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PHYSICAL SCIENCE

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Understanding Electricity

走进电的世界

STEPHEN M. TOMECEK (美) 著

外语教学与研究出版社

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物理科学

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* * *

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这套丛书以英文注释形式出版，注释由国内重点中学教学经验丰富的英语教师完成。特别值得推荐的是本套丛书在提高青少年读者英语阅读能力的同时，还注重培养他们的科学探索精神、动手能力、逻辑思维能力和沟通能力。

本丛书既适合学生自学，又可用于课堂教学。丛书各个系列均配有一本教师用书，内容包括背景知识介绍、技能训练提示、评估测试、多项选择题及答案等详尽的教学指导，是对课堂教学的极好补充。

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A tourist strolls through a tunnel of neon lights
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Who Turned Out the Lights?

谁关了灯?

You're sitting at home eating dinner and suddenly—the lights go out¹. The refrigerator² goes off³. The street lights blink⁴ off. What happened to the electricity?

- | | |
|-----------------|------------|
| 1. go out | (灯火等)熄灭 |
| 2. refrigerator | 电冰箱 |
| 3. go off | (电等)供应源被切断 |
| 4. blink | 闪烁 |

On March 21, 2001, situations¹ like this happened all over the state of California². It was the first full day of spring and the weather was unusually warm. People turned on air conditioners³ and fans to cool off. These devices⁴ run on⁵ electricity—and they added to the electrical demand created⁶ by the computers, lights, and other equipment⁷ already running. Suddenly there wasn't enough electricity to meet the demand. So power⁸ companies cut power to some areas. This caused many problems—but a statewide power failure would have been far worse.

Will this happen in California again? Can it happen in other parts of the country? To understand the answers to these questions, you have to understand how electricity works. This is a book about electrical power and how it affects⁹ all of us. So get ready to explore¹⁰. You may find the experience quite shocking¹¹!

1. situation	<i>n.</i>	情况
2. California		加利福尼亚州
3. air conditioner		空调
4. device	<i>n.</i>	装置
5. run on		靠(某种动力或燃料)运转
6. create	<i>v.</i>	引起; 造成
7. equipment	<i>n.</i>	设备
8. power	<i>n.</i>	电力
9. affect	<i>v.</i>	影响
10. explore	<i>v.</i>	探究; 探索
11. shocking	<i>adj.</i>	令人震惊的



A store in California during a power failure

Making Electricity:

Going with the Flow

电的产生：电流

Do you know where electricity comes from? Even though most of us use it all the time, many people don't have a clue¹ how electricity is produced².

- | | | |
|------------|----|-------|
| 1. clue | n. | 线索，思路 |
| 2. produce | v. | 产生 |



Simply put, electricity is a form of energy¹. Energy at work, or power, makes things move. You need energy to live and grow. The energy to run your body comes from food. Most cars get their energy from the gasoline² they burn. Most of the energy that powers³ living things on Earth comes from our sun.

Using Electricity

Of all the different types of energy we use in our daily lives, electricity is one of the most important. What makes electricity special? It can be used to power many different things. It can give us light. It can keep us cool in the summer and warm us in the winter. You can use it to make popcorn⁴ or watch your favorite movie. You can even use electricity to talk to your friends.

Today most people on Earth use electrical power. Electricity is used in homes, schools, businesses, and cars. In fact, people come up with new uses for electricity every day. It's hard to believe that a little more than 200 years ago nothing ran on electricity. While people of the past knew about electricity, they didn't know how to tap⁵ into its power.

**Electricity
powers CD
players and
brings music
to your ears.**

- | | | |
|-------------|----|----------|
| 1. energy | n. | 能量; 能源 |
| 2. gasoline | n. | 汽油 |
| 3. power | v. | 赋予……动力 |
| 4. popcorn | n. | 爆米花 |
| 5. tap | v. | 接通(电源总线) |

*How many of
the things that
you have used
today run on
electricity?*



Simple Attractions¹

One of the first people to record experiments with electricity was Thales² of Miletus³, a philosopher⁴ who lived more than 2,500 years ago in ancient Greece. Thales discovered that if he rubbed⁵ a piece of fossilized⁶ tree sap⁷ called amber⁸ with sheepskin, something amazing⁹ happened. When he brought the amber near dried grass or feathers, these objects¹⁰ would jump up and stick to the amber.

