И.М. Долгополова

Английский язык для физиков

Москва
«Книга по Требованию»

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Настоящее учебное пособие предназначено для обучения физиков чтению, переводу и реферированию научной литературы на английском языке.Пособие состоит из 22 уроков. Тексты пособия подобраны с таким расчетом, чтобы отразить по возможности все разделы физики и различные стили научной литературы: от классических произведений до статей в научно-популярных журналах. Такой подбор текстов дает возможность охватить основные трудности языка и вооружить будущих ученых ключом к пониманию и реферированию любой литературы по специальности. Упражнения к каждому уроку состоят из вопросов к тексту, которые дают возможность развивать навыки устной речи, подготавливая таким образом учащихся к беседе на языке по специальности, предложений для перевода с английского на русский язык и лексических упражнений, учитывающих специфику научной литературы

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ПРЕДИСЛОВИЕ

Настоящее учебное пособие предназначено для обучения физиков чтению, переводу и реферированию научной литературы на английском языке.

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Кроме того, в каждом уроке имеется упражнение для перевода с русского языка на английский, которое составлено таким образом, что обучающиеся могут найти все необходимые слова и выражения в тексте урока. Это упражнение также может быть использовано как основа для устного сообщения на тему урока.

Пособие сознательно не снабжено словарем, так как оно предполагает создание у учащихся необходимых навыков пользования различными словарями, и особенно умения подбирать нужное значение слова из многих, приведенных в словаре.

В лаборатории устной речи кафедры английского языка физического факультета МГУ имеются магнитофонные пленки с записями текстов пособия, над которыми учащиеся могут работать самостоятельно с целью развития навыков чтения. Эти записи оказались очень полезными для занятий, которые

проводились по этому пособию с аспирантами физического факультета МГУ в течение 1968/69 учебного года.

Автор благодарит старших преподавателей кафедры английского языка физического факультета МГУ С. М. Кондратьеву, Л. А. Столярову и преподавателя И. Д. Лепешову за ценные замечания по подбору материала и за помощь, оказанную при подготовке рукописи к печати, и будет признателен всем, кто пожелает высказать свои замечания по поводу данного пособия.

И. М. Долгополова

§ 1

READ THE FOLLOWING WORDS:

entirely, remind, effect, effective, cause, disrupt, disruptive, disruption, treat, treatment, crude, tumor, tissue, rough, roughly, bearing, bear, health, healthy, afford, harm, harmful.

BIOLOGICAL EFFECTS OF NUCLEAR RADIATIONS AND NEUTRONS

For the investigation of the biological effects of nuclear radiations and some of the possible applications of these effects, it is well, at first, to look at the progress of nuclear radiation through, for example, tissue from the physicist's point of view and then see whether he is able to simplify the actual findings. Let us therefore remind the reader that the two radiations most effective in producing useful biological reactions, hard electromagnetic radiation and neutrons, do not, themselves, produce any effects at all their action is entirely by virtue of the action of charged particles which they produce as secondary products. There can therefore be no action of nuclear radiations on living material other than that which would be produced by fast charged particles. The essential difference between neutrons and gamma radiation is that the neutrons produce heavy charged particles as secondaries, whereas gamma radiation produces electrons as secondaries. The action of a charged particle in passing through matter was described in the second chapter; we can remind the reader that the particle acts as a field of electrical force to attract or repel electrons out of their normal positions in atoms and so produces ionization and excitation with subsequent emission of light. The heavy charged particles knocked forward by neutrons produce dense local ionization (called columnar ionization); the light electrons secondary to X- or gamma radiation cause ionization which is far less dense and covers a much greater volume.

The material traversed by the charged particle is in a state of chemical combination, then the moving field of electrical force, in acting on the charged parts of the atoms in the molecule, may produce disruption of the molecule. In addition the effect of ionization may make it possible for unusual reactions to take place after the primary ionizing particle has passed by. The reader can see that the most definite action of the swift charged particle is the disruption of the established order. The consequences of this disruption will depend greatly on the tissue concerned in the bombardment, but the first process will nearly always be destructive. It is for this reason that it is hard to be too optimistic about the future of radiation as a method of treatment; it appears to be too crude. However, it has certainly proved to be of value in many respects, and so the best thing to do at the present time is to devise methods of making the use of radiation as effective as possible.

