高等学校教材

王高 姚密红 张记龙 编

电子科学技术专业英语与科技论文写作

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兵器工业出版社

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内 容 简 介

本书是为提高我国普通高等院校电子科学技术专业本科生专业英语综合水平而编写的教材。本书从实际应用的角度出发，以普通高等院校电子科学技术专业本科生学习课程为题材，内容涉及半导体、电子学、数字电路、模拟电路、计算机、数据采集和MEMS等；以培养兴趣、提高综合应用能力为目的，从培养科学精神，熟悉专业词汇，了解基本翻译方法，掌握信息检索方法与技能，培养撰写科技论文的能力等几个层次上全面学习科技英语。附录中列有常用数学符号表达方法，部分院校系、机构及职务名称和常用课程名称。

本书内容丰富，题材广泛，是普通高等院校电子科学技术专业本科生专业英语教材，亦可作为大专院校学生和有关科技人员的专业英语教材或阅读材料。

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前　　言

目前，大多数电子科学技术专业本科生学完大学基础英语之后，在阅读专业书刊和写作科技论文时，尚存在不少困难。其原因在于尚未掌握一定量的专业词汇，不了解基本的翻译方法，不熟悉科技论文写作的基本特点。编写此书的目的就在于提供这方面的学习材料，以提高电子科学技术专业本科生专业英语的综合水平，培养其科学技术研究的能力。

编者对教材内容的选择与安排，本着由浅入深、循序渐进的原则。通过学习科技英语阅读资料、信息检索方法、科技论文的撰写、同义词的用法、常见不规范表达方式和标点符号的用法，从六个层次上全面地对电子科学技术专业科技英语教学进行了全新的设计。

本书由中北大学王高、姚密红、张记龙合编，编者多年从事科研、本科专业英语教学和学报编辑工作，具有丰富的经验。该校张思洁副教授、周汉昌教授和刘汉云教授分别审阅了全书并给予了热忱指导和帮助。该校杨晓敏和李仰军同志对本书的构思、出版付出了辛苦的努力，在此表示深深的谢意！同时对刘双峰老师和公慧老师在校对中的辛苦工作也表示感谢！

本书编写尚不够充分，不足或错误之处在所难免，望读者给予批评指正。

编　者

2005 年 3 月 20 日

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第一部分 科技英语阅读资料

UNIT 1 Scientists

Physicist: Albert Einstein

The scientific touchstones of the modern age—the bomb, space travel, electronics, quantum physics—all bear his imprint.

He discovered, just by thinking about it, the essential structure of the cosmos. The scientific touchstones of our age—the bomb, space travel, and electronics—all bear his imprint.

We may as well join him in 1905, when he was a patent-office clerk in Bern, Switzerland—not the revered white-haloed icon of a thousand photographs, but a confident 26-year-old with wavy black hair and droll wide eyes. That year, in his spare time, he produced three world-shattering papers for a single volume (now priceless) of the premier journal Annalen der Physik. They were "blazing rockets which in the dark of the night suddenly cast a brief but powerful illumination over an immense unknown region", as the physicist Louis de Broglie said.

One offered the startling view that light comes as much in particles as in waves—setting the stage for generations of deep tension between granularity and smoothness in physicists' view of energy and matter. Another discovered, imaginatively, the microscopic motion of molecules in a liquid—making it possible to calculate their exact size and incidentally proving their very reality (many scientists, as the century began, still doubted that atoms existed). And the third—well, as Einstein said in a letter to a friend, it "modifies the theory of space and time". Ah, yes. Relativity.

The time had come. The Newtonian world view was fraying at the edges. The 19th century had pressed its understanding of space and time to the very limit. Everyone believed in the ether, that mysterious background substance of the whole universe through which light waves supposedly traveled, but where was the experimental evidence for it? Nowhere, as Einstein realized. He found it more productive to think in terms of reference—because these could move along with a moving observer. Meanwhile, a few imaginative people were already speaking of time in terms of a fourth dimension—H. G. Wells, for example, in his time—obsessed science fiction. Humanity was standing on a brink, ready to see something new.