In the year 1600, an English doctor named William Gilbert discovered that amber wasn't the only thing with this strange power. He found that other substances¹¹ like rubber, glass, and wax¹² also attracted things when rubbed.

Static electricity can be a hair-raising experience.

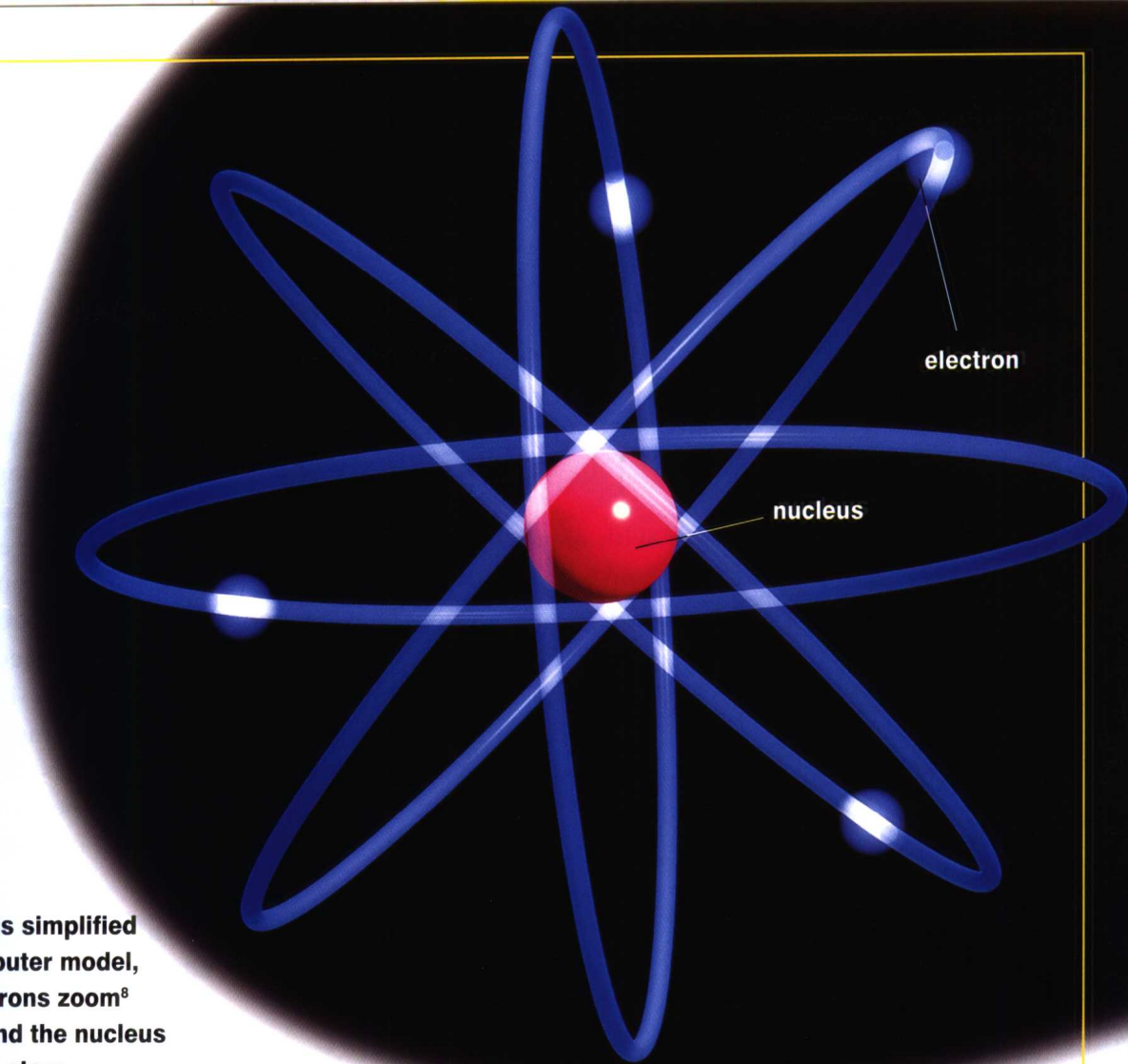
Static Electricity¹³

Did you know that it is electrons¹⁴ that make electric power possible? Everything on Earth is made of very small particles¹⁵ called atoms¹⁶. Atoms are made of protons¹⁷, neutrons¹⁸, and electrons. The protons and neutrons are packed together to form what's called the nucleus¹⁹ of the atom. Whizzing²⁰ around the outside of the nucleus are electrons that can roam²¹ from atom to atom. The movement of these tiny electrons is electricity.

