ФЕДЕРАЛЬНОЕ АГЕНТСТВО ПО ОБРАЗОВАНИЮ

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Кафедра иностранных языков

Инновационная образовательная программа

«Опережающая подготовка по прорывным направлениям развития науки, техники и гражданского общества на основе формирования инновационно-образовательного пространства классического университета в партнерстве с академической наукой, бизнесом, органами власти с использованием мирового опыта в области качества образования и образовательных технологий»

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UNIT 1

Phonetic exercises:

Ex.1.Read the words first in columns and then in lines:

[I:]	[I]	[e]	[æ]	[^]	[a:]
bean	bin	Ben	ban	bun	barn
beat	bit	bet	bat	but	Bart
bead	bid	bed	bad	bud	bard
peak	pick	peck	pack	Puck	park

Ex. 2. Read the following phrases several times, paying attention to the sounds.

Each time try to pronounce it faster:
An accident happened to my brother Jim.
Somebody threw a tomato at him.
Tomatoes are juicy and don't have skin
But that one was specially packed in a tin.

Mr .Slim and Master Jack
Sister Jane and Mr. Slack
Drink their tea completely black.
But Miss Knee and Philip Speaker
Take their tea a little weaker.

It isn't his business!

Memory work

THE ENGLISH

They dress in what they like;
They are interested in sport;
They partake in all activities
If they think they ought.
They all succeed in doing
Their work in five short days,
Which leaves them the two longest ones
To spend in different ways.
Then some indulge in gardening.
Or walking in the rain
And some delight in cricket,
Or in riding in the plain
In spite of what's around him.
The average Englishman
Does crossword in the newspaper
In pencil− if he can.
Involved in any accident
The English take a pride
In being unemotional;
They take things in their stride.
In any circumstances
Whatever they may be −
The English solve their problems
With an English cup of tea.

Lexical and grammar exercises:

Ex.3. Put the words in the **right order** and translate the sentences (see Appendix 1):

1. And / for/ of interest / related materials / amorphous alloys / applications / a diverse range / are.
2. To do / these changes / nothing / the difficulty / with / has.
3. A full review / it is not appropriate / the mechanical properties / here of / to undertake / of amorphous alloys.
4. Among the features of / these are just discussed/ there are / some particular to / shear bands / wear scars / the vein pattern and / amorphous alloys / the inducing of crystallization.
5. Do not possess / understanding of / any / cause and effect / we / accurate.
6. Chemical effects / was playing / in the wear / shown in Fig.9 / the dominant role / to be strong / because/ it / for these tests / was concluded that / oxidation / would be expected / in the results.
7. The new model / with the help of / can be done away / these effects.
8. At a higher speed / is / the alloy richer / consistent with / in nickel / to be / this difference / to show / more oxidation resistant / its transition / would be expected / and therefore / the oxidation mechanism / as.
9. Earned / among / the scientist / great popularity / his colleagues / the achievements.
10. And / occurs / of annealing / by nucleation / the more extreme consequence /crystallization / which is / growth.
11. Under rather / both arithmetic / making it possible / electronic computers / perform / and logical operations, to control / complicated conditions / the process.
12. Whang and Giessen / sliding or / simple correlation / already discussed / between / abrasive wear resistance / there is no / and / showed that / hardness / in the previous section / the work of.

Ex.4. a) Study the following means of coordination denoting **addition**:

In addition	Moreover
Also	Furthermore
As well as	Besides

b) Read and translate the sentences:

1. *In addition*, the prior β-grain boundaries are effective sites for heterogeneous nucleation of α.

2. *In addition* to depending upon the acceleration, force also depends upon the mass of the object.

3. *Furthermore,* one need not even know how to make the reaction in question occur.

4. *Moreover*, in the last years these aspects have been improved by the adaptation of a new technology: the teleoperation.

5. The map *also* reveals that regions of space containing large quantities of luminous matter almost always *also* contain large quantities of dark matter, which is exactly what physicists would expect to see if the gravitational collapse of dark matter was responsible for the structure in the Universe.

6. *Besides* being important for industry oxygen is *also* important for medicine.

7. A*dditionally*, it was deduced that within such a period of time Antarctica could not drift from the equator to the South Pole.

8. Leggett's discovery that several simultaneously broken symmetries can appear in condensed matter is, however, of more general importance for understanding complex phase transitions in other fields *as well, as* liquid crystal physics, particle physics and cosmology.

9. *Moreover*, there is little sign of exhaustion of any one technique and still there are signs of new ones coming along− for example the use of nuclear magnetic resonance, on the one hand, and of computers, on the other.

10. The Internet is a tool of communication, a place for people *as well as* for extensive information.

c) *Fill in the gaps with the linking words above*:

11. It allows inexpert users to elaborate data and build a model making use of data manipulation tools… clustering and decision tree induction algorithms.

12. …, the planet has 1.500 times less water vapor than Earth.

13. Surface amorphisation can … be achieved by ion or electron irradiation.

14. …, a small diffusion of hydrogen from the external core of the Earth through the mantle allows to explain the mechanism of the generation of water on the Earth.

15. …, the phenomenon is of great interest to current researchers because the transit of Venus may shed light on a hot topic in modern astronomy: the detection of planets in other solar systems.

Ex. 5. a*) Translate the following scientific expressions into Russian*[1]:

1. The present article / report is about / is concerned with / is devoted to …
2. This essay / paper deals with / centres on / concentrates on / touches upon / focuses on / presents …
3. The main concern of this paper will be on …
4. The paper presents the analysis …
5. The discussion will be concentrated on …
6. I shall confine my attention strictly to ...
7. We shall concern ourselves with the problem of …

b*) Translate into English:*

8. Нас интересует …
9. Мы хотели бы сосредоточиться на …
10. Нас в основном (прежде всего) интересует …
11. Важно, чтобы мы сосредоточились на …
12. Я сосредоточу внимание в основном на …
13. Книга охватывает широкий круг проблем.
14. Мой доклад будет сосредоточен на следующих вопросах …
15. … будет рассмотрено здесь.
16. В работе дан сравнительный анализ …

[1] Миньяр-Белоручева А.П. Англо-русские обороты научной речи: Практикум. М., 2004.

17. В данной работе мы представим …

Reading and speech exercises:

Ex. 6. a) *Read the extract from the article and define its main idea:*

In 1898, when Otto von Bismarck was an old man, a journalist asked him what he saw as the decisive factor in modern history. He replied: “The fact that the North Americans speak English”. This Bismarckian alarm, says Geoffrey Nunberg, of Stanford University in California, now has a new significance. For electronic media that bind the world together are essentially carriers of language. To work efficiently they need a common standard. The personal computer (PC) has one: Microsoft’s operating system, Windows. The Internet has another: TCP/IP, its Esperanto or transmission protocol, which allows computers anywhere in the world to hook into it, whether they are PCs or rival APPLE Macs. The English language is now the operating standard for global communication.

In fact, electronic communications have affected, and will continue to affect, language in three distinct ways. First, they change the way language is used. Secondly, they have created a need for a global language− and English will fill that slot. Third, they will influence the future of other languages, which people will continue to speak.

Start with the simplest sort of change: the way English is used in electronic converse. The language of electronic chat is splattered with abbreviations that make it not just faster to type but also impenetrable to the novice. Plenty of activities have vocabularies of their own, badges of identity for the cognoscenti: think of motoring enthusiasts. So, too, with electronics.

Technology is, after all, fertile ground for vocabulary. Technology and science, including medicine, together account for 50−60% of the new words in the addenda pages of Webster Third New International Dictionary.

Not only is the vocabulary of electronic communication different from ordinary English; so is the way in which it is used. In his magisterial "Cambridge Encyclopedia of the English Language", David Crystal argues that broadcasting has already created some novel language forms.

One is for sports: "Because commentary is an oral reporting of ongoing activity, it is unlike other kinds of narrative (which are typically reported in past time)". Indeed, it is unlike any other kind of speech. A radio commentary is a particularly odd creature. Charles Ferguson, an American linguist, describes it as "a monologue… directed at an unknown, unseen, heterogeneous mass audience who voluntarily choose to listen, do not see the activity being reported, and provide no feedback to the speaker."

(taken from an introduction written by John Ayto to Words).

b) *Divide in groups of three- four people, work out three or four questions to the extract and let the others answer them.*

Ex.7. Choose an article close to the subject investigated and **define its main idea.**

Ex.8. Put each of the following phrasal verbs in its correct place in the sentences below.

get down	***take down***	***try out***	***put up***
bring up	***call off***	***bring up***	***see off***

1. Don't worry about the journey to the airport. I'm coming to … you… .

2. The other car didn't stop after the accident but luckily I was able to … its number.

3. The car is in quite good condition but you can … it …before you make any decision to buy.

4. Would you like to … any other matters before the meeting closes?

5. Stop worrying about. Don't let this failure … you … .

6. I’m afraid we’ll have to … the meeting … . Alice and John can’t come.

7. Her parents died when she was eight and her uncle decided to … her …himself.

8. I’ve got a spare room, so I can … you … if you are ever here again.

Ex.9. *Idioms are key words. The following sentences all contain an idiom with one key word missing. Choose one of the four alternatives to complete the idiom.*

1. He used the business profits to … his own nest. His employees gained nothing. (*fill, feather, enrich, build)*

2. She is so quick to criticize other people. I think she should learn to set her own … in order first. (*home, house, business, place)*

3. He paid an absolute fortune for a really tiny flat. There’s not enough room to swing a … .(*cat, handbag, monkey, rope)*

4. Don’t be so impatient. You can’t hurry the decorating if you want to do it well. … wasn’t built in a day. (St. Paul’s, New York, Rome, Colossus)

5. Friends may let you down, but your family will always stand by you. Blood is thicker than … .(*tea, wine, tears, water)*

6. My car has just about had it. It’s on his last … . We’ll have to get a new one. (*legs, life, way, routes)*

7. Politics is a cut- throat business where your friends can be more treacherous than your enemies, but, as they say, “If you can’t stand the heat, stay out of the ... .(*forge, kitchen, hearth, desert)*

8. I don’t know what she’s got to be so cocky and so important about. Someone should put her … .(*place, boots, cradle, post)*

UNIT 2

Phonetic exercises:

Ex.1. *Read the words first in columns and then in lines*:

[O]	[Ó:]	[ʊ]	[ʊ:]	[ə:]
pot	pour	pull	pool	pearl
folly	floor	full	fool	fur
lot	law	look	loop	learn
wand	water	wood	wooer	word

Ex. 2. *Read the following phrases several times, paying attention to the sounds. Each time try to pronounce it faster:*

It looks good.

Let's have news of you soon.

Who'll do the rooms?

Memory Work

England! With all thy faults, I love thee still,
I said at Calais, and have not forgotten it.
I like the taxes when they're not too many;
I like a sea- coal fire, when not too dear;
I like a beef- steak, too, as well as any;
Have no objection to a pot of beer;
I like the weather when it is not rainy,
That is, I like two months of every year.

George Byron

Lexical and grammar exercises:

Ex. 3. a) *Read and translate the following sentences, paying attention to* **passive constructions**:

1. This atmospheric interference has often been made reference to by radio and TV commentators.

2. There is no doubt that in the course of further scientific development extensive use will be made of modern computing machines and electronic devices.

3. His curiosity was excited when reference was made to still earlier publications.

4. Recently the problem has been given close consideration in connection with a new space project.

5. Unfortunately no advantage was taken of the fast reaction.

6. Several outstanding contributions have been made to the study of crystal growth.

7. It must be admitted that the problem of science classification can be approached from several viewpoints.

8. The rate of the reaction is affected by the change in such parameters as concentration, temperature and pressure.

9. Some diseases may show only when an organism containing mutant genes is influenced by certain factors of the environment.

10. An alternative to the models discussed above is the steady- state theory of continuous creation referred to earlier and depicted in Fig. 1.

11. Mathematics is loved by many, disliked by a few, admired and respected by all.

12. The changes in water content will be accompanied by alterations in salt concentrations, and the latter are also affected by the ionic concentrations of the food ingested.

b) *Paraphrase the following sentences using passive constructions:*

13. These scientists have reviewed the role of texture on properties of titanium alloys.

14. Our data suggested a different reaction course.

15. Automation has given rise to a number of special problems which call for careful analysis by economists.

16. We cannot rely upon his experimental findings.

17. He has described the factors which affect the formation of these constituents in detail previously.

18. You ought to dedicate all your spare time to science, if you want to become a true scientist.

19. People should arrange Green Peace Marches.

20. Throughout this review we will refer to this microstructure as Widmanstatten α.

Ex. 4. a) *Study the following means of coordination denoting* **comparison**:

Compared to	Similar to	Unlike	Either … or …
	Like	Different from	Neither … nor …
	Alike		
	Equally		

b) *Read and translate the sentences:*

1. My preliminary ideas, however, have not yet reached *either* a general solution*, or* a practical application.

2. These corpuscles have *either* no electric charge and mass, *or* at any rate a charge and mass negligible as compared with those of the electrons, minute as the latter are.

3. *Neither* the addition of heat *nor* the combination with air increases the weight of metal.

4. This new ability to chart the evolution of dark matter through *both* space *and* time could also shed light on another elusive quantity − dark energy, which is believed to be accelerating the expansion of the Universe.

5. Secondly, because calculators are now inexpensive and portable, *compared with* the earlier generation of desk- top models, the use of them for the four basic arithmetical operations and percentages has increased enormously.

6. The solar shell *like* core of the Earth is shown in Fig. 5.7.

7. That is at the moment of the birth of the Earth (4.5 billion years ago) the end of a position vector of the electrostatic field was at 115 km below the surface, and conditions on the Earth were a little bit *similar to* the conditions existing nowadays on Venus.

8. We should not be too surprised to find that the climate in one part of the continent is very *different to* the climate in others.

9. This grain boundary α-phase is soft *compared to* the precipitation strengthened matrix and thus deforms preferentially in the region of a crack tip.

10. The distinctive deformation modes of amorphous alloys, *both* inhomogeneous *and* homogeneous, have their effects on wear behaviour.

c) *Paraphrase the sentences using the linking words in brackets, making necessary changes:*

11. The changes in the structure under heating and deformation are not the same as in conventional materials (*different from*).

12. This constituted an evolutionary advance which differs from any other known to have occurred (*unlike*).

13. To compare human and chimpanzee genes, one compares both homologue proteins and nucleic acids (*either…or*).

14. This discrepancy which is not important in the calculation being made here is probably due to both a variation in the properties of the photosurfaces and an experimental error (*equally)*.

15. I believe the loss of the accelerator is likely to put Princeton into a same position, in some respects, that of Cambridge in 1938 (*similar to).*

Ex. 5. a) *Translate the following scientific expressions into Russian:*

1. Here we need to consider the problem of …
2. The problem here to be studied …
3. I shall dwell upon the problem of …
4. The question raises all sorts of problems …
5. We are facing the problem …
6. The current interest in the problem lies in …
7. The problem which is setting is …
8. Thus the core of the problem is …
9. The problem arises in connection with …
10. The problem posed here is …
11. We turn our attention to a new and more urgent problem.

b) *Translate into English:*

12. Мы обращаем наше внимание на новую и более насущную проблему.
13. Таким образом, суть проблемы заключается в …
14. Нам необходимо поднять все… вопросы в общих чертах.
15. С этой точки зрения мы должны рассмотреть поднятый вопрос.
16. У нас нет сейчас возможности рассмотреть поднятый вопрос.
17. Обстоятельства помогают нам отказаться от разъяснения проблемы.
18. Проблема изучения … требует особого внимания к использованию методологической концепции.
19. Хотя многие аспекты проблемы остаются спорными, несомненно, что…
20. Для того, чтобы более глубоко осветить различные аспекты, необходимо.
21. В решении проблемы единственное, что может помочь, это …

22. Обычно вопрос рассматривается как …

23. Другие стороны… кратко рассматриваются в …

Reading and speech exercises:

Ex. 6. a) *Read the extract from the article and define its main idea:*

Dark- matter map points to galaxy formation

The Universe is permeated by filaments of invisible dark matter that intersect at galaxies and other major structures. This is the conclusion of astronomers from the Cosmic Evolution Survey (COSMOS), who have created the first large-scale map of the distribution of dark matter. The apparent overlap of dark matter filaments with galaxies and other massive structures adds further weight to the theory that the Universe owes its structure to the gravitational pull of dark matter (Nature doi: 10.1038/nature05497). Dark matter is fundamentally different from normal ″luminous″ matter that makes up stars, planets and humans. It is invisible to modern telescopes, giving off no light or heat, and it seems to interact with normal matter only through gravity. Although dark matter has never been observed directly, most cosmologists believe dark matter plays a crucial role in how large structures such as galaxies emerged after the Big Bang.

The COSMOS team used the Hubble Space Telescope and several terrestrial instruments to chart the position of elusive dark matter in three dimensions. This was done by observing how light from distant galaxies is bent by the gravitational pull of dark matter in a process called gravitational lensing.

The map also reveals that regions of space containing large quantities of luminous matter almost always also contain large quantities of dark matter, which is exactly what physicists would expect to see if the gravitational collapse of dark matter was responsible for the structure in the Universe. ″It’s reassuring how well our map confirms the standard theories for structure formation″, said lead researcher Richard Massey of the California Institute of Technology.

However, the survey also reveals areas with large quantities of dark matter with no corresponding luminous matter. In principle, this is also feasible because physicists believe that there is much more dark matter in the Universe than luminous matter.

While astronomers have already used gravitational lensing to map smaller regions surrounding individual galaxies, this is the first ″wide-sky″ survey that covers a region of the sky about the eight times the size of a full moon. The survey is also the first to look at dark matter in three dimensions − the third dimension being the distance (or time) travelled by the light after interacting with the dark matter. The distance was determined by combining observations made by Hubble and earthbound telescopes. This new ability to chart the evolution of dark matter through both space and time could also shed light on another elusive quantity − dark energy, which is believed to be accelerating the expansion of the Universe.

(taken from Physics Web / Hamish Johnston / January 2007)

b) Divide in groups of three-four people, work out three or four questions to the extract and let the others answer them.

Ex. 7. Choose an article close to the subject investigated and define **its main idea.**

Ex.8. Put each of the following phrasal verbs in its correct place in the sentences below.

run down	***bear out***	***make up***	***let down***
rule out	***put forward***	***put off***	***leave out***

1. I’m depending on you to pay me back the money on Monday. Please don’t … me … .

2. To cover his absence he decided to … a completely false story about being involved in a car accident.

3. If you think I’m wrong, check in the encyclopedia. I’m sure it will … me …

4. Because of pressure of work, he had to … his summer holiday until October.

5. We want to give younger players a chance in the team. That's why we've decided to … you … of next Saturday match.

6. They're very two-faced. They are very nice to her when she's there but they … her … behind her back.

7. I'd like to … a proposal. I suggest we start production in May.

8. The government intend to take very serious measures against this interference in their country's affairs. They do not … the possibility of military action.

Ex.9. Idioms are key words. Choose the right answer (A−E):

1. Some old-aged pensioners live hard lives and find it very difficult to keep … together on the small amount of money available to them each week

A. skin and bone
B. body and soul
C. head and shoulders
D. muscle and sinew
E. limb and joint

2. The pilot said that it was a … to know that, in the event of his death by accident, his family would be provided for by the company.

A. bundle off his shoulders
B. weight off his mind
C. pack off his back
D. load off his feet
E. ton off his head

3. "John, why do you read those light trashy novels all the time. Why don't you read something more serious, something you can … ?"

A. get a grip on
B. put your head into
C. lay a finger on
D. put your heel on
E. get your teeth into

4. The clerk thought that the manager was mean and unfair to his staff and he … about it either, but told him so to his face.

