化学专业英语

饶小桐　蒋安培　编

尹代益　审

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CONTENTS

1. THE CHEMICAL PROPERTIES OF SUBSTANCES

The chemical properties of a substance are those properties that relate to its participation in chemical reactions.

Chemical reactions are the processes that convert substances into other substances.

Thus sodium chloride has the property of changing into a soft metal, sodium, and a greenish-yellow gas, chlorine, when it is decomposed by passage of an electric current through it. It also has the property, when it is dissolved in water, of producing a white precipitate when a solution of silver nitrate is added to it; and it has many other chemical properties.

Iron has the property of combining readily with the oxygen in moist air to form iron rust; whereas an alloy of iron with chromium and nickel (stainless steel) is found to resist this process of rusting. It is evident from this example that the chemical properties of materials are important in engineering.

Many chemical reactions take place in the kitchen. When biscuits are made with use of sour milk and baking soda there is a chemical reaction between the baking soda and a substance in the sour milk, lactic acid, to produce the gas carbon dioxide, which leavens the dough by forming small bubbles in it. And, of course, a great many chemical reactions take place in the human body. Foods that we eat are digested in the stomach and intestines. Oxygen in the inhaled air combines with a substance, hemoglobin, in the red cells of the blood, and then is released in the tissues, where it takes part in many different reactions. Many biochemists and physiologists are engaged in the study of the chemical reactions that take place in the human body.

Most substances have the power to enter into many chemical reactions. The study of these reactions constitutes a large part of the study of chemistry. Chemistry may be defined as the science of substances---their structure, their properties, and the reactions that change them into other substances.

Example. Which of the following processes would you class as chemical reactions?

(a) The boiling of water.

(b) The burning of paper.

(c) The preparation of sugar syrup by adding sugar to hot water.

(d) The formation of rust on iron.

(e) The manufacture of salt by evaporation of sea water.

Solution. The burning of paper and the formation of rust on iron are chemical reactions. The boiling of water, the preparation of sugar syrup, and the manufacture of salt by evaporation of sea water are changes of state that are not classes as chemical reactions.

词 汇

participation [pa:,tisi'peiʃən] n. 参与

reaction [ri'ækʃən] n. 反应

process ['prəuses] n. 过程

convert [kən'və:t] v.t. 转换；转化

greenish-yellow ['gri:,niʃ-'jeləu] a. 黄绿色的

chlorine ['klɔ:ri:n] n. 氯(气)

