科技英語通俗讀物

原子和原子能

〔苏联〕瑪卡尔耶娃編选

商务印書館

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ATOMS AND ATOMIC ENERGY

原子和原子能

〔苏联〕瑪卡尔耶娃 編选
施明德 注释

商务印書館
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В. Макарьева

АТОМ И АТОМНАЯ ЭНЕРГИЯ

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內容提要

本書是苏联出版的尖端科学的英語通俗讀物，內容簡明地闡述了原子能方面的基础知識，包括：1. 原子理論的历史沿革；2. 原子的結构；3. 什么是原子能；4. 原子的利用（医学方面，农业方面，工业方面）；5. 原子能发电；6. 原子能交通；7. 原子武器；8. 苏联第一个原子能发电站；9. 热核反应的控制等九个方面。文章主要选自英美出版的通俗科学書籍，原文都未經删节。

本書詞汇量約 2,000 余个，可供我国目前高等学校或高等工业学校一、二年級的学生閱讀。本書对課文中的习語，慣用法及某些較复杂的語法現象，都加了注釋，書后并附有英汉总詞汇表（1750 个单詞），对独立閱讀很有帮助，已具备中学英語水平的学生，参照了注释和总詞汇表后，可順利地閱讀本書。

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原子和原子能

〔苏联〕瑪卡尔耶娃編述　施明德注释

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目　录

原書出版者的話

这本“原子和原子能”所收集的課文都是从英美的通俗科学讀物中选来的，原文都未經刪节，書后附有注释和总詞汇表.

本書供培养英語科技文献的翻譯熟巧之用，适合于已有中学十年級教学大綱所規定的英語水平的学生.

本書可用作高等学校和高等工业学校（一、二年級）的教本或課外讀物，也可以供进修英語者自学之用.

"The electron is as inexhaustible as[1] *the atom, nature is infinite..."*

V. LENIN

A SHORT HISTORICAL REVIEW OF THE ATOMIC THEORY

The Rise of the Atomic Theory

It is a striking fact that[2] the most remarkable researches of the twentieth century have substantiated two ideas about the nature of matter which the Greek philosophers fashioned twenty centuries ago. One is the theory that[3] the many thousands of substances which exist in the world are formed out of[4] a small number of simpler substances[5] or elements. The other theory is that[6] matter is constructed out of tiny particles or units, the so-called atoms of matter.

As early as[7] 400 B. C.,[8] the Greek philosopher, Democritus,[9] taught that[10] the world consisted of[11] empty space and an infinite number of[12] small invisible particles. Matter,

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1. as...as 和...同样地... 2. It is...that. 当主語是整个从句时往往用 It is...that 的結构，此处的 that 是連接詞，本身沒有意义，也不是句子成分，它所引起的从句是眞正的主語，而 It 仅是語法形式上的主語. 3. that 引起的名詞从句作 theory 的同位語，并說明它的具体內容. 4. are formed out of 由...构成. 此处的 of=from. 5. simpler substances 簡单物質，原素. 6. that 引起的名詞从句作表語. 7. as early as 早在. 8. 400 B. C. [bi:'sir] (=400 years before Christ [bi'fɔ: 'kraist]) 公元前 400 年. 9. Democritus [di'mɔkritəs] 德謨克利特. 10. that 引起的名詞从句作 taught 的宾語. 11. consist of 由...組成，包括.... 12. an infinite number of 无数的.

he held,[1] was formed by the formation of aggregations of these tiny particles. This theory, which perhaps came into existence[2] before 400 B. C., later became known as[3] the "atomic theory" and the particles as "atoms",[4] because "atomos" in Greek means "indivisible" or "uncuttable".

The followers of his theory asked this question: Suppose[5] you cut a piece of metal in half; then cut one of the two resulting pieces in half;[6] then cut one of those two resulting pieces in half and continued this process, time after time;[7] could you keep the process up forever?[8] They answered the question in the negative.[9] Eventually, they held, you would have a tiny particle which could not be cut. That, they held, was the atom. They also speculated upon the nature of atoms[10] and concluded that liquids were composed of[11] smooth atoms which moved about easily, thus accounting for the nature of liquids,[12] while solids were composed of rough atoms whose surface had little hooks by which the atoms clung to[13] one another.

