

Comparison of The Main Features and The Chemistry Questions of University Entrance Examinations in China and Turkey

Çin ve Türkiyedeki Üniversite Giriş Sınavlarının Genel Özelliklerinin ve Kimya Sorularının Karşılaştırılması

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Abstract

China and Turkey are countries with different cultural, historical, and social contexts. However, there are some similar points in these countries' educational system. Each year, millions of secondary school students in these countries take the entrance exams, but limited number of them gains admission into the universities. This study aims to compare those countries' university entrance exams and chemistry questions in these exams according to some criteria such as exam applications, content, and question types. The data of study was collected by documentary review and analyzed by descriptive analysis. At the end of the study, it was determined that there are some differences in some aspects of university entrance exams, and chemistry questions in China are extremely comprehensive, and required high level chemistry knowledge. In the light of these results, some recommendations were presented for educators in Turkey.

Keywords: China, chemistry questions, comparative education, Turkey, university entrance examination,

Özet

Çin ve Türkiye farklı kültürel, tarihsel ve sosyal şartlara sahip ülkelerdir. Bununla birlikte, bu ülkelerin eğitim sistemlerinde bazı benzer noktalar mevcuttur. Her yıl bu ülkelerde yaşayan milyonlarca ortaöğretim öğrencisi üniversiteye giriş sınavına katılmakta, fakat sadece sınırlı sayıda öğrenci üniversitelere girmeyi başarabilmektedir. Bu çalışmada, iki ülkenin üniversite giriş sınavlarının ve bu sınavlarda sorulmuş olan kimya sorularının, sınav uygulamaları, içerik ve soru tipi gibi belli kriterlere göre karşılaştırılması amaçlanmaktadır. Çalışmanın verileri doküman incelemesi ile elde edilmiş olup, betimsel olarak analiz edilmiştir. Çalışmanın sonunda, iki ülkedeki üniversiteye giriş sınav sistemlerinin bazı yönlerinde farklılıklar olduğu, Çin de yapılan üniversite giriş sınavında yer alan kimya sorularının çok daha geniş kapsamlı ve daha üst düzey kimya bilgisi gerektirdiği belirlenmiştir. Bu sonuçlar ışığında, Türkiye'deki eğitimcilere bazı öneriler sunulmuştur.

Anahtar Kelimeler: Çin, kimya soruları, karşılaştırmalı eğitim, Türkiye, üniversite giriş sınavı

1. Introduction

In the light of developments in science and technology, the process of globalization and changes in the countries, societies' need changed. To satisfy these needs, the society that accept new knowledge acquisition as a life-style, and renovate itself continually, has become important (Sağlam, Özüdoğru & Çıray, 2011; Turan, 2005). In the process of increased competition between countries, the importance of educational institutions responsible for educating of qualified human increase to proceed in the fields of economy, politics, and technique in all developing countries (Delibaş & Babadoğan, 2009). For this reason, many developing countries struggle to develop all aspects of educational systems.

Science has an important role in the development of countries and economy, therefore countries give special importance to science in order to educate individuals who can generate knowledge and technology (Ayas, 1995; Ünal, Coştu & Karataş, 2004) Accordingly, during the last century a number of attempts have been made to improve the quality of science education. The majority of these initiatives are about changes in the development of new and established curriculum parallel to changes in society (Ayas, 1995; Baskan, Aydın & Madden, 2006). For this purpose, by examining the evaluation of curriculum and keeping up to date in the light of developments in the world has become mandatory. Recent years, educational policies and practices have increased tendency to effectively model the countries on these issues. For this reason, both in terms of international comparison of education and training systems in terms of policy changes are often made (Alexander, 2001).