1. attraction	<i>n.</i>	引力
2. Thales		泰利斯(古希腊哲学家)
3. Miletus		米利都学派
4. philosopher	<i>n.</i>	哲学家
5. rub	<i>v.</i>	摩擦
6. fossilize	<i>v.</i>	变成化石
7. sap	<i>n.</i>	树液
8. amber	<i>n.</i>	琥珀
9. amazing	<i>adj.</i>	令人惊奇的
10. object	<i>n.</i>	物体
11. substance	<i>n.</i>	物质
12. wax	<i>n.</i>	蜡
13. static electricity		静电
14. electron	<i>n.</i>	电子
15. particle	<i>n.</i>	颗粒; 微粒
16. atom	<i>n.</i>	原子
17. proton	<i>n.</i>	质子
18. neutron	<i>n.</i>	中子
19. nuclear	<i>n.</i>	(<i>pl. nucleus</i>) (原子)核
20. whiz	<i>v.</i>	(使)嗖嗖移动(或飞驰)
21. roam	<i>v.</i>	漫游
22. material	<i>n.</i>	材料
23. ancient	<i>adj.</i>	古代的

Word Power

William Gilbert called all the attracting materials²² he tested "electrics" because the ancient²³ Greek word for *amber* was *elektron*. The modern word "electricity" comes from this word.



In this simplified computer model, electrons zoom⁸ around the nucleus of an atom.

Static is one form of electricity. For example, when Thales rubbed amber with sheepskin, some of the electrons from atoms on the sheepskin were rubbed off onto the amber. When many electrons collect on a surface¹, they crowd together. Eventually² some of them can jump off the surface, or discharge³.

Sometimes you can get a shock from this static discharge. When you walk across a rug⁴ in dry weather, electrons rub off the rug and

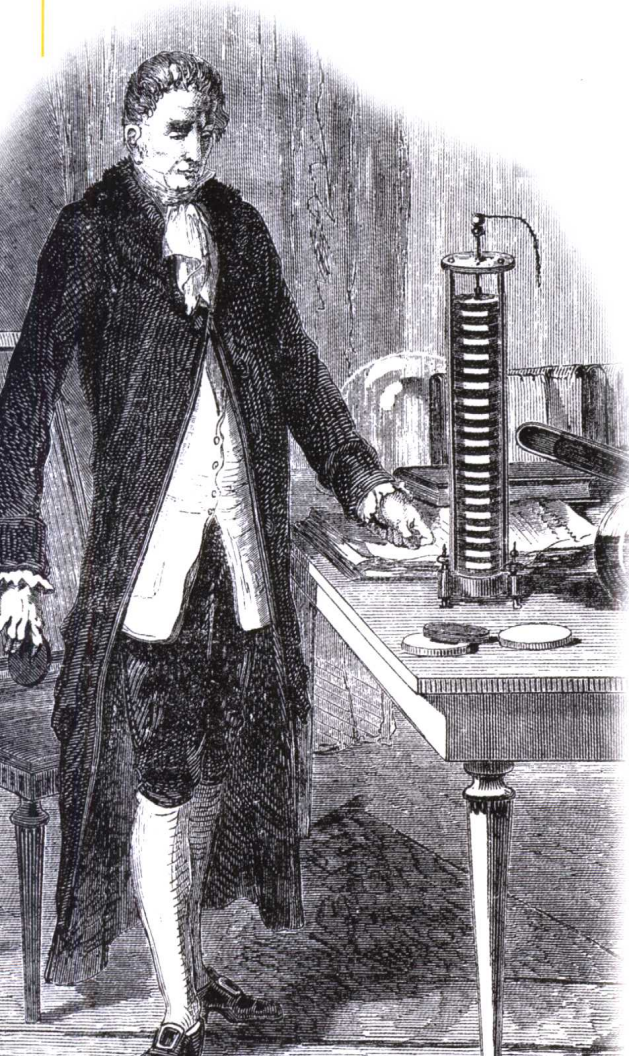
collect on you. As you get close to an object like a doorknob⁵, the electrons can jump to it. Ouch! You get a zap⁶ and see a little spark⁷. If you want to see static big time, just look at lightning. It is a static discharge, too.

