高等学校教材

分析化学专业英语

ENGLISH FOR ANALYTICAL CHEMISTRY

夏之宁　等编著

化学工业出版社

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·北京·

本书是分析化学专业英语教材，书中课文与阅读材料皆选自英文原版书刊。课文以分析化学（包括化学分析、仪器分析、环境分析、生物分析、化学计量学、计算机在分析化学中的应用等）内容为主干，辅以趣味性较强的化学概述（包括化学史、分析化学史、化学文献介绍等）和分析化学内容介绍等阅读材料。课文注释全部采用英文，并附有不同形式的练习，全书配有双解形式生词和专业单词432个；另外，书末还附有进一步阅读文章的出处以及39种英文期刊的介绍及500个配合课文学习的专业单词。

本书可作为化学专业本科三年级以上学生和研究生的分析专业英语教材，同时，也可作为研究所及厂矿企业分析化学专业人员英语学习之用。

图书在版编目（CIP）数据

分析化学专业英语/夏之宁等编著.—北京：化学工业出版社，2012.7

高等学校教材

ISBN 978-7-122-14291-7

Ⅰ.分… Ⅱ.夏… Ⅲ.分析化学-英语-高等学校-教材 Ⅳ.H31

中国版本图书馆CIP数据核字（2012）第094442号

责任编辑：杜进祥　　　　文字编辑：向　东
责任校对：宋　玮　　　　装帧设计：韩　飞

出版发行：化学工业出版社（北京市东城区青年湖南街13号　邮政编码100011）
印　　装：三河市延风印装厂
787mm×1092mm　1/16　印张10　字数254千字　2012年9月北京第1版第1次印刷

购书咨询：010-64518888（传真：010-64519686）　售后服务：010-64518899
网　　址：http://www.cip.com.cn
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定　　价：25.00元

前 言

本书是分析化学专业英语教材，共有 18 课。书中课文与阅读材料皆选自英文原版书刊。课文以分析化学（包括化学分析、仪器分析、环境分析、生物分析、化学计量学、计算机在分析化学中的应用等）内容为主干。阅读材料为趣味性较强的化学概述（包括化学史、分析化学史、化学文献介绍等）和分析化学内容介绍。课文注释全部采用英文。课文与阅读材料后附有不同形式的练习。课文和阅读材料共选出生词和专业单词 432 个，采用了双解，供学习时参考。另外，我们从《分析化学辞典》中选出了 500 个配合课文学习的专业单词放在本书附录中，熟记这些单词，对于强化阅读和翻译分析化学英语资料有一定帮助作用。书末附录还有进一步阅读文章的出处以及 39 种英文期刊的介绍。这些都有助于读者更好地掌握分析化学专业相关内容。建议课堂教学时间为 36～72 学时，自学以集中时间学习完整一课全部内容为好。

本书可作为化学专业本科三年级以上学生和研究生的分析专业英语教材，同时，也可作为研究所及厂矿企业分析化学专业人员英语学习之用。通过本书的学习可以达到：（1）尽快从基础英语的学习过渡到专业英语中，了解科技英语、特别是分析化学英文文章的结构和特点，掌握一定的专业词汇并掌握科技外语的翻译技巧。（2）力求拓宽学生的视野，以对化学史、分析化学史有所了解。同时巩固已学过的分析化学各方面的知识，提高学习化学各科的兴趣。

本书在编写过程中，重庆大学化学化工学院和外国语学院的彭静、冯巨澜、陈华、陈刚、杨丰庆、陈慰、陈玉婷等教师与研究生参加了编写工作，赵红教授、徐溢教授曾参与 1998 年讲义的部分编写，肖尚友、陈华参与了 2006 年讲义的部分编写，杨丰庆、穆小静参与了 2010 年讲义的部分编写,在此表示感谢。

由于水平有限，书中一定存在不足之处，望广大读者批评指正。

夏之宁

2012 年 4 月于重庆大学虎溪校区

Contents

LESSON ONE

The Basic Tasks in Analytical Chemistry

Analytical chemistry has bounds which are amongst the widest of any technological discipline. An analyst must be able to design, carry out, and interpret his measurements within the context of the fundamental technological problem with which he is presented. The selection and utilization of suitable chemical procedures requires a wide knowledge of chemistry, whilst familiarity with and the ability to operate a varied range of instruments is essential. Finally, an analyst must have a sound knowledge of the statistical treatment of experiment data to enable him to gauge the meaning and reliability of the results that he obtains.