Comparative education is a discipline which helps two or more of the education systems to identify similarities and differences in different cultures and different countries, also offers useful ways to educate people (Türkoğlu, 1985). In other words, comparative education is a research area in which current educational problems and their reasons are detected, and interpreted by stating similar factors in other societies (Lauwerys, Varış & Neff, 1979). In this respect, education politicians and administrators can benefit from the results of comparative education during decision-making process (King, 1979). The comparative education researches help understand the past and today, at the same time it plays an important role how to be the future's education system (Noah, 1984). Comparative educational studies have important roles on educational system since they provide educational practices from different countries. Comparative educational studies include many parts of educational system such as curriculum, teacher education programs, secondary education, higher education and entrance to higher education system. Countries' entrances of higher education system vary according to some criteria such as number of students who have completed secondary education, and student capacity. Particularly, there is a need for studies inves-

tigating similar entrance of higher education systems. In this context, it was thought that the comparison of university entrance examinations in China and Turkey provided opportunities to evaluate these systems for educators in these countries. Although some studies were conducted to compare university entrance examinations in Turkey with the other countries' exams, these countries' exams were not exactly equivalent with Turkey. In this sense, the comparison of Turkey and China that two countries have similar university entrance examinations, and similar criticisms about these examinations may contribute educators in two countries. Results of this study indicate that there are some different points between two countries' university entrance exams such as application, content, and types of questions. Particularly, it was determined that chemistry questions in China's university entrance exams are extremely comprehensive, and required high level chemistry knowledge.

When the comparative educational studies are examined, it is seen that mostly European countries or like USA, Canada, –developed countries- are often elected (Akpinar & Aydın, 2007; Aldemir, 2010; Güzel, 2010; Kilimci, 2006). In this respect, the comparison of educational systems of different countries from different continents will provide variant perspectives to educators. In addition, it was observed that such studies were mostly grouped under two main headings about educational systems. First group includes studies on teacher education programs. In these studies, Chemistry teacher education program in Turkey was compared with teacher education program in USA, France, and Switzerland (Nakipoğlu, 1999; Ergun, 2009, 2013a). Second group study is related to comparison of chemistry curriculum, and in this study, secondary school chemistry curriculum of various countries (USA, Canada, England, and Australian) are examined comparatively with Turkey (Aydın, 2006).

Another important part of educational systems of countries is entrance to higher education system. Countries' entrance of higher education system are based on some factors such as the number of students who have completed secondary education, higher education institutions' student capacity, and as a result of these factors, students' registrance of universities are varied (Ergun, 2013b; Gölpek & Uğurlugelen, 2013). While some countries like France, Switzerland, and Germany prefer secondary school-leaving examinations such as baccalaureate, and matriculation examination for entry of higher education, some countries such as China, Turkey, and Japan apply university entrance examinations.

Despite the importance of these exams on societies, there is limited study available in the literature. One study was conducted by Ergun (2013b). In this study, he compared university entrance exams in France, Switzerland, Turkey, and the chemistry questions asked in these exams. As a result of this study, it was found out similarities and differences among these countries in chemistry questions asked in access to university education exams. On the other hand, the university entrance exam in Turkey is not equivalent with the other countries' exams investigated in this study. Consequently, the study on comparison between the university education exam in Turkey and

its equivalent in other countries is needed.

China and Turkey have different cultural, historical, and social contexts, however, they have some similarities in educational systems. Multiplicity of population in China and Turkey leads to application of university entrance examinations in these countries. Each year, millions of high school students in China and Turkey sit the entrance exams, and limited number of them can be admitted to university. Also, these exams are only offered once a year in two countries, and most of the students only can take university according to these exams scores. This and similar reasons lead to criticisms of these examinations by educators in two countries. For example, many researchers stated that these examinations caused the pressure on students and family (Baştürk, 2011; Cüceloğlu, 1993; Dong, Yang & Ollendick, 1994; Dai, Chen & Davey, 2007; Davey & Higgins, 2005; Davey, Lian & Higgings, 2007). In addition, it was stated that there were similar pressure upon schools and teachers (Baştürk, 2011; Lewin & Xu, 1989; Zhuuqiong, 2005). In this context, it is thought that the comparison of university entrance examinations in these countries according to some criteria such as content, and application procedure is useful for Turkish, Chinese Educators and future research

Purpose of Study

The purpose of study is to compare China and Turkey's university entrance exams according to some criteria such as content, and exam application. Based on the purpose, two research questions are investigated:

1. What are the similarities and differences in university entrance exams that are applied in Turkey and China?
2. What are the similarities and differences about question types and content in terms of chemistry questions in the university entrance exam of Turkey and China?

