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主编 韩振声 连翠飞

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前　言

按照全国第三次教育工作会议的精神和教育部关于全国高职高专教材建设的基本要求，我们以“必需、够用”为度，突出应用和操作技能为原则编写了本教材。

随着国民经济的迅速发展，高等职业教育更加注重学生基本素质和实际工作能力的培养。对于非英语专业的学生而言，英语水平和能力的培养不仅是构成其文化素质的重要部分，也是其综合能力的补充和延伸。因此，选择针对性强的专业英语教材显得尤为重要。在总结前几年专业英语教学的基础上，广泛征求老师和学生的意见，组织编写了适合药学、生物技术及应用、药物制剂技术、生物制药技术、化学制药技术、食品营养与检测及化学工程类等专业使用的专业英语教材。

本教材的编写既考虑到专业英语与公共英语的关系，更注意到学生学习专业英 984
语之前所缺少的有关化学、化工、生物化学等学科的基础英语词汇及用法，同时也注意到学生英语水平逐年提高的前提。既要重视基础性，也要突出专业性。在试用一年进行修改的基础上，本着从实际出发，本教材包括十八课精读课文、生词表及练习，每课后还配有相关的阅读材料。前面四课为基础部分，后面十四课为专业部分。基础部分要重视和加强，保证学时。专业部分可根据不同专业和学时数适当选择部分课文。这样，学生既掌握了化学、化工、制药、食品等方面的科技文献翻译技能技巧，又能提高阅读专业英语文献的能力。

书后附有生词表及附录一、二、三、四

本教材编写分工如下：

韩振声编写第一、二、三课，附录一、二、三及每课课后练习；连翠飞编写第七、八、九、十课及附录四；董芝编写第十三、十四、十五、十八课及组织协调工作；郑琴编写第四、十一、十七课；王琪编写第五、六课；杨军艳编写第十二课；高维旭编写第十六课。全书由韩振声、董芝、连翠飞统稿并整理。

本书涉及多种专业，又由于编者水平有限，虽尽力选材编写，但我们的付出能否满足高职高专教育规律的要求，能否被广大师生所肯定，还有待于实践的检验。

本书也适用相关专业的本科生和有关专业科技人员参考。希望广大读者，特别是高职高专相关专业的师生提出宝贵意见。

编　者

2008年8月

CONTENTS

Unit 1

1-A TEXT

Solutions

Water is a very good solvent for many substances. This is particularly true for the compounds known as acids, bases and salts. There are still several other liquids besides water which have considerable solvent power. Alcohols, for example, will dissolve a number of materials which are not soluble in water. Some substances, like fats, waxes and gums are insoluble in water but soluble in certain organic compounds, such as ether, carbon tetrachloride, carbon bisulfide and gasoline.

There is a certain limit to the amount of material which a solvent will dissolve. This limit varies greatly with the nature of the material to be dissolved and the nature of the solvent. Thus, 100 grams of water at 20℃ will dissolve 34 grams of potassium chloride and only 7 grams of potassium chlorate. When a solution contains a large quantity of the dissolved material, it is said to be concentrated. When it contains only a small quantity, it is dilute. When it contains all the dissolved substance that it possibly can take up at a specific temperature, it is said to be saturated. We call the maximum amount of solid which can be dissolved in 100 grams of solvent the solubility of the substance.

A solution is homogeneous to the eye because the material which is dissolved in it is uniformly distributed throughout. It will not separate out even on long standing. These are the essential differences between a mechanical mixture like sand and water, and a true solution like sugar or salt in water. If some of the solvent is removed by evaporation from a saturated solution, the dissolved material will separate out in the form of crystals.

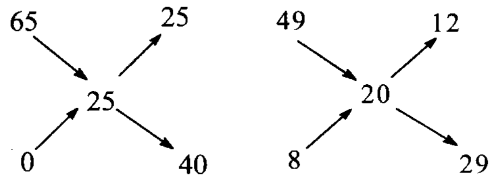
Sometimes when we cool a hot, clear, saturated solution to room temperature, no crystals appear. This is not what we might expect, for the solution now contains much more material than could be taken up by the solvent at this temperature. Such a solution is said to be supersaturated. Crystals will, however, usually appear in it if it is allowed to stand or if it is shaken or violently stirred. The addition of a very small crystal of the substance in solution will always start crystallization at once.

Under normal conditions pure water freezes at 0℃ and boils at 100℃. The addition of any soluble solid lowers the freezing point and raises the boiling point.

