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The methods in preparation of the new type of test questions In Chemistry and their grading ability

For 15 years,we have a new test system for admitting students to institutes of higher educationion and it has an important role in providing the objectivity.The new system includes chemistry questions as well as other sciences for checking students' knowledge and ability .The asked questions are prepared in accordance with the profile specialities of profession group (math, physics, engineering, chemistry-tecnology,architech, art projects,medical,chemistry,biology and sportive activity). One of the main conditions to grade the exam results is preparation of the test questions in accordance with proper standards and criterias and these questions must correctly grade the knowledge of examinees.
The test questions are based on some rules stated below.

Standard- Admission programme basing on the syllabus which are used in primary schools

Used resources - Primary School Books for 8-11 Grades, the test books made by State Students Admission Commission of the Azerbaijan Republic and material on chemistry.

Complexity degree of questions :

basic	**intermediate**	**hard**
No require deep intellectual activity and based on primary computation and primary opinion and the required time is not over 30 seconds	Required certain intellectual activity, base on logical analysis, computation and generalization. required time is not over 1,5 minutes	Reqires deep intelletual activity and base on deep intellectul analysis and logical opinion and . required time is not over 3 minutes

The variety of test questions

Factology

Tests are based on the structure of matters, their properties,their application and other materials. The main factors for grading such tests:showing of factual materials, explanation, differenciate, classification and other abilities

Terminology

Tests are prepared on the base of terms, way of naming matters. The main factors for grading such tests: showing the terms and the names ability of using naming methods of matters

general

This side of questions sets on base on rules of chemistry and their progress.this type of tests includes logical, analysis and solving the problems and their ability

Calculating

Type of this question rules inculed of accounting and finding their values and this type of test's look for logical analysis and ability of solve the problems and the applicants ability on this test.

Prognosis

The test questions base on rules and the things on the top .the rules of the test,logical,analysis, solve the problem and sytmulate the questions and their ability on this

Explanation

This type of questions look for base on rules and means of chemistry ,their means, solving their materials and looks for the ability of the student for using their logical analysis

Offered activity

The important tip on the questions are asking for the chemical reaction and their results for their logical,analysis,functional thesis of their ability to solve them.

Since the test booklet are prepared in different variants in the university examination to accept the candidate , choosing the type and structure of these multiple choice question booklets have an important role in grading the knowledge and ability of candidate.

In State Students Admission Commission of the Azerbaijan Republic (Tələbə Qəbulu üzrə Dövlət Komissiyası) a lot of research effort are going on to raise grading ability of the question booklets. In admission exams, in test exams generally in all exams which are done by SSAC (TQDK) all questions analysed in graphics , it is searched how these exams grade the ability of students. After all these searching process questions are rewritten and refined.

The questions for question booklet are prepared two different analogous variants. It is very important for all questions in booklet to grade the needed ability and knowledge of canditate. Questions must have only one idea and depends on scientific bases. Some terms and general signs are given in questions make to them easier. Some disputable questions are not asked in booklet. Besides the questions some chemical formulas , their structures or some information are given to students to make them easier. The complex questions are not asked in booklet .

According to the properties of candidates in different groups the questions asked in examination are prepared in different categories. The questions which are going to be asked in admission exam are checked in some previous test exam in schools and university preparatory courses. After checking all these previous test examination it is cleared that whether these type of questions are hard or not.

In earlier admission exams which were done by test type, the questions were very simple and thus the ability and knowledge of the students could not be graded. These types of questions were based on the memories of candidates. Lets look at a question asked in a previous exam...

2001

$2SO_2(g) + O_2(g) \leftrightarrow 2SO_3(g) + Q$

In the reaction above how does the equilibrium shifts towards SO_3 preparation ?

