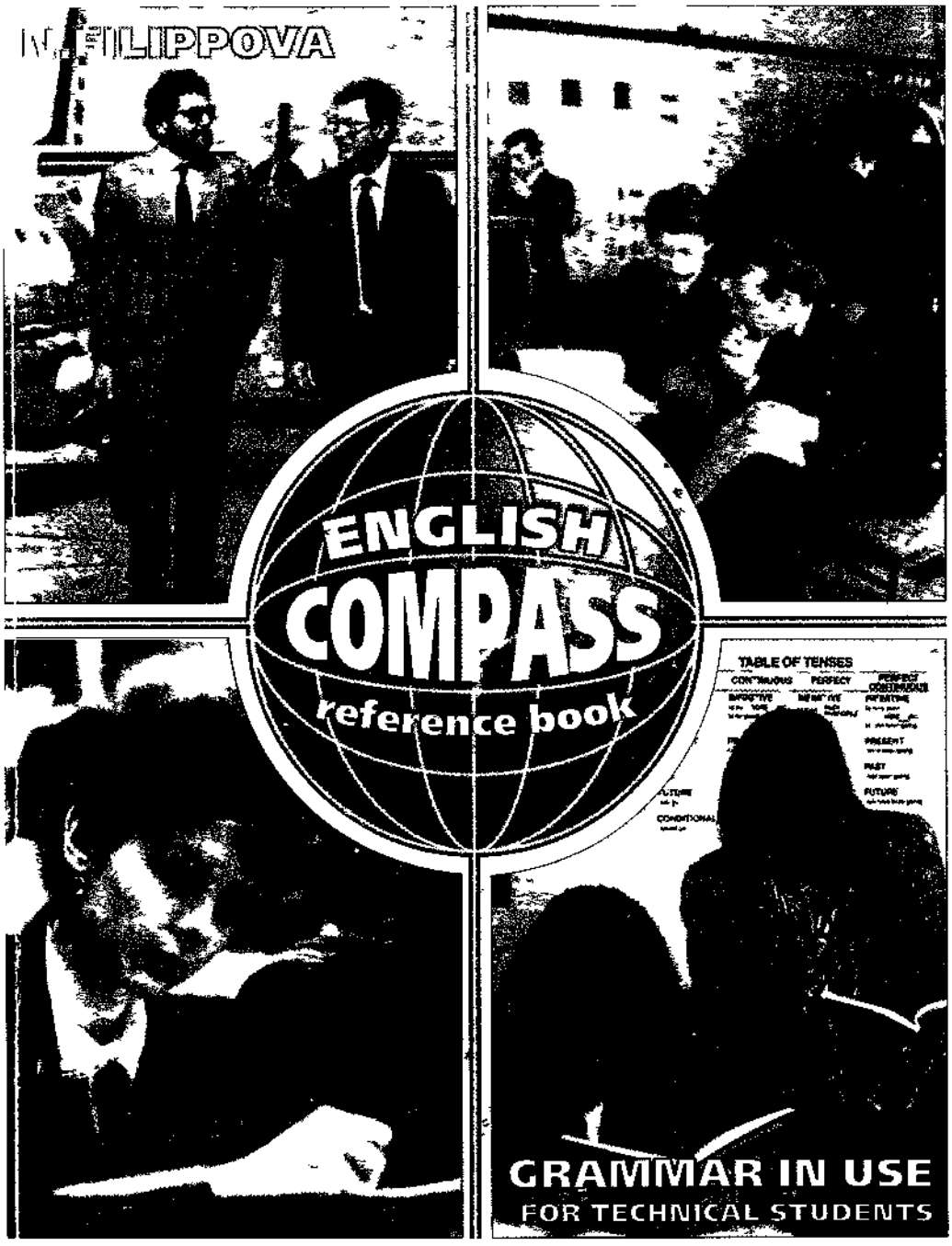
M. FILIPPOVA
ENGLISH
COMPASS
reference book
TABLE OF TENSES
GRAMMAR IN USE
FOR TECHNICAL STUDENTS

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
УКРАЇНСЬКИЙ ДЕРЖАВНИЙ МОРСЬКИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ
ім.адм.Макарова

COMPASS

GRAMMAR IN USE

ПОСІБНИК З АНГЛІЙСЬКОЇ МОВИ
ДЛЯ СТУДЕНТІВ ТЕХНІЧНИХ ВИЩИХ НАВЧАЛЬНИХ ЗАКЛАДІВ

Миколаїв
2000

УДК 46:62(07)
ББК 82.2 Англ.–9
Ф 51

Рекомендовано Міністерством освіти і науки України як навчальний посібник для студентів вищих закладів освіти.

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Філіппова Н.М., Лук'янова С.Г., Кібарова С.І., Клемент'єва І.О.
Ф 51 Граматика англійської мови для студентів технічних вищих навчальних закладів: Навчальний посібник. – Миколаїв: УДМТУ, Атол, 2000. 108 с.:іл
ISBN 5-87848-065-4 (УДМТУ)
ISBN 966-7726-04-5 (АТОЛ)

Даний посібник – це можливість представити декілька елементів навчальної практичної (функціональної) граматики, мета якої підвести студента до розміркування над різними можливостями використання граматичних засобів і на практиці показати, як взаємодіють когнітивна і комунікативна функції мови.

УДК 46:62(07)
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Глибока подяка МФ «Відродження» за фінансову допомогу, яка сприяла публикації цього посібника.

ISBN 5-87848-065-4 (УДМТУ)
ISBN 966-7726-04-5 (АТОЛ)

ПЕРЕДМОВА

Даний посібник – це можливість представити декілька елементів навчальної практичної (функціональної) граматики, мета якої підвести студента до розміркування над різними можливостями використання граматичних засобів і на практиці показати, як взаємодіють когнітивна і комунікативна функції мови.

Ми намагаємося показати одну з можливостей пояснення: тобто представити засоби, які задовольняють такі функціональні потреби:

1. Засоби вираження темпоральних відношень (час): минулого, теперішнього, майбутнього
2. Засоби вираження деяких модальних відношень;
3. Засоби вираження квантативних відношень (кількість);
4. Засоби вираження локативних відношень.(місце);
5. Засоби вираження цілі;
6. Засоби вираження причини та наслідку;
7. Засоби вираження компаративних відношень (порівняння).

Це означає, що на відміну від традиційного представлення граматичного матеріалу ми намагаємся використати таку ієрархію пріоритетів, метою якою стає: опанування смислом вислову – відповідна цьому смислу граматична форма – місце граматичної форми у системі правил. Система завдань підпорядкована такому підходу до вивчення граматики: translating ... forms, reading about, expressing or descussing ideas, talking about ..., writing about. Таким чином, при такому підході ми навчаємося виходити від комунікативного наміру, обволікати смисл відповідними йому граматичними формами, йти від базових функцій до того асортименту мовних засобів, які можуть їх реалізовувати.

Цей підхід не можно вважати самостійним при вивченні граматики. Він являється допоміжним: доповнює курс нормативної граматики і допомагає систематизувати знання для використання їх в усній і письмовій комунікації. Посібник доцільно використовувати для повторення та узагальнення курсу граматики.

Граматичний матеріал подано невеликими порціями. Виклад матеріалу дозволяє вивчати одну тему незалежно від іншої, тому їх послідовність можно змінювати.

UNIT 1

TEMPORALITY

Time & Tense

When and How?
or
When or How?

Tense – any of the forms of a verb which show the time at which the action happened.
Time – a particular point of the day, week, month, year, etc. that is suitable for a particular activity, or at which something is expexted to happen.

Cambridge International Dictionary of English, CUP, 1995

1. STUDY THIS:

TIME LINE

PAST	PRESENT	FUTURE

Past		Present	Future
in the past		at present	in the future
recently lately not ... yet	so far up to now already	now currently at the moment	in the near future
last morning last afternoon last night		this morning this afternoon tonight	next morning next afternoon next night
the day before yesterday yesterday		today	tomorrow the day after tomorrow
last week last month last year last decade last century last millenium		this week this month this year this decade this century this millenium	next week next month next year next decade next century next millenium
once formerly previously	then ago long ago	from ... and now since ... and now	in two days by the end of (the month)

Time When?	Tense How?	Simple	Progressive	Perfect	Perfect Progressive
PRESENT		I, we, you, they *study* He, she *studies* **Do? Does?**	I **am** *studying* He, she **is** *studying* We, you, they **are** *studying*	I, we, you, they **have** *studied* He, she **has** *studied*	I, we, you, *they* **have been** *studying* He, she, it **has been** *studying*
		always usually often sometimes seldom occasionally never every day (week, month, year)	now still currently at the moment	this week already just recently lately	**from** 2 p.m. **since** 2 o'clock **for** 2 hours
PAST		**Did?** I, he, she, it, we, you, they *studied*	I, he, she **was** *studying* We, you, they **were** *studying*	I, he, she, we, you, they **had** *studied*	I, he, she, it, we, you, they **had been** *studying*
		yesterday last week the day before ... ago	yesterday **at** 4 p.m., when we came, they...	**by** some time in the past	**for** some time in the past
FUTURE		**will** *study* next week tomorrow in 2 hours	**will be** *studying* **at** 4 p.m. tomorrow	**will have done** **by** the end of the week	**will have been doing** **for** some time in the future

Key Tense ideas:

Time When?	Simple	Progressive	Perfect	Perfect Progressive
PRESENT	1) permanent situations; 2) routines and frequencies; 3) scientific facts; 4) programs and timetables. (always, usually, sometimes...)	1) action at the moment of speaking; 2) current projects; 3) slow changes; 4) temporary situations. (now, currently, at the moment)	1) a present situation which is a result of smth that happened at an unspecified time in the past; 2) an action that has taken place very recently (just, recently, already, not ... yet). 3) for since	1) actions that started happening in the past and are still happening now.
PAST	1) completed actions in the past at a definite time; 2) actions whose time is not given but which occupied a period of time now terminated.	1) an action or activity that was in progress at a particular moment of time in the past; 2) an action or activity that was in progress, and which was interrupted by another action.	1) a completed action that happened before other event in the past;	1) an action that began before the time of speaking in the past, and continued up to that time.
FUTURE	1) an action that expresses the speaker's opinions about the future (prediction); 2) habitual actions in the future. 3) decision at the moment of speaking	1) an action that will be in progress at a particular moment of time in the future; 2) an action that expresses a future without intention.	1) a completed action that will happen by some moment of time in the future.	1) an action that began and will continue up in the future

2. DISTRIBUTE THE FOLLOWING INTO THREE COLUMNS ACCORDING TO THE TIME PREPOSITIONS:

in **on** **at**

6 p.m.	Sunday	summer	midnight
lunch time	teatime	Sunday morning	autumn
Christmas	a rainy day	morning	2000
Easter	my birthday	winter	New Year
spring	afternoon	January 1st	evening
the end	the beginning	January	dinnertime

3. USE THE FOLLOWING PREPOSITIONS TO MAKE AS MANY TIME EXPRESSIONS AS POSSIBLE:

within	at
during	on
for	in
before	nearly
after	past

March	three minutes	Monday	4 o'clock
Saturday	Tuesday	morning	midnight
two decades	hours	10 p.m.	fortnight

4. TRANSLATE FOR THE "TIME-TENSE" IDEAS. ATTENTION: "TIME" WORDS. COMMENT ON THE IDEAS EXPRESSED IN THE SITUATIONS.

1. Antiquities are history defaced, or some remnants of history, which have casually escaped the shipwreck of time. *(F.Bacon)*

2. The present contains nothing more than the past, and what is found in the effect was already in the cause. (H.Bergson)

3. There was a young lady named Bright,
Whose speed was far faster than light;
She set out one day
In a relative way
And returned on the previous night. *(A.Buller)*

4. The present is the funeral of the past. *(J.Clare)*

5. A money lender serves you in the present tense, lends you in the conditional mood, keeps you in the subjunctive, and ruins you in the future. *(G.Addison)*

6. Time is a sort of river of passing events, and strong is its current; no

sooner is a thing brought in sight than it is swept by and other takes its place, and this too will be swept away. *(Marcus Anrelins).*

7. Know the true value of time; snatch, seize, and enjoy every moment of it. No idleness, no laziness ...; never put off till tomorrow what you can do today. *(Ph.Chesterfield)*

8. I never think of the future. It comes soon enough. *(A.Einstein)*

5. READ ABOUT "TIME-TENSE" IDEAS. EXPLAIN HOW YOU UNDERSTAND THEM.

WHO CAN SAY?

Who can say
Why today
Tomorrow will be Yesterday?
Who can tell
Why to smell
The violet, recalls the dewy prime
Of youth and buried time?
The cause is nowhere found in rhyme.

(Alfred Tennyson)

* * *

Time present and time past
Are both perhaps present in time future
And time future contained in time past.
If all time is eternally present
All time is unredeemable.
What might have been is an abstraction
Remaining a perpetual possibility
Only in a world of speculation.
What might have been and what have been
Point to one end, which is always present.

Th. Eliot

Настоящее и прошедшее,
Вероятно, наступает в будущем,
Как будущее наступало в прошедшем.
Если время всегда настоящее,
Значит, время не отпускает,
Ненаставшее – отвлечённость,

Остающаяся возможностью
Только в области умозрения.
Ненаставшее и наставшее
Всегда ведут к настоящему.

Пер. О.Сергеева

* * *

Ah, fill the Cup: - what boots it to repeat
How **Time is slipping underneath our feet:**
Unborn TO-MORROW and dead YESTERDAY,
Why fret about them if TO-DAY be sweet!

Rubaiyat of Omar Khayyam

6. TALK ON WHAT TIME IS IN YOUR LIFE.

7. WRITE A SHORT ESSAY EXPLAINING WHAT THE PAST, THE PRESENT AND THE FUTURE ARE IN YOUR LIFE.

UNIT 2

THE PRESENT

Present – the period of time which is happening now, not the past or future.
Cambridge International Directionary of English

1. STUDY THIS:

Time	Tense		
	Simple	**Progressive**	**Perfect Progressive**
PRESENT	I, we, you, they *study* He, she *studies* **Do? Does?**	I ***am*** *studying* He, she ***is*** *studying* We, you, they ***are*** *studying*	I, we, you, *they* ***have been*** *studying* He, she, it ***has been*** *studying*
	always usually, every day... often sometimes seldom occasionally never	now still currently at the moment	from 2 p.m. since 2 o'clock for 2 hours

2. TRANSLATE FOR THE "PRESENT" IDEAS. COMPARE THE ENGLISH AND UKRAINIAN VERB-FORMS.

1. There are two golden rules for an orchestra; start together and finish together. The public doesn't give a damn what goes on in between. *(Th.Beecham)*
2. Money speaks sense in a language all nations understand. *(A.Behn)*
3. If people are unwilling to hear you, better it is to hold your tongue than them *(Ph.Chesterton)*.
4. The man who makes no mistakes does not usually make anything *(E.Phelps)*
5. A pessimist? A man who thinks everybody as nasty as himself, and hates them for it *(G.B.Shaw)*
6. Every day, in every way, I am getting better and better *(E Coué)*
7. I do not know which makes a man more conservative – to know nothing but the present, or nothing but the past. *(J M.Keynes)*

3. EXPLAIN WHY THE AUTHOR USES THE PRESENT TENSE FORMS:

METAMORPHOSIS.

When water turns ice, doesn't it remember one time it was water?
When ice turns back into water, does it remember it was ice?
Carl Sandburg

* * *

PHILOSOPHIC ADVICE.

He who knows, and knows not that he knows not; he is a fool; shin him.
He who knows not, and knows that he knows not; he is simple, teach him.
He who knows, and knows not that he knows; he is asleep wake him.
He who knows, and knows that he knows; he is wise, follow him.

* * *

The tide rises, the tide falls.
The tide rises, the tide falls,
The twilight darkens, the curfew calls;
Along the sea-sands damp and brown
The traveller hastens toward the town,
And the tide rises, the tide falls.
Darkness settles on roofs and walls,
But the sea in the darkness calls,
The little waves, with their soft, white hands,
Efface the footprints in the sands,
And the tide rises, the tide falls.
The morning breaks; the steeds in their stalls
Stamp and neigh, as the hostler calls;
the day returns, but nevermore
Returns the traveller to the shore,
And the tide rises, the tide falls.
Henry Longfellow

* * *

AFTERNOON IN FEBRUARY

The day is ending,
The night is descending;
The marsh is frozen,
The river dead.
Henry Longfellow

4. READ FOR "THE PRESENT" IDEAS.

Explain what the Present Simple Tense forms express:

RETURN TO THE "TITANIC".

The mission of the Alvin, a submersible vehicle, shatters another myth about the Titanic.

The Alvin in many ways resembles some of the first manned capsules of the Mercury space program. There is barely enough space for its pilot inside and he sits on a six-inch stool, two other crew members seat on the floor. The light is dim because they try to conserve power and take advantage of what little visibility there is at great depths. Woolen clothing and deodorants are taboos inside Alvin because they add contaminants to the life-support system.

Three palm-sized Plexiglas portholes are the crew's window to the outside world. An underwater telephone that uses a sonar transmits voice and Morse codes at limited frequency. The life-support system lasts up to three days.

Before each dive they check it for leaks, they measure voltage and check lubrication levels in the motors.

Controlling Alvin's dive requires great precision on the part of the mother ship. The cost of each trip is $20,000. They try to conserve the batteries and save time, therefore Alvin passively sinks until it reaches the required depth. It usually takes up to two and a half hours. They widely use in shipwreck scavenging and on offshore oil platforms. Commercial remotely operated vehicles operate for the most part in relatively shallow depths around the continental shelf where they perform observations. They are unable to descend to midocean depths.

Explain what the Present Progressive Tense forms express.

A MAYAN ENGINEERING LEGACY "COBA".

By 700 A.D., the Mayan city of Coba covered 30 square miles, had an estimated population of 50,000 and 120-foot-high pyramid. Two centures later it was left almost abandoned.

Today, scientists are attempting to solve the mystery behind this city. Archeologists are digging through layers of dense jungle. From the top of the 120-foot-high pyramid they can see some 6500 mounds spread throughout the jungle. Dense vegetation covers the ruins and is creating the appearance of mounds. Now when the excavation in the Gucation is uncovering an advanced urban centre where Mayan engineers built their

pyramids, temples and roads, the experts try to explain how the structure could stand for more than 1000 years.

Fill in the chart:

Voltage regulator	Definition	Application	Operation	Classification

VOLTAGE REGULATOR

Voltage regulator, any electrical or electronic device that maintains the voltage of a power source within acceptable limits. The voltage regulator is needed to keep voltages within the prescribed range that can be tolerated by the electrical equipment using that voltage. Such a device is widely used in motor vehicles of all types to match the output voltage of the generator to the electrical load and to the charging requirements of the battery. Voltage regulators are also used in electronic equipment in which excessive variations in voltage would be detrimental.

In motor vehicles, voltage regulators rapidly switch from one to another of three circuit states by means of a spring-loaded, double-pole switch. At low speeds, some current from the generator is used to boost the generator magnetic field, thereby increasing voltage output. At higher speeds, resistance is inserted into the generator-field circuit so that its voltage and current are moderated. At still higher speeds, the circuit is switched off, lowering the magnetic field. The regulator switching rate is usually 50 to 200 times per second.

Electronic voltage regulators utilize solidstate semiconductor devices to smoth out variations in the flow of current. In most cases, they operate as variable resistances; that is, resistance decreases when the electrical load is heavy and increases when the load is lighter.

Voltage regulators perform the same function in large-scale power-distribution systems as they do in motor vehicles and other machines; they minimize variations in voltage in order to protect the equipment using the electricity. In power-distribution systems the regulators are either in the substations or on the feeder lines themselves. Two types of regulators are used: step regulators, in which switches regulate the current supply, and induction regulators, in which an induction motor supplies a secondary, continually adjusted voltage to even out current variations in the feeder line.

* * *

Tell what is happening.

SPACEPOEM 3: OFF COURSE.

the golden flood
the cabin song
the growing beard
the shining rendezvous
the hot spacesuit
the imaginary somersault
the turning continents
the golden lifeline
the crawling deltas
the pitch velvet
the crackling headphone
the turning earth
the cabin sunrise
the shining spacesuit

the weightless seat
the pitch black
the floating crumb
the orbit wisecrack
the smuggled mouth-organ
the visionary sunrise
the space debris
the space walk
the camera moon
the rough sleep
the space silence
the lifeline continents
the hot flood
the growing moon

the cracking somersault
the rough moon
the weightless headphone
the floating lifeline
the crawling camera
the space crumb
the orbit mouth-organ

the smuggled orbit
the visionary rendezvous
the cabin debris
the pitch sleep
the turning silence
the crackling beard
the floating song.

Edwin Morgan

* * *

5. DISCUSS THE FOLLOWING.

YOUR LIFE AND THE PRESENT SIMPLE TENSE.

A. Find out what could you like to be?

1. Do you like to travel?
2. Do you prefer to work indoors?
3. Do you like talking to people?
4. Do you prefer to work alone?
5. Are you energetic?