2. Method

This study, which gives information about the methods and procedures used in different countries, is a comparative education study (Kandel, 1933; King, 1979). In this research, two different techniques as horizontal and definition were used. Horizontal technique was used to understand University Entrance Examination Systems in both Turkey and China (Türkoğlu, 1998). Definition technique was preferred to compare similarities and differences between University Entrance Examination Systems and chemistry questions which were used in University Entrance Examinations in these countries (Ültanır, 2000).

Data collection

The data of research was collected by documentary review. Document review is the investigation of collected written and visual materials which are relevant with incidents and phenomena of the research (Cohen, Manion & Morrison, 2007; Sönmez & Alacapınar, 2011). In this context, Secondary school chemistry curriculums and

chemistry questions in the university entrance exam of Turkey and China, theses, books and articles were used as a source of research data

Data analysis

The data obtained from the study were analyzed by descriptive analysis according to a comparative purpose. Based on the research questions, similarities and differences between these countries were combined, compared and contrasted.

3. Results

In this section, in the light of research problems, the university entrance exam system, and the chemistry questions in the university entrance exam of 2012 were examined, and presented similar and different points between these countries.

University Entrance Exams

While university entrance exams of two countries were compared, firstly, main features, content, schedule, assessment of exams, types and number of questions were discussed, after that, chemistry questions were examined. In the last stage, sample chemistry questions in these exams were analyzed.

Main Features of University Entrance Exams

The students who wish to enter college or university in China must take College Entrance Examination (CEE) which is called as Gaokao. CEE is only offered once a year, and CEE scores are main determinant of higher education admission for most of the students (Bai, Chi & Qian, 2013). The CEE has a two-level management model. While the Ministry of Education administers the policies on examinations, admissions and develops examination specification guidelines, local governments are related to administration of examinations by setting up examination sites, delivering the exam papers, marking, and reporting results (Liu, 1994; Davey, Lian & Higgings, 2007; NIEA, 2012). Also, college admission process in China includes some applications. One of application forms includes personal and family information, previous school attendance and educational achievement, a medical certificate, and moral-political assessment. This information belongs to each student is used to determine eligibility to enter the exam (Davey, Lian & Higgings, 2007). In addition, the students complete another application form, and they select the universities they wish to attend in this form. However, the time of application varies from province to province. For example, while the students file a college application before CEE results are published in some provinces like Beijing, Shanghai and Tianjin, some provinces like Jilin, Gansu, and Yunnan accept the students' college applications after receiving CEE results (Bai, Chi & Qian, 2013).

Students graduating from secondary school in Turkey must take a centralized two-stage university entrance examination to admit higher education. University entrance examinations are administered by the Student Selection and Placement Center (OSYM), affiliated with and supervised by The Higher Education Council (YÖK). The students gain access to

higher education based on secondary school grade point average and scores on the university entrance examinations. Transition to Higher Education Examination (YGS) is the first stage of university entrance system, and the students who pass the YGS could take Undergraduate Placement Examination (LYS) as a second stage of university entrance system. In the application procedure, the students submit their forms to secondary schools or ÖSYM Examination Centers throughout Turkey. This application form includes some questions such as birth date, birth place to identify the students. Also, there are some questions about secondary school the students has graduated from or is attending, as well as average grade at graduation and the year of graduation (URL-1). When this application was compared with China, it can be say that the application process in China is more complicated than Turkey. For example, moral-political assessment is not necessary in application process in Turkey. Similarly, a medical certificate is only necessary for some students have healthy problems. After the results of LYS are announced, the students select the universities they want to attend according to LYS scores. The time of process does not change throughout Turkey.

The Contents and Schedule of University Entrance Exams

The University Entrance Examination format can vary between provinces in China, however, '3 + X' examination system has been implemented in most parts of the country. The '3' represents three compulsory subjects required for all college applicants. These compulsory subjects are 'mathematics', 'Chinese', and 'foreign language (usually English)'. The 'X' component includes a combination of subject tests based on the students' selection of majors in college. For example, if the students pursue liberal arts in college, 'X' component includes history, politics, and geography. On the other hand, if the students pursue science and engineering in college, "X" component consists of, physics, chemistry, and biology (Bai, Chi & Qian, 2013; Davey, Lian, & Higgins, 2007; Liu & Wu, 2006; Wang, 2006). CEE exams are commonly administered in different sessions on June 7-8 each year throughout China (NIEA, 2012). Sample schedule of CEE was presented in Table 1.

