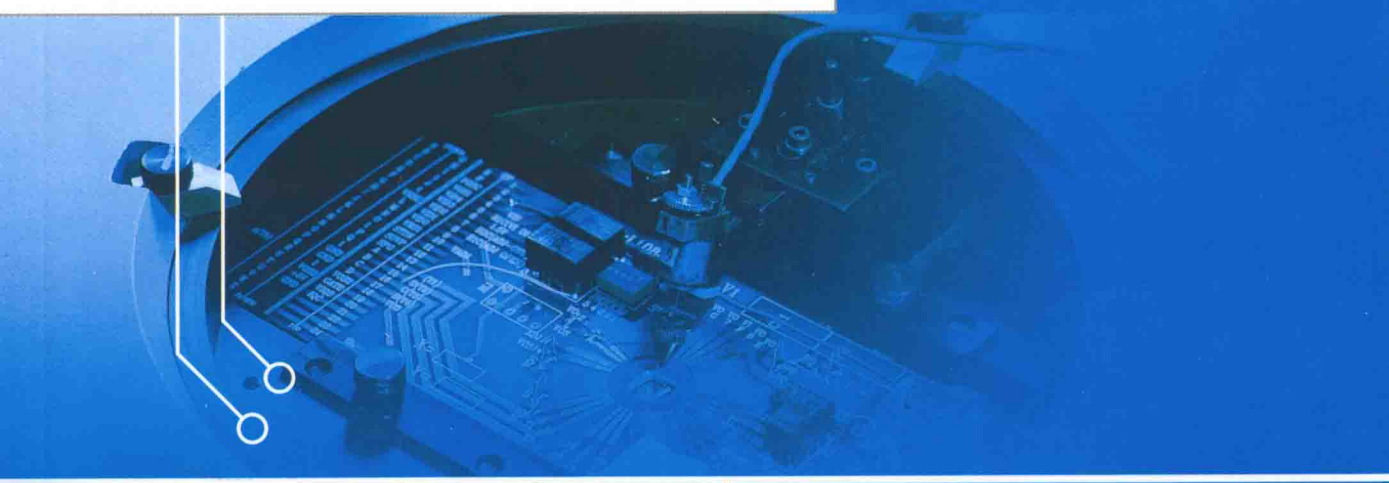
高职高专电子制造类专业规划教材
英特尔公司推荐教材

电子制造工程专业英语

金 鸿 主编



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电子制造工程专业英语

Dianzi Zhizao Gongcheng Zhuanye Yingyu

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内容提要

本书旨在使读者掌握电子制造工程专业群的英语术语及用法，培养和提高读者阅读和翻译专业英语文献资料的能力，为今后获取和交流专业技术信息打下良好的基础。全书共18课，内容包括电的本质、电场、简单电路、半导体材料、电化学基础、光化学基础、电子封装、印制电路板成像、电镀技术、柔性电路、柔性电路的检测、显示技术简介、液晶显示、等离子显示、发光二极管、半导体器件及集成电路、半导体制造工艺、封装及测试等。每课由课文、语法(或翻译或应用文)和扩展阅读组成。本书还简单介绍了翻译知识，并配有适量的练习与扩展阅读材料，供教师选用及学生自学用。

本书内容新颖，图文并茂，浅显易学，可用作光电子技术、电子电路设计与工艺、微电子技术、光伏发电技术及应用等专业的专业英语教材或教学参考书，也可供从事电子制造工程类专业的工程技术人员学习参考。

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序　言

短短的20年，消费类电子产品就发展成为继衣食住行后人们生活的必需品。中国在改革开放时恰逢世界电子产品普及的前夜，赶上了电子制造业飞速发展的步伐，一跃成为世界最大的电子产品制造国，电子工业也成为世界第一大工业。

我国对电子制造工程(包括集成电路设计与制造、电子与光电子封装)方面各层次的人才需求非常旺盛，从低级(技工)到高级(博士)各层次的人才需求量都非常大。反观我们的中等和高等教育没有形成培养适应电子工业发展的电子制造工程类专门人才的培养体系，造成了该领域人才奇缺的局面。目前电子制造业招募的大量工程技术人员都是来自材料、机械、物理、自动化等专业的人员，用人单位需要花大力气对其进行进一步培训(养)。

