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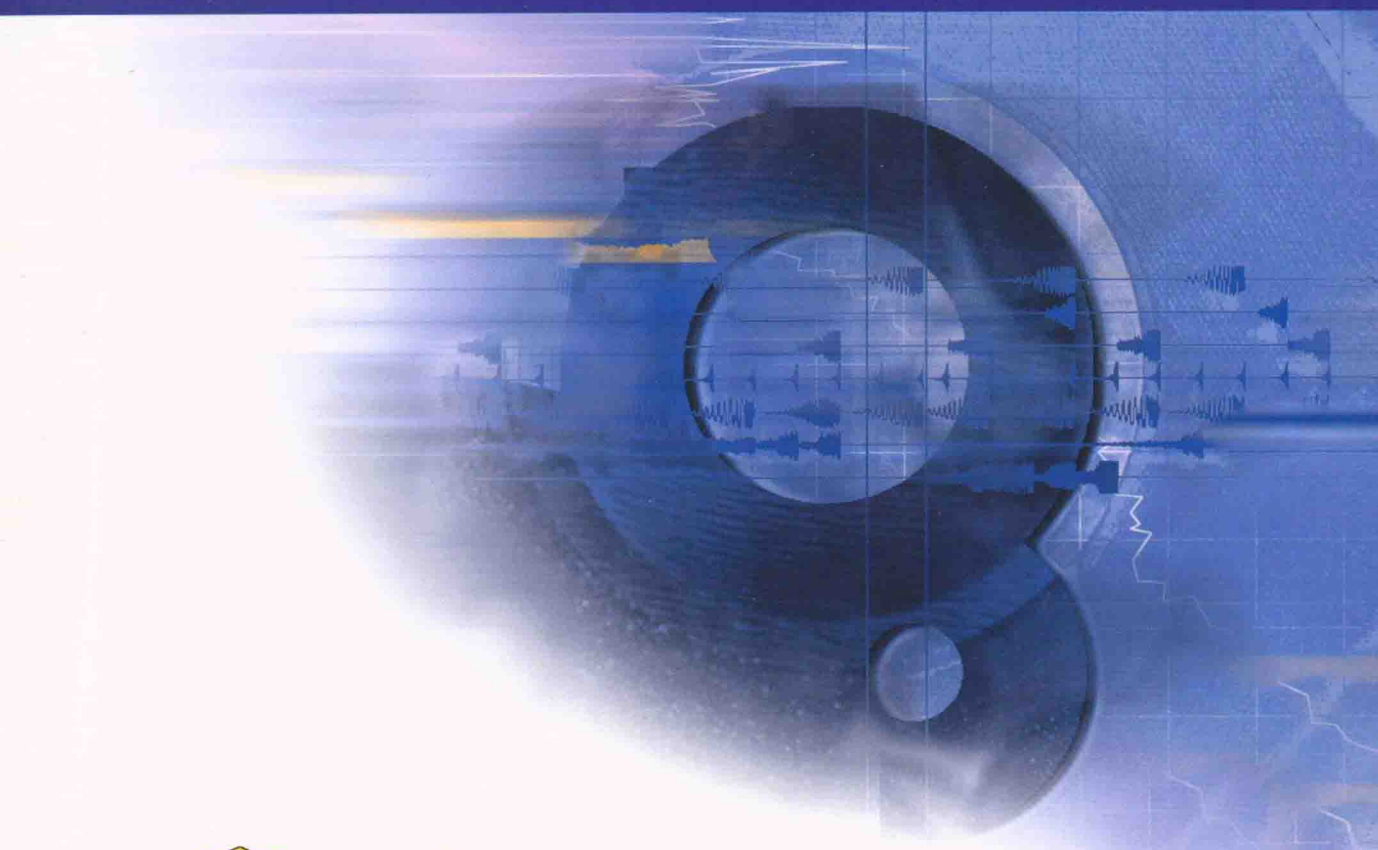

