Név: ..... osztály:.....

ÉRETTSÉGI VIZSGA • 2008. május 15.

KÉMIA
ANGOL NYELVEN

KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA

2008. május 15. 8:00

Az írásbeli vizsga időtartama: 120 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

OKTATÁSI ÉS KULTURÁLIS MINISZTÉRIUM

Important informations

- The examination test should be solved within 120 minutes, after 120 minutes the work should be finished.
- The sequence of answering the questions is free.
- For the solution of the problems calculators without text-storage capability and four-place logarithm tables can be used. Use of other electronic or written help is forbidden.
- Read the introductory text of the questions carefully and keep its instructions.
- Write the answers in ink. If you cancel an answer or part of an answer, the canceled work can not be evaluated.
- For the calculations, you can get maximum number of points only if the main steps of the calculation are indicated, too.
- Please, don’t write anything into the gray squares.

1. Essay

Read the following text carefully and answer the questions.

Chemical composition of must

The main component of must is water. The sugar content of must can vary between 5 and 47%, other dissolved substances are up to 2 and 6% and its water content can reach 55 - 95% (in average it used to be 70 - 88%).

The water content of wine is higher than that of must because half of the sugar content escapes from the solution after being converted to carbon dioxide and part of the other dissolved components precipitates in form of insoluble substances.

The sugar in must is not a uniform substance, it is mostly composed of two sorts of sugar: glucose and fructose. The first detectable organic product of the metabolism in the leaves is starch. Starch is converted to sugar and in this form, it is transported from the leaves into the grapes. During the transport, sugar can be possibly converted to starch again. After reaching the grapes, such a recovery of starch from sugar is no more possible – the reason of this phenomenon is not yet known. Starch can be detected in the grapes only in early stages of growth.

The completely fermented (or so-called „bone dry") wine which does not contain any more fructose or glucose still reduces the Fehling solution. The reducing substances acting in this process are pentoses which can not be fermented. In a study, 113 different sorts of wine were analysed and 0.252 - 1.199 g/dm^3 L-arabinose, furtheron D-arabinose and xilose were found in the wines. However, no methylpentose could be detected. Lateron, pentoses and methylpentoses were identified in every part of the grapes. The peel, the seed and the stem contain more pentose than methylpentose; in the must, the ratio is just the opposite. There is not too large difference between fresh grapes and raisins.

Consequently, pentoses are ingredients of grape juice and must and because they can not be fermented, they get into the wine, too.

(The essay was written using the following book:
István Soós: The Chemistry of wine,in Hungarian,
Agricultural Press, Budapest, 1955.)

a) Why is the water content of wine higher than that of must?

b) Which hydrocarbons can be found in must?

c) In which process is grape juice converted to wine?

d) Formulate the essential chemical part of the process. Write also the equation of the reaction.

e) Give the structural formulae of the educt and the products of the process.

f) Why is it dangerous to stay in a cellar while wine is prepared?

g) Classify the group of compounds and the functional group which can be identified by the Fehling test?

h) How can you explain that fermented wine gives a positive Fehling test?

i) Under oxidative conditions by the action of microorganisms, the alcohol content of wine is decreasing while it gets an unpleasant acidic taste. Why? Give also the structural formula of the compound formed in the process.

16 points	

2. Simple choice

Write the only correct letter mark into the empty cell on the right-hand side of the answers.

1. Which is the line containing the listed compounds *not* in increasing order of their boiling points ?

A) Methane, propane, ethanol.
B) Ethane, butene, acetic acid.
C) Methanol, acetylene, formic acid.
D) Methane, ethane, propane.
E) Acetylene, propane, butane.

2. Choose the only correct statement.

A) Between the molecules of sulfur dioxide, there exist a hydrogen bonding.
B) In the main groups of the periodic table, the size of atoms is decreasing with increasing molar mass.
C) The aqueous solution of acetic acid is basic.
D) The catalytic water addition to ethene results in propanol.
E) Calcium reacts with water under hydrogen evolution.

3. Which line contains exclusively substances giving a positive silver mirror test?

A) Acetaldehyde, acetone, formaldehyde.
B) Glucose, maltose, formaldehyde.
C) Glucose, sucrose, cellobiose.
D) Acetic acid, maltose, cellobiose.
E) Acetone, sucrose, acetic acid.

