职业技术教育教学用书

制冷与空调专业英语

（制冷和空调设备运用与维修专业）

主编　寿明道

air-condition

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主编　寿明道

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内容提要

本书是根据高职高专制冷与空调专业专业英语教学方案的基本要求编写的。全书共设制冷基础、压缩系统与压缩机、自动控制与应用、家用冰箱与商业系统、空调系统5个单元，共计18篇课文。本教材着重介绍设备与系统、操作、安装及维护中出现的专业俗语、术语、缩略语、简称和专业名称，以及上述专业用语的含义。本教材中选用了较多的设备外型和内部结构插图，便于学生建立较直观的概念。

本教材注重英语语言教学、专业内容教学两方面。教材中出现的英语语法现象及词汇与学生的英语基础相衔接，并针对课文中出现的常见句型、短语，论述其理解、翻译与处理方法。专业内容则根据专业特征，较完整地论述了专业教学中的主要的、实用方面的内容。此外，从深化专业教学内容、扩大知识面的目的出发，教材中编入了英美国家最新的专业标准与现行规范、操作规程，使学生在毕业或培训后可较快地应对实际工作中的问题。

本教材适用于高职高专院校、中等职业学校制冷与空调专业学生使用，同时可供本专业的各类公司培训使用，对本专业的工程技术人员也有较大的参考价值。

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前　言

随着国民经济的快速增长和人民生活水平的不断提高，制冷与空调技术应用的普及，相关的专业资料，特别是英语专业文献日益增多，开设本专业的专业英语课程已成为各类院校的共识。制冷与空调专业英语的教学以培养学生专业英语的阅读能力、熟悉和掌握本专业的专业词汇和专业术语为主要目标，同时加强基础知识，深化专业内容，扩大知识面，提高专业英语的阅读能力和翻译能力。

本教材适用于高职高专院校、中等职业学校制冷与空调专业学生使用，同时可供本专业的各类公司培训使用，对本专业的工程技术人员也有较大的参考价值。

本教材共分5个单元，计18篇课文，19篇阅读材料。

本教材的参考学时为40～80学时。

编写过程中，本教材力求体现以下特色：

1. 反映现代制冷与空调专业中的最新成果。课文及阅读材料均选自近年来英、美等国出版的文献资料以及本专业国际著名公司的技术培训资料。

2. 理论联系实际。本教材着重介绍设备与系统、安装与操作及维护中出现的专业俗语、术语、缩略语、简称和专业名称，以及上述专业用语的含义。本教材中选用了较多的设备外型和内部结构插图，使学生建立较直观的概念，由表及里，既便于课堂教学内容的理解，又便于由外观辨认、实际工作中应用。

3. 本教材注重英语语言教学、专业内容教学的两个方面，避免专业英语教材中科普化、泛泛而谈的教学内容。在课文与阅读材料的选编过程中，编者对其中涉及的英语语法现象以科技英语中常见的、与学生的英语基础相一致为取舍原则。对专业内容的取舍则以专业课程的教学大纲为参照。从专业内容来说，本书也是一本教学内容较完整的专业教材，可使学生了解国外相关的专业理论与实践，了解英、美国家文献资料中论述的专业标准与现行规范、操作规程，学生在毕业或培训后可较快地应对实际工作中的问题。

4. 避免较大篇幅论述翻译的基本理论与方法，而是有意识地针对专业英语中常见句型、短语及其翻译方法，在课文注释中选择课文中出现的例句做出解释，并论述其翻译、处理方法。为便于学生对原文的理解，教材中的例句和参考译文多采用相对直译的方式。

本书由上海商学院寿明道主编，黄振华、付华芬、朱乃进参编。编写过程中，得到了美国特灵(Trane)公司滕毅博士、美国约克(York)国际(北亚)有限公司戴益先生、美国开利(Carrier)空调(上海)有限公司、美国麦克维尔(McQuay)空调(上海)有限公司的大力支持与帮助，得到了上海商学院副院长、教授、同济大学博士生导师冯伟国博士的指导和帮助。初稿完成后，承冯伟国教

授在百忙之中审阅了全部书稿。在此一并表示诚挚的谢意。

由于编者水平有限，书中难免有疏漏和谬误之处，恳请读者批评指正。

编 者

2004 年 10 月

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Unit 1

Fundamentals of Refrigeration

By studying this unit, you will be able to:

1. Describe the early development of refrigeration and its main applications.
2. Discuss the basic physical, and engineering principles that apply to refrigeration.
3. Compare Fahrenheit, Celsius, Kelvin, and Rankine temperature scales.
4. Use temperature conversion formulas to convert from one temperature scale to another.
5. Discuss the differences between sensible heat and latent heat.
6. Describe the basic operation of a refrigerator.