It was Einstein who saw it. Space and time were not apples and oranges, he realized, but mates—joined, homologous, inseparable. "Hence force space by itself and time by itself are doomed to fade away into mere shadows, " said Hermann Minkowski, a teacher of Einstein's and one of relativity's first champions, "and only a kind of union of the two will preserve an independent reality." Well, we all know that now. "Space-time", we knowingly call it. Likewise energy and matter: two faces of one creature. $E = mc^2$, as Einstein memorably announced.

All this was shocking and revolutionary and yet strangely attractive, to the public as well as to the scientists. The speed of light; the shifting perspective of the observer—it was heady fare. A solar eclipse in 1919 gave English astronomer Arthur Eddington the opportunity to prove a key prediction of relativity: that starlight would swerve measurably as it passed through the heavy gravity of the sun, a dimple in the fabric of the universe. Light has mass. Newspapers and popular magazines went wild. More than 100 books on relativity appeared within a year. Einstein claimed to be the only person in his circle not trying to win a $5,000 Scientific American prize for the best 3,000-word summary ("I don't believe I could do it").

The very name relativity fueled the fervor, for accidental and wholly unscientific reasons. In this new age, recovering from a horrible war, looking everywhere for originality and novelty and modernity, people could see that absolutism was not good. Everything had to be looked at relative to everything else. Everything—for humanity's field of vision was expanding rapidly outward, to planets, stars, galaxies.

Einstein had conjured the whole business, it seemed. He did not invent the "thought experiment", but he raised it to high art: Imagine twins, wearing identical watches; one stays home, while the other rides in a spaceship near the speed of light. Little wonder that from 1919, Einstein was—and remains today—the world's most famous scientist.

In his native Germany he became a target for hatred. As a Jew, a liberal, a humanist, an internationalist, he attracted the enmity of nationalists and anti-Semites, abetted by a few Jealous German physicists man all too vigorous faction that Einstein called, while it was still possible to find this amusing, "the Antirelativity Theory Company Ltd." His was now a powerful voice, widely heard, and always attended to, especially after he moved to the U. S. He used it to promote Zionism, pacifism and in his secret 1939 letter to Franklin D. Roosevelt, the construction of a uranium bomb.

Meanwhile, like any demigod, he accreted bits of legend: that he flunked math in school (not true). That he opened a book and found an uncashed $1,500 check he had left as a bookmark (maybe—he was absent-minded about everyday affairs). That he was careless about socks, collars, slippers… that he couldn't work out correct change for the bus… that he couldn't even remember his address: 112 Mercer Street in Princeton, N. J., where he finally settled, conferring an aura of scientific brilliance on the town, the university and the Institute for Advanced Study.

He died there in 1955. He had never accepted the strangest paradoxes of quantum mechanics. He found "intolerable", he said, the idea that subatomic particles would not obey the laws of cause and effect, or that the act of observing one particle could instantly determine the nature of another halfway across the universe. He had never achieved what he considered a complete, unified field theory. Indeed, for some years he had watched the burgeoning of physics, its establishment as the most powerful and expensive branch of the sciences, from a slight remove. He had lived, he said, "in that solitude which is painful in youth but delicious in the years of maturity".

And after the rest of Einstein had been cremated, his brain remained, soaking for decades in a jar of formaldehyde belonging to Dr. Thomas Harvey, the Princeton Hospital pathologist. No one had bothered to dissect the brain of Freud, Stravinsky or Joyce, but in the 1980s, bits of Einsteinian gray matter were making the rounds of certain neurobiologists, who thus learned... absolutely nothing. It was just a brain—the brain that dreamed a plastic fourth dimension, that banished the ether, that released the pins binding us to absolute space and time, that refused to believe God played dice, that finally declared itself "satisfied with the mystery of life's eternity and with a knowledge, a sense, of the marvelous structure of existence".

In embracing Einstein, our century took leave of a prior universe and an erstwhile God. The new versions were not so rigid and deterministic as the old Newtonian world. Einstein's God was no clockmaker, but he was the embodiment of reason in nature—"subtle but malicious he is not". This God did not control our actions or even sit in judgment on them. This God seemed rather kindly and absent-minded, as a matter of fact. Physics was freer, and we too are freer, in the Einstein universe. Which is where we live.

Qian, Father of China's Rocket Development

Qian Xuesen, father of China's rocket and satellite development, was declared "State Scientist of Outstanding Contributions"by the State Council this month.

