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Research Paper

Analysis and Evaluation of Chemical and Technological Process Examination in the National Paper Ⅱ of China

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Abstract: *A detailed analysis on chemical and technological process tests in the national comprehensive science paper Ⅱ of the college entrance examination for the past five years of China has been carried out in this article. The frequency and direction of the tests have been investigated and the changing tendency of the tests have been diagnosed. Combined with the examination syllabus of China for the college entrance examination, the assigning rules of this type of questions have been exposed for the recent questions. It is found that the obtained conclusions will provide some important reference information for middle school teachers in teaching and teaching research.*

Key words *National Comprehensive Science, College Entrance Examination Paper Ⅱ of China, Chemical and Technological Process Tests, Analysis and Evaluation*

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I. INTRODUCTION

Chemical and technological process questions have become one of the most popular ones in the national comprehensive science papers of college entrance examinations of China with distinctive features. The questions are more related to the actual life of the students, highlighting that the purpose of chemistry is a source of life and service. Such topic enhances the practicality of chemistry knowledge, which not only requires students to master the knowledge, but also to understand the principles in depth, moreover to expand the application with the comprehensive application of knowledge and skills [1]. With the help of this type of question, you can check whether the students really integrate this knowledge and whether they can use knowledge to solve some practical problems creatively in theory and practice. The chemical and technological process questions is the product of the industrial mode for the factory, which is connected to the students' lives. It is not a delicate laboratory operation process, and moreover it is based on the core concept of green chemistry to achieve the safety of raw material, energy saving, environmental protection and product recycling. And also the atom utilization rate of the reactant is high and economical. Chemical and technological process questions come from the life and the selection of materials is novel. At the same time, they are also related to the knowledge points the students have learned. Most of them are based on the industrial production[2]. In terms of the topics, new substances and new materials have received so much attention. The inference analysis and innovative application in unfamiliar situations are operation purpose for the students. Zitian Hong et al. have made a deep interpretation on the technological process questions of the chemistry experiments according to the 2019 National Comprehensive Test Paper Ⅰ. And they have studied the characteristics of the proposition and summarized the five key steps in answering the experimental questions[1]. Xiaofan Gong et al. have found the differences and provided the preparation strategies on the 2017 College Entrance Examination Chemistry Exam and some suggestions were made for the relevant preparations[3]. Haiyu Yu et al. have pointed out the method on solving the process problems of college entrance examination chemistry[4]. Pengcheng Zhang et al. have elaborated the strategies on solving problem of the process questions deeply[5]. Yaorong Du et al. have comprehensively analyzed the tests combined with the proposition experience in the chemistry simulation proposition competition on Shenzhen college entrance examinationand and the obtained conclusions were effectively fed back to the teaching[6], which will provide an important reference for the simulation tests and review preparation. Although the current research on this type of problem is relatively scarce, there are few reports on the analysis of chemical and technological process questions in the national volume II for China. Therefore, in this paper we have summarized some methods and strategies for solving the chemical and technological process questions throughout investigating and analysising the national volume II in the past

five years, which will bring an important reference for the education of middle school teachers in China.

II. TESTS AND ANALYSIS

Chemical and technological process questions are mainly composed of three parts including the text explanation, the flow chart and the question. The types can be divided into the operation process class, substance conversion class and comprehensive process class. Generally the proportion in the comprehensive test paper is stable and the scores are between 13 and 15 points. It is based on the production problems of comprehensive chemical experiments in industry and involves the related knowledge of process flow and related operations, instruments, drugs, reaction processes, energy and organic chemical reactions [4]. These questions are based on the actual industrial production and the basic knowledge of chemistry learned in high school, and are adapted on this basis. The topics that can test students' basic knowledge and independent thinking ability can be used to mobilize students. The enthusiasm of learning is to pay more attention to scientific inquiry and innovative consciousness for the students. The process questions for the past five years have mainly focused on the preparation of substances and the quantitative determination of an element in the sample, especially the preparation of substances has become a hot topic in process questions[2]. The content of the examination includes the redox reactions, elements and their compounds, electrochemistry, basic operations of substance preparation, chemical titration analysis, etc. Specially, writing chemical reaction equations, ion equations, and performing quantitative calculations are based on the basic knowledge of redox reactions. Describing the reaction phenomenon, identifying the composition of each component in the entire process, adding related reagents, separating and purifying the substances, impurity removing and exhausting gas treatment should take qualitative and quantitative research. In these steps mastering the test site is just the first one. After grasping the general direction of the process tests, we must tap the knowledge and skills accumulated in the usual time, understand the relevant knowledge points, conduct in-depth research and analysis, and learn to integrate and achieve inferences.