Text 1*: *History of Refrigeration and Air Conditioning

Supplementary Reading: ***Refrigeration***

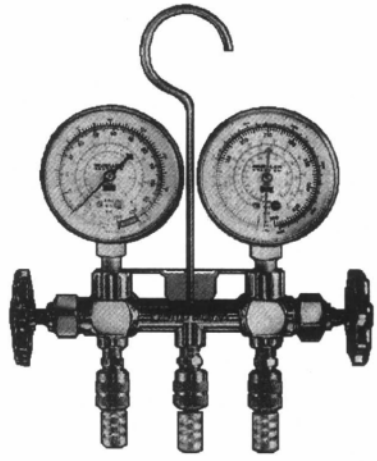
Text 2*: *Heat and Temperature

Supplementary Reading (1): ***Heat Transfer***

Supplementary Reading (2): ***Sensible Heat, Latent Heat and Specific Heat***

Text 3*: *Pressure

Supplementary Reading: ***Pressure and Temperature Relationship***



Text 1

History of Refrigeration and Air Conditioning

Most evidence indicates that the Chinese were the first to store natural ice and snow to cool wine and other delicacies. Evidence has been found that ice cellars were used as early as 1000 B. C. in China. [1] Early Greeks and Romans also used underground pits to store ice, which they covered with straw, weeds, and other materials to provide insulation and preserve it over a long period.

In the 18th and 19th centuries, natural ice was cut from lakes and ponds in the winter in northern climates and stored underground for use in the warmer months. Some of this ice was packed in sawdust and transported to southern states to be used for preserving food. In the early 20th century, it was still common in the northern states for ice to be cut from ponds and then stored in open icehouses. This ice was insulated with sawdust and delivered to home and businesses.

In 1902, Willis Carrier, the "Father of air Conditioning", designed a humidity control to accompany a new air-cooling system. He pioneered modern air conditioning. In 1915, he, along with other engineers, founded Carrier Engineering, now known as Carrier Corporation.

Mechanical domestic refrigeration first appeared about 1910. J. Larsen produced a manually operated household machine in 1913. By 1918 Kelvinator produced the first automatic refrigerator for the American market. Beginning with 1920, domestic refrigeration became an important industry. The Electrolux, which was an automatic domestic absorption unit, appeared in 1927.

By 1940, practically all domestic units were of the hermetic type. Commercial units had also been successfully made and used. These units were capable of refrigerating large commercial food storage systems. They could provide comfort cooling of large auditoriums. They could also produce low temperatures used in many commercial operations.

Starting in the 1960s, the home air conditioning market experienced tremendous growth. Energy was inexpensive, and therefore, simple air conditioning became common in many homes. Solar energy and other alternative energy sources became additional sources for powering heating and cooling systems.

Due to a tremendous growth in technology, by 1990 all areas of refrigeration and air conditioning were using microprocessor control systems. The purpose of these systems is to increase reliability and efficiency of the heating and cooling units. By 1990, the automobile air conditioner became as standard as the automatic transmission. [2]

In 1974, two professors from the University of California, Sherwood Rowland and Mario

Molina, presented the "ozone theory". This hypotheses states that released CFC refrigerants were depleting the earth's protective ozone layer. Scientists conducted high-altitude studies and concluded that CFCs were linked to ozone depletion.

Representatives from the United States, Canada, and more than 30 other countries met in Montreal, Canada, in September, 1987 to try to solve the problems of released refrigerants and the effect they had on ozone depletion. This meeting was known as the Montreal Protocol. This Protocol was ratified by 100 nations in 1989 and mandated a global production freeze on CFCs that froze their production levels back to 1986 levels.