Table 1. Schedule of CEE

Time	Date	
	June 7 th	June 8 th
09:00-11:30	Chinese	Liberal Arts/Science
15:00-17:00	Mathematics	Foreign Language

The University Entrance Examinations (YGS and LYS) has been implemented in the same format throughout Turkey. The students take YGS in March or April. YGS consists of four curriculum fields-Turkish, social sciences (history, geography, philosophy, religious education and ethics), mathematics, and science (physics, chemistry, and biology). All the students are expected to answer the items of these fields. LYS as a second stage of university entrance examinations consisted of five sessions- mathematics exam (LYS-1), science exam(LYS-2), literature- geography (LYS-3), social sciences (LYS-4, history, geography II, philosophy gro-

up, religious education and ethics), and foreign language (LYS-5). The LYS sessions take place in June, and the students whose one of the YGS scores is minimum 180 points can sit the LYS (OSYM, 2014). The students select LYS sessions according to their domain in secondary school. Sample schedule of YGS and LYS in 2014 was presented in Table 2.

Table 2. Schedule of YGS and LYS in 2014

Exams	Mount	Time
YGS	March 23 th	10:00-12:40
LYS1	June 15 th	10:00-12:15
LYS2	June 21 th	10:00-12:15
LYS3	June 22 th	10:00-12:00
LYS4	June 14 th	10:00-12:15
LYS5	June 15 th	14:30-16:30

Types and Number of Question

The CEE includes a series of subject oriented examinations based on curriculum knowledge. It is aimed to check the students' knowledge as well as academic abilities (NIEA, 2012). The CEE includes different question formats such as "multiple choice questions," "fill in the blanks" and "calculation", and "English speaking test" (Davey, Lian & Higgings, 2007; Liu, 1994; NIEA, 2012). The number of "multiple and non-multiple choice questions" for each subject, time limits, are presented in the Table 3.

Table 3. Numbers of Question formats and Exam Times in CEE

Subject	Number of multiple choice questions	Number of multiple choice questions	Exam time (min)
Chinese	10	11	150
Mathematics (Liberal Arts)	12	10	120
Mathematics (Science)	12	10	120
English (including listening)	75	11	120
English (not including listening)	65	21	120
Liberal Arts	35	5	150
Science	21	10	150

Similar to CEE, The University Entrance Examinations (YGS and LYS) in Turkey are based on curriculum knowledge. On the other hand, the one of the important differences between these exams is related to question formats. While all of the questions in YGS, and LYS are multiple-choice questions, CEE includes different types of question such as multiple-choice, and fill in the blanks. Also, listening is a part of English exam in CEE, however, foreign language (LYS-5) in Turkey does not include listening. The number of "multiple choice questions", exam time in YGS, and LYS, are presented in the Table 4, and Table 5.

Table 4. Numbers of Question, and Exam Time in YGS

Subject		Number of multiple choice questions	Exam time (min)
Turkish		40	
Social sciences	History	15	
	Geography	12	
	Philosophy	8	
	Religious education and ethics	5	160
Mathematics		40	
Science	Physics,	14	
	Chemistry	13	
	Biology	13	

Table 5. Numbers of Question, and Exam Time in LYS

Subject		Number of multiple choice questions	Exam time (min)
Mathematics Exam (LYS-1)	Mathematics	50	75
	Geometric	30	60
Science Exam(LYS-2)	Physics	30	45
	Chemistry	30	45
	Biology	30	45
Literature-Geography(LYS-3)	Turkish language and literature	56	85
	Geography-I	24	35
	History	44	65
Social sciences(LYS-4)	Geography II	14	20
	Philosophy group	24	
	Religious Education and Ethics	8	50
Foreign Language(LYS-5)		80	120

Assessment of Exams

In China, Provincial Education Authorities take responsibilities for review and marking examinations papers (NIEA, 2012) Since the CEE exams includes different types of questions, assessments of questions vary. For example, multiple-choice questions are marked through a computer program; however, the other types of questions like fill in the blanks require individual marking. For these type questions, two teacher are selected randomly and electronically, and these teachers assess the questions. If the score differences between the teachers' assessment is greater than five points, the student's paper is sent to a third teacher for the final score. The provincial education authorities check the whole process very closely, during the examination (Australian Education International [AEI], 2009) Most of the provinces in China, a maximum CEE score is 750 points, with 150 points for each compulsory subject test and 300 po-

ints for the “X” component (Bai, Chi & Qian, 2013). Exam results are reported within two to three weeks after the exam period (Davey, Lian & Higgings, 2007).