4. Bonding energy gives

A) the energy necessary to remove the charge-causing electron of 1 mol anion.
B) the energy necessary to convert 1 mol substance into free atoms.
C) the energy necessary to break the bondings in a molecule.
D) the energy necessary to break the given covalent bonding in 1 mol of the molecules.
E) the energy necessary to melt 1 mol of the studied substance.

5. Which line contains exclusively substances which are in solid state at 25 ^{o}C and standard pressure?

A) Sodium chloride, copper sulfate, bromine.
B) Mercury, sulfur, sodium.
C) Sulfur, sodium carbonate, sodium hydrogen carbonate.
D) Red phosphorus, sulfuric acid, aluminium.
E) Hydrogen chloride, copper, lead. ☐

6. Which of the following substances is a gas at 25 ^{o}C and standard pressure and is toxic even if inhaled in small concentrations?

A) Chlorine.
B) Nitrogen.
C) White phosphorus.
D) Methanol.
E) Oxygen ☐

7. Which two substances react with each other to form a gas?

A) Silver and sodium hydroxide solution.
B) Copper and distilled water.
C) Hydrochloric acid and calcium carbonate.
D) Magnesium oxide and water.
E) Table salt and hydrochloric acid. ☐

8. Which of the following substances is a weak acid?

A) Sulfuric acid.
B) Hydrogen chloride.
C) Nitric acid.
D) Acetic acid.
E) All the above listed four substances. ☐

9. The rate of chemical reactions

A) decreases with increasing temperature.
B) can be increased by using a catalyst.
C) is never changed with increasing pressure.
D) increases with decreasing concentrations of the initial substances.
E) increases with decreasing temperature in exothermic processes. ☐

10. In which of the following substances is there *no* hydrogen bonding formation between the molecules?

A) Water
B) Formic acid.
C) Ethyl acetate.
D) Ethanol.
E) Liquid ammonia.

11. Substitution is a process in which

A) molecules accept halogen atoms.
B) double bondings of the molecules are broken and a polimer is formed.
C) two molecules are connected to each other without forming any byproduct.
D) an atom of the molecule is replaced by an other atom or group of atoms.
E) an oxygen atom is connected to the molecule.

12. Which statement is *not* characteristic for sulfuric acid?

A) It is well miscible with water.
B) It causes oxidative destruction of organic substances.
C) It can reduce several metals.
D) It is an important industrial raw material.
E) Its concentrated solution is denser than water.

13. Iron

A) is well dissolved in water.
B) can be prepared by the oxidation of its sulfide.
C) is denser than mercury.
D) conducts electricity.
E) is occurring in nature in elemental state

13 points	

3. Four types of assotiation

Below, you have to compare two substances. Write the correct letter mark in the empty cells of the table.

A) Sodium
B) Aluminium
C) Both of them
D) None of them

1.	It gives a characteristic flame test.	
2.	At room temperature it is a liquid.	
3.	It is a heavy metal.	
4.	It reacts with water only after having removed the oxide layer.	
5.	It is dissolved in diluted acids under hydrogen evolution.	
6.	It is a soft substance which can be cut with a knife.	
7.	It has an ionic lattice structure.	
8.	It evolves oxygen from aqueous solution of bases.	
9.	Its hydrated ions are colorless.	
10.	One of its important compounds is the raw material of the calcination of lime stone.	
11.	Its atom contains one unpaired electron in the ground state.	
12.	It is stored under kerosene.	

12 points	

4. Panel question

Physical and chemical properties and practical importance of the hydrocarbons

Fill the numbered cells of the table in a well readable handwriting.

