МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ

РОССИЙСКОЙ ФЕДЕРАЦИИ

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"КАЗАНСКИЙ ГОСУДАРСТВЕННЫЙ ЭНЕРГЕТИЧЕСКИЙ УНИВЕРСИТЕТ"

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**АНГЛИЙСКИЙ ЯЗЫК ДЛЯ МАГИСТРАНТОВ**

**(технических специальностей)**

**Учебно – методическое пособие**

**по дисциплинам**

**"Иностранный язык в профессиональной сфере" (английский)**

**"Технический иностранный язык" (английский)**

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 Учебно-методическое пособие представляет собой грамматический справочник, а также сборник текстов и упражнений по различным аспектам английской грамматики.

Данное пособие предназначено для магистрантов технических специальностей и имеет целью приобретение и развитие навыков научно-технического перевода.

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 **ПРЕДИСЛОВИЕ**

 Настоящее пособие представляет собой элемент учебно-методического обеспечения по дисциплинам "Иностранный язык в профессиональной сфере" (английский язык) и "Технический иностранный язык" (английский язык) и предназначено для аудиторной и самостоятельной работы магистрантов технических специальностей.

 Цель данного пособия отвечает основной цели обозначенных дисциплин в рамках магистратуры: формирование у магистрантов иноязычной коммуникативной компетенции, а именно: лингвистической, социолингвистической, социокультурной, дискурсивной, а также формирование компетенций, необходимых для использования английского языка в учебной, научной и профессиональной деятельности.

 Основные задачи, стоящие перед составителями данного учебно-методического пособия, соответствуют основным задачам данных дисциплин. Среди них целесообразно назвать следующие:

* формировать у магистрантов способность и готовность к речевой коммуникации (усвоение умений и навыков опосредованного письменного (чтение, письмо) и непосредственного устного (говорение, аудирование) иноязычного общения;
* использовать и опознавать различные грамматические структуры в письменных и устных текстах общекультурного и профессионально-технического характера;
* приобрести навыки чтения и перевода оригинальных текстов средней трудности с минимальным использованием словаря;
* научиться грамотно строить высказывание на английском языке, вести беседы на темы, связанные со специальностью, на общекультурные, бытовые темы.

 Материалы представленного учебно-методического пособия способствуют формированию необходимых компетенций в рамках обозначенных дисциплин:

- способность использовать иностранный язык в профессиональной сфере (ОПК-3);

- готовность к защите приоритета и новизны полученных результатов исследований, используя юридическую базу для охраны интеллектуальной собственности (ПК-4).

 **I.** **СТРАДАТЕЛЬНЫЙ ЗАЛОГ**

 Страдательным залогом (пассивной формой) мы называем такую конструкцию предложения, при которой подлежащее не является действующим лицом (или предметом), а само подвергается действию со стороны дополнения (при этом дополнение может лишь подразумеваться, не будучи выражено в предложении):

 Radium **was discovered** in 1898 (by the Curies).- Радий был открыт в 1898 г. (супругами Кюри).

 Сказуемое в пассивной форме состоит из вспомогательного глагола *to be* в соответствующем времени и причастия прошедшего времени смыслового глагола:

 to be + Participle II

Инфинитив - to be constructed:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   |  Present  |  Past  |  Future  | Future in the Past  |
| Indefinite  | The bridge is constructed.  | The bridge was constructed.  | The bridge will be constructed.  | The bridge would be constructed.  |
| Continuous  | The bridge is being constructed.  | The bridge was being constructed.  |  —  |  —  |
|  Perfect  | The bridge has been constructed.  | The bridge had been constructed.  | The bridge will have been constructed.  |  The bridge would have been constructed.  |

 The bridge **was constructed** last year. - Этот мост **был построен** в прошлом году.

 После глаголов в страдательном залоге часто следует предложное дополнение с предлогом **by:**

 This music **was composed by** Beethoven. - Эта музыка была написана Бетховеном.

 **Значение временных форм глагола в страдательном залоге**

 **и способы их перевода:**

 Временное значение глагольных форм в страдательном залоге соответствует временному значению глаголов в таких же временных формах действительного залога:

 *Простое настоящее*:

 Every year we **build** new roads in this region. Каждый год мы строим новые дороги в этом районе. (действительный залог)

 New roads **are built** in this region every year. Каждый год в этом районе строятся новые дороги. (страдательный залог)

 *Настоящее перфектное:*

 Someone **has spilt** some wine on the table-cloth. Кто-то пролил вино на скатерть. (действительный залог)

 Some wine **has been spilt** on the table-cloth. Вино было пролито на скатерть. (страдательный залог)

 *Простое прошедшее*:

 They **staged** “Othello” last year. В прошлом году они поставили «Отелло». (действительный залог)

 “Othello” **was staged** last year. «Отелло» был поставлен в прошлом году. (страдательный залог)

 *Прошедшее продолженное*:

 They **were building** a new school in our town. Они строили новую школу в нашем городе. (действительный залог)

 A new school **was being built** in our town. Новая школа строилась в нашем городе. (страдательный залог)

 *Простое будущее:*

 We **shall pack** the suitcases in ten minutes. Мы уложим чемоданы через десять минут. (действительный залог)

 The suitcases **will be packed** in ten minutes. Чемоданы будут уложены через десять минут. (страдательный залог)

 Английские глаголы в страдательном залоге переводят на русский язык одним из следующих способов:

 1) страдательным оборотом, в котором сказуемое (аналогично сказуемому страдательного залога в английском языке) образовано сочетанием глагола *быть (был, будет)* с краткой формой страдательного причастия:

 He **was invited** to the meeting.- Он **был приглашен** на собрание.

 2) глаголами, оканчивающимися на –ся:

 Apples **are being sold** in this shop. – Яблоки **продаются** в этом магазине.

 3) неопределенно-личным предложением (подлежащее в переводе отсутствует; сказуемое стоит в 3-м лице множественного числа действительного залога):

 The book **is** much **spoken** about.-Об этой книге много **говорят**.

 4) когда нельзя применить какой-либо из указанных выше способов, страдательный оборот при переводе заменяют равнозначным ему оборотом в действительном залоге (дополнение с **by** при переводе становится подлежащим):

 They **were invited** by my friend. – Их **пригласил** мой друг.

 **Упражнение 1. Прочитайте, определите пассивные структуры:**

1. The problem was first recognized in the 19th century. 2. Later an idea was suggested to apply it to practical things. 3. Many possibilities for practical applications were analysed. 4. Some of these were tested by experiment. 5. The experimental results were not generally accepted, and the idea was discarded. 6. Then other consequences were deduced and a new model proposed. 7. Recently the model has been modified and is now being used in many practical situations. 8. The discovery of radium was followed by a number of important inventions. 9. The current is measured with the ammeter. 10. This problem may be approached from different standpoints.

 **Упражнение 2. Проанализируйте следующие предложения, обращая внимание на глаголы в страдательном залоге:**

 1. Some people are easily influenced by other people's opinions. 2. The distribution of plants is greatly affected by local conditions. 3. The seminar was attended by all the participants. 4. His lectures are always followed by heated discussions. 5. In several areas of research the efforts of scientists are joined by those of philosophers and sociologists. 6. At the university students are offered a curriculum of study which is followed by a test and the award of a degree. 7. The members of the laboratory were consulted prior to this successful operation. 8.

He was not offered any help. 9. We have been given all the necessary information. 10. The institute was promised financial support. 11. The speaker was asked a lot of questions. 12. The teachers are recommended to give the passage as a talk. 13. If the mixture is allowed to .stay overnight, it gradually decomposes. 14. At that time girls were taught hardly more than three R's (reading, writing and 'rithmetic).

 **Упражнение 3. Переведите текст, выделяя сказуемые в страдательном залоге:**

 Research that is directed toward the solution of problems can be divided into two major classes: evaluative and devel­opmental. An evaluative problem is one in which the alterna­tive courses of action are completely specified in advance and the solution consists of selecting the best of these. A devel­opmental problem is concerned with the search for (and per­haps construction or synthesis of) instruments which yield a course of action that is better than any available at the time.

 In discussing the phases of research we shall consider each of the types of research that have been identified and explore their methodological differences and similarities. But the basis of these comparisons will be laid throughout by a de­tailed consideration of evaluative problem solving.

 As it will be seen in some detail, applied research has the advantage of being able to formulate criteria of its own effi­ciency in terms of the objectives for which the problem is being investigated. Because of lack of specific objectives, in pure research such criteria cannot be formulated as explicit­ly. Consequently, in pure research many implicit assumptions are made about the conditions under which its results will be applied. In applied research these assumptions are frequent­ly found to be unrealistic. To elaborate a previous example, in pure research the seriousness of various errors can seldom be measured. In applied problems, however, there are few cases in which this condition holds. Hence different estima­tion procedures are required in applied science, and serious questions about the estimating procedures of pure science are raised. This fact is not generally appreciated; to the contrary, it is commonly believed that pure research tends to be meth­odologically superior to applied research. Hence, the general approach of this book may be contrary to the intuition and beliefs of many.

 We shall first discuss the methodological aspects of each phase of research in an applied context, and then consider what can be learned from this representation that can be used in the pure research context.

 **Упражнение 4. Прочитайте текст, переведите его, обращая внимание на глаголы в страдательном залоге:**

 Automation is often referred to as a new subject and its vari­ous aspects have not yet all been paid adequate attention to. Thus, for example, its commercial aspects have been only recently fully appreciated. Many problems arising from the impact of auto­mation on national and world economy have not even been dealt with. It is, therefore, of paramount importance that general pub­lic should be informed both of its technological and social aspects.

 There is hardly any aspect of human life that would not be affected by the changes that automation will bring about. Un­fortunately, there is relatively little factual material available for analysing the consequences of automatization. Indeed, most economists are not yet fully aware of the problems that might arise in the process of automatization. The effect of these de­velopments on the trend of prices, capital investments, balance of payments have not yet been fully appreciated. These sub­jects should be adequately dealt with in foreseeable future.

 **Упражнение 5. Переведите предложения, обращая внимание на место предлога в пассивных структурах:**

1. This atmospheric interference has often been made reference to by radio and TV commentators. 2. Unfortunately no advantage was tak­en of the fast reaction rate. 3. So far no notice has been taken of the obvious advantage of this technique. 4. His curiosity was excited when reference was made to still earlier publications. 5. Recently the problemhas been given close consideration in connection with a new space project. 6. Mention has already been made of the fact that gold is slowly attacked by these substances. 7. Several outstanding contributions have been made to the study of crystal growth. 8. There is no doubt that in the course of further scientific development extensive use will be made of modern computing machines and electronic devices.

**Упражнение 6.**

А. *Перефразируйте безличные пассивные структуры по примеру:*

We (the author, they, etc.) have found that... — It has been found that...

1. I must admit that... 2. He has found that... 3. Everybody accepts that… 4. I believe that... 5. The author hopes that... 6. Scientists sometimes say that... 7. Most people assume that... 8. Physicists recognize nowadays that...

В. *Переведите на русский язык следующие фразы, используя безличные пассивные структуры:*

1. Говорят, что... 2. Предполагается, что... 3. Можно надеяться, что... 4. Следует признать, что... 5. Было найдено, что... 6. Общепризнанно, что... 7. Считают, что... 8. Широко распространено мнение, что....

 **Упражнение 7. Переведите текст, выделите случаи употребления страдательного залога и дайте возможные варианты перевода:**

 ***COAL***

 It has been proved that all coals had their origin in the vegetable matter of prehistoric forests. The woody fiber and other vegetable matter were transformed into peat by fermentation due to bacteria. During this process, a great part of the oxygen and hydrogen was eliminated, while the amount of carbon remained practically the same. Subsequently the peaty matter was changed into coal by a process of destructive distillation, which had been caused by great pressure and high temperature. The differences in types of coal can be easily explained by different conditions during this process of evolution. Among these variable conditions by which the formation of coal had been affected the following may be mentioned: time, depth of the bed below the surface of the earth, and amount of disturbance of the bed due to movements of the earth.

 Foreign matter was introduced during this movement of the earth. Coal is composed of the following principal elements: carbon, oxygen, hydrogen, nitrogen, and sulphur. However, these are not present solely in their elementary state, but also in various combinations, principally moisture and volatile matter. Consequently, coal is classified into various types according to its constituents; some of these types will be mentioned below.

 Peat is an intermediate condition between wood and coal. It is often used as fuel in the Temperate Zone, where it is found in large quantities in the swampy regions. It is commonly cut into blocks and dried in the air.

 Bituminous coal is the name which is usually given to coal containing more than 20 per cent volatile matter. Bituminous coal is not susceptible to spontaneous combustion, although care must be exercised in its storage. Since there is a wide range of variation in the characteristics of the bituminous coals, they have been divided commercially into the following classes: coking, cannel, and non-coking. Coking coal, upon being burned gives off considerable gas and tends to fuse together in a pasty mass (coke). Cannel coal has a high percentage of volatile hydrocarbons, ignites easily and is so valuable as a gas-producing coal that it is rarely burned to produce steam.

 Non-coking coal does not coke upon being burned and is very extensively used as a fuel to produce steam.

 **II. БЕЗЛИЧНЫЕ И НЕОПРЕДЕЛЕННО-ЛИЧНЫЕ ПРЕДЛОЖЕНИЯ**

 В отличие от русского предложения (со свободным порядком слов) английское имеет фиксированный (твердый) порядок слов. Подлежащее и сказуемое являются обязательными членами в английском предложении, и поэтому русские безличные предложения (например: *Холодно. Поздно.*) и неопределенно-личные предложения (например: *Говорят, что он здесь.*) передаются в английском языке с помощью формальных подлежащих **it, one, they.** Данные формальные подлежащие выполняют исключительно грамматическую функцию и не переводятся на русский язык.

 1. Формальное подлежащее it.

 It is evening. - Вечер. It's late. - Поздно.

 It is said that he has come. - Говорят, что он приехал.

 В некоторых случаях, из стилистических соображений, истинное подлежащее ставится после сказуемого, на место дополнения, а его место занимает формальное подлежащее **it**:

 **It** was impossible to dissolve the substance in water. - Было невозможно растворить вещество в воде.

 **It** is clear that he will not come. - Ясно, что он не придет.

2. Эмфатический оборот с формальным подлежащим it.

Для сильного эмфатического выделения любого члена предложения, кроме сказуемого, употребляется оборот **it is (was) ... that (who, whom)**, причем выделяемый член предложения помещается в середине этого оборота и становится предикативом главного предложения, например, предложение:

 Popov invented the radio in 1895.

можно передать следующими эмфатическими вариантами, которые при переводе передаются личными предложениями со словом ***именно***:

**It was** Popov **who** invented the radio in 1895. - Именно Попов изобрел радио в 1895 г.

**It was** the radio **that** Popov invented in 1895. - Именно радио изобрел Попов в 1895 г.

**It was** in 1895 **that**Popov invented the radio.- Именно в 1895 г. Попов изобрел радио.

  Таким же образом можно выделить и придаточное предложение. В переводе оно выделяется словом ***только.***

 **It was** after we had defeated fascist Germany **that**we could complete rehabilitation of our ruined cities. - Только после того, как мы разгромили фашистскую Германию, мы смогли завершить восстановление наших разрушенных городов.

3. Неопределенные подлежащие one, they.

 Когда высказывание касается людей вообще или группы людей, объединенных общим признаком, то в качестве подлежащего употребляются местоимения **one** или **they**. При этом one указывает на то, что говорящее лицо включается в сферу действия высказывания, тогда как they имеет в виду людей вообще (исключая говорящего).

 Перевод таких предложений производится с помощью неопределенно-личного или безличного оборота.

*Примечание:*

*one must (one should*) переводится *нужно*

*one can* переводится *можно*:

 **One**must be careful when handling mustard gas. - Нужно быть осторожным при обращении с горчичным газом.

 **One** can easily decompose mercuric oxide at high temperature.- Можно легко разложить окись ртути при высокой температуре.

 **They** say the weather will be better tomorrow.- Говорят, что погода будет завтра лучше.

 **Упражнение 8. Переведите следующие предложения, обращая внимание на употребление формального подлежащего it, неопределенных подлежащих one, they:**

1. It has long been known that metals can pass from a metallic to an earthy form. 2. It was in 1896 that natural radioactivity was discovered. 3. It is difficult to liberate oxygen from a compound as most of its compounds are very stable. 4. In atomic studies it has become the practice to express energies in electron-volt units. 5. It is the sun that steadily sends out a great amount of radiant energy. 6. It is the steam turbine that has replaced the old reciprocating engine. 7. On a physical map one can see seas, rivers and mountains. 8. The engine stopped; it was badly damaged. 9. A few years ago they had an exhibition of the Indian art in Leningrad. 10. One can still see Magellan's ship in Spain exhibited ashore in memory of the first journey around the world. 11. The coming winter, they say, will be extremely cold. 12. One could hardly expect such a turn of circumstances.

**Упражнение 9. Переведите следующие предложения, выделяя эмфатические сочетания it is... that (who, which) и it is not until... that:**

 1. It is these special properties of sound that are the subject of the present chapter. 2. It was the Dutch physicist, Christian Huygens, who first offered an explanation for the phenomena. 3. It was not until about 1911 that a first really successful theory of atomic structure was suggested by Rutherford. 4. It was not until Einstein discovered the connection between gravitation and inertia that the mystery Newton could not understand was solved. 5. Radioactive phenomena occur within the nucleus, and it is here that mass and positive charge resides. 6. A solenoid carrying a current behaves just like a magnet. 7. It was the great French physicist Ampere who first showed this to be the case. 8. It is just energy which the atom thus yields up that is held to account for the radiation.