将电子制造与机械制造相类比：涉及机械制造的专业有很多，如机械、铸、锻、焊、热处理、机电一体、工程机械、冶金机械、模具技术、工业设计等；而真正涉及电子制造的专业却没有一个，如果有的话，可能就是微电子专业了。电子制造对人才的需求与机械制造领域培养学生的相对过剩已经形成了非常鲜明的对比。

在欧美国家和日本，大量的机械、电子、物理、冶金、材料等人员均转向电子制造领域。在人才培养上，各专业已经在专业设置上开设了多门电子制造工程方面的专门课程，也形成了很多有影响的教材。现在的中国已经成为世界电子产品制造的基地，但现状是国外研发、中国制造，人才的需求自然具有中国的特色。我们在人才的培养上欠账太多，必须立即起步，大量培养电子制造领域的专科应用型人才和本科及更高层次的研发人才，才能有大量的属于中国的原创电子产品和先进的电子封装形式，真正将这一领域的发展掌握在中国人的手里。

近年来，无论是中央还是地方各级政府，都将加速微电子、光电子、平板显示、光伏太阳能、半导体照明等电子制造业的发展列为发展经济的一项重要工作。新型的电子制造行业不断出现，更加剧了对高素质技能型专门人才的旺盛需求。迫切要求开设光电子技术、平板显示技术、光伏太阳能、汽车电子等新专业，构建电子制造工程专业群，但这些新专业又很难找到合适的教材，严重制约了专业的发展和人才培养质量的提高。

为此，2009年11月，高等教育出版社联合英特尔(中国)有限公司在南京召开了“高职高专电子制造工程专业教学研讨与教材组稿会”。此次会上组建了高职高专电子制造类专业规划教材编写组，确定了近20本教材，基本涵盖电子制造工程专业群各专业教材需求。在英特尔公司的大力支持和国内多所业内知名高职高专院校的通力合作下，在各位作者的辛勤努力下，高职高专电子制造类专业规划教材即将由高等教育出版社出版。这是我国高职高专电子制造工程专业群教育史上的一个划时代的事件，标志着我们构建了一个面向电子制造工业的全新和完整的高职高专电子制造工程人才培养体系。

随着电子制造工程专业群各专业选用本系列教材，定会为我国乃至世界的电子制造业培养大量优秀的高素质技能型专门人才。这套教材的出版也能够为正在从事电子制造领域的科技工作者以及工业界的朋友提供一个系列参考书。

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2010 年 8 月 27 日

前　言

《电子制造工程专业英语》是为高职高专电子制造工程专业群编写的专业英语教材，是编者根据多年的教学经验，参考国内外最新的英文专业教科书及科技资料，从实际教学的需要出发，结合专业的特点编写而成的。教材遵循循序渐进，由浅入深，由一般到专业的思路编写。

本书共18课。每课分为三部分：课文、语法(或翻译或应用文)和扩展阅读。

第一部分：所选课文以科普介绍性文章为主，避免抽象理论内容，难度适中，主要拓展学生知识面和词汇量，使学生熟悉专业英语的语言风格和表述习惯。每篇课文配有词汇、注释及相应的练习。这部分内容为教材的核心。

第二部分：第1～4课为词法，5～8课为句法，9～12课为翻译技巧，13～18课为应用文写作。词法和句法针对专业英语的特点，尽量以专业英语为例加以说明；翻译是专业英语的一个重要内容，因此，翻译部分除了一些通用的翻译方法和理论外，均以专业英语为对象详细说明。应用文写作也与专业英语相关，以提高学生英语的实际应用能力，为求职和将来工作奠定基础为目标。这部分内容可根据学生具体情况，适当选取讲授。

第三部分：以介绍产业发展等内容的文章作为学生课后阅读材料，以扩展学生的专业词汇和知识面，可以不在课堂中讲授。

本教材由南京信息职业技术学院金鸿任主编并负责统稿，成都电子机械高等专科学校吴非任副主编，参与编写的还有南京信息职业技术学院的陈刚、赵玮和韩萌，以及重庆城市管理职业学院的刘新。其中，第8、11课由金鸿编写，第3、5、18课由吴非编写，第1、12、13、14课及第1、3、4、5、6、8课的语法由陈刚编写，第6、9、10课及第9、10、11、12课的翻译部分由赵玮编写，第4、16、17课以及第13、14、16、17、18课的应用文由韩萌编写，第2、7、15的全部内容由刘新编写。电子科技大学的陈文彬审阅了全书，并提出了宝贵的修改意见和建议，在此表示感谢。

