工程技术英语注释读物

CHEMICAL ENGINEERING

化工

胡树声 编

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前　言

为提高学生阅读英文资料的能力，编者参阅了主要是70年代中后期的较新书刊，编写了这本读物，供高等院校化工系三年级以上学生以及具有一定英语水平的化工技术人员使用。本书内容包括化学基本原理、化工简介、单元操作、化工作业、传质、传热、环境保护和新技术等共30篇。内容的安排和选择尽量考虑到化工专业的系统性，文字也由浅入深、由易到难。期望在学完这本书以后，能逐渐过渡到顺利阅读当前的一般化工文献。本书除了对疑难点作注释外，最后还有参考译文和总词汇表，以便读者能更多地依靠自己的力量顺利阅读这本材料。新词汇和词组共一千个。这是以当前许多理工科院校采用的由上海交通大学主编的四册“英语”为标准选定的。

本书在编写过程中，承陈以一、梁嘉玉副教授和桂济世老师大力协助，王秉鑑同志帮助插图，谨此致谢。书中缺点和错误，敬希读者批评指正。

编　者

CONTENTS

1. CHEMISTRY

Possibly you are sitting at your desk with some paper and a wooden pencil or a plastic pen at hand① to take notes. Maybe there are some metal paper clips, a bottle of ink and a pottery tea cup on your desk. What could you do to investigate the materials in your paper, your pencil or pen, the paper clips, the cup or the bottle? Scratch them. Which is harder? Put a drop of water, or alcohol, or acid on each one. What happens? Weigh pieces of equal size. Which is heavier? Try to burn a small piece of each. Which one burns? What is left afterwards?

If you have a curious nature, your next questions should begin with 'Why ...?' and 'How ...?' Why does wood burn, but pottery not?② How can I predict whether other things will or won't burn? Why are some things heavier or harder than others? Why don't these things dissolve in water? How does acid change a metal paper clip?

Chemistry has its roots in③ just this kind of speculation about the nature of simple things. In early times,④ people wondered about air, and water, and rocks, and fire, and looked for mysterious answers to questions about the physical world around them. Once the importance of systematic observation was recognized, the foundation was laid for chemistry and all

① at hand: "在手边"或"即将到来". ② 这里 not 代表 does not burn, 是一种省略形式. ③ has its roots in ...: "其根源在于...". ④ early times: "古代".

the sciences.①

Simply defined, chemistry is the science of matter. Chemistry is necessary in the study and manipulation of any material. Our automobiles are made of metals, fabrics, and plastics. Few of these materials can be obtained from natural sources in forms that are readily usable. The metals are recovered from mineral ores; the fabrics are produced from plant, animal, or synthetic fibers; the plastics are made by combining simple materials to form new and more complex materials.

We travel on highways surfaced with asphalt and concrete. We drink water that has been purified with② chlorine. We read from paper made from cellulose and printed with highly colored inks. We watch television screens that have been coated with tiny chemical spots, each of which responds with③ a color when energy is applied. With chemistry, we alter an almost endless variety of materials to form other materials with characteristics that we desire.

Not all chemistry has a practical product as its objective, of course. Chemists search for understanding and the ability, based on understanding, to predict what will happen when changes occur.④ And some chemists pursue inquiries ⑤into the nature of matter solely because they enjoy it.

With these observations in mind⑥, we may consider a

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① 当 science 用作可数名词时，表示学科．作"科学"解时，是不可数名词． ② 这里 with 表明由人用氯来净化水． ③ respond 后面跟 with时表示以(什么)表示回答或反应．例如 respond with a smile (报以微笑)． ④ happen 和 occur 都是"发生"的意思．但 happen 更通用，而 occur 常指特定事件在特定时间发生．在这里 occur 含有"出现"的意思． ⑤ inquiry = enquiry. 前者用得更广泛些．在作"查究"讲时，是可数名词，后面跟介词 into. pursue inquiry 的意思是"探索"． ⑥ with ... in mind:"把...放在心上","考虑到"．

more formal definition of chemistry. Chemistry is the branch of science that deals with matter, with the changes that matter can undergo, and with the laws that describe these changes.

2. A NEW VIEW OF MATTER

(Part One)

Gases ... liquids ... solids! Which of these kinds of matter are around you right now?

Surely some of the things around you are gases, like the gases in the air① you are breathing. Some are liquids, like the water you drink, or the rain that sinks into the soil. Some are solids like the paper in this book, or like steel wool②. Some are mixtures of solids and liquids ... like the soup you take. Some of the things around you are mixtures of liquids and gases, like beer or some soft drinks③.