The concentration of solutions is sometimes expressed as the number of gram-molecules of solute in 1000 g of solvent. Concentrations expressed in this way are known as molal concentrations (m). Their chief merit is that they are independent of the temperature (being purely gravimetric). The number of gram-molecules of solute contained in one litre of solution may be specified. The concentrations specificed in this way are called molar concentrations (M). They are usually denoted as follows: M = molar solution (1 mole per litre), 2M = two molar solution (2 moles per litre), 0.1M = a decimolar solution (0.1 mole per litre) etc. As regards the way in which they are denoted, all that was said above molar solutions applied to molal solutions.

Concentrations of solutions are sometimes also expressed as the number of grams of solute in a certain volume of solution, or in a certain volume of solvent, and very often they are expressed as the percentage by weight of solute（in 100 g of solution）. In industry, the concentration of solutions is often characterised by their specific gravity.

If more dilute or stronger solutions have to be prepared from solutions of a definite percentage composition, the necessary quantity by weight of the initial liquids can easily be found by applying the so-called blending rule. The later is a method of calculation which will become clear from the following examples. Suppose that it is required: 1) to prepare a 25% solution from a 65% solution and water (0%); 2) to prepare a 20% solution from a 49% and an 8% solution.



It is necessary: 1) to add 40 parts by weight of water to 25 parts by weight of the 65% solution; 2) to add 12 parts by weight of the 49% solution to 29 parts by weight of the 8% solution.

new words and expressions

solvent	['sɔlvənt]	n. 溶剂，溶媒
alcohol	['ælkəhɔl]	n. 酒精，乙醇，醇
fat	[fæt]	n. 肥肉，脂肪，油脂
wax	[wæks]	n. 蜡，蜡状物
gum	[gʌm]	n. 树胶，胶浆
tetrachloride	[tetrə'klɔ:raid]	n. 四氯化物
bisulfide	[baisʌlfaid]	n. 二硫化物
potassium	[pə'tæsjəm]	n. 钾
chloride	['klɔ:raid]	n. 氯化物
chlorate	['klɔ:rit]	n. 氯酸盐
concentrate	['kɔnsentreit]	v. 集中，浓缩
dilute	[dai'lju:t]	vt. /a 稀释，冲淡；稀释的
saturate	['sætʃəreit]	vt. 使饱和
homogeneous	[ˌhɔməu'dʒi:njəs]	a. 同类的，同质的，均匀的
evaporation	[iˌvæpə'reiʃən]	n. 蒸发（作用），发散
crystal	['kristl]	n. 水晶，晶体
supersaturate	[sju:pə'sætʃəreit]	vt. 使过饱和
violently	['vaiələntli]	ad. 猛烈地，激烈地
stir	[stə:]	vt. 摇动，搅拌

merit	['merit]	n. 长处，优点
gravimetric	[ˌgrævi'metrik]	a. (测定)重量的，重量分析的
denote	[di'nəut]	vt. 指示，表示
molar	['məulə]	a.（体积）克分子的
molal	['məuləl]	a.（重量）克分子的
gravity	['græviti]	n. 重力，引力
blend	[blend]	v. /n.使混合；混合，掺合

Exercises

1. Explain the following basic concepts

1) dilute solution
2) concentrated solution
3) saturated solution
4) super saturated solution
5)solubility of the substance
6)molal concentration
7)molar concentration
8)percentage concentration

2. Answer the following questions

1) How can you get crystals from a saturated solution?
2) How to prepare a 15% solution from a 75% solution and water (0%)?
3) How to prepare a 25% solution from a 50% solution and 10% solution?

3. Complete the passage below and then translate it into Chinese.

Any solution consists of a dissolved substance called the ________and the ________ through which the solute is uniformly distributed as _________or _________. This medium being commonly know as the ________. However, it is not always easy to determine which of the substance is the ________and which the ________. Usually the component, which in the pure form has the same physical state as the solution itself, is considered the ________. If both components possess the same _________out of solution, the component present in large quantity is the_________.

1-B Reading Material

Solutions

Solutions play a very important part in life and in the practical activities of man. Suffice it to mention that the processes of food assimilation by man and animals involve the dissolving of nutritious substances. All the most important physiological liquids (blood, lymph, etc.) are solutions. Finally, all industrial processes based on chemical processes are connected more or less with the use of various solutions.

