	Items	**Score**	
1	Circle the letter **T**, if the statement is true and the letter **F**, if it is false.		
	1) **T F** The chemical element situated in the periodic table in the 4th period, group 7, secondary subgroup, is of „*d*''- element.	L 0 1 2 3 4 5	L 0 1 2 3 4 5
	2) **T F** The chemical element with the electronic configuration $1s^22s^22p^63s^23p^63d^{10}4s^24p^3$ forms the higher oxide with the composition E_2O_3.		
	3) **T F** The most active metal of the 4th period is a strongest reducing agent than the chemical element with an atomic number 37.		
	4) **T F** In the solution of the higher hydroxide of the element which contains 16 protons, in the nucleus the phenolphthalein is colored in raspberry.		
	5) **T F** The mass of argon with a volume of 11,2 *l* (STP) is equal with the mass of $3,01 \cdot 10^{23}$ calcium atoms.		

2	The mineral waters of Cahul are characterized as thermal waters, salines, which due to their chemical composition have anti-inflammatory, analgesic and regenerative effects. Complete the proposed statements for the chemical elements contained in essential quantities in these mineral waters.	L 0 1 2 3 4 5 6 7 8 9	L 0 1 2 3 4 5 6 7 8 9

Chemical element	Characteristics
Nitrogen	a) the type of chemical bond in the simple substance .... b) the name of the compound between whose molecules form hydrogen bonds .... and a specific field of use of this compound ....
Carbon	a) the type of crystalline lattice in the simple substance .... b) the chemical formula of a compound that contains only the **σ** bond .... c) the chemical formula of a compound used in the manufacture of glass ....
Bromine	a) the type of chemical bond in the volatile compound with hydrogen .... b) the chemical formula of a compound with different type of chemical bond ....and the electronic configuration of the one of particle that is included in the composition of this compound ....

3	Cinnabar ceramics keep the heat for a long time, giving the products a special, unique taste, particularly tea. The characteristic red color of this ceramic is due to the addition of mercury sulfide, which can be identified to the following scheme:	L 0 1 2 3 4 5 6 7	L 0 1 2 3 4 5 6 7
	$$HgS \;+\; HCl \;+\; HNO_3 \;\rightarrow\; S \;+\; HgCl_2 \;+\; NO \;+\; H_2O$$		
	Establish for this process: the degrees of oxidation of all elements, the oxidant and the reductant, the oxidation and the reducing processes; determine coefficients by electronic balance method and balance the equation reaction.		
	....		

4	One of the research directions for methods of reducing greenhouse gas emissions is the development of efficient technologies for capturing and regenerating methane produced by natural ecosystems.	L	L

One of the research directions for methods of reducing greenhouse gas emissions is the development of efficient technologies for capturing and regenerating methane produced by natural ecosystems.

For each characteristic in column **B**, select from the column **A** the corresponding reagent system and indicate that figure in the reserved space.

A	**B**
	.... a) presents a catalytic system
1) $H_2O_{(g)} + CH_{4(g)} \rightleftarrows CO_{(g)} + 3H_{2(g)} - Q$	.... b) increasing pressure shifts the chemical equilibrium towards final products
[ZnO] 2) $2CH_{4(g)} + O_{2(g)} \rightleftarrows 2CH_3OH_{(g)} + Q$	.... c) decreasing the temperature shifts chemical equilibrium to the left
3) $4NO_{(g)} + CH_{4(g)} \rightleftarrows 2N_{2(g)} + CO_{2(g)} + 2H_2O_{(g)} + Q$	.... d) removing the water vapor increases the yield of the direct reaction

Column 4 marking boxes: L 0 1 2 3 4 / L 0 1 2 3 4

5 The mineral powder has a light and fine texture, perfectly adhering to the skin. The chromatic range of this cosmetic product is determined by the content of iron (III) oxide used as a pigment: in powder for light skin – up to 2%, and in powder for darker skin – 4-6%.

Solve the problem. The precipitate, obtained at the complete interaction of 968 g of iron (III) nitrate solution with the mass part of $Fe(NO_3)_3$ of 10% with a sodium hydroxide solution, was subjected to the decomposition reaction.

a) Calculate the mass of iron (III) oxide obtained from these reactions.

b) Give arguments by calculation, if it is correct to put the marking "for light skin" on the powder boxes when packing 2 kg of mineral powder containing such an amount of iron (III) oxide.

It is given: *Solution:*

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Answer: a) .... ; b) ....

