

科技英語通俗讀物

原子和原子能

〔苏联〕瑪卡尔耶娃編选

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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

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Е. Макарьева

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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礎知識，包括：1. 原子理論的历史沿革；2. 原子的結構；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。

本書詞匯量約 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，都加了注释，書后并附有英汉总詞匯表（1750 个單詞），对独立閱讀很有帮助，已具备中学英語水平的学生，參照了注释和总詞匯表后，可順利地閱讀本書。

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原子和原子能

〔苏联〕瑪卡尔耶娃編选 施明德译

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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，原文都未經删节，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 as¹
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 that² the most remarkable re-
searches of the twentieth century have substantiated two
ideas about the nature of matter which the Greek philo-
sophers fashioned twenty centuries ago. One is the theory
that³ the many thousands of substances which exist in
the world are formed out of⁴ a small number of simpler
substances⁵ or elements. The other theory is that⁶ matter
is constructed out of tiny particles or units, the so-called
atoms of matter.

As early as⁷ 400 B. C.,⁸ the Greek philosopher, Demo-
critus,⁹ taught that¹⁰ the world consisted of¹¹ empty space
and an infinite number of¹² small invisible particles. Matter,

1. as...as 和...同样地... 2. It is...that. 当主语是整个从句时, 往往用 It is...that 的结构, 此处的 that 是连接词, 本身没有意义, 也不是句子成分, 它所引起的从句是真正的主语, 而 It 仅是语法形式上的主语. 3. that 引起的名词从句作 'theory' 的同位语, 并说明它的具体内容. 4. are formed out of 由...构成. 此处的 of=from. 5. simpler substances 简单物质, 元素. 6. that 引起的名词从句作表语. 7. as early as 早在. 8. 400 B. C. [bi/'si:] (=400 years before Christ [bi/'fo: /'kraist]) 公元前 400 年. 9. Democritus [di/'mɒkrɪtəs] 德谟克利特. 10. that 引起的名词从句作 taught 的宾语. 11. consist of 由...组成, 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 existence² before 400 B. C., later became known as³ 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: Suppose⁵ 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 atoms¹⁰ and concluded that liquids were composed of¹¹ 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 to¹³ one another.

Not all the Greeks, however, accepted the theory.

1. he held 他认为。插入句。 2. come into existence 成立, 出现。 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。连接条件从句, 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继续下去吗? keep up=continue。 9. in the negative 否定地。 10. They also speculated upon the nature of atoms. 他们也思考过了原子的性质。 speculate upon 作“思索”解。 11. be composed of 由...组成。 12. thus accounting for the nature of liquids 这样就解释了液体的性质。 thus 往往和现在分词短语连用, 修饰前面的整个句子, 说明结果; account for 作“解释”解。 13. cling to 粘住, 钩住。 cling 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 so³ the notion of atoms was in disfavour⁴ for many centuries. But the theory always had its advocates. Epicurus,⁵ who lived about 300 B. C., clung to⁶ 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 Autruchia, who assumed that physical phenomena could be explained on the basis of¹⁰ 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 favoured¹² 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

1. Aristotle [ˈæristɒtl] 亚里斯多德. 2. whose writings became the authority of the Middle Ages in scientific matters 他的著作在中世紀時已成為科學問題方面的權威. 3. and so 所以. 4. be in disfavour 受冷遇, 被輕視. 5. Epicurus [ˌepɪˈkjuərəs] 伊壁鳩魯. 6. cling to 抱定, 堅持. 7. Lucretius [luːˈkriːʃɪəs] 盧克萊茨. 8. that is 即是. 9. few in number 數量上很少. few 表示否定, a few 表示肯定. 10. on the basis of 在...的基礎上, 依據... 11. was forced to recant this idea as a piece of heresy 被迫放棄這個被認為是異端的概念. 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 從亞里斯多德的關於元素的學說中發展出了中世紀的有魅惑力而無益的點金術. 倒裝句, 主語是 alchemy, 謂語是 grew, out...elements 是狀語. 14. though 和 futile 間省略了 alchemy was.

chemistry had its beginnings in the mystical vapourings of alchemy.