Having daily to deal with solutions, men long since took an interest in their properties, but the fundamental relationships governing their behavior were established only in the Eighteenth Century.

Lomonosov investigated the influence of the temperature on the dissolving of various substances, thermal phenomena taking place when substances dissolve, the freezing of solutions, crystallization phenomena etc. He established that the act of dissolving is always accompanied by an energy effect, and in this connection indicated the necessity of distinguishing strictly between two types: a) processes of dissolving during which heat is released, such as when metals are dissolved in acids, which is essentially a chemical reaction between the acid and the metal, since evaporation of the solution does not lead to deposition of the initial metal, but of its salt with the acid used; b) processes of dissolving during which heat is absorbed , such as the dissolving of a salt in water, where-upon the solute undergoes no chemical change, but is deposited as the same substance when the solutions evaporated.

A solution is a solid or liquid homogeneous system consisting of two or more components, the relative quantities of which may vary over quite a wide range. The most important are liquid solutions.

Any solution consists of a dissolved substance called the solute and the medium through which the solute is uniformly distributed as molecules or as ions, this medium being commonly known as the solvent. However it is not always easy to determine which of the substances is the solvent and which the solute. Usually the component, which in the pure form has the same physical state as the solution itself, is considered the solvent (for instance, in the case of an aqueous solution of a salt the solvent is, of course, water). If both components possess the same physical state out of solution (for instance, alcohol and water), the component present in greater quantity is the solvent.

The homogeneity of solutions makes them very similar to chemical compounds. Ten homogeneity of heat observed when some substances are dissolved also indicates that a certain chemical reaction takes place between the solvent and the solute. The difference between solutions and chemical compounds is that the composition of the latter is constant, while the composition of a solution prepared from any given components may sometimes vary over quite a wide range. Besides, many properties of the separate components can be detected among the properties of the solution, which is not the case with chemical compounds. The inconstancy of the composition of solutions approaches them to mechanical mixtures, but they differ sharply from the latter by their homogeneity, Thus, solutions are intermediate between mechanical mixtures and chemical compounds .

(selected from N.GLINKA, chemistry, Moscow, 1960, 210)

Unit 2

2-A TEXT

Acids, Bases and Salts

All acids contain hydrogen. In a dilute water solution, the hydrogen can be set free by certain metals. The chemical action is a case of replacement because the hydrogen of the acid is replaced by the metal. Some other substances, like sugar, also contain hydrogen, but since it can not be replaced by metals, they are not acids. Water solutions of all acids have a peculiar sour taste, and all turn a certain natural dye, called litmus, from blue to red.

Another characteristic of acids is their rapid reaction with certain compounds known as bases. A base is the hydroxides of a metal or of a metallic radical. Sodium and potassium hydroxides are typical bases, which may be prepared by the electrolysis of the chloride solution. Their water solutions turn red litmus blue and neutralize acids.

When solutions of a base and of an acid are brought together in just the right proportions, the characteristic properties of each disappear. It is evident that there has been a chemical change. The base and the acid are said to neutralize each other, and the process is called neutralization. To determine just when the right amount of acid has been used to neutralize a given amount of base, we use litmus or some other indicator like phenolphthalein.

By the reaction of sodium hydroxide and hydrochloric acid, sodium chloride (common salt) and water have been formed. The sodium chloride is soluble in water and therefore can be obtained only by evaporation. The equation for this important reaction is:

$$\underset{\text{sodium hydroxide}}{\overset{\text{base}}{NaOH}} + \underset{\text{hydrochloric acid}}{\overset{\text{acid}}{HCl}} \longrightarrow \underset{\text{sodium chloride}}{\overset{\text{salt}}{NaCl}} + \underset{\text{water}}{\overset{\text{water}}{H_2O}}$$

Sodium chloride is an example of a large and important group of compounds known as salts. The process of neutralization always produces a salt and water. It should be noted that the metal of the base and the non-hydrogen part of the acid are united in the salt. The compounds that are formed when a metal takes the place of the hydrogen in an acid are called salts.

In naming bases, we simply prefix the name of the metal to the word "hydroxide". Thus we have sodium hydroxide (NaOH), calcium hydroxide ($Ca(OH)_2$), aluminum (aluminium) hydroxide ($Al(OH)_3$).