6. Do you like organizing things?
7. Are you patient?
8. Do you like animals?
9. Are you noisy?
10. Do you like to work with your hands?
11. Are you artistic?
12. Do you like working with numbers?
13. Do you like children?
14. Do you like looking after children?
15. Are you calm?
16. Are you musical?
17. Do you like sport?
18. Do you like working at night?
19. Do you mind seeing blood?
20. Do you like talking on the phone?

Here are the marks for your answers. Check your answers and add up your score.

	Yes	No		Yes	No	.	Yes	No	.	Yes	No
1.	10	1	**6.**	10	3	**11.**	5	4	**16.**	5	7
2.	5	0	**7.**	2	0	**12.**	5	2	**17.**	10	1
3.	10	5	**8.**	2	5	**13.**	2	5	**18.**	2	4
4.	5	0	**9.**	10	1	**14.**	2	4	**19.**	2	5
5.	10	4	**10.**	5	2	**15.**	2	5	**20.**	10	4

If your score is between **5** and **45**:
You are calm, strong, sensitive, reliable. You enjoy working with people and helping them. You are also a practical person. One of these careers will suit you: teacher, doctor, nurse, social worker.

If the score is between **45** and **90**:
You like to work quiety and concentrate. You are gentle, quiet, talented, methodical, tidy. You prefer to work on your own. One of these careers will suit you: researcher, lab technician, librarian, artists hairdresser, architect.

If the score is between **90** and **135**:
You are a lively person. You like to be very busy, to be with people. You like organizing things for them. One of these carrers will suit you: journalist, manager, air hostess, buss conductor, guid.

B. Find out how healthy you are.

Check-your diet.	You	Your friend	Scores Yes	Scores No
1. Do you usually have much bread for breakfast?			0	1
2. Do you usually have sugar in your tea or coffee?			0	1
3. Do you drink half a litre of milk a day?			1	0
4. Do you often eat fruit?			1	0
5. Do you eat sweets or chocolates every day?			0	1
6. Do you drink much tea and coffee?			0	1
7. Do you often eat biscuits or cakes?			0	1
Check your spare time activities.				
8. Do you go for a run in the morning?			1	0
9. Do you do morning exercises every day?			0	1
10. Do you play outdoors games three times a week?			0	1
11. Are all your activities sitting down hobbies?			0	1
Check your daily routine.				
12. Do you get up before 8 o'clock?			1	0
13. Do you go to bed before 11 o'clock?			1	0
14. Do you often watch TV for more than two hours?			0	1
15. Do you sleep with your windows open?			1	0

Total:

How did you score?

15 – 12: Congratulations! You always take care of your health. You can expect to live until you're over 100.

12 – 8: It is not too bad! But think over your daily routine and spare time activities.

8 – 0: Your diet and lack of sport activities may spoil your life in future.

C. Find your walking personality.

1. How often do you exercise?
a. Rarely.
b. Occasionally.
c. Regularly.
2. How much time do you spare for a workout?
a. 50 minutes or more.

b. 30 to 50 minutes.
c. 30 minutes or less.

3. You have:
a. back, knee, hip or ankle problems.
b. no chronic muscular conditions.
c. no chronic lower-body problems.

4. Which sounds the most like you?
a. I like to keep things simple.
b. I love trying out new gadgets and activities.
c. I like good equipment and up-to-date information, but the basics are fine with me.

5. You prefer to take:
a. the scenic route.
b. the road less traveled.
c. the fast lane.

6. Which motto do you relate to best?
a. Slow and steady wins the race.
b. Variety is the spice of life.
c. Full speed ahead.

Scoring

If your answers are mostly a's, brisk walking is for you.
More b's? Speed up and head for the hills.
And if c's predominate, try walk/run program three to five times a week.

D. What's your fitness style?

Are you more apt to find success with a diet program, health club or on your own?

- Do you thrive in structured setting?
- Do you need feedback to attain goals?
- Does support help you?

If you answers are "yes", try health centres or clubs. You'll find much support, advice, specific food plans.

- Do you like a variety of fitness options?
- Is it easy for you to eat healthfully?
- Are you motivated and disciplined?
- Do you like to do things your way?

Developing your own plan may be best.

Chart your fitness program.

FILL in two sections – now, during your fitness program and when you reach your goal.

My present exercise: any regular physical activity/exercise you do (aerobics class, gardening, home chores, walking to work, etc.):

Activity	# Days per week/month	Time/Distance

2. Changes in my routine.

Date	Activity	Old level:	New level:

How do you fell after exercising (e.g. more refreshed, energetic)?
What keeps you motivated (working out in the morning, with a friend)?

FILL in the following diary.

Day	Food		Mood		
	What (type of food, how you prepare it)	How (measure portions)	Why (record your emotions)	Where (exact place)	Who
Breakfast					
In-between					
Lunch					
In-between					
Dinner					
After dinner					

(alone, with family, friends, coworkers)

Where do you live (study, ...)
How long have you (for ... since ...)

E. Find out what is your temper?

1. What do you tell if you are invited to the party. What is your reaction?
a) Good. I hope I meet some new people.
b) I don't want to go. Nobody spoke to me at the last party.
c) I love parties. I think I'll enjoy myself.

2. What do you do when you are at the party? Everyone is telling jokes.

a) You have dozens of jokes to tell.
b) You manage to remember a couple of jokes.
c) You can't think of a single joke to tell.

3. What do you feel if you have nothing planned for Saturday night.
a) You feel sad. You ring up some friends and arrange an outing to the cinema.
b) You think, it's time I had an evening in.
c) You think, it's a good chance to read more of my new library books.

4. Do you take risks?
a) Sometimes;
b) never;
c) often.

5. What do you do if they are ask to organize an excursion.
a) You accept willingly. You are ready to help when you know you can.
b) You hesitate for a moment and then accept.
c) You refuse because you think you won't be able to do it.

6. How do you spend your leisure time?
a) By yourself;
b) with one or two friends;
c) with a group.

7. Do you think about the meaning of life?
a) Sometimes;
b) often;
c) never. I'm too busy living.

8. Do you find it easy to make decisions?
a) It depends.
b) It is always easy to decide.
c) I can never make up my mind.

9. Your friends make jokes about you.
a) You don't mind at all.
b) You smile and try not to pay atention.
c) You are embarrassed. You don't like people making fun of you.

10. Somebody at your office (in your group) is says horrible things about you.
a) You are worried about it.
b) You don't care what you say.
c) You begin saying horrible things about them.

Now add up your score:

	1	2	3	4	5	6	7	8	9	10
a	3	5	5	3	5	1	3	3	5	1
b	1	3	3	1	3	3	1	5	3	5
c	5	1	1	5	1	5	5	1	1	3

35–60 points:

You are a true extrovert. You enjoy being in a group. You have lots of self confidence. You are an active practical person. You are outward-looking. You enjoy making decisions and taking risks. But be careful. Don't be too sure of yourself. Remember that you can hurt sensitive people.

26–34 points:

Like many people you are the mixed type. The outside world is important to you as your own inner world. You are somewhere in between the extrovert and introvert. Be careful tha you haven't all the bad qualities.

10–25 points:

You are a true introvert. Your inner world of dreams and ideals is more important to you than the external world. You are not always realistic or practical. You do not like showing your feelings to other people in case they hurt you. Use your sensitivity to understand other people's feelings.

6. WRITE ABOUT THE EVENTS WHICH ARE TAKING PLACE IN YOUR COUNTRY RIGHT NOW?
WHAT ARE THE PEOPLE TALKING ABOUT?

UNIT 3

THE PAST

Past – the form of a verb used to describe actions, events or states that happened or existed before the present time.

Cambridge International Dictionary of English

1. STUDY THIS:

Time	Tense			
	Simple	**Progressive**	**Perfect**	**Perfect Progressive**
PAST	**Did?** I, he, she, it, we, you, they *studied* yesterday the day before last week ... ago	I, he, she ***was*** *studying* We, you, they ***were*** *studying* yesterday at 4 when we came, they...	I, he, she, we, you, they ***had*** *studied* by some time in the past	I, he, she, it, we, you, they ***had been*** *studying* for some time in the past

2. TRANSLATE FOR THE "THE PAST" IDEAS.
COMPARE THE ENGLISH AND UKRAINIAN VERB-FORMS.

1. An empty house is like a stray dog or a body from which life has departed *(S.Butler)*
2. I have always been a quarter of an hour before my time, and it has made a man of me *(H.Nelson)*
3. I regret often that I have spoken, never that I have been silent *(P.Syrus)*
4. I have received up more than one or two letters in my life that were worth the postage *(H.Thoreau)*.
5. Every dog has his day, and mine has been a fine one. *(G.Borrow)*
6. I slept, and dreamt that life was beauty; I woke, and found that life was duty *(E.Hooper)*
7. I have always been a quarter of an hour before my time, and it has made a man of me. *(H.Nelson)*
8. The candle in that great turnip has gone out *(Of Stanley Baldwin, Sir Winston Churchill)*
9. In Italy for thirty years under the Borgias they had warfare, terror,

murder, bloodshed – they produced Michelangelo, Leonardo da Vinci and the Renaissance. In Switzerland they had brotherly love, five hundred years of democracy and peace and what did they produce . ? the cuckoo clock (Orson Welles)

10. I used your soap two years ago, since then I have used no other (Punch).

3. EXPLAIN WHY THE AUTHORS USED THE PAST VERB-FORMS:

ROUGH

My parents kept me from children who were rough
Who threw words like stones and who wore torn clothes.
Their things showed through rags. They ran in the street.
And climbed cliffs and stripped by the country streams.

I feared more than tigers their muscles like iron
Their jerking hands and their knees tight on my arms.
I feared the salt coarse pointing of those boys
Who copied my lisp behind me on the road.

They were lithe, they sprang out behind hedges
Like dogs to bark at my world. They threw mud
While I looked the other way, pretending to smile.
I linged to forgive them, but they never smiled.

Stephen Spender

ON TIME FOR ONCE

I was sitting thinking of our future
and of how friendship had over come
so many nights floated with pain,

I was sitting in a room that looked on to a garden
and a stillness filled me,
bitterness drilled from me.
I was as near paradise as I am likely to get again.

I was sitting thinking of the chaos
we had caused in one another
and was amazed we had survived it.

I was thinking of our future
and of what we would do together,

and where we would go and how,
when night came
burying me bit by bit,
and you entered the room
trembling and solemn-faced
on time for once.

Brian Patten

BUNDLES

I have thought of beaches fields,
Tears, laughter.
I have thought of homes put up—
And blown away.
I have thought of meetings and for
Every meeting a good-by...
I have wanted to let go and cross over
To a next star, a last star.
I have asked to be left a few tears
And some laughter.

Carl Sandburg

4 READ FOR THE "PAST" IDEAS.
explain what the past tense forms mean:

RETURN TO THE "TITANIC"

Robert Ballard and his team from the Woods Hole Oceanographic Institution found a series of buckled steel plates which, indicating that the "Titanic" sank not from a piercing collision with an iceberg, but from a sideswipe that loosened its rivets and buckled its seams. The accident was gentle and violent at the same time. While the water funnel that swallowed the ship quickly tore away the stern, twisting it on its way down, much of the bow descended intact.

In some places, even the glass portholes appeared to be intact. They think many light artifacts (pots and pans) drifted down untouched. Some of the copperware looked new, having been polished continuously for the past 75 years by gentle sea-floor currents. To the crew's relief, they found no human remains. Neither was any of the woodwork.

Marine life evidently consumed them long ago.

The scene suggested a monument, not a tomb, said Ballard. Jason Jr., the robot, explored around corners. The robot's camera captured a lot

of striking images. Martin Bowen, the operator of Jason Jr., compared th scene to a ghost house from a Walt Disney Movie. The expedition's primar purpose was technological rather than archeological.

The operator told that when they had deployed Jason Jr. up to 200 fee away where staircases had once been. They had seen the grotesqu orange-red stalactites of rust hanging from the ceilings like grim chandeliers.

The mission proved that the submersible had been very useful t explore the hazardous area with precision, that they had corrected some mistaken assumptions. Many people told that the mission had made the famous ship seem all the more intriguing

* * *

Today, Alvin, the submersible they used for their mission, contains little of its original equipment. Its three hydraulic propellers have been replaced with six smaller, lighter electric ones. With the new system, Alvin's top cruising speed has increased from one and a half to two knots. The scientific equipment, in contrast to the propulsion system, has been switched from electric to hydraulic power.

Equipment on the mother ship "Atlantis II" is as important as that aboard Alvin. They have refitted the ship with an enlarged lab and advanced data-collection systems.

Fill in the following chart.

Turbine	First applications	Early design	Operation

TURBINE

There are four broad classes of turbines: water (hydraulic), steam, wind, and gas. The most important application of the first three is the generation of electricity, while gas turbines are most frequently employed in aircraft to provide the motive power for jet propulsion. The principles of turbine operation were applied in ancient times. The waterwheel, the ancestor of the water turbine, was used for grinding grain by the Romans about 70 BC. Early devices of this sort were simple paddle wheels immersed in streams where the flow of water was available to turn the wheels. A precursor of the steam-driven turbine was supposedly constructed by Hero of Alexandria about the 1st century AD. This device operated on the principle of reaction; rotation was achieved by steam issuing from curved tubes in a manner similar to that of water issuing from a rotating lawn sprinkler. The windmill, from which the modern wind turbine developed, was already in use by the

mid-7th century AD in Persia. Windmills with vertical sails on horizontal shafts appear to have reached Europe through contact with the Arabs several hundred years later.

b. TALK ABOUT "THE PAST IDEAS". EXPLAIN WHAT IS DESCRIBED, WHAT WAS HAPPENING AND WHY THE PAST PROGRESSIVE TENSE FORMS ARE USED:

THE GHOSTS OF THE BUFFALOES

Last night at black midnight I woke with a cry,
The windows were shaking, there was thunder on high,
The floor was atremble, the door was ajar,
White fires, crimson fires, shone from afar.
I rushed to the dooryard. The city was gone.
My home was a hut without orchard or lawn.
It was mud-smear and logs near a whispering stream,
Nothing else built by man could I see in my dream...
With bodies like bronze, and terrible eyes
Came the rank and the file, with catamount cries,
Gibbering, yipping, with hollow-skull clacks,
Riding white bronchos with skeleton backs,
Scalp-hunters, beaded and spangled and bad...
Buffaloes, buffaloes, thousands abreast,
A scourge and amazement, they swept to the west.
With black bobbing noses, with red rolling tongues,
Coughing forth steam from their leather-wrapped lungs,
Cows with their calves, bulls big and vain,
Goring the laggards, shaking the mane...

Vachel Lindsay

LONDON

When men were all asleep the snow came flying,
In large white flakes falling on the city brown.
Stealthily and perpetually settling and loosely lying,
Hushing the latest traffic of the drowsy town;
Deadening, muffling, stifling its murmurs failing;
Lazily and incessantly floating down and down:
Silently sifting and veiling road, roof and railing;
Hiding difference, making unevenness even,
Into angles and crevices softly drifting and sailing.

All night it fell, and when full inches seven
It lay ill the depth of its uncompacted lightness.
The clouds Idew oft from a high and frosty heaven;
And all woke earlier for the unaccustomed brightness
Of the winter dawning, the strange unheavenly glare:
The eye marvelled—marvelled at the dazzling whiteness;
The ear hearkened to the stillness of the solemn air...

Robert Bridges

6. DISCUSS THE FOLLOWING.

1. Work in pairs. Interview your partner about his/her yesterday evening last weekend.
2. Describe your last family reunion. What usually happened? What was happening at that timw?
3. Think of your typical day a year ago and now. What changed? What didn't change? Write about it or discuss it in pairs.
4. Describe your first day at the University.

7. WRITE

1. Put down a list of 5 exciting or interesting things you have done in your life. Compare your lists.
2. Think about your family history. Put down 10 sentences. Discuss it with your neighbour. Compare your stories.
3. What did you do the day before yesterday? Try to recollect as many actions as possible and put them down (5 min.). Then read them to each other and cross out the same sentences. The person with the largest number of sentences that are not crossed out is a winner.
4. What happened or didn't happen on your friend's last birthday? Put down 5 'did' sentences and 5 'didn't' sentences. Compare your list with you neighbours' list.

UNIT 4

THE FUTURE

Future – time which is to come;
not the present or the past.
Cambridge International Dictionalry of English

1. STUDY THIS:

Time	Tense			
	will	**be going to**	**Present Progressive**	**Present Simple**
FUTURE	1) prediction Tomorrow will be warm 2) I think, I guess (inside knowledge) Don't lend him your car – he'll crash it. 3) polite requests. Will you stay in this evening? 4) decision at the moment of speaking • offer to do • agree to do • ask to do • promise	1) is going to happen a future event is on the way 2) plans, decisions, firm intentions have decided but not arranged 3) polite requests Are you going to stay in this evening? (pressing for a decision)	1) personal arrangement, fixed plans (time, date, place) have decided and arranged 2) prediction outside evidence Look out! We're going to crash	1) timetables routines schedules programs ; Next term starts in February 2) to give or ask for instructions. Where do I pay?
	- weather fore cast	- intentions for the coming week	- plans for the coming week	- time tables

Time	Tense			
	Future Progressive	**Future Perfect**	**I am to**	**shall**
FUTURE	1) smth will be going on at a certain time in the future. 2) Polite enquiries Will you be staying in this country (just asking about plans)	1) smth will have been completed by certain time in the future The car will soon have done 100.000 miles. How long you have been learning English?	1) smth is to happen official plans, fixed personal arrange-ments.	1) asking for smb's opinion Shall I open the window?
	- at a definite time in the future	- by a definite moment of time in the future	- in contracts (obligation)	- asking for smb's opinion

2. TRANSLATE FOR "THE FUTURE" IDEAS. COMPARE THE ENGLISH AND UKRAINIAN VERB-FORMS.

1. No young man believes he shall ever die *(W.Hazlitt)*
2. If a man does not make new acquaintances as he advances throug life, he will soon find himself left alone *(S.Johnson)*
3. I cannot and will not cut my conscience to fit this year's fashion *(L.Hellman)*
4. You cannot fight against the future. Time is on our sid *(W.E.Gladstone)*
5. Those who'll play with cats must expect to be scratched *(Cervantes)*
6. I shall be as secret as the grave. *(Cervantes)*
7. Accidents will occur in the best-regulated families. *(Ch.Dickens)*
8. A thing well said will be wit in all languages. *(J.Dryden)*
9. Money will say more in one moment than the most eloquent love can in years. *(H.Fielding)*
10. You will go most safety in the middle. *(Ovid)*

3. EXPLAIN WHAT THE AUTHORS MEAN BY USING THE FUTURE VERB-FORMS:

I will not let thee go.
Ends all our month-long love in this?

Can it be summed up so,
Quit in a single kiss?
I will not let thee go.
I will not let thee go.
The stars that crowd the summer skies
Have watched us so below
With all their million eyes,
I dare not let thee go.
I will not let thee go.
I hold thee by too many hands:
Thou sayest farewell, and lo!
I have thee by the hands,
And will not let thee go.

Robert Bridges

ROMANCE

I will make you brooches and toys for your delight
Of bird-song at morning and star-shine at night.
I will make a palace fit for you and me,
Of green days in forests and blue days at sea.

I will make kitchen, and you shall keep your room,
Where white flows the river and bright blows the broom,
And you shall wash your linen and keep your body white
In rainfall at morning and dewfall at night.

And this shall be for music when no one else is near,
The fine song for singing, the rare song to hear!
That only I remember, that only you admire,
Of the broad road that stretches and the roadside fire.

R.L.Stevenson

4. READ FOR "THE FUTURE" IDEAS.
Explain what the future tense-forms mean:

RETURN TO THE "TITANIC"

(written in 1986)

In the future, optical fibers will eliminate the need to multiplex power and data. It will provide higher-quality video, more rapid transmission and the processing of more data. This will reduce noise.

New arrangements will allow computers on the submersible and th mother ship to operate in parallel. They will use the same software and w not require complex synchronization.

Automatic control will be needed. Human operators will send high-leve commands, which the control system will convert to lower-leve instructions. Both the unmanned submersible and the vision system wi have their own processors, but they will not be fully autonomous.

Jason will make its debut in 1987, they will test it in waters less tha 100 feet deep. In 1988 it will make its first midocean dive.

It will probably be used to explore dangerous areas (shipwrecks or oper lava pits).

* * *

(written in 1998)

The shuttle-Mir expeditions will continue to study the weird effects o weightlessness. The evidence to date, NASA doctors say, that bones and muscles continue to atrophy indefinitely in space, typically at a rate of abou I percent per month. But the evidence is thin. Since Gagarin's 1961 flight only 304 humans have ventured into space-most on short flights. To NASA this leaves space medicine a mystery, thousands of cases short of "N" the magic minimum number needed to establish clear conclusions. "It's the difference between American and European medicine. For the Russians, N equals one," says John Charles, NASA's chief medica researcher for the upcoming shuttle-Mir missions.

On the future international Space Station, all the "spacefaring nations" will collaborate to push the space-endurance record to at least three years Manned and unmanned spacecraft will lift off from two continents at the rate of more than one a month and gather more than 200 miles above the Earth to assemble modules that have never been fitted together on the ground. There will be Japanese and European science labs, a Canadian mechanical arm, Russian power plants. Critics say it can't be done in so short a time.