When an examination is restricted to the identification of one or more constituents of a sample, it is known as *qualitative analysis*, while an examination to determine how much of a particular species is present constitutes a *quantitative analysis*. Sometimes information concerning the spatial arrangement of atoms in a molecule or crystalline compound is required or confirmation of the presence or position of certain organic functional groups is sought[1]. Such examinations are described as *structural analysis* and they may be considered as more detailed forms of analysis. Any species that are the subjects of either qualitative and quantitative analysis are known as *analytes*.

There is much in common between the techniques and methods used in qualitative and quantitative analysis. In both cases, a sample is prepared for some analysis by physical and chemical 'conditioning', and then a measurement of some property related to the analyte is made. It is in the degree of control over the relation between a measurement and the amount of analyte present that the major difference lies[2]. For a qualitative analysis it is sufficient to be able to apply a test which has a known sensitivity limit so that negative and positive results may be seen in the right perspective. Where a quantitative analysis is made, however, the relation between measurement and analyte must obey a strict and measurable proportionality; only then can the amount of analyte in the sample be derived from the measurement. To maintain this proportionality it is generally essential that all reactions used in the preparation of a sample for measurement are controlled and reproducible and that the conditions of measurement remain constant for all similar measurements[3]. A premium is also placed upon careful calibration of the methods used in a quantitative analysis[4]. These aspects of chemical analysis are a major preoccupation of the analyst.

Chemical analysis is an indispensable servant of modern technology whilst it partly depends on that modern technology for its operation. The two have in fact developed hand in hand. From the earliest days of quantitative chemistry in the latter part of the eighteenth century, chemical analysis has provided an important basis for chemical development[5]. For example, the combustion studies of La Voisier and atomic theory proposed by Dalton had their bases in quantitative analytical evidence. The transistor provides a more recent example of an invention which would have been almost impossible to develop without sensitive and accurate chemical analysis. This example is particularly interesting as it illustrates the synergic development that is so frequently observed in differing fields. Having underpinned the development of the transistor, analytical instrumentation now makes extremely wide use of it. In modern technology, it is impossible to overestimate the importance of analysis. Some of the major areas of application are listed below.

(a) Fundamental Research

The fist steps in unravelling the details of an unknown system frequently involve the identification of its constituents by quantitative chemical analysis. Follow up investigations usually require structural information and quantitative measurements. This pattern appears in such diverse areas as the formulation of new drugs, the examination of meteorites, and studies on the results of heavy ion bombardment by nuclear physicists.

(b) Product Development

The design and development of a new product will often depend upon establishing a link between its chemical composition and its physical properties or performance. Typical examples are the development of alloys and of polymer composites.

(c) Product Quality Control

Most manufacturing industries require a uniform product quality. To ensure that this requirement is met, both raw materials and finished products are subjected to extensive chemical analysis. On the one hand, the necessary constituents must be kept at the optimum levels, while on the other impurities such as poisons in foodstuffs must be kept below the maximum allowed by law.

(d) Monitoring and Control of Pollutants

Residual heavy metals and organo-chlorine pesticides represent two well known pollution problems. Sensitive and accurate analysis is required to enable the distribution and level of a pollutant in the environment to be assessed and routine chemical analysis is important in the control of industrial effluents.

(e) Assay

In commercial dealings with raw materials ores, the value of the ore is set by its metal content. Large amounts of material are often involved, so that taken overall small differences in concentration can be of considerable commercial significance. Accurate and reliable chemical analysis is thus essential.

(f) Medical and Clinical Studies

The level of various elements and compounds in body fluids are important indicators of physiological disorders. A high sugar content in urine indicating a diabetic condition and lead in blood are probably the most well-known examples.

Words and Vocabulary

1. amongst	prep. 在…中间; surrounded by; in the middle of
2. gauge	vt. 精确计量; measure accurately
3. qualitative	a. 定性的; relating to quality

4. quantitative a. 定量的; relating to quantity
5. calibration n. 校正; action of calibrating, the act of checking or adjusting
6. synergic a. 协作的，协同的; cooperative, to work in coordination with
7. fundamental a. 基本的，基础的; of a foundation, serving as a starting point
8. meteorite n. 陨石; fallen meteor, meteoric stone
9. bombardment n. 轰炸，轰击; attacking with shells from big guns
10. polymer n. 聚合物; a compound whose chemical part built up from a number of simple ones of the same kind.
11. optimum n. (形容用法)最佳的，最优的; best or most favorable
12. pollutant n. 污染物; a substance or thing that pollutes
13. assess v. 评定，评价…; decide or fix the amount of...
14. significance n. 意义，重要性; meaning, importance
15. physiologic a. 生理学的, (尤指)动物生理学; of science of the normal functions of living things, esp. animals
16. diabetic a. 糖尿病的; of diabetes

Notes

1. Sometimes the analysts need acquire the information about the spatial arrangement of atoms in a molecule or crystalline, or try to confirm whether certain organic functional groups exit and what's their position.