Not all the Greeks, however, accepted the theory.

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1. he held 他認为. 插入句. 2. come into existence 成立, 出現. 3. become known as 被称为. 4. the particles as "atoms" 此处 as 前省略了 later became known. 5. suppose 如果. 連接条件从句, suppose 后有 that 时, 用法相同. 6. then cut one of the two resulting pieces in half 然后把所得的两块中的一块切成两半. 7. time after time 好多次, 反复地. 8. could you keep the process up forever? 你能把这个过程永远繼續下去嗎? keep up=continue. 9. in the negative 否定地. 10. They also speculated upon the nature of atoms. 他們也思考过了原子的性質. speculate upon 作"思索"解. 11. be composed of 由...組成. 12. thus accounting for the nature of liquids 这样就解释了液体的性質. thus 往往和現在分詞短語連用, 修飾前面的整个句子, 說明結果; account for 作"解释"解. 13. cling to 粘住, 鈎住. clung 是 cling 的过去时态.

Unfortunately, Aristotle,[1] who lived from 384 to 322 B. C., and whose writings became the authority of the Middle Ages in scientific matters,[2] rejected it, and so[3] the notion of atoms was in disfavour[4] for many centuries. But the theory always had its advocates. Epicurus,[5] who lived about 300 B. C., clung to[6] it and Lucretius,[7] the Latin poet, enunciated the theory in his famous scientific poem, *De Rerum Natura*, that is,[8] *Concerning the Nature of Things*. It likewise had its followers, though few in number,[9] in the Middle Ages. In 1348, Nicholas of Antrucia, who assumed that physical phenomena could be explained on the basis of[10] the union and separation of atoms, was forced to recant this idea as a piece of heresy.[11]

The other theory, that the multitude of substances to be seen in the universe were fashioned from a few simpler substances or elements was favoured[12] by Aristotle and so became a popular notion in the Middle Ages. Out of Aristotle's doctrine of the elements grew the fascinating but futile alchemy of the Middle Ages.[13] But though futile,[14] alchemy was not fruitless, for the modern science of

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1. Aristotle ['æristɔtl] 亚里斯多德. 2. whose writings became the authority of the Middle Ages in scientific matters 他的著作在中世紀时已成为科学問題方面的权威. 3. and so 所以. 4 be in disfavour 受冷遇，被輕視. 5. Epicurus [ˌepi'kjuərəs] 伊壁鳩魯. 6. cling to 抱定，坚持. 7. Lucretius [lu:'kri:ʃiəs] 卢克萊茨. 8. that is 即是. 9. few in number 数量上很少. few 表示否定，a few 表示肯定. 10. on the basis of 在...的基础上，依据... 11. was forced to recant this idea as a piece of heresy 被迫放棄这个被認为是异端的概念. 12. was favoured 被贊同. 13. Out of Aristotle's doctrine of the elements grew the fascinating but futile alchemy of the Middle Ages 从亚里斯多德的关于元素的学說中发展出了中世紀的有魅惑力而无益的点金术. 倒装句，主語是 alchemy，謂語是 grew，out...elements 是状語. 14. though 和 futile 間省略了 alchemy was.

chemistry had its beginnings in the mystical vapourings of alchemy.

According to[1] Aristotle, there were four elements: earth, air, water and fire. These were not elements in the sense that[2] we think of chemical elements today, but rather were elemental properties. They represented the four properties of warmth, cold, dryness and wetness. Earth was the combination of dryness and cold; water was the combination of wetness and cold; fire, of[3] dryness and warmth; air, of wetness and warmth.

Aristotle imagined that all substances were composed of some sort of primordial stuff mixed with various amounts of the four elementary properties. The Arabian scientists of the early part of the Middle Ages added three more elements to Aristotle's four — sulphur, mercury, and salt. Of course,[4] they did not use these terms as we do[5] today. Mercury, they said, made bodies brilliant, sulphur made them combustible, while salt made them soluble.