A. made no bones
B. lost no breath
C. had no teeth
D. gave no blood
E. held no tongue

5. George used to bully his young brother John but now that John is six inches taller than George and a champion boxer, the … .

A. arm is in the opposite sleeve
B. hand is in a different glove
C. belt is round a bigger waist
D. boot is on the other foot
E. hat is on a bigger head

6. The soldier was warned that, if he disobeyed the orders of a superior officer, he would find himself in … .

A. hot water
B. the frying pan
C. boiling oil
D. the fire
E. thick soup

7. A good general doesn't act impulsively. He always stops now and again to … of the situation before making new decisions.

A. strike a balance
B. make a sum
C. take stock
D. compile an agenda
E. get profit

8. Jim said to his friend, "Come on Joe, cheer up. I failed the examination too, so we're both in the same … . But we can try again next year."

A. boat *B. cart* *C. train* *D. vessel* *E. wagon*

UNIT 3

Phonetic exercises:

Ex.1. Read the words first in columns and then in lines:

[eiI]	*[ai]*	*[oi]*
bay	buy	boy
age	aisle	oil
page	pine	point
rate	rite	roil

Ex.2 Read the following phrases several times, paying attention to the sounds. Each time try to pronounce it faster:

What's the boiling point of oil?
The rain in Spain stays mainly in the plain.
It rises in the east,
It shines in the sky,
It gives us light,
The light is bright.
The sun isn't in the sky at night.

Memory work

My Special Friend

When life's clouds make my spirits low,
My special friend will listen.
She'll comfort me and stop the rains
Which in my sad eyes glisten.
I feel her presence in my soul

Each step along the way.
Her beauty clears from my lone path
The mist which shrouds my day.
She brings the sunrise and the light
Into my yearning heart;
But night and longing shall return
When e'er we are apart.

Steven A. Seager

Lexical and grammar exercises:

Ex.3. Read and translate the following sentences, paying attention to **gerund and gerund constructions:**

1. Since deformation is affected by alloying, grain size temperature, texture and thermo mechanical processing, so also is ductility.

2. Life is the art of drawing sufficient conclusions from insufficient premises (S. Butler).

3. Research is searching without knowing what you are going to find.

4. We succeeded in building a flexible system.

5. Besides being useful in general interpolation technique, the procedure can be effectively used to approximate the first coefficients of F.

6. Learning without thought is labour lost; thought without learning is perilous (Confucius).

7. The new opportunities may make life on this planet much more worth living.

8. Upon switching off the current the pressure dropped.

9. Thomson investigated the possibility of these cathode rays being charged particles.

10. Oxygen is an active element of the atmosphere, and in addition to being essential for the maintenance of life it is also essential for combustion, the rusting of metals and the decay of organic matter.

11. Einstein's being awarded the Nobel prize in physics soon became widely known.

12. Since sugar is a non-electrolyte it remains stationary as the current passes and provides a means for detecting any changes in concentration around the electrodes due to water molecules being carried in or out while attracted to the moving ions.

b) Open the brackets using the correct form of the gerund:

13. Without (*to know*) chemistry it is not always easy to make clear the distinction between chemical combinations and physical changes.

14. The molecules of a polar substance because of their (*to be)* reactive combine with one another.

15. Mme Curie's (*to discover*) radium enabled her to isolate other radioactive elements.

16. Besides (*to be*) important for industry oxygen is also important for medicine.

17. Most actual crystals are imperfect, owing (*to grow*) under conditions in which solid material is somewhat impeded in (to reach) and (*to deposit*) on certain faces.

18. (*To introduce*) an "ideal" substance is a favourite device in theory, but it is sometimes dangerous.

19. Pride is therefore pleasure arising from a man's *(to think*) too highly of himself (B. Spinoza).

20. There is unmistakable proof of Pauling's (to be) wrong.

Ex.4. a) Study the following means of coordination denoting **contrast:**

In spite	Although	On the contrary	Whereas
Despite	Still	However	Whilst
Though	Yet	On the other hand	

b) Read and translate the sentences:

1. As mentioned in the introduction above, crystallized materials may *still* have desirable properties.

2. *Although* procedure-oriented languages may be viewed as problem-oriented, the term 'problem-oriented' is usually reserved for languages restricted to the description of specialized problems.

3. *However*, the presence of the invariance property has a few disturbing applications.

4. A printer gets assigned temporally to a user as his own *whilst* he uses it.

5. There is *yet* another problem involved: are we to accept submissively any possible course of events, or are we to work for a future most suited for most people?

6. An understanding of these particles, *in spite of* their being connected with the basic forces of the universe, presents a tremendous challenge to the human intellect.

7 *Though* it's lightweight and pliant, the material is actually a rugged engineering plastic that has been specifically treated to give it piezoelectric properties.

8. *Despite* the challenges posed by solid-state qubits there has been no shortage of ideas about how to make them.

9. *On the other hand,* the molecules are so many that programming a single cell, let alone even an insect, is the work of life for hundreds of programmers.

10. *In contrast to* these straightforward cases, significant transient effects can also be found.

c) Fill in the gaps with the linking words above:

11. …, if Martian life resembles Earth life, there are far fewer branches on the road of evolution than believed.

12. It is the biological difference, …, which has always meant that men had done one part to play and women another.

13. … other arguments have already been produced in studies following quite a different line.

14. … the alloys contained only copper and gallium, the effects of the other elements likely to be present with gallium were also examined.

15. This section will address the former of these two categories, … the latter will be addressed in the following section.

Ex.5. a) Translate the following scientific expressions into Russian:

1. It would be instructive to examine in detail … from the point of view of …

2. We shall examine the relations between …

3. The report should introduce you to the ideas and directions of …

4. At the discussion is …

5. In the study special problems are never isolated from general problems which may help to …

6. We shall make a thorough study of …

7. It requires a detailed study of …

8. The study of … raises several interesting problems of a general nature.

9. This is achieved by comprehensive study of …

10. It requires a direct study of …

11. We hope that some aspects of the present studies will help to make … more widely known.

12. In connection with the study of various phenomena it is necessary to …

b) Translate into English:

13. Это исследование, скорее всего, связано со сравнительным изучением различных форм...

14. Детали должны быть изучены.

15. Проблема … не потеряла своей актуальности.

16. Следовательно, при изучении … необходимо принять во внимание.

17. Проблема стала более острой, она приобрела новую форму.

18. Вопрос, имеющий большое практическое значение, заключается в …

19. Эта проблема требует детального изучения.

20. Основным вопросом является …

21. Вопрос … стал особенно актуальным.

22. Изучение … имеет первостепенное значение.

23. Детальное (всестороннее, тщательное, внимательное, глубокое) изучение имеет большое значение.

24. Эта точка зрения широко разделяется многими в последнее время.

25. Всестороннее исследование … имеет особое значение для решения поставленных проблем.

26. Комплексный подход к изучению позволил мне не только тщательно проанализировать материал, но и на этой основе сделать выводы.

Read and speech exercises:

Ex.6. a) Read the extract from the article and define its main idea:

Is It Possible to Create Perfect Virtual REALITY?

Human beings have always been seeking for a better place to live, better food to eat, better people to meet. The wise have concluded that there's no perfection itself. Human's brain identifies reality by its imperfection. And thus, the attempts to create ideal world turned to creating the world alike reality − virtual reality.

On the first stage, when technology wasn't so developed, virtual reality models just presented the essence of the current processes. But along with the development of technology and science a real world model is quite similar to our life. It's still something alike, a copy but not perfect. Copying itself isn't an example to follow, but this way we may explore the universe more carefully. So what are the problems of creating perfect virtual reality − cyberspace where you can't say whether it's cyberspace or not?

One of the difficulties is that it doesn't look like reality. We can't present the needed number of colours, the full palette our eye can catch. We can't introduce

shades that really look like shades because the rendering algorithms we have are huge and approximate. And it's still not possible to show such a movie in real time.

If we'd like just to imitate the movements of molecules, which are easy to be programmed, and this way to model the reality, again, we have a great wall to be stepped over.

Our knowledge of micro world is poor and even though Einstein himself worked at the Uniform Field Theory, it is still uncompleted. On the other hand, the molecules are so many that programming a single cell, let alone even an insect, is the work of life for hundreds of programmers. Nobody can imagine the difficulty of virtualization of a human being. To model the universe we should create another one .

There are tasks to be solved before we can create 99% acceptable virtual reality: e.g. the speed of processing, fractal algorithms for rendering, quark mechanics and so on. But has anybody thought of connecting a computer to human's brain and clipping the images you and your ancestors have seen to present for someone else, or maybe using the calculating and data processing capabilities of the cortex? By the way, the process of seeing, hearing, smelling, and feeling the world is just a bunch of electric signals entering the brain. May be, the answer is here, and the distance is not the unaccomplished technical achievements, but ideas, strategic decisions, some crazy projects like the Head Of Professor Dowel. Will there be the final step to create perfect virtual reality? Let's see.

(taken from Reader's Digest. USA, 2000.)

b) Divide in groups of three-four people, work out three or four questions to the extract and let the others answer them.

c) Write the **précis** *of the article (see Appendix 2).*

Ex.7. Choose an article close to the subject investigated and define its main idea and write the **précis** *of it.*

Ex.8. Put each of the following phrasal verbs in its correct place in the sentences below.

give away	***do up***	***turn away***	***put up***
look up	***put off***	***pull down***	***turn out***

1. The authorities intend to … … these old buildings and … … a modern office block in their place.

2. They'll never believe you're American. Your British accent will …you … immediately.

3. If you persist in refusing to pay the rent for this flat, we shall have no option but to …you …

4. When I was in New York, I was able to … … several old friends I hadn't seen for years.

5. We're very sorry to have to … you …, but I'm afraid the hotel is fully booked.

6. The flat hasn't been very well looked after, but I think that after I … it … it'll look very nice.

7. The old-fashioned appearance of the hotel might … … some people, but in fact it's really modern and comfortable inside.

Ex.9. Idioms are key words. Choose the right answer (A−E):

1. The young clerk at the enquiry desk was quite rude to the old lady and so she gave him a … .

A. lump of her liver
B. piece of her mind
C. slice of her tongue
D. sight of her teeth
E. buzz in his ear

2. When we go on holiday we always stay at the cheaper hotels because in the large ones we always have to pay …

A. out of hand
B. over our heads
C. through the nose
D. under our thumb
E. from the heart

3. The soldiers defending the fort were exhausted and almost out of ammunition but they took … from the news that troops were on their way to relieve them.

A. hand *B. stomach* *C. blood* *D. foot* *E. heart*

4. The boy said to his friend, "Come on Jim, if we're late for school again we'll get it … from the headmaster this time."

A. under the thumb
B. in the neck
C. under the skin
D. behind the back
E. from the shoulder

5. The director of the firm told the chief engineer on the new project, "You are the boss and as far as I'm concerned you have … on this job as long as it is completed in time."

A. a free hand
B. an empty head
C. a loose grip
D. an open
E. a light finger

6. The old man said, "I don't like all these new-fangled ways of producing our food. I'm sure that all this artificial rearing of animals and interfering with nature will do the human race no good. I don't know how or why, but I can feel it … ."

A. under my skin
B. on my mind
C. in my bones
D. through my veins
E. up my nose

7. The chairman of the fund for helping the victims of the terrible earthquake said that it … to know that there were still some people in the world willing to help others.

A. made his blood boil
B. turned his hair white
C. put his best foot forward
D. did his heart good
E. set his teeth on edge

8. Jane is a bit of a snob; she fancies herself as a … because she listens to symphony concerts on the radio.

A. long-neck
B. broad-brain
C. blue-blood
D. wide-eye
E. high-brow

UNIT 4

Phonetic exercises:

Ex.1. Read the words first in columns and then in lines:

[aʊ]	*[oʊ]*
Ow!	Oh!
astound	a stone
grouse	growth
mount	mown
loud	load
browser	brochure
town	tone
sound	sown

Ex.2. Read the following phrases several times, paying attention to the sounds. Each time try to pronounce it faster:

Nobody knows.

Mister Brown, Mister Brown,
Are you going down town?
Could you stop and take me down?
Thank you kindly, Mister Brown.
There was a house
And a cold old house by the sea
If there were a mouse
In that old cold house
What a cold old house it would be?

Memory work

1. Archimedes plunged in water
Landing safely on tub's bottom
But seeing water on the floor
He discovered a new law.

2. It was thought the earth was ridged
And it rested on three whales;
But Copernicus declared:
Around the sun the earth rotates.

3. A new problem had been set
When an apple hit his head;
Newton cast ahead his glance −
The solution came at once.

4. There was a Dutch optician
Who invented microscope,
To find life on other planets
With the help of it I hope.

5. All the people gaped in awe
When they learnt he saw his law
Of the Periodicity of things
In his happy nightly dreams.

6. He predicted noosphere
With all people happy here
Blissful kingdom ruled by reason
In the world without treason.

7. Dr. Fleming wasn't silly
To experiment with mould
He discovered penicillin
Which is valuable as gold.

8. Lots of forecasts have been made,
But a lot of them in vain;
He who hits the target well
Will live happily and swell.

9. Tsiolkovsky was a prophet,
He foretold a cosmic flight;
But I think a cup of coffee
Will be now just all right.

Lexical and grammar exercises:

Ex.3. Read and translate the following sentences, paying attention to use of the **present participle and participial construction:**

1. The linking of the molecules is much more flexible, consisting of ad hoc bilateral or multilateral interfaces.

2. Electronic computers perform both arithmetic and logical operations, making it possible to control the process under rather complicated conditions.

3. The chemical and physical properties of these dimers are being studied.

4. Pride, the never-failing vice of fools (A. Pope).

5. Using the energy of the atom we produce electric energy at atomic plants.

6. Growing science accumulates examples of quantitative relations.

7. The overall rate of growth of the economy was seriously disappointing.

8. This tube is very similar to others, save being a bit wider.

9. Algol is a system being developed and intended to become a universal programming language.

10. Having taken everything into consideration he decided not to go there.

11. The compound being treated for several hours turned dark red.

12. Iron being treated with hydrochloric acid, we see that it goes into solution.

13. The temperature being raised, the kinetic energy is increased.

14. A new technique having been worked out, the yields rose.

15. With the structure of various companies being different, the model is often inadequate in each particular case.

16. Thus observing the arrangement of atoms in a solid, one can better understand its properties.

17. Bohr recognized the substance as having a condensed-ring system.

18. Faraday never considered bodies as existing with nothing between them but distance, and acting on one another according to some function of that distance.

19. Active centres are not to be envisaged as occupying fixed positions on the surface.

20. What is a friend? A single soul dwelling in two bodies (Aristotle).

b) Paraphrase the following sentences using the present participle or participial constructions:

21. Almost all metals are good conductors of electricity, but silver is the best conductor of all.

22. After semi-conductors had been discovered, scientists tried to find ways of applying them in different fields.

23. The mechanism which plays an important role here is still obscure.

24. The phenomena which accompany this reaction are well understood.

25. The lecturer spoke on the problems of surface pressures, and his lecture was illustrated by diagrams.

26. Everything depends on the proportion of the two substances which are distilled.

27. The atmosphere always contains some moisture, and the amount varies not only from day to day, but from hour to hour.

Ex.4. a*) Study the following means of coordination denoting* **subordination:**

After that	Before	While	First of all	Finally
Then	Beforehand	In the meantime	First(ly)	Eventually
Afterwards	Previously	Throughout	Second(ly)	
	Formerly	During	Third(ly)	

b) Read and translate the sentences:

1. *Finally,* the effect of grain size on toughness of β-alloys has not been systematically studied.

2. *During* the last few years we have witnessed remarkable progress in the space research techniques.

3. *While* isolating and separating radium, Mme Curie found other radioactive elements.

4. It was not long *before* two additional particles were found.

5. The procedure is straight-forward and is the one followed *throughout* the experiment.

6. *Finally* one must remark that, whatever validity an application of the principle of equipartition may possess, it must be applied with caution to a rotating system.

7. *Meanwhile,* the oil and gas industry bucked predictions that the North Sea's fields are entering their twilight years as reserves begin to run dry.

8. Early in 1975, Gates, by *then* a sophomore at Harvard University, and Allen, who was working as a programmer in Boston, set out to overtake the revolution.

9. A second reason for increased interest is that it has become clear that some of the most exceptional properties are obtained not in the fully amorphous alloys, which were *previously* the focus of attention, but rather in partially crystalline alloys with nanometer scale microstructures.

10. Soon *afterwards,* gamma-ray-burst afterglows were found to emit not just X-rays and gamma-rays but radiation across the entire electromagnetic spectrum.

c) Paraphrase the sentences using linking words above similar in meaning:

11. Virtually no systematic work has been done in assessing these factors, and they will not be discussed *further here.*

12. However, gamma-ray bursts do not emit equal amounts of energy in all directions, as astronomers had *previously* assumed.

13. The story starts hundreds of thousands of years *before* the explosion that creates the gamma-ray burst when a massive gaseous star runs out of fuel and sheds its outer envelope of hydrogen and helium.

14. *First,* the α-phase morphology can be controlled by varying both cooling rate and thermo mechanical processing. *Second,* the microstructure of α+β and β-alloys typically consists of a mixture of α and β-phases. This mixture contains a very high density of α/β interfaces per unit volume. *Third,* several micro structural constituents can form within the primary α and β constituents.

15. They *then* compared the model with the real orbital data and produced a graph of “residuals”, which quantify the difference between the real and modeled orbits.

Ex.5. a) Translate the following scientific expressions into Russian:

1. Our immediate aims are confined to …
2. The present book is aimed at …
3. To attain our aim we must consider …
4. In the framework of … the first objective to achieve is …
5. One of the chief aims was to test the hypothesis.
6. The purpose of my work is to examine and investigate …
7. Our intention in writing this article is …
8. Our objective is to explain …
9. We are fully aware of the nature of the objective …
10. This paper is aimed to reveal some of the features of …
11. The overall goals of … require an initial consideration of the general problem …

b) Translate into English:

12. В наши задачи не входит проведение глобального исследования.
13. Цель работы заключается в изложении в современном понимании.
14. То, к чему мы стремимся, заключается в …
15. Задачей данной главы является изучение некоторых основных причин.
16. Цель моей работы состоит в том, чтобы изучить и исследовать, и в результате более точно определить относительные и абсолютные хронологические границы.
17. Для этого можно проанализировать пример из …
18. Нашей целью в данном случае является анализ основных вопросов …
19. Цель данной работы заключается в том, чтобы привлечь внимание к …

20. Целью данной статьи является объяснение основных положений данной концепции.

21. Для осуществления этой задачи необходимо …

22. Одной из первостепенных задач являлась проверка и по возможности расширение знаний по …

23. Эта задача требует переосмысления и пересмотра.

Reading and speech exercises:

Ex.6. a) Read the extract from the article and define its main idea:

A BRIEF HISTORY OF THE FUTURE

Will we colonize the universe? Are aliens out there? Can computers outsmart us? In a unique interview, Professor Stephen Hawking, who has spent a lifetime applying his formidable intellect to the big questions, gives Nigel Farndale his predictions for the human race.

I've come here − to Cambridge University's Department of Applied Mathematics and Theoretical Physics, where Hawking holds the professorial chair once held by Isaac Newton− on the turn of the millennium to ask him what he thinks the future has in store for the human race.

If the world's population continues to grow at its present rate− doubling every 40 years − there isn't going to be enough room for us all on Earth by the year 2600. So will we, I, ask, be able to spread out to other planets? 'We shall probably manage a manned or should I say, personned, flight to Mars in the next century,' Hawking says. 'But Earth is by far the most favoured planet in the solar system. Mars is small, cold and without much atmosphere, and the other planets are quite unsuitable for human beings. We either have to learn to live in space stations or travel to the next star. We won't do that in the next century.'