Many studies of the effects of X-rays and gamma rays on tissue have been made, with results that bear out roughly the supposition that the effect produced by the radiation is proportional to the ionization it produces in the part affected. There is not always perfect agreement, which shows that the actual changes observed are the consequences of complex chemical reactions, if not chains of reactions, and that the simple primary ionization is greatly complicated by what the tissue does about it afterwards.

One great result of significance about the effects of radiation on tissue is the fact that tumor tissue is destroyed more rapidly by the action of fast charged particles than healthy tissue; and that this affords a method of treatment of cancer is well known. The question arises whether it would be better to bombard the tumor by means of densely ionizing particles, such as would be produced as secondaries by fast neutrons, rather than by the secondary electrons of gamma radiation; and also whether the harmful effects of neutrons on the healthy organs are less that those of gamma or X-rays.

EXERCISES

I. ANSWER THE QUESTIONS:

1. What produces useful biological reactions?
2. What is the essential difference between neutrons and gamma radiation?
3. What is the most definite action of the swift charged particle?
4. What affords a method of treatment of cancer?

II. TRANSLATE INTO ENGLISH:

Имеется 2 типа излучения наиболее эффективных в создании полезного биологического действия — жесткое электромагнитное излучение и нейтроны. Но они сами не производят никакого действия. Только быстрые заряженные частицы, являющиеся вторичным продуктом электромагнитного излучения, могут действовать на живую ткань. Вторичным продуктом нейтронов являются тяжелые заряженные частицы, а жесткое гамма-излучение дает электроны в качестве вторичного продукта. При прохождении через материю заряженная частица, действуя своим электрическим полем, притягивает или отталкивает электроны и таким образом создает ионизацию. Тяжелые заряженные частицы, выбитые нейтронами, создают плотную местную ионизацию, а электроны (вторичные продукты *X*- или гамма-излучения) вызывают ионизацию значительно менее плотную и занимающую больший объем. Действие быстрой заряженной частицы состоит в нарушении установленного порядка молекул ткани. Грубо можно сказать, что действие, производимое излучением, пропорционально ионизации, которую оно вызывает в ткани.

Наиболее значительным результатом является то, что опухолевые ткани разрушаются быстрее под действием быстрых заряженных частиц, чем здоровые ткани, что и используется как метод лечения рака.

III. CHANGE THE FOLLOWING SENTENCES ACCORDING TO THE PATTERN:

It is for this reason that it is hard to be optimistic about the future of radiation as a method of treatment. For this reason it is hard to be optimistic about the future of radiation as a method of treatment.

1. It is the passing of a charged particle through matter that produces ionization and excitation with subsequent emission of light.
2. It is the light electrons secondary to X- or gamma radiation that cause a far less dense ionization.
3. It is in acting on the charged parts of the atoms in the molecule that the moving field of electrical force may produce the disruption of the molecule.
4. It is to devise methods of making the use of radiation as effective as possible that is the best thing to do at the present time.
5. It is by what the tissue does about it afterwards that simple primary ionization is greatly complicated.

IV. TRANSLATE INTO RUSSIAN:

a) Concentrate on the Clauses introduced by *whether.*

1. Many times, when electron beams were caused to interact with atoms, whether they were in the form of a gas or in a solid array at the surface of a crystal, the observed effects were not in agreement with the conventional view of the corpuscular nature of the electron.

2. Consequently this class, whether using electrostatic or magnetic lenses (or some of each) is known as the emission type of electron microscope.

3. The term "simple" and "compound", as applied in microscopy, could be used of either the emission or the transmission type of electron microscope, depending, on whether we are making use of *one* lens or *more* than one.