2. The major difference between qualitative and quantitative analysis lies in the degree of control over the relation between a measurement and the amount of analyte present.

3. In order to keep this proportionality, all reactions used in the preparation of a sample for measurement must be controlled and can be reproduced, and the conditions of measurement must not change when similar measurements are made.

4. The acquisition of optimal value also depends on the careful adjustment of the methods which are used in a quantitative analysis.

5. Quantitative chemistry began in the latter part of the 18th century, and from then on, chemical analysis has played a very important and basic role in chemical development.

Exercises

A. Answer the following questions according to the passage.

1. Please try to explain *qualitative analysis*, *quantitative analysis*, and *structural analysis*.

2. What are the common points between the techniques and methods used in qualitative and quantitative analysis?

3. What's the major difference between qualitative analysis and quantitative analysis?

4. What major aspects of analytical chemistry are the focuses of an analyst based on the text?

5. Please talk about the applications of analytical chemistry in some major areas listed in the text.

B. Choose the best answer for each of the following.

1. According to the passage, which of the following analytical methods belongs to the analytical chemistry?_____

A. Commercial analysis

B. Digital analysis

C. Scattchard analysis

D. Structural analysis

2. Which of the following statements is NOT mentioned in the passage?_____

A. An analyst must be able to design and carry out experiment independently

B. Analytical chemistry consists of chemistry analytical and instrument analytical

C. Analytical chemistry could be used for production of medicine and monitoring of pollutants

D. When operating the similar measurements, the conditions of measurement must remain constant

3. As an analyst, how can he obtain the correct and credible experimental results?_____

A. He must possess a sound knowledge of the statistical treatment of experiment data

B. He must familiarize himself with various instruments and be capable of operating them

C. He must possess a sound knowledge of analytical chemistry

D. He must have the ability to apply the methods of sensitive and accurate analysis

4. The author takes transistor as example to show that_____.

A. Modern technology promotes the development of analytical chemistry

B. The development of modern technology and analytical chemistry mutually reinforce each other

C. The development of modern technology depends upon analytical chemistry

D. Modern technology is the basis of analytical chemistry

5. According to the passage, which of the following statements is NOT true?_____

A. Poisonous substances in food must be kept below the maximum allowed by law

B. Structural analysis can be considered as more detailed forms of analysis

C. measurement and analyte must follow a strict proportion in a qualitative analysis

D. Chemical analysis plays an important role in the control of industrial effluents

6. According to the passage, which of the following options does NOT belong to the application of analytical Chemistry?_____

A. Detection of physiological indicators

B. Structural Health Monitoring

C. Heavy ion bombardment

D. Food quality control

Reading Material

The Origins of Chemistry

The word "chemistry" comes from "alchemy". Two different sources have been proposed for the latter term: (1) the Greek *cheo*, meaning "I pour" or "I cast", referring to an activity of metal workers who were the originators of alchemy; (2) *khem*, the ancient name for Egypt, thus reflecting the Egyptian origin of alchemy. During the Arabic period the prefix *al* was added. When chemistry later developed into an independent science, the prefix was dropped.

The origins of alchemy are indefinite, but took place in Egypt and Middle East, and probably also in China and India independently. It developed among artisans such as metal workers, who wanted to record their knowledge without revealing trade secrets. Hence early alchemical writings were a confusing mixture of practical observations mysticism, and are clouded in symbolism and allegory. Alchemy began to be a formal subject in the first century A.D. at the hands of Greek scholars in Alexandria.

Earlier Greek philosophers naturally dabbled in the subject. Because they scorned manual labor they did no experimentation, but they speculated freely. (Does not this make them forerunners of today's theoretical chemists?) Democritus will be mentioned when the Kinetic Theory is discussed. Aristotle (384—322 B.C.) suggested that all things are made of the four elements: air, fire, water and earth. He also proposed that all elements can be interchanged with one another, and from this came the idea that base metals can be transmuted into gold.