 **Упражнение 10. Переведите текст, выделите безличные и неопределенно-личные предложения и дайте возможные способы их перевода.**

 ***THE RUSTING OF METALS***

 It has long been known that metals can pass from a metallic to an earthy form. One must be careful not to expose unprotected iron to the open air, as under the influence of atmospheric conditions the outer layer of the iron quickly changes into a reddish crust called the rust. One can easily find that this new material is a different substance from iron. The rust is very brittle, it is much lighter, bulk for bulk, than iron and it is not attracted by a magnet.

 It was early observed that, although the specific gravity of the earthy product was less than that of the metal, yet there was a much greater bulk of it, and that, in fact, the earthy material weighed more than the original specimen of the metal.

 It was Lomonosov who first proved that the extra material came from the air. He placed some tin in a flask and sealed up the mouth of the vessel. The tin was heated and converted into the white powder. Upon weighing the apparatus it was found that no change in weight occurred. It turned out, however, that when the mouth of the flask was opened, a good deal of air rushed in and the total weight was then greater. A portion of the original air had joined itself with the tin to form the powder.

 Eighteen years later the same experiment was made and the same conclusion drawn from it by Lavoisier. He named the gas taken from the air, oxygen.

 It is possible to confirm these conclusions in various ways. For example, when the air is pumped out of the flask before it is sealed, the metal can be heated in the vacuum indefinitely without rusting. Thus it can be seen that fundamentally rusting is the process in which metals oxidize and form compounds.

 It has been estimated that more than 25 per cent of the annual production of iron in the USA is consumed in replacing other iron that has been rendered incerviceable by rusting.

 It is necessary, therefore, to wage a constant battle against this chemical process and our immediate concern is how to take care of metallic devices and structures once they enter our possession.

 We try to prevent or reduce rusting by various means, such as electroplating, painting or otherwise treating the metals that are susceptible to attack by the agencies of this harmful action.

**III. МОДАЛЬНЫЕ ГЛАГОЛЫ**

 Модальные глаголы (*modal* означает «касающийся формы, а не существа») выражают не действие, а отношение к действию (возможность, вероятность и необходимость его совершения), поэтому никогда не употребляются самостоятельно (кроме кратких ответов), а только в сочетании со смысловым глаголом.

 Модальные глаголы отличаются от других глаголов рядом особенностей:

 1. они не изменяются по лицам и не имеют окончания –s в 3-м лице единственного числа.

 2. у них нет неличных форм – инфинитива, причастия и герундия, а следовательно, нет и аналитических видовременных форм.

 3. за исключением глаголов *can (could)* и *may (might)* имеют только одну форму.

 4. инфинитив смыслового глагола, следующий за модальными, за исключением глагола *ought,* употребляется без частицы *to.*

 5. в вопросительном и отрицательном предложениях они употребляются без вспомогательного глагола. В вопросительном предложении перед подлежащим ставится сам модальный глагол, в отрицательном отрицание *not* присоединяется к модальному глаголу.

 Глагольные способы выражения модальных оттенков долженствования и возможности, наиболее часто встречающиеся в английских научно-технических текстах:

1) Долженствование:

 **Must** в сочетании с инфинитивом смыслового глагола выражает необходимость или неизбежность совершения действия в силу определенных обстоятельств, а также служит для выражения приказания.

Переводится на русский язык как ***должен***, безличными оборотами ***нужно, надо, необходимо:***

 Force **must be** applied to produce motion.- Чтобы вызвать движение, **необходимо** приложить силу.

 In passing through the metal electrons **must collide** with many ions.- При прохождении через металл, электроны **должны сталкиваться** со многим ионами.

 Сочетание глагола **must** с инфинитивом в пассивной форме удобнее всего переводить безличным или неопределенно-личным предложением (***надо, нужно, необходимо, следует***):

 То melt potassium chloride, а temperature of 360 **must be** reached. - Чтобы расплавить хлористый калий, **необходимо** поднять температуру до 360.

**tо have (to)** в сочетании с инфинитивом смыслового глагола выражает необходимость совершения действия в силу определенных обстоятельств и близок по значению к глаголу **must**, заменителем которого он часто выступает, и переводится как ***надо, нужно, приходится***:

 Our scientists **had to solve** many complicated practical problems in the construction of the first atomic power plant.- Нашим ученым **пришлось разрешить** много сложных практических задач при строительстве первой атомной электростанции.

**to be** в сочетании с инфинитивом смыслового глагола выражает необходимость, вытекающую из договоренности или намеченного плана, и переводится ***должен***:

 The new line of the Metro **is to be commissioned** next spring.- Новая линия метро **должна вступить в строй** следующей весной.

 Этот оборот часто выражает возможность или допустимость, особенно в отрицательных предложениях и в предложениях с ограничительным словом **only**:

 This kind of information **was to be obtained** only with great difficulty. - Такие сведения **можно было получить** только с большим трудом.

**Should** в сочетании с инфинитивом смыслового глагола (без частицы ***to***) употребляется со всеми лицами и выражает необходимость, обусловленную моральным долгом или советом, и переводится: ***должен, следует, следовало бы***:

 You **should lower** the voltage in the circuit.- Вам **следовало бы уменьшить** напряжение в цепи.

Выражение **one should** переводится безличным оборотом - ***нужно, следует***:

 **One should take into consideration** that electrical currents flow only in complete circuits.- **Нужно принять во внимание, что электротоки проходят только в замкнутых цепях.**

**Ought to** с последующим инфинитивом смыслового глагола выражает необходимость, обусловленную моральным долгом или советом и аналогичен глаголу **should**, но употребляется значительно реже и переводится: ***должен, следует, следовало бы.***

 Не **ought to know** the properties of the mixture.- Ему **следовало бы знать** свойства этой смеси.

**2)** Возможность**:**

**Can (could)** в сочетании с инфинитивом смыслового глагола (без частицы ***to***) выражает физическую возможность, способность или умение совершить действие и переводится ***мочь, уметь***:

 Man **can subdue** atomic energy.- Человек **может подчинить** себе атомную энергию.

 I **can handle** the rheostat. - Я **умею обращаться** с реостатом.

Сочетание глагола **can** с инфинитивом в пассивной форме обычно переводится безличным или неопределенно-личным оборотом:

 Electric energy generated at the power station **can be transmitted** over long distances.- Электроэнергию, вырабатываемую на электростанциях, **можно передавать** на большие расстояния.

Выражение **one can** переводится ***можно***:

 Using a transformer **one can transform** power at low voltage into power at high voltage and vice versa.- С помощью трансформатора **можно преобразовать** ток низкого напряжения в ток высокого напряжения, и наоборот.

 Заменителем глагола **can** является оборот **to be able (to)**:

 Any moving object **is able to do** work. - Любой движущийся предмет **может произвести** работу.

**May (might)** в сочетании с инфинитивом смыслового глагола (без частицы ***to***) выражает разрешение или позволение и переводится: ***могу, можно, разрешено***:

 You **may touch** the wire, as the circuit is open. - Вы **можете дотронуться** до провода, т. к. цепь разомкнута.

 Глагол **may** нередко выражает также возможность совершения действия аналогично глаголу **can**:

 One kilogramme of Uranium **may produce** 20 million kilowatt-hours of electricity.- Один килограмм урана **может дать** 20 миллионов киловатт-часов электроэнергии.

 Глагол **may** может также выражать предположение, в котором говорящий не уверен, и переводится: ***может быть, возможно***:

 Не **may finish** his work today.- Он, **может быть (возможно)**, окончит работу сегодня.

 **Упражнение 11.** **Прочитайте текст, найдите модальные глаголы, переведите их, пользуясь списком, приведенным ниже:**

 If we are to fly to other planets we shall have to design a gigantic spacecraft. The conditions there must be as close to those of the Earth as possible so that we will not have to worry about all the usual hardships of space travel.

The capability of man as a space researcher should be the subject of close examination. The problem of overload is to come first. Depending on its direction it is to be classified as longitudinal, transverse, or perpendicular. Next, the problem of weightlessness is to be considered.

Each spaceman must know the design of his own craft, and he must be able to maintain the systems during the flight. If some unforeseen situation develops he should know where to look for the breakdown, and should be able to remove its cause if the crew is to feel confident during the flight and experiments.

*должен, должны; пришлось, придется; принято, захотим, стре­мимся, нужно; следует.*

 **Упражнение 12. Переведите следующие предложения, обращая внимание на модальные глаголы:**

 1. Atomic nuclei can interact with neutrons, electrons, and gamma radiation. 2. As we should infer from the vigour with which its constituents combine, water is a very stable substance. 3. The current can flow through a wire only when the circuit is closed. 4. The magnitude of electrical current may vary from a minute amount to a very large quantity. 5. In the ammeter the current which is to be measured flows between terminals A and B. 6. Speaking about the structure of the atom one should remember that the proton is smaller but heavier than the electron. 7. Only very little current should flow through the voltmeter to operate it and its mechanism must be very delicate and fine. 8. To tear away from the liquid the molecule which leaves it should have a large amount of kinetic energy. 9. Elastic limit is the point beyond which one should not attempt deforming the body if it is to return to its original condition. 10. The convocation of international scientific conferences, which are to be attended by scientists from different countries and belonging to different schools, can undoubtedly promote the development of science. 11. The investment in an atomic reactor must be high, but the running cost is so low that something like a large tanker can be run as cheaply on atomic energy as on conventional fuel.

 **Упражнение 13.** **Переведите следующие предложения, обращая внимание на модальные глаголы:**

1. Working with picric acid one must remember of its explosive nature. 2. Our scientists had to solve the problem of controlling chain reactions. 3. The nature of the raw material must be taken into consideration in the selection of a method of its analysis. 4. One can obtain better results if the solution is slightly heated. 5. A voltmeter may be connected between any two points whose voltage difference is to be measured. 6. You ought to know the properties of the ingredients. 7. There must be a greater number of turns of wire on the field magnets to produce a magnetic field of adequate strength. 8. If "water gas" is to be used as a source of pure hydrogen, carbon monoxide must be removed. 9. One must remember that any reaction is theoretically reversible. 10. If we are to convert a gas into a liquid, we must increase the attraction of the molecules for one another. 11. The unit of heat should not be confused with the degree of temperature. 12. This explosive may be either a liquid or a solid.

 **Упражнение 14.** **Переведите предложения, обращая внимание на модальные глаголы и форму инфинитива, следующего за ними:**

 1. In the past the island must have been inhabited by some primitive tribe but now it has obviously been deserted. 2. The Moon, with its soft surface like damp sand, might have been designed for descending spacecraft. 3. Under such an assumption they ought to have arrived at completely different conclusions. At least they might have. 4. With our present-day technology such phenomena could not have been observed in the laboratory; what was registered must, in fact, have been due to some malfunctioning of the recorder. 5. It is difficult to figure out what actually happened. They may have changed their minds at the last moment and may have set out in a different direction. Or else, they might be repelled by the idea of loneliness, and could have made an attempt to return. 6. According to his hypothesis, individual men cold have covered the distance between the two continents but would never have risked to take their families along. 7. His idea was that these cosmic objects should have originated under such harsh conditions that no analogy might be valid.

 **Упражнение 15.** **Переведите текст, обращая особое внимание на глагол should:**

 Thus the following requirements were suggested:

 1) the central adding and multiplying apparatus of the computing machine should be numerical, rather than on a basis of measurement.

 2) These mechanisms should depend on electronic tubes rather than on the basis of mechanical relays.

 3) The entire sequence of operations should be laid out on the machine itself so that there should be no human interven­tion from the time the data were entered until the final results should be taken off, and all logical decisions necessary for this should be built into the machine itself.

 4) 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.

 **Упражнение 16.** **Переведите текст, обращая внимание на модальные глаголы:**

According to some authors, intelligent life on any planet should develop exponentially, with all the curves going infinitely upwards. The Earth's civilization has already reached a stage at which we have to abmit that, with this trend of development, mankind may face a really grave critical situation in the future, as the resources of this planet are inherently exhaustible.

What alternative is mankind to choose under these circumstances, in order to survive as a civilization? Undoubtedly, an end must be put to the anarchic development of the productive forces, tо the uncontrolled growth of the population, to the barbarous treatment of nature. Naturally these urgent tasks facing the world can be successfully accomplished only with the establishment of a scientifically organized world community, that is, with the triumph of communism throughout the world. Yet, until then, no effort should be spared in trying to handle the present-day situation as best we can.

It is already obvious that the continuing growth of the productive forces would, before too long, make this planet unsuitable for life as a result of heat and waste pollution of the environment, overpopulation and the like. This prospect makes some authors in the West speak of an urgent need to put a stop to unbounded development of the productive forces and establishing a stringent control over them.

However, it can hardly be imagined that a civilization (the Earth's civilization, for one) would consciously restrict itself to a purely qualitative development and abstain from any quantitative expansion. Such a situation would seem most improbable indeed. For example, can a decree be passed that space exploration shall be abandoned and no use shall be made of potentially unlimited resources which are to be found outside this planet? Or, who should ban utilizing outer space for accommodating the industries adversely affecting the Earth's ecology? Clearly, once brought to life by the technological progress, space ex­ploration cannot be discontinued and is to be carried on for the benefit of those living on the planet Earth.

 **Упражнение 17.** **Переведите предложения, выделяя модальные глаголы и их эквиваленты:**

 1. However useful it may be, it cannot be employed to advan­tage unless it can be obtained in adequate quantities and at reasonable price. 2. The full five names do not have to be speci­fied. 3. For other types of signals the carrier level may have to be increased. 4. In order to make the satellite a whole number of highly involved scientific and engineering problems had to be solved. 5. There will inevitably be components that cannot be reduced entirely to physically measurable quantities and so will have to be evaluated subjectively. 6. The women were not allowed to take their tea breaks until she had left. 7. Bad news should be broken gently and good news all at once. 8. Such a corrupt and despotic government must in itself be weak just when a govern­ment ought to be strong. 9. This latter case is considerably more difficult to represent, since all subcomponents of a program will need to be activated. 10. Special techniques have had to be advised for solving the problem. 11. They will, in general, have to be content with the data available. 12. If computers are ever to gain wide acceptance for process control they must be under­stood by the people who have to operate them. For this reason they should be kept as simple as possible. 13. He may have to supply judgement to cover those aspects of the problem which could not be covered by the research. 14. If a physiologist, who knows no mathematics, works together with a mathematician who knows no physiology, the one will be unable to state his problem in terms that the other can manipulate, and the second will be unable to put the answers in any form that the first can understand.

 **Упражнение 18. Переведите текст, обращая внимание на значения модальных глаголов:**

 ***EQUILIBRIUM***

 With what can we associate the word "equilibrium"? We ought to know that the term applies equally well to a motor-car moving along a straight road at a constant speed. From a scientific point of view an object can be in equilibrium not only when it is standing motionless, but also when it is moving in a straight line at constant speed. On the other hand it would not be in equilibrium if it were increasing speed or slowing down or provided it were going around a corner.

 Evidently, when there are no forces pulling or pushing a body, that body must always be in equilibrium. However, objects with forces acting on them may also be in equilibrium. But, then, the forces must balance; that is, their vector sum is to equal zero. Thus, in the case of the speeding automobile there are forces acting, but they balance each other in pairs. The pull of gravity downward is counteracted by the push of the road upward. The driving force supplied by the motor is balanced by air resistance and other frictional forces. However, as the driving force supplied by the motor is greater than the frictional resistance, the car is accelerated.

 But sometimes an object may not be in equilibrium even though the vector sum of all the forces is zero. It may have a tendency to rotate unless all the forces are applied at a single point, or unless the tendency to rotate in one direction balances the tendency to rotate in the opposite.

 Thus the second condition for equilibrium is that the tendency to rotate should be zero. There are always two requirements for equilibrium: first, the vector sum of all the forces acting on a body should be zero; and, second, there must be no tendency to rotate, that is, the tendency to rotate the body in one direction must be balanced by the tendency to rotate it in the opposite direction.

 We have to point out the importance of equilibrium in any engineering design and construction. For example, if a house is to stand, each of its parts must evidently be in equilibrium.

 **НЕЛИЧНЫЕ ФОРМЫ ГЛАГОЛА**

Наряду с личными формами в английском языке существуют неличные формы глагола: причастие, герундий, инфинитив. Данные формы обладают рядом особенностей, которые необходимо учитывать при чтении и переводе научно-технических текстов.

Неличные формы глагола отличаются от личных форм прежде всего тем, что они не имеют категорий лица, числа и наклонения. Таким образом, герундий, причастие и инфинитив не могут согласовываться с подлежащим и, следовательно, самостоятельно никогда не выступают в функции простого сказуемого.

Другой общей особенностью неличных форм является то, что категория времени у них имеет относительный характер, т.е. их временные отличия приобретают значение лишь в сопоставлении со временем личной формы (сказуемого) данного предложения.

В результате особенностей своего возникновения и исторического развития неличные формы глагола близко соприкасаются с неглагольными категориями и обнаруживают тесную связь: герундий и инфинитив - с существительным, а причастие - с прилагательным.