Russians and Americans look to space, and they see themselves in a different way. Russians know they were first to put a man in orbit. Americans know they were first to put a man on the Moon. The last time they met in space, they were both in capsules originally built for the moon race. Today the old rivals are no longer running in the same event. Cosmonauts of the Russian Space Agency go on six-month marathons to Mir. NASA astronauts run two-week sprints on the shuttle, working round the clock. No cultures clash more sharply. To commemorate the docking, commander Gibson

and Russian commander Vladimir Dezhurov joined two halves of a single medallion - in the same way the crews of Apollo and Soyuz did 20 years ago.

NASA will pay Russia $400 million for six more shuttle expeditions to Mir, helping turn Mir from a survival shelter into a working lab. The shuttle-Mir missions will also prep astronauts and cosmonauts for their next great leap. The construction of a new station will take at least five years and more than 70 launches; and much of the hardware is already built. The International Space Station, in turn, would serve as a platform for long space voyages and, someday, as a stepping-stone to Mars. That planet is already within reach of a Russian rocket. But can humans make it as well?

On Shuttle-Mir, the experiments will continue with quail and wheat. So far, no one has gotten a second generation of plants or animals to grow in space—suggesting that any hope of space farming or animal husbandry is years away. Plants, in particular, could be vital to sustaining life on deep-space voyages.

Fill in the chart:

Future project	Location	Purpose	Dimensions	Structural characteristics

MAN-MADE ISLANDS GROW IN TOKYO BAY

They do not yet appear on maps, but two new man-made islands are being formed in Tokyo Bay. The concrete and steel islands will support the Trans-Tokyo Bay Highway, a 15-kilometer-long four-lane toll road that will connect Kawasaki City in the west to Kisarazu City in the east when it is completed in 1996. The highway is expected to reduce traffic congestion within the metropolitan Tokyo area.

Only a third of the highway will run above the water, in the form of a bridge. The remainder will consist of two parallel 10-kilometer undersea tunnels. Kawasaki Man-made Island will be located at the midpoint of the two tunnels and Kisarazu Man-made Island will connect the tunnels to the bridge. While the highway is being built, the islands are serving as launching platforms for the drilling equipment that is boring the tunnels in the ocean floor. When the tunnels are complete, the islands will provide ventilation to the tunnel and facilities for maintenance and management personnel.

Kajima Corp. (Tokyo) is heading the joint venture, which includes Nippon Steel Corp. (Tokyo) and Toyo Contruction Co. (Tokyo), that is building the western half of the island that will bisect the tunnels. The entire doughnut-shaped structure of Kawasaki Man-made Island will measure

198 meters in diameter when it is finished and will consist of two concentric rings of interconnected jacket-type steel trestles with a slurry wall between them.

The construction site for the Kawasaki man-made island lies five kilometers offshore of that city at an average depth of 28 meters. The soft seabed had to be improved considerably to provide a solid foundation for the structure. Beginning in April 1989, sand compaction piles and deep mixing method cement slurry injection were used to stabilize an area 420 meters in diameter and 30 meters deep at the site.

While the foundation was prepared, Nippon Steel began casting the steel trestles that would serve as the Kawasaki man-made Island's skeleton. Each of the trestles for the island's outer ring measured 35 meters wide and 35 meters high, about as tall as a nine-story building, and each weighed about 2300 metric tons. After they were cast, the units were loaded on barges and towed to the Tokyo Bay construction site 885 kilometers away.

A 4100-ton floating crane lifted the huge trestles and dropped them into place on the ocean floor. The trestle sections were secured by means of 116 steel tube piles driven 70 to 80 meters into the now-stable foundation below and connected to each other. Steel-reinforced concrete slabs served as decking so construction crews could make use of the trestle ring for later work.

Outside of the trestle ring a series of precast concrete panels have been placed to provide a wave barrier for the site. At present, 257 steel pipe-sheet piles measuring 45 meters in length are being driven into the foundation between the dual rings of the island. They will form a waterproof containing wall for the earthy that will be filled in the space provided.

5. TALK ABOUT "THE FUTURE" IDEAS.
AFTER READING THE TEXT WHICH WAS WRITTEN IN 1975 TELL WHAT IS THE PAST, PRESENT OR FUTURE AT THE MOMENT.

NEW JOBS FOR ROBOTS

Another promising field is robotics. Computer scientists and engineers from several companies and universities are starting a major push to develop robots to replace people in hazardous locations or simple jobs. These mechanical workers will have skills far beyond those robots now working on assembly lines.

While some companies are working on robot-intelligence elements, such as photo computers, others are developing lightweight arms or

methods of electronic-speech recognition.

Eastman says major home appliances eventually will have self-diagnostic systems that "speak" to a repair center by telephone. When a malfunction occurs, a homeowner will call a service center, punche a button on the appliance and hold the telephone nearby.

A series of tones from the appliance will tell the service-center computer which part will need repair. If a service call is needed, the repair technician will know which replacement part to bring. The goal of the system is to make repairs faster and less expensive.

6. DISCUSS THE FOLLOWING:

1. When you come home from work you will start doing...
2. You are moving or going to move to a new house, flat. What will the place look like? What kind of furniture will there be?
3. Work in pairs. Discuss what you think the world will be like in 10 years' time.
4. Say what you are going to do next weekend, summer.
5. You decided a decorate your English-speaking Club. You haven't got much money. You are going to do the work in your spare time. Say what you are going to do.

7. WRITE:

1. Put down your schedule for tomorrow. Compare your schedule with your neighbour's schedule.
2. Imagine you are a fortune-teller. Write 5 predictions that you would like to tell your groumates (will, will be, will have).

UNIT 5
LOCALITY

Place & Direction

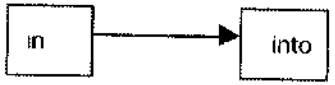
Proper words in proper places,
make a true definition of a style.
J.Swift

A place for everything and
everything in its place.

1. STUDY THIS:

Place (Де?)		Direction (Куди?)	
in, inside	across	into, to, towards	up
out, outside	on	out of, off	down
in front of	above/over	forward	through
behind	under	backward	onto
at	against	along	where
between	among	past	far
opposite	there	there	here
here	where		
near	far		

Show all the prepositions and verbs in a schematic way.



What Ukrainian prepositions do the following English ones correspond?

1. What are the dimensions of the room you are sitting in?
2. In the picture you can see a diesel engine.
3. The indicator is mounted on the instrument panel.
4. In Fig.14a the piston is shown at its lowest position.
5. The plan shows an object viewed from above.
6. A flow of electric current through the wire can be indicated.
7. Don't lean against the back of the chair, sit up.
8. Only four basic oxides dissolve in water.
9. If the two plates are connected by a copper wire, electricity will flow through it from the copper plate to the zine plate.
10. In the picture we can see a diagram of a battery.
11. Suspend two tennis balls on a long string from a door frame or other support, using a bicycle pump, direct a blast of air between the two balls. What happens to the position of the balls?
12. The experiment is carried on in our laboratory.
13. Diagram in Fig.3 shows a thermocouple connected by wires to an ammeter.
14. Fig.14 shows the transmission of electrical energy from the power house in the mountains to the consumer in the distant city.

What English prepositions do the following Ukrainian ones correspond?

a) in; b) at; c) on; d) to; e) across: f) opposite; g) under; h) above; i) between

в

- знаходиться в аудиторії, лабораторії, коридорі, університеті, їдальні, кафе
- вчитися в університеті, академії, школі, гімназії, коледжі
- читати у бібліотеці
- грати у теніс у спортивному залі

на

- знаходиться на столі, на даху, на установці, на підлозі, на вулиці
- писати на дошці, на папері
- розміщувати схеми на стіні, на стендах, на полицях
- працювати на верді, на заводі

до

- підійти до дошки
- доїхати до зупинки
- поспішати до університету, до аудиторії, до пошти
- заходити до аудиторії.

біля

- жити біля парку,
- поставити біля установки,
- знаходитися біля заводу,
- вчитися біля

під

- під комп'ютером,
- під двигуном,
- під дахом,
- під столом.

над

- над двигуном,
- над магнітофоном,
- над домом,
- над яхтою.

між

- між парком і університетом,
- між столами,
- між комп'ютером і відеомагнітофоном,
- між телевізором і стіною

серед

- серед студентів,
- серед книг,
- серед професій,
- серед інструментів

2. TRANSLATE FOR "PLACE & DIRECTION" IDEAS. COMPARE ENGLISH AND UKRAINIAN PREPOSITIONS AND ADVERBS.

1. A little thing in hand is worth more than a great thing in prospect. *(Aesop)*.
2. Nationalism is a silly cock crowing on its own dunghill *(A.Aldington)*.
3. Give me one firm spot on which to stand and I will move the earth *(Archimedes)*.
4. Houses are built to live in, and not to look at. *(Fr.Bacon)*.
5. In the country of the blind the one-eyed man is a king *(Erasmus)*.
6. A good laugh is sunshine in a house *(W.Thackeray)*.
7. The world is a looking-glass, and it gives back to every man the reflection of his own face. *(W.Thackeray)*.
8. The best way out is always through *(R.Frost)*.
9. When peace has been broken anywhere, peace of all countries everywhere is in danger *(F.Roosevelt)*.

3. EXPLAIN WHAT FORMS EXPRESS "PLACE & DIRECTION".

LOVE IN A LIFE

Room after room,
I hunt the house through
We inhabit together.
Heart, fear nothing, for, heart, thou shalt find her,
Next time, herself! – not the trouble behind her
Left in the curtain, the couch's perfume!
As she brushed it, the cornice-wreath blossomed anew, -
Your looking-glass gleamed at the wave of her feather.

Robert Browing

4. READ FOR "THE PLACE & DIRECTION" IDEAS. FIND THE FORMS EXPRESSING PLACE OR DIRECTION.

CONTINENTS NEVER DIE, THEY JUST DRIFT AWAY

In the remote past Georgia was not in its present location.

Not only is Georgia moving, the whole North American continent is traveling with it. In fact all of the continents are sliding around from place to place on the surface of the earth.

That, at least, is what geologists who support the theory called "plate tectonics" believe. Plate tectonics, also known as the theory of continental

drift, was first proposed more than 50 years ago and at first the idea was considered entirely too fantastic to have any real validity. The theory was first proposed because some geologic features were unexplainable. For instance, fossils of animals with common ancestry have been found on continents separated by thousands of miles of ocean. Evidence of glaciation has been found in areas of Africa and South America, locations where ice formation is unlikely because of the climate's warmth. But if the continents were not always in their present locations, the facts begin to make sense. Plate tectonics also explains why the east coast of South America seems to fit the curve of the west coast of Africa.

According to the plate tectonics theory, the continents are resting on rocky plates that float on denser molten material beneath in much the same way that icebergs float on the ocean. The plates are moved around by currents in the molten material. Millions of years ago, some geologists now believe, South America and Africa were joined together. They were split apart and pushed in opposite directions by one of these currents and are still moving away from each other. As the South American and African plates, each about 100 miles thick, drifted apart, material welling up from deep in the earth began filling in the space between them, forming the bed of the Atlantic Ocean and the Mid-Atlantic Ridge. As the ridge expanded, lateral cracks called fracture zones appeared in the seabed.

Occasionally material erupting through one of the fracture zones piled up high enough to extend above the surface of the ocean, forming an island. One island that may have been formed in this way is Fernando de Noronha off the coast of Brazil. This island was the subject of a recent investigation by Dr. Stormer. "The island is fascinating". Dr. Stormer said. "These rocks are probably the result of a series of volcanic eruptions which occured between 2 and 20 million years ago, which forced huge quantities of subterranean material through the earth's crust to the surface", he said. "I was looking at a portion of the world turned inside out". Since Fernando de Noronha is located directly over a fracture zone, Dr. Stormer said, "it is possible there is some connection between the overall motion of the plates and the time of the eruption which formed the island".

It is also thought that at one time, India was further south that it is now and drifted northward to bump into the Asian continent. The force of this colossal collision forced masses of rock upward, forming the Himalayas, the highest mountain range in the world. Continental drift is still continuing, it is believed, with individual plates traveling at rates of from one-half inch to four inches per year. This movement will, over a period of millions of years, result in some radical changes in the earth's geography.

THE BEGINNING OF LIFE

Almost three-quarters of your body is water. In your blood scientists have found all the chemicals and minerals that make up sea water. Why? Many scientists think that all life began in the waters of the sea.

Then, sunlight acted upon certain chemicals in the warm mud on the sea floor near the land. Lifeless chemicals joined together. They formed a new kind of molecule, or particle. These molecules had new powers: they could grow by taking food. And they could make other beings like themselves. Life had begun!

What were the first bits of living matter?

The first bits of living matter were tiny pieces of protoplasm. You have heard about protoplasm, haven't you? Protoplasm was in the form of tiny shapeless dots; very, very small spots. After a long time those tiny spots of protoplasm began to change. One type began to make food by using the energy of the sun. This type developed into the first plants. Others lived by eating the food-makers, Another group could get food from plants, or by eating other beings like themselves.

The sea gave birth to living matter. It also played a part in bringing many of the great changes in the forms of life. And the sea has left us the story of later changes, written in stones. Scientists know the earliest forms of life, because they study the simple forms of sea life today.

The sea had risen and fallen for billions of years before the first, one-celled beings appeared. Scientists call those first one-celled beings *protozoa*. After this great event, another long period went by. Very many soft-bodied animals appeared in the sea; they tried to eat each other. Little by little, in the terrible struggle for life some of the soft-bodied animals developed hard shells.

For 75 million years, numberless hard-shelled animals lived in warm seas. Then came one of the greatest changes in the level of the ocean. Waters fell back from the land, leaving great, dry beds of sea floor, which became rock. Scientists find shells of dead sea creatures between rock layers even today.

Later, a new kind of sea creature appeared. It was the fish. It could swim. It had a bony framework inside its body.

Again the sea changed its level, leaving lakes and marshes behind. Life in the marshes had to change, or die out. Sea plants changed and some began to live in the open air.

A few fish learned to get oxygen from the air, and not from the water. They grew feet and not fins. " They could live on dry land and returned to the sea only to lay eggs and to raise their young. They were the first

amphibians. The amphibians continued to live on the edge of water. But when they grew up they stayed on the land.

Then the sea began again very slowly to cover the edge of the land. Some amphibians returned to the sea. Others learned to lay eggs and raise their young on dry land. They were a new form of life. They were all reptiles, from tiny lizard to dinosaur.

Strange animals of a new kind appeared in the marshes. They carried their young in their bodies and fed them with milk from their own bodies. Their bodies stayed at about the same temperature in cold or warm weather. They were the first mammals.

From these earliest beginnings have come all the living plants and animals on land and sea: birds, insects, free-swimming fish and mammals. They all have developed from the first tiny bits of matter that could eat, grow and reproduce. All trees, grasses, vegetables and flowers, and all sea plants have developed from the first green cell that could get energy from sunlight and sea water.

5. TALK ON "THE PLACE & DIRECTION" IDEAS.
AFTER READING, MAKE UP 10 SENTENCES USING "IN, ON, AT, BETWEEN, AMONG, THERE, ACROSS, NEAR, FAR, INSIDE".

Volta is the artificial lake in Ghana, western Africa. The lake is formed by the Akosombo Dam. It is a product of the Volta River Project, which, begun in 1961 and completed in 1965, dammed the Volta River just south of Ajena and created a lake extending upstream from the Akosombo Dam to Yapei, beyond the former confluence of the Black Volta and White Volta rivers. With a storage capacity of 120,000,000 acre-feet (148,000,000,000 cubic m) of water. Lake Volta is one of the largest man-made lakes in the world. It is about 249 miles (400 km) long and covers 3,283 square miles (8,502 square km), or 3.6 percent of Ghana's area. It is navigable and provides a cheap route linking Ghana's northern savanna with the coast, as well as a water supply, freshwater fisheries, and potential irrigation for the Lower Volta plains. The lake's creation involved the inundation of 15,000 homes and of 740 villages and the resettlement of 78,-000 people. In 1968 the Volta Lake Research Project began-, it was set up to study the development potential of the lake.

Complete the following:

1. The University is situated ... .
2. The Department of Foreign Languages is ... .
3. The Canteen is ... .

4. The Dean Office is ... .
5. The gym is ... .
6. The Department of Physics is ... .
7. The Library is ... .
8. The Department of Descriptive Geometry is ... .
9. The rector's office is ... .
10. The University Museum is ... .

6. DISCUSS THE FOLLOWING:

1. Imagine you are Nosy Parker. You like peeping into people's windows to see what there is there. Now you are peeping into... flat. Let your groupmates ask you 10 questions to find out what you see.

2. Tell 10 sentences describing the place, the house you live in. Let your groupmate draw a layout on the blackboard. You will correct them.

3. Tell 10 sentences describing your flat. Let your groupmates draw a layout in their notebooks and then compare.

4. Tell 10 sentences describing your native city and telling how to get to the place from the University.

5. Tell 10 sentences describing the layout of the laboratories to your teacher.

7. EXPRESSING "LOCATION" IDEAS.

Work in pairs. Let one of you read the sentence and the other draw or explain what it describes.

8. WRITE A SHORT ESSAY DESCRIBING THE PLACE YOU'RE GOING TO WORK IN THE FUTURE (OFFICE OR LABORATORY).

UNIT 6

QUANTITY

Quantity – the amount of something
that can be measured,
weighed, counted, etc.
or a fixed amount of number.
Cambridge International Dictionary of English

1. STUDY THIS:

QUANTITY				
Numerals			Nouns	Pronouns
1-one (first)	11-eleven(th)	10-ten(th)	**Countable nouns:**	**too large amount**:
2-two(second)	12-twelve(th)	20-twenty(ith)	singular: cube,	all/every/each
3-three (third)	13-thirteen(th)	30-thirty(ith)	cage, mat	**large amount**:
4-four(th)	14-fourteen(th)	40-fourty(ith)	plural: cubes,	many/much, more
5-five(fifth)	15-fifteen(th)	50-fifty(ith)	cages, mats	most, a lot (of)
6-six(th)	16-sixteen(th)	60-sixty(ith)	of-phrases:	**indefinite amount**:
7-seven(th)	17-seventeen(th)	70-seventy(ith)	a box of matches	some, something, any
8-eight(th)	18-eighteen(th)	80-eighty(ith)	a drop of water	**sufficient amount**.
9-*nine*(th)	19-nineteen(th)	90-*ninety*(*ith*)	**Uncountable**	enough
100-hundred(th)	10^9-milliard(th)		**nouns:**	**small amount**:
1000-thousand(th)	billion(th)		of-phrases:	few/a few, little/a little
1000,000-million(th)			a kilo of apples	**negative amount**:
			half a gram of paper	no, none, nothing

What Ukrainian expressions do the following English ones correspond?

1. The speed was one third as high as that measured.
2. The speed was reduced to $1/60^{th}$.
3. The weight increased approximately tenfold.
4. The ask content per unit dry weight was higher in this sample.
5. If 60% of the leaves have been consumed and after tree spraying only 30%, the insecticide has reduced leaf consumption by 50%.
6. The rate growth rate is proportional to the temperature.
7. This defect was found in one car in four.
8. The normal range of listening ability for man covers about 10S octaves.
9. The height of the tree is 100 m.
10. There was less fuel in the tank than it was expected.

2. TRANSLATE FOR "QUANTITY IDEAS".

Compare English and Ukrainian "quantity" forms.

1. No one means all he says, and yet very few say all they mean, for words are slippery and thought is viscous. *(H.B.Adams)*

2. Nothing is more dangerous than an odea, when you have only one idea. *(E.Chartier)*

3. There are neither finite quantities, or quantities infinitely small, nor yet nothing. May we not call them the ghosts of departed quantities? *(G.Berkeley)*

4. Let no one who loves be called altogether unhappy. Even love unreturned has its rainbow. *(J.M.Barrie)*

5. Of two evils choose the least. *(Erasmus)*

6. Modern poets mix too much water with their ink. *(J.W.Goethe)*

7. You can fool all the people some of the time, and some of the people all the time, but you can not fool all the people all of the time. *(A.Lincoln)*

8. Nothing is so firmly believed as what we least know.

9. Those who have few things to attend to are great babblers; for the less men think, the more they talk. *(Ch.Montesquieu)*

10. One eye – witness is of more weight than ten hearsays. *(Plantus)*

3. EXPLAIN WHAT THE UNDERLINED WORDS MEAN.

THE ENGLISH LANGUAGE

We'll begin with box, and the plural is boxes,
But the plural of ox should be oxen, not oxen.
The one fowl is a goose, but two are called geese,
Get the plural of mouse should never be meese.
You may find one mouse, or a whole nest of mice.
But the plural of house is houses, not hice.
If the plural of man is always called men,
Why shouldn't the plural of pan be called pen?
The cow in the plural may be cows or kine,
But a bow, if repeated, is never called bine;
And the plural of vow is vows, never vine,
If I speak of a foot, and you show me your feet,
And I give you a boots, would a pair be called beet?
If one is a tooth and a whole set are teeth,
Why shouldn't the plural of booth be called beeth?
If the singular of this and the plural is these,

Should the plural of kiss ever be nicknamed keese?
Then one may be that and three would be those,
Yet hat in the plural would never hose,
And the plural of cat is cats, not cose.
We speak of a brother and also of brethren,
And though we say mother, we never say methren.
Then the masculine pronouns are he, his, him,
But imagine the feminine she, shis and shim!
So English, I think you all will agree,
Is the greatest language you ever did see.