I ask whether we humans will keep on changing, or will we eventually reach an ultimate level of development and knowledge? 'In the next 100 years or even in

the next twenty, we may discover a complete theory of the basic laws of the universe (the so-called Theory of Everything, in which quantum theory is unified with Einstein's theory of general relativity), but there will be no limit to the complexity of biological or electronic systems we can build under these laws.'

A few minutes pass before Hawking adds: 'By far the most complex systems we have are our own bodies. There haven't been any significant changes in human DNA in the past 10,000 years. But soon we will be able to increase the complexity of our internal record, our DNA, without having to wait for the slow process of biological evolution. It is likely that we will be able to redesign it completely in the next 1,000 years − by increasing our brain size, for example. Of course, many will say genetic engineering on humans will be banned but I rather doubt that they will be able to prevent it. Genetic engineering on plants and animals will be allowed for economic reasons and someone is bound to try it on humans − unless we have a totalitarian world order, someone will improve humans somewhere.'

'We need to become more complex if biological systems are to keep ahead of electronic ones. At the moment computers have an advantage of speed but they show no sign of intelligence. This is not surprising as our present computers are less complex than the brain of an earthworm, a species not known for its intellectual powers. But computer' speed and complexity double every eighteen months and this will probably continue until computers have a similar complexity to the human brain.'

But will computers ever show true intelligence, whatever that might be? 'It seems to me that if very complicated chemical molecules can operate in humans to make them intelligent, then equally complicated electronic circuits can also make computers act in an intelligent way. And if they are intelligent, they can presumably design computers that have even greater intelligence and complexity.' 'On the biological side, the limit of human intelligence has been set by the size of the human brain that will pass through the birth canal,' Hawking says. 'But in the next 100 years I expect we will learn how to grow babies outside the human body so this limitation will be removed. But ultimately, increases in the size of the human brain through genetic engineering will come up against the problem that the chemical messages re-

sponsible for our mental activity are relatively slow-moving − so further increases in the complexity of the brain will be at the expense of speed. We can be quick-witted or very intelligent, but not both.'

It's time to ask the big one: will we make contact with aliens in the next millennium? He smiles. The answer is the following: 'Even if the life developed in other stellar systems, the chances of catching it at a recognizably human stage are very small. Any alien life we encounter will be much more primitive or much more advanced than us. And if it's more advanced why hasn't it spread through the galaxy and visited Earth? It could be that there is an advanced race out there which is aware of our existence but is leaving us to stew in our own primitive juices. However, I doubt they would be so considerate to a lower life form. Some people believe that the reason we have not been contacted is that when a civilization reaches our stage of development it becomes unstable and destroys itself. But I'm an optimist. I think we have a good chance of avoiding nuclear war and Armageddon.'

(Adapted from The Sunday Telegraph, 2nd January 2000)

b) Divide in groups of three-four people, work out three or four questions to the extract and let the others answer them.

c) Write the **précis** *of the article (see Appendix 2).*

Ex.7. Choose an article close to the subject investigated and define its main idea and write the précis of it.

Ex.8. Put each of the following phrasal verbs in its correct place in the sentences below.

take to	***come into***	***stand for***	***get round***
get over	***run into***	***account for***	***take after***

1. The initials V.I.P. … … very important person.

2. Scientists are mystified by the sudden increase in the world's temperature. They are quite unable to … … it.

3. I don't think he will ever completely … …his wife's death. He'll always miss her.

4. John works in that office. I quite often … … him in the streets round here.

5. I can't think of a way to … … the problem.

6. She has a very pleasant manner . I'm sure the children will … … her at once.

7. He expects to … … a lot of money in his grandfather's will.

8. My father and I have the same character. I … … him much more than my mother.

Ex.9. Idioms are key words. Choose the right answer (A−E):

1. The thief was a good liar. Even when the police said they had discovered some of the stolen goods in his house he didn't … but kept on protecting his innocence.

A. bite a lip
B. lift a finger
C. bat an eyelid
D. twitch an ear
E. curl a hair

2. When the woman found the stray dog cold and shivering outside her back door, she didn't have the … to turn it away but brought it inside and fed it.

A. nerve *B. hand* *C. heart* *D. head* *E. stomach*

3. Jane is so prim and proper at a party. I don't know why she can't … now and again and have a good time like everyone else.

A. open her eyes
B. put her finger on it
C. show a leg
D. let her hair down
E. take to her heels

4. The scoutmaster said to his troop, "Come on now boys … or we'll never get back to camp before dark."

A. shake a leg
B. turn a hair
C. bat an eyelid
D. lift a finger
E. show a hand

5. The minister was very angry because, when he went to see the director of the large firm, he was left to … in an outer office for over half an hour.

A. cool his heels
B. rack his brains
C. prick up his ears
D. hold his tongue
E. eat his heart out

6. Ever since George left the navy he has not been able to settle down to anything. He says the trouble is that he still has ….

A. a hot head
B. itchy feet
C. hot blood
D. a clean pair of heels
E. a heart of gold

7. The chief clerk was in a bad mood this morning. When I asked him if he had had a good week-end he just … .

A. trod on my toes
B. got under my skin
C. jumped down my throat
D. gave me a pain in the neck
E. stabbed me in the back

8. There was no doubt that, after the Dunkirk evacuation, and threatened with imminent invasion, Britain had her … .

A. a shoulder to the wheel
B. back to the wall
C. head in the sand
D. tongue in her cheek
E. finger in the pie

UNIT 5

Phonetic exercises:

Ex.1. Read the words first in columns and then in lines:

[k]	*[g]*
cap	gap
back	bag
hack	hag
clock	clog
curd	gird
lock	log
class	glass

[p]	*[b]*
pack	back
pea	bee
Peter	beta
park	back
pear	bear
pin	bin
posh	bosh

[t]	*[d]*
train	drain
white	wide
taunt	daunt
neat	need
wait	wade
part	bard

tend tend

[d]	*[t]*	*[id]*
prayed	preached	moderated
cleaned	pushed	waited
banned	jumped	boasted
intervened	asked	pointed
desired	developed	
competedseized	taped	selected
designed	locked	granted

Ex.2. Read the following phrases several times, paying attention to the sounds. Each time try to pronounce it faster:

It's Greek to me.
The man in the wilderness asked me
How many strawberries grew in the sea.
See a pin and pick it up,
I answered him as I thought good,
As many as red herrings in the wood.
All the day you'll have good luck,
See a pin and let it lay,
Bad luck you'll have all the day.

Memory work

If you are supposed
To write a report,
Do not be opposed,
I want you to remember
The plan I gave.
Try and do it quickly,

Begin with the plot:
First comes the Introduction,
Then the central theme,
Then "Why it is important,"
This is the scheme.
Connect with other branches,
Suggest a use,
Then goes a conclusion,
These are the clues.

Just to be safe.
I see you feeling low ,
But don't be sad.
I recommend you, students,
To take your pads.
The plan's for you to finish,
To think and write.
Then you'll be regarded.
To be very bright.

Lexical and grammar exercises:

Ex.3. a) Read and translate the following sentences, paying attention to the use of **past participle and participial constructions***:*

1. When tested this alloy showed the desired results.
2. The values so far obtained are little concerned with the problem under investigation.
3. Concealed talent brings no reputation (D.Erasmus).
4. A thing well said will be wise in all languages (J.Dryden).
5. Stated bluntly, a different set could be selected for this purpose.
6. Once designed and if designed properly a relational database is very flexible.
7. A function defined by means of a formula may have its domain restricted by the character of the formula concerned.
8. Unless otherwise specified, the word "set" in this book will refer to a set of real numbers.
9. If represented by arrows, the forces can be easily computed.
10. No number exists which has a negative value when multiplied by itself.
11. However, when attention is drawn to the results of extensive sequences of random experiments, experience has shown that the data reveal a certain statistical

regularity, as in the averages of the results obtained and as in the long run stability of frequency ratios.

12. Science accumulates examples foreseen and verified through practice.

13. The set of basic operations provided is not, in general, suited to the execution of commonly needed procedures.

14. All factors considered, we believe that the mechanism is the most likely.

15. We have the program debugged.

16. Active centres are not to be envisaged as occupying fixed positions on the surface.

17. The results were interpreted by Arnauch as pointing to the formula mentioned.

18. Only those substances which can be considered as being mixtures have a depressed melting point.

19. We know the small NH_2 group as conjugated with the ring in durene.

20. Statements, in turn, are strings of symbols from a given alphabet, composed of letters, digits and special characters.

b) Paraphrase the following sentences using past participle and participial constructions:

21. The analyses which had been made in the laboratory confirmed the hypotheses.

22. Even when an amorphous layer is formed, it is typically one in a sequence of surface layers.

23. When a liquid metallic alloy is cooled into the solid state without crystallization, a metallic glass is formed.

24. We verify the equality for our particular choice of numerical values which are involved.

25. A thorough discussion of the results which was obtained in the proceeding work has already been published.

26. After radioactivity had been discovered, we made great progress in atomic physics.

27. These compounds may be prepared by similar methods, namely, by the action of the corresponding acids upon the hydroxides or carbonates, by the action of the elements on solutions of hydroxide which was followed by evaporation to dryness and subsequent ignition to decompose the oxysalts.

Ex.4. a) Study the following means of coordination denoting **reason and purpose***:*

Because	Due to	To cause
As	So that	To lead to
Since	Owing to	To result in

b) Read and translate the sentences:

1. The inability of phosphorus atoms, *because of* their large radius, to establish triple bonds among themselves results in the phosphorus molecule having a very different structure from the nitrogen molecule.

2. Combustion may be incomplete *owing to* insufficient oxygen being present.

3. *Since* rate of reaction is dependent on the concentration of the reactants, it is apparent that the rate will decrease as the reaction proceeds, *due to* the lowered concentration of the substances taking part in the reaction.

4. *As* the solid is further heated there comes a time when the molecules break away from their neighbours.

5. *Because* a gas molecule is so tiny, its size can often be completely neglected and it can be said to be at a particular point.

6. That's *because* modifying gravity to give large-scale acceleration also *results in* unwanted small-scale alterations, such as deviations to the way the planets orbit in the solar system.

7. Astronomers already have most of the equipment to hand to start their grand survey, *as* observatories around the world are littered with outmoded telescopes.

8. Different apes split from the line that *leads to* humans at different times.

9. Raman analyzers shine laser light into a sample, *causing* molecules to emit infrared radiation, which is collected at the same point where the laser is focused.

10. *Because of* the large number of variables involved it is difficult to predict what the world would look like without the denitrification reaction, but it would certainly not be the world we know.

c) Paraphrase the following sentences using the linking words above similar in the meaning:

1. *Since* annealing is often necessary to optimize the physical properties of the alloys, it poses significant problems in applications.

2. *Because* nothing is directing allergens to the right place in immune cells, it takes a lot of allergen to generate a response.

3. Further experiments showed that these foundation species benefit the others largely *because* they shade the surface, prevent the cobbles from rolling and create crevices for smaller organisms to live in .

4. The five discontinuities shown to exist in the M region are *due to* the five sublevels in the shell.

5. *Owing to* the measures of λ being made around the pole as an axis, the apparent displacement *due to* a given Δ λ is less, the nearer the direction of the point ρ is to that of the pole, the general law being: displacement − cos β Δ λ.

Ex.5. a) Translate the following scientific expressions into Russian:

1. The conventional approach to this problem is based on …
2. Our approach is to study …
3. There are different approaches to the solution of this problem.
4. The most promising approach is …
5. Our approach may be summarized in the following way …
6. The method is based on the idea …
7. The proposed method allows us to solve the problem …
8. An analogical approach will help to distinguish a few common features …

9. This method has thrown light upon …

10. This research method provides a reasonably objective criterion …

b) Translate into English:

11. Метод исследования зависит от …

12. Самый распространенный метод …

13. Прежде чем мы начнем применять данный метод анализа мы должны рассмотреть …

14. Метод используется для установления данных.

15. Этот метод дает возможность найти ответ на вопрос …

16. Этот метод можно применить для изучения …

17. Сейчас мы обратимся к другому направлению.

18. Наша работа ведется в следующем направлении.

19. Существует ряд направлений в изучении …

20. Мы не считаем, что это единственный способ.

21. Это непосредственно связано с методами, разработанными для решения данной проблемы.

22. Любое наблюдение можно интерпретировать по-разному.

Speech and reading exercises:

Ex.6. a) Read the following article:

George Smoot Wins Nobel Prize in Physics

BERKELEY,CA − George F. Smoot, 61, leader of a research team that was able to image the infant universe, revealing a pattern of miniscule temperature variations which evolved into the universe we see today, has been awarded the 2006 Nobel Prize for physics. He shares the award with John C. Mather of NASA Goddard Space Flight Centre. The citation reads “for their discovery of the blackbody form and anisotropy of the cosmic microwave background radiation.’’

Smoot has been an astrophysicist at Lawrence Berkeley National Laboratory (Berkeley Lab) since 1974 and a Universe of California at Berkeley physics professor since 1994. Smoot becomes Berkeley Lab's 11th Nobel laureate. "A Member of the Nobel Committee called me at around 2:45 AM, he had a Swedish accent and told me that John Mather and I were sharing the Nobel Prize in physics," said Smoot. "I soon talked to someone I knew personally and by the time the phone call had ended I was convinced it was legitimate. The ceremony is December 10, which is when I have scheduled a final exam for my students so I will have to do some rescheduling. The upside though is that maybe now my students will pay more attention to me."

On May 1, 1992, at a meeting of the American Physical Society, Smoot made an announcement that essentially silenced all the scientific critics of the Big Bang theory and helped change the course of future investigation into the origin and evolution of the universe. Smoot and his research team, after analyzing hundreds of millions of precision measurements in the data they'd gathered from an experiment aboard NASA'S Cosmic Background Explorer (COBE) satellite, had produced maps of the entire sky which showed "hot" and "cold" regions with temperature differences of a hundred-thousandth of a degree. These temperature fluctuations, produced when the universe was smaller than a single proton, were consistent with Big Bang predictions and are believed to be the primordial seeds from which grew our present universe.

"At the time captured in our images, the currently observable universe was smaller than the smallest dot on your TV screen," Smoot said, "and less time had passed than it takes for light to cross that dot."

Theorists had been predicting temperature variations in the ancient universe since the Big Bang theory on the origin of the universe was first developed in the 1940s. However, until Smoot and his team announced their discovery, the cosmic background radiation, microwaves left over from the Big Bang that have taken some 15 billion years to reach Earth, had appeared to be persistently uniform. Without temperature variations there would be no ripples in the fabric of space that gravity, working over the great expanse of time, could magnify into the universe we observe

today. Since Smoot's announcement in 1992, subsequent cosmic microwave background experiments, including data from the MAXIMA and BOOMERANG balloon flights and the WMAP satellite, have confirmed and refined the original maps. With the results of his team's discovery, based on the measurements they made using Differential Microwave Radiometres (DMR) which they designed and built, Smoot provided the strongest evidence yet that the Big Bang theory is correct. As Smoot has explained, "The tiny temperature variations we discovered are the imprints of tiny ripples in the fabric of space-time put there by the primeval explosion process. Over billions of years, the smaller of these ripples have grown into galaxies, clusters of galaxies, and the great voids in space." Smoot was one of the first astrophysicists to devise ways of conducting experiments that produce data and information about the early universe.

"People have contemplated the origin and evolution of the universe since before the time of Aristotle," he said. "Although cosmology has been around since the time of the ancients, historically it has been dominated by theory and speculation. Very recently, the era of speculation has given way to a time of science. The advance of knowledge and of scientific ingenuity means that at long last, we can actually test our theories." To understand how our universe was created, Smoot focused on clues hidden in the extremely faint heat left over from the Big Bang. This relic radiant energy or cosmic microwave background radiation (CMB) has been called a "message from the beginning of time." According to theory, all space began to expand at the moment of the Big Bang and was pervaded with the physical contents produced by the leviathan explosion, including the relic CMB radiation. To this day, CMB radiation saturates all of space throughout the universe. In fact, at any given instant, every cubic metre of space is bathed in millions of photons of CMB radiation zipping along at the speed of light. In 1976, Smoot was a key member of the team that found startling evidence in the CMB which contradicted the prevailing scientific view that galaxies are spread uniformly throughout the universe. Instead, the data revealed that vast regions of space are virtually devoid of galaxies while elsewhere, billions of galaxies are clustered together. These findings met with strong skepticism but a second

set of experiments by Smoot and colleagues confirmed it. “On the galactic scale, the universe has densely crowded neighbourhoods and equally vast empty spaces,” Smoot said. The new view of the universe created by this discovery required scientists to rethink the origin of the universe. Earlier studies had shown a virtually uniform CMB temperature − 2.7 degrees above absolute zero − which is consistent with the idea that in the early universe, matter was evenly distributed. With the finding that the universe is “lumpy”, however, scientists realized there should be minute temperature variations in the CMB radiation. Smoot began a search for these tiny fluctuations in 1974, submitting a satellite was launched joining a competitive quest that at that stage involved many scientific teams. In April 1992, Smoot’s team − his group involved some 40 researchers − was ready to announce they’d found what had evaded scientists for decades.

At the May 1, 1992 APS meeting in Washington, D.C., Smoot made his historic announcement of the discovery of the hot and cold regions of differing densities in the infant universe. A map developed by the COBE team was called a “baby photo”of the universe. The map showed the universe as it looked when it was about one-ten-thousandth of its current age, or about 300,000 years after its birth.

Smoot was born on February 20, 1945 in Yukon, Florida. His father was a hydrologist for the U.S. Geological Survey and his mother was a science teacher and school principal. He studied at the Massachusetts Institute of Technology (MIT) where he earned B.S. degrees in mathematics and physics in 1966, and received his Ph.D. in physics 1970. Although his doctoral thesis was on the decay of subatomic particles, Smoot jumped to the field of cosmology for his research because he saw it as a frontier of fundamental science ripe for exploration. Smoot recalls that when he first started his career, cosmology wasn’t even considered a real science. “It was a fringe field,” he said. “Back then, you could get all of us in the field into a single room. I remember the teasing from my particle physics colleagues that real physics is done at accelerators. Today, opinions have changed. We have begun to explore the early universe, the original accelerator. The fields of particle physics and cosmology have been joined.” For his CMB research, Smoot won wide scientific acclaim and a

number of awards and recognitions including most recently the 2003 Albert Einstein Medal. He has also written a popular book about cosmology and the CMB experiments entitled 'Wrinkles in Time'.

The COBE team that Smoot headed was a large collaboration involving participants from Berkeley Lab, UC Berkeley, the NASA Goddard Space Flight Centre, JPL, UCLA, MIT, and Princeton. In addition to Smoot, team members at Berkeley Lab included astrophysicist Giovanni De Amici, data analyst Jon Aymon, and Berkeley graduate students Charley Lineweaver and Luis Tenorio. Berkeley Lab is a U.S. Department of Energy national laboratory located in Berkeley, California. It conducts unclassified scientific research and is managed by the University of California.

(Taken from the Press Release of Berkeley Lab, October 2006)

b) Divide in groups of three-four people, work out three or four questions to the extract and let the others answer them.

c) Write the **précis** *of the article (see Appendix 2).*

Ex.7. Choose an article close to the subject investigated and define its main idea and write the précis of it.