It was only natural that such theories should give rise to the idea[6] that one substance might be transformed into[7] another and so the alchemists arose,[8] actuated by the desire to change iron and other "base" metals[9] as they called them, into gold. The spirit of mysticism thrived in the atmosphere of alchemy, and soon its devotees were seeking a mysterious "philosopher's stone",[10]

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1. according to 按照. 2. in the sense that 像...那种意义的. 3. of 前省略了 was the combination. 4. of course 当然. 5. do 英語中为了避免重复，往往用助动詞 do 来替代已出現过的动詞，此处 do 替代 use. 6. It was only natural that such theories should give rise to the idea 这些理論会非常自然地引起这样一个概念. 7. might be transformed into 可以被轉变成. 8. and so the alchemists arose 因此点金术士出現了. 9. "base" metals 賤金屬. 10. philosopher's stone 哲人石.

which not only would turn iron into gold, but which would also[1] insure perfect health and perpetual youth.[2]

The old atomic theory of the Greeks was revived with[3] the publication of John Dalton's[4] *New System of Chemical Philosophy*, in 1808. A forerunner of Dalton, Joseph Proust,[5] had established the principle now known as the "law of definite proportions",[6] showing that any chemical compound[7] always contained the same chemical elements[8] combined in exactly the same proportions by weight.[9] Dalton repeated Proust's experiment and enunciated a second law which Proust had not stated, but for which he had laid the groundwork.[10] This was the "law of multiple proportions".[11] Certain chemical elements united with each other[12] to form a variety of[13] chemical compounds. The law of multiple proportions states that when this is the case,[14] the different amounts of one element, by weight, which will unite with a given weight of another element, will be exact multiples of each other.

From these considerations, Dalton, who was a schoolmaster in Manchester,[15] England, formulated his atomic theory. He showed that the law of definite proportions could be explained by assuming[16] that each chemical element was composed of atoms of definite weight. He showed further that the law of multiple proportions could be

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1. not only ... but (also) 不仅...而且. 2. perpetual youth 青春永驻, 长生不老. 3. with 随着. 4. John Dalton ['dʒɔn 'dɔ:ltən] 約翰·道尔頓. 5. Joseph Proust ['dʒouzif 'pru:st] 約瑟夫·普鲁斯特. 6. law of definite proportions 定比定律. 7. chemical compound 化合物. 8. chemical element 化学元素. 9. by weight 重量上. 10. for which he had laid the groundwork 他奠定了它的基础. 11. law of multiple proportions 倍比定律. 12. each other 相互. 13. a variety of 各种各样的. 14. when this is the case 当发生这样的情况时. 15. Manchester ['mæntʃistə] 曼彻斯特. 16. by assuming 以假設.

explained by assuming that an atom of one element might combine with one, two, or more atoms of another element under various conditions. Modern chemistry is based upon the atomic theory as laid down[1] by Dalton.

This theory was further strengthened and clarified in 1811 by Amadeo Avogadro,[2] the Italian physicist, who advanced the idea of molecules. According to his view, the smallest particle of a compound which could exist was called a "molecule". Prior to[3] this time, the word atom had been used loosely to refer both to the atoms of elements and to their union.[4] Thus chemists spoke of[5] both an atom of hydrogen and[6] an atom of water. Avogadro made the distinction[7] which is still in use.[8] The word "atom" was reserved for[9] the particles comprising chemical elements, while their union in compounds was named the "molecule". Thus, two atoms of hydrogen and one of oxygen formed a molecule of water. Avogadro also advanced the idea, which modern chemists agree with,[10] that gaseous elements were organized into molecules, so that[11] a molecule of hydrogen consisted of a union of two hydrogen atoms, a molecule of oxygen of a union of two oxygen atoms, and so on.[12]