New Words and Expressions

1. cellar	['selə]	*n.*	地窖，地下室，酒窖
2. insulation	[ˌinsju'leiʃən]	*n.*	绝缘，绝热，保温，隔热(层)
3. conditioning	[kən'diʃəniŋ]	*n.*	调节，整理，改善，调节作用
4. humidity	[hju:'miditi]	*n.*	湿气，潮湿，湿度，含湿量
5. mechanical	[mi'kænikl]	*adj.*	机械的，机械制的
6. domestic	[də'mestik]	*adj.*	家庭的，家用的，国内的
7. refrigeration	[riˌfridʒə'reiʃən]	*n.*	冷藏，致冷，冷却，制冷，冷冻
8. manually	['mænjuəli]	*adv.*	用手，人工地，手动
9. automatic	[ˌɔ:tə'mætik]	*adj.*	自动的，自动化的
10. refrigerator	[ri'fridʒəreitə]	*n.*	电冰箱，冷藏库，制冷器
11. absorption	[əb'sɔ:pʃən]	*n.*	吸收
12. hermetic	[hə:'metik]	*adj.*	密封的，封闭的
13. heating	['hi:tiŋ]	*n.*	加热，供热
14. technology	[tek'nɔlədʒi]	*n.*	工艺，科技，技术
15. reliability	[riˌlaiə'biliti]	*n.*	可靠性
16. efficiency	[i'fiʃənsi]	*n.*	效率，功效
17. standard	['stændəd]	*n.*	标准，规格
		adj.	标准的，第一流的
18. ozone	['əuzəun, əu'z-]	*n.*	臭氧，新鲜的空气
19. refrigerant	[ri'fridʒərənt]	*n.*	制冷剂
20. deplete	[di'pli:t]	*vt.*	耗尽，使衰竭
21. depletion	[di'pli:ʃən]	*n.*	损耗
22. freeze	[fri:z]	*v.*	(使)结冰，(使)冷冻，冻结

Phrases and Expressions

1. along with...	与…一起	2. be known as...	被称为，以…著称
3. begin with...	从…开始，从…着手	4. be capable of...	能…的，可以…的
5. start in...	开始于，着手	6. due to...	因为，由于，归因于

Technical Terms

1. ***Air conditioning***：空气调节(概念、方法、技术与设备)，指对特定区域内空气的温度、湿度、空气流动和清洁度的控制。
2. ***Humidity***：湿度，水分含量，含湿量
3. ***Automatic refrigerator***：自动化冰箱，指具有自动温度控制的冰箱，与文中的 manually operated household machine(人工操作的家用冰箱)相对应。
4. ***Absorption unit***：吸收式制冷机组，它是一种利用氨或水作蒸气，用水或溴化锂作吸收剂，并用火焰、水蒸气等加热器加热液体而获得制冷效应的一种制冷设备，与文中 Mechanical refrigeration unit(机械压缩式制冷机组)相对应，二者同为制冷与空调技术中主要制冷方式。Domestic absorption unit 家用吸收式机组
5. ***Hermetic type***：封闭式，密闭型(机组，压缩机)
6. ***Comfort cooling***：舒适性供冷，指仅对生活和工作区域在夏季作降温处理，由于不提供供热、增湿、降湿和空气循环，因此，Comfort cooling 不是一种完整的空调。
7. ***Low temperature***：低温，文中"低温"并无具体温度范围。对于食品冷冻冷藏来说，0℃以下即为低温。
8. ***Microprocessor control systems***：微处理器控制系统，指由集成电路组成的、能够处理信息、可以存储、并能控制输出设备的电器元件。
9. ***Heating and cooling units***：供热与制冷机组
10. ***CFC refrigerants***：氟氯化碳制冷剂，由氯、氟原子和碳氢化合物组成的一种制冷剂，俗称氟里昂，除用于制冷系统作制冷剂外，生产过程中还常用作发泡剂。

Notes to the Text

[1] 句型应为：Evidence that ice cellars were used as early as 1000 B. C. in China has been found. that 引导的定语从句修饰主语 Evidence，当主语和修饰主语的从句较长、动词之后的句子成分较短时，往往采用文中的句型。

[2] The automobile air conditioner became as standard as the automatic transmission. 为便于理解，此句可改写为：The automobile air conditioner became a standard component as the automatic transmission. 汽车空调如同自动变速器一样已成为汽车的标准配置。

Supplementary Reading

Refrigeration

Refrigeration is the process of removing heat from a place where it is not wanted and

transferring that heat to a place where it makes little or no difference.[1] The term refrigeration is used here to include both the cooling process to preserve food and comfort cooling (air conditioning).