Ex.8. Put each of the following phrases in its correct place in the sentences below.

make up for	***put up with***	***be up to***	***be up to***
look down on	***do away with***	***catch up with***	***go back on***

1. If they … … … their promise, I'll never trust them again.

2. You must make your suggestion to the director. Then it'll … … … him to decide.

3. He missed a month's school through illness, so now he'll have to work hard to … … … the other pupils.

4. I don't think I can … … … this noise any longer. I'm going mad.

5. I'm sorry we had to cancel the party but to … … … it let's all go to the cinema.

6. The growing use of credit cards may ultimately … … … the use of cash altogether.

7. There are some strange noises coming from Jane's room. What on earth can she … … … ?

8. I'm afraid they are very snobbish. They … … … their poorer relations.

Ex.9. Idioms are key words. Choose the right answer (A−E):

1. "John, why do you read those light trashy novels all the time. Why don't you read something more serious, something you can …?"

A. get a grip on
B. put your head into
C. lay a finger on
D. put your heel on
E. get your teeth into

2. The clerk thought that the manager was mean and unfair to his staff and he … about it either, but told him so to his face.

A. made no bones
B. lost no breath
C. had no teeth
D. gave no blood
E. held no tongue

3. George used to bully his young brother John but now that John is six inches taller than George and a champion boxer, the … .

A. arm is in the opposite sleeve
B. hand is in a different glove
C. belt is round a bigger waist
D. boot is on the other foot
E. hat is on a bigger head

4. The soldier was warned that, if he disobeyed the orders of a superior officer, he would find himself in … .

A. hot water
B. the frying pan
C. boiling oil
D. the fire
E. thick soup

5. A good general doesn't act impulsively. He always stops now and again to … of the situation before making new decisions.

A. strike a balance
D. compile an agenda

B. make a sum *E. get profit*

C. take stock

6. Bill, who is the school goalkeeper, failed to turn up to the important match which the school lost. Now he is really in the headmaster's … .

A. brown study *D. black books*

B. dark room *E. dark shadow*

C. blue prints

7. Jim said to his friend, "Come on Joe, cheer up. I failed the examination too, so we're both in the same … . But we can try again next year."

A. boat *B. cart* *C. train* *D. vessel* *E. wagon*

8. My wife bought herself an automatic dishwasher but it's always breaking down, and as far as I'm concerned it's just … .

A. wages in the hell *D. pennies down the pipe*

B. money down the drain *E. salary down the sewer*

C. cash in the coal hole

UNIT 6

Phonetic exercises:

Ex.1. Read the words first in columns and then in lines:

[v]	*[w]*
v	we
vine	whine
vest	west
vie	why
vile	wile
vim	whim
verse	worse
very	wherry
veil	whale

Ex.2. Read the following phrases several times, paying attention to the sounds. Each time try to pronounce it faster:

When a twister twisting would twist him a twist,
For twisting a twist three twists he will twist;
But if one of the twists untwists from the twist,
The twist untwisting untwists the twist.

Whether the weather be fine,
Whether the weather be not,
Whether the weather be cold,
Or whether the weather be hot,
We'll weather the weather
Whatever the weather

Whether we like it or not.

The weaver in Vienna
Weaves wonderful velvet
But he never wears it
Since winters are warm.

Memory work

LEISURE

What is this life, if, full of care,
We have no time to stand and stare?
No time to stand beneath the boughs
And stare as long as sheep or cows.
No time to see, when woods we pass,
Where squirrels hide their nuts in the grass.
No time to see in broad daylight
Streams full of stars, like skies at night.
No time to turn and Beauty's glance,
And watch her feet, how they can dance.
No time to wait till her mouth can
Enrich that smile her eyes began.
A poor life this is, full of care,
We have no time to stand and stare.

William H. Davies

Lexical and grammar exercises:

Ex.3. Read and translate the following sentences, paying attention to **infinitive and infinitive constructions:**

1. The reward of a thing well done is to have done it (R. Emerson).

2. It is too late to lock the stable when the horse has been stolen.

3. The experiments described by Fisher, to mention only a few, indicate that the time paths can be considerably different.

4. A small computer company announced a computer small enough to set on a desktop and powerful enough to support high level language programming.

5. The operations are efficient enough to have little effect on the speed of the simulation.

6. Rotation spectra can be used to measure bond lengths.

7. In his immortal “Experimental Researches in Electricity” Faraday had been the first to use the term “ion”.

8. To go back again to the analogy of a map, potential may be compared to the heights above sea-level marked on the map.

9. The beta-particles have such small momentum and energy, as to be easily deflected in their encounters with gas atoms.

10. It is not usual for the phosphatic uranium minerals to be used as a commercial source for uranium.

11. Rusting represents the natural tendency for the iron to revert from the unstable condition.

12. The solution of this salt which we might expect to be neutral acts as a base.

13. Lansmair’s attempt to account for spectral series without the assumption of moving electrons cannot be said to possess any real value.

14. There does not seem to be any obvious correlation between the amount of various impurities and the absolute resistivities.

15. Many materials which may appear to be amorphous are really crystalline in structure.

16. The following laws were found by Snell and Descartes to hold good for all cases of simple refraction.

17. An effect reported to be due to the space charge in a retarding field was found and investigated by Marx and Meyer.

18. This was the cubic equation which was believed in ancient Egypt to be insoluble.

19. In 1886, the Allis Lake Laboratory, a privately supported institution and said to be the first fresh-water biological station in this country, was established in Wisconsin.

20. It will be necessary for the observer to remain in the dark at least ten or fifteen minutes to accustom his eyes to the darkness.

b) Paraphrase the following sentences using infinitive constructions:

21. It was found that void nucleation is more frequent in these structures.

22. People believe that gold and silver were used by the ancients prior to any other metal.

23. It is considered that the laser has caused a real revolution in technology.

24. In his Table Mendeleev left several gaps for the new and unknown elements that would be found in the future.

25. The theorists were not sure whether what the observers considered that the brightest stars in a galaxy were actually stars.

26. Numerous experiments have found that ions move as easily through a jell as through the liquid solution.

27. The speed of the particles (about ten thousand miles per second) is a bit too swift so that we'll study it in detail.

Ex.4. a) Study the following means of coordination denoting **result:**

So	Consequently	Outcome
Therefore	As a result	Thus

b) Read and translate the sentences:

1. There is no way to detect dark energy directly, *so* we have to measure its effects.

2. *As a result,* transits typically recur only four times every 243 years.

3. *Thus,* on the eve of the19th-century transits of Venus, the distance to the sun was still a value of considerable uncertainty.

4. Astronomers *therefore* did not know where precisely to point their telescopes to find out more about bursts that had been spotted by the Burst and Transient Source Experiment (BATSE).

5. *Therefore*, in order to compare the toughness of different alloys, both micro structural condition and strength level must be considered simultaneously.

6. *As a result,* the classification of risks into homogeneous groups is an important function within a market-based insurance system.

7. *Thus,* the Dedekind theory of ideals was abstracted and generalized, as was the Galois theory.

8. *Consequently,* the pace of scientific development in the areas of the greatest theoretical significance is drastically limited by the rate of building new research facilities, the latter depending on a number of economic and technological factors not directly linked to the aims of the research.

9. *Therefore,* extending the notion of the equal sign within the framework of arithmetic equalities prior to the introduction of algebraic equations was considered essential in the construction of meaning for non-trivial equations.

10. *Consequently,* in pure research many implicit assumptions are made about the conditions under which its results will be applied.

c) Paraphrase the following sentences using the linking words above similar in the meaning:

1. *In general,* if planar slip is the operating deformation mode which is controlling the crack propagation, then the effect of environment is large.

2. *So* the Sudbury Neutrino Observatory (SNO) detector will be able to observe separately the number of electron neutrinos and the number of all neutrinos.

3. The dimensionality of a macroscopic quantum system can have a large impact on its physical behaviour, and it is *therefore* crucial to understand the role and effects of reduced dimensionality.

4. *As a result,* atoms cannot be located at the same position in space, which effectively mimics the Pauli exclusion principle.

5. *Consequently,* the instrument using such an element would respond not to the amount of water vapour present but to the relative humidity.

Ex.5. a) Translate the following scientific expressions into Russian:

1. The question remains unclear.

2. Though a number of books exist concerning …, this is the first paper to be devoted solely to…

3. This paper abounds in illustrative material, examples.

4. He is far from giving a complete picture of …

5. He was the first to state clearly the concept of …

6. The essence of the conception is …

7. This supports the concept of …

8. Further difficulty arises from the conception of …

9. The solution of the great number of problems connected with … does not alter our conception of …

10. There is clearly no need to point out the limitations of this hypothesis …

11. This hypothesis would be as improvable as it is unnecessary.

12. To take all possibilities into account, we are compelled to rule out the hypothesis that …

b) Translate into English:

13. Чтобы поддержать нашу концепцию необходимо …

14. Обобщенное представление выражено во взгляде.

15. Если мы тщательно изучим концепцию, то обнаружим, что …

16. Большая часть этой работы совершенно не соответствует современным теориям.

17. Обзор некоторых концепций, приведенных в работе, был проделан в …

18. Его взгляды часто подвергались критике или тот час же отвергались.

19. Впервые изложенная сравнительно давно, данная точка зрения нашла свое подтверждение.

20. Мы должны сформулировать рабочую гипотезу относительно …

21. Это можно принять в качестве рабочей гипотезы …

22. В настоящее время у нас нет научного подтверждения первоначальной гипотезы как…

23. Все взаимоисключающие гипотезы, упомянутые выше, имеют своих сторонников и противников.

24. Эти данные подтверждают нашу гипотезу.

Speech and reading exercises:

Ex.6. Read the following article:

Quantum Computing with Solids

Science and technology could be revolutionized by quantum computers, but building them from solid-state devices will not be easy. Robert W Keyes of IBM's research division outlines the challenges in scaling up the technology from lab experiments to practical devices. Quantum processing is a fascinating new approach to computing that has attracted great attention in recent years. Much of this interest has stemmed from the discovery of non-classical quantum algorithms that could allow otherwise intractable problems − such as factoring very large numbers − to be solved. In quantum computing the straightforward sequences of binary digits or ″bits″ that have served computing well for over half a century are abandoned. A working quantum computer uses a physical system that can be in either of two quantum states − representing ″0″ and ″1″ − known as quantum bits or ″qubits″. But quantum mechanics also allows these qubits to be placed in a superposition of the two states. In principle, therefore, a superposition of the states of a large collection of qubits can contain an enormous amount of information. Quantum computing directs the evolution of the superposition towards a final state that contains a result that de-

pends on all of the original information, such as a number to be factored. Unwanted interactions (other than those between the qubits) interrupt the planned evolution of the wave functions and are known as ″decoherence″.

A powerful quantum computer that could realize the remarkable potential of quantum computing would need at least many thousands of qubits. So how would we build such a device? The obvious solution is to turn to solid-state technology, which is a well-established method for making large numbers of complex small devices. Many researchers are already following this path and are carrying out work on solid-state qubits that has − as a bonus − opened up many new areas of physics. In particular, experiments aimed at creating qubits have helped us to understand the interface between quantum mechanics and the macroscopic world.

Although this research is to be encouraged, I believe that the obstacles in the path to achieving a large quantum computer have been too hastily dismissed. The 40-year history of electronic technology for computers suggests that it will be hard to make a large number of devices that are sufficiently alike to meet the rigorous demands of quantum computing. The problem is that nominally identical solid-state qubits are likely to be physically different. While some physicists have recognized this difficulty, I think that many others have not fully appreciated that these differences may limit − or even prevent altogether − a collection of qubits from working as a quantum computer.

Quantum Computing in Solution

All quantum-computing experiments to date have used qubits made from atomic nuclei, which are relatively isolated from their environment and therefore have some protection against decoherence. The most advanced quantum computer built so far was constructed in 2001 by Isaac Chuang and his colleagues at Stanford University and IBM's Almaden Research Centre in California. Chuang and his co-workers managed to factor the number 15 using a solution of specially synthesized molecules containing seven spin-half nuclei. The seven nuclei served as qubits when a magnetic field was applied to the molecules to create two distinguishable states. The nuclei interacted with one another through their contact with the electronic wave

function of the molecule, while the orientations of the nuclei were manipulated using the well-established technique of nuclear magnetic resonance (NMR) spectroscopy.

By exposing the molecules to a sequence of accurately timed pulses of radio waves at carefully chosen frequencies, Chuang's team was able to prepare some of the molecules − each of which served as a quantum computer − into a desired initial state. Further sequences of pulses served as quantum logic gates that caused the nuclei to interact to produce a logical result, in this case the factors of the number 15. These computations with molecules in solution were a real tour de force that relied on the extraordinary precision of NMR technology. Frequencies of hundreds of megahertz were selected with a resolution of just a few hertz, while the magnetic field had to be homogeneous to within one part in a billion. The timing of the interactions and the pulse shapes of the high-frequency radiation also had to be rigorously controlled.

From Solution to Solids

Scientists believe, however, that computation using atomic nuclei in molecules will be limited to very few qubits − perhaps ten at most. The problem is that extending quantum computation from atomic nuclei in molecules to atomic nuclei in solids will not be easy. Ever since the integrated circuit was invented in the 1950s, the electronic industry has developed increasingly sophisticated methods for fabricating small, complex structures. Materials are heat treated, exposed to reactants and deposited on substrates. However, it is difficult to make accurately reproducible structures with these techniques. Tiny variations in the temperature across a substrate, for example, can lead to differences between nominally identical devices on the substrate. Differences between the thermal expansion of materials that have been bonded together can strain the substrate and change the characteristics of the devices.

A real solid that has been processed for an electronic application is, in other words, quite different from the ideal crystal of solid-state theory. Its properties will differ from one device to another and it will possess characteristics that are known only to within certain finite limits. Solid-state devices will not be able to duplicate the high-precision calculations that have been possible with molecules and NMR.

These problems do not, of course, affect conventional digital logic, which can cope with the imperfections of material objects. A hole in a punched card, for example, is not rendered unreadable by wear that increases its size. A relay contact is either open or closed and its conductivity does not need to be accurately known. The silicon transistors of modern electronic devices make connections to potentials the values of which represent zero and one throughout a system. The transistor acts as a switch and needs no fine-tuning.

Despite the challenges posed by solid-state qubits there has been no shortage of ideas about how to make them. Many proposals based on silicon have been put forward. Some use the spin of nuclei in a magnetic field, while others use the spin of electrons. Solid-state qubits using superconducting devices based on quantum effects first predicted by Brian Josephson in 1962 are also being explored. All of these qubits contain elements used in integrated electronics, such as thin films, metal electrodes and different kinds of materials. Their behaviour is controlled by voltages applied to the electrodes, with the size and placement of the electrodes − and the underlying material structure − affecting the performance of the qubits. The uncertainty in the properties of these physical elements means that responses to the signals applied are also uncertain.

The unpredictable variability in the properties of qubits makes them difficult to use in a system with a continuum of choices. The signals required to control the qubits and their interactionswill vary from device to device and from place to place on a substrate. The NMR computing experiments succeeded only because they relied on precisely timed pulses of high-frequency radiation. There is little hope of achieving the same accuracy with solid-state devices the parameters of which may be known to only within a few per cent.

Tackling the Problems

Although these differences between nominally identical solid-state devices are known in the quantum-computing community they are regarded more as a minor irritant than a major limitation on the performance of hardware. Some researchers have suggested that the variability of solid-state hardware could be overcome by fine-

tuning each device's properties using appropriate voltages. However, these ″biases″ delivered through other solid-state devices will be imperfect and differences between devices intended to be identical will remain. Conventional silicon electronics encounters the limits of devices with imperfectly known properties when it attempts to represent information in other than strict binary form. A bit in memory is represented by the presence or absence of charge on a capacitor. Engineers have long sought to store more than one bit on the capacitor. In theory this could be achieved by measuring the charge and expressing the amount as a sequence of binary digits. For example, if 16 levels of charge could be distinguished then four bits of information could be stored. The quest has long been unsuccessful because the circuits that place charge on the memory capacitor and analyse the removed charge are not perfect. The charge leaks away with time and storing more than one bit has proved impossible. The development of non-volatile RAM − so-called flash memory − has recently led to the successful storage of two bits, or four levels of charge, on a single capacitor. The question of how much information can be contained in superpositions of states of randomly different qubits can contain also demands attention.

Decoherence is justly recognized as a serious threat to quantum processing. The currently accepted solution is to use more than one qubit to represent one bit of information. Encoding each bit in several qubits would, however, require much more hardware. Much more processing for the comparisons that detect and correct errors would also have to be carried out. Unless processing is almost error-free then the process will not converge. Estimates of the permissible probability of error vary from 10^{-6} to 10^{-4}. Can solid-state devices meet this challenging target?

Since only a few single solid-state qubits have so far been realized no experiments have examined the interactions of qubits. The duration of an interaction must change the affected qubit by just the right amount. Accurate timing and shaping of the pulses that controlled the interactions of qubits were difficult parts of the NMR computations. Uncertainty in the properties of solid-state qubits will make proper timing of the interactions between them much harder.

Quantum Futures

Quantum computing is, in principle, possible. But how can we build a system with tens of thousands or more of qubits? Solid-state devices are the most promising answer, but the devil is in the detail. Making many solid-state qubits all perform a prescribed function with high accuracy is thwarted by one device never having exactly the same characteristics as the next. Dealing with devices with imperfectly known characteristics poses questions that remain unanswered and sometimes even unasked.

The fundamental question is how much information can be contained in a superposition of the wave functions of qubits when the properties of those qubits are known with limited precision? In spite of much literature that ignores the question, it cannot be infinite. How will a limit on the amount of information contained affect the power of a quantum computer?

The result of interaction between qubits depends on the length of time that the interaction evolves. Will the result of errors in timing caused by deficient knowledge of qubit properties mimic decoherence? Can devices perform with a low enough raw error rate to permit correction with redundancy? These questions must be addressed soon because the answers will determine the role that the solid state can realistically be expected to play in quantum computation.

b) Write the summary of the article (see Appendix 2).

c) Make out the **plan** *of the article.*

d) Speak in public on the following article using the plan.

e) Listen to the presentation and mark if the speaker managed:

− **to present the material in the logical way;**

−**to maintain contact with the audience;**

−**to implement the goals and objectives.**

Ex.7. Choose an article close to the subject investigated and do the following steps:

- define its main idea;

- work out the plan;

- write the summary of the article.

Ex.8. Put each of the following phrases in its correct place in the sentences below.

go down	***drop off***	***break down***	***come up***
fall out	***drop in***	***fall off***	***hold on***

1. The number of tourists visiting Britain is at its peak in July and August and begins to … … in September.

2. The subject of higher salaries will probably … … at the meeting.

3. Don't get so nervous about your speech tonight. I'm sure it'll … …very well.

4. She's not a very strong person. I'm afraid she might … … when she hears the news.

5. They haven't spoken to each other since that argument about the taxi fare. How silly to … … over such a trivial thing.

6. I think we are going in the wrong direction. … …, I'll look at the map.

7. I live at 32, Rutherford Street. … … , if you are in the district.

8. The meeting was long and the room was hot. I was afraid I might … … .

Ex.9. Idioms are key words. Choose the right answer (A−E).

1. On certain subjects like politics and religion Smith has very strong opinions which he is always trying to … .

A. push up your nose
B. poke into your ears
C. feed into your mouth
D. ram down your throat
E. pull over your eyes

2. The captain of the ship was tried in court because during the shipwreck he was only interested in saving his own … and neglected his passengers.

A. *hair* *B. skin* *C. head* *D. body* *E. soul*

3. The manager is very strict on the young men in the office. He is always checking up on them. He says that it is the only way to keep them … .

