rivers	розташування річок
movement of the tides	рух припливів
outflow point	точка відтоку, витоку
to recharge	дозаправляти, перезаряджати
to refresh	оновлювати, охолоджувати, освіжати
permeability	проникність, прохідність
porosity	пористість
precipitation	опади, стрімкість, прискорення
saline	сольовий розчин, солончак
saturated	насичений, інтенсивний
separate	відокремлювати, розподіляти, окремий, самостійний
stable transition zone	стабільна перехідна зона
stalk	стебло, стержень
storehouse of Earth's water	водо сховище Землі
streamflow	русло, потік
supply	постачання, поставка, запас, постачати, доставляти
surface area	площа поверхні
top of the surface	верхня частина поверхні
tremendously valuable	надзвичайно цінний
water-bearing formation	водоносне утворення
watershed	вододіл, басейн ріки
water vapor	водяна пара

UNIT III NATURAL GAS. EQUIPMENT OF GAS SUPPLY SYSTEMS

anaerobic decay	анаеробний розпад
anaerobic lagoon	анаеробна лагуна
bitumen	бітум, асфальт
bog	болото, трясовина
butane	бутан
carbon dioxide	вуглекислий газ
carbon monoxide	окис вуглецю
coal bed	вугільний пласт
coal tar	кам'яновугільний дьоготь, смола
condensate removal	видалення конденсату
to effervesce	виблискувати, іскритися, пінитися
enteric fermentation	кишкове бродіння
ethane	етан
emission standards	норми викидів
fertilizer	добриво
fireplace	камін, топка
fossil fuels	горючі корисні копалини
greenhouse gas	парникові гази
helium	гелій
hydrocarbon	вуглеводень
hydrogen sulfide	сірководень
to hold	вміщувати, тримати, володіти
industrial applications	промислове застосування
liquid	рідина, тіло
methanogenic	метаногенний
natural gas	природний газ
nitrogen	азот
methane	метан
offshore	офшор, у відкритому морі
pentane	пентан
permafrost	вічна мерзлота
pollutant	забруднювач
processing	переробка, обробка, технологія

propane	пропан
retrograde condensation	ретроградна конденсація
shale gas	сланцевий газ
storage	зберігання, склад
sulfur	сірка, зеленувато-жовтий
swamp	болото, трясовина
wellhead	свердловина, першоджерело

UNIT IV ENVIRONMENT, ITS PROBLEMS AND PROTECTION

atmosphere-ocean environment	атмосферне та океанське середовище
atmospheric concentration	атмосферна концентрація
atmospheric circulation pattern	схема циркуляції атмосфери
available	корисний, придатний, доступний
bare	голий, бідний, порожній
closely interconnected	тісно взаємопов'язані
degree	ступінь, градус
to determine	визначити, обумовлювати
to depend	залежати, надіятися
to devote	присвятити, прирікати
to discharge	випускати, звільняти
to eliminate	усувати, ігнорувати
electronic device	електронний пристрій
environmental pollution	забруднення навколишнього середовища
exact exchange	точний обмін
to explain	пояснювати
harmful elements	шкідливі, стихійні елементи
humanity	людство
greenhouse effect	парниковий ефект
influence	вплив, впливати
international agreement	міжнародна угода
living-organism environment	середовище живого організму
litter	сміття, смітити
rnoisture	сирість, вологість

natural biological processes	природні біологічні процеси
nuclear power	ядерна енергетика
polluting surroundings	забруднення навколишнього середовища
pollution	забруднення
to provide	забезпечувати
to quantify	кількісно оцінити, порахувати
radioactive waste	радіоактивні відходи
to remove	видаляти, переміщувати
rubbish	сміття, мотлох
science	наука
scientific knowledge	наукові знання
solid-earth environment	середовище поверхні землі
surface	поверхня
survival	виживання
surrounding conditions	умови подолання
ugliness	потворність, огидність
waterlogged fields	заболочені поля

ВИКОРИСТАНІ ДЖЕРЕЛА ТА ЛІТЕРАТУРА

1. Английский язык: учеб. пособие / Н. И. Веренич [и др.]. – Минск: Тетра Системс, 2012. – 304 с.

2. Євчук О.В., Доценко І.В. Англійська мова. Збірник тестових завдань/ О.В. Євчук, І.В. Доценко – Кам'янець – Подільський: ФОП Сисин О.В., 2018. – 500 с.

3. Коул С. Письмові теми з англійської мови/ Writing Tutor. – Чернігів: КММЕДІА, 2016. – 192 с.

4. Письменная О.А. Ecology and Environmental Protection – Английский язык: экология и охрана окружающей среды: - Л.: ООО «ИП Логос-М», М: ООО «Айрис-пресс», 2007. – 368 с.