The paper, the steel wool, the soup, water, rain, soil — all the things around you, you can take in your hands or touch④. You know that these are matter. But you have also learned that a large mountain—much too big to take⑤ in your hands —is matter as well.

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① 作"空气"或"空中"解时，air 的前面常带定冠词 the. 作为"物质"用时,不带冠词. ② steel wool: "钢丝绒". ③ soft drinks: "不含酒精的饮料" 或 "清凉饮料." ④ 在这一句里，谓语 take 和 touch 的宾语 the paper, the steel wool ... 被放在整个句子的最前面，是倒装语序，目的在于强调宾语. ⑤ 这是主动形式表示被动的意思，这里用 to be (taken in your hands 也是可以的. 但是在有些句子中，不定式与离它最近的名词(或代词)虽然有动宾关系，但是它与句子中另一名词(或代词)却有主谓关系. 这样的句子一般都用主动形式而不用被动形式. 例如: I found this book hard to understand. I still have a lot to do. 上述那样的句子都不用被动式.

And you have begun to understand that all matter is constantly changing. Iron rusts. Oxygen is being taken from the air. And a mountain breaks down①. Day in, day out②, the matter of every mountain is slowly breaking down.

You have investigated many of the changes in the earth's matter. You have studied how changes take place in the matter in mountain and in air. You have studied how changes take place in steel wool, in a burning candle.

What different changes in matter there are! What different kinds of matter there are! At first it seems that there can be no likenesses at all among all this matter.

Is there any way in which③ all this matter is alike? We know that all matter, whatever kind it is, is made up of tiny particles.

The gases you breathe, the water you drink, the paper of this page—most of the matter around you is made up of the tiny particles that we call molecules. A molecule is the smallest part of a substance that is still that substance. A molecule of alcohol, for instance, is the smallest part of alcohol that is still alcohol.

Yet the tiny particles we call④ molecules are made up of still smaller particles that we call atoms. Some molecules are made up of atoms that are all of the same kind. Some molecules are made up of atoms that are different.

注：① **break down:** "破坏"，"发生故障"。 ② **day in, day out:** "天天(表示连续不断)"。 ③ 作为代词，that 常被用来代替 which 表示事物。但是，如果前面紧挨一个介词时，那末就不能用 that 代替 which。用 way 表示方式或方法时，前面往往带有介词 in，例如：in this way。所以，在代词 which 前还应保留介词 in。 ④ we call 前面省略了一个关系代词，作为 call 的宾语。

(Part Two)

A molecule of oxygen is made up of① two atoms bound tightly together. The atoms are alike. Since the atoms in oxygen are alike, oxygen is an element. An element is made up of only one kind of atom.

A molecule of water, however, is made up of different kinds of atoms. It has two atoms of hydrogen and one atom of oxygen, all tightly bound together. Water is a compound, for a compound is made up of atoms of different elements. The elements in a compound are not just mixed together. They are bound tightly together by certain forces.

Put a drop of water in a dish, for example, little by little② the drop gets smaller, until it disappears altogether. The drop of water evaporates, of course. The water changes from a liquid to a gas. The water molecules move away from the dish and into the air.

When the water becomes a gas, the water molecules themselves do not change. Each molecule is still made up of two atoms of hydrogen and one atom of oxygen. Each molecule is still a water molecule. Its atoms have not changed. But the molecules are now moving around more rapidly and are taking places farther from each other.

This change from a liquid to a gas is one kind of physical change. The molecules themselves do not change. When water evaporates, a physical change takes place.

There is another kind of change in matter. Here is an example. As you breathe in now, you are inhaling molecules