Qian was born on December 11, 1911 in Shanghai. He graduated from the Shanghai Communications University in 1934 and a year later went to study at the Massachusetts Institute of Technology (MIT), where he was awarded a Master's degree.

Then he shifted to the California Institute of Technology (Caltech), where he studied under the Hungarian-born Theodore von Karman, one of the founders of the aerospace industry in the USA.

Standing before Karman when they met was a short and serious Chinese with an impressively sharp mind. Teacher and student later became close friends and colleagues.

When talking about Qian, Karman once said that his Chinese assistant had a rich imagination and a gift for mathematics.

After his graduation in 1938, Qian, now with a Doctorate, was employed as an assistant researcher at Caltech, where he was an important member of the Guggenheim Aeronautical laboratory headed by Karman. His theories helped the development of surface-to-surface missiles and space rockets in the US, and he made outstanding contributions in aerodynamics and guidance-systems for missiles and spacecraft.

He and Karman established a theory to help overcome the heat problem associated with breaking the sound barrier in airplanes. The Karman-Tsien (Qian) Formula published in 1941, has been widely applied in aero-science.

Between 1947 and 1955, Qian was appointed professor both at MIT and Caltech. And it was also in 1947 that 36-year-old Qian married Jiang Ying, a soprano.

Soon after the founding of the People's Republic of China in 1949, Qian made up his mind to return to his motherland, but it wasn't until 1955, and with the help of late Premier Zhou Enlai, that he finally set foot again on Chinese soil.

Soon after his return, Qian presented a report to the government urging the establishment of a national defence industry. He also outlined a program to develop rockets and missiles.

Adopting his proposal, the government assigned him to the task. On May 10, 1956, the Fifth Institute under the National Defence Ministry, which was China's first missile research center was established. On that day, Qian gave his first missiles lecture to 156 college graduates of the New China, most of whom were later to become the backbone of China's missile and satellite industry.

Qian was appointed chairman of the institute in 1957, after which he stayed on to be the country's top missile and space leader.

In 1960, China successfully launched its first home-made short range missile, and in 1964, it fired its first medium-range missile.

Two years later, a nuclear-war-headed missile was successfully launched at Jiuquan, in Gansu Province, taking China into the ranks of nations with their own nuclear missiles.

As early as 1953, Qian started studying the possibility of space flight. In 1965, he suggested to the government that China should start building satellites as early as possible, which until then was still the monopoly of the Soviet Union and the United States.

This was on the eve of the chaotic "cultural revolution" (1966 ~ 1976), during which almost all research was disturbed by the radical leftists. However, as a leader, Qian, backed by late Premier Zhou, tried his best to keep the cause going. At the same time, he personally settled several key technical problems in the course of research and experiment.

He set up China's Academy of Space Technology (CAST) in 1986, and was the first president. The academy is in charge of developing satellite technology and space research.

China's first satellite "Dongfanghong 1", weighing 173 kilograms, was blasted into space on April 24, 1970, on board a Chinese-made rocket in which Qian's technical talent had played a prominent role.

Since then, China has made significant advances in both space science and missile development. To date, it has launched more than 30 satellites.

Qian has written seven academic books and more than 300 scientific papers, which have been published at home and abroad. Among them, the most renowned is Engineering Cybernetics which, first published in the US in 1954 and followed by Russian, German and Chinese versions, greatly promoted the development of computer, space and nuclear science.

His greatest academic contribution, according to this week's People's Daily, is his theory on space systems engineering which guided China's development of rocket and satellite. He also applied this theory to the overall design for national economic construction in the early 1980s.

Although he was invited several times to accept awards, Qian hasn't been back to America since his return to China in 1955—and he says he never will.

"The highest reward for me is the satisfaction of the people in my work," said the scientist after he was granted the title of "State Scientist of Outstanding Contributions" this month adding that the honour belonged to all who support his cause.