I. By increasing pressure II. By increasing temperature III. By catalysis

A) only I B)only III C) only II D) I, II C) II, III

To answer this question above:

Candidate must know :

- How the factors can affect the equilibrium

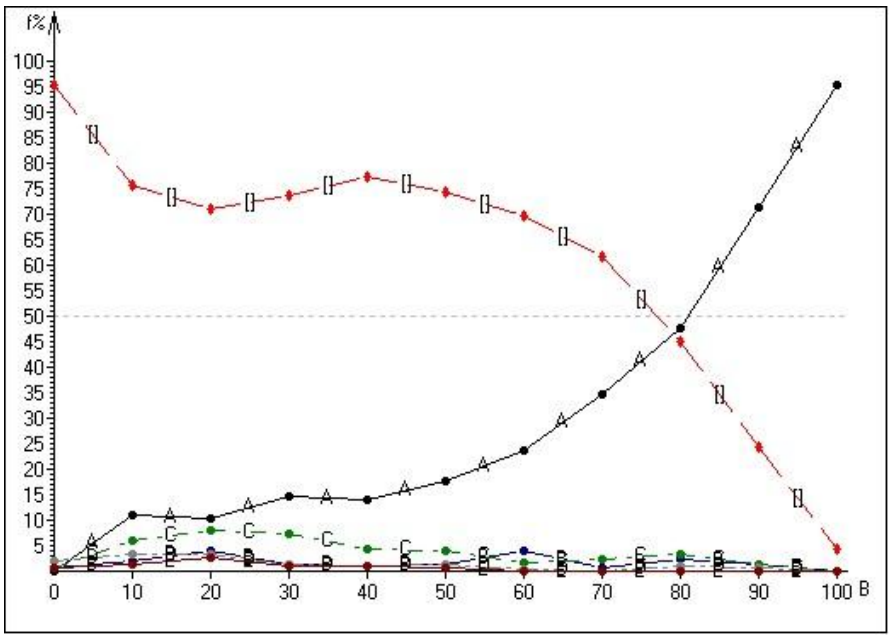
Which abilities are graduated :

- How does the temperature, pressure and concentration affect the reestablishing of equilibrium ;

It is obviously seen after the question is clearly solved.

Solution : I. When the pressure is increased the equilibrium shifts toward in favor of volume reduction. Therefore it is needed to increase pressure to shift the equilibrium toward product to obtain more SO_3.
II. when temperature is raised, the equilibrium will proceed to the right to decrease the temperature. Thus increasing temperature disturbs the equilibrium in favor of reactant production.
III. Catalys can not affect the equilibrium because of the affecting the rate of reverse and forward reaction.
Correct answer is A

Answers



Candidate level

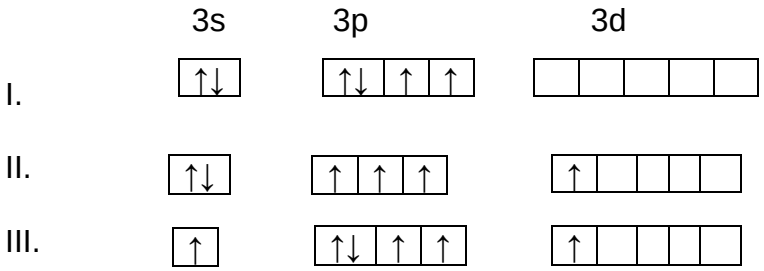
It is seen from diagram above which shows the candidate answers , that test exam is sufficent for graduating ability of candidates. Some of the poor students did not answer , where all skilful students answered these questions. The deficient of that test exam was that it does not have criterias to graduate the the ability of students and based on the memories of students.

It is important to indicate that in order to improve experts , the students addmitted to university must have some knowledge ,skills , logical thought and creative ability.

In State Students Admission Commission of the Azerbaijan Republic , the researches during 15 years affected the test questions to grade all abilities of students. Research shows that in order to graduate a lot of criterias the question booklet should have a huge volume. These types of test are not useful. For these reason the questions asked in test booklet must include a lot of graphics.

2003

In wich state the arrangment of valence electrons in the orbitals of ($_{16}$S) atom is displayed correctly?



A)I, II B)I, III C)only I D)II, III E)only II

In order to answer this quesiton the student must know;

- How to write the electron configuration of element (or the rule of writing elec. config. of element)
- The maximum and minimum valence numbers of elements

Which criterions are estimated in this test quesiton?

- the ability of writing electron configuration of elements
- the valence number of elements the investigation ability of student (or The investigation ability of student in order to find possibility valence numbers of chemical elements)
- the ability of analysis, explanation and generalize

You can see these criterions in the explanatory solution of the test quesiton;

Solution :

The electrons of the last shell of the A group elements are called <u>valence electrons.</u> (or The last shell electrons af A group elements are valence electrons). We know that the single electrons participiate to create chemical bond.