第2版

制冷与空调专业英语

林慧珠　主编

机械工业出版社
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普通高等教育“十一五”国家级规划教材
高职高专规划教材

制冷与空调专业英语

（第2版）

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本书是普通高等教育“十一五”国家级规划教材之一，也是高职高专制冷与空调专业规划教材之一。

本书介绍了制冷与空调专业相关的英语知识，分6个单元，共24课。附录部分收录了制冷与空调专业相关的专业术语。为了便于阅读对照，书后还附有参考译文。

本书可作为高等职业院校、高等工程专科院校以及成人高等院校制冷与空调专业的通用教材，也可供其他相关专业的学生和工程技术人员参考。

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前　言

当今时代，对培养高等技术应用型人才的院校而言，专业英语已成为学生重要的必修课程之一。专业英语课程的开设可以使学生了解和拓展所学专业的专业术语和相关知识，在基础英语的基础上提高专业英语应用水平。本书是普通高等教育“十一五”国家级规划教材之一，适用于制冷与空调专业的专业英语课程的教学，也可作为制冷与空调专业技术人员的参考用书。

本书是根据编者多年的教学经验，阅读参考了大量的外文资料，结合空调与制冷专业发展的特点编写而成的。本教材按40学时编写，全书分为6个单元，根据专业特点精选了24篇课文，内容涉及制冷与空调专业的专业基础课和专业课。为配合各院校开展的模块化、项目化、任务式和单元式等教学改革的需要，提高双语教学效果，在内容编排上由浅入深，循序渐进，实用性、针对性强。每课由一篇课文、单词和词组、课文注释、一篇阅读材料及练习组成。书后附有词汇总表、课文的参考译文、专业术语表等。

本书由南京化工职业技术学院张国东、扬州工业职业技术学院袁强、河北农业大学苗文艺、常州工程职业技术学院杜存臣和江苏工业学院林慧珠共同编写。林慧珠担任主编并统稿。

本书由南京工业大学陆晓峰博士主审。陆晓峰博士对本书提出了许多修改意见和建议，对提高本书的质量起到了重要的作用。常州工程职业技术学院张黎明副教授、南京化工职业技术学院孙见君教授、浙江树人大学魏恩宗副教授和江苏商业管理干部学院殷雷副教授等对教材的编写给予了大力支持，在此一并表示衷心的感谢。

由于编者水平有限，书中难免有错误和不妥之处，诚恳欢迎广大师生和读者批评指正。

本书配有电子教案，**凡使用本书作为教材的教师**可登录机械工业出版社教材服务网 www. cmpedu. com 下载。咨询邮箱：cmpgaozhi@ sina. com。咨询电话：010-88379375。

编　者

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Unit One

Lesson 1 Air

Air is a mixture, not a compound. It is essentially composed of nitrogen, oxygen, and argon with small amounts of water vapor, carbon dioxide, and dust. Air can be liquefied and separated into its constituents by letting the more volatile nitrogen to boil off first.

There is a definite temperature below which a gas must be cooled before it can be liquefied. [1] This is known as the critical temperature, and it is different for different gases. The critical temperatures of both oxygen and nitrogen are so low that it is impossible to liquefy these gases at ordinary temperatures however much we compress them. [2] To liquefy air we must cool it to a very low temperature as well as subject it to a high pressure. [3] Thus air is liquefied by the combined effect of pressure and low temperature. Liquid air is really only a mixture of liquid nitrogen and liquid oxygen. It is possible to separate the more volatile nitrogen from the oxygen. In this way, oxygen is manufactured for industrial use and is compressed into steel tanks. Nitrogen is also prepared by the same process.

Nitrogen is an inert substance. It is a colourless, odourless, tasteless gas; does not burn; does not support combustion or respiration; is not poisonous. It does not easily unite directly with other elements. [4] At high temperatures it combines with a few metals, such as magnesium, and also with oxygen and hydrogen. Oxygen is also a colourless, odourless gas. It is somewhat heavier than air. It is the most active element in the atmosphere. It is essential to life. Argon is present in air to the extent of nearly one percent by volume.