1. surface	<i>n.</i>	表面
2. eventually	<i>adv.</i>	最后；终于
3. discharge	<i>v.</i>	放电
4. rug	<i>n.</i>	小地毯
5. doorknob	<i>n.</i>	(门上的)球形把手
6. zap	<i>n.</i>	击；震击
7. spark	<i>n.</i>	火花；火星
8. zoom	<i>v.</i>	飞快地掠过

Current Electricity¹

Ever hear of a volt²? When you buy a battery, you might look to see how many volts it has. The voltage³ of a battery tells something about its power. A volt is a unit of electrical pressure⁴. It is named for the Italian scientist Alessandro Volta⁵. Volta discovered a type of electricity called current electricity. Current electricity is a constant⁶ stream⁷ of electrons.

In 1800 Volta did experiments⁸ with metal disks⁹ and fabric¹⁰ that had been soaked¹¹ in acid¹². He found that if he connected the



metal disks with a wire, electrons would flow from one disk to another. This stack¹³ of metals, fabric, and acid was the very first battery.

The Electricity-magnetism Connection

During the early 1800s, scientists discovered a link¹⁴ between magnetism¹⁵ and electricity. Scientists had known for years that magnets attracted metals. Then scientists learned that when electricity flows through a wire, the wire attracts other metals, such as iron and steel. In other words, the wire becomes magnetized. When the current is turned off, however, the wire no longer acts like a magnet. Wrapping¹⁶ a current-carrying coil¹⁷ of wire around a piece of iron causes the iron to become magnetized as well. When a metal is magnetized by electricity, it is called an electromagnet¹⁸.

Volta used a stack of metal disks, fabric, and acid to make the first battery.

1. current electricity		电流
2. volt	<i>n.</i>	伏特
3. voltage	<i>n.</i>	伏特数; 电压
4. pressure	<i>n.</i>	压力
5. Alessandro Volta		亚历山德罗·伏特(意大利物理学家, 发明了电池等)
6. constant	<i>adj.</i>	不断的; 经常的
7. stream	<i>n.</i>	流动; 一连串
8. experiment	<i>n.</i>	实验
9. metal disk		金属盘
10. fabric	<i>n.</i>	纺织品, 织物
11. soak	<i>v.</i>	浸湿
12. acid	<i>n.</i>	酸
13. stack	<i>n.</i>	组; 套
14. link	<i>n.</i>	联系
15. magnetism	<i>n.</i>	磁
16. wrap	<i>v.</i>	缠绕
17. coil	<i>n.</i>	(一)卷; (一)圈
18. electromagnet	<i>n.</i>	电磁体, 电磁铁

The real breakthrough¹ came in 1831 when English scientist Michael Faraday² asked a simple question. If electricity could make wire and metal act like a magnet, could a magnet be used to make electricity flow in a wire? After many experiments, he discovered that the answer was yes! To get electrons to flow through a wire, Faraday moved a strong magnet past a coil of wire. He built the first electric generator³—a machine that uses a magnet to produce current electricity. Why was this such an important discovery? Well, without a generator, almost none of today's power plants would be able to make electricity.

