ÉRETTSÉGI VIZSGA • 2008. május 15.

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KÖZÉPSZINTŰ ÍRÁSBELI ÉRETTSÉGI VIZSGA

JAVÍTÁSI-ÉRTÉKELÉSI ÚTMUTATÓ

OKTATÁSI ÉS KULTURÁLIS MINISZTÉRIUM

Basic guidelines of the evaluation of written exercises

Evaluation of the written test-papers should follow the distributed correction instructions

Evaluation of the theoretical questions

- No deviation from the correction instruction is allowed.
- ½ points can not be given, the questions can only be evaluated according to the allowed part-points in the correction key.

Evaluation of the calculation problems

- Test-papers following the way of solution of the correction instruction, must be evaluated according to the part-points of the correction key.
- Beside objectivity, attention must be paid to ***honesty***. During the evaluation, punishment with a pedagogical intention can not be applied!
- In a given – errorless – solution no points can be subtracted because of the lack of ***not required*** (but in the correction key given) subresults. (Those subresults help only the evaluation of partial solutions.)
- **Approaches differing from the correction key – if correct – get maximum points or part-points according to the nodes of the correction key.**
- For a bare result ***without any derivation or explanation*** only 1-2 points can be given ***as a maximum*** according to the the points of that result in the correction key!
- A calculation problem gets maximum points even if it contains a ***theoretically incorrect reaction equation*** which is not necessary to the solution (and the question did not ask to write it).
- In case of a problem containing several subproblems, part-points for a given subproblem can be given even if the candidate makes the calculation ***using an incorrect result of a beforegoing subproblem*** – if the solution doesn't lead to a contradiction.
- Relations which can be regarded as ***trivial*** can be used without any derivation in calculation problems of the maturity examination, and they get maximum points – even without detailed explanation. For example:
  - conversion of mass, number of moles, volume and number of particles,
  - trivial facts following from Avogadro's law (equal stoichiometric ratios or volume ratios in case of gases under the same conditions, and so on),
  - using the mixing (dilution) equation, and so on.
- For each ***calculation error*** maximum 1-2 points can be subtracted (if the candidate continues the calculation correctly with the incorrect subresult, he or she should get all other part-points for the further part of the calculation)!
- In case of a ***smaller error***, the candidate doesn't get points for the incorrect part of the calculation, but the following steps of the calculation using incorrect data should get the corresponding points. A smaller error is for example:
  - incorrect use of density in the conversion of volume and mass,

- other incorrect simple mathematical procedure,
- incorrectly balanced equation,

which doesn't lead to an ***obviously*** unrealistic result.

- In case of a ***gross error***, the candidate doesn't get further points ***for the given subcalculation*** as allowed in the correction key even if he continues the calculation correctly with the incorrect subresult. A gross error is for example:
  - a calculation based on an ***incorrect*** (e. g. not occurring) ***reaction equation***,
  - if the result ***estimated*** from the data is ***obviously irrealistic*** (for example if the mass of the solution calculated from the mass of the solute is smaller than the mass of the solute dissolved in it, and so on).

  (The solution of further subcalculations which can be regarded as independent calculation units can be evaluated of course also in this case according to the previously discussed principles. Points can be given – if calculating correctly with incorrect subresults - if the calculation doesn't lead to irrealistic results.)

1. Essay (16 points)

a) Half of the sugar content leaves the solution in form of carbon dioxide, part of the other dissolved components precipitates during fermentation in form of insoluble substances. ***1 point*** ***1 point***

b) Glucose and fructose, ***1 point***
pentoses (in detail: e.g. L-arabinose, D-arabinose, xilose). ***1 point***

c) Must is converted to wine by alcoholic fermentation. ***1 point***

d) The essential chemical part of the process is the conversion of glucose to ethanol and carbon dioxide. ***1 point***
$C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$
(1 point for correct formulae, 1 point for correct balancing) ***2 points***

e) Structural formulae of glucose, ethanol and carbon dioxide **(3x1 point).** ***3 points***

f) Because during fermentation, carbon dioxide gas is evolved and under the same conditions, its density is higher than that of air, carbon dioxide displaces air and causes death by suffocation.
(Every answer with a similar content can be accepted!) ***1 point***

g) Compounds containing formyl groups (or aldehydes) can be identified by the Fehling test. ***1 point***

h) Must contains reducing pentoses which do not take place in the fermentation process (they are not converted to alcohol). ***1 point***

i) Under oxidative conditions, ethanol in wine is converted to acetic acid. ***1 point***
The structural formula of acetic acid. ***1 point***