Table 1 The propositions of synthesis process tests for the national paper Ⅱ in the past five years

Year	Question number	Score	Stem background	Test center
2015	12	6	Comprehensive development and utilization of seawater	The nature of halogen, redox reaction, crude salt purification, sea water extraction, choice of precipitant, tail gas treatment, etc.
	28	15	Preparation of chlorine dioxide	Oxidation-reduction reaction, writing of ion reaction equation, determination of ions in solution, reagent selection, impurity removal, chemical titration analysis, quantitative calculation, etc.
2016	36	15	Preparation of hydrogen peroxide by anthraquinone method	Writing of chemical reaction and ion reaction equations, solute judgment, selection of extractant, quantitative calculation, etc.
2017	26	14	Determination of calcium content in cement samples	The writing of chemical equations, the properties of acids and ammonia, the composition of precipitation components, the calculation of mass fractions, etc.
2018	26	14	Preparation of metallic zinc from sphalerite	Chemical reaction, ion reaction, writing of electrode reaction equation, chemical properties of common metals and non-metals and their compounds, electrochemistry, impurity removal, etc.
2019	26	13	Preparation of lithopone $ZnS•BaSO_4$ with barite ($BaSO_4$) as raw material	Redox reaction equation writing, flame reaction, chemical titration analysis, etc.

The chemistry part of the unified examination syllabus for ordinary college admissions in 2017 has undergone great change with deleting the chemistry and life and selecting chemistry and technology. The test only retains the structure and nature of the substance with organic chemistry. This means that the comprehensive inorganic test ones in the mandatory questions, especially the comprehensive difficulty for the process tests will increase and the examination will be more difficult, implying the selectivity increasing of the college entrance examination. The structure, type, test angle and process flow of the selected questions in this part of chemistry and technology are similar to each other. Compared with other questions, they are more difficult and less differentiated. They have no characteristics and have a low score rate. The proportion of students in selecting chemistry and technology is relatively low. The optional questions of chemistry and technology include not only basic experimental operations such as the preparation and identification of substances that are usually used, but also reaction devices and professional terms that are relatively unfamiliar to high school students, such as

decomposition kettle, distillation tower, acid leaching, hydrothermal treatment, surface treatment, etc., which can make it difficult for students to acquire knowledge from the question stems, causing the students' fearing. Removing this part of the question conforms to the new curriculum standards, which is conducive to the selection of talents in colleges.

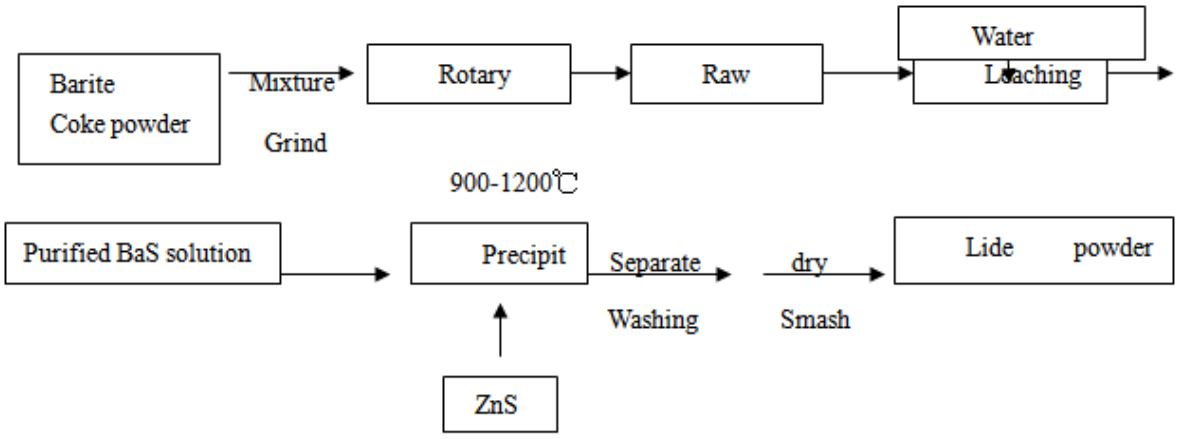
The study of 2019 process flow questions is of great reference for the preparation of the 2020 college entrance examination. The following is a detailed analysis of the 26th question in the process flow of preparing barite powder $ZnS•BaSO_4$ from barite ($BaSO_4$) as raw material, as follows Said in 2019.