Preserving food is one of the most valuable uses of refrigeration. Food spoilage slows down as molecular motion slows. This retards the growth of bacteria that causes food to spoil. Below the frozen hard point, food-spoiling bacteria stop growing. The frozen hard point for most foods is considered to be 0°F (- 18℃). The food temperature range between 35°F (2℃) and 45°F (7℃) is known in the industry as medium temperature; below 0°F is considered low temperature. These ranges are used to describe many types of refrigeration equipment and applications.

For many years dairy products and other perishables were stored in the coldest room in the house, the basement, well, or a spring. In the South, temperatures as low as 55°F (13℃) could be reached in the summer with underground water.[2] This would add to the time that some foods could be kept. Ice in the North and to some extent in the South was placed in "ice boxes" in kitchens. The ice melted when it absorbed heat from the food in the box, cooling the food.

In the early 1900s, ice was manufactured by mechanical refrigeration and sold to people with ice boxes, but still only the wealthy could afford it.[3]

Also in the early 1900s, some companies manufactured the household refrigerator. Like all new items, it took a while to become popular. Now, most houses have a refrigerator with a freezing compartment.[4]

Frozen food was just beginning to become popular about the time World War Ⅱ began. Because most people did not have a freezer at this time, central frozen food locker plants were established so that a family could have its own locker. Food that is frozen fresh is appealing because it stays fresh. Refrigerated foods, both medium temperature and low temperature, are so common now that most people take them for granted.[5]

The refrigeration process is now used in the comfort cooling of the home and business and in the air conditioning of automobiles. The air conditioning application of refrigeration is known in this industry as high-temperature refrigeration.

In the average household, the room temperature from summer to winter is normally between 70°F (21℃) and 90°F (32℃). The temperature inside the refrigerator fresh food section should be about 35°F (2℃). Heat flows naturally from a warm level to a cold level. Therefore, heat in the room is trying to flow into the refrigerator, and it does through the insulated walls, the door when it is opened, and warm food placed in the refrigerator.

New Words and Expressions

1. process [prə'ses] *n.* 过程，方法，程序，步骤，进行

2. remove	[ri'mu:v]	*vt.*	移动，开除，移交
3. transfer	[træns'fə:]	*vt. vi.*	迁移，移动，传递，转移
4. term	[tə:m]	*n.*	术语，学期，期间，条款，条件
5. spoilage	['spɔilidʒ]	*n.*	损坏
6. molecular	[məu'lekjulə]	*adj.*	分子的，由分子组成的
7. retard	[ri'tɑ:d]	*vt.*	延迟，使减速，阻止，妨碍，阻碍
8. bacteria	[bæk'tiəriə]	*n.*	细菌
9. spoil	[spɔil]	*vt.*	损坏，搞糟
10. frozen	['frəuzn]	*adj.*	冻结的，冷冰的，freeze 的过去分词
11. medium	['mi:djəm]	*adj.*	中间的，中等的
12. perishable	['periʃəbl]	*adj.*	容易腐烂的
13. basement	['beismənt]	*n.*	地下室，墙脚
14. spring	[spriŋ]	*n.*	春天，泉，弹簧，发条，弹性，弹力
15. melt	[melt]	*v.*	(使)融化，(使)熔化，使软化
16. absorb	[əb'sɔ:b]	*vt.*	吸收，吸引
17. manufacture	[ˌmænju'fæktʃə]	*vt.*	制造，加工，生产
18. establish	[is'tæbliʃ]	*vt.*	建立，设立，安置，确定

Phrases and Expressions

1. transfer...to... 将…传递到…
2. make little or no difference 几乎没有或完全没有关系，无关紧要
3. to some extent 某种程度上，有些，有点
4. take...for granted 认为…理所当然(不成问题，必然的)