In Turkey, review and marking examinations papers was done by Student Selection and Placement Center (OSYM). A computer program is used to mark examinations papers because all questions in the exams are multiple-choice questions. For this reason, assessments of examinations papers are independent from teachers. Maximum scores in YGS, and LYS are 500 points. Mostly, exam results are reported within two to three weeks after the exams.

Chemistry Questions in University Entrance Exams

While two countries’ chemistry questions in university entrance exams are compared, firstly, the content, question format and cognitive domain levels of questions are presented. Later, sample chemistry question are examined. Table 6 shows the analyses of chemistry questions in CEE 2012 according to the content, cognitive domain levels, and question format. Similarly, Table 7, and 8 indicate the analyses of chemistry questions in YGS, and LYS 2012.

Table 6. Analyses of Chemistry Questions in CEE 2012

Question	The Content of Questions	Cognitive Domain	Level	Question Format
6	Chemical bonds	Knowledge		Multiple-choice question
7	Chemical reaction	Application		Multiple-choice question
8	Chemical equilibrium	Comprehension		Multiple-choice question
9	Velocity of chemical reaction	Analysis		Multiple-choice question
10	Atomic structure and elements	Application		Multiple-choice question
11	Electrochemical cells	Application		Multiple-choice question
12	Common inorganic elements and compounds and their applications	Application		Multiple-choice question
13	Components and structures of organic compounds	Analysis		Multiple-choice question
27	Chemical bonds and properties of substances	Application		Fill in the blanks
28	Experimental Chemistry	Application		Fill in the blanks
29	Separation of mixtures	Application		Fill in the blanks
30	Components and structures of organic compounds	Application		Fill in the blanks

From Table 6, it can be seen that chemistry questions in CEE 2012 were designed in two formats as multiple-choice and fill in the blanks questions. While multiple-choice questions were designed according to different cognitive domain levels such as knowledge, comprehension, application and analysis, all of fill in the blanks types questions were prepared according to application level. Within these questions, it was seen that application level questions (7 questions) were predominant. At the same time, when the content of questions were examined, it can be understood that the chemistry questions were coherent with the contents of compulsory (Chemistry I, II) and selective courses.

When Table 7 was examined, it was understood that chemistry questions in YGS were

mostly related to basic chemical knowledge, were coherent with the contents of 9th Grade Chemistry. All questions in YGS are multiple-choice questions, and these questions were designed according to different cognitive domain levels such as knowledge, comprehension, application and analysis. When these questions were examined considering cognitive domain levels, it was seen that comprehension level questions (5 questions) were predominant.

From Table 8, it can be seen that questions in LYS are related to high level chemical knowledge, and mostly include the contents of 10, 11, and 12th grade Chemistry. Also, it was determined that application level questions (11 questions) in LYS were predominant.

Table 7. Analyses of Chemistry Questions in YGS 2012

Questions	The Content of Questions	Cognitive Domain Level	Question Format
15	Chemical laws	Comprehension	Multiple-choice question
16	Heat-temperature	Comprehension	Multiple-choice question
17	Atomic structure	Comprehension	Multiple-choice question
18	Atomic structure	Application	Multiple-choice question
19	Chemical bonds	Comprehension	Multiple-choice question
20	Oxidation state	Analysis	Multiple-choice question
21	Types of Chemical Reactions	Knowledge	Multiple-choice question
22	Oxidation-reduction reaction	Analysis	Multiple-choice question
23	States of matter	Comprehension	Multiple-choice question
24	Solubility	Analysis	Multiple-choice question
25	Mixtures	Analysis	Multiple-choice question
26	Soap qualities	Knowledge	Multiple-choice question
27	Chemical bonds	Knowledge	Multiple-choice question