[National Volume] 26. (13 points) Lide powder $ZnS•BaSO_4$ (also known as zinc barium white) is a commonly used white pigment. Answer the following questions:

(1) The principle of flame color reaction can be used to make colorful holiday fireworks and qualitatively identify certain metal salts. When burning the lithopone sample, the flame color of barium is _____ (filling in the label).

A. Yellow B. Red C. Purple D. Green

(2) Using barite ($BaSO_4$) as raw material, lithopone powder can be produced according to the following process:



① In the rotary furnace, barite is reduced to soluble barium sulfide by excess coke. The chemical equation of this process is _____. Rotary furnace tail gas contains toxic gas, which can be converted into CO_2 and a clean energy gas by steam shift reaction in production. The chemical equation of this reaction is _____.

② "Returning raw materials" placed in moist air for a long time will escape the smell of rotten eggs, and the water solubility becomes poor. The reason is that the surface of the "returning raw materials" produces insoluble _____ (filling chemical formula).

③The ion equation of the reaction in the precipitator is _____.

(3) The content of S^{2-} in the finished product can be measured by the "iodometric method". Weigh the g sample, place it in an iodine flask, transfer 25.00 mL of 0.1000mol•L^{-1} I_2-KI solution to it, and add acetic acid solution, which is sealed and react in a dark place for 5 min. Elemental sulfur precipitates. Using starch as an indicator, excess I_2 is titrated with the solution of 0.1000mol•L^{-1} $Na_2S_2O_3$, the reaction formula is_____, The solution $Na_2S_2O_3$ was consumed in V mL during the measurement. The color change in the end is _____, and the content of S^{2-} in the sample is _____ (write the expression).

Analysis: This question belongs to the single-line production process question (from raw materials to product "one-stop" production, adding reagents in the process to achieve the effect of separation and purification). The following information should be obtained when reading the dry text materials: (1) Select raw materials ——Barite ($BaSO_4$); (2) Target product—Lide powder ($ZnS•BaSO_4$); Questions that should be considered when reading the flow chart: (1) Why the raw material may be returned; (2) what is the product and which chemical reaction has occurred; (3) what the role of adding reagents are?

(1) Belonging to the problem of memorization, examine the concept of flame color reaction and the color of common metals. The flame color reaction refers to the reaction of certain metals or their compounds when the flame shows a special color when it is burned in a colorless flame. The burning color of element Na is yellow. The burning color of element Li is purplish red. The burning color of element K is light purple. The burning color of element Ba is yellow and green.

(2) Analysis of Flow chart. Barite ($BaSO_4$) is used as raw material to react with coke. After mixing and

grinding, the reaction is carried out in a rotary furnace at 900-1200℃. According to the chemical properties of coke, it can be known that an oxidation-reduction reaction has occurred. Combined with the problem, we can see that the reduction product is soluble barium sulfide (BaS), and the coke is oxidized into toxic gas CO, so the chemical reaction equation is

$$BaSO_4 + 4C = BaS + 4CO\uparrow$$

The coke produces carbon monoxide in excess, and carbon monoxide reacts with water vapor to produce CO_2. And a clean energy gas (Lenovo hydrogen) produced, so the chemical reaction equation is

$$CO + H_2O = CO_2 + H_2$$

According to the flow chart and the title, long-term "returning raw materials" placed in humid air will escape the smell of rotten eggs Gas, and the water solubility becomes poor. It can be known that the raw material (BaS) will react with water and carbon dioxide in humid air to generate a gas (H_2S) containing the smell of rotten eggs. According to the reaction principle from strong acid to weak acid, the product is known as $BaCO_3$ and H_2S in this step, students may not think of the principle from strong acid to weak acid for a moment. It can be understood as follows. The raw material (BaS) first reacts with water to generate hydrogen sulfide, and the chemical reaction equation is folowing.