 **IV.** **ПРИЧАСТИЕ I.**

 Причастие I (Participle I) является неличной формой глагола. Причастите образуется от инфинитива без частицы **to** прибавлением окончания **-ing**. Причастие I соответствует русскому причастию действительного залога (т.е. причастию с суффиксами -ущ, -ющ, -ащ, -ящ, -вш), например:

 to play – playing играющий, игравший

 to have – having имеющий, имевший

 to plan – planning планирующий, планировавший

 Так же, как и у герундия, временные отличия причастия имеют относительный характер.

 Present Participle выражает действие, одновременное с действием глагола-сказуемого:

 **Taking** the book he promised to return it soon.- Беря книгу, он обещал скоро ее вернуть.

 Perfect Participle выражает действие, предшествующее действию глагола-сказуемого.

 **Having taken** the book, he went away.- Взяв книгу, он ушел

 Функции причастия в предложении и их перевод:

 Одиночные Причастия I и причастные обороты могут играть роль одного из трех членов предложения: определения, обстоятельства и вводного члена предложения.

 **1.** В роли определения (какой?) одиночное причастие может стоять до и после определяемого слова, оборот - ­только после определяемого слова. Причастие I следует переводить причастием действительного залога либо ска­зуемым в придаточном определительном предложении, вводимом союзным словом *который*, например:

 **Conflicting** reports have been published. – Были опубликованы **противоречащие (противоречившие)** друг другу сообщения (или: которые противоречили друг другу).

 A number of animals **living** in the soil feed of plants.- Целый ряд животных, **живущих** в земле (или: которые живут в земле), питаются растениями.

 2. В роли обстоятельства (когда? как? почему? и т. д.) причастие I может стоять в начале или в конце предложе­ния и иногда вводится обстоятельственными словами when когда, while когда, пока, в то время как. Переводится оно либо деепричастием (глагольные формы с окончанием -ая, -яя, -ав и др.), либо сказуемым в обстоятельственном при­даточном предложении, для которого (если перед причастием нет союзного слова) подбирается по смыслу союз типа когда, так как, после того как, хотя, если (при этом по­вторяется подлежащее всего предложения, если оборот за­висимый), например:

 (When) **reading** books I make notes.- **Читая** (или: **когда я читаю**) книги, я делаю пометки.

 This universal motor was adopted (as) **being** more economical.- этот универсальный мотор был принят, **так как** он **был (является)** более экономичным.

 Если причастный оборот в роли обстоятельства оказы­вается в середине предложения (и в некоторых случаях в конце предложения), то он выделяется запятыми, что ис­ключает возможность принять его за определение к слову, стоящему слева от него. Значит, если перед ***ing-***формой стоит запятая, то оборот следует переводить деепричаст­ным оборотом, обстоятельственным придаточным предло­жением или придаточным предложением, вводимым со­юзом *что*, например:

 Water, **having** weight and **occupying** space, is a form of matter.- Вода, **поскольку** она **имеет** вес и **занимает** пространство, является формой материи.

 We have used the simpler method, **eliminating** questioning.- Мы использовали более простой метод, что дало возможность **избежать** опроса.

 3. Обороты с причастием I в роли вводного члена пред­ложения образуются с глаголами, выражающими ограни­чение, уточнение, обусловленность, типа:

allowing for - принимая во внимание,

assuming that - предполагая, что

beginning with - начиная с

judging bу - судя по

sреаking of (for) - говоря о (в пользу)

broadly (generally) sреаking - вообще говоря

strictly speaking - строго говоря

roughly speaking - грубо говоря

 Причастные обороты в функции вводного члена предложения обязательно выделяются запятыми, на­пример:

 **Putting it mildly**, the experiment was not conducted properly.- **Мягко говоря**, эксперимент не был проведен должным образом.

 Причастие I в составе сказуемого

 1. Причастие I может также входить в состав сказуемого, являясь его смысловой частью. В этом случае причастие стоит после вспомогательного глагола be, который указывает на время, лицо и число и не переводится. Такое сочетание образует форму Continuous:

 We **are developing** a new program.- Мы **(сейчас) разрабатываем** новую программу.

 2. После глагола ***be*** может также употребляться прилагательное, совпадающее по форме с причастием I, что дает составное именное сказуемое, в котором глагол be является связочным, и его можно переводить словами являться, быть.

 The question **is confusing**.- Этот вопрос **является нечётким** (путающим).

 Образование сложных форм причастия I и их перевод

Participle I (как и другие неличные формы глагола) может иметь сложные формы. И если простую форму причастия (Indefinite Active) можно переводить причастием (определение) или деепричастием (обстоятельство), то его сложные формы обычно следует переводить сказуемым в придаточных предложениях, учитывая при этом, что:

 - форма **Indefinite** употребляется, когда действие причастия происходит одновременно с действием сказуемого;

 **Being invited** to the conference he **left** for Kiev.- Так как его **пригласили** на конференцию, он **уехал** в Киев.

 - форма **Perfect** - когда действие причастия происходит (или заканчивается) раньше действия сказуемого;

 **Having been warmed** to 0 C the ice **began** to melt.- **После того как** лед **нагрели** до нуля градусов, он **начал** таять.

 - форма **Passive** - когда действие причастия, которое становится при переводе сказуемым, направлено на подлежащее придаточного предложения, которое образуется в результате перевода причастного оборота.

 The property **depends** on the substances **being used**.- Это свойство **зависит** от веществ, которые **используются** (от используемых веществ).

**Упражнение 19. Определите функцию формы с окончанием -*ing,* выделите среди представленных форм причастия и переведите предложения:**

1. The molecules of a gas are moving about freely. 2. Knowing the volume, the pressure, and the temperature of the gas, we can determine the state of its mass. 3. At the beginning of the century scientists succeeded in breaking the nucleus of the atom by attacking it with tiny particles flying with a great speed. 4. Being taken in proper proportion hydrogen and oxygen combine forming water. 5. The ammeter is a measuring device. 6. The forces acting between atoms within a molecule are very strong. 7. When speaking of water, we must remember that it is composed of tiny particles its molecules. 8. Having been detained by a snow storm, the liner was three days late. 9. I was told of their having been sent to the rescue operation. 10. He had good hopes of being sent to fulfilling this mission, and therefore, before returning home he spent some hours in preparing the plane for flight, trying it again and again.

**Упражнение 20. Переведите предложения, обращая особое внимание на причастие I в предложении:**

 1. Another factor influencing the level of detail is the progress reporting requirements. 2. Using the energy of the atom we produce electric energy at atomic power plants. 3. Conversion from one oxidation state to another can be accomplished readily by common oxidizing and reducing agents. 4. It is quite possible that goodness, being' a property of a man, is not conditioned by nature. 5. Electronic computers perform both arith­metic and logical operations, making it possible to control the process under rather complicated conditions. 6. System design progresses through several stages, becoming more detailed in each stage. 7. Growing science accumulates examples of quantitative relations. 8. The yield was 12% of the dried wood, varying with the amount of hydrochloric acid used. 9. When being pure, water is a colourless liquid. 10. Considering the limited scope of the method, it has yet been used by comparatively few workers. 11. The chemical and physical properties of these dimers are being studied. 12. Sometimes such experiments, even if performed only in the imagination, are convincing even to mathematicians.

**Упражнение 21. Переведите предложения, обращая особое внимание на причастие I в роли определения, обстоятельства, смысловой части сказуемого и вводного члена предложения:**

 1. Generally speaking, a liquid having a free surface is one on whose surface there is absolutely no pressure. 2. A gram of water is proved to change exactly to a gram of ice when freezing and to a gram of water vapour when evaporating. 3. This means that a space program must be flexible and diverse, making it possible to explore completely new fields. 4. Strictly speaking, this somewhat arbitrary division may be justified taking into account an imperfect technique. 5. More or less saturated chloraparaffines are formed, depending on the temperature of reaction. 6. However, speed and power consumption specifications for the devices can be misleading. 7. This country embracing over four millions (of) square miles, being thus larger than the whole of Europe, contained but about two millions (of) inhabitants.

**Упражнение 22. Переведите предложения, обращая внимание на сложные формы причастия I:**

 1. Having eliminated the other classes of earthquakes we are left with the remaining class - tectonic. 2. A new technique having been worked out, the yields rose. 3. Peter was absent, having quitted the army to hurry on reinforce­ments. 4. Having been taught Latin by an Englishman, and having travelled to Western Europe, he realized the vital importance to Russia of attracting the foreigners into the Muscovite Empire. 5. Having seen the way in which decision theory handles the future, and having examined some of the difficulties inherent in this approach, we should give further consideration to what is altogether another line of attack.

 **Упражнение 23. Переведите текст, обратите внимание на способы перевода причастий.**

 ***ELECTRIC CURRENT GENERATION***

 The term "electric current" is used to mean electricity which flows through a conductor, a direct current being a cur. rent which flows in one direction only. There are four principal ways by which a direct current can be generated, viz.

 1) chemical action;

 2) thermal or heat action, the word thermal, coming from the Greek word "therme" which means "heat";

 3) light action;

 4) magnetic action.

 To set up a current by chemical action, an alkali or an acid is used to react with a metal. Such an apparatus is called an electric cell, a group of two or more cells connected together forming a battery.

 To produce a current by thermal action, heat is applied to two unlike metals soldered together in two places, the apparatus of this kind being called a thermoelectric couple or thermocouple, for short. We get the prefix "thermo" from "thermal", the origin of the last word having been mentioned above. The word "couple" in this term means that two unlike metals or metals and alloys are joined together so that they can be properly heated in the point of the joint.

 The reason the thermocouple generates a current is due to the fact that the heat tears the electrons off of the negative inetal at the junction, just as the chemical action of an electric cell tears the electrons off of the zinc electrode. It is these electrons that form the current flowing through the circuit.

 To develop a current by light action, light is made to fall on a special kind of a cell, the apparatus to be used in such a case being called a photoelectric cell.

Finally, in order to generate a current, a wire is made to cut, that is, to pass through a magnetic field, this latter being set up either by a permanent magnet or an electromagnet. Where the wire cuts through the magnetic field of a permanent magnet, the apparatus is called a magneto-electric machine or just "magneto", for short. The wire cutting through the magnetic field of an electromagnet, the apparatus is called a dynamo electric machine, or "dynamo", for short.

 In general there are a number of ways by which electric currents can be generated by magnetic action, all of them being based on the same principle, that of cutting the magnetic lines of force with a conductor.

 **V.** **ПРИЧАСТИЕ II.**

 Participle II (3-я форма глагола) образуется прибавлением окончания ***–ed*** к инфинитиву без частицы **to** правильных глаголов. Формы причастия II неправильных глаголов приведены в особых списках в словарях.

 Participle II не имеет сложных форм и соответствует русскому причастию страдательного залога (т.е. причастию с суффиксами *–ен, -ем, -ат, -ят* и др.), например:

 to play- played играемый, сыгранный

 to study- studied изучаемый, изученный

 to plan- planned планируемый, запланированный

 to take- taken взятый

 to do- done делаемый, сделанный

 Роль причастия II в предложении

 Одиночное причастие II и его обороты могут выступать в роли одного из трех членов предложения: определения, обстоятельства и вводного члена предложения.

1. В роли определения (какой?):

а) одиночное причастие II может стоять **до** и **после** определяемого слова (оборот только после) и иногда имеет союз *as* в том виде, как. Переводится причастием **страдательного залога** или **сказуемым в страдательном залоге** в придаточном предложении, вводимом союзным словом *который,* например:

The **described** method is widely used in electroplating. - **Описанный** метод широко применяется в гальванопластике.

We used all the methods **recommended**.- Мы применили все методы, **которые были рекомендованы**.

б) одиночное причастие 2 в роли определения, стоящее **после** определяемого слова, при переводе на русский язык следует или поставить перед определяемым словом, или перевести придаточным предложением после определяемого слова, например:

The instrument **used** is very reliable. – **Используемый** прибор очень надежный (Прибор, который используется, очень надежный).

A fault **confessed** is half redressed.- **Признанная** ошибка – наполовину исправленная (ошибка, которая признана, наполовину исправлена).

в) если причастие II, играющее роль определения, образовано от глагола, который требует предложного дополнения (например, to depend on- зависеть от), или если его русский эквивалент требует после себя предлога (например, to follow- следовать за), то перевод этого причастия или оборота придаточным предложением следует начинать с этого предлога с последующим словом ***который***, например:

 Some theoretical considerations only **touched upon** in the last chapter will be considered in detail in another work. – Некоторые теоретические соображения, **о которых** только вскользь **упоминалось** в последней главе, будут подробно изложены в другой работе.

 The lecture **followed by** a film was very interesting.- Лекция, **за которой последовал** фильм, была очень интересной.

г) если в предложении рядом стоят два слова с окончанием ***–ed***, то, как правило, первое из них - определение к слову, находящемуся слева от него, а второе – сказуемое в прошедшем времени, например:

 The method **used facilitated** the procedure. - **Используемый** метод **упростил** всю процедуру.

2. В роли обстоятельства (когда? как? почему? и т.д.) причастие II стоит в начале или конце предложения (если оказывается в середине, то выделяется запятыми) и может вводиться союзами **when** (когда), **if** (если), **as** (как) и др. Перевод таких оборотов может осуществляться тремя способами, например:

 **When heated** solids expand little as compared with liquids.

*Деепричастием:* **Нагреваясь,** твердые вещества расширяются незначительно по сравнению с жидкими.

*Придаточным предложением****:* Когда твердые вещества нагреваются,** они расширяются незначительно по сравнению с жидкими.

*Существительным с предлогом:* **При нагревании** твердые тела расширяются незначительно по сравнению с жидкими.

 В роли обстоятельства причастие II переводится глаголом-сказуемым в страдательном залоге придаточного обстоятельственного предложения, для которого союз подбирается по смыслу (если его нет перед причастием), и повторяется подлежащее всего предложения, если оборот зависимый, например:

  **Written** in pencil the article was difficult to read.- **Так как** статья **была написана** карандашом, ее трудно было читать. (а не: *Написанную* карандашом статью трудно было читать).

3. Обороты с причастием II в роли вводного члена предложения выделяются запятыми и обычно переводятся обстоятельственными придаточными предложениями или деепричастными оборотами:

 all told – когда все сказано

 stated bluntly- откровенно (прямо) говоря

 stated differently- говоря другими словами, иначе говоря

 all things considered- когда все уже рассмотрено, учтя все

 present company excepted- не говоря о присутствующих

 **All things considered**, we can hardly say that we have the means of measuring directly such changes. – **Учтя все (что нам известно)**, едва ли мы можем сказать, что имеем способ непосредственного измерения таких изменений.

 Причастие II в составе сказуемого

 В роли смысловой части сказуемого причастие II стоит после служебных глаголов *be* или *have* (которые выражают время, лицо, число) и образует следующие формы:

 1. **Passive** - в этом случае причастие стоит после вспомогательного глагола **be**, который обычно не переводится, например:

 I **was asked** to come. – меня **попросили** прийти.

а) после глагола **be** в роли связочного глагола (а не вспомогательного, как в пассиве) может использоваться прилагательное, совпадающее по форме с Participle II, типа ***involved*** – сложный, ***suited-*** подходящий, при этом образуется составное именное сказуемое. В этом случае глагол-связку **be** можно переводить словами *являться, быть* или вообще не переводить, например:

 The article **is concerned** with a new aspect of the problem. – Статья **касается** нового аспекта этой проблемы.

 Psychology of creative work is **many-sided**. – Психология творческого труда **является многосторонним** процессом.

б) причастие II, стоящее после глагола **be,** иногда может быть определением к существительному, стоящему справа от него. В этом случае за причастием не следует предлог, как это обычно бывает в том случае, когда сочетание “be + -ed” образует страдательный залог, например:

 Listed in the table **are considered** estimates.- В таблице **перечислены рассмотренные** оценки.

 **Но:**

 The estimates **are considered** in their article.- Эти оценки **рассматриваются** в их статье.

 2. **Perfect** – причастие II стоит после вспомогательного глагола *have*, который не переводится, например:

 I **have asked** a question. – Я **задал** вопрос.

 **Упражнение 24. Переведите следующие предложения, выделите формы причастия II:**

 1. The force of gravitational attraction exerted on a body by the earth known as the weight of the body is one of the most important forces in everyday life. 2. The total quantity of pure radium obtained is quite insignificant. 3. Intermolecular space exists even in a gas which, subjected to exceedingly high pressure ceases to contract its volume. 4. When used as an amplifier the radio-tube allows a small voltage to control a strong flow of current from a battery. 5. If a body is totally immersed in a fluid, the upthrust of the fluid on the body is equal to the weight of the fluid displaced. 6. When the water has reached the boiling point, the temperature ceases to rise, and the heat supplied is used in changing the water into steam. 7. A beaker filled with cold water and held over a flame of burning hydrogen will condense the steam to droplets of water. 8. Glass and porcelain neither lose nor gain in weight when heated. 9. Any open mass of water if left unreplenished will evaporate little by little. 10. The modern war is an all-round test of the material and spiritual strength of every nation involved. 11. Under ordinary pressure a given liquid boils at a fixed temperature. 12. Nitre gives off oxygen only when raised to a bright-red heat. 13. The efficiency of a machine is determined by the ratio of the useful work performed to the total work expended. 14. Radioisotopes produced by our atomic industry are widely used in medicine and agriculture. 15. Capacity is the property of two electrical conductors, when separated by insulation, to receive and retain electricity. 16. Fermentation used for producing alcohol from naturally occurring substances is one of the oldest processes known to man. 17. Alloys in general consist of two or more metals melted together and then allowed to solidify. 18. The properties of matter are better learned and understood when correlated with its structure in terms of molecules, atoms, and still smaller particles. 19. When ozone decomposes, the amount of energy liberated is equivalent to that absorbed in its formation. 20. Some liquids, and to a much smaller extent some solids, if placed in contact, tend to diffuse one into the other.