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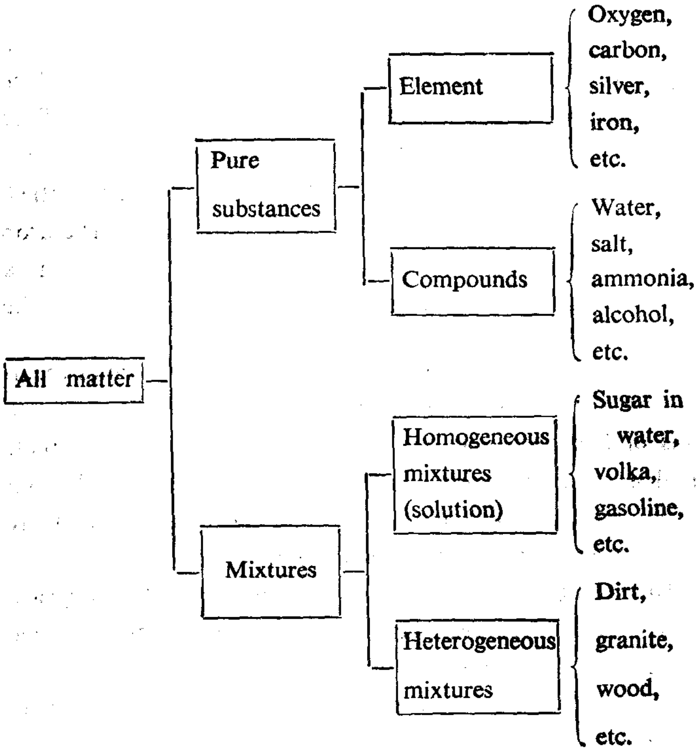
① made up of: "由…组成". ② little by little: "逐渐地".

of oxygen. As you breathe out, you are exhaling molecules of carbon dioxide. The molecules of oxygen that you breathe in are taken apart① into atoms of oxygen in your body. Then these atoms of oxygen combine with atoms of carbon, which you get from food. When the oxygen atoms and carbon atoms combine, they become molecules of carbon dioxide. In this

A scheme for classifying matter



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① take apart: "拆开","分成".

way, new molecules are formed.

This is a chemical change. Always①, in a chemical change, new molecules are formed.

Molecules can take part in a physical change or a chemical change. Matter can change because the particles that make up matter are in constant change. And so you become aware of② how all matter is alike. You reach this concept of matter: Earth's matter is in continuous change. All around you — all around you — matter is in continuous change.

3. ATOMIC THEORY AND ATOMIC STRUCTURE

In the nineteenth century Dalton postulated that:

(1) matter is composed of③ small particles called atoms;
(2) atoms can be neither created nor destroyed;
(3) atoms of one particular element are all exactly alike, but different from the atoms of all other elements;
(4) chemical combination takes place between whole numbers of atoms in definite numerical proportions.

Although we know that not all of these ideas are strictly correct, they are the foundations on④ which modern atomic theory has been built. While⑤ a detailed study of the structure of the atom lies in the realm of physics, some knowledge is essential for a reasonable understanding of how atoms bond together.

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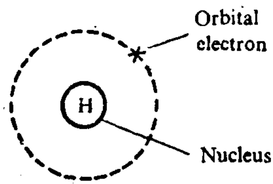
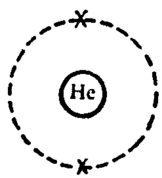
① always: 这里放在句首,表示强调. ② become aware of: "发觉", "开始意识到". ③ to be composed of: "由…组成". ④ on 在这里是跟在 built 后面 的介词. 我们可以把这一从句改写成 which … has been built on. 但是,现代英语往往把介词与动词拆开而放在关系代词的前面. ⑤ while 包含有对照的意思,可译为"虽然"或"尽管".

It is now accepted that the atom is **not** the ultimate particle, it consists of a central nucleus surrounded by one or more orbital electrons. The nucleus always contains protons and usually contains neutrons, and both together make up most of the weight of the atom. Both protons and neutrons are particles of unit weight, but a proton has a unit positive charge and a neutron is electrically neutral (i.e.,① carries no charge). Thus the nucleus always carries a positive charge which is exactly balanced by negative charges carried by each of the orbital electrons. Electrons are relatively light — about 1/1836 the weight of a proton, and they circle the nucleus in orbits.

The hundred odd elements at present known are all built up from these three fundamental particles in a simple way. The first and most simple element, hydrogen, consists of a nucleus containing one proton and therefore has one positive charge, which is balanced by one negatively charged orbital electron. The second element, helium, has two protons (and two neutrons) in the nucleus and hence a charge of + 2, which is balanced



Hydrogen: atomic number 1,
symbol H



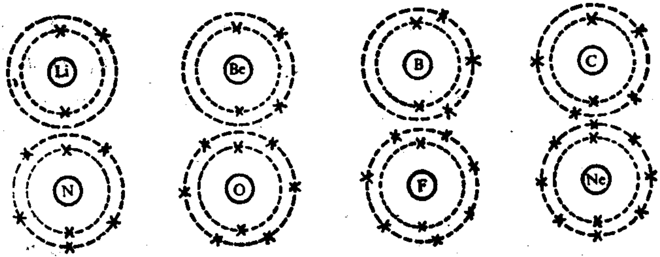
Helium: atomic number 2,
symbol He

by two negatively charged orbital electrons. This pattern is repeated for the rest of the elements, and element 103, lawrencium, has 103 protons in the nucleus (and some neutrons); hence

① i.e. 是拉丁语 id est 的缩写，等于 that is（也就是，即）.

the nuclear charge is +103 and is balanced by 103 orbital electrons. The number of positive charges on the nucleus of an atom always equals the number of orbital electrons, and is called the atomic number① of the element.