In naming acids, we must distinguish between an acid consisting of two elements (a binary acid) and an acid consisting of three elements (a ternary acid). In the binary acid we have put one element beside hydrogen; here we prefix hydro—to the name of the second element and add the termination-ic. Thus we have hydrochloric acid (HCl) and hydrosulfuric acid (H_2S). The large majority of ternary acids contain oxygen as the third element. It often happens that the same three elements form more than one acid. The most familiar one is named from the characteristic element and ends in suffix-ic; while the one with less oxygen has a similar name, but the ending is the suffix –ous. Thus we have sulfuric acid (H_2SO_4) and sulfurous acid (H_2SO_3); chloric acid ($HClO_3$) and chlorous acid ($HClO_2$); also nitric acid (HNO_3) and nitrous acid (HNO_2).

In naming a salt, we have to consider very carefully the acid from which it has been derived. If the acid is binary, then the salt is named after its two constituent elements with the ending—ide. Thus we have sodium chloride (NaCl), zinc chloride ($ZnCl_2$), and copper sulfide (CuS). If the acid is ternary and its name ends in -ic, then the name of the salt ends in -ate; but if the ternary acid ends in -ous, then the name of the salt ends in -ite. This will be made clear in the following examples.

Name of Acid	Formula	Name of Salt	Formula
Hydrochloric	HCl	Sodium chloride	$NaCl$
Chloric	$HClO_3$	Sodium chlorate	$NaClO_3$
Chlorous	$HClO_2$	Sodium chlorite	$NaClO_2$
Sulfuric	H_2SO_4	Copper sulfate	$CuSO_4$
Sulfurous	H_2SO_3	Potassium sulfite	K_2SO_3
Hydrosulfuric	H_2S	Zinc sulfide	ZnS
Nitric	HNO_3	Potassium nitrate	KNO_3
Nitrous	HNO_2	Sodium nitrite	$NaNO_2$

With acids like sulfuric and sulfurous that have two replaceable hydrogen atoms, we can have salts in which only one of the hydrogen atom is replaced by a metal. Such salt are sometimes called acid salts, and the prefix bi-employed in naming them. Thus, sodium bisulfate ($NaHSO_4$), sodium bisulfite ($NaHSO_3$), sodium bicarbonate ($NaHCO_3$), are examples.

new words and expressions

dye	[dai]	n.	染料，染色
litmus	['litməs]	n.	石蕊
hydroxide	[hai'drɔksaid]	n.	氢氧化物
radical	['rædikəl]	a.	基本的，基的，原子团的
sodium	['səudjəm]	n.	钠
electrolysis	[ilek'trɔlisis]	n.	电解，慢蚀
neutralize	['nju:trəlaiz]	v.	使中立，中立化，使中和
indicator	['indikeitə]	n.	指示剂，指示物
phenolphthalein	[ˌfinɔl'fθæli:n]	n.	酚酞
hydrochloric	[ˌhaidrəu'klɔ:rik]	a.	氢氯的
calcium	['kælsiəm]	n.	钙
aluminium	[ˌælju:'minjəm]	n.	铝
binary	['bainəri]	a.	二元的，二进制的
ternary	['tə:nəri]	a.	三元的，三重的

termination	[ˌtə:miˈneiʃən]	n.	结束，终点，词尾
hydrosulfuric	[haidrəusʌlˈfjuərik]	a.	氢硫的
sulfuric	[sʌlˈfjuərik]	a.	（正）硫的
sulfurous	[ˈsʌlfərəs]	a.	亚硫的
chloric	[ˈklɔ:rik]	a.	氯的．（含五价氯的）
chlorous	[ˈklɔ:rəs]	a.	亚氯的．（含三价氯的）
nitric	[ˈnaitrik]	a.	含氮的（含五价氮的）
nitrous	[ˈnaitrəs]	a.	亚硝（酸）的.（含三价氮的）
zinc	[ziŋk]	n.	锌
copper	[ˈkɔpə]	n.	铜
sulfide	[ˈsʌlfaid]	n.	硫化物
bisulfate	[baiˈsʌlfeit]	n.	酸性硫酸盐
bisulfite	[ˌbaiˈsʌlfait]	n.	酸性亚硫酸盐
bicarbonate	[baiˈkɑ:bənit]	n.	酸性碳酸盐，碳酸氢盐