**Упражнение 25. Переведите следующие предложения, выделите формы причастия II в роли определения, обстоятельства, смысловой части сказуемого и вводного члена предложения:**

 1. The characteristics of the components so far considered can be presented by the following scheme. 2. The recent talks resulted in the agreement just signed. 3. The same encoded picture used to generate Fig. 8 was analysed using a balanced correlation procedure to produce Fig. 9. 4. Historical records show that a given region may undergo a spasm of activity follow­ed by a lull of two or more centuries. 5. In this section we establish that, based on a stability assumption, these solutions exist and are unique in the mean absolute sense. 6. Based on a stage-by-stage schedule, the program embraces different fields of space research and exploration. 7. The data obtained out­weighed those that we had had before. 8. At the end of the day, reports on all completed analyses can be provided, including the number of tests run that day, the amount of time required for those tests, and the number of samples completed. 9. As indi­cated, these similarities and differences will be explored in some detail. 10. Stated differently, the purpose of the present work is to explore the so far developed related theory and to stimulate attention on some connected still open questions. 11. The feasi­bility of this system depends on several related factors. 12. All things considered, the meeting may be declared closed.

 **Упражнение 26. Переведите текст, найдите формы причастия II; определите их функции и способы перевода.**

 ***BORAX***

 This salt, when crystallised from solution, combines with water forming a hydrate. It is made by adding calcium borate to sodium carbonate solution. It is a white crystalline salt. It is added to the glass, used for enamelling and glazing, to make it more fusible and easier to spread in a thin layer. Since it contains but a small proportion of the metallic oxide, it combines with other metallic oxides if fused with them. For this reason, the powdered salt is sometimes sprinkled on tarnished metallic surfaces being soldered or brazed. The heat of the blowpipe melts the borax and the latter removes the oxide and permits perfect running of the solder over the surface.

 The borates thus formed are often coloured and the colours afford a means of recognising the metallic compound which produced them.

 In chemical analyses a bead of borax, produced by fusion on a platinum wire, is heated with a particle of the unknown compound and its colour then examined.

 **VI. ГЕРУНДИЙ**

Герундий – особая грамматическая категория с суффиксом –ing, выражающая название действия, представленного как процесс.

Семантически герундий имеет сходство с русскими именами действия на ***-нье, -ние*,** -***тие, --ка, -ство, -ба***. например:***(singing-пение, arriving-прибытие, building-строительство,firing- стрельба)***.

Герундий позволяет избегать употребления громоздких придаточных предложений и облегчает создание кратких и сжатых оборотов речи.

Следы двойственной природы герундия сохранились в современном языке в виде двойственности его функций: он имеет черты и существительного, и глагола и сохраняет связь с каждой из этих категорий.

**Связь герундия с глаголом:**

а) происходит от глагольного корня;

б) имеет временные и залоговые отличия:

I know of his **leaving** Frisco.- Я знаю, что он **уезжает** из Сан-Франциско.

I know of his **having left** Frisco.- Я знаю, что он **уехал** из Сан-Франциско.

в) принимает прямое дополнение:

Their aim was **exploring** the Pole.- Их целью было **исследование** полюса.

г) может определяться наречием:

Writing quickly is tiring.- Писать быстро - утомительно.

**Отличие от глагола:**

 Являясь неличной формой глагола, т.е. такой формой, которая не выражает ни категории лица, ни категории числа, герундий не может выполнять функции сказуемого (может быть лишь частью сказуемого).

**Связь с существительным:**

а) выражает не действие, а лишь название, процесс действия;

б) выполняет в предложении функции существительного, выступая в качестве подлежащего, дополнения, определения, обстоятельства, части сказуемого;

в) сочетается с предлогами, определяется притяжательными местоимениями и существительным в притяжательном падеже.

**Отличие от существительного:**

а) не может иметь артикля;

б) не может употребляться с номинативным сочетанием **(*of*** + существительное);

в) не имеет множественного числа;

г) не может определяться прилагательным.

 Герундий может выполнять в предложении следующие функции: подлежащего, дополнения, части сказуемого, определения (перед определяемым словом без предлога и после определяемого слова в сочетании с предлогом ***of***), обстоятельства времени, цели, причины, образа действия и др. (всегда в сочетании с предлогом).

Вследствие того, что в русском языке нет формы, соответствующей герундию, его перевод осуществляется различными способами, а именно:

Герундий в роли подлежащего и дополнения переводится преимущественно существительным, иногда инфинитивом:

**Splitting** the atom is a difficult task.-

1. **Расщепление** атома является трудной задачей.

2. **Расщепить** атом - трудная задача.

Transformers are used for **changing** d.c. into a.c.-

1. Трансформаторы применяются для **преобразования** постоянного тока в переменный.

2. Трансформаторы применяются для того, чтобы **преобразовывать** постоянный ток в переменный.

Сложный герундий в этой функции обычно переводится придаточным предложением, причем перевод часто начинается словами ***то, что (чтобы.)***:

**His having obtained** a residue at such a temperature was a great success.- **To, что ему удалось получить** осадок при такой температуре было большим успехом.

They knew about **our having done it**.- Они знали о том, что **мы уже сделали это**.

Герундий в качестве предикативного члена или части составного глагольного сказуемого передается ближе всего русским инфинитивом:

Their aim was **collecting** all the necessary data.- Их цель заключалась в том, чтобы **собрать** все необходимые данные.

Герундий в функции определения может переводиться или инфинитивом, или существительным:

Many solids have the power of **absorbing** gases on their surfaces.- Многие твердые вещества обладают способностью **абсорбировать** газы (**абсорбирования** газов) на своей поверхности.

Герундий в различных обстоятельственных функциях может переводиться деепричастием, существительным с предлогом или придаточным предложением:

**After closing the circuit** we measured the resistance.-

1. **Замкнув цепь**, мы измерили сопротивление.

2. **После замыкания цепи** мы измерили сопротивление.

3. **После того, как мы замкнули цепь,** мы измерили сопротивление.

Итак, герундий переводится на русский язык следующими четырьмя способами: существительным, глаголом в инфинитиве, деепричастием, придаточным предложением. При этом выбор способа перевода часто диктуется не функцией герундия в предложении, а удобством использования той или иной русской грамматической формы в данном контексте.

 **Упражнение 27. Определите функцию формы с окончанием *-ing* и переведите следующие предложения:**

1. In passing through a metal electrons collide with many ions. 2. When the boiling is reached the adding of heat does not raise the temperature. 3. The proper work of an engine depends upon its being well lubricated. 4. All the chemical transformations that take place around us only change energy from one form into another without affecting the total. 5. Coal and any other fuel provide the heat required for driving our engines and turbines. 6. In carrying out the plan of launching an artificial satellite our scientists had to solve many difficult problems. 7. The bridge having been repaired so quickly surprised us very much. 8. Before discussing this question they made a short break. 9. I knew nothing about the recent happenings. 10. Their having crossed the river caused a great surprise. 11. War causes hard sufferings.

**Упражнение 28. Переведите следующие предложения, определяя роль герундия в предложении:**

 1. A committee has been established for the purpose of coordinating the nomenclature. 2. They con­tinued experimenting with the substance. 3. From here on, the theory starts evaluating the various alternatives of action in terms of the objectives. 4. We have modified the network while retaining the SFS property. 5. Having access to the code was symbolic. 6. It is worthwhile thinking over the effects I have just described. 7. Besides being useful in general interpolation technique, the procedure can be ef­fectively used to approximate the first coefficients of *F.* 8. The new opportunities may make life on this planet much more worth living. 9. They were against postponing the meeting and for going on with the discussion of this problem. 10. We were all for starting the experiment at once. 11. Operating conditions differed widely. 12. It is customary to dry the precipitate on the paper without removing it from the funnel. 13. They could not help seeing the importance of the process. 14. It is commonly understood that regular queues before a theatre or a cinema are one sign that the show is worth seeing. 15. The purpose of the method is determining system stability. 16. In one's search to under­stand what happens in this particular case, one cannot help being influenced by the history of quite another problem. 17. We succeeded in building a flexible system 18. Search theory is potentially applicable to any sort of searching process.

**Упражнение 29. Переведите текст, определяя герундий в предложении:**

 ***Automation in the Research Process***

Our goal should be automating the routine and thereby leave more time for the creative process.

With that word of caution, let's proceed by arbitrarily di­viding research into three stages and examining each stage to find what functions of the research process might be automated without endangering creativity. Stage one includes the dreams, the ideas, the exploratory work, selecting the problem, setting the objective, testing technical feasibility, and searching the literature. Stage two involves planning the experiment, conduct­ing the experiment, checking the alternates, data taking, and data evaluation. Stage three is the solution of the problem ­drawing conclusions and making recommendations.

Although there is a great deal of creativity involved in stage one, there are also opportunities for automation. The burden of keeping up with the literature even in one's own restricted field is becoming heavier with each passing year. The mass of reading necessary to make a literature search has increased immensely. Advances in computer technology have made possible storing and quick retrieving essentially all the scientific literature.

**Упражнение 30. Определите функции герундия в предложении:**

 1. Two special cases are worth highlighting. 2. The question is answered in part by studying the behaviour of the optimal strategy for the task described here. 3. It is worthwhile recon­sidering this case as well as adding another even more impres­sive example. 4. Up to the present time, several writers have succeeded in finding exact solution of the fundamental dif­ferential equation in certain particular cases. 5. This justifies our coming here. 6. Programming a computer involves analys­ing the problem to be solved and a plan to solve it. 7. Having the source code is a way of achieving independence. 8. Today we cannot help witnessing a tendency in science to direct the collective efforts of a research team at the achievement of a common goal. 9. The opening words of this curious treaty are worthy of being recorded. 10. They were accused of being the friends of the Pretender. 11. Peter insisted upon laying aside all the ceremonial of royalty. 12. He had died without leaving either a personal or a political will. 13. Perhaps one of the biggest problems is ventilating suckers. 14. Air cooling instead of water cooling would also reduce the weight of the engine. 15. Trying to minimize the importance of the discovery was of no use. 16. The ability of the device to place max poles while preserving others is clearly attractive. 17. Life is a matter of making wise choices - of knowing when to draw the line. 18. The method as developed by W. R. Evens is indicating the location of roots of the characteristic equation.

 **Упражнение 31. Переведите текст, выделите все формы, оканчивающиеся на *-ing* и определите их функции:**

 ***ELASTICITY***

 Pulling a rubber band increases its length. However, if you cease pulling it and release one of its ends, the rubber band will quickly return to its original shape and size.

 Solids in greatly differing degrees resist being changed in shape, i.e. resist deformation. Some of them, like a rubber band or a steel spring, are called elastic because they return to their original size and shape after having been stretched or compressed. Others are known as elastic because they straighten after having been bent.

 Gases and liquids are perfectly elastic. In spite of then having been compressed they return to their original volume after the removing of the applied force.

 Air, for instance, is perfectly elastic. If it is compressed and then allowed to return to its original pressure and temperature, it returns exactly to its original volume.

 We may define an elastic body as one tending to return to its original shape and size when the deforming force is removed. On the contrary, bodies that are not very elastic do not show the tendency of returning to their original form. Thus, elasticity is the tendency to return to the original condition after deformation.

 Careful experiments made on various elastic materials show that there is a simple relationship existing between the acting force and the resistance force. This relationship must have a limit somewhere and the stretching cannot be increased indefinitely.

 Elastic limit is the point beyond which one should not attempt deforming the body if it is to return to its original condition.

 As we are stretching an elastic object such as a steel spring, for instance, there must come a time when the elastic limit is reached, and then the above-mentioned relationship will not hold any longer. However, stretching the steel spring repeatedly or leaving it stretched moderately has no practical effect upon it. Considering further the example of the rubber band, one finds that the more the rubber band is pulled, the longer it will become until the elastic limit is reached, at last. It is known, however, that rubber can stretch a relatively long distance before reaching the elastic limit.

 **VII.** **ИНФИНИТИВ**

 Показателем инфинитива (неопределенной формы глагола) является частица **to**.

Инфинитив называет действие, но не указывает ни лица, ни числа. Он, как и все неличные формы, не может согласовываться с подлежащим и, следовательно, самостоятельно не может выступать в предложении в качестве сказуемого.

Инфинитив, так же как и герундий, произошел от существительного и может выполнять в предложении функции существительного.

Функциональная близость инфинитива и герундия сказывается в том, что во многих случаях возможно употребление одной формы вместо другой.

Выполняя функции существительного, инфинитив обладает и некоторыми **глагольными свойствами:**

а)Инфинитив может иметь прямое дополнение

Не decided to raise **the temperature**.- Он решил поднять **температуру**.

б) Инфинитив может определяться наречием:

They wanted to start **at once**.- Они хотели отправиться **немедленно**.

в) Инфинитив может иметь сложные формы:

 to be written - быть написанным

 to have written- написать до определенного момента

 to have been written - быть написанным до определенного момента.

Остальные формы английского инфинитива выражают различное отношение ко времени и к степени совершения действия сравнительно с действием сказуемого и переводятся в соответствии с контекстом.

Формы **Indefinite** выражают действие одновременное с действием сказуемого. Они переводятся инфинитивом глагола как совершенного, так и несовершенного вида.

They wanted **to introduce** a new system.- Они хотели **вводить (ввести)** новую систему.

 Формы **Perfect** выражают действие, предшествующее действию сказуемого и переводятся инфинитивом совершенного вида:

 Не was expected **to have done** his work.- Предполагали, что он **уже сделал** свою работу.

 **Восемь функций инфинитива**

 1. **Подлежащее** — в начале предложения с последующим сказуемым.

 **То work** is important. - Работать важно.

 2. **Дополнение** — после сказуемого.

 I like **to work**. — Я люблю работать.

 3. **Обстоятельство** цели — до или после «костяка». При переводе вставляется союз «чтобы».

 **То work** I must have all the necessary equipment. — Чтобы работать, я должен иметь все необходимое оборудование.

 Примечание 1. Инфинитив в функции обстоятельства нередко переводится существительным: То raise the yield use must be made of another catalyst. — Для повышения выхода надо использовать другой катализатор.

 Примечание 2. Если пассивный инфинитив в функции обстоятельства стоит после имени прилагательного, он имеет модальный оттенок и переводится на русский язык с добавлением глагола «мочь».

Some molecules are large enough to be seen in the electron microscope. Некоторые молекулы достаточно большие, чтобы их можно было увидеть в электронный микроскоп.

Usually hydrates are too unstable to be isolated. — Обычно гидраты слишком неустойчивы, чтобы их можно было выделить.

 Примечание 3. Глаголы типа to give, to form, to yield после «костяка» часто выступают в функции обстоятельства следствия и переводятся деепричастием. Condensation proceeds as usual to give the corresponding compounds. — Конденсация протекает обычным путем, давая соответствующие соединения.

 4. **Определение** — после определяемого существительного. Может быть развернуто в определительное придаточное предложение:

 The result **to be expected** is important. = The result which is to be expected is important.

 Возможны два варианта перевода: Ожидаемый результат важен, и; Результат, который следует ожидать, важен.

 5. **Смысловая часть составного сказуемого** — после глагола-связки to be.

 Another possibility was **to use** **quartz**. — Другая возможность заключалась в применении кварца.

 Our task is **to get good results**. — Наша задача заключается в том, чтобы получить хорошие результаты.

 Примечание 4. Три функции инфинитива в начале предложения.

Инфинитив в начале предложения вызывает трудности при переводе, так как может выступать как в функции подлежащего, так и обстоятельства.

 1. Подлежащее — с последующим сказуемым — То work well is to live well. Работать хорошо, значит жить

хорошо.

 2. Обстоятельство — с последующим подлежащим

То work well I must read very much. — Чтобы работать хорошо, я должна очень много читать.

 3. Инфинитив глагола to be, входящего в состав сочетания, указывающего на долженствование (логическое выделение).

То be particularly considered are the following reaction mechanisms. — В особенности следует рассмотреть следующие механизмы реакций.

 6. **Перфектный инфинитив с модальными глаголами** .

 Формула: can (must, may) +have+ III форма смыслового глагола.

This experiment **must have been carried out**. Этот опыт, вероятно, уже проведен.

 7. **Дополнение с инфинитивом**.

 Формула: подлежащее + глагол-характеристика + дополнение + инфинитив. При переводе на русский язык этот оборот надо развернуть в два предложения следующим образом:

1. После глагола-характеристики вводим союз «что» (чтобы).
2. Дополнение становится подлежащим второго предложения.
3. Инфинитив становится сказуемым второго предложения.

I know her **to have come**. — Я знаю, что она пришла.

We wanted them **to go away**. — Мы хотели, чтобы они ушли.

 8. **Подлежащее с инфинитивом**.