5. Погожих Г. М., Волкова О. Ю. Усі розмовні теми. English. Харків: ПП Торсінг плюс, 2016. – 608с.

6.Силкович Л.А. Английский язык для студентов сельскохозяйственных вузов. Чтение для студентов специальности «Энергетическое обеспечение сельскохозяйственного производства» - Минск, 2005. – 166 с.

7. Тучина Н.В., Меркулова Т.К., Кузьміна В.С. «Speak English», Київ 2006. – 286 с.

8. Хант Г. О., Коновалова В. А., Лазаренко І. С. Англійська мова. Навчальний посібник. Житомир: ЖНАЕУ, 2017. – 120 с.

9. Aspinall Tricia, Bethell George. Test your Business Vocabulary in Use. Cambridge University Press, 2003.

10. Bruce Kay, Parrish Betsy, Wood Allan. Business Review. Longman Group UK Limited, 1992.

11. Business English Essential. /Частина 2: Посібник з англійської мови для навчання ділового спілкування. / Укл. О. Біленька, А. Павлюк, О. Чепурна – Тернопіль: Видавництво Карп'юка, 2003. – на англ. мовою – 236 с.

12. Business English / Textbook/ E.B. Nikolaenko – Tomsk: Tomsk Polytechnic University Publishing House, 2008. – 145 с.

13. Cambridge ESOL. BEC 1, 3. Cambridge University Press, 2001.

14. Jones Leo, Alexander Richard. New International Business English. Cambridge University Press, 2003.

15. Kay Susan. Reward Intermediate Resource Pack. Heinemann English Language Teaching, 1995.

16. Lees Gerald, Thorne Tony. English on Business. Practical English for International Executives. Chancerel International Publishers, 1993.

17. MacKenzie Ian. English for Business Studies. Cambridge University Press. 1997.

18. MacKenzie Ian. Financial English with Mini-dictionary of Finance. Language Teaching Publication Series, 1995.

19. MacKenzie Ian. Management and Marketing. Language Teaching Publications, 1997.

20. Miller Roger LeRoy. Economics Today and Tomorrow. Glencoe Division of Macmillan/McGraw-Hill School Publishing Company, 1995.

21. Misztal Mariusz. Tests in English Thematic Vocabulary. Intermediate and Advanced Level. Киев: «Знания», 1999.

22. Practice tests for IELTS. Edition 1. Cambridge University Press, 2000.

23. Practice tests for IELTS. Edition 2. Cambridge University Press, 2000.

24. Practice tests for IELTS. Edition 3. Cambridge University Press, 2000.

25. Sandler P.L., Stott C.L. Manage with English. Oxford University Press, 1993.

26. Vicki Hollett. Business Opportunities. Oxford University Press, 1999.

27. Vince Michael with Paul Emerson. First Certificate. Language Practice with Key. English Grammar and Vocabulary. Macmillan Education, 2006.

28. Vince Michael with Peter Sunderland. Advanced Language Practice. Macmillan Education, 2003.

29. Wyatt Rawdon. Check your Vocabulary for English for the IELTS examination. A workbook for students. Peter Collin Publishing, 2001.

Інтернет ресурси

https://water.usgs.gov/edu/watercyclesummarytext.html
https://www.britannica.com/art/Western-architecture/Roman-and-early-Christian#ref488581
http://naturalgas.org/naturalgas/processing-ng/
http://jobsearchtech.about.com
http://resume-help.org
http://www.bbc.co.uk
http://www.jobsinusa.al.ru/

Навчальне видання

АНГЛІЙСЬКА МОВА

ЗА ПРОФЕСІЙНИМ СПРЯМУВАННЯМ

НАВЧАЛЬНИЙ ПОСІБНИК

ДЛЯ СТУДЕНТІВ

спеціальність **192 «Будівництво та цивільна інженерія»**
освітні програми
«Монтаж, обслуговування устаткування і систем газопостачання»
«Обслуговування устаткування систем водопостачання і водовідведення»

Формат 60х84/16. Ум. друк. арк. 16,97.
Наклад 5. Зам. № 000.

Видавець О. О. Євенок
м. Житомир, вул. М. Бердичівська, 17А
тел.: (0412) 422-106

Свідоцтво про внесення суб'єкта видавничої справи до Державного реєстру видавців, виготівників і розповсюджувачів видавничої продукції України серія ДК № 3544 від 05.08.2009 р.

Друк та палітурні роботи ФОП О. О. Євенок
10014, м. Житомир, вул. М. Бердичівська, 17А
тел.: (0412) 422-106, e-mail: book_druk@i.ua