4. If the molecular-orbital method were applied to distant atoms we would be led to the result that the probability of the presence of an electron near a nucleus is independent of the question whether an electron is already there; thus we include in the description of the two hydrogen atoms the ionic case where both electrons are on the same hydrogen; for great distances this is evidently a very poor approximation to the lowest state.

5. If we pass to heavier atoms containing more electrons, it will make no difference whether we treat the 1s electrons by the molecular-orbital method or simply distribute them into the K shells of the nuclei; in fact, for heavy atoms the interatomic distance will always be great compared to the radius of the K shell, so that for the 1s electrons we are practically always in the case of great interatomic distances, all approximations leading to the same result: complete K shells with practically no interaction.

6. In the discussion of photochemical processes it is often of importance to know whether or not predissociation has occurred.

7. It is, however, difficult to say whether we are dealing with an internal rearrangement or whether actual predissiciation is taking place.

8. So long as his material contained uranium it did not matter whether it was fluorescent or not, whether it lay in light or darkness, whether it was solid or in solution; it seemed to Becquerel worth trying whether pure, metallic uranium might not give the rays also.

9. Of course, the fact that large quantities of uranium have lain around for years without blasting this old planet out of existence indicates that something prevents a chain reaction of the type mentioned. Also, uppermost in the minds of physi-

cists was the question whether bombarding particles other than neutrons could induce fission.

10. First, the predicted radii of the dwarf systems can be compared with the observed radii, and the agreement or lack of agreement can be used as a check on whether or not forces other than Newtonian gravitation are at work.

11. Amplifiers are also classified as to whether they are tuned or untuned, i. e. whether they amplify a narrow or a wide band of frequencies, respectively.

12. The theory as simply outlined above lacks one important feature: we must include in the kinetic energy (whether positive or negative) the term m_0c^2 which corresponds to kinetic energy possessed by a particle in virtue of its mass alone.

13. Was the transformation theory true? This seems like a reasonable question to ask here, but it would be better to ask (as we have already suggested) whether it was useful.

14. Although the disturbance due to the tracing point appears to be very small, it is doubtful whether this method could compete in respect of accuracy with those above described where the comparison with the standard is optical or acoustical.

b) Concentrate on the *"for phrase"*.

1. For an explosion to take place, a certain minimum quantity of fissile material must be concentrated in one place; such concentrating is avoided carefully by the designer.

2. One necessary condition for dissociation to occur is for the molecule to have sufficient energy to dissociate.

3. In a large galaxy the concentration of stars is often too dense for them to be examined individually.

4. Clearly for cooperative magnetic phenomena to occur, there must be some mechanism for coupling between the localized ionic moments.

5. The "Tube" was simply a bulb of glass, which might be round or sausage-shaped or pear-shaped, pumped down to a good vacuum and provided with a pair of metal "electrodes" for the electric discharge to pass between.

§ 2

READ THE FOLLOWING WORDS:

magnetism, magnetic, magnetize, magnetization, vertical, oscillate, oscillation, azimuth, bisect, intersect, axis, axes, deviate, deviation, hemisphere, horizon, horizontal, intermediate, extreme, extremity, extremely.

ELEMENTARY THEORY OF MAGNETISM

Certain bodies, as, for instance, the iron called loadstone, the earth itself and pieces of steel which have been subjected to certain treatment, are found to possess the following properties, and called magnets.

If, near any part of the earth's surface except the magnetic poles, a magnet be suspended so as to turn freely about a vertical axis, it will in general tend to set itself in a certain azimuth, and if disturbed from this position it will oscillate about it. An unmagnetized body has no such tendency but is in equilibrium in all azimuths alike.

It is found that the force which acts on the body tends to cause a certain line in the body, called the Axis of the Magnet, to become parallel to a certain line in space, called the Direction of the Magnetic Force.