由于教材篇幅有限，内容不能涵盖电子制造工程专业群所有方面，但各种电子信息产品及其制造技术有相近和相通之处，且很多专业术语也可通用，因此，本教材对于电子制造工程专业群各专业具有通用性，适合用作高职高专光电子技术、电子电路设计与工艺、微电子技术、光伏发电技术及应用等专业的专业英语教材或教学参考书。

由于编者水平有限，编写时间仓促，错误在所难免，望读者不吝指正。

编　者

2011年5月

Contents

Lesson One 1

Part Ⅰ Intensive Reading: The Nature of Electricity 1

Part Ⅱ Grammar: Parts of Speech 6

Part Ⅲ Extensive Reading: Why do We Get a Shock from Electricity? 7

Lesson Two 9

Part Ⅰ Intensive Reading: Electric Field, Potential and Voltage 9

Part Ⅱ Grammar: Prefix and Suffix 13

Part Ⅲ Extensive Reading: Electric Field and Electric Field Lines 15

Lesson Three 18

Part Ⅰ Intensive Reading: Simple Electric Circuit 18

Part Ⅱ Grammar: Word-Formation 23

Part Ⅲ Extensive Reading: DC Biasing—BJTs 24

Lesson Four 26

Part Ⅰ Intensive Reading: Semiconductor Material 26

Part Ⅱ Grammar: Word-activity 30

Part Ⅲ Extensive Reading: Growth of Semiconductor Materials 31

Lesson Five 33

Part Ⅰ Intensive Reading: Electrochemistry Basis 33

Part Ⅱ Grammar: Sentence Backbones 38

Part Ⅲ Extensive Reading: The History of Electrochemistry 39

Lesson Six 43

Part Ⅰ Intensive Reading: Photochemistry Basis 43

Part Ⅱ Grammar: Sentence Elements 47

Part Ⅲ Extensive Reading: Photolithography Introduction 49

Lesson Seven 51

Part Ⅰ Intensive Reading: Electronic Package and High-density Interconnectivity 51

Part Ⅱ Grammar: Complex Sentence Ⅰ 55

Part Ⅲ Extensive Reading: Electronic Packaging 57

Lesson Eight 59

Part Ⅰ Intensive Reading: Printed Circuit Board Imaging 59

Part Ⅱ Grammar: Complex sentence Ⅱ 63

Part Ⅲ Extensive Reading: HannStar Board-GBM Consolidation to Create Largest PCB Maker in Taiwan Province 64

Lesson Nine 66

Part Ⅰ Intensive Reading: Plated-Through-Hole(PTH) Technology ····· 66
Part Ⅱ Translation Skills: Translation Standards and Process ····· 71
Part Ⅲ Extensive Reading: The Disadvantages of Pattern Plating ····· 72
Lesson Ten ····· 74
Part Ⅰ Intensive Reading: Flexible Circuits ····· 74
Part Ⅱ Translation Skills: Conversion of Part of Speech ····· 78
Part Ⅲ Extensive Reading: Design of Flexible Circuits ····· 80
Lesson Eleven ····· 81
Part Ⅰ Intensive Reading: Inspection and Test of Flexible Circuits ····· 81
Part Ⅱ Translation Skills: Translation of Complex Sentences in Scientific English ····· 86
Part Ⅲ Extensive Reading: Printed Electronics Make PCB "Green Up" ····· 87
Lesson Twelve ····· 89
Part Ⅰ Intensive Reading: Introduction of Display Technology ····· 89
Part Ⅱ Translation Skills: Amplification and Deletion ····· 95
Part Ⅲ Extensive Reading: Flat Panel Buying Tips ····· 96
Lesson Thirteen ····· 99
Part Ⅰ Intensive Reading: Liquid Crystal Display ····· 99
Part Ⅱ Practical Writing: Resume ····· 104
Part Ⅲ Extensive Reading: High Luminance and Wide Color Gamut—for clear, vivid color ··· 106
Lesson Fourteen ····· 107
Part Ⅰ Intensive Reading: Plasma Display Panel ····· 107
Part Ⅱ Practical Writing: Cover Letter ····· 112
Part Ⅲ Extensive Reading: Full HD Plasma Panel Creates a True Full HD 3D World ····· 113
Lesson Fifteen ····· 115
Part Ⅰ Intensive Reading: Light Emitting Diodes ····· 115
Part Ⅱ Practical Writing: Reference Letter ····· 119
Part Ⅲ Extensive Reading: Organic Light Emitting Diodes ····· 120
Lesson Sixteen ····· 122
Part Ⅰ Intensive Reading: Semiconductor Devices and Integrated Circuits ····· 122
Part Ⅱ Practical Writing: Advertisement ····· 127
Part Ⅲ Extensive Reading: How Solar Cells Work? ····· 128
Lesson Seventeen ····· 130
Part Ⅰ Intensive Reading: Semiconductor Manufacturing Processes ····· 130
Part Ⅱ Practical Writing: Self-Introduction ····· 135
Part Ⅲ Extensive Reading: Photolithography ····· 136
Lesson Eighteen ····· 137
Part Ⅰ Intensive Reading: Packaging and Testing ····· 137
Part Ⅱ Practical Writing: Work Report ····· 141
Part Ⅲ Extensive Reading: Chip Scale Package ····· 142
Reference ····· 144