$$BaS + 2H_2O = H_2S + Ba(OH)_2$$

Barium hydroxide will react with carbon dioxide in the air to produce barium carbonate ($BaCO_3$) and the water solubility becomes poor. And the problem can be solved by rigorous thinking. The chemical reaction that occurs in the precipitator is that Barium sulfide (BaS) is added with zinc sulfate ($ZnSO_4$) to undergo a metahesis reaction. After separation, washing, drying, and crushing, and the target product lithopone ($ZnS\bullet BaSO_4$) is written. The chemical reaction equation is written firstly.

$$BaS + ZnSO_4 = ZnS\bullet BaSO_4 \downarrow$$

Barium sulfide and zinc sulfate are soluble strong electrolytes, and the product is precipitated, not ionizable. Then it is converted into ion reaction equation.

$$S^{2-} + Ba^{2+} + Zn^{2+} + SO^{2-} = ZnS\cdot BaSO_4\downarrow$$

Question (2) includes two sub-questions. The points examined are mainly how to give chemical reaction equations based on the question and the flow chart. First of all, we must know the physical and chemical properties of coke, carbon monoxide, barium carbonate and other substances. The nature should correspond to it. For example, the clean energy mentioned in the title stems from the hydrogen, methane, etc. We usually learn the gas with the smell of rotten eggs H_2S, SO_2, and then according to the specific analysis what is the kind of substance. Finally, we must answer the questions when writing the ion reaction equation, and we must pay attention to the fact that the sparingly soluble substances, insoluble substances, weak electrolytes and other substances are not split, and the core focuses on the principles of atomic conservation and electronic conservation. The difficulty of the whole question is not great, and the flowchart is not complicated. After reading the question carefully, it is easy to make the coupling with the knowledge accumulated in the usual time. It is a question with a high score rate for the process flow question as long as the basic knowledge. Read the question solidly and conscientiously. The process question pays attention to the student's comprehensive thinking ability of reading information on the spot and solves the problem. Each part of the single-line process question is connected with each other and has a joint effect. The core develops all reactions and operations. When we read the information, it is necessary to combine flowcharts and questions to control the reaction process from a macro perspective, but there is no need to push out every substance, combine inside and outside, and analyze while thinking from easy to difficult. We can achieve the method of solving this problem skillfully.

(3) It is related to the calculation of sulfide in products by iodometric method and describes the color change phenomenon at the titration end point. Iodometry is a redox titration based on the determination of the oxidizability of I_2 and the reducibility of I^-. It is the most common titration analysis method. In the course of studying in high school, there is little exposure to titration analysis, but the basic principles of the iodometric method can also be analyzed through the knowledge given in the title. It can be known from the description section of the title. The compounds containing sulfur will react with I_2-KI and will be precipitated as elemental sulfur after being oxidized. We use starch as an indicator, and the excess of I_2 will react with sodium thiosulfate to obtain finished products S^{2-}content. The iodine element will be mixed with starch to form a blue color. During the reaction between the iodine element and sodium thiosulfate, as the reaction progresses, the iodine element will gradually decrease, so the phenomenon of the titration end point should be from light blue to colorless. Through the analysis of the reaction just now, the amount of sodium thiosulfate-consuming substances can be calculated to know the amount of iodine substances, and then derive the content of divalent sulfur anions. According to the oxidation-reduction reaction, the conservation of gain and loss of electrons and the rise and fall of the valence are listed as equal. The solution is as follows:

$$S^{2-} + I_2 = S + 2I^- \qquad I_2 + 2S_2O_3^{2-} = 2I^- + S_4O_6^{2-}$$

$$S^{2-} \sim I_2 \qquad 2S_2O_3^{2-} \sim I_2$$

1mol 1mol 2mol 1mol

N mol N mol $0.1V\times10^{-3}$ $\frac{1}{2}\times0.1V\times10^{-3}$

The amount of iodine substance reacting with sulfur ions is: $25\times0.1\times10^{-3}-\frac{1}{2}\times0.1V\times10^{-3}$