 Формула: подлежащее + глагол-характеристика + инфинитив. Глаголы-характеристики типа to find, to consider, to suggest, to regard, to suppose, to report, to postulate в этом обороте, как правило, выступают в страдательном залоге (Passive)

It is found that he is clever. — Находят, что он умный.

It is known that he has come. — Известно, что он пришел.

It is believed that they work well. — Полагают, что они хорошо работают.

**Упражнение 32. Определите функцию инфинитива в следующих предложениях и переведите их:**

1. То assign a numerical value to the inertia of any given body, we choose as a standard somebody whose inertia is arbitrary taken as unity. 2. Each organ of the living organism has its own work to do. 3. When cells which have similar functions become congregated together to form distinct anatomical structures, we call such structures organs. 4. Oxygen is extremely hard to liberate from a compound. 5. The disintegration of radioactive substances is known to be a spontaneous process. 6. We know the electric cell to consist of two plates of conducting material assembled together and immersed in an electrolyte. 7. Atomic energy is likely to become the main source of power-supply in the years to come. 8. Dilute solutions appear to obey laws exactly analogous to the laws of gases. 9. The difficulties to overcome in the manufacture of synthetic camphor seem to be great. 10. There was a time when lightning proved to be a dangerous problem to be solved. 11. Devices for changing ac into dc are needed to charge storage batteries. 12. The weather is unlikely to change for the better in the coming days. 13. I asked him to inform me about the results of the test.

**Упражнение 33. Переведите предложения, определяя функцию инфинитива:**

 **A.** 1. To make a choice between these two alternatives is not an easy task. 2. To be on the safe side, take special care of the accuracy of the calculation. 3. To foresee what the future will be like requires analysis of the past experience. 4. To tell the truth, the results have no direct bearing on the problem under investigation. 5. To argue about it is not fruitful at the moment. 6. To establish cause-effect relationship be­tween smoking and some diseases, extensive research is being carried on at several research centres. 7. To sum up, synthetic problems are studied for the possibilities which they hold for practical applications. 8. To put it another way, the experimental procedure must suit the purpose of the experiment. 9. To be able to forecast the future, we must begin by a thorough analysis of the past course of events.

 **В.** 1. The aim was to discuss the impact of scientific activity on technology. 2*.* If we are to achieve the aim we must confine our attention to one point only. 3. Perhaps the greatest problem at present is to get some understanding of the remarkable phenomenon of memory. 4. The original idea was to take advantage of the high temperature of the process. 5. Glass which is to be used for lenses must be almost colourless. 6. The train is to reach its destination in 52 hours. 7. The joint programme of Russian and foreign scientists on space research is to be discussed at the next COSPAR conference. 8. Many terrigenous bacteria which have become adapted to salt water are to be found close inshore.

**Упражнение 34. Переведите текст, обращая особое внимание на инфинитив:**

 The design of an automatic computer is not a simple mat­ter. To understand how to use a computer one must fully ap­preciate its design. Therefore, a brief introduction to the logical design is necessary for the users to understand the un­derlying idea. To present some background material on theo­retical and philosophical aspects of information processing is to give the user more profound understanding of comput­ers' application. From what has been said above, it is clear that a computer may be thought of both as a machine by which to handle information and a machine by which to transform one set of symbols into another. For the user it is a machine to process the information, a way to obtain an output by ap­plying to an input a specified sequence of logical operations. The designer considers a computer to be a device for apply­ing a sequence of logic operations to symbols representing information.

Since mathematical operations are a particular group of logic operations, the consideration of logic operations by def­inition includes mathematical operations. To appreciate the significance of the conventional character of logic, and to gain some understanding of computer logical design we must con­sider a few simple games. These games are to illustrate some significant factors.

**Упражнение 35. Переведите предложения, определяя функции инфинитива в предложении:**

1. There is one more important factor to be considered. 2. it is of importance to know the basis principle to be observed in the design and use of optical equipment. 3. To summarize the findings of the tremendous work would require many pages. 4. It is ironical that we publish articles on cybernetics yet fail to develop simple and effective feedback mechanisms to serve our purpose. 5. To specify the model in this field will require advances both in mathematics and physics. 6. Such a chapter would necessarily have too ephemeral value to be worth undertaking. 7. To construct an experiment of this kind seems nearly impossible. 8. It is this type of change which is particularly to be avoided. 9. Under these circumstances the computer cannot be made to function. 10. To be sure, much of this work was initiated from actual applications. 11. The theory to be developed only aims at verifying to above discussions but is not sufficiently detailed to give a complete description. 12. The habitations of the common people were rude huts made so as to be easily taken down.

 **Упражнение 36. Переведите текст, обращая внимание на встречающиеся формы инфинитива и способы их перевода:**

 ***GRAVITY***

 The force of gravity is known to play an important part in many common phenomena of mechanics, as well as in everyday life.

 We know the weight of a body to be nothing but the pull of gravity toward the earth. A body is said to weigh one kilogram if the mass of the earth exerts upon it a pull equal to one kilogram.

 According to the universal Law of Gravitation, any two objects in the Universe are attracted to each other with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

 The Law of Gravitation is universal, of course, but it is impossible to notice the force between two ordinary objects, as the attraction between them is too small to be perceptible at all.

 But with a body as large as the Earth or the Moon it becomes a different thing. It is this force that holds the planets in their circular orbits and due to this very force the first man-made earth satellite created by Soviet scientists began to circle around our Globe.

 We know gravity to pull on every particle of a body so that its weight is actually distributed throughout the body. But a solid body seems to have one point at which it can be supported by a single upward force; this point is called the centre of gravity. In technique the centre of gravity is considered to be the location of the resultant of all gravitational pulls exerted on the body.

 Now we are to consider the question of stability, interrelated with gravity.

A book lying on a table is expected to keep its position without any difficulty, as one knows it to be in a state of equilibrium. However, to make it stand on end is not so' easy at all. In the same way, a pencil will lie on the table without any tendency to tip over. With some difficulty one can even make it stand on its unsharpened end, but it will not stand at all upon its sharp end.

 All common objects differ in their tendency to keep a given position, their stability depending on their shape, weight, and position, and everyday experience shows us that heavy objects are harder to tip over than light ones.

 The stability of an object is measured by the amount of work to be required to make it take a new position. The lower the centre of gravity, the greater the stability of an object; that is why, to increase the stability of a motorcar, its designer tries to keep the centre of gravity as low as possible.

 **VIII. Повторение. Личные и неличные формы глагола.**

###  ***1. Различные функции окончания –ed***

Окончание -ed употребляется для образования II и III форм стандартных глаголов.

1. *То be + III форма — Passive Voice.*

2. *То have + III форма —Perfect Tense.*

3. *Past Indefinite Tense*.

4. *III форма глагола — причастие в функции определе­ния, стоит до или после определяемого существительного.*

 Иногда бывает трудно провести различие между третьим и четвертым случаями употребления глаголов с окончанием -ed. Во избежание ошибок при переводе следует помнить, что: II форма глагола является сказуемым в прошедшем времени (Past Indefinite Tense) и всегда имеет активное значение. III форма глагола является причастием в функции определения и всегда имеет пассивное значение. Обнаружив глагол с окончанием -ed (в самостоятельном употреблении), необходимо выяснить, нет ли в пред­ложении другого глагола (сказуемого) в личной форме. Если его нет, то глагол с окончанием -ed является II формой, т. е. сказуемым.

 **Не invented a machine**. — Он изобрел машину.

 Если же в предложении имеется другое сказуемое, то гла­гол с окончанием -ed является III формой, т. е. определением:

 **The machine invented by him was of great value.** — Машина, изобретенная им, была очень ценной.

 Примечание 1. Если после глагола с окончанием -ed стоит предлог by, то это, как правило, III форма (так как предлог by указывает на пассив).

 Примечание 2. Если в предложении два глагола с окончанием -ed стоят подряд, то первый из них III форма (после существительного), а второй II форма (после глагола).

 The results **obtained differed** depending on the substance **used**. — Полученные результаты были разными в зависимости от примененного вещества.

 Примечание 3. При логическом выделении глагол в III форме стоит в начале предложения и переводится пассивом.

 **Presented** in the paper are new data on this subject. — В статье представлены новые данные по этому вопросу.

 **Associated** with this is another phenomenon. — С этим связано еще одно явление.

 **Упражнение 37. Определите сказуемое и переведите предложения:**

1. The method applied increased the accuracy of the results. 2. After a heated discussion the laboratory applied the method improved by Dr. N. 3. The scientist theoretically predicted complicated interaction between the components involved in the process. 4. At that time the problem presented increased danger of radioactive contamination and encountered opposition at most laboratories concerned. 5. The hypothesis concerned synthesized materials and did not apply to natural products. 6. Heat resistant materials developed in the last decade produced a revolution in a number of industries. 7. Automatized information processing radically modified the method devised. 8. The crystal produced revealed cracked faces.

 **Упражнение 38. Прочитайте и переведите предложения, обращая внимание на глагольные формы с окончанием - ed:**

1. Mathematics, mechanics, statics and geometrical optics referred to as classical disciplines started mathematical traditions in the
history of natural science. *2.* The heads of the laboratories were asked
questions formulated and agreed upon by a group of sociologists. 3. The
scientist's eloquence substituted for logical argumentation in defending an "extreme" viewpoint failed to win the audience over. 4. The
mixture allowed to stay overnight gradually decomposed. 5. The physicists showed that particles thought of as "elementary" were in fact
"non-elementary". 6. The subjects dealt with under this topic aroused a
heated discussion.

**Упражнение 39. Прочитайте текст, проследите последовательность событий, обращая внимание на Ved – формы:**

Last month our laboratory developed a new technique required for thermodynamic studies of a two-phase system. The technique allowed us to obtain results predicted by theory. The results obtained disagreed with earlier data reported by Dr. D. At our laboratory seminar Prof. S. suggested a new model to account for the mechanism of the process involved in the system. The model suggested described adequately the thermodynamic peculiarities studied by Dr. D.

 **Упражнение 40. Прочитайте и переведите предложения, определяя функции глагольных форм с окончанием - ed:**

1. The usual procedure is that information storage is followed by information analysis. 2. The procedure proposed provided the required mechanism of reaction. 3. The opening session of the Congress was preceded by a meeting of the General Assembly to elect a new president. 4. It must be admitted that the problem of science classification can be approached from several viewpoints. 5. There are fields which cannot be dealt with on a national scale only, such as environmental protection, space exploration and so on. 6. The difficulties encountered by anyone who attempted to solve the problem are much greater than those faced the endeavour to reach the summit of Mount Everest. 7. In most important applications cotton has been substituted for by synthetic tires. 8. The rate of the reaction is affected by the change in such parameters as concentration, temperature and pressure. 9. Under these circumstances one is faced with a magnified form of a danger common to all inventions: a tendency to use them whether or not the occasion demand. 10. In most cases the solution of such problems is called for by Industrial needs. 11. It is often argued that in the 20th century we are left with no expansion of wisdom and with greater need for it. 12. These ideas are hardly recognized as mathematics at all by the people trained in the classical branches of the subject. 13. Some diseases may show only when an organism containing mutant genes is influ­enced by certain factors of the environment. 14. No attempts have been made to list all the contributions in which different procedures have been developed and later used. 15. Recent discoveries in all sciences have been greatly assisted by the developments in contemporary search techniques dealt with in the last section of this book. 16. The congress attended by scientists from all the institutions concerned attracted much attention and was referred to as a most representative forum in this field.

 ***2. Функции - ing- формы.***

Глагольные формы с окончанием -ing могут иметь следующие функции:

 1. *Отглагольное существительное.* Обладает по крайней мере одним из трех признаков существительного (артикль, окончание множественного числа -s, предлог of после него).

 The **savings** of workers. — Сбережения рабочих.

 2. *Герундий.* После предлогов или глаголов, показывающих на начало, конец, продолжение процесса или отношение к процессу.

 3. *Герундиальном оборот*. Формула: предлог + притяжательное местоимение (или существительное) + инговая форма.

 I did not know of her **having been ill**. — Я не знал, что она была больна.

 There are unmistakable proofs of Pauling's **having been wrong**. — Имеются несомненные доказательства того, что Полинг ошибался.

 The possibility of ethylene **being converted** into aromatic hydrocarbons is slight. — Возможность того, что этилен превратится в ароматические соединения, незначительна, или: Возможность превращения этилена в ароматические соединения незначительна.

 4. *Перфектный герундий (Active)* Формула: having + III форма смыслового глагола («перфектная инговая форма»). Показывает, что процесс (действие, обозначенное герундием) совершился или совершится до другого действия (перфект). Переводится дополнительным придаточным предложением.

 I did not speak of **having read** this book. — Я не говорил о том, что (уже) читал эту книгу.

 5. *Перфектный герундий (Passive)* Формула: having been + III форма смыслового глагола. Показывает, что процесс совершился до первого действия и что подлежащее не является деятелем этого процесса.

 After **having been discussed** the report was published. — После обсуждения доклад опубликовали.

 6. *Continuous Tense (Active)*. Обычно сказуемое.

 Формула: to be + инговая форма смыслового глагола. Употребляется при обозначении действия, происходящего в определенный момент в настоящем, прошедшем или будущем времени, когда нас интересует не так само действие, как время его протекания.

 **I am working**. — Я работаю сейчас. **I was workin**g at 5 о 'clock. — Я работал в 5 часов. **I shall be waiting for** you at 7 о 'clock. — Я буду ждать вас в 7 часов.

 7. *Continuous Tense (Passive).* Всегда сказуемое. Формула: to be + being + III форма смыслового глагола.

 The letter **is being written**. — Письмо пишут сейчас.

 Сочетание глагола to be с III формой глагола указывает на пассив. То, что глагол to be стоит в Continuous (to be + being) указывает на Passive Continuous.

 The experiments **are being carried on**. — В настоящее время опыты продолжают.

 8. *Participle I (Причастие I) в функции обстоятельства.*

 Указывает, когда, как, при каких обстоятельствах совершилось главное действие. Переводится на русский язык деепричастием.

 **Going** home I met my friend. — Идя домой, я встретил друга.

 Причастие в функции обстоятельства часто употребляется после союзов while, when, if. Эти сочетания часто переводятся деепричастием: while working — работая; when investigating — исследуя.

 9. *Participle I (Причастие I) в функции определения*.

 Стоит рядом с определяемым существительным и имеет активное значение. Переводится на русский язык причастием настоящего или прошедшего времени действительного залога, оканчивающимся обычно на -щий и иногда на -вший.

 The **running** boy was very tired. — Бегущий (бежавший) мальчик очень устал.

 The boy **running** at some distance looked tired. — Мальчик, бегущий (бежавший) на некотором расстоянии, выглядел усталым.

 10. *Абсолютный причастный оборот.*

 Формула: подлежащее + - ing форма (при отсутствии личной формы глагола). Может начинаться с непереводимого with.

 **With the isomerization preceding** the reaction, the yields were very low. — Поскольку до реакции происходила изомеризация, выходы были очень низкие.

 **With the experiments (having been) carried out**, we started new investigations. —После того как опыты были закончены, мы начали новые исследования.

 **Упражнение 41. Прочитайте и переведите предложения, обращая внимание на Ving - формы:**

 1. Establishing relationship between the phenomena of the Uni­verse is a major task of theory. 2. Having reported of his discovery of rays of unknown nature Bequerel excited the curiosity of Marie Curie. 3. Realizing the necessity for a different approach the physicists reluctantly abandoned the project. 4. Confining his attention to one problem the scientist will surely achieve its solution much sooner. 5. Putting the discovery to use sometimes requires more effort than making it. 6. Pointing out their mistakes to some people is often quite difficult. 7. Every new idea is immediately taken up and developed further, forming the initial point of an avalanche-like process. 8. It has been shown that there is a distortion of the crystal lattice, accompanying the charge-ordered state. 9. What is worth doing is worth doing well. 10. At this stage innovation becomes a group and not an individual activity, involving both a sophisticated body of information and a sophisticated techno1ogy. 11. Soon Pierre Curie joined Marie Curie in her search for "mysterious" substance, giving up his own research. 12. It is no good stressing a paradox if you wish to excite curiosity of the audience unprepared for the lecture. 13. In 1913 Bohr proposed the solar theory of the atom, giving rise to still greater activity in both theoretical and experimental nuclear physics. 14. Some people have been so scared reading aboutharmful effects of smoking that they gave up reading. 15. Now mention should be made of the fact that geochemistry applies the con­cepts of chemistry to terrestrial circumstances, studying the distribution of elements in the course of geologic evolution. 16. The editor could not help detecting many errors both of fact and of thinking. 17. Are these prognoses really worth making? 18. To find out more about the space scientists sent little moons, or satellites, circling in orbits above the Earth.

 **Упражнение 42. Переведите часть предложений в скобках, используя следующие словосочетания:**

 *to aid in freeing; to aim at understanding; to be concerned with measuring and analysing; to be interested in constructing; to be responsible for modernizing; to insist on making use of; to prevent scientists from making; to result from combining; to result in establishing; to succeed in working out.*

1. His research (привело к установлению) a new principle. 2. The success of the space research program (явился результатом соединения) the latest achievements in science and technology. 3. Using modern installations and techniques the scientists (удалось решить) а complicated engineering problem. 4. Pure science (стремится постичь) the laws of the material world. 5. Traditionally chemists (занимались измерениями) the properties of matter and (анализом) the reac­tions by which some chemical substances are transformed into others. 6. A quantum chemist (интересует построение) adequate mathematical models of atomic and molecular structures. 7. Prof. E. was the first to see the advantages of the new approach and (настаивал на использовании) it to interpret the results. 8. Adequate theories often (избавляли ученых от проведения) many useless experiments. 9. This group of engineers (ответственна за модернизацию) the laboratory equipment. 10. The advent of electronic computers (способствовалo освобождению) man's brain from the labour of measurement and computation.