Name	Structural formula	Property
Benzene	**1.**	*Reaction equation of nitration (indicating conditions):* **2.**
3.	**4.**	**A gaseous alkane, its density relative to oxygen gas is 0.9375.**
5.	**6.**	**The first member of the homologous series of alkynes.** *Reaction equation of its complete combustion:* **7.**
Isoprene	**8.**	*Its industrial importance:* **9.**
10.	**11.**	**The second member of the homologous series of alkenes, by its polimerisation an important plastic compound can be prepared.**

15 points	

5. Alternative question

In the following question – depending on your field of interest – **<u>you have to solve only one version</u>.** ***At the corresponding place of the examination paper, you have to indicate the letter mark of the chosen question (A or B). If it doesn't happen and the fact of your choise doesn't emerge unambiguously from the test-paper, in every case the solution of the first alternative question will be evaluated.***

Letter mark of the chosen question:	

A) Analytical question

Redox reactions, electrochemistry
A zinc plate is immersed into an aqueous solution of copper(II) sulfate and let there stand for half an hour.

a) What is the colour of the copper(II) sulfate solution before immersing the zinc plate into it? Which particles give this colour?

b) What changes can be observed in the solution and on the surface of the plate after half an our time?

c) Write balanced equation of the occurred process.

d) What was oxidized and what was reduced in the above reaction?

e) Write the cell diagram of the galvanic cell consisting of zinc and copper electrodes and zinc sulfate and copper(II) sulfate solutions, respectively.

f) Write the reaction equation of the processes occurring at the cathode and at the anode in this galvanic cell.

Cathode process:

Anode process:

g) Calculate the electromotive force of this cell under standard conditions (25 ^{o}C, standard pressure, the electrodes are immersed into solutions of 1 mol/dm^3 concentration).

h)The cathode of an other galvanic cell is also copper, its electromotive force is 0.57 V (at standard pressure, 25 ^{o}C temperature and a metal ion concentration of 1 mol/dm^3). Using the logarithm table determine what substance was applied as anode in this galvanic cell.

B) Calculation problem

292.0 g of a 25.0 mass% hydrochloric acid is electrolized. At the cathode, 12.25 dm^3 gas is evolved at 25 ^oC and standard pressure.
$A_r(H) = 1.0$; $A_r(Cl) = 35.5$

a) Write the reaction equations of the electrode processes.

b) How many g and how many mol of hydrochloric acid did the solution contain before the beginning of electrolysis?

c) What is the number of moles of the gas produced at the cathode and at the anode?

d) Calculate the decrease of the mass of the solution.

e) Calculate the mass of the solution produced in the process and determine its mass% composition.

15 points	

6. Analytical question and calculation problem

In four, labelled test tubes, there are 0.1 mol/dm^3 aqueous solutions of the following substances:

A) Potassium hydroxide **B)** Sodium carbonate
C) Ammonium chloride **D)** Nitric acid

We examine with an indicator paper whether the solutions are acidic, basic or neutral.

a) Predict whether the above solutions are acidic, basic or neutral.

b) Write the ionic equations of the processes determining whether the pH of the solutions in test tubes B, C and D is acidic, basic or neutral.

c) How many g dissolved substance is contained in 2.000 dm^3 volume of solution A?
A_r(O) = 16.0; A_r(H) = 1.0; A_r(K) = 39.1

d) Calculate the pH of solutions A and D.

15 points	

7. Calculation problem

A household limestone remover is tested. It can be regarded as an 18 mass% phosphoric acid having a density of 1.09 g/cm^3.
A_r(O) = 16.0; A_r(Ca) = 40.0; A_r(P) = 31.0; A_r(C) = 12.0; A_r(H) = 1.0

a) Calculate how many grams of phosphoric acid are contained in 500 cm^3 of the solution.

b) Calculate the number of moles of phosphoric acid, too.

c) Calculate the molar (mol/dm^3) concentration of the solution.

d) What mass of limescale deposit can be removed using 500 cm^3 dissolution agent? (The deposit can be regarded as pure calcium carbonate. Other losses can be neglected.) Make the calculation based on the reaction equation below:

$$2\ H_3PO_4 + CaCO_3 = Ca(H_2PO_4)_2 + CO_2 + H_2O$$

e) What volume of gas is produced during the above process at 25 ^oC and standard pressure?

14 points	

	maximum points	reached points
1. Essay	**16**	
2. Simple choice	**13**	
3. Four types of assotiation	**12**	
4. Panel question	**15**	
5. Alternative question	**15**	
6. Analytical question and calculation problem	**15**	
7. Calculation problem	**14**	
TOTAL	**100**	

marking teacher

Date: .....

	elért pontszám reached points	programba beírt pontszám points written in the program
Feladatsor Test		

javító tanár
marking teacher

jegyző
underwriter

Dátum/Date: ..... Dátum/Date: .....