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KÉMIA
ANGOL NYELVEN

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. Four types of association (10 points)

Every correct answer gets one point.

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

2. Essay (10 points)

a) With carbon dioxide. ***1 point***
Structural formula ***1 point***
b) $CO_2 + H_2O \rightleftharpoons H_2CO_3$ ***2 points***
(Written as a one-directional process, only one point can be given.)
c) Pressure is increased. ***1 point***
d) Structural formula ***1 point***
e) With phosphoric acid. ***1 point***
H_3PO_4 ***1 point***
f) High caffein content → diuretic agent/ dehydration *(Points should be given together!)*
High sugar content → overweight *(Points should be given together!)*
Use of phosphoric acid → calcium uptake hindered.
Artificial sweeteners → a lot of additives/can be harmful ***2 points***

In case of mentioning any two couples, 2x1 points can be given.

3. Analytical question (20 points)

1. from hydrochloric acid ***1 point***
2. In a glass cylinder, its open end up, ***1 point***
because it is a gas having a larger density than air. ***1 point***
3. yellowish green (greenish yellow) ***1 point***
has a pungent odour ***1 point***
4. Light effect: the flame of sodium (exothermic reaction) ***1 point***
the white smoke: NaCl ***1 point***
$2\ Na + Cl_2 \rightarrow 2\ NaCl$ ***1 point***
5. $Cl_2 + H_2O \rightleftharpoons HCl + HOCl$ ***1 point***
If the equation is written as a one-directional process, one point can still be given.
6. In Cl_2 zero, ***1 point***
in HCl **–1**, ***1 point***
in HOCl **+1**. ***1 point***
7. There is a reaction, (chlorine oxidizes bromide ions and/or bromine is produced) ***1 point***
because the standard potential of bromine is smaller, than that of chlorine. ***1 point***
8. The paper is bleached/decolorized. ***1 point***

9. it is a desinfection agent/ it has a bactericide effect/ it has an oxidizing effect *1 point*
10. $C_2H_4 + Cl_2 \rightarrow C_2H_4Cl_2$ *1 point*
11. Structural formula *1 point*
1,2-dichloroethane *1 point*
12. addition *1 point*

4. Alternative question (14 points)

A) Analytical question

a) ethanol, diethyl ether, acetic acid / all three *1 point*
If not all three are listed, no point should be given.
b) ethanol *1 point*
acetic acid *1 point*
c) acetic acid *1 point*
d) diethyl ether *1 point*
e) $2\ C_2H_5OH \rightarrow C_2H_5{-}O{-}C_2H_5 + H_2O$ *1 point*
f) ethanol, acetic acid *2 points*
g) $C_2H_5OH + CH_3COOH \rightleftharpoons C_2H_5O(CO)CH_3 + H_2O$ *2 points*
(If a one-directional arrow is used, only one point can be given.)
Name of the product: ethyl ester of acetic acid / ethyl acetate *1 point*
h) acetic acid *1 point*
i) diethyl ether *1 point*
It is an apolar molecule. *1 point*

B) Calculation problem

a) $Fe_2O_3 + 3\ C \rightarrow 2\ Fe + 3\ CO$ *2 points*
b) $M(Fe_2O_3) = 160$ g/mol *1 point*
1 mol Fe_2O_3 can be reduced by 3 mol carbon / 36.0 g carbon *1 point*
hence, for the reduction of 14.8 g Fe_2O_3 $\frac{14.8g}{160\,\text{g}} \cdot 36.0$ g = **3.33 g** carbon is needed. *2 points*
c) By the reaction of 1 mol Fe_2O_3 2 mol iron can be prepared / 112 g iron *1 point*
hence, in case of 14.8 g Fe_2O_3 $\frac{14.8g}{160\,\text{g}} \cdot 112$ g = **10.4 g** iron is produced. *2 points*
d) $Fe + 2\ HCl \rightarrow FeCl_2 + H_2$ *1 point*
In the reaction of 1 mol iron, 1 mol hydrogen is produced / 24.5 dm^3. *1 point*
80% of 10.4 g iron represents 8.32 g iron, this amount was reacting. *1 point*
$\frac{8.32g}{56\,\text{g}} \cdot 24.5$ dm^3 = **3.64 dm^3** hydrogen is produced. *2 points*
If the equation is written using a wrong oxidation number, but the whole calculation using the incorrect equation is correctly carried out, then 3 points can be given.