If there are vacance orbitals in the last shell of an element the couple electrons can be separated into single electrons in that orbitals, and all electrons create bond. The atom of S has such chance. $3s^2\ 3p^4\ 3d^0$ Here d orbitals are empty.

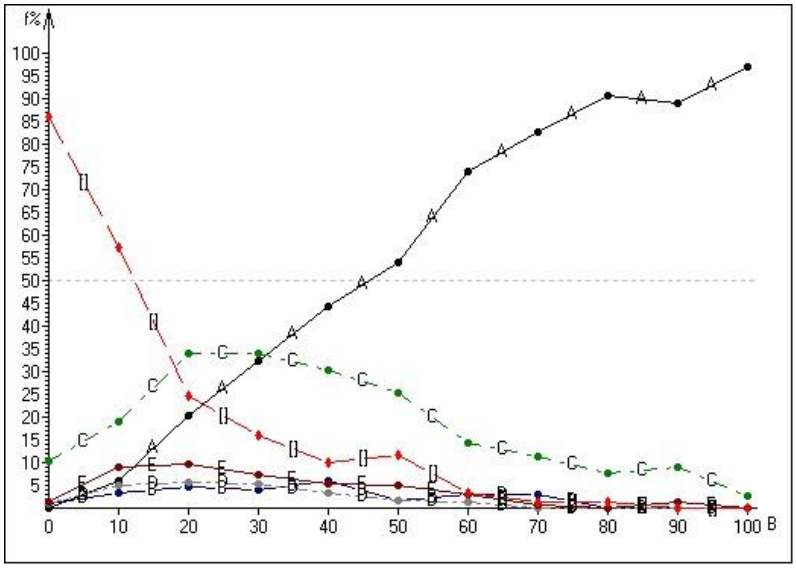
I - electron formula express the normal condition of S atom. This writing is true.

II - electron formula express the first excited condition of S atom. This writing is true too.

III - electron formula is not true. Because, firstly, couple electrons of 3p subshell must be promated and transfer into d orbitals to be single and then 3s electrons.

So the true answer is A

Answers:

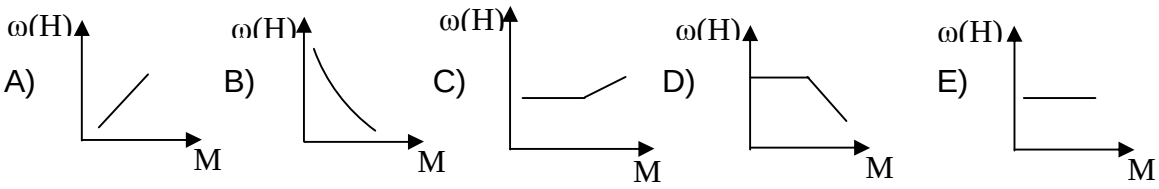


Candidate level

It is clearly seen that test exam worked well. The level of candidate and their answers are changed appropriately. It is understood C choice could be coherent and clear**.**

2004

Which one of the following graphics expresses the dependence of mass percent of hydrogen in the alkene according to its molar mass (M).



In order to answer this test quesiton the student must know;

- general formula of the alkenes
- how to count mass percent of elements
- the description of graphics which is expressed dependence of mass percentage of the element from molar mass of alkenes .