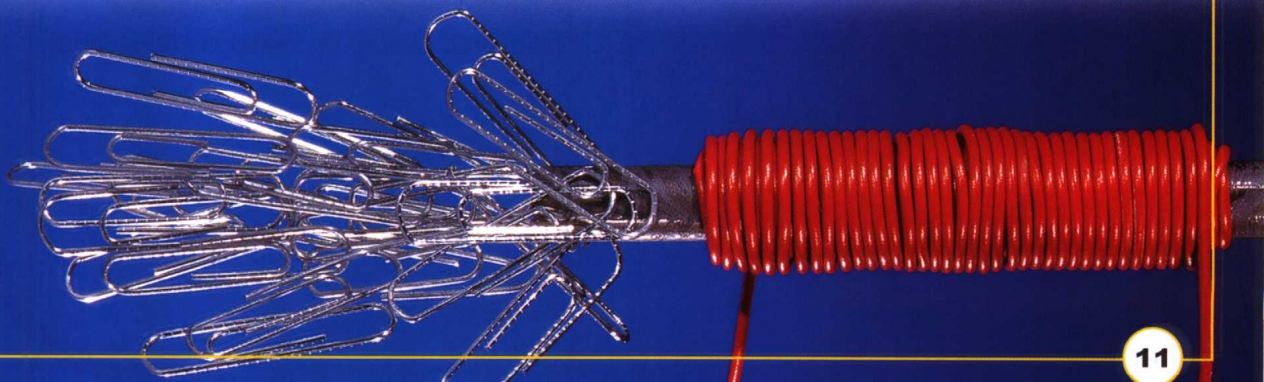
Thinking Like a Scientist: Making a Model

Models are representations⁴ of real-life things. When scientists want to try out new ideas, they often use models to help test the ideas. By using small models, scientists can get answers without spending time and money on huge experiments.

How did Faraday's electric generator change our lives?

This nail⁵ is an electromagnet. The coils of current-carrying wire make the nail act like a magnet and attract the paper clips⁶.

1. breakthrough	<i>n.</i>	突破：重大进展
2. Michael Faraday		迈克尔·法拉第(英国物理学家和化学家，发现电磁感应现象)
3. generator	<i>n.</i>	发电机
4. representation	<i>n.</i>	代表
5. nail	<i>n.</i>	钉子
6. paper clip		回形针



Closing the Circuit¹

All electrical devices, from simple flashlights² to the most complex³ computers, operate⁴ on the same basic principle⁵. It's called a circuit. A circuit can be thought of as a circle of electricity, which is how it got its name. A circuit is nothing more than a continuous loop⁶ or pathway⁷ through which electricity can flow.

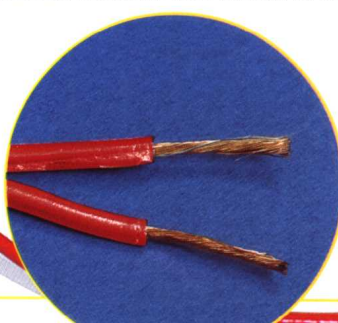
The most important part of a circuit is the conductor⁸. This is the material that the electrons actually flow through, just as water flows through a pipe. Many different materials can be used as conductors. The most common conductors are metals, such as copper⁹, aluminum¹⁰, or steel.

The opposite¹¹ of a conductor is an

insulator¹². This is a material that makes a very poor conductor, so electrons don't flow through it well. Common insulators include glass, rubber, dry wood, and most plastics. Look at the electrical wires used to connect appliances¹³ to an outlet¹⁴. You can see that they have both insulators and conductors. The conductors are on the inside, attached¹⁵ to the metal plugs¹⁶. The plastic or rubber around the wire is an insulator that keeps you from getting shocked¹⁷.

1. circuit	<i>n.</i>	电路
2. flashlight	<i>n.</i>	手电筒; 闪光灯
3. complex	<i>adj.</i>	复杂的
4. operate	<i>v.</i>	运转
5. principle	<i>n.</i>	原理
6. loop	<i>n.</i>	圈; 环
7. pathway	<i>n.</i>	路; 径
8. conductor	<i>n.</i>	导体; 导线
9. copper	<i>n.</i>	铜
10. aluminum	<i>n.</i>	铝
11. opposite	<i>n.</i>	相反的事物
12. insulator	<i>n.</i>	绝缘体
13. appliance	<i>n.</i>	器具; 装置
14. outlet	<i>n.</i>	出线盒
15. attach	<i>v.</i>	连接
16. plug	<i>n.</i>	插头
17. shock	<i>v.</i>	使受电击

**The metal inside a wire is a conductor.
The plastic around the metal is an insulator.**



A video game¹ electrifies²
a boy's free time.

1. video game

电视游戏

2. electrify

v.

使兴奋；使激动