Another frequently used solution:
a) $Fe_2O_3 + 3\ C \rightarrow 2\ Fe + 3\ CO$ *2 points*
b) $M(Fe_2O_3) = 160$ g/mol *1 point*

1 mol Fe_2O_3 can be reduced by 3 mol carbon/ 36.0 g carbon
14.8 g Fe_2O_3 represents 0.0925 mol, ***1 point***
to this amount 3·0.0925 = 0.2775 mol carbon is needed, ***1 point***
its mass is 0.2775 mol·12g/mol = **3.33 g**. ***1 point***

c) In the reaction of 1 mol Fe_2O_3 2 mol iron can be produced / 112 g iron ***1 point***
in case of 0.0925 mol Fe_2O_3 0.0925·2 = 0.185 mol iron is produced, ***1 point***
its mass is 0.185 mol · 56 g/mol = **10.4 g**. ***1 point***

d) $Fe + 2\ HCl \rightarrow FeCl_2 + H_2$ ***1 point***
80% of 10.4 g iron represents 8.32 g iron, this amount was reacting. ***1 point***
8.32 g iron represents $\frac{8.32g}{56\,g/mol} = 0.1486$ mol, ***1 point***
in its reaction 0.1486 mol hydrogen is produced, ***1 point***
its volume is 0.1486 mol · 24.5 dm^3/mol = **3.64 dm^3** hydrogen ***1 point***

Every other correct answer can be accepted!

5. Simple choice (10 points)

For every correct answer one point can be given.

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

6. Panel question (15 points)

1. hydrogen bonding ***1 point***
2. $H_2SO_4 + 2\ H_2O \rightarrow 2\ H_3O^+ + SO_4^{2-}$ ***1 point***
3. acid-base reaction ***1 point***
4. molecular lattice ***1 point***
5. it becomes black / it is blown up / it is warmed up/ a gas of an unpleasant odour is produced ***1 point***
6. dehydration agent / destructing effect ***1 point***
7. Structural formula ***1 point***
8. $C_2H_5OH \rightarrow C_2H_4 + H_2O$ ***1 point***
9. elimination / (decomposition) ***1 point***
10. ionic lattice ***1 point***
11. $2\ NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2\ H_2O$ ***1 point***
12. $H^+ + OH^- \rightarrow H_2O$ / $H_3O^+ + OH^- = 2H_2O$ ***1 point***
13. It is not corroded / its surface is covered by a protecting oxyde layer / there is no change ***1 point***

14. $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ ***1 point***
15. Redox reaction (gas evolution reaction) ***1 point***

7. Calculation problem (8 points)

a) In 500 g 32.0 m/m% solution, there is 160 g sugar ***1 point***
in 500 g 17.5 m/m% solution, there is 87.5 g sugar ***1 point***
The mass of the entire solution is 1000 g, ***1 point***
which contains 160 g + 87.5 g = 247.5 g sugar ***1 point***
The obtained sugar content is: $\frac{247.5g}{1000g} \cdot 100$ = **24.75 g,** that is
24.8 m/m% (24.75 m/m%). ***1 point***

Or using the mixing equation:
$(500 \cdot 32.0) + (500 \cdot 17.5) = 1000 \cdot x$ ***3 points***
$x = 24.75$ ***2 points***
The concentartion of the solution is **24.8 m/m% (24.75 m/m%).**

b) 1000 g solution contains 175 g sugar and 825 g water. ***1 point***
The water content of the resulting solution is: $\frac{68\%}{32\%} \cdot 175g$ = 371.9 g ***1 point***
825 – 371.9 = **453.1 g** water, that is **453 g water** must be evaporated. ***1 point***

Another frequently used solution:
The mass of the resulting solution is: $\frac{100\%}{32\%} \cdot 175g$ = 546.9 g. ***2 points***
1000-546.9 = **453.1 g** water, that is **453 g** water must be evaporated ***1 point***

Every other correct solution can be accepted!

8. Calculation problem (13 points)

a) $2\ C_2H_2 + 5\ O_2 \rightarrow 4\ CO_2 + 2\ H_2O$ ***1 point***
For the reaction of 150 cm^3 acetylene 375 cm^3 oxygen was needed, ***1 point***
and 300 cm^3 carbon dioxide was produced. ***1 point***
The composition of the original air is: 630 cm^3 oxygen and 2370 cm^3 nitrogen. ***1 point***
After the reaction 630 cm^3 – 375 cm^3 = 255 cm^3 oxygen remained. ***1 point***
The volume of the burnt gas is: 255 + 2370 + 300 = **2925 cm^3**. ***1 point***

b) The concentration of carbon dioxide is $\frac{300\ cm^3}{2925\ cm^3} \cdot 100$ = **10.3 V/V%.** ***1 point***

The concentration of oxygen is $\frac{255\ cm^3}{2925\ cm^3} \cdot 100$ = **8.72 V/V%.** ***1 point***

The concentration of nitrogen is 100- 10.3-8.72 = **81.0 V/V%.** ***1 point***

c) $C_2H_2 + 2\ Br_2 \rightarrow C_2H_2Br_4$ ***1 point***

150 cm^3 acetylene represents $\frac{150\ cm^3}{24500\ cm^3 / mol} = 0.006122$ mol =

$= 6.12 \cdot 10^{-3}$ mol (that is 6.122 mmol) ***1 point***

For this amount $2 \cdot 0.006122$ mol = 0.01224 mol bromine is needed, ***1 point***
Its mass is 0.01224 mol · 160 g/mol = **1.96 g bromine**. ***1 point***

Every other correct solution can be accepted!!