Therefore, the content of S^{2-} in the sample is

$$\frac{(25.00-\frac{1}{2}V)\times0.1000\times32}{m\times1000}\times100\%$$

Question (3) is more difficult from a student's point of view, but this kind of question can often test the students' mastery of knowledge, test students' ability of analyzing and solveing the problems in unfamiliar situations and tap students' learning potential. When finishing a question, you must combine the question and the text information of the question. Throughout reading the question carefully, you can get a lot of important information. For example, the chemical reaction mechanism was given in the question-iodination reaction. We can analyze it whether it has a chemical valence increasing or decreasing. It is found that electron transfer and migration has occurred. At this time, we must connect with the redox reaction we have learned and use the knowledge we have mastered to solve the problem step by step as well as rational analysis. The quantitative analysis methods involved in previous college entrance examination questions are thermogravimetric analysis, titration, precipitation, Kjeldahl method and gas volume measurement. Generally the problems reflected by students during learning process include the calculation of chemical reaction equations, which is more difficult, but in the final analysis, the reaction principle can be not completely understood. The calculation involved in the oxidation-reduction reaction can be related to the gain and loss of electrons and the specific solution method can be based on the chemical reaction equation. In the examination, when encountering such difficult questions, it is necessary to analyze them firstly. The information in the questions provided by someone is very critical and maybe establish a substantial relationship with the knowledge in the original cognitive structure.

III. FREQUENCY OF QUESTIONS

The subjective chemistry questions of the college entrance examination are mainly composed of the experiments, comprehensive inorganic chemical process, chemical reaction principles, material structures and properties. Among them, the comprehensive inorganic chemical process has 14 scores, accounting for about one tenth of all the chemistry tests. From this view, the process is one of the very important questions. This content is also what the students must master. Through the analysis of the process questions in the national volume I and the national volume II in the past five years, the frequency of these problems can be obtained as:

$$A = \frac{8}{10}*100\% = 80\%$$

It is very likely that the process questions will appear again in the 2020 comprehensive chemistry tests of college entrance examination. Therefore, we must master these kinds of questions, make reasonable suggestions for preparing for the exam and explain these kinds of questions as the most difficult points in ordinary teaching. There should be also a moderate increase in job placement.

Table 2 Questions about the process flow

Year	National Volume I	National Volume Ⅱ
2019	✔	✔
2018	✔	✔
2017	✘	✔
2016	✔	✘
2015	✔	✔

Note: The frequency of the process flow tests only selects the mandatory questions, and the selected questions are not within the scope of this statistic. Because of the difficulty in selecting the questions, the proportion of students who choose to take the test is low every year, and in 2017, it is clearly stipulated that the part of the test-Chemistry and Technology will be deleted.

IV. SOLVING PROBLEM STRATEGIES

Technological process questions are novel there are few blank questions. But the question is very difficult, the score is high and the calculation work are so much. The knowledge points involved are also very diverse. To deal with this kind of questions, you need to master some skills and methods, closely follow the process and clarify the product. The role of various chemical reagents is different in the preparation.

The basic flow of process questions is as follows. Firstly, the raw materials will be pretreated, such as grinding, water immersion, acid leaching, etc. and then the chemical reaction will be separated and purified to obtain the target product. During the reaction, attention must be paid to control the reaction conditions and the recycling of intermediate products to save costs. The basic process is shown in Figure 1.