2. Simple choice (13 points)

1. **C**
2. **E**
3. **B**
4. **D**
5. **C**
6. **A**
7. **C**
8. **D**
9. **B**
10. **C**
11. **D**
12. **C**
13. **D**

3. Four types of assotiation (12 points)

1. **A**
2. **D**
3. **D**
4. **B**
5. **C**
6. **A**
7. **D**
8. **D**
9. **C**
10. **D**
11. **C**
12. **A**

4. Panel question (15 points)

1.	Structural formula of benzene.	***1 point***
2.	$C_6H_6 + HNO_3 \rightarrow C_6H_5NO_2 + H_2O$	***1 point***
	Conditions: cc sulfuric acid, catalyst.	***1 point***
3.	Ethane.	***2 points***
4.	Structural formula of ethane.	***1 point***
5.	Acetylene (ethyne).	***1 point***
6.	Structural formula of acetylene.	***1 point***
7.	$C_2H_2 + 2{,}5\ O_2 \rightarrow 2\ CO_2 + H_2O$	***2 points***
8.	Structural formula of isoprene. **(Only in case of a correct formula!)**	***2 points***
9.	Production of synthetic rubber.	***1 point***
10.	Propene.	***1 point***
11.	Structural formula of propene.	***1 point***

In case of reaction equations for two points
- writing correct formulae 1 point
- balancing reaction equations 1 point
In the reaction equations equality mark can be accepted, too!

5. Alternative question

A.) Analytical question (15 points)

a)	Blue	***1 point***
	(Hydrated) Cu^{2+} ions (aqua complexes can also be accepted!)	***1 point***
b)	The color of the solution fades (it is decolorized).	***1 point***
	On the surface of the plate, a red substance (**also acceptable:** a black, powder-like substance) is deposited.	***1 point***
c)	$Zn + Cu^{2+} = Zn^{2+} + Cu$ (or $Zn + CuSO_4 = Cu + ZnSO_4$)	***1 point***
d)	Zn was oxidized. Cu^{2+} was reduced.	***1 point***
e)	$-$ Zn(s) $\vert$ Zn^{2+}(aq) $\Vert$ Cu^{2+}(aq) $\vert$ Cu(s) + **(Correct denotation of the electrodes: 1 point. Signing of the poles: 1 point!)**	***2 points***
f)	Cathode process: $Cu^{2+} + 2\ e^- = Cu$ Anode process: $Zn = Zn^{2+} + 2\ e^-$ **(1 point for the two correct equations, 1 point for the correct assigning of the names of the electrodes!)**	***2 points***
g)	Finding the corresponding standard potential values in the logarithm table.	***1 point***
	$E = \varepsilon^\circ_{cathode} - \varepsilon^\circ_{anode} = 0.34\ V - (-0.76\ V) =$ **1.10 V**	***1 point***
h)	$\varepsilon^\circ_{anode} = \varepsilon^\circ_{cathode} - E$	***1 point***
	$\varepsilon^\circ_{anode} = 0.34\ V - 0.57\ V = -0.23\ V$	***1 point***
	According to the data of the logarithm table this electrode is **nickel**.	***1 point***

B.) Calculation problem (15 points)

a) Cathode: $2\ H^+ + 2\ e^- = H_2$ ($2\ H_3O^+ + 2\ e^- = H_2 + 2\ H_2O$) ***1 point***
Anode: $2\ Cl^- = Cl_2 + 2\ e^-$ ***1 point***

b) $m(HCl)_1 = 0.25 \cdot 292.0\ g =$ **73.0 g** ***1 point***
$M(HCl) = 36.5$ g/mol