According to¹ Aristotle, there were four elements: earth, air, water, and fire. These were not elements in the sense that² 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, of³ 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 do⁵ 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 idea⁶ that one substance might be transformed into⁷ another and so the alchemists arose,⁸ actuated by the desire to change iron and other "base" metals⁹ 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

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 英语中为了避免重复，往往用助动词 do 来替代已出现过的动词，此处 do 替代 use。 6. It was only natural that such theories should give rise to the idea 这些理论会非常自然地引起这样一个概念。 7. might be transformed into 可以被转变成。 8. and so the alchemists arose 因此炼金术士出现了。 9. "base" metals 贱金属。 10. philosopher's stone 哲人石。

which not only would turn iron into gold, but which would also¹ insure perfect health and perpetual youth.²

The old atomic theory of the Greeks was revived with³ the publication of John Dalton's⁴ *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 compound⁷ always contained the same chemical elements⁸ 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 other¹² to form a variety of¹³ 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 school-master in Manchester,¹⁵ England, formulated his atomic theory. He showed that the law of definite proportions could be explained by assuming¹⁶ that each chemical element was composed of atoms of definite weight. He showed further that the law of multiple proportions could be

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 [ˈdʒɒn ˈdɔltn] 约翰·道尔顿. 5. Joseph Proust [ˈdʒoʊzɪf ˈpruːst] 约瑟夫·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 [ˈmæntɪstə] 曼彻斯特. 16. by assuming 以假设.

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 down¹ 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 to³ 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 of⁵ both an atom of hydrogen and⁶ an atom of water. Avogadro made the distinction⁷ which is still in use.⁸ The word "atom" was reserved for⁹ 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 that¹¹ 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 as¹³ developments in the field of¹⁴ chemistry led

1. as laid down 被奠定. 2. Amadeo Avogadro [ˈɑ:məˈdeɪou ˈɑ:vouˈɡɑ:drou] 阿美迪奧·阿伏伽德羅. 3. prior to 在...以前. 4. had been used loosely to refer both to the atoms of elements and to their union 不精確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 (講起)的過去時態. 6. both...and ...和...(都), 既...又. 7. made the distinction 作出了區別. 8. in use 使用着, 通用着. 9. was reserved for 被保留下來指... 10. agree with 同意. 11. so that (因而) 可以連接結果從句和目的從句, 連接結果從句時譯作“因而”或“所以”, 連接目的從句時, 譯作“使得”. 12. and so on 等等, 依此類推. 13. just as 正如. 此處的 as 和下文的 so 呼應, 翻譯時 so 不譯出. 14. in the field of 在...領域內, 在...範圍內.

inevitably to¹ the theory of molecules and atoms, so research in the domain of² physics led to the same conclusion. The pioneer chemists regarded heat as³ a substance which they named "caloric", but as early as the seventeenth century, such thinkers as Bacon⁴ and Descartes⁵ realized that heat must be a movement of the ultimate particles composing bodies. In 1738, Daniel Bernouilli⁶ 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 total⁷ 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 volume¹¹ caused it to exert more pressure, because the collisions of the particles became more frequent and violent. But Bernouilli was ahead of his

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 [beɪkən] 培根. 5. Descartes [deɪ'kɑ:t] 笛卡儿. 6. Daniel Bernouilli ['dænjəl bər'nu:ɪli] 丹尼尔·贝尔努意. 7. sum total 总和. 8. kinetic theory of gases 气体运动学说. 9. for example 例如. 10. which was not closely confined 不是紧紧地被闭合(在一定空间内)的. 11. confined to a given volume (被限定在一定体积内的), 用作 gas 的定语.

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 then² forgotten. A century later, they sprang to life³ 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 energy⁵ could be converted into⁶ heat and that the amount of heat developed was always exactly proportional to⁷ the amount of mechanical work⁸ done. The truth of this discovery is to be found⁹ in every-day life. Suppose you saw a piece of wood¹⁰ 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 of¹³ 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: *On¹⁴ Infinitely Small Physical Particles*, which he presented to the Russian Academy of Sciences in 1743, Lomonosov, the great Russian scientist,

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 is spring 的过去时态。 4. James Prescott Joule [ˈdʒeɪmz ˈpreskət ˈdʒəʊl] 詹姆斯·普里斯科特·焦耳。 5. mechanical energy 机械能。 6. be converted into 被转换成。 7. proportional to 和...成比例的。 8. mechanical work 机械功。 9. is to be found 可以找到。 动词 to be 的现在时态或过去时态后面接有其他动词的不定式时, 可以表示: ① 必要性(指完成预定的某动作); ② 必然性; ③ 将来的动作; ④ 可能性; 汉语往往译作“该”, “要”, “必须”, “将”, “可”等。 10. suppose you saw a piece of wood 假如你锯开一块木头。 11. as a result 结果。 12. the saw begins to grow hot 锯子开始发热了。 13. as a result of 由于...的结果。 14. on 关于..., 论...

asserted that all matter was made up of¹ minute material particles which he called "elements" and "corpuscles". By "corpuscles," he meant² compound particles, consisting of simple particles — "elements". Now, instead of³ "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 as⁵ 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 — that⁹ of creating "mathematical chemistry". The solution of such a problem would have turned chemistry from a science depending on¹⁰ skill into¹¹ a precise science.