Lesson One

Part I Intensive Reading

The Nature of Electricity

We will begin by looking at atoms. The atom is the basic building block of all matter. Everything in the universe is made up of various combinations of approximately 90 different kinds of elements that occur in nature. ① A substance composed of only one type of atom is called a simple substance, while a substance composed of more than one element may be either a compound (the atoms are attached to each other through some kind of chemical bond) or a mixture. Here are some everyday examples of all three types of substances:

Simple substance: iron, copper, carbon, sulfur, oxygen

Compounds: water (hydrogen + oxygen), salt (sodium + chlorine)

Mixtures: brass (copper + zinc), air (nitrogen + oxygen + argon + carbon dioxide)

Atoms, in turn, are composed primarily of three elementary particles as Fig. 1.1:

- protons (positively charged)
- electrons (negatively charged)
- neutrons (uncharged)

The protons and neutrons are clumped together in the center of the atom. This collection of protons and neutrons is known as the nucleus and its protons give it a positive charge. The electrons orbit the nucleus somewhat like the solar system's planets orbit the sun. ② The electrons are held in orbit around the nucleus because the positively charged nucleus exerts an electrostatic force on the negatively charged electron. When we remove electrons from an atom, we have electricity. Electricity is simply a collection of charged particles, usually electrons. ③ There are certain cases in which electricity can be composed of ions, which are atoms that have either extra electrons or too few electrons (an example would be the ionized gas in a neon lamp or a fluorescent lamp). Electricity never consists of collections of protons—they are too tightly bound to the nucleus to be removed without destroying the entire atom.

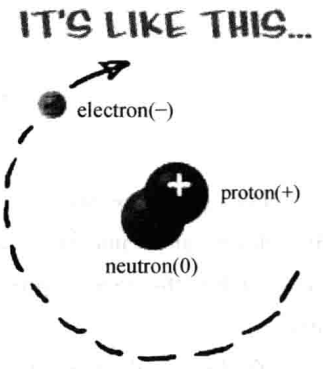

Fig. 1.1 The structure of an atom

There are many ways that electrons can be removed from atoms to create electricity, including:

- friction(the static electricity we observe after walking across a rug and touching a doorknob)
- chemical reactions(batteries)
- mechanical motion(alternators and generators)
- heat(thermocouples)
- light(solar cells)

The electricity created by these processes falls into one of two categories:

- Static Electricity—a collection of electrons with no net motion
- Electric Current—a collection of electrons all of which are moving in a particular direction.

④ Of these two types, electric current is the most useful and the entire field of electronics ultimately is concerned with the creation and control of electric currents. ⑤ A flow of electric current is the result of electrons being acted on by an electric field, so this is a good time to take a small detour and talk about electric charge and the electric field. A subatomic particle that has an electric charge, such as a proton or electron, creates an electric field. This electric field extends throughout all space and can affect other charged particles that it encounters. Consider a region of empty space that contains only a single proton. The proton's positive electrical charge gives rise to an electric field that fills the entire space. Now let us add an electron. Because the electron is negatively charged as Fig. 1.2(a), it is affected by the electric field. The field causes the electron to be attracted to the proton. Therefore, (1) Unlike charges attract one another.