After the rise of Islam the Arabs spread alchemy to western Europe in the 12th century through Spain and Italy. To the four elements of Aristotle they added three principals: mercury, sulfur, and salt. In Europe during the late Middle Ages alchemy concentrated on two goals: to turn base metals into gold, and later to find the philosopher's stone. This stone would accomplish the transmutation of the elements, and was also the elixir of life. We know now that these goals were hopeless, but alchemy left an important heritage. One aspect was a collection of techniques and instruments: furnaces, stills, flasks, water baths, and beakers. The most symbolic to us are the retort and the alembic. Alchemical signs are also part of this inheritance.

Another interesting residue is term "hermetically sealed." The Egyptian god Thoth was the god of magic and science. The Greeks identified him as their god Hermes, and called him Hermes Trismegistos ("Hermes thrice greatest"). Alchemists adopted the latter as patron, and frequently placed a seal bearing a likeness of Hermes on containers of samples they had prepared. From this came the term "hermetically sealed," which we now use to mean airtight.

A few famous alchemists will be mentioned. Avicenna (980—1037) was born in what is now Iraq. He was an infant prodigy who could recite the entire Koran by age ten. Avicenna became a noted Persian physician who also wrote on alchemy. He was one of the few alchemists who thought transmutation impossible.

Albertus Magnus (1193—1280) was a German scholar whose real name was Albert, Count von Böllstädt, but who was later called Albert the Great because of his learning. He was particularly interested in botany, but did much more, including alchemy. For example he used nitric acid to separate gold from silver. He insisted on the value of personal observation. Arsenic was described so clearly that he is sometimes given credit for its discovery, although it was probably known to earlier alchemists, at least in impure form. He also compiled a list of hundreds of minerals. Pope Pius XI canonized him in 1931.

Paracelsus(1493—1541) was a Swiss physician and alchemist. His real name was the wonderful Theophrastus Bombast von Hohenheim, but he modestly took the name Paracelsus, meaning "better than Celsus." (Celsus was a Roman physician whose translated writings hand recently appeared and excited much interest.) Paracelsus was eccentric and quarrelsome and made many enemies. However he initiated the beginning of the transition from alchemy to chemistry. He decided that the purpose of alchemy was not to transmute metals, but to prepare medicines. He thus founded *iatrochemistry*, the chemistry of medicines. He was particularly interested in the medicinal use of minerals and metallic compounds, and unfortunately prescribed the use of mercury and arsenic derivatives for his patients even after they were known to be toxic. He was the first to use tincture of opium in medicine, and called it laudanum. He was also the first to describe zinc, although its use was known long before in the alloy brass.

Georgius Agricola (1494—1555) was originally Georg Bauer, but Latinized his name as was then the fashion. (Both Bauer and Agricola mean "farmer.") He was a German physician who became interested in mining and minerals, and who became wealthy from shrewd mining investments. His chief work was the famous book "De Re Metallica," which was published a year after his death. Hebert Hoover, later President of the United States, and his wife made a notable translation of it from the Latin in 1912. Agricola's book was one of the first treatises on applied chemistry. In it he summarized the practical knowledge of the Saxon miners, using clear writing and numerous excellent illustration. It earned him the designation "father of mineralogy."

Robert Boyle (1627—1691) believed in transmutation into gold, but was more instrumental in transmuting alchemy into chemistry. In 1661 he published "The Sceptical Chemist." In it he insisted on the need for experimental observation rather than intuition; he defined elements in their modern sense; and he removed chemistry from medicine and made it a separate science. He was a remarkable man and did much more, including playing a key role in founding the Royal Society. His tombstone in Dublin bears the inscription "Father of Chemistry and Uncle of the Earl of Cork."

Hermann Boerhaave (1668—1738) was a Dutch teacher at the University of Leiden who worked primarily in medicine, but also in chemistry and biology. Because students published notes from his lectures on chemistry without his permission, he wrote "Elemente Chemiae' in 1732. It was translated into English, French, German, and Russian, and became the most influential of the early textbooks on chemistry. Boerhaave believed in the possibility of transmutation. He was also a man of exceptional patience and persistence, for he kept some mercury heated for fifteen years to see whether any change would occur! He distilled another sample of mercury over 500 times to see whether its volatility would alter.