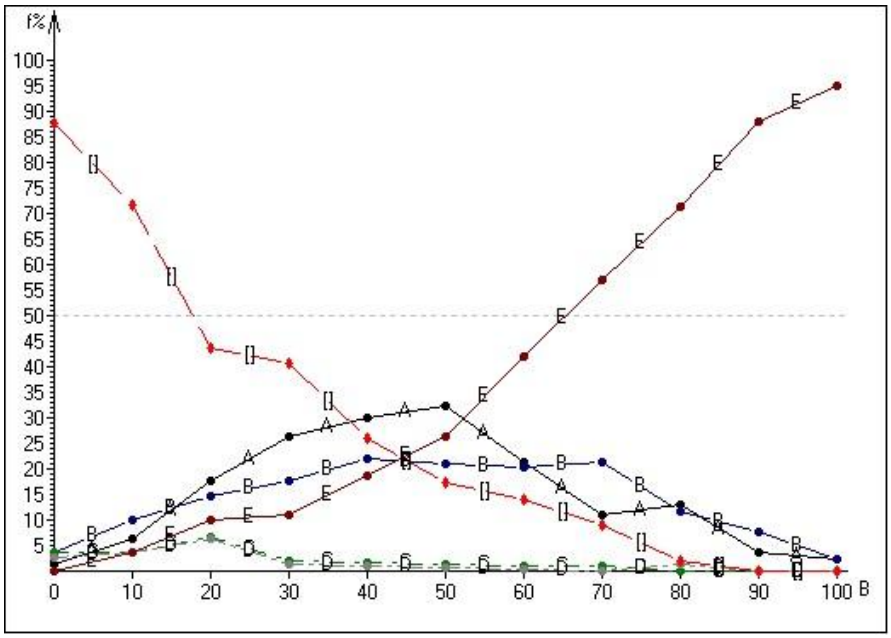
Which criterions are estimated by this test quesiton?

- Counting ability of the mass percentage of the element according to the general formula
- The ability to describe the graphic which express dependence mass percentage of the elements from molar mass of alkenes

The mathematical analysis, investigation(or research) and generalize ability

Solution:
According to general formula (C_nH_{2n}) of alkenes let's calculate the mass percent of hydrogen $w = \frac{2n}{14n} = \frac{1}{7}$. As you see the mass percent of hydrogen is independent from the molar mass of alkenes. Therefore molar mass of alkenes is changed the mass percent of hydrogen remained stable in given graphic. The best answer for this question is **E.**

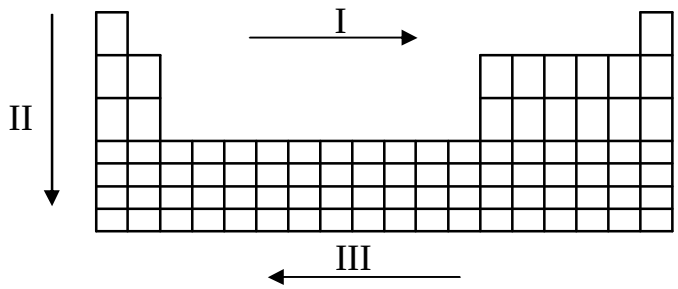
Answers:



Students levels

From the chart revealed that question is good solved. Repudiation and changing of correct answer is not related with students levels. From the middle level students answer we observed that students have learned the text superficially and didn't determine functional dependence in graphic.

2005



In which state changing of properties of elements at I, II and III direction doesn't correct?

A) direction II reducing increased
B) direction II electronegativity increased
C) direction III electronegativity decreased
D) direction III atomic radii increased
E) direction I atomic radii decreased

To solve this test students must know:

- Structure of periodic table
- Electronegativity of elements and changing of it according to groups and periods
- Reducing of elements and changing of it according to groups and periods
- How changes atomic radii according to groups and periods

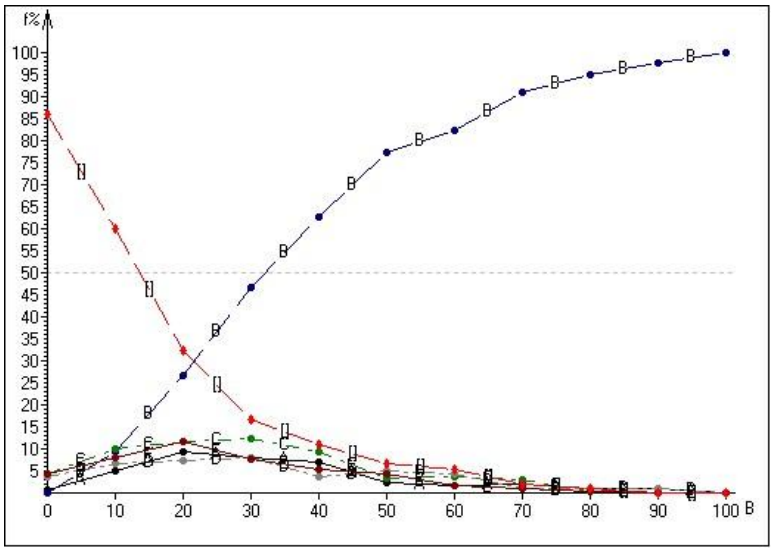
Which criterion to be valued with this test?

