ÉRETTSÉGI VIZSGA • 2020. október 22.

KÉMIA
ANGOL NYELVEN

KÖZÉPSZINTŰ
ÍRÁSBELIVIZSGA

JAVÍTÁSI-ÉRTÉKELÉSI
ÚTMUTATÓ

EMBERI ERŐFORRÁSOK MINISZTÉRIUMA

Basic guidelines to the evaluation of written tasks

The evaluation of the written test papers follows the distributed instructions of correction.

Evaluation of the theoretical questions

- No deviation from the correction instruction is allowed.
- ½ points cannot be given; the questions can only be evaluated according to the allowed partial points in the correction key.

Evaluation of the calculation problems

- Besides being objective, the correction has to be ***bona fide***. During the evaluation, punishment with a pedagogical intention cannot be applied!
- In a given correct solution no points can be subtracted because of the lack of ***not required*** subresults (which are given in the correction key). (Those subresults help only the evaluation of partial solutions.)
- Approaches differing from the correction key – if correct – get maximum points or partial 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 points of that result in the correction key!
- A calculation gets maximum points even if it contains a ***theoretically incorrect reaction equation*** if it is not necessary to the solution (and the question was not asked to be written).
- In the case of a problem containing several subproblems, partial points for a certain subproblem can be given even if the candidate makes the calculation ***using an incorrect result of the previous subproblem*** – if the solution does not lead to a contradiction.
- Relations, which can be regarded as ***trivial***, can be used without any derivation in the 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 the case of gases under the same conditions, etc.),
  - using the equation of mixing (dilution), etc.
- 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 partial points for the further part of the calculation).
- In the case of a ***smaller theoretical error***, the candidate does not get points for the incorrect part of the calculation, but the following steps of the calculation using incorrect data get the corresponding points. A smaller error is for example:
  - incorrect use of density in the conversion of volume and mass,
  - other incorrect but simple mathematical procedure,
  - incorrectly balanced equation, which does not lead to an obviously unrealistic result.

- In the case of a ***gross error***, the candidate does not get further points for the specific part of the calculation given 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 unrealistic*** (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, etc.).
  - (Naturally, the solution of further subcalculations, which can be regarded as independent calculation units, can be evaluated according to the previously discussed
  - principles. Points can be given – if calculating correctly with incorrect subresults – if the calculation doesn't lead to unrealistic results.)

1. Case study (11 points)

a) Metals do not contain molecules. ***1 point***
b) Giving the constitution of methylacetylene (propyne).
(Constitution of propene can also be given.) ***1 point***
c) Methylacetylene and propadiene. ***1 point***
d) No, because the reactivity of propane is low
(it will not have unwanted reactions). ***1 point***
e) 1 : 2.5 (or the giving of a properly balanced combustion reaction) ***1 point***
Steel is to be welded by neutral flame, ***1 point***
were oxygen is just enough for the combustion. ***1 point***
f) Carbon produced during the incomplete combustion become incorporated into the steel (the carbon content would increase),
therefore its quality would decrease. ***1 point***
g) Giving the combustion of zinc and propane ***1 point***
$2\ Zn + O_2 = 2\ ZnO$ ***1 point***
$C_3H_8 + 5\ O_2 = 3\ CO_2 + 4\ H_2O$ ***1 point***

2. Single choice (12 points)

Each correct answer worth 1 point.

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

3. Multiple choice (8 points)

Each correct answer worth 1 point.

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

4. Panel question (15 points)

1.	Structural formula of CH_4	***1 point***
2.	Structural formula of CH_2O	***1 point***
3.	Structural formula of NH_3	***1 point***
4.	tetrahedral	**(*)**
5.	triangular planar	**(*)**
6.	triangular base pyramid	**(*)**
7.	nonpolar	**(*)**
8.	polar (dipole)	**(*)**
9.	polar (dipole)	**(*)**
10.	dispersion forces	**(*)**
11.	dipole-dipole interactions	**(*)**
12.	H-bonding	**(*)**
13.	poor	**(*)**
14.	good	**(*)**
15.	good	**(*)**
16.	E.g. $CH_4 + Cl_2 = CH_3Cl + HCl$	***1 point***
17.	$CH_2O + O_2 = CO_2 + H_2O$	***1 point***
18.	E.g. $NH_3 + HCl = NH_4Cl$	***1 point***
19.	E.g. energy production (production of other organic materials…)	***1 point***
20.	E.g. conservation (production of Bakelite…)	***1 point***
21.	E.g. refrigeration (production of fertiliser…)	***1 point***

Any two correct answers marked by (*) is worth 1 point.

5. Alternative question

A) Analytical task (12 points)

1.	Chlorine (or argon)	**(*)**
2.	Its opening pointing downwards,	**(*)**
	because it is more dense (has higher molar mass) than air.	**(*)**
3.	Sodium	**(*)**
4.	It is highly reactive (or it has low electronegativity, or it has low ionisation energy, or it is a strong reducing agent…)	**(*)**
5.	Aluminium (or magnesium)	**(*)**
6.	$4\ Al + 3\ O_2 = 2\ Al_2O_3$ (*or* $2\ Mg + O_2 = 2\ MgO$)	***1 point***
7.	Silicon	**(*)**
8.	Semiconductor	**(*)**
9.	Argon (or sulphur)	**(*)**
10.	8	**(*)**
11.	Sulphur	**(*)**
12.	E.g. it causes acid rain.	**(*)**
13.	Phosphorous	**(*)**
14.	Colour: red and white (yellow) Biological effect: the white one is poisonous, the red one is not. Crystal lattice type: the white one has molecular, the red is atomic crystal. Flammability: the white one ignites at lower temperatures. Solubility: the white one dissolves in nonpolar solvents, the red does not. *Giving any two of these:*	***2 points***
15.	Chlorine	**(*)**
16.	$Cl_2 + H_2O = HOCl + HCl$	***2 points***

Any two correct answers marked by (*) is worth 1 point.