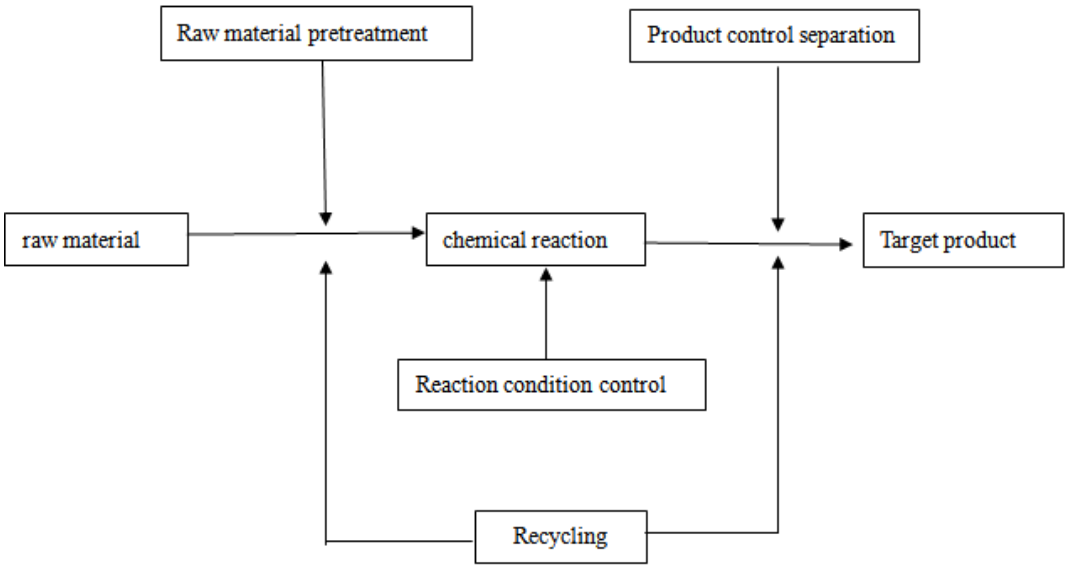


Figure 1 The basic process

The main sources of the two products of the process flow tests are: (1) Separate and purify a substance from the mixture. Separate and purify the target product from a cheap and easily available raw material because the purity of the raw material is not high and it is necessary to remove impurities. To produce a production line, consider the problems of cost and workload, and seek the best method; (2) Use the properties of certain substances to prepare another target product. The target product has a certain relationship with raw materials, which can be passed through a series of chemical reaction and operation acquisition, considering the recycling of mother liquor, the recycling of heat, the recovery of impurities to maximize the benefits. The analysis process flow chart is the key to solving the entire problem. If you encounter a relatively unfamiliar and complicated flow chart, you should grasp the whole process macroscopically, and then analyze the details for specific problems. You can divide them into the selection of reagents and the separation of impurities according to the operation process of each part. Separation and purification of products, common hot issues and other four parts are elaborated.

Questions can be asked first: (1) What are the reactants and products of each step? (2) What happened ? According to the relationship between the feed and the product, it is estimated which type of reaction (usually redox reaction), different reactions use different reagents at the same time, combined with the flow chart and problem information to select the appropriate reagent, the next product and the previous step. It is necessary to deduce reagents for the chain reaction of reactants, and to grasp the types and functions of commonly used reagents and related chemical reactions.

Table 3 Types and functions of common reagents and related chemical reactions

Category	Common reagents	Role or answer consideration angle
Oxidant	$KMnO_4$, $HNON_3$, Thick H_2SO_4, Fe^{3+}, O_2（air）, H_2O_2, $KrCr_2O_7$, Cl_2	Purify by removing impurities after oxidizing a substance
Reducing agent	SO_2, SO_3^{2-}, I^-, Fe^{2+}, Active metal element, H_2O_2	After reducing a certain substance, removing impurities and purifying
Acid	H_2SO_4, HCl, HNO_3 etc.	Dissolve or remove a substance

Alkali	$NaOH$, $NH_3 \cdot H_2O$ etc.	Dissolve or remove a substance

In addition to the above methods of using oxidants, reducing agents and acid leaching, impurities can also be converted into precipitates and separated, and the pH value can be controlled to separate and remove impurities. Use $NaOH$, H_2SO_4 and other substances to adjust the pH value of the solution, and select a precipitant to convert some impurity metal ions into hydroxide precipitates. The following table shows the common metal ion precipitation pH values.