decompose [di:kəm'pəuz] v.t. & v.i. 分解；分析

add [æd] v.t. (添)加

iron ['aiən] n. 铁

combine [kəm'bain] v.t. & v.i. (使)结合

readily ['redili] ad. 容易地

oxygen ['ɔksidʒən] n. 氧

passage ['pæsidʒ] n. 通过

current ['kʌrənt] n. 电流

precipitate [pri'sipiteit] v.t. & v.i. (使)沉淀 n. [pri'sipitit] 沉淀物

solution [sə'lu:ʃən] n. 溶液

silver ['silvə] n. 银 a. 银(白)色的

nitrate ['naitreit] n. 硝酸盐

silver ~ 硝酸银

human ['hju:mən] a. 人类的

digest [di'dʒest] v.t. 消化

stomach ['stʌmək] n. 胃

intestine [in'testin] n. (常用复)肠

inhale [in'heil] v.t. 吸入

hemoglobin [hi:məu'gləubin] n. 血红蛋白

moist [mɔist] a. 潮湿的
rust [rʌst] n. (铁)锈
alloy ['ælɔi] n. 合金
chromium ['krəumiəm] n. 铬
nickel ['nikl] n. 镍
stainless ['steinlis] a. 不锈的
resist [ri'zist] v. t. 抵抗；阻挡
evident ['evidənt] a. 明显的
engineering [ˌendʒi'niəriŋ] n. 工程(学)
biscuit ['biskit] n. 饼干
sour ['sauə] a. 酸的
bake [beik] v. t. 烘；烤
soda ['səudə] n. 苏打
lactic ['læktik] a. 乳汁的
～ acid 乳酸
leaven ['levn] v. t. 使发酵
dough [dəu] n. 生面团
cell [sel] n. 细胞
blood [blʌd] n. 血液
release [ri'li:s] v. t. 放出
tissue ['tisju:] n. 组织
biochemist ['baiəu'kemist] n. 生物化学家
physiologist [fizi'ɔlədʒist] n. 生理学家
engage [in'geidʒ] v. t. [in] 使从事
define [di'fain] v. t. 规定；下定义
boil [bɔil] v. t. 煮沸
burn [bə:n] v. t. 燃烧
syrup ['sirəp] n. 糖浆
formation [fɔ:'meiʃən] n. 形成
manufacture [ˌmænju'fæktʃə] n. 制造
evaporation [iˌvæpə'reiʃən] n. 蒸发
bubble ['bʌbl] n. 气泡

Reading Comprehension:

Choose the best answer for each of the following:

1. When sodium chloride is decomposed by passage of an electric current through it, it becomes _______.
   a. a soft metal b. a greenish-yellow gas
   c. sodium and chlorine d. none of them
2. Why does the dough leaven when biscuits are made with use of sour milk and baking soda?
   a. Baking soda and lactic acid together product the gas carbon dioxide, so that small bubbles in it are formed.
   b. The sour milk is added into it.

c. The function of oxygen and red cells.

d. The sodium chloride in the sour milk.

3. Do the scientists know the chemical reactions in the buman body? They know _______.

   a. all of them
   b. some of them
   c. nothing
   d. there is no change in the body

4. According to the article from which example can we see that the chemical properties of substances are important?

   a. When sodium chloride is dissolved in water, of producing a white precipitate when a solution of silver nitrate is added to it.
   b. Foods that we eat are digested in the stomach and intestines.
   c. The burning of paper.
   d. an alloy of iron with chromium and nickel is found to resist this process of rusting.

2. ATOMS CONSIST OF PROTONS, NEUTRONS, AND ELECTRONS

Atoms are the smallest units of matter that, when brought together in large numbers, constitute the chemical elements. But atoms are by no means the smallest units of matter. Every atom contains a tiny, central body called the nucleus, which has a positive electric charge and about 99.9% of the mass of the atom. The nucleus contains particles called protons, each of which has one positive charge (in units called the electron charge, which can be positive or negative) and a mass of 1.6726×10^{-24} gram (g). The nucleus also contains neutrons, which have no charge (they are electrically neutral) and a mass of 1.6749×10^{-24} g. Note that the mass of a proton and the mass of a neutron are nearly identical (they differ by two parts in one thousand). The total number of protons in the nucleus, Z, plus the total number of neutrons, N, is called the mass number, A. Thus,

$$A=Z+N$$

The mass of any nucleus is approximately A $(1.67 \times 10^{-24}$ g). For this reason the helium nucleus, which contains two protons and two neutrons, has a mass about four times greater than that of a hydrogen nucleus, which is a single proton. The charge on the nucleus is equal to the number of protons, Z, which is also called the atomic number (do not confuse with mass number!). Thus, the hydrogen nucleus ($Z=1$; $A=1$) has a charge of +1 electron charge unit, and the helium nucleus ($Z=2$; $A=4$) has a charge of +2 electron charge units.

The actual volume of an atom is defined---roughly---by a diffuse distribution of very rapidly moving electrons, centered around the nucleus. An electron has one negative electron charge and a mass of 9.1096×10^{-28} g, or about 1/1836 the mass of a proton or neutron. Electrons therefore contribute very little to the mass of the atom.

An atomic nucleus is extremely small compared to the radius of the atom. A nuclear diameter is about 10^{-13} to 10^{-12} cm (10^{-5} to 10^{-4} Å). Since an atomic diameter is about 10^{-8} cm (1 Å), this means that the nucleus, with almost all the mass of the atom, occupies only about one part in 10^{14} (on the average) of its volume. If we could magnify a typical atomic nucleus to the size of a ping-pong ball, the diameter of the atom would be about 2 miles. Thus, even "solid" matter as we know it consists almost entirely of empty space! If we could eliminate this space by compressing atomic nuclei into a truly compact mass, a human being would be reduced to a microscopic speck. A lump of such nuclear matter the size of our ping-pong ball would weigh about 4 billion tons! As incredible as it may seem, nuclear matter does exist---in neutron stars, whose previously hypothetical existence was confirmed in 1968.