Carbon dioxide is introduced into the air by combustion and respiration. It is removed by green plants, which get all their carbon from the carbon dioxide in the air and produce oxygen. The balance of plant and animal life keeps the amounts of oxygen and carbon dioxide in the air constant. [5]

The chief factors in the air which affect human comforts are 1) moisture, 2) temperature, 3) dust, 4) small amounts of impurities given off by the human body. The human body is normally at a constant temperature 37℃, and this temperature is regulated by the evaporation of water from the surface of the body. The temperature and moisture of the surrounding atmosphere affect this process of evaporation. If the air is very hot and moist, this process of evaporation is very slow, and we feel uncomfortable. If the air is too dry, the evaporation from the body is too rapid, and we also feel uncomfortable. Thus it is very important to have a proper regulation of temperature and moisture.

The presence of dust in the air causes a great deal of discomfort to human body. Air in the country is far much cleaner than that in the cities. [6] After a rain, the air is also much cleaner than

at ordinary times.

New Words and Expressions

mixture [ˈmikstʃə] *n.* 混合，混合物，混合剂
compound [ˈkɔmpaund] *n.* 混合物，[化] 化合物
essentially [iˈsenʃəli] *adv.* 本质上，本来
essential [iˈsenʃəl] *adj.* 实质的，基本的，精华的；*n.* 本质，实质，要素，要点
nitrogen [ˈnaitrədʒən] *n.* [化] 氮
oxygen [ˈɔksidʒən] *n.* [化] 氧
argon [ˈɑːgɔn] *n.* [化] 氩
carbon dioxide 二氧化碳
volatile [ˈvɔlətail] *adj.* 挥发性的，可变的，不稳定的，轻快的，爆炸性的
critical temperature [物] 临界温度
compress [kəmˈpres] *vt.* 压缩，摘要叙述；*n.* （外科）敷布
manufacture [ˌmænjuˈfæktʃə] *vt.* 制造，加工；*n.* 制造，制造业，产品
prepare [priˈpɛə] *v.* 准备，预备，有能力而且愿意
process [prəˈses] *n.* 过程，作用，方法，程序，步骤；*vt.* 加工，处理
inert [iˈnəːt] *adj.* 无活动的，惰性的，迟钝的
combustion [kəmˈbʌstʃən] *n.* 燃烧
respiration [ˌrespiˈreiʃən] *n.* 呼吸，呼吸作用
poisonous [ˈpɔiznəs] *adj.* 有毒的
unite [juːˈnait] *v.* 联合，团结
magnesium [mægˈniːzjəm] *n.* （化）镁
hydrogen [ˈhaidrəudʒən] *n.* 氢
atmosphere [ˈætməsfiə] *n.* 大气，空气，气氛
introduce [ˌintrəˈdjuːs] *vt.* 介绍，传入，引进，提出
balance [ˈbæləns] *n.* 秤，天平，平衡；*v.* 平衡，权衡
constant [ˈkɔnstənt] *n.* [数、物] 常数，恒量；*adj.* 不变的，持续的
comfort [ˈkʌmfət] *n.* 安慰，舒适；*vt.* 安慰，使（痛苦等）缓和
uncomfortable [ʌnˈkʌmfətəbl] *adj.* 不舒服的，不安的，不合意的
discomfort [disˈkʌmfət] *n.* 不便之处，不适
impurity [imˈpjuəriti] *n.* 杂质，混杂物，不洁，不纯
regulate [ˈregjuleit] *vt.* 管制，控制，调节，校准
evaporation [iˌvæpəˈreiʃən] *n.* 蒸发（作用）
moist [mɔist] *adj.* 潮湿的；*n.* 潮湿

Notes to the Text

1. There is a definite temperature below which a gas must be cooled before it can be liquefied.

在这复合句中，主句是 There is a definite temperature；在这里，主语是 temperature，below which a gas must be cooled 是定语从句，修饰 temperature；关系代词 which 在意义上代替 temperature，起着连接两句的作用，又是定语从句中前置词 below 的宾语。before it can be liquefied 是定语从句中的状语从句，修饰 must be cooled。本句可翻译为“气体必须冷却到一定的温度以下才能液化”。

2. The critical temperatures of both oxygen and nitrogen are so low that it is impossible to liquefy these gases at ordinary temperatures however much we compress them.