Exercises

1. General speaking, what are the characteristics of all acids in dilute water solution?

2. What is the so-called "salt"?

3. Translate the last three paragraphs of the text into Chinese.

4. Naming the following compounds in English (including acids , bases &salts)

$NaCl$	$NaOH$	$HCl(g)$	$HCl(L)$	$HClO_3$	$HClO_2$
$HClO$	H_2SO_4	H_2SO_3	$CaCl_2$	$AlCl_3$	CuS
ZnS	Na_2SO_4	Na_2SO_3	$Al(OH)_3$,	$Ca(OH)_2$	K_2SO_4
K_2SO_3	$CuCl_2$	Na_2CO_3	$NaHCO_3$	$NaHSO_4$	$NaHSO_3$,
$CuSO_4$	$NaClO$	$KClO_4$	CaO	Na_2O_2	$NaNO_3$
KNO_3	$NaNO_2$,	KNO_2	HNO_3	HNO_2	H_2CO_3
$H_2S_2O_3$	$Na_2S_2O_3$	$H_2S(g)$	$H_2S(L)$	Al_2O_3	FeO
Fe_2O_3	CaC	K_2MnO_4	$KMnO_4$	Na_2CrO_4	NH_3
KCr_2O_7	$HCLO_4$				

2-B Reading Material

Introduction of Organic Acids

Formic acid, HCOOH and acetic acid , CH_3COOH , are the first two members of an homologous series known as the fatty acid series. The name arises from the fact that two of the higher members — palmitic and stearic acids — are prepared from animal fats . All the acids of the series, except the first, may be represented by the general formula RCOOH; formic acid has a hydrogen atom instead of alkyl group. The carboxyl group $-\overset{O}{\overset{\|}{C}}-OH$ is characteristic of organic acid.

The hydrogen atom of the carboxyl group is acidic; dilute water solutions of organic acid color blue litmus red, evolve hydrogen when acted on by metals, and are neutralized by metallic hydroxides forming salts. In terms of the electrolytic theory of dissociation we write the ionic equilibrium as follows: $RCOOH \rightleftharpoons RCOO^- + H^+$

Most organic acids are relatively weak, that is, the degree of the dissociation even in dilute solution is small. For example, in a tenth normal solution of acetic acid, only a few per cent of the molecules are dissociated. However, the organic acids are strong enough to displace the very weak carbonic acid from its salts.

The salts of the fatty acids are non-volatile, crystalline solids and are usually soluble in water. The acids are prepared from them by treating with sulfuric acid. If the acid is sufficiently volatile, it may be distilled. In this case, the dry salt and concentrated sulfuric acid are employed. The higher acids that distill only at high temperatures are more readily obtained from their salts by adding the mineral acid to an aqueous solution and extracting with ether. The organic acid, but not the salt, is soluble in the ether layer. This is an excellent illustration of the use of an immiscible solvent in separating an organic substance (the acid) from an aqueous solution containing inorganic material (Na_2SO_4). The ether is easily removed by evaporation.

The first member of the homologous series occurs in nature, particularly in nettles and ants (formica). The irritating effect of ant stings is due in part to formic acid. The early chemists prepared formic acid by distilling red ants. The acid is a colorless liquid boiling at 101℃; it cannot be freed from water by simple distillation. The anhydrous acid is prepared by distillation from anhydrous copper sulfate under diminished pressure. It is also prepared from the simple substance carbon monoxide (from water gas) and sodium hydroxide , under the pressure of 6—10 atmospheres and the temperature of 200℃.

$$CO + NaOH \longrightarrow HCOONa$$

Then the salt is heated with the calculated quantity of sulfuric acid.

The most important of all the simple acids is acetic acid. One meets with it commonly in two forms—concentrated acetic acid (often called glacial acetic acid) and a dilute solution of the acid known as vinegar. It is interesting that two entirely different processes are used for preparing acetic acid according to whether a very dilute solution (vinegar) is wanted or at least a 50 per cent solution of the acid.

Vinegar is still prepared by the ancient process in which fruit juices are allowed to undergo first the alcoholic fermentation, and then an acetic acid fermentation. A dilute solution of alcohol is produced by the alcoholic fermentation of wine or cider. In the presence of a certain microorganism bacterium aceti (often called "mother of vinegar"), oxygen from the air oxidizes the alcohol to acetic acid. This change is undoubtedly brought about by an enzyme present in the organism.

For chemical purposes, a concentrated acetic acid is required. This is not prepared by concentrating a crude vinegar, because the evaporation of so much water is an expensive operation. At one time the more concentrated solutions of acetic acid were obtained solely from the by-products of the destructive distillation of wood. It well be recalled that in this process acetic