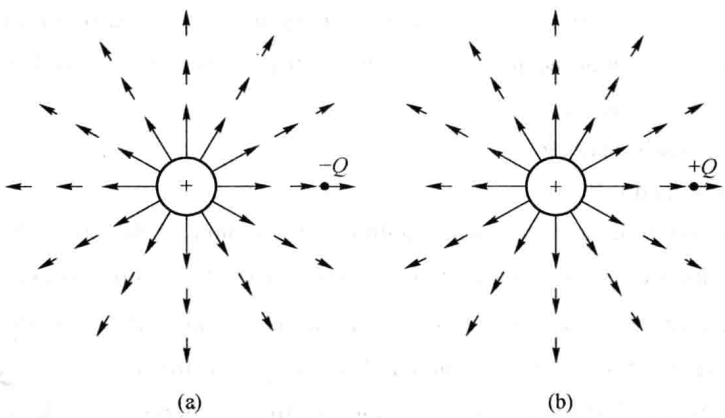

Fig. 1.2 The charges and field

Let us remove the electron and add a proton as shown in Fig. 1.2(b). The proton carries a positive charge and thus the electric field created by the other proton affects it. In this case, the electric field pushes the second proton away from the first proton. Therefore, (2) Like charges repel one another.

⑥ In a real atom, the interaction between protons in the nucleus and electrons in a cloud surrounding the nucleus is very complex because more than just two particles are involved.

Words and Expressions

alternator /'ɔ:ltəneɪtə/ *n.* 交流发电机
argon /'ɑ:gɒn/ *n.* 氩，氩气
atom /'ætəm/ *n.* 原子
battery /'bætərɪ/ *n.* 电池(组)
brass /brɑ:s/ *n.* 黄铜
chlorine /'klɔ:ri:n/ *n.* 氯，氯气
compound /'kɒmpaʊnd/ *n.* 化合物
copper /'kɒpə/ *n.* 铜，铜元素
detour /'di:tʊə/ *n.* 迂回，绕道
electron /ɪ'lektrɒn/ *n.* 电子
element /'elɪmənt/ *n.* 元素
generator /'dʒenəreɪtə/ *n.* 发电机
hydrogen /'haɪdrədʒən/ *n.* 氢，氢气
ion /'aɪən/ *n.* 离子
matter /'mætə/ *n.* 物质
mixture /'mɪkstʃə/ *n.* 混合物
neon /ni:ən/ *n.* 氖
neutron /'nju:trɒn/ *n.* 中子
nitrogen /'naɪtrədʒən/ *n.* 氮，氮气
nucleus /'nju:klɪəs/ *n.* 原子核
proton /'prəʊtɒn/ *n.* 质子
rug /rʌg/ *n.* 小块地毯，毯子
sodium /'səʊdɪəm/ *n.* 钠
thermocouple /'θɜ:məʊˌkʌpl/ *n.* 热电偶
zinc /zɪŋk/ *n.* 锌
carbon dioxide 二氧化碳
charged particle 带电粒子
electric current 电流
electric field 电场
electrostatic force 静电力
elementary particle 基本粒子
fluorescent lamp 荧光灯
mechanical motion 机械运动
solar cell 太阳能电池
static electricity 静电

Notes

① A substance composed of only one type of atom is called a simple substance, while a substance composed of more than one element may be either a compound (the atoms are attached to each other through some kind of chemical bond) or a mixture.

由一种原子构成的物质称为单质，由两种或两种以上元素组成的物质称为化合物(原子以某种化学键结合在一起)或混合物。

② The electrons are held in orbit around the nucleus because the positively charged nucleus exerts an electrostatic force on the negatively charged electron.

由于带正电的原子核对带负电的电子施加一个静电力，因此电子被束缚在围绕原子核的轨道上。

③ There are certain cases in which electricity can be composed of ions, which are atoms that have either extra electrons or too few electrons.

在某些情况下，电由离子组成，离子就是多余电子或缺少电子的原子。

④ Of these two types, electric current is the most useful and the entire field of electronics ultimately is concerned with the creation and control of electric currents.

这两种类型中，电流是最有用的，整个电子学领域最终关心的就是如何产生和控制电流。

⑤ A flow of electric current is the result of electrons being acted on by an electric field, so this is a good time to take a small detour and talk about electric charge and the electric field.