在这复合句中，主句是 The critical temperatures of both oxygen and nitrogen are so low；其中主语是 temperatures，critical 及 of both oxygen and nitrogen 修饰 temperature。that it is impossible to liquefy these gases at ordinary temperatures 是结果状语从句；it 是先行主语，真正的主语为 to liquefy，at ordinary temperatures 是修饰 to liquefy 的状语。however much we compress them 是让步状语从句，修饰 impossible to liquefy。本句翻译为：氧和氮的临界温度很低，所以无论怎样压缩都不可能使它们在常温下液化。

3. To liquefy air we must cool it to a very low temperature as well as subject it to a high pressure.

这复合句的主句是 we must cool it to a very low temperature。To liquefy air 是用作目的状语的不定式短语。as well as 是连接词，连接状语从句 subject it to a high pressure，从句省略主语“We”。

4. It does not easily unite directly with other elements.

句中 unite：“使合成一体；联合；结［接］合”“使混合；使粘合，使结婚”。在句中，解释为“化合”。例如：

Unite bricks and stones with cement. 用水泥将砖和石块粘合在一起。

Unite two families by marriage. 两家联姻。

Working men of all countries, unite! 全世界无产者，联合起来！

Oil and water will not unite. 油和水不相融。

5. The balance of plant and animal life keeps the amounts of oxygen and carbon dioxide in the air constant.

植物和动物生活的平衡使空气中氧和二氧化碳的含量维持恒定。在本句中，The balance 是主语；keeps 是谓语；amounts 是宾语；of oxygen and carbon dioxide 和 in the air 都是修饰用的定语；constant 是宾语补足语。

6. Air in the country is far much cleaner than that in the cities.

cleaner 是形容词的比较级，其前面的 far much 是程度副词，用于修饰 cleaner。

Reading Material

Residential and Commercial Air Conditioning Requirements

Under warm, humid conditions, heat and moisture enter buildings from the environment. In most areas of the country, air conditioning is needed to remove the energy and water vapor and

maintain comfort in the interior space. Air conditioning currently accounts for about 8 percent of the energy used in the residential and commercial sectors, and this usage will increase since air conditioning is becoming widely accepted in both commercial buildings and residences. Virtually all air conditioners are electrically driven, which affects the electrical generation requirements of utilities. The electrical consumption due to air conditioning is large, and, for most utilities, the peak electrical loads occur in summer. The electrical generating system must be able to meet the maximum load imposed on it. Air conditioning usage is thus a major factor in determining both the installed capacity of the power plant and its total electrical output.

The energy used for air conditioning depends on the climate, the interior conditions, and the building structure. Historically, the interest has been in sizing of equipment, and the ASHRAE guides present detailed methods for evaluating peak loads. These calculations have been extended to estimate annual consumption. The maximum cooling loads are based on design wet and dry bulb temperatures for each location. These are the 1 percent values, which means that the environmental conditions are exceeded only 1 percent of the time. Of 30 hours during the summer the room conditions are between 73 to 78°F and 30 to 70 percent relative humidity. Recent government legislation has attempted to set 80°F as a design room temperature for air conditioning, but it appears that 78°F is a more realistic, and acceptable, upper temperature.