Technical Terms

1. ***Frozen hard point***：冻硬温度，指食品中所含水分已形成固体时的初始温度。
2. ***Food-spoiling bacteria***：食品致腐性细菌，主要有细菌、酵母和霉菌。
3. ***Medium temperature***：中等温度，中温，指 35℉(2℃)至 45℉(7℃)温度区间内的冷藏温度。
4. ***Dairy products***：乳制品
5. ***Perishables***：鲜活类食品，指水果、蔬菜和水产品。

Notes to the Text

[1] a place where it makes little or no difference. 几乎或完全无关紧要的地方，几乎或完全不产生影响的地方。

[2] 在夏季，利用地下水可以获得低至 55℉(13℃)的温度。

[3] In the early 1900s, ... but still only the wealthy could afford it. 20 世纪初，… 但仍仅仅是有钱人能够消费。

[4] Now, most houses have a refrigerator with a freezing compartment. 句中 a refrigerator with a freezing compartment 译为:带有冷冻室的冰箱。

[5] Refrigerated foods are so common now that most people take them for granted. 句中 so ... that 引导结果从句,全句译为:冷藏食品如此普遍,以致大多数人都以为是理所当然的了。

Text 2

Heat and Temperature

The laws of thermodynamics can help us to understand what heat is all about.[1] One of these laws states that energy can neither be created nor destroyed, but can be converted from one form to another. This means that most of the heat the world experiences is not being continuously created but is being converted from other forms of energy like fossil fuels (gas and oil).[2] This heat can also be accounted for when it is transferred from one substance to another.

The term used to describe the quantity of heat or heat content is known as the *British thermal unit* (Btu). This term explains how much heat is contained in a substance. The Btu is defined as the amount of heat required to raise the temperature of 1 lb of water 1°F. For example, When 1 lb of water is heated from 68°F to 69°F, 1 Btu of heat energy is absorbed into the water.

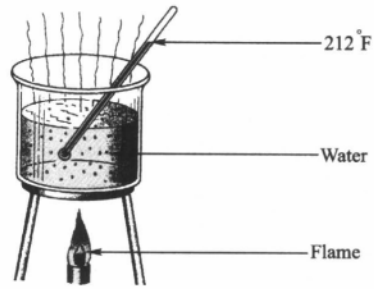


Figure 1-1. *When the water reaches 212 °F, boiling will occur.*

In the metric or SI system of measurement, the term joule (J) is used to express the quantity of heat. Because a joule is very small, metric units of heat in this industry are usually expressed in kilojoules (kJ) or 1 000 joules. One Btu equals 1.055 kJ.

Temperature can be thought of as a description of the level of heat. Temperature also is referred to as heat intensity. Both heat level and heat intensity should never be confused with the amount of heat, or heat content. Heat can be thought of as energy in the form of molecules in motion. The starting point of temperature is, therefore, the starting point of molecular motion.

Most people know that the freezing point of water is 32 degrees Fahrenheit [32°F(0℃)] and that the boiling point is 212 degrees Fahrenheit [212°F(100℃)], Figure 1-1. The points are commonly indicated on a thermometer, which is an instrument that measures temperature.

Early thermometers were of glass-stem types and operated on the theory that when the substance in the bulb was heated it would expand and rise in the tube,[3] Figure 1-2. Mercury

and alcohol are still commonly used today for this application.

We must qualify the statement that water boils at 212℉ (100℃). Pure water boils at 212℉ when standard atmospheric conditions exist. Standard conditions are sea level, the barometer reading 29.92″Hg (14.696 psia), and the air temperature is 59℉(15℃).

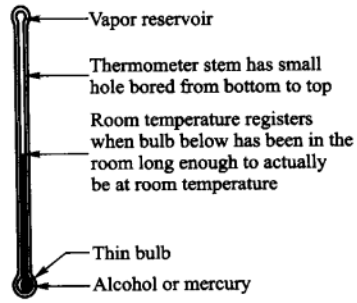


Figure 1-2. *Glass stem thermometer.*

Pure water has a freezing point of 32℉(0℃). Obviously the temperature can go lower than 32℉(0℃), but the question is, how much lower? The theory is that molecular motion stops at −460℉(−273℃). This is theoretical because molecular motion has never been totally stopped. The complete stopping of molecular motion is expressed as absolute zero. This has been calculated to be −460℉(−273℃). Scientists have actually come within a few degrees of causing substances to reach absolute zero.

