Név: ..... osztály:.....

ÉRETTSÉGI VIZSGA • 2009. május 14.

KÉMIA
ANGOL NYELVEN

KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA

2009. május 14. 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. Four types of association

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

A) Acetone
B) Glucose
C) Both of them
D) None of them

1.	It is a compound containing hydroxyl groups.	
2.	Its aqueous solution is called formalin.	
3.	At 25 ^{o}C and standard pressure it is a solid substance.	
4.	It is a compound of characteristic odour, formed also in diabetes.	
5.	Its molecule contains an oxo group.	
6.	It is reduced to a monovalent secondary alcohol.	
7.	It gives a positive silver mirror test.	
8.	It is a component of starch.	
9.	It is miscible both with water and apolar liquids.	
10.	It is a flammable, combustible substance.	

10 points	

2. Essay

Read the following text carefully and answer the questions.

Soft drinks

Nowadays, there is a large variety of soft drinks offered for customers in the stores, think only of the fruit juices, ice teas or carbonated soft drinks. Among the mentioned ones, most attention should be paid to the latter sort because it is well known that they are not the most healthful beverages for quenching one's thirst. (...)

In Hungary, Ányos Jedlik was the first to invent a machine that saturated water with carbonic acid, but the construction of an apparatus manufactured on industrial scale is the work of Jenő Wagner.

Well, how is a carbonated soft drink prepared? Their raw material – at least in case of fruit flavoured soft drinks – is fruit pulp, a vegetal extract which is later diluted to such an extent that the fruit content of most products does not exceed 2-5%. It means that water is added to this pulp and then, the product is saturated with carbon dioxide under pressure. Beside drinking water or mineral water, also sugar, possibly some artificial sweeteners, flavours, colors, edible acids and conserving agents are added to the drink in the bottle. (…)

Carbonated soft drinks have a constant quality, an optimal acid-sugar ratio, an outstanding refreshing effect, high carbon dioxide content and a long lifetime.

Carbonated soft drinks have the advantage to have a refreshing effect, partly because of the carbon dioxide and in case of cola drinks also due to the added caffein. They improve digestion by accelerating salivation and acidification, by causing hiperaemia and not to forget the pleasant, sweet, fruity taste of these drinks, after all most people consume soft drinks because of this taste.

Before the decision to drink much more carbonated soft drinks in the future, let's speak about the less advantageous effects of these beverages, too:

– Cola drinks contain added caffein which is not only a stimulating but also a diuretic agent, enhancing therefore dehydration. We must remember, how large quantities of coffein are getting into the human body by consuming cola drinks, as one liter cola contains ca. 250 mg caffein.

– Carbonated soft drinks contain large quantities of sugar (one liter soft drink contains ca. 110 mg sugar), that is useless energy and hence, their frequent consume can contribute to overweight. This phenomenon represents an increasing hazard for kids, as soft drinks – mostly because of their sweet taste - are very popular among them. Drinks containing artificial sweeteners are not more healthful either, because they contain even more additives.

– The acidic taste of carbonated soft drinks is controlled by phosphoric acid which is binding calcium in the human body and therefore, the calcium uptake is hindered. (It was shown in the United States that teenager girls consuming cola frequently have five times more fracture of bones than girls drinking no cola. This phenomenon is correlated to the fact that consumption of cola replaces the consumption of milk and hence, children do not get enough calcium responsible for the strength of bones.)

(Source: http://www.gourmandnet.hu/barpult)

a) Which gas is used for the production of carbonated soft drinks? Give its name and write the structural formula of the gas molecules indicating both bonding and nonbonding electron pairs.

b) After dissolution in water, the gas mentioned in question a) is also reacting in a chemical reaction with water. Write the reaction equation of the process.

c) Which conditions are provided to increase dissolution of carbon dioxide during the preparation of carbonated soft drinks?

d) Give the structural formula of carbonic acid indicating both bonding and nonbonding electron pairs.

e) Which compound controls the acidic taste of soft drinks? Give its name and chemical formula.

f) Mention two negative facts that represent disadvantages of carbonated soft drinks and write their consequences, too.

10 points	

3. Analytical question

Answer the following questions
The following experiments are made with chlorine under laboratory conditions.