Unknown

4. READ AND TALK ON "QUANTITY" IDEAS.

Comment on the information in the table.

TYPICAL PROPERTY VALUES OF CERMETS AND PRECURSORS

Properties (units)	Materials		
	Thermally Processed boron Carbide-0775 Aluminum (10-30 vol%) Cermet[1]	Chemically Processed boron Carbide-0775 Aluminum (10-30 vol%) Cermet[2]	Laminated Boron Carbide-Aluminum (32 vol%) Cermet[3]
Fracture toughness (MPavm)	5-7	12-18	~15-19
Specific gravity (g/cm^3)	2.54-2.59	2.54-2.59	N/A
Thermal expansion coefficient (μin/in °C)	N/A	6.5-8.0	N/A
Thermal conductivity (W/m °C)	N/A	4.1-6.0	N/A
Electrical resistivity (Ω-cm)	N/A	0.01-0.03	N/A
Wear resistance (subjective data)	High	High	N/A

BULLETPROOF STRENGTH

A family of hard, lightweight and tough ceramic-metal materials developed for military purposes is starting to find commercial and industrial application.

Boron carbide is the third hardest material known to man. It is also lightweight, extermely stiff and less expensive than diamonds and cubic boron nitride – the leading entries on the hardness scale. But boron carbide is quite brittle.

In the early 80s researchers almost understood how ductile aluminium could be combined with brittle boron carbide to overcome its weekness.

After several years of continued development they got a ceramic-metal

composite (cermet) – stronger than steel, somewhat less dense than aluminium and several times more resistant to fracture than usual ceramics. It is one-third the weight of steel, so you get three times the material for a given weight.

There are two processes for its manufacturing: molten aluminium is infiltrated into porous "sponges" of boron carbide or into boron carbide powder at temperatures below 1200°C and then heat-treated at lower temperatures.

Among its uses there are: lightweigh police body armor, components for hard-disk drives, long-life bearings, high-quality sporting goods, cutting tools. Tons of boron carbide were poured over the Chernobyl nuclear reactor melt down because it is a high neutron absorber. At present there are three methods to produce boron carbide: thermal, chemical and laminate.

* * *

Complete the following figures with the facts from the box.

"Yantar"		
120 l	9,4%	4,4 mn
10 sorts	doubled	80%

"YANTAR": THE SUNNY BREWER

Europeans drink an average of 88 liters of beer per person annually. In countries renowned for their beer brewing traditions – like Germany, the Czech Republic, Slovakia, and Belgium – the average is no less than 120 l. Ukraine also has a long brewing history, although the average consumption level is less than 12 l per person annually. One the giants is Mykolaïv-based Yantar Brewery.

Yantar was founded in 1973. It was the first Soviet plant built by famous Czech brewers according to their own design and equipped with their complex equipment. The annual capacity was 7.2mn dal.

Within two decades of operation, Yantar's fixed assets dropped to 80% and the difference between actual and planned capacity had grown significantly. In 1994, when it was decided to privatize the plant as a joint stock company, the equipment was only being used to 30% capacity.

It was impossible to survive with obsolete equipment under market conditions, plant management immediately decided to re-equip the plant. The search for investors did not take long – a large international group within the British company INVESCO CEAM.

In 1995, Yantar received the first part of the US $3mn investment which was used to launch two new bottling lines, thus resolving production 'bottle-necks'.

The company modernized its filtering equipment, installed steam and tunnel pasteurizers, and started producing beer in kegs and PET-bottles. In fact, Mykolaïv Yantar was the first brewery in Ukraine to produce beer in original souvenir kegs. The investments and personal contributions allowed Yantar to re-equip 70% of the plant, and the result were quickly visible.

Production capacity today now exceeds 90%. From 1996 to 1997, beer production nearly doubled. In 1998, production capacity increased another 29% and profits were Hr 22mn.

Yantar's share of the domestic market is constantly growing and is now at 9.4%. Today, it produces 10 sorts of beer with densities of 11-17%. There four dark beers – Oksamytove, Mykolaïv At Night, Jolly Roger and Yantar Dark – and five light beers - Yantar Special, Mykolaivske, Favorit, Admiral, and Yantar Light, which is the leader at 41% of the total sales.

The quality of the Mykolaïv beer is highly regarded abroad, and lately, many professional brewers have expressed interest in the plant, to the extent that leaders in the world beer industry are considering the use of Yantar's production facilities for bottling their trade marks.

Work in pairs, make up as many examples as you can. Compare your examples with your groupmates. Who is a winner?

5. EXPRESS THE FOLLOWING.

Give the definitions for the following uncountable nouns:

1. Money is ...
2. Advice is ...
3. Experience is ...
4. Time is ...
5. Work is ...

Compare your definitions.

Look up the words in English-English dictionaries. Read their definitions.

6. DISCUSS IF "THE MORE THE BETTER" IS ALWAYS RIGHT.

7. WRITE A SHORT ESSAY ON THE PROBLEM: "WHEN DO YOU THINK "THE MORE THE BETTER" AND WHEN "THE LESS THE BETTER"?

UNIT 7

COMPARISON

Compare – to judge, suggest or consider that (something) is similar or of equal quality (to something else).

Cambridge International Dictionary of English

1. STUDY THIS:

Comparison			
Adjectives	**Adverbs**	**Clauses of comparison**	**Conjunctives**
Degrees of comparison: Regular: - er/more (than) - est/most Irregular: good-better-best bad-worse-worst little-less-least far-farther-farthest further-furthest	**Degrees of comparison:** Regular: - er/more - est/most Irregular: well-better-best badly-worse-worst many/much-more-most adverbs of degree: extremely very enough quite rather a little a bit	... than ... ... as well as ...	as ... as so ... as

What Ukrainian expressions do the following English ones correspond?

1. The equipment does not operate as well as we expected it should be.
2. Buying a new instrument is sometimes as cheap as repairing the old one.
3. This method gives values about 20% lower than those which were used before.
4. The blood pressure is higher in women aged 50-60 years than in those aged 40-50 tears.
5. In the mutant the eyes contain only half as much pigment as in the wild type.

2. TRANSLATE FOR "COMPARISON" IDEAS.

Compare the ways of expressing "comparison" ideas in English and Ukrainian.

1. Truth is always strange, stranger than fiction. *(G.Byron)*
2. Clever men are good, but they are not the best. *(Th.Carlyle)*
3. The best is the enemy of the good. *(F.Voltaire)*
4. There is only one thing in the world worse than being talked about, and that is not being talked to. *(O.Wilde)*
5. The best way to make the children good, is to make them happy. *(O.Wilde)*
6. The old believe everything; the middle-aged suspect everything; the young know everything. *(O.Wilde)*
7. A pessimist a man who thinks everybody as nasty as himself, and hates them for it. *(G.Shaw)*
8. There is nothing so bad or so good that you will not find Englishman doing it, but you will never find an Englishman in the wrong. *(G.Shaw)*
9. Life is long, and too much of it must not pass in idle deliberation how it shall be spent. (G.Shaw)
10. It is much easier to be critical than to be correct. (B.Disraeli)

3. EXPLAIN WHAT IS COMPARED.

OUT OF SIGHT, OUT OF MIND

The oftener seen, the more I lust,
The more I lust, the more I smart,
The more I smart, the more I trust,
The more I trust, the heavier heart,
The heavy heart breads mind unrest;
The rarer seen, the less in mind,
The less in mind, the lesser pain,
The lesser pain, less grief I find,
The lesser guef, the merrier I;
Therefore I wish thy sight to fly.

The further off, the more I joy,
The more I joy, the happier life,
The happier life, less hurts annoy,
The lesser hurts; pleasure most rife;

Such pleasure rife shall I obtain
When distance doth depart us twain.

Barnable Googe

* * *

The more we study, the more we know,
The more we know, the more we forget.
The more we forget, the less we know.
The less we know, the less we forget.
The less we forget, the more we know.
Why study?

4. READ FOR "CAMPARISON" IDEAS.
Compare the engines described.

POWER TO BURN

A history of the spark-ignition engine

The foundation for the four-stroke-cycle reciprocating gasoline engine that dominates the automotive field today was laid in the early 1900s. During the first half of the century, there was a major focus on avoiding combustion knock, which was blocking the route to increased efficiency and specific power. Research led to the discovery of tetraethyl lead, pointed the way to improved gasoline, and influenced combustion-chamber design.

Beginning in the 1950s, emissions became a major concern. Mixture preparation and spark timing, once mainly manually controlled, had become automatically regulated, using mechanics, hydraulics, or pneumatics. Those engine control functions are now increasingly done electronically.

Of the American cars built in 1900, 1681 were powered by steam, 1575 were electrics, and only 936 used spark-ignition engines.

For example, in those early days it took 20 to 45 minutes to raise pressure for the steam car, while the internal combustion engine could be started almost instantaneously. The early steam car lacked a condenser, so frequent stops for make-up water were required. The electric car started promptly, like the internal combustion engine, and it was appreciated for its comparative silence. However, it was expensive and storage batteries could not be recharged.

The four-stroke cycle used in most automative engines today is usually credired to a German travelling salesman, Nicolaus Otto, who was intrigued by the possipilities of the internal combustion engine. He demonstrated the first working four-stroke engine in 1876.

Otto progressed to an atmospheric engine, in which explosive

combustion drove a free piston vertically upward, after which the cooling of the hot gases caused the piston to fall and turn the output shaft through a free-wheeling clutch that was disengaged during the up-stroke of the piston. This engine was produced and marketed in quantity.

This four-stroke engine was much quiter than Otto's atmospheric "Silent Otto."

TWO-STROKE ENGINES: CLEANER AND MEANER

The two-stroke engine has been a hot topic at recent auto shows and automotive engineering conventions. BB, Ford, General Motors, Chrysler, Mazda, Toyota, Honda, and Subaru all have two-stroke engine pro grams under way.

Two-stroke engines have long been used in lawn mowers, outboard motors, snowblowers, and motorcycles. But the renewed interest in automotive two-stroke engines has been spurred by the stringent emissions control regulations.

The modern two-stroke engine represents a means of obtaining the performance consumers want while satisfying the need for reduced emissions and good fuel economy. The auto industry does not want to relive the early- to mid-1970s, when it could offer only anemic engines in order to meet the then-new emissions and fuel economy regulations. The simplicity of the two-stroke engine also interests automakers who are looking at ways to reduce manufac turing costs.

The two-stroke engine achieves reduced emissions through a variety of techniques. Lean-burning stratified combustion and exhaust-gas charge dilution control the oxides of nitrogen (NOx) so that an emissions-control oxidizing catalyst is not needed. As with four-stroke engines, an oxidizing catalyst is still needed to reduce hydrocarbon and carbon monoxide emissions. However, two-stroke engines can use a two-way platinum and palladium convertor, rather than the more expensive three-way converters containing rhodium that are needed for four-stroke engines. Experts believe that current two-stroke models would have little trouble even if NOx emission limits are tightened from the current level of I.0 gpm to 0.7 gpm.

DIESEL DESIGN

Toyota is also developing a diesel version of the S-2 engine that provides smooth operation with reduced noise and vibration. The vibration is reduced by as much as 80 percent at idle compared to a regular four-stroke engine, mainly because the maximum combustion pressure is reduced. Its reduced noise could also make it a good candidate for use in a luxury car. Toyota's prototype S-2 diesel has a displacement of 2.5 l and produces 100 hp at 3200 rpm.

Toyota sees fuel economy as one of its biggest challenges with its S-2 concept. Externally scavenged two-stroke engines present fuel economy reduction problems similar to their four-stroke cousins.

The S-2 has also presented some interesting engineering mechanism and material challenges, since valves must open and close twice as often in a two-stroke engine as in a four-stroke. This requires precise and durable valve operation, as well as new materials for valve train components. For this reason, the S-2 uses lightweight titanium valves and valve springs, aluminum tappet buckets, and ceramic valve-adjusting shims.

5. TALK ON "COMPARISON IDEAS"

Compare the performance of Job Shop and Flexible Manufacturing System

Manufacturers show a great interest to innovations in manufacturing technology. A decision to install a new manufacturing system requires a comparison of cost of the old and new systems. Manufacturing performance can be measured in terms of productivity, quality, flexibility.

Productivity is a measure of manufacturing performance that indicates a firm's efficiency in converting inputs to total outputs.

Quality is a measure of manufacturing performance that indicates the degree of perfection of the goods produced.

Flexibility is a measure of manufacturing performance that indicates a system's adaptability to changes in the manufacturing environment.

Let's compare a conventional job shop and flexible manufacturing (an automated set of computer-controlled machine tools linked by a materials handling system).

COMPARISON OF PERFORMANCE BETWEEN JOB SHOP AND FLEXIBLE MANUFACTURING SYSTEM

Measures	Job shop	Flexible manufacturing
Integral	83	103
Productivity	148	155
labor	1200	3230
capital	1480	728
material	284	287
overhead	577	793
Quality	627	1060
process	1010	1130
product	1640	16700
Flexibility	270	432
equipment	2030	926
product	1420	12000
process	780	2260
demand	816	1390

The Table summarizes the job shop and FMS performance measures based on the results of the first replication experiment. The values of some partial measures, such as capital productivity and equipment flexibility, show a decrease because of the large initial investment and the general tendency to maintain an overcapacity in integrated manufacturing systems. The values of the remaining partial measures, especially product quality, product flexibility, process flexibility, and labor productivity, show significant increases. These results demonstrate that the FMS reduces product defects, setup, WIP, and labor. And since most of the partial measures increase, each total measure also increases – productivity by five percent, quality by 69 percent, and flexibility by 60 percent. With pronounced improvement in both quality and flexibility, the total performance measure for the FMS increases by 24 percent. Note that these comparative figures are based on only one replication, and that any claim of their significance must be validated through more replications.

Thus, a hypothetical case study demonstrates that, compared with a conventional job shop, the adoption of an FMS can improve total manufacturing performance.

6. DISCUSS THE FOLLOWING.

1. The world is the best of all possible worlds, and everything in it is a necessary evil *(F.H.Bradley)*

2. Where everything is bad it must be good to know the worst *(F.H.Bradley)*

3. An expert is one who knows more and more about less and less. *(N.M.Butler)*

4. Examinations are formidable even to the best prepared, for the greatest fool may ask more than the wisest man can answer *(Ch.Colton)*

5. It's wiser being good than bad: It's safer being meek than fierce; It's fitter being sane than mad. *(R.Browning)*

7. EXPRESS "COMPARISON" IDEAS.

Look at the table and make comparisons:

Elements	In the Earth's crust: %	Sea water elements %
Oxygen (O)	49	91
Calcium (Ca)	3	0.04
Potassium	2.4	0.04
Magnesium (Mg)	2	0.1
Hydrogen (H)	0.13	5.7
Sulphur (S)	0.052	0.08
Carbon (C)	0.032	0.003

Can you tell what is right from your own knowledge?

1. Too much/a lack of/an excess of	iron causes anaemia
2. Sufficient/excessive/insufficient	calories help you to have emough energy
3. A lack of/a sufficient quantity/ an excess of	carbonhydrate causes fatness
4. The right quantity/ an inadequate amount/an excess of	vitamins is necessary for health
5. An adequate amount/ an excessive amount/an inadequate amount	of calcium causes bone disease

Tell what is "too/enough" for ... to ...

is are	too/ enough	cold hot dry damp deep shallow wide narrow salty high	for	people fresh water fish apples flowers corn wheat	to	line in drink swim across climb eat cross sail grow plant

8. WRITE A SHORT ESSAY TO EXPRESS YOUR IDEAS ON ANY OF THE ABOVE TOPICS.

UNIT 8

MODALITY

Modality – the state of being modal.
Modal – Logic (of a proposition) which involves the affirmation of possibility impossibility, necessity or contingency.
The Oxford English Reference Dictionary

1. STUDY THIS:

Modal meanings	English equivalents	Ukrainian equivalents
absolute obligation, a very strong opinion	must	має бути зроблено обов'язково, необхідність, обов язок, впевненність
necessity obligation	have to	маю, змушений, доведеться, мусимо зробити, треба необхідність, обов'язковість дії, зумовлена обставинами
preatragned necessity	be to	треба, необхідно наказ, інструкція, необхідність, яка обумовлена порядком, розкладом, планом
advice obligation	should should like to I advise to needn't had better should (perf)	треба, слід, краще, моральний обов'язок (з точки зору того, хто говорить), порада, рекомендація
reproach	ought to, should (have done) had better	міг би, повинен був, слід було зробити, докір, несхвалення, дія, що відбулася як небажено з точки зору того, хто говорить
obligation necessity	ought to	рекомендується, слід порада, рекомендація
necessity	need	треба, потрібен, необхідність
asking for instructions, obligation, necessity	shall I do it? I shall do it	повинен, треба, належить, забов'язан зробити це? наказ, попередження, обіцянка, перестрога, розпорядження, вказівка з метою дістати

Modal meaning	English equivalents	Ukrainian equivalents
prohibition (strict)	You can't (cross the street)., You may not do it. You are not to leave the room. You must not do it.	нема потреби, необхідності, зовсім не треба, заборона
absence of necessity	needn't do needn't have done didn't have to do	не треба, ні в якому разі відсутність необхідності
permission	may can be allowed to	можно, дозволяється, незаборонено дозвіл, ввічливе прохання
physical or mental ability	can be able to be capable of it is impossible	буде здатний, фізична розумова, здатність можливість виконати дію при певних обставинах
volition	want should like to will would	охоче, залюбки, бажання
polite requests	will would can could would you mind do you mind if . . ing	дозвольте, будь ласка, не заперечується ввічливе прохання, запрошення
preference	would rather I'd prefer (perf) we'd love to	зробив би, віддав би перевагу, краще би я..., перевага
related action in the past	would (тільки дія) used to (стан, ситуація)	бувало дія або стан, які повторювалися в минулому
uncertainly surprise doubt	it is impossible it is possible I don't believe can't/couldn't probably must be Perhaps maybe may/can	повинно бути, напевно, певна річ, хто знає, невже, не може бути, можливо, могло би, навряд чи припущення, здогад, невпевненність, здивування, невіра, сумнів

A
Necessity/obligation

Necessity! thou mother of the world
P.B.Shelley
Necessity knows no law except to conquer.
P.Syrus
Necessity is the mother of invention

1. STUDY THIS:

Необхідність

must	have to	be to	should	ought to	need	shall I	needn't didn't have to
треба мусить бути має бути впевнений	треба маю зробити змушений доведеться мусимо	треба планується має повинно є намір	треба слід краще бажано	треба бажано слід рекомендуеться	треба потрібно необхідно	(Треба) зробити ..? (Повинен) зробити	не треба ні в якому разі
необхідність обов'язок впевненність	необхідність обов'язковість дії зумовлені обставинами	наказ інструкція	моральний обов'язок (з т зору того, хто говорит) порада рекомендація	необхідність рекомендація	необхід-ність	наказ попередження погроза обіцянка перестороога	нема потреби необхідності зависім не треба немає потреби
absolute obligation necessity a very strong opinion	necessity, obligation due to circumstances	order, prearranged necessity	a good advice	obligation necessity advice	necessity	obligation, necessity asking for instruction	absence of obligation or necessity

2. TRANSLATE FOR "OBLIGATION" IDEAS.

Compare English and Ukrainian "comparison" forms:

1. What can't be cured, must be endured.
2. Every tub must stand on its own bottom.
3. Genius must be born, and never can be taught.
4. What must the English and French think of the language of our philosophers when we Germans do not understand it ourselves?
5. When liberty is mentioned, we must always be careful to observe whether it is not really the assertion of interests which is thereby designated.