Table 4 Precipitation pH of some metal ions

Chemical formula	K_{sp}	When precipitation begins pH（The initial concentration is 0.01mol/L）	pH at complete precipitation (residual ion concentration $<10^{-5}$mol/L）
$Fe(OH)_3$	3.2×10^{-38}	2.3	4.1
$Fe(OH)_2$	1×10^{-15}	7.5	9.7
$Al(OH)_3$	1.3×10^{-33}	4.0	5.2
$Cr(OH)_3$	6.3×10^{-31}	4.9	6.8
$Mn(OH)_2$	1.1×10^{-13}	8.8	10.4

The optimal pH value is selected by combining the pH value of the product and the impurities, which not only allows the impurities to be precipitated in the form of precipitation and then directly filtered, but also can improve the utilization rate without losing the product. The problem may give a removing metal ion impurities. At this time, pay attention to the information provided, calculate the ion concentration according to the solubility product table or special reaction, and control the pH value. In order not to introduce new impurities, the pH value is adjusted to precipitate a certain ion. Metal carbonates and metal oxides are usually selected[3]. Common operations for separation and purification of substances include filtration, liquid separation, extraction, distillation, recrystallization, burning, etc. The purpose and instruments commonly used are shown in Table 5.

Table 5 Common substance separation and purification operations

Common operations	Purpose and commonly used instruments
filter	Add a certain reagent, and then consider whether it needs to be filtered after the precipitation occurs. The separation of solid and liquid, the separation of filtrate and filter residue, which is filtered while hot to prevent the solution from cooling and crystal precipitation, and some reagents will deteriorate when the temperature drops Unable to filter.
	Filter paper, funnel, glass rod, vacuum suction filter, etc.
liquid separation extraction	Separation of two immiscible liquids; The operation of transferring the solute from one solvent to another by using the difference of the solubility or partition coefficient of the substance in two incompatible solvents.
	Separation funnel, iron stand, iron ring, common extractants are: toluene, methylene chloride, gasoline, ether, carbon tetrachloride, etc.
distillation	The boiling point of each component in the mixed liquid or liquid-solid system is different, so that the low boiling point component is evaporated, and then condensed to separate the entire component of the unit operation process (evaporation + condensation).
	Distillation flask, condenser, conical flask, iron stand, alcohol lamp, thermometer, etc.
recrystallization	After dissolving the crystals in the solvent or melting, the process of recrystallization from the solution or melt is the further purification of the crude product without chemical changes. Recrystallization can be the purification of impure substances, or the separation of mixed salts from each other.
	Evaporating dish, alcohol lamp, glass rod, beaker, funnel, filter paper, iron stand, etc.
burning	The operation of heating the solid matter to a high temperature to achieve the purposes of dehydration, decomposition or removal of volatile impurities, and burning off organic matter. Burning in chemical experiments usually removes organic matter and ammonium salt from the sample.
	Crucible, crucible tongs, alcohol lamp, asbestos net, iron stand, etc.

V. HOT ISSUES

The hot issues of process questions are as follows:

(1) Writing of strange ion reaction equation

Write oxidants, reducing agents, oxidation products and reduction products according to the title information and element chemical properties.

a. The basic law of redox needs to be used to predict whether products coexist;

b. Write into the form of ion reaction according to the splitting rules of ion reaction;

c. Use the balance method, the cross method, to first balance the atoms whose valence changes, and then use the ions in the environment to balance the charge conservation. For example, there are a large number of hydrogen ions in acidic solutions, a large number of hydroxide ions in alkaline solutions, and exposure to air may Will react with oxygen, carbon dioxide, etc.;

d. Reuse substances and can not change the valence to balance the conservation of atoms except O and H atoms, and finally use water to balance the conservation of O and H atoms;

(2) Operation process for obtaining crystals/solids from solution: evaporation-concentration-cooling crystallization-filtration washing and drying, etc.