电流的产生是电场作用在电子上的缘故，因此现在最好简单地讨论一下电荷和电场。

⑥ In a real atom, the interaction between protons in the nucleus and electrons in a cloud surrounding the nucleus is very complex because more than just two particles are involved.

在一个真正的原子里面，核内质子与电子云里电子的相互作用非常复杂，因为牵涉在内的不止这两种粒子。

Exercises

1. Answer the following questions briefly according to the text.

1) What is the basic unit that made up of matter in the universe? And how many kinds of that occur in nature?

2) What is the difference between compounds and mixtures according to the first paragraph?

3) What is the brass made up of? Is it element, compound or mixture? And why?

4) What are the main elementary particles contained in an atom? And which one is positively charged?

5) What is at the center of an atom, and what is orbiting around it?

6) How is electricity created?

7) What is the difference between static electricity and electric current?

8) What kind of particle can create an electric field? And what can the electric field affect?

9) What will be the effect when an electron is put near a proton?

2. Translate the phrases into Chinese, and fill it in the following blanks with symbols of the right phrases.

A. electrical field _____

B. chemical reaction _____

C. charged particle _____

D. electrostatic force _____

E. chemical bond _____

F. like charge _____

1) Atoms are attached to each other through some kind of _____ in compound.

2) Positively charged protons exerted an _____ on the negatively charged electron.

3) Electricity is simply a collection of _____.

4) The batteries creates electricity through _____.

5) This _____ extends throughout all space and can affect other charged particles that it encounters.

6) _____ repel one another.

3. Read and choose the best answer.

1) What is the basic building block of all matter?

A. Compound. B. Atom. C. Proton. D. Electron.

2) According to the text, the air belongs to _____.

A. element B. compound C. mixture D. elementary particle

3) Why the electrons orbit around the nucleus somewhat like the planets around the Sun?

A. Because the electrons are negatively charged.

B. Because the nucleus are positively charged.

C. Because the nucleus and electrons are of the same charges and repel each other.

D. Because the nucleus and electrons are of the unlike charges and attract each other.

4) What is not true about the electricity?

A. Electricity is simply a collection of charged particles.

B. Electricity consists of collections of electrons, protons, and ions.

C. Electricity is created by removing the electrons from atoms.

D. There are many ways to create electricity.

5) What is orbiting around the nucleus?

A. Atoms. B. Electrons. C. Protons. D. Neutrons.

6) When a proton is put near an electron, _____.

A. they attract each other B. they repel each other

C. they are not interacted D. they lose their electric charge

7) What does the text mainly tell us?

A. The structure of an atom. B. Static electricity and electric current.

C. The nature of the electricity. D. How to produce electricity.

4. Translate the following passage into English.

原子由三种基本粒子组成，即质子、中子和电子。质子带正电，电子带负电，中子不带电。质子和电子相互吸引，而两个质子则相互排斥。

Part Ⅱ Grammar

Parts of Speech（词性）

英语中的单词可以根据词义、句法作用和形式特征分为十大词类。

词　性	英语名称	作　用	例　词
名词	noun(*n.*)	表示人或事物的名称	apple 苹果 China 中国
代词	pronoun(*pron.*)	用来代替名词、形容词或数词等	he 他 that 那
数词	numeral(*num.*)	表示数量或顺序	one 一 first 第一
形容词	adjective(*adj.*)	用来修饰名词，表示人或事物的特性、性质	safe 安全 great 伟大
副词	adverb(*adv.*)	用来修饰动词、形容词或其他副词，表示动作或状态的特性	badly 严重地，糟糕地 here 这里
冠词	article(*art.*)	用在名词前，帮助说明名词所指的人或事物	an，a，the
动词	verb(*v.*)	表示人或事物的动作或状态	eat 吃 have 有
介词	preposition(*prep.*)	用在名词、代词等前面，说明句子中词与词之间的关系	under 在…下 in 在…里
连词	conjunction(*conj.*)	用来连接词、短语或句子	and 和 but 但是
感叹词	interjection(*interj.*)	表示说话时的感情或口气	hello 喂，你好 why 呃，嘿

例：We will begin by looking at atoms.

- We：代词
- will：时态动词
- begin：动词
- by：介词
- looking：动名词

- at：介词
- atoms：名词

Exercise

Mark the part of speech of the words in the following sentence.

A flow of electric current is the result of electrons being acted on by an electric field, so this is a good time to take a small detour and talk about electric charge and the electric field.