* * *

1. He who would write heroic poems should make his whole life a heroic poem.

2. A university should be a place of light, of liberty and of learning. *(B.Disraeli)*

3. A man should keep his little brain attic stocked with all the furniture that he is likely to use, and the rest he can put away in the lumber – room of his library, where he can get it if he wants it. *(A.C.Doyle)*

4. Books and friends should be few but good.

5. Law-makers should not be law-breakers.

* * *

1. Shall we make a new rule of life from tonight: always to try to be a little kinder than is necessary? *(J.M.Barrie)*

2. You shall judge of a man by his foes as well as by his friends.

3. If the blind lead the blind, both shall fall into the ditch.

4. Man shall not live by bread alone.

5. Deeds, not words shall speak me. *(F.Beaumont)*

* * *

1. Gratitude is a duty which ought to be paid but which none has a right to expect. *(J.J.Rousseau)*

2. Life being very short and the quiet hours of it few, we ought to waste none of them in reading valueless books.

3. I portray men as they ought to be portrayed, but Euripides portrays them as they are. *(Sophocles)*

4. Even when laws have been written down, they ought not always to remain unaltered. *(Aristotle)*

5. We desire nothing so much as what we ought not to have. *(Syrus)*

* * *

1. Fashion is a form of ugliness so intolerable that we have to alter it every six months. *(O.Wilde)*

2. If you make your bed, you have to lie on it.

3. If we want things to stay as they are, things will have to change. *(G.di Lampedus)*

4. If Jesus Christ were to come today, people would not even crucify him. They would ask him to dinner, and hear what he had to say and make fun of it. *(Th.Carlyle)*

* * *

1. Friendship is not to be bought at a fair.

2. Old birds are to be caught with chaff.

3. Men are not to be measured by inches.

4. Who is to blame?

5. When doctors differ who is to decide?

3. EXPLAIN WHAT FORMS EXPRESS "NECESSITY AND OBLIGATION":

THE CURTAIN POEM

A home should have a wife, a cat
and blinds upon the windows that
when pulled aside are suddenly drawn back
again. A wife should have a cat to kick

a home to love and, if I have not made
my meaning, plain, a curtain to be drawn
aside and suddenly pulled back again.

A man should have a wife to love
a home to kick and cats upon the curtains which
he may from time to time refrain
from seizing to and back again

But if a home should have a man
who waits upon a window-sill
endeavoring to find a plan
for all that moves outside the pane

be sure the home will have a wife
perhaps the wife will have a cat
but if by now my meaning is not plain
the wife in all sincerity should
turn her back upon the scream
and, singing, seize the cloth across again.

Edwin Broock

4. READ FOR "OBLIGATION/NECESSITY" IDEAS.

After reading the following texts, write 10 sentences to express "obligation and necessity".

THE SIGNS ARE SPEAKING

Our life is full of different signs and symbols. They help us to deliver important information in short form. Signs show us what we must do and

what we must not do, for example, signs saying "Stop", "Be careful", "Go only this way", "Don't cross the street here", etc. Signs inform us of many important things and give us many important instructions. Signs meet you' in the street as your old friends. They are speaking to you from buses and trams, from the asphalt of roads and from walls of houses. In the street, you can see the big yellow "T". The sign shows where the trolley-bus which you take to go to the institute stops. Another sign on the other side of the street shows where the tram stop is. The sign in the form of a hand with the word "Crossing" under it shows the way to the place where you may cross the street. The two white parallel lines on the road asphalt, connecting the two opposite sides of the street show the limits of the crossing. You want to take a tram. To do so you are going to cross the street. But the red light stops you. "Wait!" it says. In a minute the red light changes to green. "Go!" it says to you now. That's how the signs in the streets speak to you. Everyone living in a town must understand the language of these signs well.

And you, do you know the language of signs that we can see along the roads? Here are some of them. There are some descriptions of them. Every sign in Fig. 13 has a number.

WORDS OF WARNING

The warning industry reveals its character in its choice or words.

"Put Stamp Here," directs New York Telephone in that corner of the return-mail envelope that used to say, "No Postage Stamp Necessary if Mailed Within US". The phone men add the admonition: "The Post Office Will Not Deliver Mail Without Postage".

Big fights occur in Washington over warnings. In 1965, Congress passed a bill requiring cigarettes to be labeled: "Caution: Cigarette Smoking May Be Hazardous to Your Health". The Federal Trade Comission and the tobacco companies wrangled over: (1) "Caution" - should it be tougher "warning"? (2) The conditional "maybe" - should it be flatly certain "is"? (3) "Hazardous" - doesn't "dangerous" sound more ominous? The FTC won; although its officials disclaint authorship of the changed warning, attributing it to nameless, faceless forces in the Congress, the wording now reads: "Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health'

The difference is semantically significant: "Hazard" is from the French *hasard,* risk: "danger" is rooted in the Latin *dominum,* from the absolute power of a lord and master to do harm. With a hazard, at least you have a chance.

The federal government has fairly intelligible standards to go by in the

language of warnings. Among toxicants like caustic soda (we used to call it lye, but Washington attorneys hate that word) a 1 percent to 2 percent solution for cleaning white wall tires must say, "Warning: irritating to skin and eyes". A 2 percent to 10 percent solution of sodium hydroxide, because it is corrosive at that level, requires the word "Danger" and "Harmful if Swallowed" or even "May Be Fatal if Swallowed". A weak oven cleaner, with 2 percent sodium hydroxide, says, "Danger, May Cause Burns", but a strong one, near 10 percent, must say, "May Cause Severe Burns". Over 10 percent, it has to say, "Poinson' and "Causes Severe Burns".

5. EXPRESS NECESSITY, PROHIBITION, LACK OF NECESSITY, PROHIBITION.

Rephrase the following:

* * *

Ring bell for service.
Park here any time.
Keep Ukraine beautiful.
Drive slowly
Drive fast and see your jail.
Conserve energy – buy a horse.
Startle your parents – say "please" and "thank you".
Please don't litter the landscape ...
Ride bikes.
Please, keep your dog on leash.
Please, do not use wheeled vehicles on grass.
Please, do not allow leashed or unleashed dogs on the grass.
Please, do not drink or use alcohol.
Please, do not use amplified sound in the park.
Keep left.
Keep right.
Stand clear of the gate.
Mind the doors.
Keep the door closed.
Pay here.
Please, call on our shop.
Fasten your belts, please.
Keep off the grass.
In emergencies dial 01 for fire brigade, 02 for militia, 03 for ambulance.

* * *

Do not boast until you see the enemy dead.
Don't cackle till your egg is laid.
Don't count your chickens before they are hatched.
Don't cross the bridges before you come to them.
Don't look a gift horse in the mouth.
Don't strike a man when he is down.
Don't teach fishes to swim.
Dress up a stick and it doesn't appear to be a stick.

* * *

In	No parking
Out	Cross only at the lights
No entry	Single file traffic
Pull	No smoking
Push	Wet paint
Private	For hire
No admittance	Keep off the grass
Emergency exit	Do not annoy the animals
No trespassing	Fasten your seat belts.
No overtaking	Caution (Do not lean out of the window)

6. TALK ON "OBLIGATION/NECESSITY" IDEAS. AFTER READING THE FOLLOWING REPHRASE IT USING "OBLIGATION & NECESSITY" WORDS:

DUAL-POWER AUTOS TAKE THE WHEEL.

Cleaner-burning, more energy efficient, and quieter, than conventional cars, hybrid vehicles combine the best features of internal combustion engines and electric designs.

No alternative has yet been found that is similar to the internal combustion engine. Electric vehicles may be okay around the town, but may never be popular with people who want to, or have to, use cars for long-range, high-speed transportation.

Gasoline provides the equivalent of 12,000 watt-hours per kilogram. Compare this to a current-day lead-acid battery, which provides only about 40 watt-hours per kilogram. Some calculations by Audi engineers show that if a battery-powered car were to have the same energy content (about 200 kW-hr) as one using an internal combustion engine burning a tankful of gasoline, it would weigh about four tons.

Nevertheless, electric vehicles are virtually noiseless and pollution-free, and are very good at conserving energy. For example, by the year 2010,70 percent of all vehicles in smog-conscious southern California must be electric-powered to meet clean air standards.

Discuss with your groupmates what a car has to be equipped with to be cleaner-burning, more energy efficient, and quieter, than conventional cars.

The Audi "duo" concept car is an Audi 100 Avant Quattro with four-wheel drive that retains its gasoline engine to drive the front wheels. It carries the duo label on the body, which identifies it as a hybrid. However, Audi added a small electric propulsion system in the rear to drive the rear wheels. A 12.6-horse-power electric motor fits into the transmission tunnel. The motor weighs 132 pounds and is coupled directly to the rear differential via an electrically operated clutch. While the car is operating on this electric motor, another smaller electric motor is used to supply hydraulic power for the power steering, power brakes, and antilock brake system.

The 400-pound battery pack, located in the spare tire well, uses a high-performance nickel/cadmium battery pack with 49 cells that supply 1.2 volts per cell. The battery has a life of at least 10 years.

Turning the key either starts the gasoline engine, or if the transmission is in neutral and the E button is pressed, the electric propulsion system will go into action.

The car's top speed on electric power is just over 30 mph. While that might seem low, one must remember that there is a high-performance engine still available for highway driving. The car's limited range of under 20 miles on electric power is compensated for by the fact that the internal combustion engine can recharge the batteries while the car is being driven.

7. WRITE A SHORT ESSAY ON 5 THINGS YOU MUST, SHOULD, NEED DO EVERY DAY.

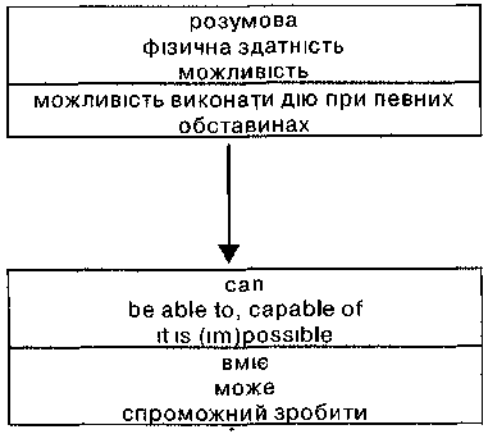
From you experience tell how you should use a toaster, a gas stove, a printer, a telephone, an electric razor, a fan.

B

Ability

They are able because
they seem they are able.
Virgil

1. STUDY THIS:



2. TRANSLATE FOR "ABILITY" IDEAS.

1. Beggars can be no choosers.
2. The devil can quote scripture for his purpose.
3. The leopard cannot change his sports.
4. Love cannot be forced.
5. A man can die but once.
6. A man can do no more than he can.
7. A man cannot spin and reel at the same time.
8. Never put off till tomorrow what you can do today.
9. You can take a horse to the water but you cannot make him drink.
10. You never know what you can do till you try.

3. READ FOR "ABILITY" IDEAS.

Put down 10 sentences to show what Alain Bombard could prove:

FIGHT FOR LIFE IN THE OPEN SEA

It was an experiment of world importance.
Need a shipwrecked sailor die?

This was the question which Dr. Alain Bombard, a French scientist on ocean life, decided to answer in 1952.

Alone in a small boat, he left Las Palmas in 1952 to cross the Atlantic Ocean without food or water.

He had a sail, two oars, a harpoon, some fishing rods and a nylon filter in his small boat.

He wanted to prove that sailors could live on the sea itself.

Bombard was sure that their deaths were the result of their fear and not of hunger — fear that when their food and water were finished, they would die.

While on the ocean Bombard was surprised to see birds flying over his head. People think that birds don't fly far from land, but that is wrong. Bombard saw a lot of birds every day. One bird even became his friend. Every day of the voyage it appeared about 4 o'clock and flew many times over his boat.

Bombard worked out his regime. He got up at dawn and went to bed at sunset. The afternoon was the longest and the most difficult part of the day, as he could not hide anywhere from the hot sun. At night he suffered from cold.

More than once Bombard looked death in the face. During stormy weather when the sky was covered with dark Clouds and his boat was caught in the roaring waves, he could not catch any fish and had nothing to eat.

But when the wind stopped, the ocean usually became calm and his boat drifted slowly to the west. Then he did not need his fishing-rods, for fish swam so near the boat that they could be caught easily with a knife. Dolphins followed him all the time. He sometimes used the harpoon to catch small sharks which, like the fish, swam quite near the boat and sometimes even touched its sides.

More than once he was attacked by sharks. When a shark appeared during the day, he wasn't afraid, because if he struck it on the nose with his oar it went away. But in the night he was afraid of them, because they could overturn his boat.

Most of all Bombard lived on plankton, caught with the help of the nylon filter. When he had no rain water, he drank sea-water, and the water he got from the fish.

After fifty-three days alone in the boat Dr. Bombard saw a large ship in the distance. It was a big British passenger ship two and a half miles away. At first, there was no sign that they had seen Bombard. Then he began to shout and wave his hands, and someone saw him and waved to him in answer. The ship was from Liverpool.

When Bombard reached the ship's side, the seamen and the passengers saw a thin man with a long beard and long hair. His face was covered with salt.

The captain and the sailors wanted to help him, but he refused their help. With great difficulty the captain could only make Bombard take a light hot meal on the ship before he continued his voyage.

Many times Dr. Bombard was reported missing in the ocean. But the brave doctor finished his unusual voyage at the Barbados Islands on the other side of the Atlantic Ocean. In sixty-five days he had drifted 2,700 miles from Las Palmas to Barbados. He spent a week in Barbados. Many telegrams of greetings arrived from France, and the people in the streets greeted him at each turn with Hello, Doc!

Although he had lived without normal food and water, Dr. Bombard was quite well. True, of course, the long days in the ocean had left their marks on him.

Since then many sailors lived on the sea itself when they were ship-wrecked and found themselves in the open sea without food or water.

Rephrase the texts using "ability" expressions:

BEARINGS

Jurnbr is a personal computer program that determines performance characteristics of all types of fixed-geometry cylindrical bearings. Program features include the ability to calculate hydrodynamic, hydrostatic, or hybrid modes of lubrication; robot-bearing misalignment; cavitaion.

PROPERTIES DATA BANK

The Esteem program creates a data bank of liquids and gases, while the Estate subroutine calculates thermodynamic and transport properties of liquids and gases. Properties computed include vapor pressure, density, heat capacity, thermal conductivity, viscosity, and surface tension. The data bank may be created from tables, graphs, equations, or from experiments. A standard data bank of 68 refrigerants is also available.

LAMINATE ANALYSIS

The PC Laminate package performs classical laminated plate analysis. A materials catalog editor allows rapid input of up to 99 material properties. Up to nine different materials can be analyzed in the same laminate. The program can determine failure strengths as well as laminate stiffness. making it a convenient to design composites design tool. A menu-oriented user interface is featured.

ELECTRONIC HANDBOOK

DE/CASE (Desktop Engineering/Computer Aided Analytical Solutions for Engineers) is an electronic handbook for mechanical and structural

engineers. The menu-driven program has 36 modules for numerically and graphically solving over 5000 commonly used mechanical and structural engineering equations. Analysis categories include: geometric and material properties; beams and columns; rings, cables, arches, and frames; plates, shells; and natural frequencies.

4. TALK ON "ABILITY" IDEAS.
OFFER THE RIGHT SEQUENCE OF ACTIONS:

With the help of	the ... door handle steering wheel seat adjuster gear lever clutch pedal brake pedal oil pressure gauge water temperature gauge speedometer starter switch	the driver can	check the temperature stop the car steer the car check the oil pressure change gear check the speed start the engine control the speed adjust the seat operate the gear lever

5. DISCUSS THE FOLLOWING.

Are your friends talented people?
Interview your friends and fill in the following:

		+	-
1.	Can you sing well?		
2.	Can you dance?		
3.	Can you paint (draw)?		
4.	Can you add up figures?		
5.	Can you make a cup of tea?		
6.	Can you speak English?		
7.	Can you write English a little?		
8.	Can you read English?		
9.	Can you ask questions in English?		
10.	Can you answer questions in English?		
11.	Can you introduce yourself?		
12.	Can you play a guitar?		
13.	Can you play Football (hockey, tennis, badminton)?		
14.	Can you guess riddles?		
15.	Can you swim across the English Channel?		
16.	Can you see with your eyes shut?		
17.	Can you drive a car?		
18.	Can you tell us what the weather would be like tomorrow?		
19.	Can you repair electrical appliances?		
20.	Can you walk 25 km?		

6. EXPRESSING 'ABILITY IDEAS'. MAKE TRUE SENTENCES FROM THE TABLE.

All	living things	can	run
Many	robots	are able to	fly
Some	engines	are capable to	swim
Few	cells	have the	drive
No	atoms	ability to	grow
	plants		reproduce
	cars		change shape
	balls		speak
	planes		feel
	chemical		move
	substances		

From your own experience tell what can be made of (from) iron, titanium, sulphur, paper, steel, stone.

7. WRITE A SHORT ESSAY ON 5 THINGS YOU CAN DO VERY WELL.

C

Supposition/probability

A likely impossibility is always preferable to an unconvincing possibility.

Aristotle

1. STUDY THIS:

припущення
здогад
сумнів
здивування
невіра
невпевненність

probability
possibility
supposition
doubt
speculating about the future

Adjectives/Adverbs			Verbs
probably	likely		must + do, be doing
perhaps	unlikely		must + have done
maybe			may, can + do, be doing
it is (im)possible			may, can + have done
it is (in)probable			might, could
it is (un)likely			

кто знає
повинно би
напевно
певна річ
невже
не може бути
можливо
могло би бути

2. TRANSLATE FOR "SUPPOSITION/PROBABILITY" IDEAS.

1. Little friends may prove great friends. (Aesop)
2. There may be heaven; there must be hell;
   Meantime, there is our earth here – well! (R.Browning)

3. A witty statesman said, you might prove anything by figures. (Th. Carlyle)
4. Make yourself an honest man and then you may be sure there is one rascal less in the world. (Th.Carlyle)
5. Any man may be in good spirits and good temper when he's well dressed. (Ch.Dickens)
6. We have two ears and only one tongue in order that we may hear more and speak less. (Diogenes)
7. Particular lies may speak a general truth. (G.Eliot)
8. A friend is a person with whom I may be sincere. Before him I may think aloud ... (R.Emerson)
9. Even peace may be purchased at to high a price. (B.Franklin)
10. Important principles may and must be flexible. (A.Lincoln)
11. Nothing is impossible to a willing heart. (J.Heywood)
12. It is impossible to enjoy idling thoroughly unless one has plenty of work to do. (J.K.Jerome)

3. READ FOR "SUPPOSITION/PROBABILITY" IDEAS.

After reading the following text, rephrase it using "supposition" expressions. Firstly, imagine it is October 1990, then it is October 2000, then it is October 2030.

ENGINEERING IN THE YEAR 2000

In October 1990 some experts looked ahead to the trends and developments that were expected to affect mechanical engineers during the next 10 years.

"In materials, in nanotechnology (building, micromechanical devices) in energy, manufacturing, and transportation, the mechanical engineer is going to have to work with someone else.

Whether it's with geologists on planetary engineering projects biologists electrical engineers in transportation, the interdisciplinary requirement is going to transform mechanical engineering.

Basically, engineers will be able to keep abreast of what's going on in their field by means of online continuing education. Whether at work, a home, or through a professional association, they'll have the chance to participate in some kind of electronic network that will provide a channel for continuing education throughout their working life.

Probably the most exciting new area is nanotechnology – the technology of building devices at the microscopic level. Nanotechnology will involve manipulating things at the atomic and molecular levels.

The second big area is materials, the technology of the new composites.

Women now make up about 16% of the graduating class and they

clearly will become more important, but they will not become a significant factor in mechanical engineering. It's interesting that mechanical engineering remains a male field more than almost any other sector of engineering. If this keeps up, it's almost certain to create a ghetto inside engineering, a low-paid women's ghetto though women in engineering are more adept at characterizing problems than they are at finding solutions, students can be recruited into engineering. They are who are oriented to facts, focused on technical skills, were good at solving problems using step-by step analysis of the facts."

Laying bare the whole world as an engineering enterprise ought to be central to an ongoing campaign.

4. TALK ON "SUPPOSITION/PROBABILITY" IDEAS:

Personality quiz.

1. If the people living next door to you always make a lot of noise late at night, would you:
A. Telephone them and complain,
B. Start making a lot of noise yourself,
C. Say nothing and start looking for another flat.

2. If a waiter served you with lukewarm soup in a restaurant, would you:
A. Complain to the waiter,
B. Say nothing but not leave a tip,
C. Say nothing and never go there again.

3. If you noticed a friend lie to you, would you:
A. Tell your friend about it,
B. Start lying to your friend yourself,
C. Pretend not to notice.

Mostly A's: the person is honest and straightforward. He (she) might be either very popular or very unpopular.

Mostly B's: The person feels strongly about certain things but he (she) is worried what others might think of him (her).

Mostly C's: The person is quiet, tries to hide emotions. It is very difficult for the person to form a lasting relationship.

Do the questionnaire yourself. Then work in pairs. Ask each other using: Could you ...? May you ...? Is it possible (likely) that you could?

5. WRITE A SHORT ESSAY ON ONE OF THE FOLLOWING IDEAS.

1. If a man will begin with certainties, he shall end in doubts; but if he will be content to begin with doubts, he shall end in certainties. (F.Bacon)

2. A likely impossibility is always preferable to an unconvincing possibility. (Aristotle)

3. Our doubts are traitors. And make us lose the good. *(W.Shakespeare)*

Unit 9

CAUSALITY

Cause & Effect

Causality is the principle that there is a cause for everything that happens.

Cambridge International Dictionary of English

Everything in nature
is a cause from which
there flows some effect.

B Spinoza

1. STUDY THIS:

A causes B by making B happen	
Why because of this	What that happened
cause sth, cause sb problems make sb/sm do sth give rise to bring about result in lead to	have an effect on take effect be a result of result from arise from come out of
because of –ing due to –ing (gerund) as a result of –ing	
because as (for subordinate clauses of reason) since	
so thus (formal) hence (formal) (at the beginning of the sentence) therefore that's why	

What Ukrainian expressions do the English ones correspond?