Words and Expressions

1. touchstone [ˈtʌtʃstoun]
   n. 试金石，标准
2. quantum physics
   量子物理学
3. echo [ˈekou]
   n. 回声，回音，回波
   vi. 发回声，随声附和
   vt. 摹仿，重复，反射
4. exalt [igˈzɔːlt, eg-]
   v. 晋升
5. emblem [ˈembləm]
   n. 象征，徽章，符号，
   vt. 用象征表示
6. cosmos [ˈkɔzmɔs]
   宇宙
7. revere [riˈviə]
   v. 尊敬，敬畏，崇敬
8. icon [ˈaikɔn]
   n. 图标，肖像，偶像
9. halo [ˈheilou]
   n. (日月周围的)晕轮，光环，荣光
   vt. 使有晕轮，围以光环
   vi. 成晕轮
10. droll [droul]
    adj. 好笑的，滑稽的，逗趣的
    n. 小丑，小闹剧
11. granularity [ˌgrænjuˈlæriti]
    n. 间隔尺寸，粒度
12. liquid [ˈlikwid]
    n. 液体，流体，流音
    adj. 液体的，清澈的，透明的，明亮的
13. fray [frei]
    n. 冲突，打架，争论，(织物等)磨损处
    vt. 使磨损
    vi. 被磨损
14. ether [ˈiːθə]
    n. 大气，苍天，【物】以太
15. obsess [əbˈses]
    vt. 迷住，使困扰
16. homologous [hɔˈmɔləgəs]
    adj. 相应的，类似的，一致的，同源的
17. perspective [pəˈspektiv]
    n. 透视画法，透视图，远景，前途，观点，看法，观点，观察
18. eclipse [iˈklips]
    n. 食，日蚀，月蚀，蒙蔽，衰落
    vt. 引起日蚀，引起月蚀，超越，使黯然失色
19. dimple [ˈdimpl]
    n. 酒窝，涟漪
    vt. 使起涟漪
20. absolutism [ˈæbsəluːtizm]
    n. 专制主义，绝对论
21. conjure [ˈkʌndʒə]
    vi. 变戏法，施魔法
    vt. 祈求，恳求，(以咒文)召唤，变戏法，想象
22. flunk [flʌŋk]
    n. 失败，不及格
    vi. 失败，放弃，考试不及格
    vt. 使不及格
23. aura [ˈɔːrə]
    n. 气氛，气味，(圣像头部的)光环
    【医】先兆，预感
24. paradoxical [ˌpærəˈdɔksikəl]
    adj. 荒谬的
25. burgeon [ˈbəːdʒ(ə)n]
    n. 嫩芽
    v. 萌芽
26. cremate [kriˈmeit]
    vt. 火葬，焚化
27. formaldehyde [fɔːˈmældiˌhaid]

n.【化】甲醛，蚁醛

28. erstwhile [ˈəːsthwail]
   adv. 〈古〉以前，往昔地
   adj. 以前的，往昔的
29. outrageous [autˈreidʒəs]
   adj. 蛮横的，残暴的，无耻的，可恶的，令人不可容忍的
30. musing [ˈmjuːzjŋ]
   adj. 沉思的，冥想的
31. seethe [siːð]
   v. 沸腾
32. incandescent [ˌinkænˈdesnt]
   adj. 遇热发光的，白炽的
33. pyrotechnic [ˌpaiərouˈteknik]
   adj. 烟火的，令人眼光的，出色的
34. oomph [umf]
   n. 性感，精神，精力
35. fizzle [ˈfizl]
   n. 嘶嘶声，微弱地结束，失败
   vi. 发嘶嘶声，失败
36. gyroscopic [ˌgaiərəsˈkɔpik]
   adj. 回转仪的

UNIT 2　Electrons

Consider the drawing in Fig. 1 - 1. Here we see a representation of a single atom—the smallest possible unit of any given element. At the center of the atom is the nucleus, which consists of two kinds of particles: protons and neutrons. The number of protons determines exactly what element we're dealing with, and the number of neutrons is similar to (but not necessarily the same as) the number of protons. We will not be concerned with the nucleus in these discussions, except to note that each proton has a unit positive charge, while each neutron has zero charge.

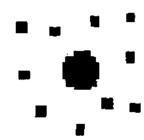

Fig. 1 - 1　A single atom

In constant motion around the nucleus we find a number of electrons. Each electron has a unit negative charge, precisely balancing the positive charge on one proton in the nucleus. As you might expect, in a normal atom with no external forces applied, the number of electrons orbiting the nucleus is equal to the number of protons in the nucleus. As a result, the entire atom is electrically neutral, or uncharged.