Words and Vocabulary

1. alchemy — n. 点金术; chemistry of the Middle Ages, the chief aim of which was to discover how to change ordinary metals into gold
2. allegory — n. 寓言; story or description in which ideas such as patience, purity and truth are symbolized by persons who are characters in the story

3. dabble in (at) v. 涉猎，业余性地研究; engage in, study as a hobby, not professionally
4. forerunner n. 先锋，先驱; person who foretells and prepares for the coming of another
5. elixir n. (中古时期科学家所制) 炼金液，长生不老药; proparation by medieval scientists hoped to change metals into gold to prolong life indefinitely
6. alembic n. 蒸馏罐
7. residue n. 剩余物; that which remains after a part is taken or used
8. prodigy n. 不凡之人，天才; person who has unusual or remarkable abilities
9. eccentric a. (指人或其举动)古怪的; (of a person, or his behavior) peculiar, not normal
10. quarrelsome a. 急躁的，爱争吵的; quick-tempered, fond of quarrels
11. tincture n. 酊剂; medical substance dissolved in alcohol
12. intuition n. 直觉; (power of) the immediate understanding of something without conscious reasoning or study
13. persistence n. 坚持，固执，持续; refusing to make any change in (what one is doing, one's beliefs, etc.)
14. volatility n. 挥发性; (of liquid) character that easily changes into gas or vapour
15. alter vt. 改变; change

Further Discussion

1. Please talk about the origin of chemistry in China, and its position in the world chemical history.

2. What are the contributions of ancient Chinese chemists to social development?

3. What are the contributions of alchemy which are of referential value to the metallurgy of other metals?

LESSON TWO

Problems and Solution in Analytical Chemistry

The solutions of all analytical problems, both qualitative and quantitative, follow the same basic pattern. This may be described under six general headings.

Choice of Method

The selection of the method of analysis is a vital step in the solution of an analytical problem. A choice cannot be made until the overall problem is defined, and where possible a decision should be taken by the client and the analyst in consultation[1]. Inevitably, in the method selected, a compromise has to be reached between the sensitivity, precision and accuracy desired of the results and the costs involved. For example, X-ray fluorescence spectrometry may provide rapid but rather imprecise quantitative results in a trace element problem. Atomic absorption spectrophotometry, on the other hand, will supply more precise data, but at the expense of more time consuming chemical manipulations.

Sampling

Correct sampling is the cornerstone of reliable analysis. The analyst must decide in conjunction with his technological colleagues how, where, and when a sample should be taken so as to be truly representative of the parameter that is to be measured.[2]

Preliminary Sample Treatment

For quantitative analysis, the amount of sample taken is usually measured by mass or volume. Where a homogeneous sample already exists, it may be subdivided without further treatment. With many solids such as ores, however, crushing and mixing are a prior requirement. The sample often needs additional preparation for analysis, such as drying, ignition and dissolution.

Separations

A large proportion of analytical measurements are subject interference from other constituents of the sample. Newer methods increasingly employ instrumental techniques to distinguish between analyte and interference signals. However, such distinction is not always possible and sometimes a selective chemical reaction can be used to mask the interference. If this approach fails, the separation of the analyte from the interfering component will become necessary. Where quantitative measurements are to be made, separations must also be quantitative or give a known recovery of the analyte[3].

Final Measurement

This step is often the quickest and easiest of the six but can only be as reliable as the preceding stages. The fundamental necessity is a known proportionality between the magnitude of the measurement and the amount of analyte present. A wide variety of parameters may be measured (Table 2.1).

Table 2.1 A general classification of important analytical methods

GROUP	PROPERTY MEASURED
gravimetric	weight of pure analyte or of a stoichiometric compound containing it
volumetric	volume of standard reagent solution reacting with the analyte
spectrometric	intensity of electromagnetic radiation emitted or absorbed by the analyte
electrochemical	electrical properties of analyte solutions
radiochemical	intensity of nuclear radiations emitted by the analyte
mass spectrometric	abundance of molecular fragments derived from the analyte
chromatographic	physico-chemical properties of individual analytes after separation

The Assessment of Results

Results obtained from an analysis must be assessed by the appropriate statistical methods and their meaning considered in the light of the original problem.

It is common to find analytical methods classified as *classical* or *instrumental*, the former comprising 'wet chemical' methods such as gravimetry and titrimetry. Such a classification is historically derived and largely artificial as there is no fundamental difference between the methods in the two groups[4]. All involve the correlation of a physical measurement with the analyte concentration. Indeed, very few analytical methods are entirely instrumental, and most involve chemical manipulations prior to the instrumental measurement. A more satisfactory general classification is achieved in terms of the physical parameter that is measured (Table 2.1).