1. Heat increase will cause (result in, lead to) temperature increase.

2. Heat increase may bring about temperature rise above boiling point and give rise to superheated steam.

3. By (due to, because of) adding heat, the temperature will be increased.

4. Because (since, as, as long as) heat is added, the temperature will be increased.

5. Thus (therefore, hence), if heat is added, the temperature will rise.

2. TRANSLATE FOR "CAUSE & EFFECT" IDEAS.

Tell how cause-effect relations are expressed in the citations:

1. Reason is the mistress and queen of all things. (Cicero)

2. The reason why worry kills more people than work is that more people worry than work. *(R.Frost)*

3. The reasons why so few marriages are happy, is, because young ladies spend their time in making nets, not in making cages. *(J.Swift)*

4. There is one basic cause of all effects. *(G.Bruno)*

3. EXPLAIN WHAT FORMS EXPRESS "CAUSE-EFFECT" RELATIONS

MINSTREL MAN

Because my mouth
Is wide with laughter
And my throat
Is deep with song,
You do not think
I suffer after
I have held my pain
So long?
Because my mouth
Is wide with laughter
You do not hear
My inner cry?
Because my feet
Are gay with dancing
You do not know
I die?

Langston Hughes

4. READ FOR "CAUSE & EFFECT" IDEAS.

Find out causes and their effects. Make up tables showing cause-effect relations.

THE SEAS TODAY

Today the ocean basins contain 300 million cubic miles of water. The sea covers 71 per cent of the earth's solid crust. This huge basin is divided into different oceans by the continents.

Men have given different names to different parts of the sea. Where the continents divide the sea, one part has been named the Pacific Ocean, one the Indian Ocean, and one the Atlantic Ocean.

The huge Antarctic Ocean is near the South Pole. A ship could sail around the world between the Antarctic continent and Africa and South America, without ever seeing land. At the other end of the world, is the Arctic Ocean.

* * *

For a long time men thought that the ocean-bed was smooth. But in 1920 scientists invented some instruments that measured the depth of water. These instruments were fixed to a ship. And then the instruments were sent down to the bottom of the ocean and brought up to the ship again. While going down to the bottom and back up to the ship they measured the time the sound wave took to travel down and up.

The scientists learned that the ocean-bed is not smooth, that under the sea there are huge mountains, volcanoes, canyons, plains, just as there are on land.

Now, tell us, please (if you remember) what a sound is? Sound is the rapid disturbance of air which affects our drums and enables us to hear. So with the help of these "rapid disturbances of air" scientists measured the depth of the ocean and learned much about that "world of wonders".

Each ocean has three main sections: the continental shelves, the slopes and the deep sea-floor. When we say "a shelf" here, we mean a piece of rock on a cliff mountain side. You know the words "rock", and "cliff mountain side" from our book and you will understand this sentence.

The shelves, which are from 200 to 600 feet deep, go out from the continental shores for 10 to 200 miles. Huge stretches of these shelves make in some places the longest unbroken cliffs in the world. The slopes go down as much as 30,000 feet, surprising in depth (or height). Everest is one of the highest continental mountains. The sides of the slopes are covered with great canyons. At the foot of these cliff-like slopes, the deep sea-floor begins.

Large mountains rise from the plain, more than five miles below sea level, in the centre of the Atlantic bed. This great range of undersea mountains runs 10,000 miles south from Iceland to the Antarctic Ocean.

VAPORIZATION OF A LIQUID

The *evaporation* of a liquid consists of the escape of molecules from its surface. Since only the *faster* molecules can get away from the attraction of the others, the *average speed* of the molecules of the liquid is, thereby, *reduced*, and this means that the temperature gets lower. Thus evaporation

produces a *cooling* effect as common experience shows.

Evaporation at the free surface of a liquid goes on at all temperatures, but when bubbles of vapour form all through the liquid, we say it is *boiling*. This *happens* as soon as the pressure exerted by the vapour becomes equal to the pressure of the *surrounding* air. If the liquid was made to boil by heating it, the *continued* application of heat will not make it any hotter, but will merely make it boil away faster. The energy *supplied* is used to *separate* the molecules from each other.

hear. So with the help of these "rapid disturbances of air" scientists measured the depth of the ocean and learned much about that "world of wonders".

Each ocean has three main sections: the continental shelves, the slopes and the deep sea-floor. ~ When we say "a shelf" here, we mean a piece of rock on a cliff mountain side. You know the words "rock", and "cliff mountain side" from our book and you will understand this sentence.

It is found that a given amount of heat is carried away for each gram of liquid that *vaporizes*. This is called the heat of *vaporization* of the substance. For water, at the normal steam point, it amounts to about 540 cal/gr. Again, we can say that this same *quantity* of heat is given off whenever a gram of steam *condenses* at the normal steam point.

If the air pressure acting on the surface of water is less than the normal *value* of 14.7 lb/in2, boiling will begin at some temperature lower than 100 °C.

WHAT WILL THE FUTURE CLIMATE BE LIKE?

... Scientists believe that the ice of the Arctic Ocean will melt when the average air temperature in the Northern hemisphere rises by two degrees.

As follows from the table below, the ice-covered area in the Arctic Ocean will have tangibly shrunk by the year 2000 and all the ice will have melted by the year 2025. Change in CO_2 concentration and in air temperature:

	1974	2000	2025
CO_2 concentration (percentage of atmospheric volume)	0.033	0.038-0.041	0.052-0.064
Rise in average temperature compared to 1960	0.5°	1.0-1.5°	2.0-3.5°

If global warming continues, the rise in temperature in different latitudes will not be identical. If by the year 2025 the average air temperature in the Northern hemisphere has risen by 2—3.5 degrees, in the big latitudes, the summer temperature will rise to +7° or even to +10° Centigrade and the winter temperature will not drop below -5°, -10° Centigrade. Such changes in the thermal regime will cause a dramatic impact on natural conditions, especially in medium and high latitudes.

There are reasons to believe that after the perennial ice of the Arctic Ocean melts, even winter ice will no longer form **over a large part of the Arctic seas.**

How will the warming develop towards the end of the 20th century and the first quarter of the 21st century? Probably this will proceed unevenly: first slowly, then (during the melting of the greater part of ice) much faster. Next, when the speed of warming again becomes dependent on the growth of the mass of carbon dioxide the process will slow down again.

The near future is likely to bring a change in the precipitation regime. The warming will lead to greater evaporation from the surface of the oceans and, consequently, to an increase in the amount of precipitation falling on the earth's surface.

THE SOURCE OF THE EARTH'S MAGNETIC FIELD

It has been known since 1600 that the earth as a whole is a *magnet*, but the source of the magnetic field is still not fully identified. The source is not permanently magnetized minerals in the earth; most of the planet is much too hot for any magnetic *mineral* to retain its magnetism. Furthermore, permanently magnetized minerals cannot move about rapidly enough to account for the known long-term changes in the strength, direction and pattern of the earth's magnetic field. The analysis of earthquake waves indicates that at least part of the earth's core is fluid, and it is almost universally *believed* the ponderous flow of matter in the core generates electric currents, which in turn induce the magnetic field.

There is little agreement, however, on how the metallic fluid in the core flows, on what energy source drives the fluid's motion and how that motion gives rise to the magnetic field. Because the core cannot be scrutinized directly and because its high temperatures and pressures cannot be reproduced easily in the laboratory these questions are hard to answer. Nevertheless, answers are starting to emerge from a combination of innovative theoretical and laboratory approaches. Such answers suggest that the core-fluid motions might be driven by gravitational energy liberated by the *migration* of heavy materials to the center of the core and of light materials to the outside of the core.

Only a few things are known with *certainty* about the earth's core and its magnetic field. Seismological, or earthquake-wave, data indicate that the core consists of a giant metallic sphere about the size of the planet Mars. Under normal conditions the core fluid conducts heat and electricity much better than copper does, it *probably* has about the same viscosity as water. With a mean *radius* of 3,485 kilometers, the core constitutes about a sixth of the earth's volume and about a third of its mass. The density of the core varies from a *minimum* at its edge of nine times the density of

water lo a maximum in its center of 12 times the density of water. The density estimates (pacuerbi) combined with *hypotheses* about the origin of the solar system *suggest* that the core is composed mostly of iron and nickel with a trace of lighter elements such as copper, sulfur and oxygen.

At the center of the core lies an *inner* core whose *seismic* properties are somewhat different from those of the surrounding region. With a radius of 1,200 kilometers, the inner core is about two-thirds the size of the moon and unlike the outer core is probably solid. Pressures at the center are measured in millions of atmospheres, and at those pressures the melting point of iron lies between 3,000 and 5,000 degrees Kelvin.

The easiest way to get an idea of the strength and direction of the earth's magnetic field is to study the behavior of a *compass* needle. The strength of the field, as measured by the force needed to deflect a needle from its preferred direction, is extremely small. The maximum of field of 3,000 gauss, near either the North Pole or South Pole, is several hundred times weaker than the field between the ends of a toy horseshoe magnet (The source of the earth's magnetic field. — Scientific American, 1979, Febr., p. 92).

* * *

4. TALK ON "CAUSE-EFFECT" IDEAS.

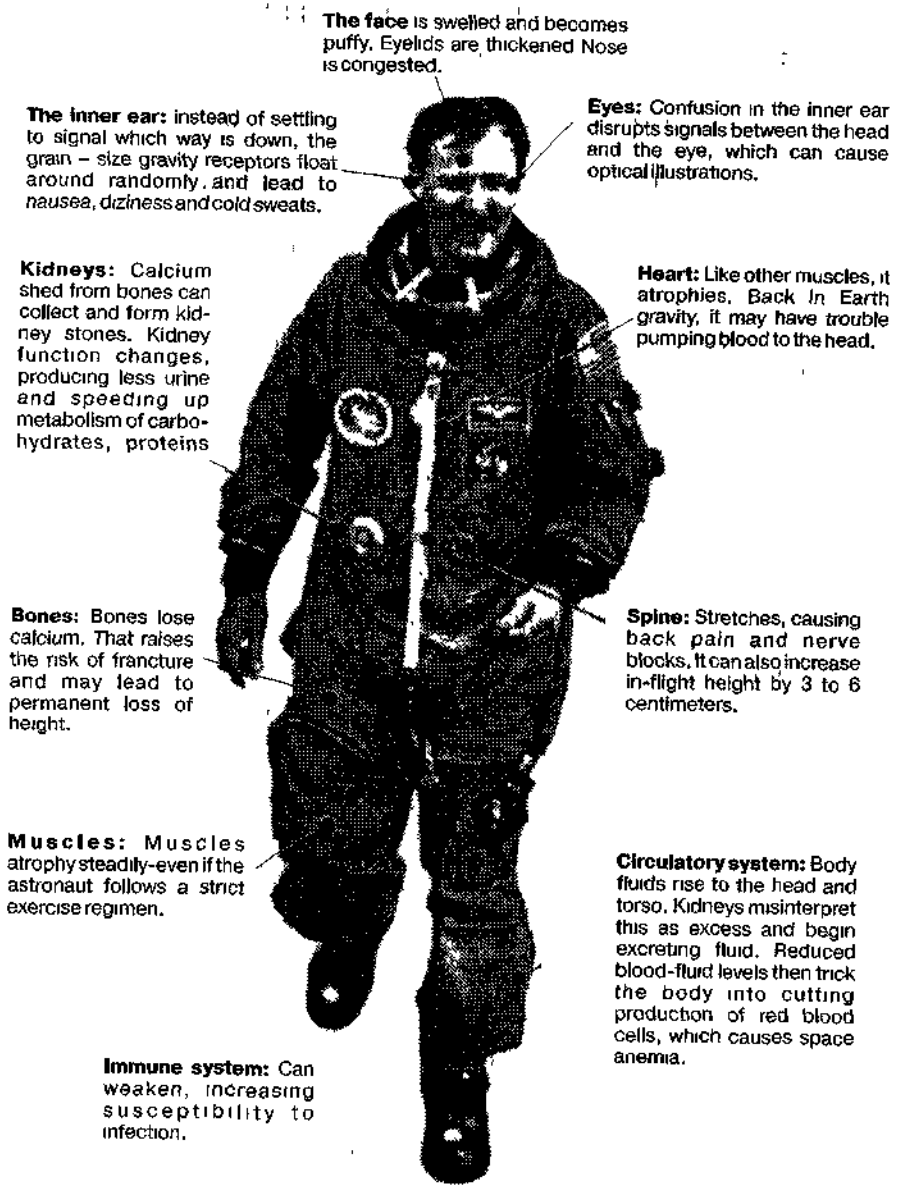
Tell how long-term weightlessness effects an astronaut

THE BODY IN ZERO GRAVITY

There is a question if humans can survive the trip to Mars. The shuttle – Mir expeditions have made a serious study of the mysterious effects of weightlessness for a long time.

WEIGHTLESSNESS _____ HUMAN BODY EFFECTS

Organ	Effect	Organ	Effect
face	swell	circulatory system	rise, reduce, space anemia
nose	congest	eyes	distrupt, optical illusions
inner ear	dizziness signal, cold sweat float	heart	atrophy, blood-pumping, troubles
kidneys	collect, urine, produce, metabolism, speed up	liver	process differently
bones	lose, raise, fracture	spine	stretch, back pain, increase in-flight height
muscles	atrophy	immune system	weaken, increase, susceptibility to infection



Complete the sentences below using cause-effect expressions:

MASS BURNING, GARBAGE IN, ENERGY OUT.

Mass burning is one of the methods of burning garbage with minimal or no presorting.

1. Because a typical plant has at least two boilers capable of handling between 150 and 750 tons of refuse per day, ...
2. After incoming refuse trucks are weighed, they enter a building and unload into a storage pit therefore ... .
3. The building protects the pit from the environment and controls dust and odours due to ... .
4. Because of cranes' mixing and loading refuse into the boilers, ...
5. As mixing produces a more homogenous fuel which improves the operation of the furnace, ...
6. Oversized and undesirable materials could cause ... .
7. By charging each boiler every five or six minutes, ...
8. As an alarm drops below a prescribed limit, ...
9. The furnace is cooled with water because ... .
10. The design of a refuse-to-energy plant must include means of scrubbing flue gases and removing ash since ... .

5. EXPRESSING "CAUSE-EFFECT" IDEAS.

Change the following sentences to express cause-effect relations. The following sentences express conditional relations.

1. If there were dreams to sell, what would you buy? *(Th.L Beddoes)*
2. If I'd known I was gonna live this long, I'd have taken better care of myself. *(E.Blake on reaching the age of 100).*
3. If my books had been any worse, I should not have been invited to Hollywood, and if they had been any better, I should not have come. *(R.Chandler)*
4. If an elderly but distinguished scientist says that something is possible he is almost certainly right, but if he says that it impossible he is very probably wrong. *(A.Clarke)*

How would you change the extracts below to note form

The countries are involved in the competition for fuel use / we should look at the oil crisis of the 1970s / the trend in increasing oil price many countries were looking for alternative energy sources / they wanted to be independent of other countries' fossil fuels / the examples of alternative energy sources include solar power, the harnessing of wind and waves,

tides, the production of biogas from human and animal waste and the production of alcohol from sugar, sugar beet, corn, sweet potato / there arises the problem whether to produce these crops for fuel or for food / there are two ways of using alcohol as car fuel / one such way is in the form of pure alcohol / and a second use of alcohol as a car full is in a mixture with petrol or gasoline (gasohol).

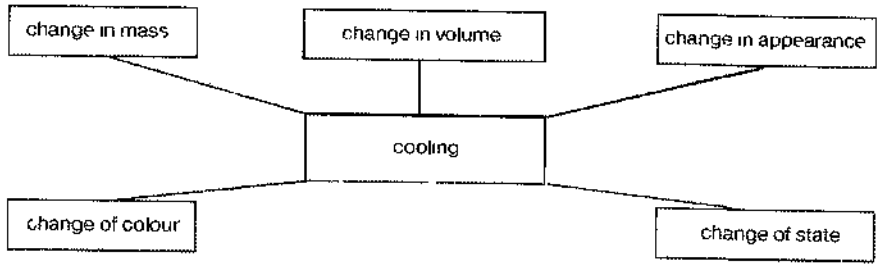
A well-balanced diet provides an adequate amount of vitamins.

Comment on the following:

Name of vitamin	Food the vitamin is found in	Results of a deficiency of the vitamin
A	milk	poor eyesight general poor health
B	eggs cheese	skin, nervous system, heart, a disease called beri-beri
C	vegetables	a disease called scurvy
D	fish	affect the growth of bones teeth

* * *

There are observable changes produced by cooling. Make sentences using your own knowledge of chemistry:



6. WRITE A SHORT ESSAY DESCRIBING THE OPERATION OF ANY HOME APPLIANCE EXPLAINING CAUSE-EFFECT RELATIONS.

UNIT 10

PURPOSE

Nature does nothing without purpose or uselessly.

Aristotle

An intention or aim, a reason.

Cambridge International Dictionary of English

1. STUDY THIS:

Purpose		
An infinitive after "in order to" ... so as to ...	For + -ing form	A clause with "so that" .., can, could, will, would, needn't

What Ukrainian expressions do the English ones correspond?

1. To lower launch costs and increase reliability and safety, the Apollo Light craft project was initiated.
2. To restict the range of the equipment application, some experiments have been carried out.
3. A special engine may be designed so that it could compensate for changes in the atmospheric air scooped up during the trip into orbit.
4. Ground or satellite-based laser beams could be used for powering spacecraft.
5. To read easily in English, it is necessary to learn the language properly.

2. TRANSLATE FOR "PURPOSE" IDEAS.

1. Laws are not made to be broken.
2. He was like a cock who thought the sun had risen to hear him crow.
3. To make a quarrel two are needed.
4. To live long, it is necessary to live slowly.
5. Houses are built to live in, and not to look on.
6. Some read to think – those are rare; some to unite – those are common; and some to talk, and those from the great majority.
7. Riches are for spending. (G.Austen)
8. For how many things, which for our own sake we should never do, dowe perform for the sake of our friends. (Cicero)
9. Art for art's sake. (V.Cousin)

10. To make a crooked stick straight, we bend it the contrary way. (M.E.Montaigne)

3. EXPLAIN WHAT FORMS EXPRESS "PURPOSE" IDEAS:

5 WAYS TO KILL A MAN

There are many cumbersome ways to kill a man:
you can make him carry a plank of wood
to the top of a hill and nail him to it. To do this
properly you require a crowd of people
wearing sandals, a cock that crows, a cloak
to dissect, a sponge, some vinegar and one
man to hammer the nails home.

Or you can take a length of steel,
shaped and chased in a traditional way,
and attempt to pierce the metal cage he wears.
But for this you need white horses,
English trees, men with bows and arrows,
at least two flags, a prince and a
castle to hold your banquet in.

Dispensing with nobility, you may, if the wind
allows, blow gas at him. But then you need
a mile of mud sliced through with ditches,
not to mention black boots, bomb craters,
more mud, a plague of rats, a dozen songs
and some round hats made of steels.

In an age of aeroplanes, you may fly
miles above your victim and dispose of him by
pressing one small switch. All you then
require is an ocean to separate you, two
systems of government, a nation's scientists,
several factories, a psychopath and
land that no one needs for several years.

There are, as I began, cumbersome ways
to kill a man. Simpler, direct, and much more neat
is to see that he is living somewhere in the middle
of the twentieth century, and leave him there.

Edwin Brock

4. READ FOR "PURPOSE" IDEAS.
Find the forms showing "purpose"

TURNING OCEAN WATER INTO FUEL

Can temperature differences in the oceans act as fuel? Definitely. Ocean surface water is warmed significantly by solar heat while, not far below, the deep water stays chillingly cold. Because of this natural and constant state, a feasible concept called Ocean Thermal Energy *Conversion* (OTEC) is now operating in the deep water off the island Hawaii.

The barge-mounted Hawaiian installation, for which the power cycle has been provided, uses warm surface water and cold deep water in a closed ammonia cycle incorporating *heat exchangers*. The generated ammonia vapour *drives* a turbine which, in turn, produces surplus electric power.

Before the turn of the century, massive Ocean Thermal Energy Conversion platforms—floating like 1,500-foot vertical buoys — may be *grouped* off-shore to generate all the electrical *needs* for large cities, using only the free and renewable ocean water as fuel.

THE FUTURE OF THE SUN

Since the energy radiated by the sun is due to the continuous transformation of hydrogen into helium in its interior, the sun evidently cannot shine for an eternity, and is bound to run out of fuel sometime in the future. It is estimated that during the 5 billion years of its existence, the core of our sun has used about half of its original supply of hydrogen, so that it still has enough nuclear fuel for anothers billion years. What will happen in 5 billion years from now, when our sun comes close to the end of its resources? To answer this question, we have to remember that thermonuclear reactions proceed almost exclusively near the center of the sun, where the temperature is the highest. Thus the shortage of nuclear fuel will be felt first in the central regions of the sun, where all the originally available hydrogen will have been transformed into helium. We can easily visualize that this will result in a rearrangement of things in the solar interior in such a way that the high-temperature region will move to the interface between the "burned-out core" and the outer layers that still contain enough hydrogen to maintain a nuclear fire. The internal structure of the sun, therefore, will be transformed from a so-called point-source model (energy source in the center) to a shell-source model in which the energy is liberated in a thin spherical shell that separates the burned-out core from

the rest of the solar body. As more and more hydrogen is consumed the "shell" will move outward from the center . . .