Just as[13] developments in the field of[14] chemistry led

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1. as laid down 被奠定. 2. Amadeo Avogadro [ˈɑːməˈdeiou ˈɑːvouˈgɑːdrou] 阿美迪奥·阿伏伽德罗. 3. prior to 在...以前. 4. had been used loosely to refer both to the atoms of elements and to their union 不精确地又用于指元素的原子，又指它們的化合物. refer to 涉及，指. 5. speak of (瞵起)的过去时态. 6. both...and ...和...(都)，既...又. 7. made the distinction 作出了区别. 8. in use 使用着，通用着. 9. was reserved for 被保留下来指.... 10. agree with 同意. 11. so that (因而) 可以連接結果从句和目的从句，連接結果从句时譯作"因而"或"所以"，連接目的从句时，譯作"使得". 12. and so on 等等，依此类推. 13. just as 正如. 此处的 as 和下文的 so 呼应，翻譯时 so 不譯出. 14. in the field of 在...領域內，在...范围內.

inevitably to[1] the theory of molecules and atoms, so research in the domain of[2] physics led to the same conclusion. The pioneer chemists regarded heat as[3] a substance which they named "caloric", but as early as the seventeenth century, such thinkers as Bacon[4] and Descartes[5] realized that heat must be a movement of the ultimate particles composing bodies. In 1738, Daniel Bernouilli[6] advanced the theory that the particles composing a gas were in vibration. He suggested that an increase in temperature merely meant an increase in the vibration of the particles. He supposed that the pressure which a gas exerts upon the walls of its container is merely the sum total of the concussions of the individual particles against them.

Bernouilli's theory furnished a beautiful explanation of what was then known of the behaviour of gases — an explanation which we still use today under the name of the "kinetic theory of gases".[8] It explained, for example,[9] why heating a gas which was not closely confined,[10] caused the gas to expand. Heating caused the particles to vibrate with a more violent motion and, therefore, they occupied more space. For the same reason, heating a gas confined to a given volume[11] caused it to exert more pressure, because the collisions of the particles became more frequent and violent. But Bernouilli was ahead of his

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1. led inevitably to 不可避免地导致. to lead to 的意思是"导致,引出". 2. in the domain of 在...领域内. 3. regard...as 把...当作. 4. Bacon [beikn] 培根. 5. Descartes [dei'kɑ:t] 笛卡儿. 6. Daniel Bernouilli ['dænjəl bər'nu:li] 丹尼尔·贝尔努意. 7. sum total 总和. 8. kinetic theory of gases 气体运动学說. 9. for example 例如. 10. which was not closely confined 不是紧紧地被閉合(在一定空間內)的. 11. confined to a given volume (被限定在一定体积內的), 用作 gas 的定語.

day.[1] This was seventy years before Dalton laid the groundwork for the modern atomic theory. And so Bernouilli's ideas were first ignored and then[2] forgotten. A century later, they sprang to life[3] in the mind of another great scientist, the British physicist, James Prescott Joule,[4] who had received part of his education from Dalton.

Joule showed that mechanical energy[5] could be converted into[6] heat and that the amount of heat developed was always exactly proportional to[7] the amount of mechanical work[8] done. The truth of this discovery is to be found[9] in every-day life. Suppose you saw a piece of wood[10] with a rapid motion. As a result,[11] the saw begins to grow hot.[12] All the familiar phenomena in which heat develops as a result of[13] friction are proofs of "Joule's law", as it is called. From the basis of Joule's law, contemporaries revived Bernouilli's theory of gases.