A. on their toes *D. off their bags*

B. up to their eyes *E. up to their necks*

C. on their feet

4. Instead of attending the professor's lectures John used to spend his time … at the pretty girls who sat round him.

A. batting eyelids *D. turning hairs*

B. gritting teeth *E. making eyes*

C. pricking ears

5. John met Mary at the seaside during the holidays and at the end of a week they were both … in love.

A. hand over fist *D. head over heels*

B. hand in glove *E. top to toe*

C. eye to eye

6. Since he has got his university degree Bill has become a snob. He now looks … at people who have not been to university.

A. down his nose *D. behind his back*

B. over his shoulder *E. along his finger*

C. under his eyebrows

7. The leader of the expedition said, "We must all co-operate and work hard together. If even one member … the expedition may be a failure."

A. turns a hair *D. lifts a finger*

B. drags his feet *E. grits his teeth*

C. eats his heart out

8. When the workers tried to get Fred to be their spokesman and put forward their claim for higher wages to the management, he refused, "Don't think I'm going to … and perhaps lose my job."

A. pull my tongue in D. turn my head round

B. prick my ears up E. stick my neck out

C. put my hair down

UNIT 7

Phonetic exercises:

Ex.1. Read the words first in columns and then in lines:

[s]	*[ʃ]*
sell	shell
sew	show
same	shame
sea	she
sock	shock
sine	shine
sort	short
mass	mash

Ex.2. Read the following phrases several times, paying attention to the sounds. Each time try to pronounce it faster:

Short sails should sail surer seawards.
She sells sea shells on the seashore,
The shells that she sells on the seashore,
Are sea shells, I'm sure.

Memory work

The Library

It looks like any building
When you pass it on the street,
Made of stone and glass and marble,
Made of iron and concrete.
But once inside you can ride
A camel or a train,

Visit Rome, Siam, or Nome,
Feel a hurricane,
Meet a king, learn to sing,
How to bake a pie,
Go to sea, plant a tree,
Find how airplanes fly,
Train a horse, and of course
Have all the dogs you'd like,
See the moon, a sandy dune,
Or catch a whopping pike.
Everything that books can bring
You'll find inside those walls.
A world is there for you to share
When adventure calls.
You cannot tell its magic
By the way the building looks,
But there's wonderment within it,
The wonderment of books.

Barbara A. Huff

Lexical and grammar exercises:

Ex.3. Read and translate the following sentences, paying attention to the use of **modal verbs:**

1. However, several factors *should be mentioned* but these will not be discussed in detail.

2. They *ought to* have paid more attention to the problem of fuel consumption.

3. Mercury is the closest planet to the Sun that is why it *may receive* more heat and light than any other planet.

4. Just as the hand of a clock completes its sweep in sixty seconds, the electron beam *can be made* to travel across any desired portion of the screen in some predetermined interval of time.

5. We *will be able to reach* any point on the globe from any other point through tunnels deep in the earth.

6. At the other stages, solids *are to be separated* from liquids in filters, centrifuges, or simply by setting the suspended solid in a settling tank or in continuous mechanical setting units generally known as thickeners or clarifiers.

7. A physician *has to know* the properties of high frequency currents, a mathematician − the properties of fast-acting computers, an astronomer − the properties of radio telescopes, a physicist − the properties of charged particles.

8. Observation of the Sun and the planets *must have been made* long before our civilization, as evidenced by recent archaeological findings.

9. The resulting figures *should have been corrected* for the energy losses to make the picture look more realistic.

10. However, quality of life *need not* necessarily *be reduced* − in fact, it *may increase* because of better physical and mental health.

11. My people and I *have come to* an agreement which satisfies us both. They *are to say* what they please, and I *am to do* what I please (Frederich the Great).

12. The program or the database *does not have to be changed*.

13. Simplification as a method of understanding *can* and *must be* the method of understanding any science.

14. But a monograph or a table *may be able to provide* only very approximate solutions to equations.

15. A further possibility that *will have* to *be taken* into account in more detailed analysis of the problem is that the iron-pairs in a given solution need not all be of the same type.

16. The machine *should contain* an apparatus for the storage of data which *should record* them quickly, hold them firmly, read them quickly, erase them quickly, and then be immediately available for the storage of new material.

17. In order that the compound *might be used* it *had to be purified*.

18. From the reservoir the water was directed through a channel to some point where it *could fall* through steel pipes.

19. Let us picture what *ought to happen* provided there were a conducting wire between two points of unequal potential.

20. It is easy to understand why astronomers were keen to know the truth about light, for the observations of two stars *might be* entirely false if the transmission of light were not instantaneous.

b) Fill in the gaps with a suitable modal verb and open the brackets putting the verb in the correct form:

21. Grain size … also (*to contribute)* to the environment effect.

22. We … *(to take)* into consideration all the advantages and disadvantages to decide what method is the best.

23. Heron's geometry … *(to regard)* as a sign of decline in Greek maths because it does not employ the refined procedures of the axiomatic method.

24. We do not know with whom the axiomatic method originated, it … *(to evolve)* with the Pythagoreans as a natural outgrowth and refinement of the early application of deductive procedures to maths.

25. Numbers … (*to put)* into the store from the mill or from the punched-card input system Babbage adapted from French weaving machines.

26. It is through cyberception that we … *(to apprehend)* the processes of emergence in nature, the media-flow, the invisible forces and fields of our many realities.

27. We … (*to say)* that photoelectric properties of transistor are largely used in TV sets.

Ex.4. Fill in the gaps with **which, that** *or* **where***:*

1. The application of mass-production techniques to weapons meant … new types of guns and shells were coming along at an unprecedented pace, making the ongoing production of firing tables no easy task.

2. Except for the almost equally advanced ideas of a German inventor by the name of Konrad Zuse, … were long unknown to British and American scientists, Turing's postwar writings about the logical complexities and mathematical challenges inherent in the construction of instruction tables were the first significant steps in the art and science of computer programming.

3. A new branch of economics called environmental economics is based on the idea … present economic systems and market forces often create environmental problems because they do not reflect the environmental costs of activities, especially costs … appear at other places and other times.

4. … their conversion is essential it should be compensated by the restoration of forests in other areas, and in their exploitation, excessive or destructive harvesting should always be avoided.

5. A laser consists of a solid or gaseous active medium in … the majority of the atoms can be pumped to an excited state by exposing them to electromagnetic radiation of a different frequency to the stimulating frequency.

6. The salts of weak acids have a different absorption even at considerable dilutions, … is perhaps due to incomplete ionization.

7. It was only after the discovery of the equivalence of heat and energy, … Rudolf Emanuel Clausius (1822−1888) was able to derive from it the second fundamental law.

8. The gas converts iron, silicon and aluminium oxides into fluoride salts, … can then be electrolysed to recover the silicon and metals.

9. This means plants cannot be built in areas … water is scarce.

10. The picture is even worse in the UK, … nearly three-quarters of the 90 million kilograms collected for recycling were shipped to countries like China.

Ex.5. a) Translate the following scientific expressions into Russian:

1. We shall begin this part of work by discussion and comparing …

2. We shall begin with a brief consideration of …

3. It is well to begin with a little clarification.

4. First something should be said about …

5. From the very start it is necessary to point out …

6. It would be clear from what has been said above …

7. It follows logically …

8. All these important questions will be elucidated in the subsequent chapters.

9. It will be briefly considered in the chapters on …

10. In order to understand the mode of thought we must turn back to …

b) Translate into English:

1. Мы должны вернуться к …

2. Мы можем вернуться к вопросу …

3. В предыдущей главе мы сосредоточили внимание на …

4. Необходимо кратко осветить (остановиться на …, коснуться) …

5. То, что мы собираемся сказать, не значит, что …

6. Здесь совершенно необходимо сказать несколько слов в качестве …

7. Мы можем сказать это иначе …

8. Иначе говоря, …

9. Можно было бы привести другие факторы …

10. Прежде чем продолжить, необходимо добавить несколько слов …

11. Это требует дополнительного разъяснения …

Speech and reading exercises:

Ex.6. a) Read the following article:

Recycled Plastic to Get Clean Bill of Health

A new generation of recycling plants will churn out cleaner, greener plastic and be more profitable.

Michael Reily

WHENEVER you throw a used plastic bottle into a recycling bin, you feel a virtuous glow. With this simple action you have prevented the bottle ending up on a landfill site, and allowed the valuable oil in the material to be re-used.

Yet, however good your intentions, plastic recycling is less green than you might imagine. The recycled plastic most plants in the US and UK produce is not clean enough to be turned into food or drink packaging, the largest and most profitable market for plastics. Instead, it is converted into industrial packaging and textiles, which earn the recycling companies less money and make it difficult for them to compete with firms in China and Vietnam where the recycling industry is flourishing because of cheap labour and lax environmental regulations. As a result, much of the plastic collected for recycling in the US and UK is shipped to Asia. What's more, the techniques used to remove contaminants from plastic bottles before they can be recycled consume up to 2 litres of water pre 500 grams of recycled material. This means plants cannot be built in areas where water is scarce. Waste from plants can also pollute local rivers. A new generation of plastics recycling plants promises to change all that. The plants will use technologies that reduce or even eliminate the need for water and produce plastics clean enough for food packaging, at a lower cost than existing techniques. If successful, such plants could significantly increase the number of plastic bottles that are recycled in the US and Europe each year. When a plastic bottle is sent to a conventional water-based recycling plant it is shredded first. These shreds are placed in float tanks that separate the polyethylene terephthalate (PET) used to make the bottles, from the high-density polyethylene used for the caps, which floats. The caps are removed to be recycled separately. The PET shreds are then moved into another tank of detergents, which eat away any glue and separate labels from the material, before the plastic is melted down and readied for reuse.

It is not hugely profitable: the plants typically earn around 1 cent per 500 grams of PET they recycle, thanks to their high water and detergent bills, and to the low returns on selling the recycled plastic for industrial packaging. Partly as a result of this low profitability , plants are few and far between in the US − of the 530 million kilograms of PET collected for recycling in the US in 2005, around half was

shipped to Asia. The picture is even worse in the UK, where nearly three-quarters of the 90 million kilograms collected for recycling were shipped to countries like China.

In those plants that do operate in the US, the water left in the float tanks at the end of the cleaning process, which is contaminated with chemicals, glues and food residues, is treated with surfactants to disperse the chemicals. Depending on state regulations, this water either goes into the local sewerage system for further treatment, or is simply released into rivers and streams. As a result, plants in the US are regularly reprimanded for discharging waste water that does not meet environmental standards, says Gary DeLaurentiis, who ran a water-based recycling plant in Heath, Ohio, in the 1990s, which was subsequently shut down. “All kinds of stuff gets into the water, like pieces of labels and plastic, soap and surfactant,” DeLaurentiis says. “We were paying a lot of fines for that.” “Seeing what water-based plants were discharging into the environment made me start looking into different ways of recycling,” says DeLaurentiis, who is now at ECO_2 Plastics in Riverbank, California. To clean up the industry and make it more profitable, DeLaurentiis has developed a system for stripping bottles before they are recycled that dispenses with water altogether so there is no waste to pollute water supplies.

Shredded bottles are first immersed in the solvent ethyl lactate to clean them, and then moved to a second chamber where they are blasted with liquid carbon dioxide to remove any remaining solvent. The solvent and CO_2 are pumped into separate stills where both are boiled off and the evaporated solvent and CO_2 captured so they can be reused. You can then remove the distillate at the bottom of the stills, mostly left-over solvent and contaminants from the bottles, and dispose of it as solid waste. The cleaned bottles can be melted down and processed into granules ready for reuse in the conventional way. The new process is cheaper than the water-based one, as the ethyl lactate and CO_2 are repeatedly reused. As there is no liquid waste, plants do not need special waste permits, further reducing the running costs.

Since ethyl lactate is derived from beets and corn, it has been approved by the US Food and Drug Administration for use in cleaning food-preparation equipment. ECO_2’s chief executive Rod Rougelot says the solvent is safe for preparing plastic for

recycling into food and drink packaging. The company is waiting for endorsement from the FDA before it can run its plant in Modesto, California, at full capacity, when it will be able to recycle 27 million kilograms of PET annually. By the end of the year it hopes to begin operating a second 27 million-kilogram plant in southern California. The company hopes to earn up to 10 cents for every 500 grams of PET recycled.

The technology will be competing with more established cleaning techniques such as the unPET process developed by United Resource Recovery (URRC) of Spartanburg, South Carolina. This uses the caustic agent sodium hydroxide to etch away a layer of contaminated PET from the shreds, leaving behind only clean plastic. The mixture is heated for four hours at 200° C to speed up the process, after which any remaining sodium hydroxide on the plastic is treated with a small dose of phosphoric acid.

The first recycling plant to use the unPET process was built in Switzerland in 2000, and there are now eight around the world. The FDA has granted approval for plastics recycled in this way to be used in food and drink packaging, so the plants can compete financially with those in Asia.

The process is not yet suitable for areas where water is scarce, such as California, as most unPet plants wash the plastic before treating it, although they consume around half the water of conventional plants. However, one unPet plant in Mullendorf, Austria, repeatedly recycles a small amount of water, making it virtually self-sufficient. Carlos Gutierrez RRC's president, says the company is exploring similar ways to recycle without water before building − Meanwhile in the UK, where water shortages, are less of a concern., most plastic bottles are shipped overseas for recycling because there are no facilities to produce food-grade recycled PET. That is set to change in December, when the first plant is scheduled to begin operating in Dagenham, London. This will be based on URRC's process and will recycle one-third of the 90 million kilograms of PET collected in the UK each year.

The high price of oil is boosting demand for recycled plastics, which is outstripping supply, so the new plants cannot be built quickly enough, says Party Moore

of Moore Recycling Associates in Sonoma, California. “Right now we have economics that are pretty favourable for expanding recycling. The environment has changed from barely scraping by to people say, ‘hey, we can make some money at this.”

(Taken from New Scientist, May 2007)

b) Write the **summary** *of the article (see Appendix 2).*

c) Make out the **plan** *of the article.*

d) Speak in public on the following article using the plan .

e) Listen to the presentation and mark if the speaker managed:

- **to promote the proper mood;**
- **to clarify the content of the speech;**
- **to provide the sense of closure.**

Ex.7. Choose an article close to the subject investigated and do the following steps:

- *define its main idea;*
- *work out theses to it;*
- *write the summary of the article.*

Ex.8. Put each of the following phrasal verbs in its correct place in the sentences below.

break up	***go off***	***come out***	***break out***
turn in	***look up***	***turn up***	***fall through***

1. It’s past midnight and I’m tired. I think I’ll … … .
2. I waited nearly an hour for them, but they didn’t … … .
3. After all the trouble you’ve taken, I hope your plans don’t … ... .
4. There’s a very real fear that war may … … soon.
5. We’ve had some hard times recently, but I think things are beginning to … … .
6. The emergency services thought that the bomb might … … at any moment.
7. The schools … … next week. I’s almost holiday time.

8. Her new book is due to … … next month. I wonder what the critics think of it.

Ex.9. Idioms are key words. Choose the right answer (A−E).

1. If you invest in that company you're likely to lose your …; the man who started it has been bankrupt five times.

A. hat *B. shirt* *C. trousers* *D. socks* *E. underwear*

2. Look at that lovely house on the hill overlooking the sea. Some rich person owns that because it must have cost a … .

A. pretty penny
B. delightful dollar
C. proud pound
D. dainty dime
E. shocking shilling

3. The typist said to the office boy, "I bet my … that you are too afraid to walk right in now and ask the general manager for a rise."

A. lovely dime
B. brass farthing
C. treasured cent
D. bottom dollar
E. pretty penny

4. As the senior men in the Government service retire there are young men eager to … .

A. put on their hats
B. get into their suits
C. take hold of their umbrellas
D. step into their shoes
E. pull on their shirts

5. We should be careful when talking to our employers because sometimes a … can make us say things we didn't intend to say.

A. catch of the breath
B. bite of the cheek
C. slip of the tongue
D. frog in the throat
E. turn of the lip

6. "I haven't seen Mary Jones for fifteen years but I still have … for her because we grew up together in the same little country town."

A. a shine in my eyes
B. a soft spot in my heart
D. a bright light in my head
E. an arrow in my heart

C. an apple in my eye

7. The police have put a lot of armed plain-clothes detectives in the bank and they knew that, if the robbers attempted a raid, they would be … .

A. climbing on to their backs
B. acting before their faces
C. playing into their hands
D. running between their legs
E. jumping into their arms

8. Mary won't talk to her old friends now. I think the fact that her husband has been made a manager has … .

A. crossed her eyes
B. turned her head
C. raised her eyebrows
D. affected her heart
E. twisted her neck

UNIT 8

Phonetic exercises:

Ex.1. Read the words first in columns and then in lines:

[s]	[θ]
sick	thick
sinker	thinker
sigh	thigh
sought	thought
gross	growth
pass	path
force	forth
miss	myth
the Norse	north
sunder	thunder

Ex.2. Read the following phrases several times, paying attention to the sounds. Each time try to pronounce it faster.

I'm thankful for a thousand things:
For faithful earth, for birth and breath,
For thought, and health, and strength, and mirth,
And maybe when it comes for death.

A thatcher of Thatchwood went to Thatchet a-thatching.
Did a thatcher of Thatchwood go to Thatchet a-thatching?
If a thatcher of Thatchwood went to to Thatchet a-thatching,
Where's the thatching the thatcher of Thatchwood has thatched?

Memory work

If I Became a Mayor

If I became a mayor,
I'd pass a most strict law
Forbidding cars and lorries,
We'd smell their fumes no more;
I'd clean all seas and rivers,
Inhabit them with fish,
Because I think cod-liver
Is a delicious dish.
I would allow no litter
In our beauty spots
With animals − forbidden
Would be all hunters' shots.
I'd plant green trees and flowers
In recreation zones
So that it might allow us
To breathe in some ozone.

Lexical and grammar exercises:

Ex.3. Read and translate the following sentences, paying attention to **conditional sentences:**

1. If a compass needle were sensitive enough, it would swing back and forth as the waves went on.

2. Unless the cathode C is water cooled, it will overheat and emit gases.

3. It would be worth while investigating the substance mentioned, provided we could get it in sufficient quantity.

4. If two hydrogen atoms were to collide each should seek an additional electron.

5. But for space meteorological stations we would not be able to observe the formation of hurricanes.

6. If the neutron and proton had the same mass, and if the Coulomb energy were completely negligible, there should be a definite correlation between the energy levels of isobars.

7. If the entire Earth were covered by ocean, high and low tides would follow one another at regular intervals in response to the rotation of the Earth and the revolution of the Moon.

8. It is desirable that they should measure all the chemical substances they deal with.

9. If you had applied this new method of work, we should have succeeded in obtaining better results.

10. Had the piezo electric effect not been discovered we could not have improved the operation.

11. The Sun radiates as much energy every second as would be released by the explosion of several billion atomic bombs.

12. Were he able to complete his experiment he would surprise us with the results obtained.

13. Should a rubber ball be immersed in liquid air and then taken out and thrown on the floor, it would fly to pieces like a ball of glass.

14. Let us picture what ought to happen provided there were a conducting wire between two points of unequal potential.

15. Should the reader question the relation between logic and usefulness, let us remind him that scientific progress during the Golden Age of Greece resulted from the application of logic to the investigation of natural phenomena and that the current scientific age followed upon the reestablishment of logic as a basic tool of scientific investigation.

16. It is easy to understand why astronomers were keen to know the truth about light, for the observations of two stars might be entirely false if the transmission of light were not instantaneous.

17. The principle of relativity requires that the law of conservation of energy should hold relative to every "Galilean" system of coordinates.