The electrons in any given atom do not just orbit the nucleus haphazardly; rather, they occupy specific energy levels, or "shells", around the nucleus. Electrons will always try to occupy the lowest energy level available to them, dropping into a closer orbit if they can. However, scientists have found that there is a limit to the number of electrons that can occupy any shell; electrons beyond that limit must take a higher-energy position in a wider orbit around the nucleus.

The first, or innermost shell is limited to two electrons. Once those two electrons are in place, this shell is filled and will force all other electrons to occupy positions further away from the nucleus. The second shell can hold a maximum of eight electrons, while the third can hold eighteen. Mathematically,

Number of electrons possible $=2N^2$,

where N is the shell number, counting out from the nucleus. This gives us maximum shell capacities of 2, 8, 18, 32, 50 and 72 electrons in the first six shells. That is enough to account for all natural elements, with room left over for those heavy elements that have so far been created in the laboratory and then some.

Of course, this discussion is very basic, and doesn't cover any of the fine details that have been gradually learned. Deeper discussions belong in the realms of chemistry and nuclear physics, and as such are beyond the scope of these pages.

The factor that becomes useful in dealing with electricity and electrical phenomena is that those elements that have only one or two electrons in their outermost shells don't hold on to these outermost electrons very strongly. Therefore it requires little external energy to pull these electrons away from their parent atoms and move them someplace else. These electrons make all electrical activities possible.

In metals such as copper and silver, these outer electrons are essentially free to move around anywhere within the body of the metal. In these metals, the outer electrons are so loosely held that the thermal energy inherent at room temperature is sufficient to free them from their parent atoms. We can cause these electrons to move from one place to another in a variety of different ways. We'll be exploring such methods and the uses to which such moving electrons can be put in these pages.

Static Electricity

Have you ever walked across a carpet and then gotten a slight shock as you reached out to turn on a light switch? Or heard and felt all the "crackles" as you removed a load of clothes from the dryer? Or gotten a similar effect when stroking a cat?

You probably already know that these phenomena are generally known as "static", but do you know how and why they happen?

What has happened in each case is that the friction of the physical action—walking over the carpet, stroking the cat, etc.—has caused loosely-held electrons to be transferred from one surface to the other. This results in a net negative charge on the surface that has gained electrons, and a net positive charge on the surface that has lost electrons. If there is no path for the electrons to take to restore the balance of electrical charges, these charges will remain where they are (although they will gradually leak off, as they cannot easily be held forever).

If the electrical charge continues building through ongoing friction or similar action, it will eventually reach the point where it cannot be contained, and will discharge itself over any available path. Lightning is a spectacular display of electrical energies discharging themselves after being built to high values by clouds rubbing and bumping against each other. It makes no difference that clouds consist of many tiny droplets of water floating in the air; each such droplet contributes a small amount to the total charge, which can reach enormous totals.

The point about static electricity is that it is indeed static, which means that it doesn't move from one place to another. Therefore, while some interesting experiments can be performed with it, it does not serve the purpose of providing energy to do sustained work in any practical capacity. Static electricity certainly exists, and under certain circumstances we must allow for it and account for its possible presence, but it will not be the main theme of these pages.

Voltage The electrical "pressure" that causes free electrons to travel through an electrical circuit. Also known as electromotive force (emf). It is measured in volts.

Current The amount of electrical charge (the number of free electrons) moving past a given point in an electrical circuit per unit of time. Current is measured in amperes. The load, in turn, has a characteristic called resistance.

Circuit Components: the Resistor

The resistor is the simplest, most basic electronic component. In an electronic circuit, the resistor opposes the flow of electrical current through itself. It accomplishes this by absorbing some of the electrical energy applied to it, and then dissipating that energy as heat. By doing this, the resistor provides a means of limiting or controlling the amount of electrical current that can pass through a given circuit.

Resistors have two ratings, or values, associated with them. First, of course is the resistance value itself. This is measured in units called ohms and symbolized by the Greek letter Omega. The second rating is the amount of power the resistor can dissipate as heat without itself overheating and burning up. Typical power ratings for modern resistors in most applications are 1/2 watt and 1/4 watt. High-power applications can require high-power resistors of 1, 2, 5, or 10 watts, or even higher.