There is constant development and change in the techniques and methods of analytical chemistry. Better instrument design and a fuller understanding of the mechanics of analytical processes enable steady improvements to be made in sensitivity, precision, and accuracy. These same changes contribute to more economic analysis as they frequently lead to the elimination of time-consuming separation steps. The ultimate development in this direction is a non-destructive method, which not only saves time but leaves the sample unchanged for further examination or processing.

The automation of analysis, sometimes with the aid of laboratory robots, has become increasingly important. For example, it enables a series of bench analyses to be carried out more rapidly and efficiently, and with better precision, while in the cases continuous monitoring of an analyte in a production process is possible. Two of the most important developments in recent years have been the incorporation of microprocessor control into analytical instruments and their interfacing with micro- and minicomputers. The microprocessor has brought improved instrument control, performance and, through the ability to monitor the condition of component parts, easier routine maintenance. Operation by relatively inexperienced personnel can be facilitated by simple interactive keypad dialogues including the storage and re-call of standard methods, report generation and diagnostic testing of the system. Microcomputers with sophisticated data handling and graphics software packages have likewise made a considerable impact on the collection, storage, processing, enhancement and interpretation of analytical data[5]. Laboratory Information and Management Systems (LIMS), for the automatic logging of large numbers of samples, Chemometrics, which involve computerized and often sophisticated statistical analysis of data, and Expert Systems, which provide interactive computerized guidance and assessments in the solving of analytical problems, have all become important in optimizing chemical analysis and maximizing the information it provides.

Analytical problems continue to arise in new forms. Demands for analysis at 'long range' by instrument packages steadily increase. Space probes, 'borehole logging' and deep sea studies exemplify these requirements. In other fields, such as environmental and clinical studies, there is increasing recognition of the importance of the exact chemical form of an element in a sample rather than the mere level of its presence[6]. Two well-known examples are the much greater toxicity of organo-lead and organo-mercury compounds compared with their inorganic counterparts. An identification and determination of the element in a specific chemical form presents the analysis with some of his more difficult problems.

Words and Vocabulary

1. fluorescence　n. 荧光（性）；property that a substance has of emitting light while being exposed to light or some other radiation of a shorter wavelength.
2. manipulation　n. 操作，操纵；operation, handling, with skill

3. cornerstone	n. 基石，(比喻) 基础; stone that forms a corner of the foundation of a building, (fig.) foundation
4. reliable	a. 可靠的，可信赖的; that may be depended upon
5. homogeneous	a. 同类的，同质的，均质的; of the same kind
6. ignition	n. 点火，燃烧; setting on fire
7. constituent	n. 成分，组成; component part
8. distinction	n. 不同之点，差别之处; point of difference
9. component	n. 部分; part
10. stoichiometric	a. 化学计量的，理想配比的; concerned with, involving, or having the exact proportions for a particular chemical reaction
11. appropriate	a. 合适的; right or suitable
12. gravimetry	n. 重量分析 (法); the measurement of specific gravity
13. titrimetry	n. 滴定分析 (法); measurement or analysis by titration, titration is the process of gradually adjusting the dose of a medication until the desired effect is achieved.
14. derive	vt. 起源，源出; have as a starting point, or origin
15. elimination	n. 消灭，剔除，淘汰; removing, taking away, getting rid of
16. facilitate	vt. 使…容易，减轻…困难; make easy, lessen the difficulty of
17. dialogue	n. 对话; conversation or talk
18. sophisticate	a. 复杂的; complicated
19. assessment	n. 评估; assessing
20. toxicity	n. 毒性; quality or degree of being toxic

Notes

1. The choice of method of analysis can only be taken when the whole problem is clearly shown and that where it is possible to make a decision by the client and the analyst in consultation is known.

2. In order to truly represent the parameter that is to be measured, the analyst must decide, together with his technological colleagues, how, where, and when a sample should be taken.

3. In some cases where quantitative measurements are to be made, separations must also be quantitative, or a known recovery of an analyte must be given.

4. The classification between classical and instrumental methods gradually forms in the history and is artificial to a large extent, therefore there's no essential difference between the two methods in the two groups.

5. Microcomputers which have complex data processing and graphics software packages are also important to the collection, storage, processing, enhancement and interpretation of analytical data.

6. In other fields, such as environmental and clinical studies, the importance of the exact chemical form of an element in a sample, not the mere level of its presence, has gained increasing recognition.