18. In many types of experiments it is essential that phage growth start almost simultaneously in all infected bacteria.

19. They lived as if it was an imaginary world.

20. Their communication would have been more vivid if it had been illustrated with examples.

b) Open the brackets using the verb in the correct form:

21. Without oxygen life (*to be)* impossible on earth.

22. If the Earth *(to be)* stationary, the movement of the atmosphere *(to control)* almost entirely by temperature differences.

23. Even if Kepler *(to accept)* Tycho's theory, in order to solve the triangle, he still *(to need)* to know the direction of the line between Mars and the Sun.

24. But for the rapid development of computer techniques and automation in our scientific age, space research never (*to make*) such great progress.

25. The problem of environment is not to be treated as if it *(to be)* of local concern for this or that country.

26. It is still debatable whether Mercury possesses an atmosphere or not. Under present conditions it *(to retain)* oxygen and heavier gases, but in the past when it was presumably hotter even than now, all gases except the very heaviest *(to stream off) into space.*

27. In any field, in order to succeed in one's career one should treat one's job as if it *(to be)* of primary significance for mankind.

Ex.4 a) Translate the following scientific expressions into Russian:

1. The following table contains …

2. A more profound examination reveals …

3. Statistics showed …

4. A few figures will illustrate …

5. We have no reliable figures, but it is clear that …

6. Authoritative surveys showed …

7. A set of figures will indicate …

8. This example illustrates well enough …

9. These examples will suffice to show that …

10. This may serve as a good example of …

b) Translate into English:

1. Для того, чтобы проиллюстрировать это, необходимо установить по возможности, как это повлияло на …

2. Это можно проиллюстрировать на следующем примере …

3. Краткая таблица иллюстрирует некоторые аспекты …

4. Данные позволяют передать типичную картину.

5. Все данные основаны на …

6. В приводимой таблице цифры красноречиво говорят о …

7. Как следует из данных таблицы …

8. Возможно показать прямую связь с …

9. Следующая таблица показывает …

10. Данные таблицы являются полезным первоисточником.

11. В таблицах содержится много данных.

Speech and reading exercises:

Ex.6 Study the following words to express **agreement and disagreement:**

To compare smth with smth	To approve of smth
To balance smth	To hold with smth

To collate smth with smth
To contrast smth with smth
To set smth against smth
To agree on /about smth, with smb
To consent to smth
To assent to smth
To concur with smb
To be of one mind
To disagree on /about smth, with smb
To differ from smb on /about smth
To dissent from smb /smth
To conflict with smb /smth
To be of variance
To part company with smb

To favour smth
To countenance smth
To sanction smth
To applaud smth
To accede to smth
To endorse smth
To frown on /upon
To disapprove of smth
To discountenance smth
To deprecate smth
To cry out against smth
To hold no brief for
To take issue with smb

b) Use them in group discussion of the following statements:

1. Cybernetics is likely to reveal a great number of interesting and suggestive parallelisms between machine and brain and society.

2. Shortly speaking, electronics is not so much a new subject as a new way of looking at electricity.

3. The genetic resources lost by extinction have both an economic value for medicine and agriculture and an ecological value because they increase diversity in ecosystems and are the basis for future evolution.

4. Modern chemistry is closely connected with other sciences and serves human needs.

5. The greatest advantages which plastics are expected to give the world is that they will make the people no longer dependent upon nature for their materials.

6. Speaking about organic compounds it is interesting to mention the fact, that more than 3,000,000 of them are already known at present, and at least a hundred new ones are added every day.

7. Experts estimate that by the year 2020 we will go by rocket from New York to Tokyo in 30 minutes.

8. It turns out that coding and storing happen to be central problems in the logical design of computing machines and the creation of software.

9. It is cyberception which enables us to perceive the apparitions of cyber-space, the coming-into-being of their virtual presence. It is through cyberception that we can apprehend the processes of emergence in nature, the media-flow, the invisible forces and fields of our many realities.

10. For problems, scientists seem to move upwards in the scale of complexity. That is to say, they go from physics and chemistry into molecular biology and from molecular biology to cell biology and so on.

11. In a mixed economy the government and private sector interact in solving economic problems.

12. New mechanics may be regarded as a theory of materials in the same sense that geometry is a theory of figures and spaces.

13. The Internet is a tool of communication, a place for people as well as extensive information.

14. One of the most damaging types of pollution is acid rain, more accurately called acid deposition because it may also take place by way of fog and snow.

15. Scientists are working on problems connected with the physical nature of supersonic waves and their application in science and everyday life.

Ex.7. The following is a joke from the Journal of Irreproducible Results. Read the text and try to appreciate its humour, bearing in mind that the italicized words are somehow connected with the names of the scientists mentioned and their contributions to science. Can you establish the connection?

A COCKTAIL PARTY

The following is a brief report of a cocktail party following a three day symposium on the History of Physics. The reporter made every effort to record the com-

ments and mannerism of many distinguished participants very accurately. The party was well under way, everyone busily discussing the previous three days of infinitely long presentations. A feeling of relief permeated the group now that it was all over. Down by the pool, Cherenkov *was positively glowing.* Marie and Pierre Currie smiled at each other *radiantly* while the Greek delegation led by Democritis sat *stoically,* except for Archimedes, who *was immersed* in thought. Several couples *were magnetically drawn* toward Gauss who was following Eddison's *current* story.

Meanwhile, on the Hill this heated exchange: "How is it *emitted* and *adsorbed*?" asked Max Born *particularly*. "Does it *travel as a wave?"* asked Einstein *lightly.* "Can it explain *diffraction*?" *interfered* Tom Young. "Possibly", *reflected* Huygens. "But is that *the principle* we're after?" questioned Heisenberg *uncertainly.* "Let's get back to *temperature",* Lord Kelvin *absolutely* shouted. "Yes", agreed Toricelli *mercurially*. "No, no", interjected Plank *constantly.* "Let's get to the *elements*", *postulated* Euclid. "It's really quite *elementary*", repeated Mendeleev *periodically*. "What a wonderful symposium!" said Archimedes *buoyantly*.

Ex.8. a) Read the following article:

Spinning Einstein

If we want a theory of everything, we might have to break a few rules, says Amanda Gefter. It's not every day that respectable scientists challenge Einstein. But that's what Nobel prizewinner Sheldon Glashow and his colleague Andrew Cohen, both of Boston University in Massachusetts, have dared to do. They believe it is time to rewrite the rules of Einstein's special theory of relativity, our best description of the nature of space and time for over a century. They call their theory very special relativity, or VSR. If Glashow and Cohen are right, it could tell us something profound about the fabric of the universe. It could solve a troubling mystery in particle physics. And it might get us a little closer to solving the problem at the top of most theorists' wish-lists: how to find a theory of everything.

The crucial evidence supporting Glashow and Cohen's theory may be right in front of your nose. Or, more accurately, passing right through it. For as you read this sentence, trillions of tiny particles called neutrinos are sailing through your body, imperceptible and undisturbed by the atoms that give you substance. Experiments conducted throughout the past decade have shown that neutrinos have mass, even though our best theory of matter claims that they ought to be massless. While formulating their new theory, Glashow and Cohen realized that a neutrino's mass may actually be a clue to an irregularity in space-time itself. Einstein's theory of special relativity revolutionized our conceptions of space and time by exposing the symmetries that underlie the reality we see around us. Symmetries are those aspects of the world that do not change when we view them from different perspectives. No matter how we rotate a circle, for instance, its geometry always looks the same, so we can say that a circle has 360-degree rotational symmetry.

Einstein began with two basic postulates from which the special theory of relativity spilled forth. The first is that the speed of light is always the same regardless of how the light source is moving; the second, that the laws of physics are the same for all observers who are moving at a constant speed.

For these two postulates to hold, space-time must have certain symmetries which, taken together, from the so-called Lorentz symmetry group, which concerns rotations and changes in velocity. If you were conducting a physics experiment, and your laboratory flipped upside down or began moving at a different speed, the fundamental laws of nature would not change, thanks to Lorentz symmetry.

Add to the Lorentz group the symmetry of space-time translations − meaning that you could move the laboratory, say, 50 metres to the west or forward three years in time without changing the results of your experiment − and you have the full set of symmetries encompassed by special relativity. You also have the full weirdness that it implies: the speed of light remains the same no matter how fast the light source is moving, time slows and distances contract at near-light speeds, energy and mass are interchangeable, and events that appear simultaneous to one observer do not to another.

Today, however, many physicists wonder whether Lorentz symmetry is a true symmetry, or if in fact it might be broken at extremely small distances or enormously high energies. They are motivated by the search for a theory of everything , something that can unite the seemingly incompatible theories of quantum mechanics − which describes the behaviour of subatomic particles − and general relativity, Einstein's extension of the theory to include gravity.

One-way universe

Various approaches to creating such a theory of everything have all suggested that Lorentz symmetry might be broken at the so-called Planck scale, around 10^{-35} metres, where both quantum mechanics and gravity come into play. Two such theories, string theory and loop quantum gravity, hint towards broken Lorentz symmetry. Another approach called non-commutative geometry explicitly calls for it. "If Lorentz violations are discovered, they would provide an experimental handle on the underlying unified theory combining gravity and quantum physics − a handle that is sorely lacking to date," says Alan Kostelecky, a physicist at Indiana University in Bloomington.

Dozens of experiments looking for signs of broken Lorentz symmetry have been carried out. Not one has found any. That doesn't mean Lorentz symmetry is safe and sound, though .It just means that experiments have not been sensitive enough so far, or that physicists are looking in the wrong place.

Until now, physicists have searched for violations of Lorentz symmetry by picking away at well-tested consequences of special relativity such as the slowing of time or the constancy of the speed light, which has led to experiments with light streaming in different directions or clocks flying at daredevil speeds. Glashow and Cohen, however, have found a way to break Lorentz symmetry without disturbing any of those cherished relativistic effects. They modified the special theory of relativity to reduce the amount of symmetry and so formulated very special relativity.

In this new theory, Lorentz symmetry is not fully intact, yet the key effects of special relativity remain unaffected. "People are shocked," says Cohen "I don't believe anyone ever contemplated that there could be Lorentz violation while one of the

basic ideas of special relativity, the constancy of the speed of light, could still be preserved."

What is lost in VSR, however, is the full rotational symmetry of space-time. "Not all directions are the same in VSR," says Glashow. "There's a preferred direction in space." "Here on Earth, for instance, the preferred direction is down. That's because the mass of the planet breaks the symmetry of the surrounding space-time and gravity selects a unique direction. But that's merely circumstantial − the underlying laws of physics see every directions as equal. Or so we thought. Cohen and Glashow are suggesting that maybe, even in the absence of a planet or anything else, space-time itself treats some directions differently from others.

According to VSR, the break in the rotational symmetry should be extremely small and therefore unnoticeable at everyday scales. That's why, if such symmetry exists, it has gone undetected for so long. "Rotational invariance is one of the additional postulates included in special relativity," Cohen says, "because people just have this intrinsic prejudice for it. What we said is, if you give up rotational invariance, there are these other possibilities." In other words, accept that space-time is even more counter-intuitive than we thought, and you might get a little closer to a theory of everything.

Although we have tested rotational invariance to a very high degree of accuracy, there is still wiggle room, "What's surprising is that if you give it up, these other possibilities nevertheless look very nearly rotationally invariant − just not exactly," Cohen says.

So at how small a scale would we find VSR's Lorentz violation? The answer lies with the neutrinos that are sailing through your body. Those ethereal little ghosts are hardly of this world, interacting with matter only through gravity, which barely notices them, and the so-called weak force, which exerts itself only in the cores of atomic nuclei. They are the least understood particles in the otherwise explicit framework of the standard model, our best description of the building blocks of matter and the forces that glue them together. Now, however, new explanations of the

strange qualities of neutrinos are paving the way toward a deeper comprehension of the universe than the standard model offers.

Spinning neutrinos

It has been eight years since physicists first found conclusive evidence that neutrinos have mass, contrary to the predictions of the standard model. The 1998 discovery was made in Super-Kamiokande, a neutrino observatory located 1 kilometre below ground in a mine in Kamiokande, Japan. Neutrinos come in three distinct types or "flavours", but the Super-K rxperiment found that they were morphing from one flavour into another as they fell from the sky. It was as if you ordered a scoop of chocolate ice cream that transformed into strawberry on its way toward your lips and settled into vanilla upon your tongue. The laws of quantum mechanics dictate that only particles with mass can change from one flavour to another. And so neutrinos, it seemed, must have a mass, albeit an incredibly tiny amount: a neutrino seems to be 100,000 million times lighter than a proton. The discovery was the first glimpse of physics beyond the standard model.

Physicists, however, still have no idea how neutrinos can have mass. It is the way that neutrinos spin that is so puzzling. Researchers have observed that some particles are "ambidextrous" − they can spin either to the right or to the left − while others are strictly one handed.

Every neutrino ever observed has been left-handed. Yet only massless particles can be one-handed, and here's why. Imagine you are watching a particle travelling along and spinning to the left. You start running and soon you are running faster than the particle. As you sprint ahead of it, you look over your shoulder and see the particle spinning the other way round.

In other words, for any particle that spins to the left, there is some reference frame from which a faster-moving observer can look back and see the particle spinning to the right, making it ambidextrous. That is, unless the particle is moving at the speed of light, the fastest possible speed, in which case there's no way that any observer can outrun it. And only massless particles can move at light speed.

If neutrinos are always observed to be spinning to the left, then no observer must be able to outrun them, which means they must be travelling at light speed and they must be massless. Yet the Super-K results clearly showed that neutrinos have mass. How can a particle be both left-handed and massive? Glashow and Cohen's theory can solve the paradox. It just so happens that the scale of VSR's Lorentz violation is right around the scale of the neutrino's tiny mass. "Suddenly we realized that within the context of very special relativity, neutrinos can acquire mass, "says Glashow.

A left-handed neutrino with mass will appear right-handed if you run past it, turn around and look back at it. But that's exactly what VSR doesn't allow you to do. Although you can run faster than the neutrino, you can't turn back around to see it spinning the other way. Turning around is forbidden by VSR, because according to the theory, the rotational symmetry of space is broken, so the laws of physics forbid certain rotations. What emerges is an elegant explanation for what seemed like an impossible paradox. Neutrinos do move more slowly than the speed of light − on account of their mass − but no observer can ever see them spinning the other way. Neutrinos in a VSR universe can be exclusively left-handed and have mass at the same time.

True, other explanations have been proposed for the origin of neutrino mass. "They don't invoke something as dramatic as violating Lorentz invariance," says physicist Sean Carroll of the California Institute of Technology in Pasadena. One way is to invent a new kind of particle called a sterile neutrino, a much heavier kind of neutrino that is right-handed. The sterile neutrino is even more ghostly than its counterpart, interacting with matter through gravity alone, which would explain why no one has ever observed one and probably never will. VSR, on the other hand, makes several clear predictions that can be tested in the clear future. One is to watch the radioactive decay of tritium, a heavy isotope of hydrogen with two extra neutrons. As it decays, tritium spits out an electron and an antineutrino. Because of the law of conservation of momentum, measuring the momentum of the outgoing electron (which is

far easier to pin down than an elusive antineutrino) provides a detailed profile of the momentum of the antineutrino, which in turn depends on its mass.

If VSR is correct, it should limit tritium's momentum as it coughs up antineutrinos. This would show up in a graph plotting the number of electrons versus energy. "You get a slightly different spectrum of the electrons coming out," says Cohen.

Predictive power

So far, tritium decay experiments have not seen any evidence of a neutrino's mass, let alone VSR. However, Cohen points out that they have not yet been done at the necessary sensitivity. A more sensitive experiment called KATRIN is being built at the Karlstruhe Research Centre in Germany. This might measure a neutrino's mass and possibly spot the first signs of Lorentz violation. Another experiment involves looking at properties of electrons such as the magnetic dipole moment, a measure of the strength and direction of the electron's response to a magnetic field. "If space has a preferred direction, as VSR claims, it will influence the electron in a way that should show up as a very peculiar time-dependent effect," Cohen says.

Glashow and Cohen are trying to convince a Harvard colleague, Gerald Gabrielse, to look for the effect. Gabrielse's team recently measured the electron's magnetic moment in the most precise measure to date of the fine structure constant, a gauge of the strength of the electromagnetic interaction. Now Gabrielse has to determine whether it is possible to measure the electron's magnetic moment with enough sensitivity to look for the VSR effect. If it is, Glashow and Cohen's theory could be put to the test within a few years.

If VSR turns out to be right, it will mark a major turning point in physics not only for our understanding of how neutrinos get their mass, but also for our understanding of the very fabric of reality. "If they were to find experimental evidence of Lorentz violation, that certainly would be ground-breaking," says Carroll.

It would also be troublesome. "Most of the physics community would rather not believe that VSR is right, and with good reason," says Glashow. The reason is that even small deviations from special relativity translate into big problems for general relativity. "It's an unpleasant fact that anyone who thinks about violations of

special relativity doesn't really know what to do to fix up general relativity," says Cohen. Solving one big mystery, it seems, may create an even bigger one. Those who challenge Einstein do so at their peril.

(Taken from New Scientist, January 2007)

b) Write the **summary** *of the article (see Appendix2).*

c) Make out the **plan** *of the article.*

d) Speak in public on the following article using the plan.

e) Listen to the presentation and mark if the speaker managed :

− to promote the proper mood;

− to clarify the content of the speech;

− to provide the sense of closure.

Ex.9. Choose an article close to the subject investigated and do the following steps:

− define its main idea;

− work out theses to it;

− write the summary of the article.

Ex.10. Complete the examples with the following:

TO LOOK

Up	***after***	***for***	***on***	***back***
forward to	***through***	***round***	***into***	***up to***
someone up	***over in***	***ahead***	***down on***	

1. If you don't know John's telephone number … it … in the directory.

2. I'd like to … … the house once more before I finally decide whether to buy it.

3. Please … me … if ever you come to London again.

4. I tapped the man on the shoulder, he … … .

5. … … ! that ladder's not safe.

6. I'm helping Peter … … his keys. He can't find them anywhere.

7. During the holidays I'm … … my neighbour's children for a week and I'm certainly not … … it. They're so naughty.

8. The people in the street just stood … … while the two youths were fighting. Nobody tried to intervene.

Ex.11. Idioms are key words. Choose the right answer (A−E).

1. Nobody likes getting injections but they are necessary, and the best thing to do is to … and put up with them.

A. bite your tongue
B. grit your teeth
C. tighten your lips
D. hold your nose
E. pull your hair

2. No matter how hard the men in the factory tried to make friends with the new worker they didn't succeed. He was resentful and suspicious and seemed to have a … .

A. corn on his toe
B. chip on his shoulder
C. splinter in his finger
D. stone in his kidney
E. speck in his eye

3. Mary's mother said, "Mary, if you don't go to the dance just because Bill Jones is not taking you, you are only … because you really want to go, don't you?"

A. cutting off your nose to spite
B. shaving your head to
C. putting lead on your feet to make you go fast
D. trimming your ears to make your face them neater
E. stamping on your toe to improve your looks punish your foot

4. "What has happened to Bill Smith? He used to be a very well-dressed person but when I saw him yesterday he was looking very … ."

A. out of ha
B. off his head
D. down at heel
E. light of foot

C. out of breath

5. Although the robber's car was a powerful one, the police in their large saloon were gaining on them … .

A. tooth and nail *D. heel and toe*

B. eye to eye *E. nose by neck*

C. hand over fist

6. Students should not be encouraged to keep studying too long and too intensely. They should be encouraged to go out now and again, … and forget about study.