The seasonal energy requirements depend on the heat and moisture flows into the building. These are basically the same as for heating, and are shown in Fig. 1-1. The solar gain and the internal heat and moisture generation become major contributions in the cooling load. The total

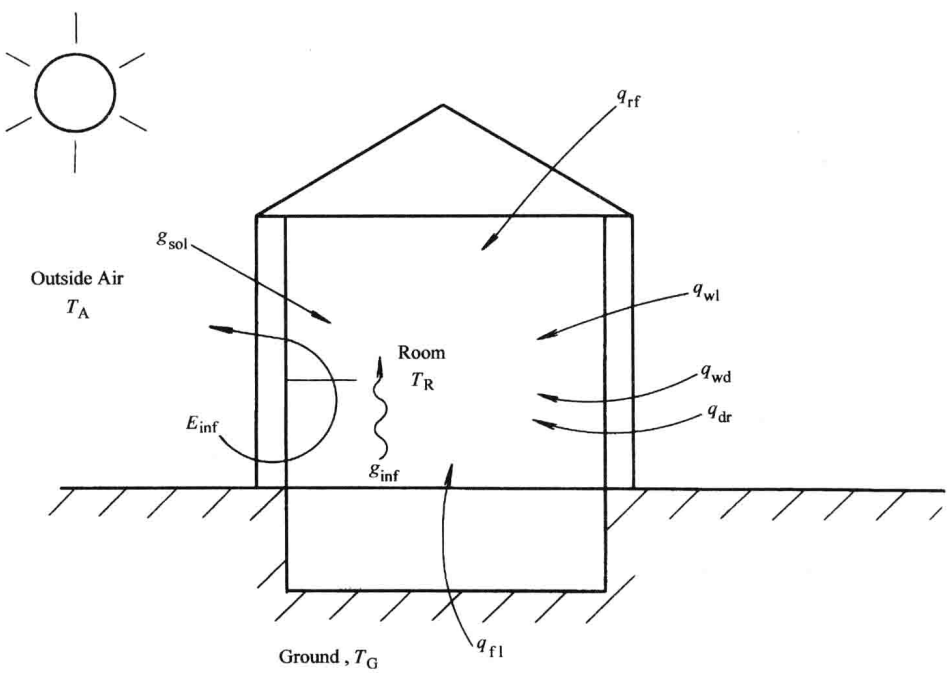

Fig. 1-1 Schematic of Heat Gains in a Building

energy gain is determined from an energy balance on the building as

$$E_{gain} = q_{wl} + q_{rf} + q_{fl} + q_{wd} + q_{dr} + E_{inf} + g_{int} + g_{sol}$$

Exercises

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

1. Air conditioning is needed to remove the energy and water vapor and maintain comfort in the interior space in most areas of the country. ( )

2. Air conditioning will account for about 8 percent of the energy used in the residential and commercial sectors since it is becoming widely accepted in both commercial buildings and residences. ( )

3. Air conditioning usage is thus a first factor in determining both the installed capacity of the power plant and its total electrical output. ( )

4. Historically, the interest has been in sizing of equipment, and the ASHRAE guides present detailed methods for evaluating bottom loads. ( )

5. The seasonal energy requirements have no relationship with the heat and moisture flows into the building. ( )

Lesson 2 The Need of Air Conditioning

Human beings are born into a hostile environment, but the degree of hostility varies with the season of the year and with the geographical locality. This suggests that the arguments for air conditioning might be based solely on climatic considerations, but although these may be valid in tropical and subtropical areas, they are not for temperate climates with industrialized social structures and rising standards of living.