- The ability of researches of periodic table
- Explain ability how changes electronegativity, reducing and atomic radii according to groups and periods
- Analysis, explanation, and generalizing ability

You can see it in explanation of test

Solution:
Direction II, According to groups from top to bottom reducing increased. A-is correct.
Direction II, According to groups from top to bottom electronegativity decreased. B-is incorrect.
Direction III, According to periods from right to left electronegativity decreased. C-is correct.
Direction III, According to periods from right to left atomic radii increased. D-is correct
Direction I, According to periods from left to right atomic radii decreased. E-s correct
The best answer for this question is **B.**

Answers:



Candidates levels

2006

	I	II	III	IV	V	VI	VII	VIII
1								
2	X							
3					Y		Z	
4			M			L		
5	R							

Which of the following statement(s) is(are) true for the main half-group elements shown in the periodic table?

I. Elements X and R can form ionic bond with Z
II. Elements X and L can form compound X_2L
III. M and Y are nonmetals

A) I, III B) I, II C) I, II, III D) II, III E) only I

To answer the test question students should know:

- Properties and atoms of their elements from the places of periodic table.
- Valent characters of the elements.
- The essential character of the chemical bonds.
-

By this test question which properties are measured.:

- To know properties and structures of the atoms of the elements in the periodic table.
- To know researching how to find the capacity of valency of the elements.
- To know how to seperate the type of chemical bonds.

To know how to solve and explain.

Solution:

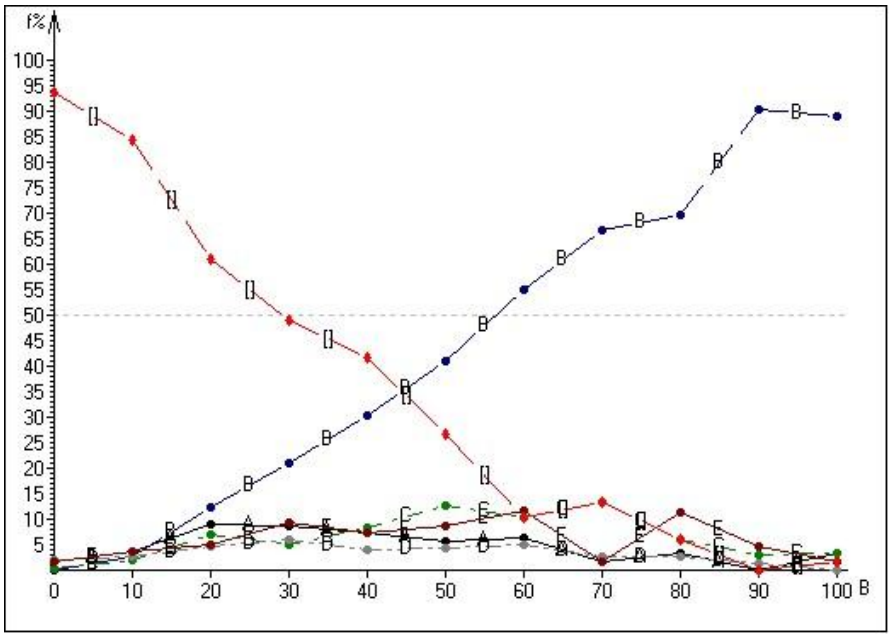
I. Accordingto the table X and R are elements of IA group, “alkali metals”.Because of the VIIA group Z is nonmetal, “halogen”.So that, Elemenys X and R form ionoc bond with Z. I statement is true.

II. Because of the alkali metal of X it has I valence electron, but L is nonmetal of VIA group so that L can form 2 bonds with metals in the compounds(8-6=2).
Because of that the elements of X and L are formed as X_2L compound. II statement is true.

III. Because of that M is in III group, 4th period it is a metal. So that III statement is not true.

The correct answer is B.

Answers



The level of students

The test is good worked shown in graph. The answers of the students are suitable for the percent of cancel and true answers. As level of the students increase the bacground and refusing approach zero.