 **Упражнение 43. Прочитайте и переведите предложения, обращая внимание на Ving - формы:**

 1. It is correct to say that basic research is directed toward understanding the foundations of nature without taking into account their practical applicability. 2. Finding an adequate solution to this most urgent technological problem will surely require much time and still more effort. 3. Today we cannot help witnessing a tendency in science to direct the collective efforts of a research team at the achievement of a common goal. 4. Let's proceed by dividing research into three stages and examining each stage to find what functions of the research process may be automated without endangering creativity. 5. Such a configuration, in addition to being amenable to analytical treatment, has significant practical importance. 6. Being interested in the subject which you are studying is the best motivation for learning it. 7. Fundamental research is that which you undertake without caring whether the results will be of practical value or not. 8. The scientist and public must equally share the responsibility for finding a desirable solution to many modern technological and social problems. 9. In determining the mechanism of genetic information transmission biochemists have observed that "the language of life" is really a simple and elegant code. 10. Taking into account individual components resulted in a radical change of the entire system. 11. One of the ways to solve the problem of feeding the ever-growing world population is by turning fishing from a hunting to a farming operation. 12. Several review committees were formed, including a special environmental group. 13. Increasing the amount of available technical information scientists also contribute to transformation of some well-rooted beliefs.

 **Упражнение 44. Прочитайте и переведите предложения, обращая внимание на Ving - формы:**

 I. Some scientists do not distinguish between pure and applied mathematics, the distinction being, in fact, of recent origin. 2. At one time a giant lake extended from Vienna to the Aral Sea, its last descendants being the Caspian Sea and the Black Sea of today. 3. They took all the measurements during the actual operation of the machine, this being the usual practice in those days. 4. With everyone being a layman in most fields but his own, it is very important to exchange information on major developments. 5. The universe is now essentially composed of about 90 percent hydrogen and 9 percent helium, with the remaining 1 percent accounting for the more complex atoms. 6. The project abandoned, the leadership in this field passed to another institute. 7. Originally a mathematician, he became engaged first in theoretical physics and then in space research, all these fields being closely interconnected. 8. The possibility of there being life on Mars is very doubtful. 9. The most interesting of these phenomena is the reduction of carbon, nitro­gen and sulfur, each concentrated at a different interface, two being out of immediate contact with air. 10. This is the principle of inertia— if something is moving, with nothing touching it and completely undis­turbed, it will go on forever at a uniform speed in a straight line. 11. 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. 12. The test consists of repeated measurements of intensity with various sizes of apertures being used. 13. The difference between the two values probably accounts for the measured sensitivity being higher than that predicted by theory. 14. One of the objectives of carrying on research at the university is to provide intellectual exercise for the lecturer. This is achieved by the lecturer doing research between lectures and other duties. This presupposes the necessary equipment being available at the university. 15. Man's principal function in space being maintenance and repair work is beyond any doubt. 16. The 35-year gap in the appreciation of Mendel's discovery is often attributed to Mendel's having been a modest monk living in an out-of-the-way Moravian monastery. 17. A few more functional elements, germanium perhaps being a good candidate, may be discovered in the future.

 **IX. СЛОВА-ЗАМЕСТИТЕЛИ СУЩЕСТВИТЕЛЬНЫХ**

 В английском научном тексте часто встречаются слу­жебные слова, которые используются вместо слов, уже упо­мянутых в данном или предыдущем предложении/предло­жениях. При переводе предложений с такими словами-заместителями обычно рекомендуется повторить замененное слово.

 Кроме личных местоимений в именительном и объектном падежах в роли слов-заместителей существительных могут использоваться и другие слова:

**1) mine, ours, his, hers, theirs, yours** - особая форма притя­жательных местоимений, которая заменяет сочетания суще­ствительного с притяжательным местоимением, например:

 Our procedure is more prac­tical than **theirs** (their proce­dure). - Наш метод (процедура) более практичен, чем **их (метод)**.

 Results similar to **ours** (our results) have previously been obtained by Prof. N.- Результаты, подобные **на­шим (результатам)**, были уже получены раньше про­фессором Н.

**2) that, those** служат для замены существительных, ко­торые имеют правое определение, выраженное или суще­ствительным с предлогом (чаще всего of или причастием (чаще всего Participle II), или прилагательным. При перево­де обычно повторяется ранее упомянутое слово, например:

 The most extensive investiga­tion was **that оf Lehman**. – Наиболее обширным исследованием было **исследование Лемана**.

 We use the method similar in form to **those derived** in.- Мы используем метод по форме схожий с **методами, изложенными** в работе.

**3) this, these** обычно используются в качестве подлежа­щего, поэтому за ними идет глагол, а не существительное, как в том случае, когда this и these являются указатель­ными местоимениями. Эти слова заменяют существитель­ные предшествующего предложения или предложений. При переводе следует помнить, что:

а) слова-заместители this и these сохраняют свое значе­ние указательных местоимений: этот (эта, это) и эти соответственно;

 б) если this и these заменяют нераспространенные члены предыдущего предложения или предложений, то их можно по­вторить, определив указательными местоимениями, например:

 The original problem is now broken up into three **regions. These** are loss free regions. - Теперь исходная задача разбивается на три **области. Эти области** являются сво­бодными от потерь.

 **These** аге the same аs the re­sults obtained when d = О. **Эти результаты** являются такими же, какие были по­лучены, когда d = О.

 в) если this и these являются заместителями понятий, детально изложенных в предыдущем предложении или предложениях, то в этих случаях рекомендуется использовать служебные слова типа *это, все это, все они, все эти явления* и т. п., например:

 **These** were some successive aсtions. - **Они** представляли собой несколько последовательных действий.

 **This** confirms our earlier sug­gestion. - **Это (явлeние, открытие)** подтверждает наше раннее предположение.

 **4) оnе (оnеs)** могут заменять существительное, которое имеет определение (обычно стоящее перед этим существи­тельным, чаще всего прилагательное). Если заменяется существительное во множественном числе, тогда используется форма ones*,* например:

 It is possible to relate this phenomenological рhаsе dia­gram to а more conventional **оnе***.*- Можно связать эту феноме­нологическую фазовую диаграмму с более обычной **диаграммой***.*

 Among the disadvantages the following **оnes**сап bе men­tioned.- Среди недостатков можно упомянуть следующие **(не­достатки)***.*

**5) the former … the latter** – эти слова-заместители име­ют значение *первый (из них) ... последний (из упомяну­тых).* Однако во многих случаях в русском предложении следует повторить замененное слово, например:

**The latter**procedure is much morecomplicated than the former one. - **Последняя (из упомянутых)**процедур гораздо сложнее, чем **первая.**

 **Упражнение 44. Переведите предложения, обращая внимание на значение местоимения that:**

 1. Every man has three characters: that which he exhibits, that which he has, and that which he thinks he has. 2. The procedure that has been followed has many disadvantages. 3. The method investigated for solving these problems is that of combinatorial programming. 4. They did not ask us to prove that the symbols in question were effective. 5. That these patterns can be critical has been demonstrated by Fogg. 6. It is necessary that the criteria should be made explicit. 7. It is imperative to good manage­ment that risks and costs be minimized. 8. We simply assume that names will be substituted by the expressions that define them. 9. This solution has the disadvantage that it is too complicated. 10. The Greeks in the fifth century B.C. had the idea that the Earth was a sphere. 11. It is from this point that the theory takes off. 12. If one believes that one will believe anything. 13. It is the end that matters. 14. This formulation reduces to that given in.

 **Упражнение 45. Переведите предложения, обращая внимание на значение слова one:**

 1. One is never old to learn. 2. One should see the situation with one's own eyes. 3. The reduced problem has the same struc­ture as the original one. 4. The problem to be solved is fun­damentally a mathematical one. 5. One may postulate that this hypothesis holds under the circumstances. 6. The use of an analogue computer permits one to obtain such records quite rapidly. 7. In Fig. 2 one. can see the negative influence of the strategy. 8. Going one step further, a complementary operator might be added. 9. As one turns the pages one is impressed by two aspects of the work. 10. Such an overall approach is obviously a long-term one. 11. This chapter considers the alternative ways in which one could try to bring about an improvement. 12. The largest countries are not as specialized the smaller ones.

**Упражнение 46. Прочитайте следующие предложения, переведите их, выделяя слова-заместители существительных:**

 1. Our ideologists linked the western pragmatic approach with that of the mysticism of the East. 2. The forces of peace are more powerful than those of war. 3. The industrial output of Austria in 1992 was nearly 10 per cent below that of 1991. 4. In 1951 the per hectare cotton yield in the USSR was nearly twice as great as that of Egypt. 5. The wages of the Europeans in South Africa are usually ten times as great as those of Africans. 6. One of Korea's acutest problems for centuries was that of water for irrigation purposes. 7. The first German edition of the Communist Manifesto was published in 1848; the first Russian one, early in the sixties.

**Упражнение 47. Прочитайте следующие предложения, переведите их, выделяя слова-заместители существительных:**

 1. An inert gas is the one, which does not enter into chemical combination with other substances. 2. The most distant planets as well as the nearest ones are beyond the atmosphere of the earth. 3. The vegetation of valleys is richer than that of mountains. 4. The earliest squatting places of man in our country are those discovered in the Caucasus and in the Crimea. 5. Every useful object such as iron, paper, etc., may be regarded from a twofold outlook, that of quality and that of quantity. 6. A pure substance is the one containing no admixtures. 7. This motherboard is much better than the one you showed me last time. 8. Markoni repeated Popov's experiments in London and built a radio apparatus, which was an exact replica of the Russian one.

 **Упражнение 48. Переведите предложения, определяя слова-заместители:**

 1. A complete test set is that of tests that test every point that can be tested. 2. These times should be compared with those in Table 5. 3. The rate is identical with that of the uninhibited reaction. 4. This follows immediately from Theorem 1. 5. One should use a new method, not the old one. 6. Our values are not in accord with those obtained by previous workers. 7. Overflow from one plate to the one below is by no means by the side arm. 8. Thus, connections that pass data are a necessary minimum. Not so the communications of control. 9. One cannot start applying probability theory before one has an adequate method for numerical representation of the data. 10. This brings the story to a third possibility: one associated primarily with the name of Skolen. 11. this leads one to regard two problems. 12. We conclude that the latter information value exceeds the former.

 **Упражнение 49. Переведите текст, отмечая в нем местоимения - заместители существительного:**

 ***GENERATION OF STEAM***

 Steam is generated in a boiler by the application of heat to some part, which is in close contact with the water it contains. The heat raises the temperature of the water to boiling point and eventually produces steam,

 Sensible heat is the one added to the water during the period in which the temperature is rising and while no steam is being generated.

 When boiling point is reached, the heat necessary to convert the water into steam is latent one and cannot be measured by the thermometer. Steam heated to a temperature above that which is necessary to make water boil at the given pressure is termed superheated steam.

 The total heat of superheated steam is the one required superheating to the desired temperature, plus to total heat of dry saturated steam above 32¦ F, and at the superheated pressure.

 When steam is generated in a closed vessel, the water and steam cannot be under the influence of the atmosphere, and therefore the pressure shown by the boiler is the pressure, which differs from the absolute pressure by an amount equal to atmospheric pressure.

 For practical purposes atmospheric pressure is taken as 15 lbs. per sq. in., and therefore the readings for the absolute pressure of steam in a boiler are 15 lbs. greater than those shown by the pressure gauge.

 **X. Тексты для чтения, перевода и реферирования.**

 **I.**

 **1. SCIENTIFIC METHOD AND METHODS OF SCIENCE**

***Прочитайте и переведите текст:***

It is sometimes said that there is no such thing as the so-called "scientific method"; there are only the methods used in science. Never­theless, it seems clear that there is often a special sequence of proce­dures which is involved in the establishment of the working principles of science. This sequence is as follows: (I) a problem is recognized, and us much information as possible is collected; (2) a solution (i. e. a hypothesis) is proposed and the consequences arising out of this solution are deduced; (3) these deductions are tested by experiment, and as result the hypothesis is accepted, modified or discarded.

***Выполните следующие задания по тексту:***

 1. Find two sentences which express two different viewpoints on the existence of "scientific method". *2.* What words show that the first sen­tence is an opinion? 3. What word shows that these viewpoints are in opposition? 4. Find the words equivalent to "scientific method". 5. What procedure does the scientist follow in his research?

 **2. PURE AND APPLIED SCIENCE**

***Прочитайте и переведите текст:***

As students of science you are probably sometimes puzzled by the terms "pure" and "applied" science. Are these two totally different activities, having little оr no interconnection? Let us begin by examining what is done by each.

Pure science is primarily concerned with the development of theories (or, as they are frequently called, models) establishing relationships between the phenomena of the universe. When they are sufficiently validated these theories (hypotheses, models) become the working laws or principles of science. In carrying out this work, the pure scientist usually disregards its application to practical affairs, confining his attention to explanations of how and why events occur.

 ***Выполните задания на понимание содержания текста:***

1. Does the author give definition of both "pure" and "applied" science? 2. Find the word which is used as an equivalent of "sciences". 3. When does a hypothesis become a principle of science? 4. What questions is the pure scientist concerned with? 5. Find the words equivalent to "how and why events occur". 6. What is usually disregarded by the pure scientist?

 **3. MATHEMATIZATION OF NATURAL SCIENCES**

***Прочитайте и переведите текст:***

Exact science in its generally accepted sense can be referred to as a family of specialized natural sciences, each of them providing evidence and information about the different aspects of nature by somewhat different working methods. It follows that mathematics in its pure sense does not enter into this frame, its object of study, being not nature itself. Being independent of all observations of the outside world, it attempts to build logical systems based on axioms. In other words, it concentrates *on* formulating the language of mathematical symbols and equations which may be applied to the functional relations found in nature.

This "mathematization", in the opinion of most specialists, is wit­nessed first in physics which deals with general laws of matter and energy on subatomic, atomic and molecular levels. Further application of these mathematical laws and studies is made by chemistry and results in structural bonds between the elements of matter being established.

 ***Выполните задания на понимание содержания текста:***

 1. What is generally understood by exact science? 2. How does the author describe "specialized" natural sciences? 3. Why does mathematics not belong to this family? 4. What is the objective of mathematics? 5. Is there only one definition of the objective? 6. What does the application of mathematical laws in chemistry result in?

 **4. THINKING ABOUT THE FUTURE**

***Прочитайте и переведите текст:***

To speculate about the future is one of the most basic qualities of man. It involves two aspects: one is to forecast what the future development will be and the other is to determine in what approximate period of time it is going to take place. To make such a prognosis means to learn from the past experience and to extrapolate the knowledge into the future. Recently, however, the rate of change has been so great as to make it difficult to learn from experience, at least as far as the time factor is concerned. To take but one example, a prediction of man's possible landing on the Moon around the turn of the century was made as late as 1961, only 8 years before the actual event! So, to be on the safe side, we had better leave time to take care of itself, and concentrate our attention on what the future may be like.

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? The choice is to be made, at different levels, by every individual and by every society.

 ***Ответьте на вопросы:***

1. What are the two aspects of speculation about the future? 2. What are the two steps of any prognosis? 3. Why has it been so difficult recently to make any predictions concerning the future development? 4. What example is cited to illustrate the difficulty? 5. Does the author make any suggestions concerning this difficulty? Why does he suggest this? 6. What dilemma are we faced with and what choice is to be made by every individual and every society? 7. What are Russian equivalents of: before the actual event, leave time to take care of itself, what the future may be like?

 **5. SCIENTIFIC ATTITUDE**

***Прочитайте и переведите текст:***

What is the nature of the scientific attitude, the attitude of the man or woman who studies and applies physics, biology, chemistry or any other science? What are their special methods of thinking and acting? What qualities do we usually expect them to possess?

To begin with, we expect a successful scientist to be full *of* curiosity - he wants to find out how and why the universe works. He usually directs his attention towards problems which have no satisfactory explanation, and his curiosity makes him look for the underlying relationships even if the data to be analysed are not apparently interrelated. He is a good observer, accurate, patient and objective. Furthermore, he is not only critical of the work of others, but also of his own, since he knows man to be the least reliable of scientific instruments.

And to conclude, he is to be highly imaginative since he often looks for data which are not only complex, but also incomplete.

 ***Ответьте на вопросы по тексту:***

1. What qualities do we expect to find in a successful scientist? 2. Why do we say that a successful scientist is full of curiosity? 3. Why is it difficult to see the underlying relationships? 4. Why is he critical of his own work? 5. Why is it necessary for him to be highly imaginative? 6. Give a Russian equivalent of the title and of «the data analysed»and «the data to be analysed».