(3) Obtain a substance without crystallization water from the substance containing crystallization water, consider whether the substance hydrolyzes during heating, if it is hydrolyzed, add corresponding substances to inhibit the hydrolysis;

(4) Check whether the precipitation is completely precipitated: if a small amount of supernatant is added dropwise to a solution, if there is no specific phenomenon (such as precipitation, color change, etc.), the precipitation is complete;

(5) Reasons for adding NaCl in a certain step: reduce the solubility of the target product to facilitate product precipitation;

(6) The topic requires that the temperature is controlled within a range for the following reasons:

a. To prevent a substance in the reaction from volatilization or decomposition due to excessive temperature;

b. Prevent the occurrence of side reactions;

c. If a catalyst is added, temperature control is to maximize the activity of the catalyst;

d. Make the chemical reaction balance move; control the direction of the chemical reaction;

e. Heating and boiling is to promote hydrolysis, and it is easier to separate and filter after settling.

VI. TREND OF THE FUTURE

Technological process tests are closely connected with real life, organic combination of knowledge and skills, novel topics, more flexible, large amount of thinking, and strong comprehensiveness. Analysis of the test sites and question background of the national Ⅱ process process tests in the past five years can be inferred. Examination of the process flow appearing in the textbook is almost non-existent, but the topic is not built on the "air pavilion", and does not leave the textbook, but takes the process flow in the textbook as a prototype, combined with the product manufacturing carried out in production and life. The design of the tests penetrates the chemical properties of metal elements and compounds, non-metal elements and compounds, involving the chemical properties of novel substances. The propositioners also test the ability of analogical reasoning and logical reasoning to transfer the knowledge of element compounds that we have learned. Ingeniously we embody the thought of applying knowledge in the setting of questions, and the proportion of calculation questions decreases, and the test basic knowledge, skills, operation and expression skills increase accordingly. The test sites for questions have both inheritance and innovation that keep pace with the times. Under the background of the new curriculum reform, more emphasis is placed on students' learning ability, innovative spirit and practical ability, reflecting the core qualities of chemistry. Process tests also penetrate this requirement, which is the proposition direction of process tests in the next few years.

VII. CONCLUSIONS

Our main advices are that we must grasp the curriculum standards and examination outlines under the new curriculum reform from a view of macro field, and implement the specific teaching from a view of micro one. We must also prepare each class carefully.

(1) From a macro field, we should follow the course standards and exam outlines closely, arrange tthe

contents and carry out teaching activities. The curriculum standards under the new reform lead the teaching and stipulate the general direction of teaching. As for teachers, we should delve into the curriculum standards. The curriculum set standards for the development of students' academic literacy according to the nature and structure of the disciplines, and set up a variety of courses. Under the requirements of the exam outline for the candidates, the depth and breadth of the college entrance examination knowledge, we must pay attention to the annual college entrance examination syllabus changes, to prevent teaching from deviating from the correct track.

(2) From a micro field, we should refine the teaching implementation process so that the teaching process conforms to the teaching curriculum standards and meets the teaching requirements. Learning the basic knowledge of memorization is the most basic requirement, but looking at the questions and test points of the process questions in the comprehensive examination paper Ⅱ of the college entrance examination in the past five years, it is not enough for knowledge to stay at the level of memory and rote memorization. The topic is derived from life and comes from outside the textbook, but the principle is inside the textbook. It is very important to lay a solid foundation. At the same time, it is necessary to carry out the comprehensive application of knowledge and fine processing. Obviously, the process flow question is based on the textbook but higher than the textbook. This requires teachers to broaden their horizons in the process of teaching. Based on the textbook and understanding of basic knowledge, they should be elevated and expanded to ensure that after reaching the basic score, you can answer more difficult questions, have good habits in the usual practice, focus on consolidating the foundation, improve the ability moderately and improve the students' ability of solving problems.

(3) Stimulate our interest and give full play to subjective initiative. Technological process tests are the closest to real life, but students do not understand such questions as plain text or other non-application ones, and even miss important information without reading the questions carefully. Usually in the classroom, we should choose special training close to students' life or social hot issues. The application of real situations will improve the sensitivity and perception of such problems, enhance the authenticity of knowledge, and make students have a profound impression, to achieve a deep understanding. Through the guidance of teachers, students will have an interest in these kinds of topics and exert their subjective initiative, so that such learning can achieve good results with less effort.

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