Part Ⅲ Extensive Reading

Why do We Get a Shock from Electricity?

Electricity shocks us, because it is an outside force that interferes with the internal electricity our bodies' nervous systems generate. To fully understand why the chance of encountering these two electrical forces results in a shock to our systems, we must first understand the fundamentals of electricity itself.

In scientific terms, electricity is considered a fundamental force, one that is extremely basic, and has been in existence since the beginning of time. Further simplified, it is so basic, that it defies explanation, and is Mother Nature's way of saying "Because I said so!"

Electricity comprises positive and negative charges, opposite charges attract each other, and similar charges repel each other. Those charges attracted to each other can be separated, with the end product being potential energy, that is, energy that will be released as voltage, should the two reunite. We pay electric companies to separate the positive and negative charges for us, so that we can have electrical energy at our disposal.

In order for the charges to reunite, and for the potential energy to be released as voltage, a conductor, a channel that they can flow through, is needed. Insulators, such as paper and glass make poor conductors, while wire and water make excellent conductors. Unfortunately, since the human body consists primarily of water, it too provides a superb conductor for electrical energy, or voltage.

If, by chance, outside electrical energy enters our bodies, now conductors, we will be shocked when the voltage encounters, and interferes with, the internal electrical energy our nervous systems produce. The shocks to our bodies, and the amount of damage the electricity does to them, depends on the voltage our bodies are subjected to, on its level of energy, and on how much our bodies resist the flow of the electrical energy.

When we are shocked, a variety of things may occur, none of which is desirable. Our muscles may twitch, we may experience problems in the nerve centers that control our breathing, or we may experience problems with our heart rhythms. The worst case scenario from being shocked is death.

Exercise

Decide whether the following statements are true(T) or false(F) according to the text.

1) Electricity shocks us, because it is an outside force that interferes with our bodies' nervous systems.

2) Electricity comprises positive and negative charges, similar charges attract each other, and opposite charges repel each other.

3) We pay electric companies to reunite the positive and negative charges for us.

4) In order for the charges to reunite, a conductor, a channel that they can flow through, is needed.

5) Human body consists primarily of water, and act as a superb insulator for electrical energy, or voltage.

6) When we are shocked, there is something desirable occur.

Lesson Two

Part I Intensive Reading

Electric Field, Potential and Voltage

The concept of electric field was introduced by Michael Faraday. ① The electrical field force acts between two charges, in the same way that the gravitational field force acts between two masses. We know about acceleration of the earth, i. e. the gravity ($g = 9.8\ m/s^2$), but where does this number come from?

It comes from Newton's Law of Universal Gravitation. ② It states that every matter which has a mass attracts other matters with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between the centers of gravity of the two matters (see Fig. 2.1).

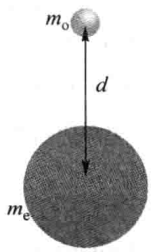

Fig. 2.1 Law of Universal Gravitation

$$F = G\frac{m_e m_o}{d^2}$$

where:

$G = 6.67 \times 10^{-11}\ N \cdot m^2/kg^2$ or $m^3/kg \cdot s^2$ (constant),

m_e is the mass of the earth (kg),

m_o is the mass of an object (kg), and

d is the distance between the earth and the object (m).

We already studied about gravitational force of an object on earth, which is $F = m \cdot g$, where "m" is mass of the object and "g" is the gravity acceleration of the earth. Then, we can say that $m_o \cdot g = G \cdot m_e \cdot m_o/d^2$. Therefore, gravity ($g$) of the earth is $G \cdot m_e/d^2$, where "m_e" is the mass of the earth and "d" is its radius (we are talking about gravitational force on the surface of the earth).

$$g = \frac{(6.67 \times 10^{-11}\ m^3/kg \cdot s^2) \times 5.98 \times 10^{24}\ kg}{(6.38 \times 10^6\ m)^2} = 9.80\ m/s^2$$

The electric field (E) is derived in the same way from the equation (see Fig. 2.2)

$$F = K\frac{Q \cdot q}{d^2}$$

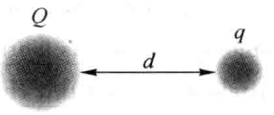

Fig. 2.2 The electric force

where:

$K = 9.0 \times 10^9\ N \cdot m^2/C^2$ (constant),