The formation of such a shell source inside the sun (or any other star) must result in a steady growth of the star's size and in a gradual increase of its luminosity. In fact, within a few hundred million years after the shell source is formed, the diameter of the sun is expected to become as large as the orbit of Venus, and its luminosity will increase by factor of bet-ween 10 and 20, making the oceans on the earth boil violently. After this last effort the sun will begin to shrink and fade out again, until it becomes quite. faint and insignificant. But there is no: reason for immediate panic—we still have 5 billion-years to go!

This will no doubt be the end of all life on the earth, but it is not the end for the sun and the other stars that follow a similar course in-their evolution.

THE PURPOSE OF A MAP

The purpose of a map is to express graphically the relations of points and features on the earth's surface to each other. These are determined by distance and direction. In early times "distance" might be expressed in units of time, or lineal measures — so many hours 'march or days' journey by river, and these might vary on the same map according to the nature of the country.

The other element is direction, but for the ordinary traveller, whose main concern was "Where do I go from here, and how far away is it?" the accurate representation of direction was not of primary importance. Partly lor this reason, written itineraries for a long time rivalled maps, and throughout the centuries from the Roman road map to the thirteenth—century itinerary from London to Rome of Matthew Paris and even to the Underground and similar 'maps' of today, no attempt is made to show true direction. Similarly, conspicuous landmarks along a route were at first indicated by signs, realistic or conventional, and varied in size to indicate their importance. Clearly the conventions employed varied with the purpose of the map, and also from place to place, so that in studying early maps the first essential is to understand the particular convention employed.

The history of cartography is largely that of the increase in the accuracy with which these elements of distance and direction are determined and in the comprehensiveness of the map content. In this development cartography has called in other sciences to its aid. Distance were measured with increasing accuracy 'on the ground'; then it was found that by applying trigonometrical principles it was unnecessary to measure every requisite distance directly, though this method required the much more accurate

measurement of a number of short lines, or bases. Similarly, instead of determining direction by observing the position of a shadow at midday, or of a constellation in the night sky, or even of a steady wind, use was made of terrestrial magnetism through the magnetic compass, and instruments were evolved which enabled horizontal angles to be measured with great accuracy. Meanwhile the astronomers showed that the earth is spherical, and that the position of any place on its surface could be expressed by its angular distances from the equator (latitude) and aprime meridian (longitude), though for many centuries an accurate and practical method of finding longitude baffled the scientists.

The application of these astronomical conceptions, and the extension of the knowledge of the world through exploration and intercourse, encouraged attempts to map the known world — but this introduced another problem: how to map a spherical surface on a flat sheet. The mathematician came to the rescue again — with his system of projections, by which some, but not all, spatial properties of the earth's surface can be preserved on a single map. Then the astronomers discovered that the earth is not a pefrect sphere, but is flattened slightly at the poles; this introduced further refinements, such as the conception of geodetic as opposed to astronomical latitudes, into the mapping of large areas, and great lines of triangulation were run north and south across the continents to determine the true "figure of the earth", and to provide bases for their accurate mapping.

Meanwhile, increasing demands were being made on the map maker. The traveller or the merchant ceased to be the sole user of maps. The soldier, especially after the introduction of artillery, and the problems of range, field of fire, and dead ground which it raised, demanded an accurate representation of the surface features, in place of the earlier conventional or pictorial delineation, and a solution in any degree satisfactory was not reached until the contour was invented. This again adds to the task of the surveyor who must run lines to levels and sometimes to the extent of pegging out the contour lines on the ground. Then the arch-aelogist, the historian, and much later, the modern geographer had their own special requirements, and in co-operation with them the cartographer must evolve methods of mapping all kinds of "distributions", from geological strata and dolmens, climatic regimes and plant associations, to land use and 'urban spread'. It is the present widespread recognition of the value of the map in the coordination and interpretation of phenomena in many sciences that has led to what may truly be called a modern renaissance of cartography.

Fill in the tables:

1	The purpose of	a solar power station	is to	
2		an airfreathing combi-ned-cycle engine		
3		an aft nozzle		
4		a rotary detonation wave engine		
5		an external source of power		

READY FOR LIFT OFF

The laser beam is received at a dozen specific locations on the primary optical surface that encircles the centre portion of the spacecraft.

Each of 12 secondary sets of optics condenses the reflected beam onto a special set of optics which projects a 2-cm laser beam across the plug nozzle surface. The laser energy is transferred directly into the air. In the rotary detonation wave engine air is automatically compressed, creating a high-pressure plasma finger which then expands over the plug nozzle impulse surface to produce thrust.

As the light craft accelerates, large quantities of transonic unheated air are connected into the engine.

* * *

1	The primary optical surface	is used intended designed	for	receiving condensing projecting	
2	12 secondary sets of optics				
3	A special set of opties				
4	A 2-cm laser beam				
5	A high-pressure plasma finger				

LASER TO LIFT LIGHTCRAFT INTO SPACE

Someday, it may be possible to launch spacecraft into orbit using a solar-energy-powered laser beam (light) rather than chemical fuels.

The laser beams would come from satellite-based solar power stations that convert solar energy to infrared or visible laser energy.

The solar power stations should be able continuously for more than 1000 hours.

The heart of the laser-boosted light craft concept is an air-breathing combined-cycle engine. The engine's aft external expansion plug nozzle

would serve as a heat shield during reentry to atmosphere. The combined-cycle engine operates in the mode of a rotary detonation wave engine during lift off and acceleration.

As almost all the spacecraft's energy, would be supplied externally, 10 to 30% of its launch weight could consist of useful payload.

* * *

1	The lightcraft concept could be used ...	so that	
2	Lightcraft could be used ...		
3	Lightcraft could use the same technology		
4	Solar orbiting power stations can be used ...		
5	About 500 solar power stations would be required ...		

PERSONAL SPACESHIPS

The lightcraft concept could be used not only for travel into space but also for a personalized global aerospace transport system. Here, lightcraft would be used like rental cars to transport from one to five people halfway around the world in a more 45 minutes.

Lightcraft could use the same technology and the same hardware for ultrahigh-speed intercontinental travel. The laser energy would come from the same orbiting solar power stations used to power space missions.

The study estimates that about 500 solar power stations would be required to support about 120.000 lightcraft flights per day.

5. TALK ON "PURPOSE" IDEAS.
DESCRIBE HOW THE HYDRAULIC SCOUR JET SYSTEM IS ARRANGED. EXPLAIN THE PURPOSE OF EVERY COMPONENT.

SCOURING THE HARBOUR

For a harbour to be maintained at a depth sufficient for handling high-tonnage ships, it must be kept clear of silt. The traditional method is periodic dredging. But it is very expensive and the harbour is temporarily closed for ships.

An alternative solution may be found in a hydraulic scour jet system. The system was installed commercially for the first time at the Port of Grays Harbor, in Aberdeen, Washington.

The nozzles are positioned at the base of each pier and at right angles to the natural tidal flow.

High-horsepower pumps deliver seawater to the nozzles during the scouring cycle. The newly deposited silt is re-suspended and carried away from the berth by the tide.

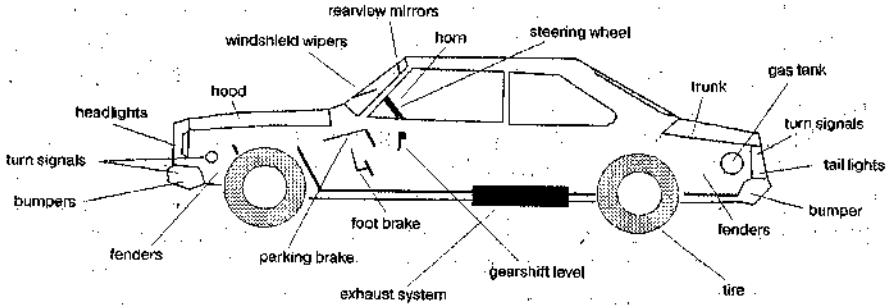
The array if submerged nozzles is connected to a 20-inch manifold pipe through which water is driven by a pair of 400-horsepower pumps at

13,700 gallons a minute. The manifold pipe is located under the pier. In this installation, 24 jets are used along a 700-foot berth. The nozzles are on 30-foot centers at a depth of 40 feet and are connected by a flexible hose to the manifold pipe. The nozzles can be individually raised to the surface by means of a cable for inspection.

The time of maximum ebb flow is computed from the tide tables.

A relief map of the harbor floor in the area of the berth is generated from this information.

6. EXPRESS "PURPOSE" IDEAS.
From your own knowledge make sentences to descibe the purpose of every part of a car.



1. to turn these on at night.
2. to use these when it rains.
3. to put gas in it.
4. to use it to stop.
5. to set it before you get out of the car to keep the car from moving.
6. to use these when you want to go left or right.
7. to cover the tires.
8. to put luggage in here.
9. to tell other drivers when you are braking.
10. to use these to see cars behind you.
11. to cover the engine.
12. to use this to warn other drivers.
13. to move this with your right hand when you change gears.
14. to turn this to steer the car.

7. WRITE A SHORT ESSAY EXPLAINING THE PURPOSE OF EVERY HOME APPLIANCE (A REFRIGERATOR, A TV-SET, A TOASTER, A VIDEO-PLAYER ...). EXPLAIN HOW IT WORKS.

SUPPLEMENTARY TEXTS

Read the texts and rephrase them to express prohibition and necessity, ability, possibility, supposition, permission, cause & effect, purpose, comparison.

BALSA-CORED FISHING BOAT

The Pettegrow 36, the round-bottomed, 36-foot boat, can be adapted to either commercial fishing or recreation. It is constructed of DuraKore. (Many sailboats have already been built of the material.)

Each form is carefully cut to size from plywood, lined up with the others, and the whole form held securely with more plywood and two-byfours. The forms are placed about three feet apart. Because of the large size of the hull, Pettegrow decided to build it in two halves, which were later joined at the keel area.

The next step is to join the eight-foot strips at their finger joints, creating strips 40 or 48 feet long. The extra length is needed so the finger joints can be staggered. Then one strip is laid at the highest point in the hull—the gunwale, midway between the keel and the shear. Care is taken to lay this strip fair, so it is lined up with the desired curve; in this case, that means ensuring that it lies flat against each of the 14 frames. Only then is it nailed (temporarily) to each form. The rest of the hull-half is built by applying a butter-like epoxy to the edge of a strip, placing the strip in the proper position, pushing it up against a strip already in place, and pressing until some epoxy works its way out the sides. Then the strip is nailed.

Because of the sharp curves—particularly in the upper hull near the bow—the strips tend not to lay fair. Pettegrow solves this problem by drilling a hole edgewise from the newest strip through into the neighboring strip, and driving in a wooden plug while the epoxy is still workable. In the future, Pettegrow hopes to make the forms closer together.

When the entire structure is laid up and the epoxy cured, the hull-half is quite stiff and can be moved about. For finishing, fiberglass running at various angles must be added to both the inside and outside of the hull to complete its resistance to bending and torsion loads.

The fiberglass strands on the Pettegrow 36 run in four different directions: along the length of the hull, across the hull, and at a 45-degree angle in each direction.

A square foot of the fiberglass hull of the Pettegrow 36 weighs only two pounds. A square foot of a comparably strong hull of solid fiberglass (which

would have to be about S-inch thick) would weigh 4.5 pounds, and even then, Pettegrow says, it would not be as stiff as the balsa composite.

ENGINEERING TECHNICAL MAGIC
Engineering analysis is serving the arts

Near the end of Bela Bartok's opera *Bluebeard's Castle,* Bluebeard's spirit is supposed to ascend into the heavens. When New York City's Metropolitan Opera staged the work during 4ts 1988-89 season, Bluebeard's ship was represented as a spaceship. The ascension was suggested by laying over one of the two 30-foot-tall by 50-foot-wide walls at the back of the set, tilting it backwards 60 degrees until it rested at a 30-degree angle. This revealed a projection of the earth, complete with swirling clouds. The wall was supposed to appear monolithic, so it couldn't wobble or shake during its descent. Additionally, because it was covered with a shiny material, it wouldn't appear flat if it deflected. To determine how to best create this effect, two of the Met's technical designers, Geoff Webb and Craig Mac-Kenzie, turned to CAE software.

Most technical designers, whose job it is to translate the vision of the set designers into actual props and backdrops, are still stuck in the eyeball engineering stage, where design decisions are based on a series of educated guesses and assumptions. They are more likely to place strain gages at various places in a finished structure to measure deflections and determine stresses than they are to perform detailed analysis before building it.

Ascending Dutchman

When the Metropolitan Opera staged *The Flying Dutchman,* the script called for the Dutchman's ship to descend to the earth from heaven. The Dutchman needed to alight from the ship on a staircase resembling the ones that drop from ocean liners. The 50-foot set of steps Webb designed for the set was essentially a large truss made of rectangular steel tubing attached to one of the galleries, or catwalks, running around the flytower of the theater. After the Dutchman's entrance, the ship needed to "fly out of sight" by being raised by a winch with a 1000-pound capacity. The Finite element analysis Webb performed helped him find the optimum structure and best material for the staircase as well as predict its behavior under unexpected loads. ("You never know exactly what a performer will do," he commented.) It also aided in the location of the structure's critical points, because it had to be constructed in pieces for later storage.

SLOW BOAT TO MARS

Five centuries after Christopher Columbus sailed to the shores of America, a flotilla of ships will take a similar journey --with a few important differences. Four unpowered, unmanned sails propelled by solar radiation will race to Mars in the Columbus 500 Space Sail Cup.

Each solar sail is folded into a small packet for launch aboard a weket. Once it is 1200 miles above the Earth, each sail will unfurl to full size to effectively catch sunlight.

The concept of a solar sail has been around since the 1920s, when Russian scientists proposed that unpowered spacecraft outside the earth's atmosphere could be accelerated through space by the sun's light pressure. NASA worked for about four years on a sail to rendezvous with Halley's comet when it most recently rounded the sun, but this project was judged too experimental in 1977 and never flew.

Italy proposed a 10.000-square-meter, aluminium – coated modal. The British entry has 24 carbon filter ribs and a polyester-film sail.

The journey to Mars, via the Moon, will take about 500 days. After reaching Mars, some of the sails may spend the rest of their lifetime taking a grand tour of the asteroids.

IGOR SIKORSKY

Avitation pioneer and engineering entrepreneur

Rotary-winged aircraft were always a vision in the fertile mind of Igor Sikorsky. For decades, he tried to build a helicopter, but success eluded him until the late 1930s. In the meantime, he built a very successful aviation business around large fixed-wing aircraft.

Sikorsky was born in Russia where he began his aviation career in 1909 at the age of 20 by attempting to build a helicopter. When his helicopter did not fly he turned to building regular aircraft. He is credited with producing the world's first successful four-engine airplane—and in the process he amassed a small fortune in rubles. In all, 75 of his aircraft were built for the czarist government for use in World War 1. During the Russian revolution of 1917, Sikorsky was forced to flee and arrived in the United States penniless, but ready to start over.

By 1923, he had founded Sikorsky Aero Engineering Corp. in New York with $800 in cash and a few thousand dollars more from stock subscriptions. His new goal was to build a twin-engine, all-metal, 14-passenger airplane. The aircraft, the S-29A, was Sikorsky's 29th design—the "A" commemorated his new home in America.

The S-29A was built on a shoestring budget. The aircraft plant consisted of a converted chicken house on a Long Island farm. His employees were other Russian immigrants who worked for the love of aviation; many held second jobs to support themselves. As often as not, homemade tools, such as metal-cutting shears made from a discarded automobile bumper that had been purchased for 50 cents, were used.

Many parts came from the junkyard or the five-and-dime store. For example, the S-29A used angle irons scavenged from bed springs in the longerons of its fuselage. The S-29A's twin engines were war-surplus 300-horsepower Hispano Suiza engines purchased for $250 each.

* * *

Some Russian immigrants who did not work for Sikorsky helped with the financing. The famous Russian pianist and composer Sergei Rachmaninoff supplied $5000 and his reputation to the project. This earned him a position as the company's vice president.

The S-29A made its maiden flight in May 1924 with Sikorsky at the controls. The flight almost ended in disaster as the S-29A was underpowered and greatly overloaded. It seems that everyone who had worked on the aircraft wanted to be on the first flight. After the flight, Sikorsky went about repairing the heavy damage and finding better engines, tires, and other parts.

One time, Sikorsky even took about 50 of his most loyal stockholders "hostage" in order to obtain desperately needed funding: the mostly friendly Russians were locked in an office where they were not allowed to leave until they came up with the $2500 needed to purchase, among other items, a couple of overhauled 400-horsepower Liberty engines.

The S-29A flew again in September 1924, this time with only three men aboard. It earned the company its first profit of $500 when it was used to transport a couple of pianos from New York to Washington. The S-29A was later purchased by the famed flyer Roscoe Turner for $11,000. Turner used the plane for charter flights, demonstrations, and advertising. He then sold it to Howard Hughes, who used it in the

World War II movie *Hell's Angels.* For the movie, the aircraft was disguised as a German bomber and crashed. This was a dramatic end for Sikorsky's first American-built airplane.

The S-29A was followed by a contract for new wings for war-surplus Curtis Jennys. The wings, which were designed by Sikorsky Manufacturing Corp. 's Michael Gluhareff, turned the lumbering Jenny into a decent performer, but few planes were sold.

Next came the S-35, an aircraft that almost ruined the struggling company when its auxiliary landing gear collapsed on take off for a nonstop

flight from New York to Paris in 1926. The plane burst into flames, killing two of the four people aboard. This left Sikorsky with a large debt and a problematic reputation. Sikorsky, however, bounced back. In the years between the two world wars, commercial aviation was rapidly opening up air routes around the world. The flying boat became the "in" craft of the era. While few cities had more than rudimentary grass airstrips, most were located on bodies of water from which seagoing aircraft could operate. In addition, the ability to land on the water provided great assurance to the passengers in the early days of commercial aviation.

Sikorsky became a leading designer and builder of seagoing aircraft. His S-37 seaplane was a candidate for a pioneer nonstop transaltantic flight until it was upstaged by Charles Lindbergh's historic solo flight in 1927.

* * *

One of Sikorsky's more successful aircraft was the twin-engine S-38 amphibian that made its maiden flight in June 1928. Up until the S-38, Sikorsky had built only 10 aircraft in the United States. A total of 114 S-38s were built. They were used by 10 different airlines to pioneer commercial air travel in the Western Hemisphere. Pan American World Airways used many S-38s on its air routes to Central and South America. With a top speed of 130 mph, it could carry eight people and a crew of two over distances as long as 600 miles. The S-38 was also used by the military and by the explorers and filmmakers Martin and Osa Johnson, who flew a zebra-striped S-38 on many of their African expeditions.

In 1928, the Sikorsky Corp. moved to its current home in Stratford, Conn. A year later, it became part of what would become United Technologies Corp.

The S-38 was followed by a smaller flying boat, the single-engine, four-passenger S-39 and the huge four-engine S-40. The S-40 could carry 44 passengers, making it the largest American flying boat of the time. The S-40 earned the distinction of being the first of the famed Pan American "Clippers" when three of these giant four-engine aircraft were built for Pan Am in the early 1930s. With their 950-mile range, they opened up new air routes in Central and South America.

The S-40 was followed by the 39-passenger S-42. Ten of these four-engine Clippers were built for Pan American. In 1935, the S-42 surveyed commerical air routes across the Pacific and in 1937 it helped chart Atlantic routes. As a transoceanic carrier it had a range of up to 3000 miles with a cruising speed of 160 mph. The S-42 established 10 world records in 1934, flying higher, faster, and with a heavier payload than any other flying boat in the world.

The next model, the 19-passenger, twin-engine S-43 flying boat,

brought air service to many remote parts of the world for the first time. The last fixed-wing aircraft to carry the Sikorsky name was the S-44. This flying boat evolved from a Sikorsky experimental patrol bomber, the XPBS-I, to become perhaps the most successful commerical flying boat. This four-engine aircraft was capable of flying the Atlantic nonstop and versions were used by the Navy for patrol duty. The last S-44 was built in 1942.

* * *

Even with his successful flying boats, Sikorsky never gave up his dream of building a helicopter. He continued to work on rotary-winged craft, mostly in his spare time. In 1931 he applied for a patent on his helicopter design; the patent was awarded in 1935. However, a successful production helicopter still eluded him, mainly because of the lack of engines that were both powerful and light enough.

When he found a 75-horsepower engine, Sikorsky built a tubular steel frame and created the VS-300, a design that allowed for easy modifications. On September 14, 1939, Sikorsky flew the VS-300 helicopter for the first time.

The impending start of World War II gave the impetus to many new inventions with wartime potential. Sikorsky's helicopter was rushed into development and hundreds of improvements were made over the next couple of years. In May 1941, the revamped VS-300, powered by a 100-horsepower engine, set an endurance record for helicopters by remaining aloft for over l'/2 hours.