There are Z electrons in an atom, which means that an atom is electrically neutral (has no net charge). The number of negative charges (electrons) in the cloud around the nucleus equals the number of positive charges (protons) in the nucleus. If an electrical imbalance is created in the atom by the removal or addition of one or more electrons, the result is an ion. Thus, an ion is an electrically charged atom (or molecule). It can be either positive or negative, depending on whether its electron cloud contains fewer electrons or more electrons than does the neutral atom (or molecule). Some examples are the hydrogen ion, H^+, which is a free proton, and the fluoride ion, F^-, which contains an extra electron in its electron distribution.

词 汇

proton ['prəutɔn] n. 质子
nucleus ['nju:kliəs] (pl. nuclei ['nju:kliai]) n. 核子
neutron ['nju:trɔn] n. 中子
electron [i'lektrɔn] n. 电子
tiny ['taini] a. 很小的
positive ['pɔzətiv] a. 阳性的 正的
charge ['tʃa:dʒ] v.t. 充电 n. 电荷
particle ['pa:tikl] n. 微粒；质点
negative ['negətiv] a. 否定的；负的
electrically [i'lektrikəli] ad. 电学上
neutral ['nju:trəl] a. 中性的
note [nəut] v.t. 注意
identical [ai'dentikəl] a. 相等的；相同的
differ ['difə] v.i. 不同；有差别
total ['təutl] a. 总计的 n. 总数
approximately [ə'prɔksimitli] ad. 大体上；大致上
helium ['hi:ljəm] n. 氦
hydrogen ['haidrədʒən] n. 氢
single ['siŋgl] a. 单独的；单个的
confuse [kən'fju:z] v.t. 使混乱
roughly ['rʌfli] ad. 粗糙地；大体，大约
diffuse [di'fju:s] a. 四散的
distribution [,distri'bju:ʃən] n. 分配；分布
extremely [iks'tri:mli] ad. 极其
radius ['reidjəs] n. 半径
occupy ['ɔkjupai] v.t. 占领
average ['ævəridʒ] n. 平均(数，标准)
magnify ['mægnifai] v.t. 放大
typical ['tipikəl] a. 典型的
elimirate [i'limineit] v.t. 除去；消除
compress [kəm'pres] v.t. 压缩
truly ['tru:li] ad. 真正地；确实地
compact ['kɔm pækt] a. 细密的；密集的
human being ['hju:mən 'bi:iŋ] 人(类)
reduce [ri'dju:s] v.t. 减少；还原
microscopic [,maikrəs'kɔpik] a. 显微镜的，极微的
speck [spek] n. 斑点；微粒
lump [lʌmp] n. 块；团
incredible [in'kredəbl] a. 不可相信的
previeusly ['pri:vjəsli] ad. 先前；以前
hypothetical [,haipəu'θetikəl] a. 假设的
confirm [kən'fə:m] v.t. 确定；证实
net [net] a. 纯净的
～ charge 净电荷
create [kri'eit] v.t. 创造
removal [ri'mu:vəl] n. 除去
contribute [kən'tribju:t] v.i. 贡献；起作用

Reading Comprehension:

Choose the best answer for each of the following:

1. The mass of proton is ______.

   a. 1.6726×10^{-24} b. 9.1096×10^{-28}

   c. 1.6749×10^{-24} d. 2.3096×10^{-25}

2. If we could eliminate this space by compressing atomic nuclei into a truly compact mass, a human being would be reduced to ______.

   a. a microscopic speck b. the size of a ping-pong ball

   c. the size of a foot ball d. 2 miles in diameter

3. How many people could lift a lump of such nuclear matter the size of our ping-pong ball?

   a. One b. Two

   c. Nine d. None of the above

4. Atomic number is equal to ______.

   a. the weight of the nucleus b. the weight of the proton

   c. the number of neutrons d. the number of protons

3. NOMENCLATURE OF INORGANIC COMPOUNDS (I)

Mastering chemical nomenclature is little different from learning a new language, such as German. In order to understand the German scientific literature, you must, e.g., learn that the compound H_2 is called Wasserstoff. English-speaking chemists call it hydrogen. Your task now is to memorize the names of enough compounds and become sufficiently familiar with the several systems of naming compounds that chemistry ceases to be a "foreign language".