$n(HCl)_1 = \dfrac{m}{M} = \dfrac{73.0\ g}{36.5\ g/mol} =$ **2.00 mol** ***1 point***

c) $V_m = 24.5\ dm^3/mol$ ***1 point***

$n(H_2) = \dfrac{V}{V_m} = \dfrac{12.25\ dm^3}{24.5\ dm^3/mol} =$ **0.50 mol** ***1 point***

If the formation of 1 mol H_2 corresponds to the formation of 1 mol Cl_2
then
the formation of 0.5 mol H_2 corresponds to the formation of **0.5 mol Cl_2**. ***2 points***

d) If 1 mol H_2 (or Cl_2) is formed by the decomposition of 2 mol HCl,
then 0.50 mol H_2 (or Cl_2) is formed by the decomposition of 1 mol HCl. ***2 points***
The mass of the decomposed HCl gives the decrease of the mass
of the solution. ***1 point***
$m(HCl) = 1.00 \cdot 36.5$ g/mol = **36.5 g** ***1 point***

e) The produced solution has a mass of
$m_2 = 292.0\ g - 36.5 =$ **255.5 g** ***1 point***
Its HCl content is $m(HCl)_1 = 73.0\ g - 36.5\ g = 36.5\ g$ ***1 point***
its mass% concentration is: $\dfrac{36.5\ g}{255.5\ g} \cdot 100\ \% =$ **14.3 %** ***1 point***

(Every other correct way of calculation should get maximum points!)

6. Analytical question and calculation (15 points)

a) **A:** basic *1 point*
B: basic *1 point*
C: acidic *1 point*
D: acidic *1 point*

b) **B:** e.g. $CO_3^{2-} + H_2O \rightleftharpoons HCO_3^- + OH^-$ *2 points*
C: $NH_4^+ + H_2O \rightleftharpoons NH_3 + H_3O^+$ *2 points*
D: $HNO_3 + H_2O = H_3O^+ + NO_3^-$ *1 point*

c) $M(KOH) = 56.1$ g/mol *1 point*
$n(KOH) = 2.0 \cdot 0.1$ mol $= 0.2$ mol *1 point*
$m(KOH) = 0.2 \cdot 56.1$ g = **11.22 g** (11.2 g) *1 point*

d) **A:** $c(KOH) = 0.1$ mol/dm^3 $= [OH^-]$ *1 point*

$[H_3O^+] = \frac{K_v}{[OH^-]} = \frac{10^{-14}}{0.1}$ mol/dm^3 $= 10^{-13}$ mol/dm^3; **pH = 13** *1 point*

D: $c(HNO_3) = 0.1$ mol/dm^3 $= 10^{-1}$ mol/dm^3 $= [H_3O^+]$;
pH = 1 *1 point*

(Every other correct way of calculation should get maximum points!)

7. Calculation problem (14 points)

a) The mass of the solution is: $m_o = 500$ cm^3 $\cdot$ 1.09 g/cm^3 $= 545$ g *2 points*
$m(H_3PO_4) = 0.18 \cdot 545$ g = **98 g** *1 point*

b) $M(H_3PO_4) = 98$ g/mol *1 point*
$n(H_3PO_4) = \frac{98 \text{ g}}{98 \text{ g/mol}}$ **= 1.0 mol** *1 point*

c) $c = \frac{n}{V} = \frac{1.0\ mol}{0.50\ dm^3}$ **= 2.0 mol/dm^3** *2 points*

d) If 2 mol H_3PO_4 is necessary to remove 1 mol $CaCO_3$,
then 1.0 mol H_3PO_4 is enough to remove 0.50 mol $CaCO_3$. *2 points*
$M(CaCO_3) = 100$ g/mol *1 point*
$m(CaCO_3) = 0.50 \cdot 100$ g/mol = **50 g** *1 point*

e) $n(CO_2) = n(CaCO_3) = 0.50$ mol *2 points*
$V(CO_2) = 0.50$ mol $\cdot$ 24.5 dm^3/mol = **12.25 dm^3** *1 point*

(Every other correct way of calculation should get maximum points!)