Briefly, air conditioning is necessary for the following reasons. Heat gains from sunlight and electric lighting, in particular, may cause unpleasantly high temperatures in rooms, unless windows are opened. If windows are opened, then even moderate wind speeds cause excessive draughts, becoming worse on the upper floors of tall buildings. Further, if windows are opened, noise and dirt enter, and are objectionable, becoming worse on the lower floors of buildings, particularly in urban districts and industrial areas. In any case, the relief provided by natural airflow through open windows is only effective for a depth of about 6 metres inward from the glazing. It follows that the inner areas of deep buildings will not really benefit at all from opened windows. Coupled with the need for high intensity continuous electric lighting in these core areas, the lack of adequate ventilation means a good deal of discomfort for the occupants. [1] Mechanical ventilation without refrigeration is only a partial solution. It is true that it provides a controlled and uniform means of air distribution, in place of the unsatisfactory results obtained with opened windows (the vagaries of wind, again particularly with tall buildings, produce discontinuous natural ventilation), it will prevail only during winter months. For much of the spring and autumn, as well as the summer, the internal room temperature will be several degrees higher than that outside, and it will be necessary to open windows in order to augment the mechanical ventilation. [2]

The design specification for a comfort conditioning system is intended to be the framework for providing a comfortable environment for human beings throughout the year, in the presence of sensible heat gains in summer and sensible heat losses in winter. Dehumidification would be achieved in summer but the relative humidity in the conditioned space would be allowed to diminish as winter approached. There are two reasons why this is acceptable first, [3] human beings are comfortable within a fairly large range of humidity, from about 60 per cent to about 20 percent and, secondly the use of single glazing will cause the inner surfaces of windows to stream with condensed moisture if it is attempted to maintain too high a humidity in winter.

The essential feature of comfort conditioning is that it aims to produce an environment which is comfortable to the majority of the occupants. The ultimate in comfort can never be achieved, but the use of individual automatic control for individual rooms.

New Words and Expressions

hostile [ˈhɔstail] *adj.* 敌对的，敌方的
hostility [hɔsˈtiliti] *n.* 敌意，恶意，不友善，敌对，对抗，反对
solely [ˈsəulli] *adv.* 独自地，单独地
valid [ˈvælid] *adj.* [律] 有效的，有根据的，正当的，正确的
tropical [ˈtrɔpikəl] *adj.* 热带的，热情的
subtropical [ˈsʌbˈtrɔpikəl] *adj.* 亚热带的
moderate [ˈmɔdərit] *adj.* 中等的，适度的，适中的
draught [drɑ:ft] *n.* 拖，拉，一网（鱼），气流
glaze [gleiz] *v.* 装玻璃，上釉，使表面光滑
intensity [inˈtensiti] *n.* 强烈，剧烈，强度
ventilation [ˌventiˈleiʃən] *n.* 通风，流通空气
uniform [ˈju:nifɔ:m] *adj.* 统一的，相同的，均衡的
distribution [ˌdistriˈbju:ʃən] *n.* 分配，分发
vagary [ˈveigəri] *n.* 狂妄古怪（反复无常）的行为，狂想，变幻莫测
dehumidification [ˈdi:hju:ˌmidifiˈkeiʃən] *n.* 除去湿气
condense [kənˈdens] *v.* （使）浓缩，精简
moisture [ˈmɔistʃə] *n.* 潮湿，湿气
ultimate [ˈʌltimit] *n.* （前面与 the 连用）最终的事物，最终
individual [ˌindiˈvidjuəl] *n.* 个人，个体；*adj.* 个别的，单独的，个人的
automatic [ˌɔ:təˈmætik] *n.* 自动机械；*adj.* 自动的，无意识的，机械的

Notes to the Text

1. Coupled with the need for high intensity continuous electric lighting in these core areas, the lack of adequate ventilation means a good deal of discomfort for the occupants.

句中 coupled with 意为“加上，外加”。

例如：Her name was coupled with his. 她的名字与他的名字连在一起。

…a good deal of discomfort for the occupants. 其中 for 是用来指一个活动的接受者或受益者，又如：prepared lunch for us. 为我们准备午餐。

2. For much of the spring and autumn, as well as the summer, the internal room temperature will be several degrees higher than that outside, and it will be necessary to open windows in order to augment the mechanical ventilation.