1. **From which substances is chlorine prepared in the laboratory?**

2. **How is chlorine gas collected and why?**

3. **What is the color and odour of chlorine?**

4. **A large glass cylinder is filled with chlorine and a piece of warm molten sodium is put into the gas. A yellow light effect is observed and a white smoke is produced. What does the yellow light indicate? Which substance is contained in the white smoke? Write balanced equation of the occurring reaction, too.**

5. **The clorine gas is introduced into water. During dissolution, a chemical reaction takes place. Write balanced equation of the reaction.**

6. **Give the oxidation number of chlorine in the compounds in chlorine water.**

7. **Potassium bromide solution is poured into a baker and chlorine gas is introduced into the solution. Indicate if a reaction takes place and explain why. The values of the standard potentials are as follows:**
   K^+/K: –2.92V, $Br_2/2Br^-$: +1.07 V, $Cl_2/2Cl^-$: +1.36 V.

8. A piece of moistured colored paper is put in another glass cylinder filled with chlorine. What can be observed after some minutes?

9. Which property of chlorine is used in water purification plants?

10. At last, clorine is reacting with ethene. Write the equation of the process.

11. Draw the structural formula of the product and indicate the bonding and nonbonding electron pairs, too. Give the systematic name of the product.

12. In which type of organic chemical reactions is the above reaction classified?

20 points	

4. 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

In the following, three compounds are examined.

- **ethanol**
- **diethyl ether**
- **acetic acid**

Answer the following questions. If there are several correct answers, give all of them.

a) Saturated organic compound:

b) Compound which is completely miscible with water (at 25 ^{o}C and 101.3 kPa pressure):

c) Its aqueous solution is acidic:

d) A volatile liquid of characteristic odour (at 25 ^{o}C and 101.3 kPa pressure) which can be prepared from ethanol by dehydratation:

e) Reaction equation of the preparation described in question d):

f) In aggregate state, the strongest secondary bonding between the particles is hydrogen bonding.

g) From two of them, an ester can be prepared directly. Write the equation of the process of preparation and give the name of the ester.

h) It is used to flavour food:

i) A volatile liquid with a characteristic sweetish odour which can be only partly dissolved in water. Which of the three substances is that and explain its solubility.

B) Calculation problem

At an appropriate temperature, 14.8 grams of iron(III) oxide is reduced by carbon and the produced carbon monoxide is collected.

a) Write the equation of the process taking place.

b) How many grams of (100 % purity) carbon is needed for the reduction?

c) How many grams of iron can be produced in the process supposing 100% yield?

d) How many dm^3 hydrogen gas is produced at 25.0 ^oC and standard pressure if 80.0% of the iron prepared before is reacting with diluted hydrochloric acid? Write the reaction equation of the process, too.

14 points	

5. Simple choice

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

1. Which statement is true, if sodium carbonate is put into water?

A) Sodium carbonate is not dissolved, because there is a strong ionic bonding between the sodium ions and the carbonate ions.
B) It is dissolved and the solution is neutral, because no reaction occurs.
C) It is poorly dissolved and a colloidal solution is formed.
D) It is dissolved and the solution will be basic, because the carbonate ion is protonated by the water molecule.
E) It is dissolved and an acidic solution is obtained, because weak carbonic acid is produced.

2. Below, the first number is indicating the number of unpaired electrons in the ground state of sulfur atom and the other one the oxidation number of sulfur in sulfuric acid. Which are the two correct numbers, listed in this order?

A) 6, 4
B) 1, 6
C) 2, 6
D) 4, 4
E) 1, 6

3. A common property of graphite and diamond is that

A) the carbon atoms are connected in a tetrahedral geometry in both of them.
B) they are hard.
C) they are dissolved in apolar solvents.
D) they are conducting electricity.
E) there is a covalent bonding between the carbon atoms in both of them.

4. For the gasoline fraction obtained by petroleum refining, it is true that

A) its further refining yields gas oil.
B) it is a mixture of hydrocarbons with a carbon atom number of $C_5 - C_{10}$.
C) all of its components are aromatic compounds.
D) from its components with higher carbon atom number, lubricating oil is prepared.
E) it is a dark-color, high-density liquid.

5. One of the characteristic properties of the covalent double bond is that

A) it is made of a sigma and a pi bond, both of them having the same strength.
B) it is 1.5 times stronger than a single bond.
C) it is composed of a sigma bond of axial symmetry and a pi bond of planar symmetry.
D) it is made of two pi bonds each of them having a planar symmetry.
E) the axes of the two bonds are perpendicular to each other.