Important Contribution to Science

In two of his theses: *On*[14] *Infinitely Small Physical Particles*, which he presented to the Russian Academy of Sciences in 1743, Lomonosov, the great Russian scientist,

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1. was ahead of his day 走在他的时代的前面. 2. first ... and then 首先…后来. 3. spring to life 新生，复活. sprang 是 spring 的过去时态. 4. James Prescott Joule ['dʒeimz 'preskət 'dʒaul] 詹姆士·普里斯科特·焦耳. 5. mechanical energy 机械能. 6. be converted into 被轉变成. 7. proportional to 和…成比例的. 8. mechanical work 机械功. 9. is to be found 可以找到. 动詞 to be 的現在时态或过去时态后面接有其他动詞的不定式时，可以表示：❶ 必要性(指完成預定的某动作)；❷ 必然性；❸ 将来的动作；❹ 可能性；汉語往往譯作"該"，"要"，"必須"，"将"，"可"等. 10. suppose you saw a piece of wood 假如你鋸开一块木头. 11. as a result 結果. 12. the saw begins to grow hot 鋸子开始发热了. 13. as a result of 由于…的結果. 14. on 关于…，論…

asserted that all matter was made up of[1] minute material particles which he called "elements" and "corpuscles". By "corpuscles" he meant[2] compound particles, consisting of simple particles — "elements". Now, instead of[3] "corpuscle" we use the word molecule and instead of "element" — atom. It is remarkable that the difference between the molecule and the atom, made clear by Lomonosov,[4] was precisely formulated for the second time at a special international congress of chemists only a hundred years later.

Lomonosov considered that such properties of substances as[5] colour, smell, specific gravity,[6] etc.,[7] are determined by the properties and the type of minute particles, and by their reciprocal arrangement and movement, and since "corpuscles" and "elements" represent infinitely small bodies, possessing all the properties of an ordinary body, their motion and interaction follow the general laws of mechanics. That is the reason why Lomonosov concluded that "inherent properties of any minute body can be explained by the laws of mechanics". And as mechanics, in its turn,[8] widely applies mathematical methods, Lomonosov set himself a very unusual problem for his time — that[9] of creating "mathematical chemistry". The solution of such a problem would have turned chemistry from a science depending on[10] skill into[11] a precise science.

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1. be made up of 由...組成. 2. by...mean by 和动詞 mean 連用表示意指的对象，例如: What do you mean by "education"? 你說的"教育"是什么意思? 3. instead of 替代; 不是...而是. 4. made clear by Lomonosov 过去分詞短語，作 difference 的定語. 5. such...as... 像...那样的... 6. specific gravity 比重. 7. etc. (et cetera [it'setrə] 的略語) 等等. 8. in its turn 又. 9. that 英語中为了避免重复，往往用 that (复数用 those) 来替代前面的名詞，此处的 that 替代 the problem. 10. depend on 依靠，决定于. 11. the solution of such a problem would have turned chemistry from...into 解决这样一个問題将会把化学从...轉变为.

One of the greatest bulwarks of the atomic theory was furnished also[1] by the Russian chemist, Dmitri Ivanovich Mendeleyev, who published his famous "periodic classification"[2] in 1869. He showed that when all the chemical elements were arranged in the ascending order of their atomic weights,[3] there were periodic recurrences of elements which resembled each other. Thus, for example, if you started with lithium and counted eight elements down the list, you came to sodium. Counting another eight brought you to[4] potassium. Now, these three elements have many properties in common.[5] They are all soft whitish metals which react chemically with water with considerable violence. There were a number of places in Mendeleyev's table which could not be filled,[6] because no elements were then[7] known which fitted in.[8] Mendeleyev boldly left blanks in his table, predicted that eventually the missing elements would be found and prophesied from his table what the characteristics of the elements, when found, would be. With the passage of the years, other chemists discovered elements which fitted into the gaps[9] in Mendeleyev's table and which possessed the properties which the table demanded that they should.[10]

The atomic theory was further strengthened by the

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1. one of the greatest bulwarks of the atomic theory was furnished also 原子理論的最伟大的堡垒(意为理論之基地)之一也是由…建立起来的. furnish 原意为"供給","装备". 2. periodic classification 周期分类法 (指門捷列夫周期率). 3. atomic weight 原子量. 4. counting another eight brought you to 再数八个 (元素)就把你引导到. 5. many properties in common 許多共同的性質. 6. which could not be filled (不能填滿的) 定語从句, 修飾 places. 7. then 当时. 8. fit in 适合. 9. fitted into the gaps 适合于填入空白处. 10. which the table demanded that they should (周期) 表要求它們 (指元素) 应該具备的(定語从句, 修飾前面的 properties; should 后省略了动詞 possess).