Let us suppose the magnet suspended so as to be free to turn in all directions about a fixed point. To eliminate the action of its weight we may suppose this point to be its centre of gravity. Let it come to a position of equilibrium. Mark two points on the magnet, and note their positions in space. Then let the magnet be placed in a new position of equilibrium, and note the positions in space of the two marked points on the magnet. Since the axis of the magnet coincides with the direction of magnetic force in both positions, we have to find that line in magnet which occupies the same position in space before and after the motion. It appears from the theory of the

motion of bodies of invariable form, that such a line always exists, and that a motion equivalent to the actual motion might have taken place by simple rotation round this line.

To find the line join the first and last positions of each of the marked points, and draw planes bisecting these lines at right angles. The intersection of these planes will be the line required, which indicates the direction of the axis of the magnet and the direction of the magnetic force in space.

The method just described is not convenient for the practical determination of these directions. We shall return to this subject when we treat of Magnetic Measurements.

The direction of the magnetic force is found to be different at different parts of the earth's surface. If the end of the axis of the magnet which points in a northerly direction be marked, it has been found that the direction in which it sets itself in general deviates from the true meridian to a considerable extent, and that the marked end points on the whole downwards in the northern hemisphere and upwards in the southern.

The azimuth of the direction of the magnetic force, measured from the true north in a westerly direction is called the Variation, or the Magnetic Declination. The angle between the direction of the magnetic force and the horizontal plane is called the Magnetic Dip. These two angles determine the direction of the magnetic force, and when the magnetic intensity is also known, the magnetic force is completely determined. The determination of the values of these three elements of different parts of the earth's surface, the discussion of the manner in which they vary according to the place and time of observation, and the investigation of the causes of the magnetic force and its variations, constitute the science of Terrestrial Magnetism.

Let us now suppose that the axes of several magnets have been determined, and the end of each which points north marked. Then, if one of these magnets be freely suspended and another brought near it, it is found that two marked ends repel each other, that a marked end and an unmarked end attract each other, and that two unmarked ends repel each other.

If the magnets are in the form of long rods or wires, uniformly and longitudinally magnetized, it is found that the greatest manifestation of force occurs when the end of one magnet is held near the end of the other, and that the phenomena can be accounted for by supposing that like ends of the magnets repel each other, that unlike ends attract each other, and that intermediate parts of the magnets have no sensible mutual action.

The ends of a long thin magnet are commonly called its Poles. In the case of an indefinitely thin magnet, uniformly magnetized throughout its length, the extremities act as centres of force, and the rest of the magnet appears devoid of magnetic

action. In all actual magnets the magnetization deviates from uniformity, so that no single points can be taken as the poles.

Coulomb, however, succeeded in establishing the law of force between two like magnetic poles (the medium between them being air).

The repulsion between two like magnetic poles is in the straight line joining them, and is numerically equal to the product of the strength of the poles divided by the square of the distance between them.

EXERCISES

I. ANSWER THE QUESTIONS:

1. What is a magnet?
2. What causes the Axis of the Magnet to become parallel to the direction of the Magnetic force?
3. What is the Magnetic Declination?
4. What is the Magnetic Dip?
5. What are the ends of a long thin magnet called?
6. When do the poles attract and repel each other?
7. What law did Coulomb establish?

II. TRANSLATE INTO ENGLISH:

Некоторые тела, как например: железная руда (магнитный железняк), куски стали, подвергнутые определенной обработке, называются магнитами. Найдено, что эти тела обладают свойством устанавливаться в определенном азимуте, если они свободно подвешены и не находятся вблизи магнитного поля земли. Сила, которая действует на тело, стремится заставить ось магнита установиться параллельно определенной линии в пространстве, называемой направлением магнитной силы, которое различно в различных частях земной поверхности. Направление, в котором устанавливается магнит, отличается от направления меридиана на некоторую величину. Кроме того, в северном полушарии магнит направлен вниз, а в южном вверх. Азимут направления магнитной силы, измеренный от истинно северного направления к западу, называется магнитным склонением, а угол между направлением магнитной силы и горизонтальной плоскостью называется магнитным наклонением.

Эти два угла определяют направление магнитной силы и их нахождение является составной частью (constituent) науки земного магнетизма.