2006

Compounds	
Saturated monoprotic carboxylic acid	Methanol
X q	6,4 q

The result of the reaction of these compounds 12 g ester is produced. Calculate the mass of carboxylic acid in grams and number of carbon atoms in this molecule.
MW(CH_3OH)=32

	X	N(C)
A)	6,4	2
B)	12	2
C)	4,6	1
D)	9,2	1
E)	9,2	2

To answer to the test question students should know:

- The reaction of forming ester
- Solving problem by given data

The criterias belove are graduated by this test :

- How to obtain esters from the reactions ;
- How to calculate the relationship in math ;
- How to draw and write the molecular and structural formula of organic acids ;

Lets look at the solution closely.

Solution : The esterification chemical reaction is written by using the general formula of organic acids and alcohol.

$$\underset{}{C_nH_{2n+1}COOH} + \underset{6,4g}{CH_3OH} \rightarrow \underset{12g}{C_nH_{2n+1}COOCH_3} + H_2O$$
$$\underset{}{} + \underset{32g}{} \qquad \underset{(14n+60)g}{}$$

The volue of “n” is calculated from the relationship.

$6,4\cdot(14n+60) = 12\cdot32$; $n = 0$, thus this is ant acid. - HCOOH

Number of Carbon atoms in acid N(C) = 1 M (HCOOH)=46

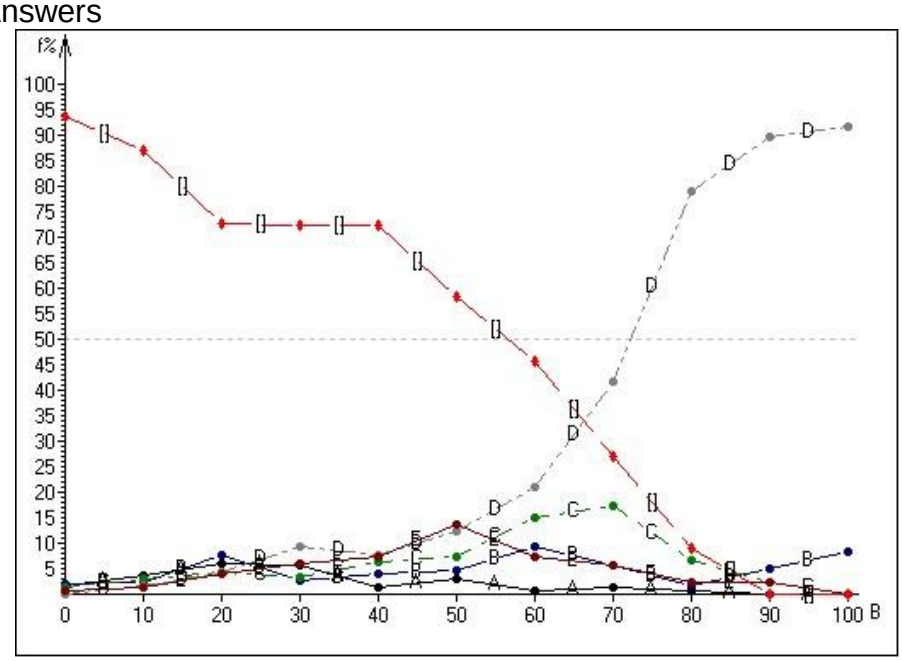
And then the mass of ant acid reacted with 6,4 grams of methy alcohol can be calculated :

$$\underset{Xg}{HCOOH} + \underset{6,4g}{CH_3OH} \rightarrow HCOOCH_3 + H_2O$$
$$\underset{46g}{} \qquad \underset{32g}{}$$

From the equation $X = \frac{46 \cdot 6,4}{32} = 9,2$ $X = 9,2$ q

Correct answer is D.

Answers



Candidates level

It is seemed from the graphic that the test has succeeded. As always weak students did not answer the questions , where the succesful students are shown in the line of graphic. As increases in the level of candidates increase the number of correct answers increase sharply.

All of the questions asked in preparatory or admission exams of TQDK (The state students admission commission) are statistically analyzed by some ways. And some suggestions are given to prepare better questions. One of these ways is formation of graphic for each question.

It seems clearly the number correct of examinees answer are directly proportional to the students.

Therefore It provides an objectivity to grade each question one by one not directly all of them .

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