句中 as well as 与 in addition to 意相近。其意为“除……之外，还，和，及（强调的是前面的部分）”。例如：I'm learning French as wall as English. 我学英语之外还学法语。

it will be necessary to open windows…本句属于“It + 谓语 + 动词不定式”这种句型。It 作形式主语，to open windows 是动词不定式作真正的主语。当动词不定式、动名词短语或从句在句中起主语作用，而这一部分用词较多时，可用 it 作为形式主语，放在句首代表其后所说的事实上的、真正的主语，而把真正的主语放在后面。如：It is difficult to climb

a mountain. 爬山是很艰难的。

3. There are two reasons why this is acceptable first.

why this is acceptable first 是由 why 引导的定语从句，why 在定语从句中作原因状语。如：We don't know the reason why they didn't complete their production plan according to schedule. 我们不知道他们为什么没按时完成生产计划。

Reading Material

Separation of Air

This passage describes how it is possible to separate the gases in the air. Some of the properties of these gases are also mentioned.

The important uses of gases, obtained from the air, have been found.

Oxygen and nitrogen can be made from other materials, but they are usually obtained from the air because air is so plentiful. Some of the other gases, such as argon, can only be obtained from the air. There is so little carbon dioxide in the air that it is better to obtain it in other ways. The problem, of course, is to find a quick and useful way of separating the gases in the air.

At very low temperature air can be made into a liquid. If the liquid is heated, it "boils" and turns back into a gas. Now oxygen does not boil away from liquid air so easily as nitrogen. By careful arrangement of the boiling, it is possible to make the nitrogen turn back into a gas and leave the liquid oxygen behind. The oxygen can be turned into a gas later. In this way the oxygen and nitrogen are separated. The other gases, such as argon, can also be obtained separately by very careful arrangement of the boiling.

Oxygen is necessary for the breathing of animals and plants, and for burning. Only one-fifth of air consists of oxygen, but this is quite enough for all ordinary purposes. Pure oxygen is used for special kinds of breathing and burning.

Sometimes an explosion takes place in a mine where men are digging for coal. The men may be hurt by the explosion, and fallen rocks may stop them from getting out. Further, much of the oxygen in the air may have been used up by the explosion. Men who go down the mine to rescue them therefore take containers of compressed oxygen. The containers are usually carried on their shoulders.

Air contains enough oxygen for the burning of a fire in a house or in a railway engine. Pure oxygen would cause the wood or coal to burn so fast that it would be wasted. When a very hot flame is needed for a special purpose, oxygen is provided instead of air.

Exercises

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

1. Because air is so plentiful, oxygen and nitrogen are usually made from the air. ( )

2. Some of the other gases, such as argon, can only be obtained from the air. ( )

3. Now oxygen does not boil away from liquid air so easily as nitrogen. ( )

4. Oxygen is provided instead of air for the burning of a fire in a house or in a railway engine. ( )

Lesson 3 The Cleaning of Air

Atmospheric dust is a complex mixture of smoke, mists, fumes, dry granular particles, and fibers suspended in air. In addition air may contain living organisms such as mold spores, bacteria, and plant pollens that may cause diseases or allergic responses. Particles in the atmosphere range in size from less than 10^{-6} up to the order of magnitude of the dimension of leaves and insects.[1] The particles exist in all sizes and shapes and generally it is impossible to design one air cleaner that is best for all applications.

Different degrees of air cleanliness are required for various applications. Another consideration is the fact that dust particles in the air may damage the conditioned spaces or its furnishings. For example, the walls may be discolored if even the smallest components of the atmospheric dust are not removed. Unfortunately the smallest particles cause the most discoloring. Therefore, in this case, electronic air cleaners or high performance dry filters are required. In clean room applications or when radioactive particles are present, extremely high performance filters should be employed. One of the most effective ways of controlling allergic disorders is to remove the allergens from the air by using high performance filters.[2] Of all the characteristics affecting the performance of an air filter, particle size is the most important; however, the cleaning efficiency of a filter is affected to some extent by the velocity of the air stream. The major factor influencing filter design and selection is the degree of air cleanliness required. In general the cost of the filter or filter system will increase as the size of the particles to be removed decreases. Maintenance will also increase in the same way.