 **6. THE EXPLORATION OF AN EXOTIC PLANET**

***Прочитайте и переведите текст:***

 Let us see what it means to explore a planet like the Earth. Imagine us living on some other planet, say, Mars. Let us start with ground-based observations. If we looked at the Earth from Mars using a large telescope, it would appear as a cloud-covered and distant planet. The bright features would soon be recognized as clouds. The underlying dark features would represent the Earth's surface. If we studied the surface features for a long time, their accurate map could be constructed. If spectroscopic investigation of the Earth's atmosphere in the ultraviolet, visible, and infrared regions of the spectrum were carried out, it would give approximately correct information about such gases as oxygen, carbon dioxide, nitrogen, and ozone. Investigations of the infrared spectrum of atmosphere gases would indicate the variation of temperature and pressure with altitude. These conclusions could be check if we sent a spacecraft to orbit the Earth. The radio signals from our spacecraft might provide some additional information. Bui if we wanted to study the planet more thoroughly, we should have to send a land mission to the Earth.

 ***1) Ответьте на вопросы:***

 1. What techniques are available for exploring an exotic planet? 2. What kind of information would be obtained with the help of a large telescope? 3. What kind of information would be obtained from spectroscopic investigation? 4. What would be the purpose of sending spacecraft to orbit the planet? 5. What would be the purpose of sending a land mission there?

 ***2)Переведите словосочетания:***

 it would appear as; the bright features; the underlying dark features; variation of temperature with altitude; a land mission.

 **7. PROBING THE UNIVERSE**

***Прочитайте и переведите текст:***

Until quite recently man had no way of looking into space еxept through optical telescope. Optical astronomy enriched science with profound knowledge of the Universe. But for radio-astronomy, however, we should have never made such new remarkable discoveries in the Universe as pulsars, radio galaxies, etc.

It should be emphasized that thanks to radio-astronomy, astronomers have detected several dozen chemical compounds in the gas and dust clouds of interstellar space. It is desirable that theorists and experimenters should try to figure out how these compounds were made. It is believed that when gas atoms collide with the dust, they would stick. The dust seems to act as if it were a collector of atoms and facilitated their combination.

Further progress in radio-astronomy will demand that scientists should take more and more advantage of instrumented satellites and should set up observatories on the Moon and on planets so that they could carry out continuous observation of space. In general, with longer observing times and with the help of cosmic laboratories, the sensitivity of detecting far-away bodies and chemical compounds would increase. More cosmic information would be obtained.

If use were made of such facilities as these, the next decade or so would reveal the richest rewards of space science.

 ***1) Ответьте на вопросы:***

 1. What are the latest discoveries in astronomy due to? 2. What is the actual contribution of radio-astronomy to science? 3. What is the hypothesis of the formation of chemical compounds in space? (What makes you think that this is a hypothesis?) 4. What are the prospects of the nearest future development in the field?

 **II.**

 **Text A. Science and Technology**

***Прочитайте и переведите текст:***

1. Science problems can be roughly classified as analytic and synthetic. In analytic problems we seek the principles of the most profound natural processes, the scientist working always at the edge of the unknown. This is the situation today, for instance, within the two extremes of research in physics — elementary particle physics and astrophysics — both concerned with the properties of matter, one on the smallest, the other on the grandest scale. Research objectives in these fields are determined by the internal logic of the development of the field itself. Revolutionary shocks to the foundations of scientific ideas can be anticipated from these very areas.

2. As to synthetic problems, they are more often studied because of
the possibilities which they hold for practical applications, immediate
and distant, than because their solution is called forby the logic of
science. This kind of motivation strongly influences the nature of scientific thinking and the methods employed in solving problems. Instead of
the traditional scientific question: ''How is this to be explained?" the
question behind the research becomes "How is this to be done?" The
doing involves the production of a new substance or a new process with
certain predetermined characteristics. In many areas of science, the
division between science and technology is being erased and the chain
of research gradually becomes the sequence of technological and engineering stages involved in working out a problem.

3. In this sense, science is a Janus-headed figure. On the one hand,
it is pure science, striving to reach the essence of the laws of the
material world. On the other hand, it is the basis of a new technology,
the workshop of bold technical ideas, and the driving force behind
continuous technical progress.

4. In popular books and journals we often read that science is mak­ing greater strides every year, that in various fields of science discovery
is followed by discovery in at steady stream of increasing significance
and that one daring theory opens the way to the next. Such may be the impression with research becoming a collective doing and scientific data exchange a much faster process. Every new idea should immediately be taken up and developed further, forming the initial point of an avalanche-like process.

5. Things are, in fact, much more complex than that. Every year scientists are faced with the problems of working through thicker and tougher material, phenomena at or near the surface having long been explored, researched, and understood. The new relations that we study, say, in the world of elementary particles at dimensions of the order of 1013 cm or in the world of superstellar objects at distances of billions of light years from us, demand extremely intense efforts on the part of physicists and astrophysicists, the continuous modernization of laboratories with experimental facilities becoming more and more grandiose and costing enormous sums. Moreover, it should be stressed that scientific equipment rapidly becomes obsolete. Consequently, the pace of scientific development in the areas of 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. It may take, for exam­ple, more than 10 years from the initial decision to build a 100—200 billion electron volt accelerator to its completion.

It should be borne in mind, too, that few measurements and read­ings given by these great facilities push science forward, results of any great significance being very rare. For instance, tens of thousands of pictures taken during the operation of an accelerator will have to be scrutinized in the hope of finding, among typically trite processes, signs of a new interaction or of a new event whose presence or absence may confirm a theoretical idea.

 ***Задания к тексту:***

 *Прочитайте параграф 1*.

 1. Определите ключевое предложение. Найдите предложение, содержащее прогноз автора и слово, указывающее на прогноз. 2. Что означают слова the situationи these very areas?

*Прочитайте параграф 2*.

 1.Определите ключевое предложение. Ответьте на вопросы: What are the two motive forces behind synthetic and analytic research? What are the consequences arising from the change in motivation for research? What is the present-day relation between science and technology? What is meant by *the doing?* 2. Найдите два близких по смыслу предложения в параграфах 1 и 2.

3. Найдите слова, выражающие сравнение в первом предложении параграфа.

4. Переведите последнее предложение параграфа на русский язык.

 *Прочитайте параграф 3.*

 1. Определите ключевое предложение и предложения, развивающие главную идею.

2. Переведите словосочетания striving to reach the essence*. . .* и the
hop of bold technical ideas.

*Прочитайте параграф 4.*

 1. Найдите слова, связанные по смыслу со словом science. Назовите главную идею параграфа.

2. Выпишите слова, эквивалентные словосочетаниям непрерывный поток, дерзкая теория, лавинообразный.

 *Прочитайте параграф 5*

 1. Разделите параграф на три части со следующими названиями: Sub­ject of Research, Tools of Research и Results of Research.

 **Text B. What Science Is**

***Прочитайте и переведите текст:***

1. It can be said that science is a cumulative body of knowledge about the natural world, obtained by the application of a peculiar method practised by the scientist. It is known that the word science itself is derived from the Latin "scire", to know, to have knowledge of, to experience. Fundamental and applied sciences are commonly distinguished; the former being concerned with fundamental laws of nature, the latter engaged in application of the knowledge obtained. Technology is the fruit of applied science, being the concrete practical expression of research done in the laboratory and applied to manufacturing commodities to meet human needs.

2. The word "scientist" was introduced only in 1840 by a Cambridge professor of philosophy who wrote: "We need a name for describing cultivator of science in general. I should be inclined to call him a scientist". "The cultivators of science" before that time were known as "natural philosophers". They were curious, often eccentric, persons who poked inquiring fingers at nature. In the process of doing so they started a technique of inquiry which is now referred to as the "scientific method".

3. Briefly, the following steps can be distinguished in this method. First comes the thought that initiates the inquiry. It is known, for example, that in 1896 the physicist Henri Becquerel, in his communication to the French Academy of Sciences, reported that he had discovered rays of an unknown nature emitted spontaneously by uranium salts. His discovery excited Marie Curie, and together with her husband Pierre Curie she tried to obtain more knowledge about radiation. What was it exactly? Where did it come from?

4. Second comes the collecting of facts: the techniques of doing this will differ according to the problem which is to be solved. But it is based on the experiment in which anything may be used to gather the essential data — from a test-tube to an earth-satellite. It is known that the Curies encountered great difficulties in gathering their facts, as they investigated the mysterious uranium rays.

5. This leads to step three: organizing the facts and studying the relationships that emerge. It was already noted that the above rays were different from anything known. How to explain this? Did this radiation come from the atom itself? It might be expected that other materials also have the property of emitting radiation. Some investigations made by Mme Curie proved that this was so. The discovery was followed by further experiments with "active" radioelements only.

6. Step four consists in stating a hypothesis or theory; that is, framing a general truth that has emerged, and that may be modified as new facts emerge. In July 1898, the Curies announced the probable presence in pitchblende ores of a new element possessing powerful radioactivity. This was the beginning of the discovery of radium.

7. Then follows the clearer statement of the theory. In December 1898, the Curies reported to the Academy of Sciences: "The various reasons enumerated lead us to believe that the new radioactive substance contains a new element to which we propose to give the name of Radium. The new radioactive substance certainly contains a great amount of barium, and still its radioactivity is considerable. It can be suggested therefore that the radioactivity of radium must be enormous".

8. And the final step is the practical test of the theory, i. e. the prediction of new facts. This is essential, because from this flows the possibility of control by man of the forces of nature that are newly revealed.

9. Note should be taken of how Marie Curie used deductive reasoning in order to proceed with her research, this kind of "detective work" being basic to the methodology of science, It should be stressed further that she dealt with probability — and not with certainty — in her investigation. Also, although the Curies were doing the basic research work at great expense to themselves in hard physical toil, they knew that they were part of an international group of people all concerned with their search for truth. Their reports were published and immediately examined by scientists all over the world. Any defects in their arguments would be pointed out to them immediately.

 ***Задания к тексту:***

*Прочитайте параграф 1.*

1. Определите главную идею параграфа. 2. Переведите на русский: a cumulative body of knowledge, a peculiar method practised by the scientist, manufacturing commodities to meet human needs.

*Прочитайте параграф 2.*

1. Найдите основное слово и его эквиваленты. Определите предложение, повторяющее идею первого предложения текста. 2. Найдите слова, эквивалентные следующим: направляет свои пытливый ум на. *. .*

*Прочитайте параграф 3.*

1. Определите главное и второстепенные предложения. Определите главное существительное и проследите его замены эквивалентами и местоимениями. 2. Найдите русский эквивалент слова initiates.

 *Прочитайте параграф 4.*

1. Определите главное предложение. Проследите изменения слов the collecting of factsи их замену эквивалентами и местоимениями.through their transformations into their equivalents and pronouns. 2. Найдите эквиваленты слов: столкнуться с трудностями, пробирка, в зависимости от проблемы.

 *Прочитайте параграф 5.*

1. Определите главное и второстепенные предложения. Найдите предложение, описывающее первый шаг на пути к гипотезе. (Какой модальный глагол показывает, что это только первый шаг?). 2. Найдите русский эквивалент слова to emerge.3. Переведите последнее предложение параграфа на русский язык.

 *Прочитайте параграф 6.*

1. Определите главное и второстепенные предложения. Найдите предложение, описывающее следующий шаг на пути к гипотезе. (Какой модальный глагол показывает, что это гипотеза?). 2. Определите функцию сочетания that is и найдите русский эквивалент 3*.*Переведите первое предложение на русский язык.

 *Прочитайте параграфы 7 и 8.*

1. Определите главное и второстепенные предложения. Найдите предложение, описывающее последний шаг в развитии гипотезы. 2. Найдите эквиваленты слов: несомненно, несмотря на это, на том основании*.* 3. Постарайтесь объяснить выбор модальных глаголов. 4. Найдите в 6-м параграфе английский эквивалент сокращения i. e.

 *Прочитайте параграф 9.*

1. Определите роль дедуктивного рассуждения в науке. Найдите слова, характеризующие условия работы супругов Кюри. 2. Переведите параграф 9 на русский язык.

 *Напишите резюме в трех предложениях.*

 **Text C. Research: Fundamental and Applied, and the Public**

***Прочитайте и переведите текст:***

1. People are always talking about fundamental research, implying
thereby the existence of a nameless opposite. A good definition of fundamental research will certainly be welcomed: let us see whether we can
invent one. We have to begin, of course, by defining research. Unfortunately the concept of research contains a negative element. Research is searching without knowing what you are going to find: if you know what you are going to find you have already found it, and your activity is not research. Now, since the outcome of your research is unknown, how can you know whether it will be fundamental or not?

2. We may say for instance that fundamental research is that which you
undertake without caring whether the results will be of practical value or not. It may not be reasonable to go further and say that fundamental research is that which will be abandoned as soon as it shows a sign of leading to results of practical value. By saying this you may limit your own achievement. It will be better to say that fundamental research is that which may have no immediate practical value, but can be counted upon as leading to practical value sooner or later. The extension of knowledge and understanding of the world around us will always be profitable in the long run, if not in the short.

3. This is a very powerful argument for fundamental research and it
is a completely unassailable one, and yet there are people who will not like it. Let us seek a definition that will give fundamental research a value of its own, not dependent upon other uses appearing soon or late. We say for instance that fundamental research is that which extends the theory. Now we have to theorize upon theory.

4. There have been several viewpoints about theory. One is that the­ory discerns the underlying simplicity of the universe. The non-theorist
sees a confused mass of phenomena; when he becomes a theorist they fuse
into a simple and dignified structure. But some contemporary theories are
so intricate that an increasing number of people prefer dealing with
the confusion of the phenomena than with the confusion of theory.

5. A different idea suggests that theory enables one to calculate the
result of an experiment in a shorter time than it takes to perform the
experiment. I do not think that the definition is very pleasing to the
theorists, for some problems are obviously solved more quickly by
experimenters than by theorists.

6. Another viewpoint is that theory serves to suggest new expe­riments. This is sound, but it makes the theorist the handman of the
experimenter, and he may not like this auxiliary role. Still another
viewpoint is that theory serves to discourage the waste of time on making useless experiments.

7. Let us try to flatter theory by giving it a definition that shall not
describe it as a mere handmaid of experiment or a mere device for
saving time. I suggest that theory is an intellectual instrument granting a
deep and indescribable contentment to its designer and to its users.
This instrument is made up of units which can be compared, for
instance, to different branches of physics: solid state physics, relativity, acoustics, elementary particles and others, which sometimes have only a remote relation with one another and may not even be interconnected at all.

8. The rest of my talk will be devoted to a different question which is: how are we going to communicate to the layman some of our passion for our science? This is a very important question, for everyone is a layman until he becomes a scientist, if we can solve the problem of interesting the layman we may succeed in attracting the potential Fermis, Slaters, Lands and Fletchers of future into the field of, say, physics. Nothing could be more desirable.

9. A frequent technique is that of surprise. The trouble with this is that one cannot be surprised if one is not accustomed to the situation which is nullified by the surprise. Imagine, for example, a physicist trying to surprise an audience of laymen by telling them that there are a dozen elementary particles instead of two or three, or that the newest cyclotron imparts an energy of 500 mev to protons. It simply will not work, because the listeners will have no background to compare this information with.

10. It is also a mistake to think that we can excite an audience by solving a mystery for them. The trouble here is that practically no one is interested in the answer to a question which he never thought of asking.

11. Relativity had a wonderful build-up in the decade before 1905, for the physicists of that era were acquainted with the sequence of experiments which were designed to show that the earth moves relatively to the ether and which obstinately showed the opposite. Each stage in the unfolding of quantum mechanics was exciting to the physicists who knew the earlier stages, because they knew the problems which were left unsolved. The writer of a detective story creates the mystery before he solves it; but the mystery usually begins with the discovery of a murdered man, and this is considerably more exciting than a murdered theory. The corresponding technique in physics consists in trying to create a particular state of out-of-dateness in the mind of the public, in the expectation of bringing them up-to-date at the end of the lecture or paper. There is too much risk of having the audience in the out-of-date condition, and this technique cannot be recommended.

12. Another mistake, in my opinion at least, is that of stressing a paradox. Try telling an audience that if you know the exact position of a particle you cannot know its momentum, and vice versa — the effect is unpredictable but obviously not what you wanted. Still another mistake is that of springing an isolated fact upon the audience. An isolated fact is not science and it is not interesting. Facts are of interest only as parts of a system. And we must strive to interest the layman in the system.

 ***Задания к тексту:***

 *Прочитайте параграфы 1—3.*

 1. Проследите изменения существительных research, definitionи argument и определите основную идею параграфов. 2. Выпишите слова, эквивалентные выражениям: весьма желательно иметь хорошее определение, предпринять, незадумываясь; ограничить возможные результаты своей деятельности: расширение знаний приносит пользу. 3. Переведите следующие сочетания: a nameless opposite; searching; outcome of your research; immediate practical value; research can be counted upon as leading; in the long run, if not in the short; a very powerful argument for.

 *Прочитайте параграфы 4—7.*

 1. Найдите главное существительное параграфов, выпишите определения понятия «теория» и начало предложений, содержащих контраргументы. 2. Выпишите эквиваленты: образуют простую, но строгую систему; теории имеют настолько сложный и запутанный характер; вспомогательная функция; предотвращать потерю времени; приносящий глубокое удовлетворение. 3. Переведите на русский: the underlying simplicity; the handman of the experimenter; a device for saving time; a remote relation.

 *Прочитайте параграфы 8—12.*

 I. Сосредоточьтесь на вопросе 8-го параграфа и на ответах, рассмотренных автором. Напишите резюме параграфов в трех предложениях.