B) Calculation task (12 points)

a) $Na_2CO_3 + 2\ HCl = 2\ NaCl + H_2O + CO_2$ ***1 point***
b) $m(NaCl) = 552.4 \times 0.0847 = 46.8$ g ***1 point***
$n(NaCl) = 46.8 / 58.5 = 0.800$ mol ***1 point***
$n(CO_2) = 0.400$ mol ***1 point***
$V(CO_2) = 0.4$ mol × 24.5 dm³/mol = ***9.80 dm³*** ***1 point***
c) $n(Na_2CO_3) = 0.4$ mol ***1 point***
$m(Na_2CO_3) = 0.4$ mol × 106 g/mol = 42.4 g ***1 point***
The solution is (42.4 : 424) × 100 = ***10.0 percent by mass*** ***1 point***
d) Mass of CO_2 (0.4 mol × 44 g/mol =) 17.6 g ***1 point***
Mass of hydrochloric acid: (552.4 + 17.6) – 424 = 146 g ***2 points***
Density of hydrochloric acid: 146 g / 133 cm³ = ***1.10 g/cm³*** ***1 point***

(Any other correct method of solution is worth maximum points.)

6. Analytical task (13 points)

a) (1.) $MgSO_4$ ***1 point***
(2.) Dissolution, the evolution of colourless, odourless gas. ***1 point***
(3.) $CaCO_3 + 2\ HCl = CaCl_2 + H_2O + CO_2$ ***2 points***
(4.) Yes, because bitter salt dissolves, while lime stone does not. ***1 point***
(5.) Bitter salt. ***1 point***
Because that is water-soluble (and contains magnesium ions). ***1 point***
b) (6.) Yes. ***1 point***
Only grape sugar gives,
because there is no reducing formyl group in cane sugar. ***1 point***
(7.) No, because both char (caramelize). ***1 point***
c) (8.) Because only starch produces a blue coloration. ***1 point***
(9.) Protein coagulates, denaturates. ***1 point***
(10.) Xanthoproteic reaction. ***1 point***

7. Calculation task (12 points)

a) $2\ CH_{4(g)} = C_2H_{2(g)} + 3\ H_{2(g)}$ ***1 point***
$\Delta_r H = (+227) - 2 \times (-75) =$ ***+ 377 kJ/mol*** ***2 points***
(For the correct use of the Law of Hess can be given 1 point.)
b) $n(C_2H_2) = 100$ kg / 26 kg/kmol = 3.85 kmol ***1 point***
Amount of heat needed for the production of acetylene is 377 MJ/kmol.
$\Delta H = 3.85$ kmol × 377 MJ/kmol = 1451 MJ ***1 point***
Heat needed due to the 80% efficiency: 1814 MJ. ***1 point***
Mass of coal to be burnt is (1814 MJ / 32 MJ/kg =) ***56.7 kg*** ***1 point***

c) Molar mass of refrigeration gas M = 24 / 0.2353 / 102 g/mol ***1 point***
Its molecule contains (102×0.0196 = 2) 2 hydrogen atoms. ***1 point***
Determining the molar mass of halogen ***1 point***
m(halogen) = 102 – 24 – 2 = 76 g
M(halogen) = 19 g/mol
Refrigerator gas contains **fluorine**. ***1 point***
Its molecular formula is $C_2H_2F_4$ ***1 point***
(Any other correct method of solution is worth maximum points.)

8. Analytical and calculation tasks (17 points)

a) There are more hydronium ions than hydroxide ions. ***1 point***
b) **B** ***1 point***
c) Soda: alkaline, table salt: neutral, ethanol neutral,
burnt lime: alkaline, vinegar: acidic ***3 points***
(3-4 correct answers: 2 points, 2 correct answers: 1 pont)
Giving a correct equation (reaction of carbonate ion *or* burnt lime
or vinegar with water) ***2 points***
d) From pH = 1 $[H^+] = 0.1$ mol/dm^3 ***1 point***
$n(H^+) = 0.15$ dm^3 × 0.1 mol/dm^3 = 0.015 mol ***1 point***
$n(OH^-) = 0.015$ mol ***1 point***
$[OH^-] = 10^{-4}$ mol/dm^3 ***1 point***
Use of $V = n/c$ ***1 point***
V = ***150 dm^3*** (litre) ***1 point***
e) No, because too much should be drunk. ***1 point***
f) 1 mol magnesium oxide neutralises the same amount of acid
as 2 moles of bicarbonate soda ***1 point***
M(MgO) = 40.3 g/mol, $M(NaHCO_3)$ = 84 g/mol ***1 point***
The mass ratio: 40.3 : 168 = ***1.00 : 4.17*** ***1 point***
(Any other correct method of solution is worth maximum points.)