The first thing to learn about naming chemical compounds is that there is usually more than one way to do it. We begin with the simplest system, in which a trivial name, i.e., one that has no sensible origin, is assigned to a compound. Some examples are

H_2O	Water
NH_3	Ammonia
Hg_2Cl_2	Calomel

Some names, such as quicklime for CaO, derive from the origin of the compound---in this case, limestone, $CaCo_3$. Such word origins are often remembered only by etymologists, but the names have persisted for so long that they are an established part of the language. Can you imagine anyone seriously asking for a drink of dihydrogen oxide? The word water serves the purpose much better.

As we come to less common and more complex compounds, the use of trivial names gives way to a more systematic approach. If there are only two elements in the compound, it is customary to name the more metallic element first and the less metallic, or more electronegative, element second, with the suffix "-ide." Some examples are

KCl	Potassium chloride
NaBr	Sodium bromide
CaO	Calcium oxide
Hl	Hydrogen iodide
BaS	Barium sulfide

For compounds containing still only two elements but more than two atoms, the prefixes "mono-," "di-," "tri-," etc., become necessary. Some examples of such compounds are the oxides of nitrogen. Another such series is that of the oxides of chlorine. Because chlorine, like nitrogen, is slightly less electronegative than oxygen, the word chlorine comes first:

Cl_2O	Dichlorine monoxide
ClO	Chlorine monoxide
ClO_2	Chlorine dioxide
ClO_3	Chlorine trioxide
Cl_2O_7	Dichlorine heptoxide
ClO_4	Chlorine tetroxide

If no confusion can result, the prefixes "mono-" and "di-" are sometimes dropped.

A class of compounds in which such prefixes are seldom used is that in which the metal atom usually exhibits only one oxidation state. Depending on the oxidation state of the other element, the number of anions per cation is then fixed. Some examples are

$ZnBr_2$	Zinc bromide
CaH_2	Calcium hydride
Na_2O	Sodium oxide
Al_2S_3	Aluminum sulfide

The next level of complexity in naming inorganic compounds arises when there are three elements present. Very often, one of these elements is oxygen. Such compounds are named by combining the suffix "-ate" with the name of the less electronegative of the two nonmetallic elements. For example, $NaNO_3$ is sodium nitrate. The problem with this is that there is a similar compound with nitrogen in the +3 oxidation state, $NaNO_2$. Such compounds with the element in a lower oxidation state use the suffix "-ite", so $NaNO_2$ is sodium nitrite. But the number of chemical compounds is not bounded by the chemists' vocabulary, and there are several such examples entailing more than two oxidation states. To solve this problem, the prefix "hypo-" (meaning "below") is used in the name of the compound in which the less electronegative element is in the lowest oxidation state, and the prefix "per-" (meaning "highest") is used when it is in the highest oxidation state. Some examples of the use of this system are shown in the following table.

Formula	Oxidation State of Less Electro-negative Atom	Name of Salt	Formula and Name of Corresponding Acid
KNO_3	+3	Potassium nitrite	HNO_2 Nitrous acid
KNO_3	+5	Potassium nitrate	HNO_3 Nitric acid
Rb_2SO_3	+4	Rubidium sulfite	H_2SO_3 Sulfurous acid

Rb_2SO_4	+6	Rubidium sulfate	H_2SO_4 Sulfuric acid
CsClO	+1	Cesium hypochlorite	HClO Hypochlorous acid
$CsClO_2$	+3	Cesium chlorite	$HClO_2$ Chlorous acid
$CsClO_3$	+5	Cesium chlorate	$HClO_3$ Chloric acid
$CsClO_4$	+7	Cesium perchlorate	$HClO_4$ Perchloric acid