work of the great Swedish chemist, Arrhenius,[1] who in 1887 put forward[2] his celebrated theory of "electrolytic dissociation". Until that time there had been great difficulty in understanding the behaviour of solutions of various salts and other substances in water. He advanced the theory that when these substances were dissolved in water, their molecules dissociated or separated into constituent parts, which he called "ions". An ion might be a single[3] atom or a group of[4] atoms, but it always differed from an atom in the ordinary state in that it showed evidence of being electrified.[5] It seems to have been the fate of each important advance in atomic theory to meet with[6] a cold reception and considerable opposition. This theory of Arrhenius was no exception. But, though his contemporaries at first[7] refused to accept it, it has now become one of the foundations of modern physics and chemistry after having been combined with Mendeleyev's "chemical theory of solutions".

The modern scientist is convinced of[8] the existence of molecules and atoms. The molecule is believed to be[9] so small, however, that[10] it cannot be seen with the most powerful ordinary microscope in existence.[11] If a drop of water were magnified to the size of the earth, the mole-

1. Arrhenius [ə'reinjəs] 阿烈紐斯. 2. put forward 提出. 3. a single 单一的. 4. a group of 一群的. 5. it always differed from an atom in the ordinary state in that it showed evidence of being electrified (它总是和通常状态下的原子不同，区别在于它可証明是带电的) 中的 differ from... 作"和...不同"解，在哪一方面不同则用前置詞 in; being electrified 是被动的动名詞，和 of 連用，作 evidence 的定語. 6. meet with 遇到. 7. at first 起先. 8. is convinced of 确信. 9. The molecule is believed to be 主格带不定式短語，此处主語是 The molecule to be，謂語是 is believed. 10. so... that (这样地...以致于)，that 引起的是結果从句. 11. in exitence 現在所有的，存在的.

cules would be about the size of oranges. Perrin,[1] the famous French physicist, succeeded in making[2] oil films less than a fifty-millionth of an inch in thickness. Consequently the molecule must have a diameter less than that. From various experiments, he concluded that the diameter of the average molecule is about one 125,000,000th of an inch. It is calculated that a cubic inch of air contains 800,000,000,000,000,000 molecules. Since atoms comprise molecules, they must be still smaller.

If molecules and atoms are so small, one might ask why[3] the scientist feels so certain of[4] their existence. His reasons might be grouped into three classifications. First, by assuming the existence of molecules and atoms, he is able to[5] explain in orderly and logical fashion[6] a great mass of[7] chemical and physical occurrences which otherwise would present a hopeless tangle of unrelated phenomena.[8] Second, no one has yet brought forward[9] any facts which contradict or invalidate the atomic theory. Third, there is a certain amount of indirect visual evidence of the existence of molecules and atoms.

More than a century ago, in 1827, Robert Brown,[10] the botanist, noticed that microscopic particles suspended in a liquid were subject to an irregular and incessant movement.[11]

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1. Perrin ['peræn] 貝当. 2. succeeded in making 成功地制成了，在制取...方面成功了. 3. one might ask why 人們可以問为什么. one 是不定人称代詞，表示任何人，此处作主語，例如 One never knows 人們永远不会知道; might 是情态动詞，表示推測，和汉語"可能"，"可以"相当. 4. certain of 对...是肯定的 (certain 后通常可以接 of). 5. be able to 能够. 6. in orderly and logical fashion 有系統地并合乎邏輯地. 7. a great mass of 許許多多的. 8. tangle of unrelated phenomena 互不相关的紛乱錯綜的現象. 9 bring forward 提出. 10. Robert Brown ['robət 'braun] 洛培脫·勃朗. 11. microscopic particles suspended in a liquid were subject to an irregular and incessant movement 悬浮在液体中的极小的粒子不断地受到不規則的运动.