6. Which of the following molecules contains the largest bonding angle?

A) SO_3
B) NH_3
C) CH_4
D) H_2O
E) CCl_4

7. How many moles are there in $1.93 \cdot 10^{24}$ pieces of carbon atoms?

A) 1.95 mol
B) 3.22 mol
C) 19.5 mol
D) $1.95 \cdot 10^{24}$ mol
E) 0.31 mol

8. At standard pressure and 25 ^{o}C, it is true for methane that

A) it is a colorless gas with a pungent odour.
B) it is a gas practically not soluble in water.
C) it is a toxic liquid.
D) it is a colorless gas having a higher density than air.
E) it is a liquid, well miscible with water.

9. In the Daniell cell

A) the copper electrode is the cathode.
B) oxidation occurs at the cathode.
C) one of the electrodes is prepared from graphite.
D) electrons are drifting through the salt bridge.
E) the negative pole is the cathode.

10. The most common isotope of carbon has a mass number of 12 and atomic number of 6. Which statement is surely characteristic for the atom of an other isotope?

A) Its atomic number is also 6.
B) Its mass number is also 12.
C) The number of neutrons in it equals to the atomic number.
D) Both their atomic numbers and mass numbers are different.
E) Its number of electrons is different.

10 points	

6. Panel question

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

The reaction of **sulfuric acid** with different reaction partners.

Reaction partner		Reaction with sulfuric acid	
water	**1.** *Name of the secondary bonding between the molecules of the reaction partner:*	**2.** *Reaction equation:*	**3.** *Type of reaction:*
saccharose	**4.** *Type of the lattice of the reaction partner:*	**5.** *Observation in the reaction with concentrated sulfuric acid:*	**6.** *Which property of sulfuric acid is presented?*
ethanol	**7.** *Structural formula of the reaction partner:*	**8.** *Equation of the reaction with a concentrated solution at 160 ^{o}C:*	**9.** *Type of the organic chemical reaction:*
sodium hydroxide	**10.** *Type of the lattice of the reaction partner:*	**11.** *Equation of the reaction with a diluted solution:*	**12.** *Ionic equation:*
zinc	**13.** *Behaviour of the reaction partner in air:*	**14.** *Equation of the reaction with a diluted solution:*	**15.** *Type of reaction:*

15 points	

7. Calculation problem

A mother made two sorts of sugar containing syrup for a fruit salad. One of them is 32.0 and the other one is 17.5 percent by mass. She made 1000 grams from both of them. Her kids found one of the syrups too sweet and the other one not sweet enough.

a) Taking 500 grams from each of the syrups and mixing them, the sugar content of the mixture proved to be suitable for the kids. What was the percent by mass composition of this syrup?

b) How many grams of water should be evaporated from 1000 grams of the original syrup having a concentration of 17.5 percent by mass, to get a 32.0 percent by mass concentration for sugar?

8 points	

8. Calculation problem

150 cm^3 of acetylene is mixed with 3.00 dm^3 of air and burned. It is supposed that the gas is completely burned under these conditions. The composition of air is 21.0 volume percent oxygen and 79.0 volume percent nitrogen.

a) What is the volume of the burnt gas after the condensation of water vapor at the original pressure and temperature? Write balanced equation of the burning, too.

b) Give also the composition of the burnt gases in volume percent after the condensation of water vapor.

c) How many grams of bromine can react in an addition reaction with the above mentioned amount of acetylene at standard pressure and 25.00 ^oC if bromine is used in excess? Write the equation of the reaction, too.

13 points	

Név: ..... osztály:.....

	maximum points	reached points
1. Four types of association	**10**	
2. Essay	**10**	
3. Analytical question	**20**	
4. Alternative question	**14**	
5. Simple choice	**10**	
6. Panel question	**15**	
7. Calculation problem	**8**	
8. Calculation problem	**13**	
Points of written exam	**100**	

marking teacher

Date: .....

	elért pontszám / reached points	programba beírt pontszám / points written in the program
Feladatsor /Questions		

javító tanár / marking teacher

jegyző / underwriter

Dátum /Date: ..... Dátum /Date: .....