One may think of the orbital electrons as being arranged in certain well-defined orbits. Thus hydrogen and helium have one and two electrons respectively in their first orbit. The first orbit is then full, and in the atoms of lithium, beryllium, boron, carhon, nitrogen, oxygen, fluorine and neon, subsequent electrons go into a second orbit (see following figure). Similarly in the atoms of elements 11 to 18 the additional electrons enter a third shell.



The negatively charged electrons are attracted to the positive nuclei by electrostatic attraction. An electron near the nucleus is strongly attracted by the nucleus and has a low potential energy. An electron distant from the nucleus is less firmly held and has a high potential energy.

① atomic number: "原子序数".

4. THE GAS LAWS

The thin layer of gases which surround the earth — the atmosphere — is the only known region of the universe in which humans① can survive unassisted②. It consists primarily of nitrogen and oxygen. These gases and all other known gases undergo either expansion or contraction as either their temperature or their pressure is changed. In this lesson we will discuss the relations of temperature and pressure changes to the volumes of gases. Those relations are sometimes called the gas laws.

The molecules in a gas are relatively far apart and move in a constant random motion. They are far enough apart that③ attractive forces between them are negligible. Heating the gas causes them to move more rapidly. Increasing the pressure forces them closer together.

At constant temperature, the volume of a gas is inversely proportional to④ the pressure. This statement is known as Boyle's law, and it is expressed mathematically as $PV=k$.

At constant pressure, the volume of a gas is directly proportional to⑤ the absolute temperature⑥. This is known as Charles' law, and it is expressed mathematically as $V=cT$.

Combining Boyle's and Charles' laws gives us the combined

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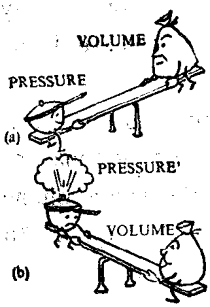
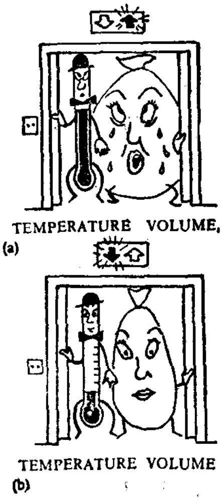
① **human:** 一般作形容词用．作名词用时，human being 较 human 更普通． ② **unassisted:** 是过去分词作状语用，说明谓语的状态，其逻辑主语就是句子的主语． ③ 这里 that 从句修饰副词 enough．在一般情况下 enough 后面常跟不定式短语． ④ inversely proportional to: "与…成反比"． ⑤ directly proportional to: "与…成正比"． ⑥ **absolute temperature:** "绝对温度"．

gas law, $P_1V_1/T_1=P_2V_2/T_2$. The volume, pressure, temperature, and moles of a gas are related in the ideal-gas law①, $PV=nRT$.

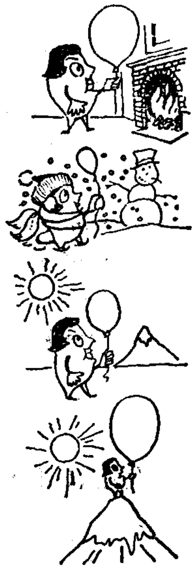
In a mixture of gases the total pressure is merely the sum of the pressures due to each gas. This relation, known as Dalton's law of partial pressures②, can be expressed mathematically



The pressure-volume relationship is like a seesaw. (a) When the pressure goes down, the volume goes up. (b) When the pressure goes up, the volume goes down. (From an idea by Cindy Hill.)



Temperature and volume are like passengers on an elevator. (a) When one goes up, the other must go up also. (b) When one goes down, the other goes down too. (From an idea by Cindy Hill.)



The volume of a gas varies with temperature and pressure.

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① ideal-gas law: "理想气体定律". ② partial pressure "分压".