There are three operating characteristics that distinguish the various types of air cleaners. These are the efficiency, the air flow resistance, the dust-holding capacity.[3] Efficiency measures the ability of the air cleaner to remove particulate matter from an air stream and the average efficiency over the life of the filter is the most meaningful for most applications.[4] The air flow resistance is the loss in total pressure across the filter at a given air flow rate. This of course is a very important consideration. The dust-holding capacity defines the amount of a particular type of dust an air cleaner can hold while operating at a specific airflow rate and maximum airflow resistance. Sometimes the dust-holding capacity refers to the value attained before the filter efficiency is seriously reduced. Therefore, to have a complete rating of an air cleaner, data should be made available on efficiency, resistance, and dust-holding capacity. The effect of the dust loading on the efficiency and resistance is also important. In general, however, the gravimetric efficiency of a filter gives the ratio of the mass of the dust arrested by the filter to the total mass of the dust fed to the filter. The second type of efficiency is called the dust spot efficiency. This is designed to rate filters for their ability to prevent discoloration. In this case white filter paper targets are used and the

efficiency is determined through light transmission measurements and expressed in terms of efficiency. The dust-holding capacity is actually given as an absolute measure of the mass of dust held by the filter. This rating gives an indication of how often the filter may have to be renewed. Of course this will vary considerably depending on the application. Air flow resistance or pressure drop is probably the simplest of all the tests made and is usually given in terms of the clean filter. Naturally, as the filter becomes loaded, pressure drop will increase.

New Words and Expressions

granular [ˈgrænjulə] *adj.* 由小粒而成的，粒状的
fiber [ˈfaibə] *n.* = fibre 光纤
suspend [səˈspend] *vt.* 吊，悬挂；*v.* 延缓
organism [ˈɔːgənizəm] *n.* 生物体，有机体
mold [məuld] *n.* 霉菌
spore [spɔː] *n.* 孢子；*vi.* 长孢子
bacteria [bækˈtiəriə] *n.* (*pl.*) 细菌
bacteria-free *adj.* 无菌的
pollen [ˈpɔlin] *n.* 花粉；*vt.* 传授花粉给
allergic [əˈlɜːdʒik] *adj.* [医] 过敏的，患过敏症的
atmospheric [ˌætməsˈferik] *adj.* 大气的
magnitude [ˈmægnitjuːd] *n.* 大小，数量，巨大，广大，量级
furnishings [ˈfɜːniʃiŋz] *n.* 家具，设备
discolor [disˈkʌlə] *v.* 使脱色，使污染
filter [ˈfiltə] *n.* 滤波器，过滤器，滤光器，筛选；*vt.* 过滤，渗透，用过滤法除去
radioactive [ˌreidiəuˈæktiv] *adj.* 放射性的，有辐射能
disorder [disˈɔːdə] *n.* 杂乱，混乱，无秩序状态；*vt.* 扰乱，使失调，使紊乱
allergen [ˈælədʒən] *n.* 变态反应原，过敏原
characteristic [ˌkæriktəˈristik] *adj.* 特有的，表示特性的，典型的；*n.* 特性，特征
velocity [viˈlɔsiti] *n.* 速度，速率，迅速，周转率
remove [riˈmuːv] *vt.* 移动，开除，移交
distinguish [disˈtiŋgwiʃ] *v.* 区别，辨别
transmission [trænzˈmiʃən] *n.* 播送，发射，传动，传送，传输，转播

Notes to the Text

1. Particles in the atmosphere range in size from less than 10^{-6} up to the order of magnitude of the dimension of leaves and insects.

在句中，Particles 是主语，“range in size from less than 10^{-6} up to the order of magnitude of the dimension of leaves and insects” 为谓语部分，order of magnitude 应译为“数量级”。range 可以是名词、及物动词或不及物动词，意为“并列，连绵，漫步，加入，站在……