A. look down their noses *D. prick up their ears*

B. get their backs up *E. put their feet down*

C. kick up their heels

7. Johnny is not very good at ball games. Whenever he tries to catch a ball he seems to be all … .

A. feet *C. knuckles* *E. joints* *B. fists* *D. thumbs*

8. You can believe the story of the accident. I got it … : from someone who was there and saw everything.

A. on fast foot *D. at first hand*

B. by quick tongue *E. at first sight*

C. by early ear

UNIT 9

Phonetic exercises:

Ex.1. Read the words first in columns and then in lines:

[n]	*[ŋk]*	*[ŋ]*
pin	pink	ping
sun	sunk	sung
thin	think	thing
linn	link	ling
clan	clank	clang
win	wink	wing
bun	bunk	bung
kin	kink	king
ran	rank	rang
tan	tank	tang

Ex.2. Read the following phrases several times, paying attention to the sounds. Each time try to pronounce it faster:

Nothing's wrong.

Oh, swing the king and swing the queen.
Oh, swing the king and swing the queen,
Oh, swing'em round and round the green.
Oh, swing'em round the green.

As I was walking
Along, along, along
And singing a beautiful

Song, song, song.

HORSES

I've seen the horses sleek and steaming.
I've seen them munching grass and dreaming.
I have heard them singing, sighing.
I have seen them flinging, flying .
Fleet and fast upon their courses!
Have you ever seen the horses?

Lewy Olfson

Memory work

For Want of …

I. For want of some paper − calculation was lost,
For want of calculation − an article was lost,
For want of an article − a thesis was lost,
For want of a thesis − a degree was lost,
For want of a degree − a job was lost,
For want of a job − a career was lost,
For want of a career − a wife was lost,
For want of a wife − a man was lost;
And all for the want of some paper.

II. For want of a pen − calculation was lost,
For want of calculation − a hypothesis was lost,
For want of a hypothesis − an experiment was lost ,
For want of an experiment − a result was lost,
For want of a result − correlation was lost,
For want of correlation − a theory was lost,

For want of a theory − a monograph was lost,

For want of a monograph − prestige was lost,

For want of prestige − reputation was lost;

For want of reputation − a career was lost;

For want of a career − a man's life was lost;

And all for the want of a pen.

Lexical and grammar exercises:

Ex.3. a) Translate the following scientific expressions into Russian

1. It seems essential to emphasize that …
2. It is necessary to stress one basic point …
3. There are special difficulties in the sphere of …
4. It is important that we should try to bring into clear focus …
5. The exact nature and purpose of … cannot be ascertained.
6. There is some evidence to suggest that …
7. It might have been suggested that …
8. On an analogy with … it may be suggested that …
9. It is becoming increasingly difficult to draw any clear line between … and … .
10. When comparing … the similarity between … it is evident that …
11. Contrary to accepted modern belief I assume that …
12. There are important differences which will be merely briefly recounted here.

b) Translate into English:

13.Есть (нет) основания полагать, что …

14.Неверно было бы считать, что …

15. В некоторой степени он объясняет …

16. Ошибочно было бы, тем не менее, считать, что …

17. Это объяснение неубедительно и исторически неоправданно.

18. Возможно, было бы полезно отказаться от ряда объяснений, которые до сих пор существуют …

19. Объяснение происхождения позволит решить вопрос относительно …

20. Долгое время не было четкого различия между …

21. Сравнение полученных фактов позволило …

22. В отличие от общепринятой современной точки зрения …

23. Это единственное существенное различие между … и …

Speech and reading exercises:

Ex.4. a) Study the following words and expressions to express the **opinion:**

To have a good /bad /high /low opinion of smth
In my opinion
To state one's views on smth
From my point of view
To have a position on smth
To have an outlook on smth
To form a judgement
In my judgement
To look at smth from the standpoint of …
To take a stand on smth
To have a thinking on the matter
To take /to have an attitude to …
To have a posture over
Belief /conviction / persuasion
To the best of my belief
It's my belief /conviction /persuasion that
I myself am not of that persuasion
To expect
To regard
To consider
To stand
To think
To believe
To reckon
To figure
To look on /upon smth
In the eyes of smb
To my mind
To suppose
To assume
To presume
To grant
To surmise
To conjecture
To guess

b) Use them in the discussion of advantages and disadvantages of the interview given in in ex.5.

Ex. 5. Read the interview given by Dr. Alexander Andreyev, Director of the Kapitsa Institute of Physical Problems and discuss the problems considered in it.

Alexander Andreyev:

'Frozen' Physics in the Hot Spot

Director of the Kapitsa Institute of Physical Problems argues that science in Russia urgently needs reform: but not in the direction that the government wants.

An Academy of Sciences institute should primarily study fundamental laws of nature," Pyotr Kapitsa told a meeting of the Academy Presidium in in1943. At the time, the country **was locked in a life-or-death battle with Nazi Germany. Does the Kapitsa Institute of Physical Problems of today follow his instructions? Its director, Dr. Alexander Andreyev, spoke to MN's Olga Orlova.**

One Type of Movement

MN: Alexander Fyodorovich, does your institute still follow the guidelines set by its founder, Pyotr Kapitsa?

Andreyev: Our first and foremost area of research − low temperature physics − is still performed exactly the way it was established by Pyotr Leonidovich Kapitsa. Fortunately for us, it is still one of the top priorities in modern physics. Our institute is the only research centre in the post-Soviet area where this subject is studied.

MN: Yet it seems that the spotlight is now on high energy physics and cosmology.

Andreyev: We are attempting to find answers to the same questions, but through low temperature physics. To do this, we need to study the properties of substances under temperatures just fractions above Absolute Zero. With high temperatures, there are too many physical degrees of freedom and types of movement, so it is very difficult to understand and disentangle their properties. Scientists engaged in high energy physics are looking for new dimensions of space, but haven't yet been able to find any . Not so long ago, it turned out that it can be done at low tempera-

tures, when substances slip into unusual states. Everything freezes, slows down and then stops, with only one type of movement remaining. It can be studied thoroughly, which enables us to understand exactly what our colleagues from related fields are studying.

MN: How competitive do you feel compared to Western laboratories?

Andreyev: We are definitely not inferior to them in any way. There are about 20 lower temperature physics labs across the world. Later this year, an international conference on low temperatures will be held in Kazan. It will be attended by about 200 reseaechers from all over the world, including Japan and Australia.

MN: What breakthroughs are anticipated?

Andreyev: That's impossible to forecast. The logic of development in fundamental science is that something new appears only every once in a while. First one field of research develops rapidly and then stagnation sets in. Knowledge [about this field] can be clarified and deepened, but nothing changes in the overall picture. Then this field is abandoned. We have colleagues at the Finnish laboratory which Pyotr Kapitsa helped to create. There is no shortage of funding available for research in Finland, so the practical Finns spare no resourses in testing the effectiveness of their research programs. Every three years, they invite an international commission of experts composed of the leading lights in sciences, including Nobel Prize winners to appraise their research programs. Not long ago, such a commission recommended the closure of one low temperature physics research area in which the Finns have outstripped the rest of the world.

Under super low temperatures, super-fluid helium 3 develops so-called 'topological defects'. The Finns studied them in-depth, while all other laboratories in the world stopped their research programs because they did not have a chance of competing with the Finns. So the commission advised them to drop that area of study since there is no challenge in it any more. That was the correct decision, as science cannot develop without competition, without constantly moving forward.

MN: Would it be a good idea to invite such international teams of experts to appraise the effectiveness of research in Russia?

Andreyev: I'm not sure about that, because there is a very big difference between Finland and Russia. Finland has always oriented itself toward international expert opinion because it does not have enough experts of its own. By contrast, Russia has plenty of research centres, and we can rely on our own resources. Consider the U.S., which never invites any 'appraisal experts' from other countries.

MN: But can Russian experts provide an objective evaluation?

Andreyev: Indeed they can. We have commissions which offer their findings and conclusions on a regular basis. They never contain harsh comments, but their tone makes it entirely clear that, say, a particular laboratory is doing a good job, while another should be closed urgently. It is a different matter that our expert conclusions have very little practical impact. Different laboratories have their own research standards, but with the current level of funding − just barely enough to keep them afloat − it is impossible to improve performance in any way.

Chasing 'Freaks of Nature'

MN: One reason for the proposed reform of the Russian Academy of Sciences (RAS) is that all RAS institutes are in equally dire straits precisely because the RAS is unable to reform itself.

Andreyev: If the government promises to provide the necessary funding for development only after the Academy is reformed, to me that means that the RAS will only begin to be reformed after it is dead. So the government will finance everything remaining after that − i.e., everything but science. If we "reform" the way they want us to, we will destroy ourselves with our own hands. Please understand that we have to be conservative today. Imagine, the bureaucrats want to bring in managers to regulate the Academy's life as they see fit. Will they want to test us and certify us? They are now proposing a new system of compensation for scientists and researchers − it's outrageous.

MN: What's wrong with it?

Andreyev: Everything. Wages depend on the number of scholarly publications. But I can publish one large article or break it into 10 parts, publish it in installments, and then follow it up with a comprehensive overview. The scientific research

value will be the same, but in the second case my wages will be raised substantially. Or consider the case of the late Yury Vasilyevich Sharvin. Today his works are regarded as classics, cited in one out of five publications in our field of research in the world. Everyone respected him and his every word was precious, fit to be carved in marble − it still is. But in his entire life he produced only 28 publications. He was constantly working on them, improving them over the years. If the proposed guidelines had been applied to Dr. Sharvin's works, he would have been expelled from the inst6itute. It is clear that people who don't know the first thing about the organization of the scientific community intend to supervise and control our lives.

MN: Could we then take a look at how your own research community is organized?

Andreyev: Ours is a small institute. We have no laboratories, departments or administrative staff. Just 50 research associates. As for the "bosses," there is just myself and my deputies. Of course, there are informal scientific groups and younger researchers have teachers who play a very important role. The atmosphere at the institute is absolutely democratic. When we discuss scientific matters, everyone is equal. My students may take issue with anything I say regardless of my status or rank, while can sometimes be rather sarcastic in evaluating a particular scientific idea.

MN: In other words, the Anglo-Saxon tradition of academic discourse that Pyotr Kapitsa brought from England is still alive. Was the "one institute, one department" organization also his idea?

Andreyev: Indeed it was. Pyotr Leonidovich maintained that the institute should be compact so that its director could know and understand exactly what was being done. That is impossible to achieve in a large organization, such as the RAS Institute of Physics (FIAN). During the Soviet era, all scientific research institutes were chasing growth and expansion. New laboratories were being opened and administrative staff. This growth meant that an institute director was unable to understand what each of the research associates was doing.

MN: In this connection, I cannot help asking you about the supply of young researchers, which seems to be rather a sensitive problem today.

Andreyev: In the past, we had no shortage of graduate or post-graduate students. We could pick the very best to work at our institute. It was considered a great honour and a piece of luck to get a job here. Today, however, like at many other institutes, the intermediate level [of researchers] is missing. Not surprisingly, wherever I go, whichever international conference I attend, I meet my former students. All of our students leave. The few exceptions are Muscovites whose parents can afford to support them. We are literally chasing such weirdoes. What can I offer a talented student? Young researchers need at least 10 times what they are being offered today.

Not long ago, two bright guys from Ukraine came to me. "What can you at least promise us in the future?" they asked. I could promise nothing: after all, they are now foreign nationals and I cannot even employ them, let alone try to provide them with accommodation. Why is it that in Finland, for example, almost all laboratories are filled with Russian researchers who have excellent compensation packages, as well as housing, while they are not even Finnish citizens?

First Fix, Then Reform

MN: Not so long ago, there was a meeting between the Coordinating Council of Young Scientists on the one hand, and Science and Education Minister Andrei Fursenko, RF presidential aide Dzhokhan Pollyeva and RAS Vice President Valery Kozlov, on the other. Young scientists single out the lack of career opportunities as one of the central problems in Russian science.

Andreyev: I can understand how they feel, but it pains me to see that reform is moving in the wrong direction. The focus should be not on career growth the way it is generally seen − i.e., "kicking out the old-timers" to make room for the young, but on creating conditions for young people to advance as scientists, on merit. Do you really think that to attract young researchers we have to get rid of all the older scientists? The problem is that young scientists will find these conditions unacceptable. We may leave, but then the scientific school founded by Pyotr Kapitsa 70 years ago will be lost forever.

MN: Incidentally, Kapitsa remained director until the age of 90.

Andreyev: But I heard him say that a director's principal mission is to not hinder others from doing their jobs. Generally speaking, administrative career growth at the RAS often suggests that all is not well with a person's scientific endeavors. In the eyes of the scientific community, it is without a doubt more prestigious to win peer recognition internationally than to become head of a laboratory or director of a research institute.

Alexei Abrikosov, a Nobel Prize winner, is a good case in point. At one time he worked at the Landau Institute at Chernogolovka [a town to the northeast of Moscow]. But he wanted an administrative position, so he quit the Landau Institute and became director of the Institute for High Pressure Physics. In the early 1990s he suddenly left for the United States. I met him at a conference later and asked why he had left. "Whenever I traveled to the West in my capacity as director and told, with great pride, of our achievements, no one would listen to me because an institute director was of no interest to anyone there," he explained. "But when I spoke about my own research, everyone listened with nothing short of admiration. And then I thought: "Why do I need this? I'd be better off doing pure research in the United States."

MN: Is there a chance that researchers who left Russia will return some day?

Andreyev: I once traveled extensively in the Netherlands to study the situation there. After they defend their dissertation and get an advanced degree, almost all Dutch researchers leave for the United States to make a name for themselves there. But when there is a vacancy for a professor, it is offered primarily to Dutch scientists who have put themselves on the map in the U.S. And they are only happy to return. Russian scientists would return in a similar situation. But this is impossible to achieve if those who remain in Russia continue to work under these conditions.

MN: But it cannot be that everything depends on just one side − the state. Doesn't anything at all depend on the scientists?

Andreyev: Scientists don't have many avenues of protest open to them. The mood at the RAS affiliated institutes today is extremely aggressive. The people are simply outraged: Russia is not a poor country, but we seem to live in the past. Just like 15 years ago, we are training researchers for other countries. What needs reform-

ing in this system? Without an overhaul of the state's financing of science, it is impossible to reform the Academy in a reasonable way because fundamental science always depends on state subsidies. I am convinced that only a sound institution can be reformed. If the Academy is in bad shape, it should first be fixed and only then reformed. We need to attract young researchers, procure new equipment and implement key projects before we can go ahead with reform.

Pyotr Kapitsa was often asked: "Why is it that your country is so unpleasant but your science is brilliant?" Pyotr Leonidovich would say that in the West, the strongest and most talented people went into business, whereas in his country they went into science because there was no business to go into. Now there is business in Russia and we are racking our brains over how to keep bright people in science.

Fact Box

Dr. Alexander Andreyev is Vice President of the Russian Academy of Sciences and Director of the P.L. Kapitsa Institute of Physical Problems. The world's leading expert on low temperature and solid state physics, he discovered what is now called Andreyev reflection − "interference between hole-like and electron-like components of the quasi particles in which a hole created to maintain charge-neutrality is then retroreflected back along the path of the incoming electron in a process known as Andreyev reflection". Dr. Andreyev is Editor-in-chief of the Journal of Experimental and Theoretical Physics and of the popular science journal Nature. He has received numerous awards, including the Lomonosov Prize (1984), the Lenin Prize (1986) and the Triumf Prize (2003). Dr. Andreyev is a member of physics societies in a number of countries.

(Taken from Moscow News, June 2007)

Ex.6. a) Discuss the advantages and disadvantages of the interview.

b) Write the **critic** *of the interview (see Appendix 2).*

Ex.7 a) Conduct an interview between an experienced scientist and a beginner making use of the following words and expressions:

- to do /to carry on /to carry out /to conduct research

- to contribute to /to make a contribution to

- to influence /to affect /to have an effect on /upon

- to study /to make studies /to investigate /to explore

- to put forward an idea

- to suggest an idea /a theory /a hypothesis

- advance /to develop /to modify a theory

- to predict /to forecast /to foresee

- to accumulate knowledge

- field of science /research

- a new area of research

- current branch /field of research

- latest /recent achievements /developments /advances

- a(an) outstanding /prominent /world-known scientist /researcher

b) Act out the dialogue in class.

Ex.8. Complete the following sentences with the correct form of the verb ***"to do"*** *+ the correct particle.*

up with without in done up away with

1. I'm so thirsty I could … … an ice-cold lager.
2. The government is trying to … … … the laws restricting drinking hours.
3. This house looks terrible. It's about time we … it …
4. She can't … … her cigarettes. She smokes about forty a day now.
5. A man was murdered on the A 40 last night. I wonder who … him ….
6. Gosh, I'm getting fat. I can't … this zip ….
7. I need a good night's sleep. I'm absolutely … … after all that work.

Ex.8. Idioms are key words. Choose the right answer (A−E).

1.“Our teacher was in a bad mood this morning. When I happened to drop a pencil during her lesson she nearly bit my … off.”

A. ears *B. hair* *C. eyebrows* *D. head* *E. arm*

2. Young Bill has a good job in that office. All he has to do is to keep his … and he’ll go a long way.

A. hair done
B. nose clean
C. head up
D. face straight
E. mouth open

3. John thought he was going to be chosen for the school football team but when his younger brother was chosen instead, this really put John’s ….

A. teeth on edge
B. feet on the ground
C. eyes out of focus
D. nose out of joint
E. head in a whirl

4. Some of these young scientists think they are going to change the whole world, they’re idealists, with their …..

A. hearts in the right place
B. feet on the ground
C. backs to the wall
D. heads in the clouds
E. ears to the ground

5. The way some shopkeepers put up their prices during the holiday season is beginning to get people’s ….

A. hairs down *C. knees crossed* *E. thumbs up*
B. backs up *D. shoulders back*

6. The man was completely innocent, but when the police came and accused him of the murder he lost his … and ran away.

A. heart *B. breath* *C. head* *D. liver* *E. stomach*

7. When the man told his wife that his business had gone bankrupt she said, “Oh well, let’s keep … and perhaps our luck will change.”

A. our eyes to the front
D. our hearts in the right place

B. our feet on the ground

C. straight faces

E. a stiff upper lip

8. Ordinary people could enjoy the eminent philosopher's lectures because, although he was at home in the absolute realms of philosophy, he also kept his … .

A. feet on the ground

B. finger in the pie

C. nose to the grindstone

D. back to the wall

E. head in the clouds

UNIT 10

Phonetic exercises:

Ex1. Read the following words first in columns and then in lines:

[pn/pm]

open	cheapness	topmost
happen	shipmate	step-mother
halfpenny	groupmate	development

[tn/tm]

eaten	certain	nutmeg	appointment	Britain
curtain	utmost	compartment	written	forgotten
bottom	department	button	fortnight	stuntman
apartment	mittens	chutney	nightmare	absent-minded
bitten	rotten	oatmeal	commitment	statement

Ex.2. Read the following phrases several times, paying attention to the sounds. Each time try to pronounce it faster:

Once bitten, twice shy.
Waste no
The rotten apple injures its neighbours.
Forbidden fruit is sweet.

Duty of the Student

It is the duty of the student
Without exceptions to be prudent.
If smarter than his teacher, tact
Demands that he conceals the fact.

by Edward Anthony

Memory work

The Law Of Hospitality

There is a very simple rule
That everyone should know;
You may not hear of it in school,
But everywhere you go,
In every land where people dwell,
And men are good and true,
You'll find they understand it well,
And so I'll tell it you:
To everyone who gives me food,
Or shares his home with me,
I owe a debt of gratitude,
And I must loyal be.
I may not laugh at him, or say
Of him a word unkind;
His friendliness I must repay,
And to his faults be blind.