Table 8. Analyses of Chemistry Questions in LYS 2012

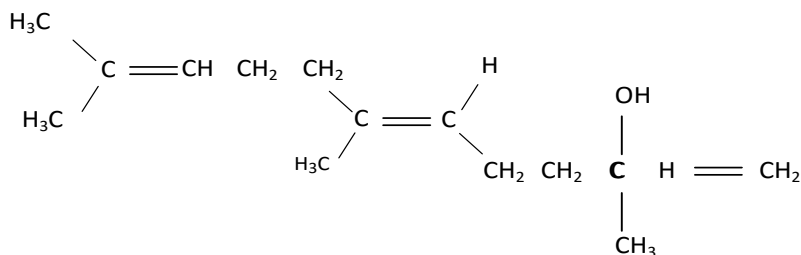
Questions	The Content of Questions	Cognitive Domain Level	Question Format
1	Atomic structure	Analysis	Multiple-choice question
2	Periodic table	Knowledge	Multiple-choice question
3	Atomic structure	Application	Multiple-choice question
4	Atomic structure	Comprehension	Multiple-choice question
5	Formulas of chemical compounds	Analysis	Multiple-choice question
6	Mole concept	Analysis	Multiple-choice question
7	Gases	Application	Multiple-choice question
8	Solutions	Application	Multiple-choice question
9	Solubility	Comprehension	Multiple-choice question
10	Atomic structure	Comprehension	Multiple-choice question
11	Heat-temperature	Application	Multiple-choice question
12	Thermodynamic	Knowledge	Multiple-choice question
13	Reaction rate	Analysis	Multiple-choice question
14	Chemical Equilibrium	Application	Multiple-choice question
15	Chemical Equilibrium	Application	Multiple-choice question

Questions	The Content of Questions	Cognitive Domain Level	Question Format
16	Chemical Equilibrium	Analysis	Multiple-choice question
17	Acids- bases	Comprehension	Multiple-choice question
18	Acids- bases	Application	Multiple-choice question
19	Electrochemistry	Application	Multiple-choice question
20	Radioactivity	Application	Multiple-choice question
21	Formulas of organic compounds	Comprehension	Multiple-choice question
22	Nomenclature of organic compounds	Comprehension	Multiple-choice question
23	Alcohols	Application	Multiple-choice question
24	Reactions of alkenes	Application	Multiple-choice question
25	Organic reactions	Knowledge	Multiple-choice question
26	Types of organic reactions	Comprehension	Multiple-choice question
27	Organic compounds	Comprehension	Multiple-choice question
28	Synthesis of alcohols	Comprehension	Multiple-choice question
29	Organic compounds	Analysis	Multiple-choice question
30	Optic isomerism	Knowledge	Multiple-choice question

Sample Chemistry Questions from CEE 2012

Figure 1. Sample chemistry question in CEE 2012 (Question 13)

Nerol alcohol has rose and apple fragrance, can be regarded as perfume, its simplified composition is as follows:



Which of the following statements about nerol alcohol is wrong?

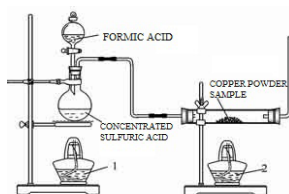
- Both substitution reaction and addition reaction can occur.
- The thermal dehydration under the concentrated sulfuric acid catalysis can produce more than one kind of alkene
- 1mol nerol alcohol fully burn in oxygen, need to consume 470.4L oxygen (standard conditions)
- 1mol nerol alcohol when reacted with the carbon tetrachloride solution of bromine at room temperature, consumes maximum 240 g bromine

Figure I indicates sample chemistry question in CEE 2012. In this question, it is expected from students to know that nerol alcohol may give an addition reaction because of π bonds and substitution reaction because of “-OH” group. Similarly, as a result of

dehydration reaction which is one kind of elimination reaction, it has been expected different types of alkene molecules may appear. In this question, it is also expected from students to know that nerol alcohol must react with 470,4 L oxygen in combustion reaction and also it is expected from them to write molecule formula and to calculate the combustion reaction. Consequently, this question required to know basic organic reactions like addition, elimination, and combustion, and also includes the application of these reactions. For this reason, it can be said that this question is high level question.

Figure 2. Sample chemistry question in CEE 2012 (Question 28)

The drawing of the device below (exhaust treatment part omitted) produces carbon monoxide, and at the same time, uses certain copper powder sample (mixed with powdered CuO) in order to determine content of copper.