 **Text D. Scientific Innovation: It’s Impact on Technology**

***Прочитайте и переведите текст:***

 Mr. A.: The impact of scientific activity on technology is often
discussed today. But one thing is not clear. What is meant here: the impact
of today's scientific activity on today's technology or the impact of today’s
scientific developments on technology thirty years from now?

 Mr. B.: I think there is usually an interval of twenty years or so
between the discovery of a new scientific principle and its impact on
industry. In the case of the transistor, for example, it took about that
long. Some things move a bit faster but it must be admitted that many
are even slower.

 For example, our computers are based on fundamental discoveries in physics that may be traced back thirty, forty, even fifty years.
What will come out of contemporary science, out of the research that
is being done today — we just do not know.

 Mr. A.: Do you think the isolated inventor is still the usual source
of innovation, or has the group inventor been put to the fore now?

Mr. B.: It seems that the lone inventor in most fields has been replaced by the group. But more often than we realize the original brilliant idea is still the product of one man's genius. He may, however, live in agroup environment and have the advantage of the scientific technical competence and intellectual contacts that come from working with a large group of people.

 Mr. A.: You are probably right. But as soon as a new idea is put
forward, it requires many people's efforts before it can be transformed
into a product. And at this stage innovation becomes a group and not an
individual activity, involving both a sophisticated body of information
and a sophisticated technology.

 ***Ответьте на вопросы по тексту:***

 1. What is often discussed today? 2. What words are equivalent to scientific innovation? 3. What is the usual interval between the discovery of a new scientific principle and its impact on industry? 4. What example is given to illustrate the above statement? 5. What period of time is meant by “it took about that long”? 6. What are computers based on? 7. Do we know what will come out of contemporary science? 8. How far back were fundamental discoveries in physics made? 9. What kind of inventors are discussed in the text? 10. What words are equivalent to “the isolated inventory” 11. Is the author sure that the lone inventor has been replaced by the group? Give your reason. 12. What is the potential role of the lone inventor? 13. When does science become a group and not an individual activity? 14. What is the Russian equivalent of “a sophisticated body of information”?

 **Text E.**

 **Physics: Its Recent Past and the Lessons to Be Learned**

***Прочитайте и переведите текст:***

1. What sort of physics are we to do between now and the end of the century? I will try to look at the next 30 years of physics not avoiding speculation but mainly concentrating on practical questions to face us today. My remarks are sure to have a personal and Princeton flavour, but principles should apply to anyone, anywhere. I will begin with an example from the past, which proves a forecast for 30 years to be sometimes possible and fruitful.

2. When I came as a graduate student to the English Cambridge 24 years ago, I found most of my physicist friends cursing the name of Sir Lawrence Bragg, who had become director in 1938, the year after the death of Rutherford. By that time the younger men thought to be brilliant physicists and known to be establishing schools of their own had left the place. The leadership in high-energy physics had passed to Berkeley. But Bragg made no effort to rebuild. He did not appear to be interested in plans for a new accelerator to be developed. He said: have taught the world very successfully how to do nuclear physics. Now let us teach them how to do something else."

 3. The people whom Bragg was interested in supporting were thought to be a strange bunch, doing things which the high energy people would hardly consider to be physics. There was Martin Ryle, who was known to be looking for radio sources in the sky. There was Max Perutz, who was said to have spent 10 years on X-ray analysis of the structure of the hemoglobin molecule and to remark very cheerfully that in another 15 years he would have it. There was a crazy character called Francis Crick, who seemed to have lost interest in, and given up, physics altogether. The place which Bragg was to leave in 7 years had become a centre of first-class international standing in two fields of research that nowadays appear as important as high energy physics: radio astronomy and molecular biology.

 4. This history of the last 30 years in Cambridge may seem to be little oversimplified. Nevertheless we can appreciate it if we think of the important lessons which it can give us today. What are the lessons? What enabled Bragg to do so well with what looked in 1938 like disastrous situation? Broadly speaking, he may be said to have followed three rules. The rules are:

1. Don't try to revive past glories.
2. Don't do things just because they are fashionable.
3. Don't be afraid of the scorn of the theoreticians.

5. The last 30 years have shown us, Princeton people, to be doing not so well as Bragg did. As for the 1st rule I can say with confidence that we score high on it. We have not since 1946 had a professor working in the field of general relativity. It seemed unreasonable to expect to find anybody in this particular field as good as Einstein. On the second rule we score middling. We have always had room for some unfashionable people, but a very high percentage of our output of papers turns out to be in the fashionable part of particle physics and seems to be quite indistinguishable from the papers produced by 20 other institutes of theoretical physics. On the third rule we score extremely bad. The most original, unfashionable and worthwhile thing done by the Institute after Einstein was the design and construction of Von Neumann's prototype electronic computer, the Maniac. In the ten years after World War II the group around Von Neumann was to lead the world in ideas concerning the development and use of computers. Bui the snobs at our Institute could not tolerate electrical engineers walking around with their dirty hands and spoiling the purity of our scholarly atmosphere.

Von Neumann was strong enough to override the opposition. But when he tragically died, they took advantage of the opportunity, and the project was given up.

1. I always thought the failure of our computer group to be a disaster not only for Princeton but for science as a whole. It meant that at that time no academic centre existed for computer people of all kinds to get together at the highest intellectual level. The field that was abandoned was to be taken over by IBM. Although it is a fine organization in many ways it cannot be expected to provide the atmosphere of intellectual fertility which Von Neumann managed to create here, at Princeton. We had the opportunity to do it, and we threw the opportunity away.
2. So much for the past. What about the future? Because our computer project appeared unique and ahead of its time, I was sorry at the news of its abandonment. But I am not equally sorry at the news that our accelerators to be abandoned next year. I believe the loss of the accelerator is likely to put Princeton into a position similar, in some respects, to that of Cambridge in 1938. We shall have an opportunity to do something different.

 ***Задания к тексту:***

*Прочитайте параграф I.*

1. Определите предложение, которое служит предисловием тексту. Найдите предложения, содержащие характеристику речи, которую собирается передать автор. Переведите их.

 *Прочитайте параграф 2.*

1. Сформулируйте тему параграфа. 2. Что означают слова the place и them?3. Опишите ситуацию в Кембридже после смерти Резерфорда. Дайте характеристику людям, покинувшим Кембридж.

 *Прочитайте параграф 3.*

1. Сформулируйте основную идею параграфа. 2. Дайте характеристику людям, которых Брэгг поддержал в 1938 году. 3. Переведите: a centre of first-class international standing.

 *Прочитайте параграф 4.*

1. Сформулируйте тему параграфа. 2.Найдите эквиваленты следующих слов: оценить no достоинству; катастрофический; возрождать; презрение. 3.Переведите вторую половину параграфа.

 *Прочитайте параграф 5.*

1. Выпишите три предложения, выражающие оценку автора ситуации в Принстоне. 2. Что подразумевается под словами the opposition and the opportunity? 3. Переведите слова: we have always had room for. . .; the most original unfashionable and worthwhile thing; the purity of our scholarly atmosphere.

 *Прочитайте параграфы 6 и 7.*

1. Сформулируйте главную идею параграфа. 7. 2. Определите, какие существительные заменяет местоимение it. 3. Переведите параграфы на русский язык.

 *Просмотрите текст еще раз и скажите, ответил ли автор на поставленный им вопрос?*

 **Text F. Molecular Biology in the Year 2000**

***Прочитайте и переведите текст:***

1. I want to consider the future of molecular biology and, to alesser extent, of cell biology. Applied biology, or the social implications of biological research, or frontiers coming into being are out of the scope of my paper as I want to keep the discussion within reasonable limits. Long-range forecasts are hard to make indeed, but those for a period of about 25 years have often proved to be successful. This enables me (in any case) to take arbitrarily a period of 30 years which brings me nicely to the year 2000.

 2. I shall argue that there are certain general factors which make a big increase in biological knowledge during this period virtually certain. In the first place, there is a very considerable amount of manpower available, not only at present, but also on an even greater scale in the future. It is fair to say that an increasingly greater number of people in one way or another appear to be showing an interest in biology and the scope of research is steadily expanding far and wide in advanced countries. In fact, the amount of effort seems to be strongly correlated with the standard of living. Because there are many countries in the world with a standard of living which is likely to rise, we can expect more countries to start contributing to biological research. Now more and more people in all countries are found to go into biology. Moreover, we can safely state that the tendency is not only for biologists themselves to increase in number, but also for quite a lot of people to move into biology from other disciplines.

 3. An interesting distinction to be made here is between problems and techniques. 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. For techniques, it appears to be quite a different matter, and one may find people borrowing techniques in any direction. Broadly speaking, modern biologists are quite at home using recently developed techniques emerging in physical sciences. In spite of this it is rare for biologists to leave biology and to take up problems in chemistry and physics proper.

 4. Another extremely important factor to be taken into consideration has been tremendous power of modern experimental techniques. One has only to think of such examples as chromatography, radioactive tracers, or the electron microscope (to mention only a few) to see how powerful and varied they are. A molecular biologist who would tackle any problem with the technique available before, say, 1935, is sure to give up the effort. 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. For these reasons, we can expect a massive research effort in biology.

 5. If we are to accept that most of the problems that we are concerned with today are likely to be solved by the year 2000, it is worth while considering what problems can be expected to remain unsolved. It seems to me there are subjects of a rather general nature which appear to fall into this class. I certainly expect some progress to take place in the intervening years, but I rather doubt whether we shall be in a position to see the answers in broad outline, let alone in great detail. Examples of such topics are: the origin of life on Earth; the existence of life on other worlds, and communication with other creatures in the galaxy, if we assume them to exist.

 6. Finally, one must consider the problems that are not to face immediately, or are of such a long-term nature that we cannot expect them to be solved by the year 2000. These are by far the hardest to guess, because such problems depend partly on questions which have not learned to ask yet. Anyway, new and unexpected developments are certain to make the whole field even more fascinating in the year 2000 than it is today.

 ***Задания к тексту:***

 *Прочитайте параграф 1.*

1. Какие проблемы не включены в обсуждение? Почему автор выбрал 30-летний период? Сформулируйте тему параграфа. 2. Переведите: to a lesser extent; the social implications of biological research: the frontiers coming into being; to take arbitrarily.

 *Прочитайте параграф 2.*

1. Найдите главное предложение и определите главную идею параграфа. Какие факторы упоминает автор в поддержку своей идеи? 2. Найдите эквиваленты словосочетаний: я берусь утверждать; во-первых; справедливо утверждать; на самом деле; более того; можно без риска утверждать. 3. Переведите: certain general factors. . . make increase virtually certain.

 *Прочитайте параграф 3.*

1. Найдите главное предложение и определите главную идею параграфа. Найдите слова и словосочетания, объединяющие отдельные предложения в текст. 2. Переведите: biologists are quite at home using; it is rare for biologists to take up problems in chemistry.

 *Прочитайте параграф 4.*

1. Найдите главное предложение и определите, какие идеи третьего параграфа развиваются в этом параграфе. К каким выводам приходит автор? Перечислите причины этих выводов. 2. Найдите эквиваленты словосочетаний: приниматься за решение проблемы; практически нет признаков того, что какая-либо методика исчерпала свои возможности.

 *Прочитайте параграф 5.*

1. Найдите главное предложение. Найдите главное слово и проследите его замену эквивалентами. 2. Переведите: it is worth while considering; we shall be in a position; in broad outline; let alone in great detail.

 *Прочитайте параграф 6.*

1. Найдите главное предложение. Найдите главное слово и проследите его замену местоимениями. 2. Как автор характеризует рассматриваемую проблему? Как он характеризует молекулярную биологию будущего?

 *Прочитайте текст еще раз. Напишите резюме текста в трех предложениях.*

 **Text G. Physics in the Next 30 Years**

***Прочитайте и переведите текст:***

1. I begin my prognostications of the future by taking a look at what might be expected to happen in high-energy physics in the next 30 years.

There are two main ways of doing research in this field. The rich man's way is to build accelerators, which give high, accurately controlled energy. The poor man's way is to use cosmic rays, which are known to come down upon poor and rich alike like the rain, but have very low intensity and completely uncontrolled energy. I think there is a better-than-even chance that the major discoveries of the next 30 years in high-energy physics may be expected to be made with cosmic rays. That is why I venture to say that it may be good for us, scientifically speaking, to be poor. I may easily happen to be wrong about the promise of cosmic rays physics. Going into any field of research is always a gamble. Only in this case I believe this gamble to be a reasonable one. I have heard some accelerator enthusiasts talk as if they seriously expect, by building one more machine and measuring a few more cross sections, to solve all the outstanding riddles of nature. Our experience in high-energy physics so far has taught us that there are new problems and new complexities to be disentangled every time that we extend the range of our observations. I would be disappointed if no surprises were found to remain in the vast range of energies beyond the reach of the accelerators. I hope and believe that the universe of high energies will prove to be as inexhaustible as the universe of astronomy and the universe of pure mathematics.

2. Apart from studying cosmic rays, what else is there for physicists to do?

An individual physicist working in close collaboration with engineers and chemists and biologists is likely to be able to make some important contributions. However, he is not to expect things which he does to be mainly physics. If he is any good, he will use his physics only as a cultural background to think about problems primarily chemical, biological or economical in nature. Accordingly, I think it would be mistake for a physics department of a university to become heavily involved in a fashionable environmental problem, for instance, as it is violation of the 2nd of Bragg's rules. I take it as self-evident that physics will not flourish in isolation from the rest of science. In particular, it is essential for physics to keep in close touch with biology, as biology rather than physics is likely to be the central ground of scientific advance during the remainder of our century. Bragg understood this in 1946when he put his money on Perutz and the X-ray analysis of hemoglobin in preference to a new accelerator.

3. I think there exists a tremendous opportunity for major advances in molecular biology to be made by means of physical techniques. But will it be good physics? I have every reason to expect you to object to this style of research saying that it may be good biology, but it is not physics. That is what many of us were saying about Bragg and Perutz in 1946. I believe we were profoundly mistaken. The idea of physics having to be pure in order to be good, was wrong in 1946 and is sill wrong today. William Spohn’s recent article called "Can Mathematics Be Saved" turned out to be a kind of sensation in the mathematical world. Spohn's thesis is that the purists who dominate the mathematical establishment have alienated mathematics from the rest of human culture to bring it to the danger of becoming sterile. Much of what he says is equally true if you change the title of his article to "Can Physics Be Saved?" and substitute "high-energy physics" for his "modern mathematics". In my opinion the surest way to save physics is to keep young physicists working on the frontiers where physics overlaps other sciences, such as astronomy and biology. It is easy to give examples. One possibility known to have been much discussed by molecular biologists is the development of electron-microscope technology to the point at which the structure of individual molecules becomes directly visible. It might be possible in this way to achieve a non-destructive and rapid analysis of large molecules...

 4. It would be pointless for me to try to make a complete list of the important things which physicists will find interesting to do in the coming decades. Inevitably the most exciting things are certain to be those that 1 haven't thought of. I myself find that the most exciting part of physics at the present moment lies on the astronomical frontier, where we have had an unparalleled piece of luck in discovering the pulsars. Pulsars turn out to be laboratories in which the properties of matter and radiation can be studied under conditions millions of time more extreme than we had previously had available to us. We do not yet understand how pulsars work, but there are good reasons to believe that they are accelerators in which Nature makes cosmic rays. Besides providing cosmic rays for the particle physicists to be able to do "cheap" physics, the pulsars are sure to provide crucial tests of theory in many parts of physics ranging from superfluidity to general relativity. . .

 5. I have tried to give here an honest evaluation of those tendencies in physics that I find to be good and bad. I am not gloomy about the future of physics. To my mind there are only two things that can be considered to be disastrous for the future of physics. One is to solve all the major unsolved problems. That would indeed be a disaster, but I do not expect it to happen in the foreseeable future. The other disastrous thing would be if we became too pure and isolated from the practical problems of life for any of the brightest and most dedicated students to want to study physics at all. This second danger seems to me to be a real one. It will not happen if we stay diversified, if we emphasize work that has important applications outside physics, and above all, if we follow Bragg's third rule: "Do not be afraid of the scorn of theoreticians".

 ***Задания к тексту:***

 *Прочитайте параграф I.*

1. Какова основная идея параграфа? 2.Выпишите эквиваленты слов: я беру на себя смелость утверждать; в научном смысле; как будто; нерешенные загадки природы. 3.переведите: to come down upon poor and rich alike like the rain; a better-than-even chance; a reasonable gamble; beyond the reach of; inexhaustible.

 *Прочитайте параграфы 2 и 3.*

1. Напишите резюме параграфов в трех предложениях. 2. Выпишите эквиваленты слов: то, чем он занимается; в этой связи; я считаю само собой разумеющимся; остальная наука; а не. ..; настоящая физика; господствуют в мире математики. 3. Переведите: if he is any good; as a cultural background; to become heavily involved in a problem; to be the central ground of scientific advance; (they) have alienated mathematics from the rest of human culture to bring it to. . .; much of what he says; to develop to the point at which. . .

 *Прочитайте параграф 4.*

1. Выпишите предложение, в котором автор оценивает будущее развитие физики.

 *Прочитайте параграф 5.*

 1.Выпишите характеристики двух опасных ситуаций. с которыми могут столкнуться физики в будущем.

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