The Fahrenheit scale of temperature is used in the English measurement system by a few countries in the world that uses this system. The Celsius scale of temperature measurement is used in the Systems International systems (SI) or metric system used by most other countries.

Equipment is rated to establish criteria for comparing equipment performance.[4] Performance ratings of equipment are established using *absolute* temperature. The Fahrenheit absolute scale is called the Rankine scale, and the Celsius absolute scale is known as the Kelvin scale. Absolute temperature scales begin where molecular motion stars; they use 0 as the starting point. For instance, 0 on the Fahrenheit absolute scale is called absolute zero or 0° Rankine (0R). Similarly, 0 on the Celsius absolute scale is called absolute zero or 0 Kelvin (0K).

You may find it necessary to convert specific temperatures from Fahrenheit t_F to Celsius t_C or from Celsius t_C to Fahrenheit t_F. We can use the formulas:

$t_C = (t_F - 32°) / 1.8$ or $t_F = (1.8 \times t_C) + 32°$

To convert a room temperature of 75℉ to degrees ℃:

$t_C = (75 - 32°) / 1.8 = 23.9$℃ so we have: 75℉ = 23.9℃

New Words and Expressions

1. law	[lɔ:]	*n.*	定律,定理,规律,法律
2. thermodynamics	[ˈθə:məudaiˈnæmiks]	*n.*	热力学
3. thermal	[ˈθə:məl]	*adj.*	热的，热量的
4. Fahrenheit	[ˈfærənhait, ˈfɑ:r-]	*adj.*	华氏温度计的
5. thermometer	[θəˈmɒmɪtə(r)]	*n.*	温度计，体温计
6. instrument	[ˈinstrumənt]	*n.*	仪器,工具，器械，器具
7. theory	[ˈθiəri]	*n.*	理论，学说,原理
8. expand	[iksˈpænd]	*vt. vi.*	使膨胀，详述，扩张

9. mercury	['mə:kjuri]	*n.*	水银，汞
10. alcohol	['ælkəhɔl]	*n.*	酒精，酒
11. qualify	['kwɔlifai]	*vt.*	限制，限定
12. atmospheric	[ˌætməs'ferik]	*adj.*	大气的
13. barometer	[bə'rɔmitə]	*n.*	气压计
14. reading	['ri:diŋ]	*n.*	读数，阅读，知识，读物
15. theoretical	[θiə'retikəl]	*adj.*	理论的
16. absolute	['æbsəlu:t]	*adj.*	完全的，绝对的
17. scale	[skeil]	*n.*	刻度，比例，数值范围，比例尺
18. Celsius	['selsjəs]	*adj.*	摄氏的
19. criteria	[krai'tiəriə]	*n.*	标准，尺度，规范，基准
20. performance	[pə'fɔ:məns]	*n.*	性能，履行，执行，成绩

Phrases and Expressions

1. neither...nor...	既不…又(也)不…	2. convert...from...to...	将…从…转变为…
3. account for...	说明，解释，引起	4. be defined as...	被定义为…
5. be thought of as...	被认为(作)是…	6. referred to as...	称为，被认为，指代为
7. confuse...with...	把…和…混淆	8. be expressed as...	表示为…

Technical Terms

1. ***Fossil fuel***：矿物燃料
2. ***Heat content***：热含量，含热量
3. ***British thermal unit (Btu)***：英国热量单位
4. ***lb***：= pound 磅
5. ***Metric or SI system***：米制或国际单位制，Systems International systems (SI) 国际单位制
6. ***Joule (J)***，***kilojoules (kJ)***：焦耳，千焦
7. ***Heat intensity***：热强度，描述热的程度，用温度计显示其程度。
8. ***Freezing point***：冰点
9. ***Boiling point***：沸点
10. ***Fahrenheit scale***：华氏温标
11. ***English measurement system***：英制
12. ***Celsius scale***：摄氏温标
13. ***Performance ratings of equipment***：设备的额定指标，设备的性能指标(参数)
14. ***Fahrenheit absolute scale***：华氏绝对温标
15. ***Rankine scale***：兰氏温标，又译为朗肯温标，朗氏温标，兰金温标。
16. ***Celsius absolute scale***：摄氏绝对温标
17. ***Kelvin scale***：开尔文温标，开氏温标
18. ***Absolute temperature scales***：绝对温标