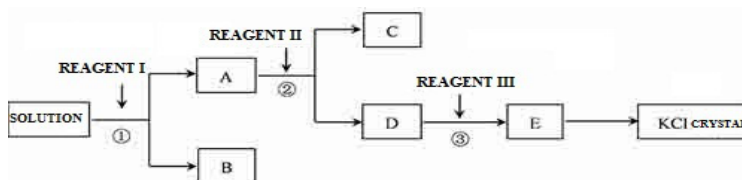


1. The chemical equation for preparation of carbon monoxide is _____;
 2. During the experiment, the phenomenon that occurs in the reaction tube is _____; The main component in the exhaust gas is _____.
 3. After the reaction is completed, the correct operation sequence is _____ (write the letters)
- a. Turn off the funnel switch b. extinguish alcohol lamp1 c. extinguish alcohol lamp2
4. If during the experiment 5.0g copper powder sample taken, after the reaction, 4.8g of solid mass remains in the reaction tube, in the original sample, the mass fraction of copper is _____ .
 5. From concentrated sulfuric acid, concentrated nitric acid, distilled water and hydrogen peroxide, select the appropriate reagent, and use to design a sample measurement scheme of mass fraction of copper;
 - ① The main steps of the design are (it's not necessary to write the details of the procedure) _____ ;
 - ② Write the equation for the chemical reaction _____ .

As can be seen in Figure 2, this question is related to experimental chemistry. The question examines whether the students understand experimental process or not. In addition, this question includes writing chemical equations, and calculation. In this context, this question is extremely comprehensive.

Figure 3. Sample chemistry question in CEE 2012 (Question 29)

The KCl sample contains a small amount of potassium carbonate, potassium sulfate and water-insoluble substances. In order to purify the KCl, first the sample is dissolved in proper amount of water, stirred well and then filtered, the operating steps in the filtrate are as shown in the below figure.



Answer the following questions:

- The initial filtrate's pH is _____ 7 (write "greater than", "smaller than" or "equal to"), the reason for that is _____.
- Chemical formula for reagent I is _____, ionic equation for the reaction in ① is _____.
- Chemical formula for reagent II is _____, the purpose of the added reagent II is _____.
- The name of the reagent III is _____, the ionic equation for the reaction in ③ is _____.
- A classmate weighs the purified product as 0.7759g. After dissolving, a classmate puts it into volumetric flasks of 100ml, each time takes 25.00ml solution, and uses $0.1000\text{mol} \cdot \text{L}^{-1}$ standard silver nitrate solution for titration. The average volume of consumed standard solution (three times titration) is 25.62mL, the purity of product is _____ (list formula and calculation results),

Question 29 related to separation of mixtures includes equilibrium in solution, and acid bases. For this reason, this question like question 28 is extremely comprehensive.

Figure 4. Sample chemistry question in CEE 2012 (Question 30)

The chemical compound A($\text{C}_{11}\text{H}_8\text{O}_4$) is heated in presence of sodium hydroxide solution, after the acidification step, chemical compounds B and C are formed. Answer the following questions:

- The molecular formula of B is $\text{C}_2\text{H}_4\text{O}_2$. In the molecule, there's only one functional group. The structure formula of B is _____, when B and ethanol are heated in presence of concentrated sulfuric acid, D is formed. The equation for the reaction is _____, the reaction type is _____, write two structural isomers of D that are capable of undergoing silver mirror reactions _____.
- C is an aromatic chemical compound, relative molecular mass is 180, its carbon mass fraction is 60.0%, mass fraction of hydrogen is 4.4%, the rest is _____.

- oxygen, the molecular formula of C is _____ .
3. The three substituents which are attached to aromatic ring are already known. One of the substituents has no branched chain, and also has a functional group that decolorizes the bromine in carbon tetrachloride solution, and a functional group can react with sodium bicarbonate solution. As a result of this reaction, gas is formed. The name of functional group on this substituent is _____. The other two substituent groups are identical, located separately as ortho- and para-position; simple structural formula of C is _____ .
 4. The simple structural formula of A is _____ .

As can be seen in Figure 5, question 30 is related to components and structures of organic compounds. However, this question includes many parts about organic compounds such as reactions, structural isomers, and definition of the molecular formula. At the same time, sub-questions are related to with each other. For this reason, it can be say that this question is one of the discriminative chemistry questions in CEE 2012.