A general rule of thumb is to always select a resistor whose power rating is at least double the amount of power it will be expected to handle. That way, it will be able to dissipate any heat it generates very quickly, and will operate at normal temperatures.

For purposes of physical comparison, the larger resistor is rated at 1/2 watt; its body is a cylinder 3/8″ long and 1/8″ in diameter. The smaller resistor, rated at 1/4 watt, is of the same shape but is only 1/4″ long and 1/16″ in diameter.

The traditional construction of ordinary, low-power resistors is as a solid cylinder of a carbon composition material. This material is of an easily-controlled content, and has a well-known resistance to the flow of electrical current. The carbon cylinder is molded around a pair of wire leads at either end to provide electrical connections. The length and diameter of the cylinder are controlled in order to define the resistance value of the resistor—the longer the cylinder, the greater the resistance; the greater the diameter, the less the resistance. At the same time, the larger the cylinder, the more power it can dissipate as heat. Thus, the combination of the two determines both the final resistance and the power rating.

The manufacturer coats a cylindrical ceramic core with a uniform layer of resistance material, with a ring or cap of conducting material over each end. Instead of varying the thickness or length of the resistance material along the middle of the ceramic core, the manufacturer cuts a spiral groove around the resistor body. By changing the angle of the spiral cut, the manufacturer can very accurately adjust the length and width of the spiral stripe, and therefore the resistance of the unit. The wire leads are formed with small end cups that just fit over the end caps of the resistor, and can be bonded to the end caps.

With either construction method, the new resistor is coated with an insulating material such as phenolic or ceramic, and is marked to indicate the value of the newly finished resistor.

High-power resistors are typically constructed of a resistance wire (made of nichrome or some similar material) that offers resistance to the flow of electricity, but can still handle large currents and can withstand high temperatures. The resistance wire is wrapped around a ceramic core and is simply bonded to the external connection points. These resistors are physically large so they can dissipate significant amounts of heat, and they are designed to be able to continue operating at high temperatures.

These resistors do not fall under the rule of selecting a power rating of double the expected power dissipation. That isn't practical with power dissipations of 20 or 50 watts or more. So these resistors are built to withstand the high temperatures that they will produce in normal operation, and are always given plenty of physical distance from other components so they can still dissipate all that heat harmlessly.

Circuit Components: the Capacitor

We have said that an electrical current can only flow through a closed circuit. Thus, if we break or cut a wire in a circuit, that circuit is opened up, and can no longer carry a current. But we know that there will be a small electrical field between the broken ends. What if we modify the point of the break so that the area is expanded, thus providing a wide area of "not quite" contact?

Two metal plates are placed close to each other but not touching. A wire is connected to each plate, so that this construction may be made part of an electrical circuit. These plates still represent nothing more than an open circuit. A wide one to be sure, but an open circuit nevertheless.

Now suppose we apply a fixed voltage across the plates of our construction. The battery attempts to push electrons onto the negative plate, and pull electrons from the positive plate. Because of the large surface area between the two plates, the battery is actually able to do this. This action in turn produces an electric field between the two plates, and actually distorts the motions of the electrons in the molecules of air between the two plates. Our construction has been given an electric charge, such that it now holds a voltage equal to the battery voltage. If we were to disconnect the battery, we would find that this structure continues to hold its charge—until something comes along to connect the two plates directly together and allow the structure to discharge itself.

Because this structure has the capacity to hold an electrical charge, it is known as a capacitor. How much of a charge it can hold is determined by the area of the two plates and the distance between them. Large plates close together show a high capacity; smaller plates kept further apart show a lower capacity.

The electric field between capacitor plates gives this component an interesting and useful property: it resists any change in voltage applied across its terminals. It will draw or release energy in the form of an electric current, thus storing energy in its electric field, in its effort to oppose any change. As a result, the voltage across a capacitor cannot change instantaneously; it must change gradually as it overcomes this property of the capacitor.

A practical capacitor is not limited to two plates. It is quite possible to place a number of plates in parallel and then connect alternate plates together. In addition, it is not necessary for the insulating material between plates to be air. Any insulating material will work, and some insulators have the effect of massively increasing the capacity of the resulting device to hold an electric charge. This ability is known generally as capacitance, and capacitors are rated according to their capacitance.