词　汇

master [ˈmaːstə] v.t. 掌握
nomenclature [nəuˈmenklətʃə] n. 命名法
German [ˈdʒəːmən] n. 德语；德国人 a. 德国的
scientific literature [ˌsaiənˈtifik ˈlitəritʃə] n. 科学文献
memorize [ˈmeməraiz] v.t. 记住
cease [siːs] v.t. 停止
trivial [ˈtriviəl] a. 平常的；通俗的
i.e. [ˈai ˈiː] (=that is) 即，那就是
sensible [ˈsensəbl] a. 能觉察到的
origin [ˈɔridʒin] n. 起源；来历
ammonia [əˈməunjə] n. 氨；氨水
calomel [ˈkæləməl] n. 甘汞；氯化亚汞
quicklime [ˈkwiklaim] n. 生石灰
derive [diˈraiv] v.i. 得来
etymologist [ˌetiˈmɔlədʒist] n. 词源学者
persist [pəˈsist] v.i. 坚持
establish [isˈtæbliʃ] v.t. 建立
imagine [iˈmædʒin] v.t. 想象
complex [ˈkɔmpleks] a. 复杂的
systematic [ˌsistiˈmætik] a. 有次序的；系统的
approach [əˈprəutʃ] n. 接近，方法
suffix [ˈsʌfiks] n. 后缀
bromide [ˈbrəumaid] n. 溴化物
iodide [ˈaiədaid] n. 碘化物
barium [ˈbɛəriəm] n. 钡
prefix [ˈpriːfiks] n. 前缀
nitrogen [ˈnaitridʒən] n. 氮
series [ˈsiəriːz] n. (单复同)系列
exhibit [igˈzibit] v.t. 表示，显示
anion [ˈænaiən] n. 阴离子；负离子
cation [ˈkætaiən] n. 阳离子；正离子
fix [fiks] v.t. 固定
zinc [ziŋk] n. 锌
aluminum [əˈl(j)uːminəm] n. 铝

Reading Comprehension:

Choose the best answer for each of the following:

1. According to the article in order not to make chemistry a "foreign language" again you must learn _______.
   a. chemical nomenclature   b. German
   c. English   d. Chinese
2. In English the trivial name of KCl is _______.
   a. to name Potassium first and Chlor second, with the suffix "-ide."
   b. to name Potassium after Chlor, with the suffix "-ide."
   c. to name Potassium first and Chlor second, with the prefix "-ide".
   d. none of the above
3. Under the following elements which one is unnecessary to follow "mono-", "di-" and "tri-"?
   a. Cl_2O_7 b. $ZnBr_2$ c. ClO_3 d. Cl_2O
4. How many nomenclatures of inorganic compounds are given in the article?
   a. One   b. Four
   c. Five   d. Eight

4. NOMENCLATURE OF INORGANIC COMPOUNDS (II)

In the inorganic acids, the suffixes "-ous" and "-ic" are used to denote the lower and higher oxidation states, respectively. These same suffixes are also used with the names of a number of metals, namely, those that usually exhibit more than one oxidation state. Some examples are cobaltous and cobaltic, and mercurous and mercuric. The nomenclature is complicated slightly by the fact that, for a few such metals, these terms are derived from the Latin name of the element rather than the English name.

All but eleven of the elements are given a symbol corresponding to one or two letters in the English name of the compound. (The first letter is always capitalized and the second letter is never capitalized.) One of these exceptions is tungsten, whose symbol (W) is derived from the German name of the element, Wolfram. The other ten have symbols derived from their Latin names. These are: stibium (Sb) for antimony, cuprum (Cu) for copper, aurum (Au) for gold, ferrum (Fe) for iron, plumbum (Pb) for lead, hydrargyrum (Hg) for mercury, kalium (K) for potassium, argentum (Ag) for silver, natrium (Na) for sodium, and stannum (Sn) for tin. The use of the suffixes "-ous" and "-ic" with three of these metals is illustrated below.

CuI	Cuprous iodide
CuI_2	Cupric iodide
$FeBr_2$	Ferrous bromide
$FeBr_3$	Ferric bromide
$SnCl_2$	Stannous chloride
$SnCl_4$	Stannic chloride

The system works well as long as there are only two major oxi-