Gelett Burgess

Lexical and grammar exercises:

Ex.3. a) Read and translate the following sentences, paying attention to the use of **emphatic sentence structures:**

1. These molecules are too small to be seen, even with the microscope, but strong experimental evidence seems to show that they *do* exist.

2. The formation of ozone during the electrolysis of water does not change the weight of the gas collected at the positive pole but it *does* decrease the volume.

3. *Related to* the chemical activity are many other effects.

4. *Nowhere* can we see such rapid progress as in radio engineering.

5. Perhaps *never* was the making of an important invention shared by so many persons distributed so widely over the world.

6. The ancients had no knowledge of stellar distances, *neither* was there then any means by which they could determine them.

7. Lever J moves upwards, *so* does lever M.

8. *Only* upon the adsorption of larger amounts was the sensitivity again lowered.

9. *Correlative with* the conception of a system of planes is that of a system of great circles.

10. *Surrounding* this nucleus are electrons, the actual number depending upon the atom being considered.

11. *Late though* it was the sun was still in the sky.

12. *Whoever* the author may have been he should have dwelt on this problem.

13. *Important as* this question is in itself, the debate on the subject went far beyond its original bounds.

14. Mars and Venus have atmospheres *not dissimilar to* ours.

15. River and lake deposits also *not uncommonly* contain remains of organisms which inhabited waters.

16. *It is* these special properties of sound *that* are the subject of the present chapter.

17. *It was* the Dutch physicist, Christian Huygens, *who* first offered an explanation for the phenomena.

18. *It was not until* Einstein discovered the connection between gravitation and inertia *that* the mystery Newton could not understand was solved.

19. Thus it is known that birds do not keep direction by orienting themselves in the earth's magnetic field, *neither* apparently, does memorizing the route play an essential part.

20. *Not* all substances separate from solution in the crystalline state: for instance, wax dissolves in petrol, *but* on evaporating the solvent we do not get crystals of wax, *nor* is glass crystalline.

b) Make the following statements emphatic using the inverted word order.

21. The researcher's skill and abilities are of great importance.

22. Computers are of great use in research.

23. Knowledge of foreign languages is of great use to scientists nowadays.

24.The potentialities of a new method are of particular significance.

25. A schematic representation of the device is shown here.

c) Contradict the following statements emphatically.

26. She says a certain Smith invented the radio.

27. He says I. Newton wrote the first book about the evolution of biological species.

28. She says the Curies discovered X-rays.

29. They say Aristotle was the founder of classical geometry.

30. She says Thomson discovered DNA structure.

d) Make the following statements emphatic using **It was not until recently that.**

31. The study of the genetic code has only recently started.

32. The role of nucleic acids in the cell processes has only recently become understood.

33. The age of the moon has only recently become known.

34. The structure of viruses has only recently become known.

35. Lasers have only recently found a wide application.

e) Translate into English.

36. Вопрос о возможности использования этих данных в нашей работе действительно заслуживает серьезного обсуждения.

37. Здесь представлены результаты, полученные на основе проведения трех серий опытов на белых мышах (white mice).

38. Именно Г. Мендель первым обратил внимание на определенное математическое соотношение наследственных признаков (traits).

39. Только сравнительно недавно в литературе получили подробное освещение вопросы, связанные с биосинтетическими (biosynthetic) процессами.

40. Мысль об атомном строении материи высказывалась еще в древние времена, но только в XX веке она была подтверждена экспериментально.

Ex.4. a) Translate the following scientific expressions into Russian:

1. We shall conclude this chapter with a few observations …
2. Perhaps it is most reasonable to conclude that …
3. It is impossible to come to any difficult conclusion on this point.
4. It enables us to draw a conclusion that …
5. Some suggestive points emerge from an analysis of …
6. On the basis of the analysis it is possible to indicate that …
7. The main issues may usefully be summarized …
8. We shall try to sum up what we have been able to learn about …
9. We, thus, arrive at the following observation …
10. We can sum up … as follows …

b) Translate into English:

11. На основании проделанной работы мы пришли к следующему выводу …

12. Итак, после проведения сравнительного описания и анализа можно сделать следующие выводы.

13. Сложно понять, каким образом сравнение привело его к этому выводу …

14. Обзор … позволил сделать вывод, который заключается в следующем …

15. Из этих диаметрально противоположных концепций вытекают различные выводы, касающиеся ряда вопросов …

16. В заключении, я хотел бы, чтобы мне позволили добавить от себя лично.

17. Мы осветили некоторые детали происхождения и причин …

18. В наши задачи не входило проведение всестороннего исследования …

19. Подводя итоги данному исследованию, мы бы хотели отметить …

20. Это подтверждается качественным и количественным анализом …

21. Чрезвычайно сложный анализ, направленный на … , подтвердил так или иначе результат …

Reading and speech exercises:

Ex.5. a) Read the tips for outstanding tips and choose those that are suitable for scientific report (see Appendix3).

b) Discuss your choice in groups.

c) Use them in the report of your own (ex.8).

Ex.6. Read the report made at the conference and discuss the problems considered in it.

Developments In the Tantalum Market.

Minor Metals 2004

Presentation by Judy Wickens, Secretary General of T.I.C.

1. I should like to thank **Metal Events** for the opportunity to talk about tantalum.

2. **The Tantalum-Niobium International Study Centre**, or T.I.C., is an association with eighty-one member companies in twenty different countries across the world.

3. **Tantalum in your life**

Tantalum is probably best known for its use in electronics, in situations like these:

If you need a pacemaker, or an insulin injector

If you brake hard in your car and avoid an accident, using the automatic braking system

In an impact, tantalum capacitors open the air bag in a split second

But tantalum is used in other ways:

Implanted in the body, it can reconstruct joints and tissue,

It is in the hottest part of jet engines

Tantalum carbides cut through steel like butter

In the chemical industry, tantalum equipment keeps corrosive acids confined, and safe.

4. **Tantalum?**

This paper will review the sources of raw materials, touch on the chemical processing methods which extract the metal, comment on the products which result, and give an idea of the applications and uses of tantalum metal and compounds.

5. **Tantalum …**

Tantalum is an element. It is a grey metal, classed as a refractory metal because it is resistant to attack. For industrial use, its important properties are a high melting point, ductility which allows it to be drawn into wire, malleability which allows sheets and tubes to be made. Once exposed to air, the metal is covered with a thin layer of oxide which allows it to resist fluids in the human body, and also acids and other corrosive liquids, in the chemical industry. It has a high dielectric, which makes it so valuable in capacitors for the electronics industry.

6. **Sources of minerals**

The chief mineral containing tantalum is tantalite, and its main source is Australia. The company Sons of Gwalia operates the two largest tantalum mines in the world, producing at least half of world mine output.

The only underground mine working is in Canada, although it produces relatively little compared with ten or fifteen years ago, now less than 5% of world output.

Other mines are open cut. There are several mines in Brazil, and some in China, notably the Yichun mine. There are traditional sources in Africa, such as those in Nigeria, Democratic Republic of Congo and Rwanda, which have supplied minerals for half a century, in variable quantities.

In the Democratic Republic of Congo the mineral is columbite-tantalite, known locally as 'coltan'. And it has been the subject of trading by militias in the civil war. The T.I.C. continues to call on its members to take care in purchasing minerals in Central Africa, as harm to local populations, wildlife or the environment is not acceptable. The mining and trading of minerals is a way of producing an income, and Central Africa has exported tantalum minerals for many years, so putting an embargo on all such trade is not the whole answer. Supply from DRC is probably not more than 10% of world mine output.

Still in Africa, Ethiopia has a productive mine at Kenticha, and in Mozambique the Marropino mine is going back into operation.

Looking at the near future, there are known reserves in Egypt and Saudi Arabia which are being actively investigated, and numerous deposits in Canada, in Greenland, and in other countries in South America and in Africa. These factors show that there is no reason for tantalum raw materials to be in short supply in the foreseeable future. Estimates of supply requirements indicate growth at 7% per annum, and these can be covered by the raw materials suppliers. They can also be covered by the processing companies which refine the metal from the minerals.

7.**Wodgina Mine**

This is the Wodgina mine in the desert in the north of Western Australia, run by Sons of Gwalia. This mine can continue to supply at its current rate for the next twenty years, and as exploration around the site is successfully finding increasing reserves, the life of the mine is likely to be longer than twenty years. Its sister at Greenbushes, in the south of Western Australia, can run at full capacity for twenty-five years, and here also exploration is showing that more resources are present and the mine could be expanded. It could be extended into an underground mine by working the hard rock deposits already known. In 2003 these two mines produced 2.1 million

pounds of tantalum pentoxide contained, the measure of production used in this industry. The T.I.C. has estimated that member companies in the association produced 3.1 million pounds of tantalum pentoxide in minerals in 2003. But even this not total world production, as there are other mines which are run by companies not in our membership.

8. **Raw materials production, T.I.C. members**

In addition to the tantalum which is mined, there are also sources in the slag left after tin has been smelted from some tantalum, as you can see from this slide. Twenty years ago the majority of tantalum came from tin slag and this situation has now changed. There are two other sources of supply to mention. The Defense Logistics Agency National Stockpile in the United States releases raw materials on to the market. And there is also recycling: about 20-25% of supply comes from recycling of materials from within the industry. With expansion of existing mines, and new potential sources, there should be no shortage of tantalum even if growth increases to two or three times the forecast 7% per annum.

9. **Processors of tantalum minerals**

The metal has then to be extracted from the minerals and slag, of course, and there are processing plants in Germany, China, Japan, Thailand, Kazakhstan, and in the United States where two of the major groups are established, H.C. Starck and Cabot Supermetals. You will recognise that these are not the same countries where the minerals were mined and where physical processing or concentration takes place. So it is necessary to transport the concentrates, mostly by sea but occasionally by air.

10. **Transport difficulties**

Recent changes to the regulations recommended by the International Atomic Energy Agency, the IAEA, have resulted in a lowering of the limit of the level of radioactivity in materials which can be transported as normal goods. There is a very small content of uranium and thorium in tantalum minerals, and as these elements are in the crystal lattice they are not removed by the initial physical treatment at or near the mine site. A survey we have carried out indicates that the majority of concentrates have radioactivity levels of up to 40 Bq/g. The regulations have moved the limit from

70 to 10 Bq/g., so many of our concentrates have have been re-classified as 'dangerous goods' and some carriers refuse to take them. Some concentrates at the higher end of the range do need particular packaging and documentation, but we do not believe that the majority of materials pose any risk during transport, and the T.I.C. is therefore making representations to various authorities to request that the limit be reviewed.

11. **Refining metal from minerals**

I mentioned that this is a refractory metal, with a high melting point. Smelting is not a possibility, and the minerals have to be treated with a mixture of hydrofluoric acid and concentrated sulphuric acid in order to dissolve the tantalum oxide or other compounds in the mineral concentrates. The solution is mixed with MIBK to effect solvent extraction, and after stages of washing and drying tantalum oxide can be obtained, or if potassium hydroxide is added to neutralize the solution the product is K-salt, potassium tantalum fluoride. In order to obtain metal, the tantalum oxide is reduced with molten sodium. These are difficult processes and the reagents have to be carefully kept and used, so they are strictly controlled and environmental regulations are observed.

Tantalum Australia is responsible for research into a new method of separating metal, by a method involving osmosis, but this is still in an experimental phase.

12. **T.I.C. members 2003: estimated processors' receipts, processors' shipments**

For the processing companies which do this work, the T.I.C. has estimated that its members received 3.2 million pounds of tantalum contained in the various materials with which they were supplied in 2003, and the output by members contained 3.33 million pounds of tantalum. This indicates a slight drawdown of inventory, which is reasonable after the inventory was built up in 2001 and not immediately required.

13. **Processors' shipments, by categories**

Almost half the tantalum processed emerged as tantalum capacitor powder. In addition to the use of powder in capacitors, the wire which is part of the mill products category was also used for capacitors.

The capacitor manufacturers also use even more of the mill products in the form of trays and bars to hold the capacitor anodes during sintering, so that as the materials are heated there is no contamination.

Tantalum chemicals can be used as chemicals − for example tantalum oxide can be purified and used in glass as it increases the refractive index, so that lenses will be more powerful for less size and weight − or the chemicals can be intermediates and processed again. Tantalum carbide goes into cutting tools, and tantalum ingot can be turned into chemical processing equipment or specialized items such as sputtering targets, after purification by electron beam melting.

14. **Tantalum capacitors**

More than half the tantalum consumed in 2003 went into the manufacture of tantalum capacitors, those small components of electronic circuits which store and release electrical energy as application demands. The vast majority of that tantalum powder and wire was used by T.I.C. member capacitor firms, which include the major manufacturers in the world, and some more was used by non- members.

World tantalum capacitor production for the year was estimated by the EIA as over 19 thousand million capacitors.

15. **Applications for capacitors**

When space is limited and reliability is vital, then tantalum capacitors come into their own. Here are some examples we all see around us. Cell phones with camera and video functions built into them can have 22 or 23 tantalum capacitors. Tantalum is not only in the handsets, it is in the infrastructure, the far larger pieces of electronic equipment which convert and transmit the signals, making the system work.

Laptop computers have more programmes and functions while being smaller and slimmer, so tantalum capacitors save space and also save your batteries because they work at low voltage, another advantage for the new generation of batteries Mr.

Amazutsumi told us about yesterday. Digital cameras and video cameras benefit from the same advantages − cases are smaller, the cameras can do more and work longer.

16. **Electronics: capacitors and other uses**

The more luxurious the car, the more features it has which are governed by computerized circuits. When the temperature in the engine compartment can rise from freezing point to running temperatures in a matter of seconds, tantalum capacitors remain reliable and tolerate the cold and the heat. The electronics industry in general is already coming back from the doldrums in which it languished in 2001 and 2002, according to observers. Demand for PCs and cell phones is starting to increase. As Neil Buxton said, Japan is emerging from the electronics bubble which burst.

But even in electronic equipment, tantalum has uses which are not in capacitors. In those pieces of equipment with multiple circuits squeezed into a restricted volume, the semiconductors can be protected from short circuits between conducting materials by a barrier film of insulating tantalum oxide, for example.

Tantalum is also used as a thin film coating print heads on laser printers, as it can withstand the high temperatures.

More and more uses for thin films are being discovered, with the film usually being applied by means of sputtering.

17. **Medical applications**

Reliability and extended life are paramount in heart pacemakers, and tantalum capacitors are therefore chosen as they can be implanted and left for a long time. Tantalum can also be used in the form of the metal, since, as I mentioned, it is impervious to body fluids.

Clips and implants made of tantalum can be used without problems of rejection.

If an injury has to be treated, or tissue replaced after removal by an operation, a form of tantalum mesh can be used which becomes absorbed into the body and the tissues re-grow around it.

Alternatively the implant can be made of steel or an alloy, which would be less dense, coated with tantalum, and the properties of tantalum would be less dense, coated with tantalum would be imparted to the implant.

In an exciting piece of research, we have heard that tantalum is used in muscle stimulation in two ways: a tiny pellet of tantalum is attached to muscle which has been detached from its nerve in an accident, and this can be stimulated by an electronic circuit with tantalum capacitors which cause the muscle to contract, allowing the patient to move a leg or arm, this is in an experimental stage but gives hope for future success.

18. **Other industries**

The alloys in the hottest section of jet engines contain tantalum. As passenger journeys are now reaching the numbers they achieved in the first half of 2001, orders for aircraft are beginning to show improvement. Both Boeing and Airbus say that their engines will work at higher temperatures, with more efficiency and lower emissions, and this will require highly resistant alloys.

The use of tantalum carbide in cutting tools is at a stable level. Tool makers have carried out research and development on various combinations of carbides of tungsten with additions of niobium and tantalum and other metals, and now use smaller amounts of carbides for tips rather than larger tools. The materials bring their own economies by cutting steel sheet into car doors or washing machine cases quickly and with reduced waste.

Tantalum is good for heat exchangers.

In the chemical industry reaction vessels are made of tantalum metal sheet when other materials would be dissolved by the acids being produced in the plant. Accessory parts of the equipment would also be made of tantalum , so that when the product is pumped out it does not corrode the pipes and valves.

19. **T.I.C.**

C. member companies range from miners and smelters and traders which supply raw materials, through processors which provide metal and compounds to capacitor manufacturers, and also assaying companies which serve the others. In recent

years we have had several companies from China join the association, we have nine Chinese members, and one from Korea. Also several of the established capacitor firms, have moved some of their activities to China, Kemet has its Asian headquarters in China now, and AVX is there as well, among others.

Tantalum is a remarkable metal, which has many uses in other fields as well as in electronics, and I encourage you to contact the members of our association, or the T.I.C. office, for even more information.

Ex.7. a) Discuss the advantages and disadvantages of the report.

b) Write the **critique** *of the report (see Appendix 2).*

Ex.8. Make the **presentation** *of your report.*

Ex.9. Listen to the other reports and assess the speech according to the following assessment system, considering a perfect speech to be assessed for 25 points:

The length of speech		–0.2 points (each extra minute) (7min)
The number of the problems touched upon in the speech		–0.2 points (each) one is enough
Implementing goals		–1 point
Structuring	Clear ideas	–1 point
	Succession	–1 point
	Logic mistakes	–1 point
Reasoning		–1 point
Lexical and grammar mistakes		–0.2-0.5 points

Ex.10. Put each of the following phrases in its correct place in the sentences below.

cap in hand	***to hand***	***hand-to-mouth***
out of hand	***offhand***	***underhand***

1. I’m afraid I don’t know her address … . I’ll tell you tomorrow after I’ve looked it up.

2. He wouldn’t have minded so much if they had told him to his face that they wanted to dismiss him. It was the … way in which they did it that upset him.

3. I’d rather borrow from the bank at high interest than go … to my father.

4. The situation is now … . The authorities admit that they cannot control the rioting and crime.

5. He makes just enough money to provide for his basic daily needs. It’s a wretched, … existence.

6. She always has pencil and paper … in case she suddenly sees an interesting person or place she wants to sketch.

Ex.11. Idioms are key words. Choose the right answer.

1. The chief engineer on the gigantic bridge project was a brilliant man. He had all the statistics and specifications … and could answer any questions without hesitation.

A. at his fingertips
B. under his nose
C. at his feet
D. in his blood
E. under his breath

2. When the brakes of the car failed on the mountain road, the driver escaped death by the … by opening the door and jumping out.

A. smile on his face
B. hair on his head
C. bridge of his nose
D. skin of his teeth
E. soles of his feet

3. The archaeologists discovered a stone with some sort of writing on it but it was so strange that for many years no one could make … of it.

A. head or tail
B. hand or foot
C. tip or toe
D. finger or thumb
E. sole or crown

4. The trouble between the workers and the employers came to a … and resulted in riots which caused much damage and many injuries.

A. crown *B. fist* *C. hand* *D. toe* *E. head*

5. If we really want to find a solution to this problem, we shall just have to pause and put our … together.

A. shoulders *B. hands* *C. heads* *D. brains* *E. feet*

6. The newly-elected Prime Minister said in his speech that, if all the people put their … , they would get the country out of its difficulties.

A. backs to the wall
B. tongues in their cheeks
C. shoulders to the wheel
D. fingers in the pie
E. feet on the ground

7. When the police accused the suspect they had arrested he swore that he had had no … in the robbery.

A. finger *B. foot* *C. arm* *D. hand* *E. leg*

8. Bill is a brilliant student. He stands … above anyone else in the school.

A. hand and foot
B. head and shoulders
C. eyes and eyebrows
D. hair and scalp
E. nose and nostril