1. be made up of 由...組成. 2. by...mean by 和動詞 mean 連用表示意指的對象, 例如: What do you mean by "education"? 你說的“教育”是什麼意思? 3. instead of 替代; 不是...而是. 4. made clear by Lomonosov 過去分詞短語, 作 difference 的定語. 5. such...as... 像...那樣的... 6. specific gravity 比重. 7. etc. (et cetera [it'setərə] 的略語) 等等. 8. in its turn 又. 9. that 英語中為了避免重複, 往往用 that (復數用 those) 來替代前面的名詞, 此處的 that 替代 the problem. 10. depend on 依靠, 決定于. 11. the solution of such a problem would have turned chemistry from...into 解決這樣一個問題將會把化學從...轉變為.

One of the greatest bulwarks of the atomic theory was furnished also¹ by the Russian chemist, Dmitri Ivanovich Mendeleev, 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,⁴ you came to sodium. Counting another eight brought you to⁴ 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 Mendeleev's table which could not be filled,⁶ because no elements were then⁷ known which fitted in.⁸ Mendeleev 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 gaps⁹ in Mendeleev's table and which possessed the properties which the table demanded that they should.¹⁰

The atomic theory was further strengthened by the

1. one of the greatest bulwarks of the atomic theory was furnished also 原子理論的最偉大的堡壘(意為理論之基地)之一也是由...建立起來的. furnish 原意為“供給”、“裝備”. 2. periodic classification 周期分類法(指門捷列夫周期率). 3. atomic weight 原子量. 4. counting another eight brought you to 再數八個(元素)就把你引導到. 5. many properties in common 許多共同的性質. 6. which could not be filled (不能填滿的) 定語從句, 修飾 places. 7. then 當時. 8. fit in 適合. 9. fitted into the gaps 適合於填入空白處. 10. which the table demanded that they should (周期) 表要求它們(指元素)應該具備的(定語從句, 修飾前面的 properties; should 後省略了動詞 possess).

work of the great Swedish chemist, Arrhenius,¹ who in 1887 put forward² 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 single³ atom or a group⁴ of 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 with⁶ a cold reception and considerable opposition. This theory of Arrhenius was no exception. But, though his contemporaries at first⁷ refused to accept it, it has now become one of the foundations of modern physics and chemistry after having been combined with Mendelejev's "chemical theory of solutions".

The modern scientist is convinced of⁸ the existence of molecules and atoms. The molecule is believed to be⁹ so small, however, that¹⁰ 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 [ɑ'reinjəs] 阿烈紐斯. 2. put forward 提出. 3. a single 單一的. 4. a group of 一羣的. 5. it always differed from an atom in the ordinary state in that it showed evidence of being electrified (它總是和通常狀態下的原子不同, 區別在於它可證明是帶電的) 中的 differ from... 作“和...不同”解, 在哪一方面不同則用前置詞 in; being electrified 是被動的動名詞, 和 of 連用, 作 evidence 的定語. 6. meet with 遇到. 7. at first 起先. 8. is convinced of 確信. 9. The molecule is believed to be 主格帶不定式短語, 此處主語是 The molecule to be, 謂語是 is believed. 10. so... that (這樣地...以致於), that 引起的是結果從句. 11. in existence 現在所有的, 存在的.

cules would be about the size of oranges. Perrin,¹ the famous French physicist, succeeded in making² 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 why³ the scientist feels so certain of⁴ their existence. His reasons might be grouped into three classifications. First, by assuming the existence of molecules and atoms, he is able to⁵ explain in orderly and logical fashion⁶ a great mass of⁷ chemical and physical occurrences which otherwise would present a hopeless tangle of unrelated phenomena.⁸ Second, no one has yet brought forward⁹ 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

1. Perrin [ˈperæn] 貝蘭. 2. succeeded in making 成功地制成了, 在制取...方面成功了. 3. one might ask why 人們可以問為什麼. one 是不定人稱代詞, 表示任何人, 此處作主語, 例如 One never knows 人們永遠不會知道; might 是情態動詞, 表示推測, 和漢語“可能”, “可以”相當. 4. certain^{of} 對...是肯定的 (certain 後通常可以接 of). 5. be able to 能夠. 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 互不相關的紛亂錯綜的現象. 9. bring forward 提出. 10. Robert Brown [ˈrɒbət ˈbraʊn] 洛德脫·勃朗. 11. microscopic particles suspended in a liquid were subject to an irregular and incessant movement 懸浮在液體中的極小的粒子不斷地受到不規則的運動.