4. Discussion and Conclusion

The main purpose of study is to compare China and Turkey's university entrance exams according to some criteria such as content, and exam application. The results of study revealed that there are similar and different points between two countries in the context of university entrance exams.

One of the problematic aspects of educational system of China and Turkey is university entrance exams. Each year, millions of high school students in China and Turkey take the entrance exams, and limited numbers of students can be admitted to university. These examinations were criticized too often by educators in two countries (Baştürk, 2011; Cüceloğlu, 1993; Dong et al, 1994; Dai et al, 2007; Davey & Higgins, 2005; Davey, Lian & Higgins, 2007). In this context, it was thought that assessment and comparison of university entrance exams of these countries were useful for educators in two countries. Firstly, when main features of university entrance exams were examined, it was seen that there are some differences in some aspects of university entrance exams. For example, university entrance system in China includes one examination (CEE), but there is two-stage university entrance examination in Turkey. The first stage of university entrance system is called as Transition to Higher Education Examination (YGS). The students who pass the YGS could take Undergraduate Placement Examination (LYS) as a second stage of university entrance system. In addition, application process to higher education in China is required more knowledge about the students such as moral-political assessment, and a medical certificate. Another important difference is that the application process can vary from province to province in China. Throughout Turkey, the same application process is applied. Also, university entrance examination format can vary between provinces in China, but "3 + X" examination system are pre-

ferred by most of provinces. The University Entrance Examinations (YGS and LYS) has been implemented in the same format throughout Turkey. Although university entrance examinations in two countries are based on curriculum knowledge, it was observed differences in types of questions in these exams. The University Entrance Examinations in Turkey include only multiple-choice type questions. For this reason, these examinations are discussed since multiple-choice questions are not able to check higher order cognitive skills, and can lead the students to success by chance. CEE does not includes one type questions, and different question formats such as “multiple- choice questions,” “fill in the blanks” “calculation”, and “English speaking test” are available in CEE (Davey, Lian & Higgings, 2007; Liu, 1994). At the assessments of examination in China, while a computer program is used for multiple- choice questions, for other type questions, two teachers are selected randomly and electronically. If there is score differences which is greater than five points, between the teachers’ assessment, the student’s paper is sent to a third teacher for the final score (AEI, 2009). In Turkey, all examinations papers are assessed by using a computer program because of all questions in YGS and LYS are multiple-choice questions.

To reveal similarities and differences of chemistry questions in university entrance examinations, chemistry questions in CEE, YGS, and LYS 2012 were examined. At the end of analysis, it was found out that while multiple-choice chemistry questions in CEE were prepared considering four different cognitive domain levels as knowledge, comprehension, application and analysis, fill in the blanks types questions were prepared according to application level. When all type chemistry questions in CEE were evaluated, it was seen that application level questions were predominant. Similar analyses was done for chemistry questions in YGS, and LYS 2012, and it was determined that comprehension level questions in YGS, application level questions in LYS were predominant. Also, most of chemistry questions in YGS are related to 9th grade Chemistry, whereas chemistry questions in LYS usually include the contents of 10, 11, and 12th grade Chemistry. Maybe, it can be said that one of the important differences in chemistry questions is related to the contents of questions. As can be seen from sample chemistry question in CEE (Figure, 2, 3, and 4), these questions includes sub-questions, and also sub-questions are related to with each other. Besides, in these questions, some processes such as calculations, writing chemical equation are expected for the students. In these context, it can be said that the chemistry questions in CEE are extremely comprehensive. In addition, from Figure 2, it was understood that the question related to experimental chemistry was very discriminative, and required high level chemistry knowledge. When the sample chemistry question in LYS, and YGS were examined, it can be said that these questions were not as comprehensive as in China. Based on these results, some recommendations were presented for curriculum developers, and educator in Turkey;

- 1) Experimental chemistry should be more focused in chemistry curriculum.
- 2) Open-ended questions should be included in the university entrance exams

3) Open-ended questions should be prepared to address the preparation of the higher-level cognitive gains.

4) The university entrance exams should include open-ended questions related to experimental chemistry.

5) To evaluate open-ended questions in the university entrance exams, a system similar to China could be used.

5. References

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