By 1941, the U.S. Army had awarded Sikorsky a contract to build the XR-4, an experimental two-place chopper, which was delivered to the Army in May 1942. As World War II was coming to an end, R-4s were coming into service. In January 1944, the U.S. Coast Guard used one of the first R-4s to deliver vitally needed blood plasma to victims of a ship explosion during a snowstorm near Sandy Hook, N.J. The R-4s also performed numerous mercy missions, rescuing downed airmen in Burma. Sikorsky always thought of the helicopter as a lifesaver rather than as an instrument of war. The military soon saw otherwise.

After the war, the military found many uses for the helicopter beyond its original search-and-rescue mission; there were also many civilian applications. Sikorsky continued to be a leader in the design and production of the helicopter.

Since Igor Sikorsky's talents were in engineering, he left the day-to-day management of the company he founded to others, spending most of his time, until his death in 1972, pursuing new ideas. Indeed, he was still on the job as an engineering consultant the day before he died at the age of 83.

APPENDIX 1

Nouns that are always singular

Some nouns are always singular in English. Compare "money" with "coins" and "notes".

Advice	He gave me **much** excellent **advice.** All his **advice was** helpful.
Damage	All the **damage was** done during July. **Damage**, to buds and shoots of spruce heavy.
Equipment	All **equipment was** purchased in January. Different **types** of equipment **were** tested.
Evidence	Further **evidence** is needed. Several **lines/types** of evidence **indicate** that ... Much of the **evidence** is ...
gear [=equipment]	The **gear** is simple. Different **types** of gear **are** needed for sampling.
Glassware	All **glassware is** heated to 180°C.
Information	Much **information is** needed on many points. Individual ants convey **scraps of information** ... an **item**/a **piece**/ a considerable **amount**/ **of information** a large **fund of information** on the subject
Knowledge	Most of our **knowledge is** limited to a few species. All **knowledge is** assumed to be tentative. A **good knowledge** of all these aspects is essential.
Work [= energy]	The **work** done by a moving force **is** measured in joules.
work [= research]	The **work** of Mendel **was** overlooked for 35 years. Much of the earlier **work** was not valid.

Nouns that have specific plural forms

analysis	*аналіз*	analyses
apparatus	*прибор*	apparatus or apparatuses
axis	*ось*	axes
basis	*базіс, основа*	bases
crisis	*кризис*	crises
criterion	*критерій*	criteria
curriculum	*навчальний план*	curricula
datum	*дана величина*	data
erratum	*опечатка*	errata
foot	*нога (ступня)*	feet
formula	*формула*	formulae
index	*індекс*	indices
locus	*траєкторія*	loci
maximum	*максимум*	maxima
medium	*середовище*	media
minimum	*мінімум*	minima
phenomenon	*явище*	phenomena
radius	*радіус*	radii
stimulus	*стимул*	stimuli
stratum	*слой*	strata
terminus	*кінцева станція, мета*	termini
thesis	*тезіс*	these
tooth	*зуб*	teeth

APPENDIX 2

List of Irregular Verbs

(In alphabetical order)

A

arise	arose	arisen	**підніматися**

B

bear	bore	borne	**носити**
become	became	become	**становитися**
begin	began	begun	**починати**
bend	bent	bent	**згинати**

	bind	bound	bound	**зв'язувати**
	bleed	bled	bled	**стікати кров'ю**
	blow	blew	blown	**дути**
	break	broke	broken	**ломати**
	breed	bred	bred	**вирощувати**
	bring	brought	brought	**приносити**
	burn	burnt/burned	burnt/burned	**горіти**
	burst	burst	burst	**розриватися**
	buy	bought	bought	**купувати**
C				
	cast	cast	cast	**бросати**
	catch	caught	caught	**ловити**
	choose	chose	chosen	**вибирати**
	cling	clung	clung	**чіплятися**
	come	came	came	**приходити**
	cost	cost	cost	**коштувати**
	creep	crep	crept	**повзти**
	cut	cut	cut	**різати**
D				
	deal	dealt	dealt	**мати справу з**
	dig	dug	dug	**копати**
	do	did	done	**робити**
	dream	dreamt/dreamed	dreamt/dreamed	**мріяти**
	drive	drove	driven	**водити (машину)**
E				
	eat	ate	eaten	**їсти**
F				
	fall	fell	fallen	**падати**
	feel	felt	felt	**почувати**
	feed	fed	fed	**годувати**
	fight	fought	fought	**боротися**
	find	found	found	**знаходити**
	fly	flew	flown	**літати**
	freeze	froze	frozen	**замерзати**
G				
	give	gave	given	**давати**
	go	went	gone	**йти**
	grind	ground	ground	**терти**
	grow	grew	grown	**рости**

H				
	hang	hung	hung	**вішати**
	have	had	had	**мати**
	hide	hid	hidden	**ховати**
	hit	hit	hit	**ударити**
	hold	held	held	**тримати**
	hurt	hurt	hurt	**спричинити (біль)**
K				
	keep	kept	kept	**тримати**
	know	knew	known	**знати**
L				
	lay	laid	laid	**положити**
	lead	led	led	**керувати**
	lean	leaned/leant	leaned/leant	**опиратися**
	leap	leaped/lept	leaped/lept	**плигати**
	learn	learnt/learned	learnt/learned	**вивчати**
	leave	left	left	**лишати**
	lend	lent	lent	**позичати**
	let	let	let	**дозволяти**
	light	lighted/lit	lighted/lit	**освітлювати**
M				
	make	made	made	**робити**
	mean	meant	meant	**означати**
	meet	met	met	**зустрічати**
P				
	pay	paid	paid	**платити**
	put	put	put	**покласти**
	read	read	read	**читати**
	ride	rode	ridden	**їхати верхи**
	ring	rang	rung	**звонити**
	rise	rose	risen	**підійматися**
	run	ran	run	**бігати**
S				
	say	said	said	**казати**
	see	saw	seen	**бачити**
	sell	sold	sold	**продавати**
	send	sent	sent	**посилати**
	set	set	set	**установити**
	shake	shook	shaken	**трясти**

shine	shone	shone	**сяяти**
shoot	shot	shot	**стріляти**
shrink	shrank	shrunk	**скорочуватися**
shut	shut	shut	**закривати**
sing	sang	sung	**співати**
sink	sank	sunk	**тонути**
sit	sat	sat	**сидіти**
sleep	slept	slept	**спати**
slide	slid	slid	**ковзати**
smell	smellt/smelled	smellt/smelled	**нюхати**
speak	spoke	spoken	**говорити**
spell	spelt/spelled	spelt/spelled	**казати по буквам**
spend	spent	spent	**проводити**
spin	spun	spun	**крутити**
spread	spread	spread	**розповсюджувати**
spring	sprang	sprung	**плигати**
stand	stood	stood	**стояти**
steal	stole	stolen	**красти**
stick	stuck	stuck	**втикати**
sting	stang	stung	**жалити**
strike	struck	struck	**ударяти**
swear	swore	sworn	**ругатися**
sweep	swept	swept	**подмітати**
swim	swam	swum	**плавати**
swing	swung	swung	**качати**
T			
take	took	taken	**брати**
teach	taught	taught	**навчати**
tear	tore	torn	**розривати**
tell	told	told	**казати**
think	thought	thought	**думати**
U			
understand	understood	understood	**розуміти**
W			
wake	woke/waked	woken	**будити**
wear	wore	worn	**носити**
win	won	won	**вигравати**
wind	wound	wound	**заводити (годинник)**
write	wrote	written	**писати**

Quick irregular verb chart

bleed	bled	bled
breed	bred	bred
creep	crep	crept
deal	dealt	dealt
feal	felt	felt
feed	fed	fed
keep	kept	kept
lead	led	led
leap	lept	lept
leave	left	left
mean	meant	meant
meet	met	met
read	read	read
sleep	slept	slept
sweep	swept	swept
bend	bent	bent
lend	lent	lent
send	sent	sent
spell	spelt	spelt
spend	spent	spent
begin	began	begun
ring	rang	rung
shrink	shrank	shrunk
sing	sang	sung
sink	sank	sunk
spring	sprang	sprung
sting	stang	stung
swim	swam	swum
blow	blew	blown
fly	flew	flown
grow	grew	grown
know	knew	known

arise	arose	arisen
drive	drove	driven
ride	rode	ridden
rise	rose	risen
shine	shone	shone
write	wrote	written

bring	brought	brought
buy	bought	bought
catch	caught	caught
fight	fought	fought
teach	taught	taught
think	thought	thought

broad	broad	broad
burst	burst	burst
cast	cast	cast
cost	cost	cost
cut	cut	cut
hit	hit	hit
hurt	hurt	hurt
let	let	let
put	put	put
set	set	set
shut	shut	shut
spread	spread	spread

bind	bound	bound
find	found	found
grind	ground	ground
wind	wound	wound

bear	bore	borne
swear	swore	sworn
tear	tore	torn
wear	wore	worn

break	broke	broken
choose	chose	chosen
freeze	froze	frozen
speak	spoke	spoken
steal	stole	stolen
wake	woke	woken

lay	laid	laid
make	made	made
pay	paid	paid
say	said	said

cling	clung	clung
dig	dug	dug
hang	hung	hung
spin	spun	spun
stick	stuck	stuck
strike	struck	struck
swing	swung	swung
win	won	won

eat	ate	eaten
fall	fell	fallen
give	gave	given
hide	hid	hidden
sell	sold	sold
shake	shook	shaken
slide	slid	slid
take	took	taken
tell	told	told

become	became	became
come	came	came
do	did	done
go	went	gone
have	had	had
hold	held	held
run	ran	run
see	saw	seen
shoot	shot	shot

sit	sat	sat
stand	stood	stood
understand	understood	understood
burn	burnt/burned	burnt/burned
dream	dreamt/dreamed	dreamt/dreamed
hang	hanged	hung
lean	leaned/leant	leaned/leant
leap	leaped/lept	leaped/lept
learn	learnt/learned	learnt/learned
light	lighted/lit	lighted/lit
smell	smellt/smelled	smellt/smelled
spell	spelt/spelled	spelt/spelled
wake	waked	woke

APPENDIX 3

GRAMMAR IN USE

Description of a process or procedure

When we give a **general description of a process or procedure, we use:** the present passive tense (is produced, are used, is designed)

When we describe a particular procedure, we use: the past passive tense (was produced, were made, was designed)

When we describe a sequence or order, we use: the present active tense (it heats ..., it melts, it becomes liquid).

For example:

Deformation is the process in which an object's shape or form is changed permanently, e.g. the deformation of a rubber band by an excessive force, causing a permant change in shape. Deformation is also the amount by which an object is deformed from its natural state or the increase in length, e.g. when a metal wire is extended beyond its elastic limit, or when a long wire is stretched, there is a deformation of 3 cm.

Absorption is the formation of a thin layer of a substance attached to the surface of a solid or liquid, e.g. a clean metal surface in contact with a gas is quickly covered by a thin layer of the gas. Molecules of the gas are held on the surface by physical or chemical forces. Often the layer is only one molecule thick. In some cases it may be two or more molecules thick. In adsorption the substance is held on the surface, in absorption it penetrates into the interior of the materials.

Electromagnetic radiation. The first electromagnetic waves were produced by Hertz (in 1888) using the apparatus shown. A_1 and A_2 were two square metal plates, one above the other, forming a kind of capacitor. The induction coil charged the capacitor, and when the insulation between T_1 and T_2 broke down, sparks passed between the knobs, forming a damped oscillatory current. The oscillatory current consisted of accelerating electric charges, which produced a changing electric field, in turn inducing a magnetic field at right angels to the gap between the knobs. A pattern of changing electric and magnetic fields was thus produced by the oscillatory current. Some of the lines of force formed closed loops which travelled into space carrying away some of the kinetic energy of the charges. An electromagnetic wave was produced with the electric vector parallel to T_1T_2; the corresponding magnetic vector was perpendicular to T_1T_2, and both vectors were perpendicular to the wave direction. A coil of wire, of one turn, with a gap between two knobs, R_1 and R_2, was held in a vertical plane in line with T_1T_2; it became linked with the magnetic field and an e.m.f. was induced in it, resulting in a spark discharge between R_1 and R_2. With the coil at right angles to T_1T_2, no spark discharge took place, so the radiation was polarized. Using the apparatus, the radiation was shown to have all the properties of a wave: it could be reflected from a metal sheet, refracted by a non-conductor such as paraffin wax, and exhibited interference and the formation of stationary waves.

APPENDIX 4
GRAMMAR IN USE
Description of a mechanism

1. The basic structure of a formal definition: an A is a B that C.
2. Purpose (what it is used for).
3. Cause and effect (what it does): basic operating principle.
4. Location (where it is used).
5. Time (when it is used).
6. Comparison (advantages & disadvantages)

For example:

Mercury-in-glass thermometer. This is the commonest type of thermometer, the device of measuring temperature. Mercury has a sufficiently high coefficient of expansion; it is opaque, does not wet glass, and is a good conductor of heat. Its melting point is –39°C and its boiling point 357°C. By filling the empty space above the mercury with nitrogen to increase the pressure, the thermometer can be used up to 500°C. The thermometer has a bulb which is a reservoir for the mercury. This leads into a fine capillary tube. A rise in temperature causes the mercury to expand up the capillary. The capillary is calibrated for the chosen temperature scale (usually the Celsius scale).

Turbine. There are four broad classes of turbines: water (hydraulic), steam, wind, and gas. The most important application of the first three is the generation of electricity, while gas turbines are most frequently employed in aircraft to provide the motive power for jet propulsion. The principles of turbine operation were applied in ancient times. The waterwheel, the ancestor of the water turbine, was used for grinding grain by the Romans about 70 BC. Early devices of this sort were simple paddle wheels immersed in streams where the flow of water was available to turn the wheels. A precursor of the steam-driven turbine was supposedly constructed by Hero of Alexandria about the 1st century AD. This device operated on the principle of reaction; rotation was achieved by steam issuing from curved tubes in a manner similar to that of water issuing from a rotating lawn sprinkler. The windmill, from which the modern wind turbine developed, was already in use by the mid-7th century AD in Persia. Windmills with vertical sails on horizontal shafts appear to have reached Europe through contact with the Arabs several hundred years later.

APPENDIX 5
GRAMMAR IN USE
Description of a diagram

In a diagram two or more quantities are compared and causally related to a certain degree and under certain conditions and the process or procedure is described (place, time, purpose).

For example:

PROPERTIES OF STEAM

To understand the properties of steam, imagine a vertical cylinder containing one pound of water. On the water is a weighted movable piston exerting a constant pressure on the contents. Imagine the water is initially at room temperature. In this condition it is called subcooled liquid because it exists at a temperature below its boiling point. It occupies the volume indicated at point A. Next, imagine heat is slowly added to the water unit it reaches the boiling point temperature and volume shown by point B, which is slightly greater than A. In this condition the water is in the saturated liquid state. The volume is often designated by the symbol v_f, it is specific volume of the saturated fluid (liquid). If still more heat is added, boiling occurs and steam is formed under the piston, forcing it upward.

When liquid and steam coexist, it means that the water exists in two physical forms; liquid and gas. As long as this condition exists, the mixture will remain at its boiling point temperature because additional heat will merely cause more water to boil. Similarly, if heat is withdrawn, some of the steam will condense but the temperature will not change. Between points B and D, therefore, the temperature is constant and will depend only on the pressure exerted by the piston.

If enough heat is added to vaporise the last droplet of liquid, the entire volume will be occupied by steam. Under this condition the steam is dry saturated

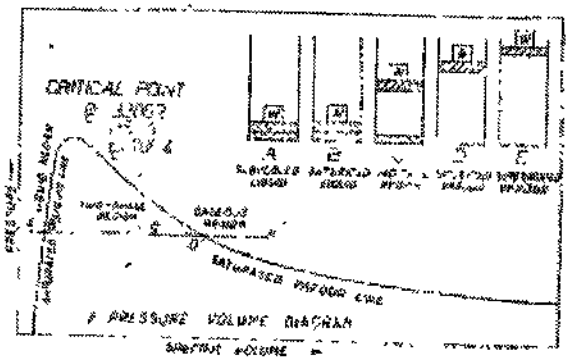
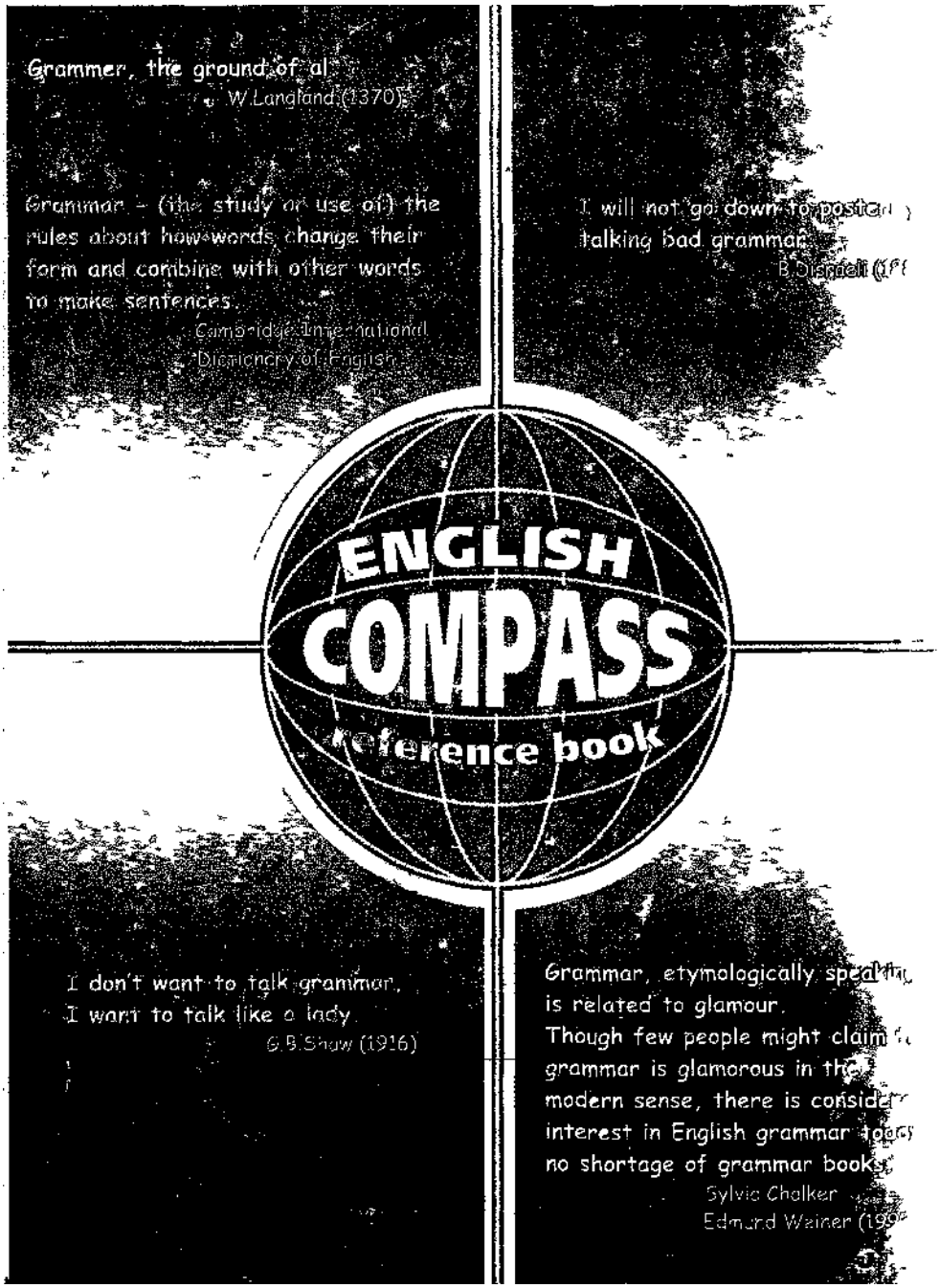


Diagram illustrations the behaviour of steam. In the two-phase region (C) both saturated liquid and saturated vapour are present

and will be shown by the point D. Its volume is usually designated by the symbol v_g, meaning specific volume of the saturated gas (vapour). If still more heat is added, there will no longer be any liquid to boil and the temperature will rise. In this condition the steam is superheated, which means that it is heated above its boiling point temperature. The volume of a pound of superheated steam is greater than that of a pound of saturated steam at the same pressure (E).

CONTENTS


Grammer, the ground of al
W.Langland (1370)
Grammar – (the study or use of) the rules about how words change their form and combine with other words to make sentences.
Cambridge International Dictionary of English
I will not go down to posteri
talking bad grammar.
B.Disraeli (1
ENGLISH
COMPASS
reference book
I don't want to talk grammar.
I want to talk like a lady.
G.B.Shaw (1916)
Grammar, etymologically spea
is related to glamour.
Though few people might claim
grammar is glamorous in the
modern sense, there is consid
interest in English grammar to
no shortage of grammar books.
Sylvia Chalker
Edmund Weiner (19