Column 5 marking boxes: L 0 1 2 3 4 5 6 7 8 9 10 11 12 / L 0 1 2 3 4 5 6 7 8 9 10 11 12

6	Aluminum sulfate sprays are recommended for insect bites to relieve pain and prevent the occurrence of severe allergies.
	I. Write the equations of obtaining reactions of aluminum sulfate according to the type of reaction proposed:
	a) substitution
	   reaction ....
	b) exchange
	   reaction ....
	II. Write the equations of reactions that characterize the chemical properties of sulfate aluminum, using as a reagents substances from the indicated classes of compounds:
	
	a) a base ....
	
	b) a salt ....
		L
		0
		1
		2
		3
		4
		5
		6
		7
		8
			L
			0
			1
			2
			3
			4
			5
			6
			7
			8

7	Write in the blank spaces in column **I** the structural semi-developed formulas of the corresponding organic substances, and in column **II** complete the sentences corresponding to these substances. **I** 1) It is a monosaccharide: .... 2) It contains the same number of carbon atoms as propane and has amphoteric properties: .... 3) It is used in manufacturing tires: .... 4) Hydroxyl compound obtained from the hydrolysis of fats: .... **II** 1) A physical property of it: .... 2) Structural semi-developed formula of a homologue: .... 3) Belongs to the homologous series with the general formula: .... 4) Chemical formula of the identification reagent:	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8
8	**I**. Complete the blank spaces in the table: |	*Structural semi-developed formula of substance*	*Name of substance according to systematic nomenclature*
---	---	---
1	$CH_3 - CH = CH - \overset{\overset{\displaystyle CH_3}{\displaystyle \vert}}{CH} - CH_3$	
2		3,3-dimethylbutan-1-ol | **II.** Circle the letter **T**, if the statement is true and the letter **F**, if it is false. a) **T F** Substance number *1* is an isomer of cyclohexane. b) **T F** Substance number *2* is a homologue of the pentanal. c) **T F** When hydrating substance number *1*, an isomer of substance *2* is obtained. d) **T F** Both substances discolor bromine water.	L 0 1 2 3 4 5 6	L 0 1 2 3 4 5 6

9	There are given the substances: *propan-1-ol, ethine, butanoic acid, methylbenzene, butane.* Write the reactions equations respecting the condition that in each case the <u>reagent</u> belongs to the indicated class of organic compounds and the <u>reaction product</u> is one of the substances in the proposed row. For the organic substances use the structural semi-developed formulas.	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8

a) of alkane ....

b) of aldehyde ....

c) of ester ....

d) of halogen derivative ....

10	The E-200 additive is a natural preservative that ensures the full preservation of the organoleptic properties of chips and fruit snacks. According to food safety standards, the optimal content of the E-200 additive in products of this type is 0,5 g/kg.

Solve the problem.
a) Determine the molecular formula of the additive E-200, if when burning a sample of this compound with a mass of 22,4 g, 26,88 l (STP) of carbon (IV) oxide, and 14,4 g of water were obtained. The vapor density of this substance *after nitrogen* is equal to 4.
b) Give arguments by calculations, if the food safety standards will be respected by using 0,1 moles of this additive in the production of 20 kg of fruit snacks.

L	L
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13

It is given: *Solution:*

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Answer: a) .... ; b) ....

11	Acid-chrome textile filters are used in environmental monitoring sensor systems because they react momentarily to any variation in pH. Textile filter AC-4 at a pH = 4,5 has a brown color, changing to purple in a more acidic medium or to red in a less acidic medium. **Solve the problem.** For the preparation of a solution with a volume of 200 *l*, 14 ml of sulfuric acid solution with a density of 1,4 g/ml and a mass fraction of 50% H_2SO_4 were used. a) Calculate the pH of the prepared solution. b) Indicate what color the AC-4 textile filter will have in the process of filtering the prepared solution.	L	L

It is given: *Solution:*

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Answer: a) .... ; b) ....

12 Solutions to the following substances are proposed:

iron (III) sulfate, hydrochloric acid, potassium hydroxide,

lead (II) nitrate, ammonium carbonate.

Using *only* the solutions of substances from the proposed line, a student performed *two* analytical reactions with a *one identification reagent* (from the same line), obtaining *different* analytical signals.

I. Complete the blank spaces in the table according to the requirements indicated.

Formula of the identified substance	Formula of the identification reagent	Analytic signal
1)		....
2)	....	....

II. Write an equation of identification reaction in molecular form, completed ionic and reduced ionic, in accordance with the data from the table above.

.... (ME)

.... (CIE)

.... (RIE)

The L columns for both items 11 and 12 contain the numbers: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

SISTEMUL PERIODIC AL ELEMENTELOR CHIMICE

	I	II	III	IV	V	VI	VII	VIII		
1	1 Hidrogen **H** 1,0079							2 Heliu **He** 4,0026		
2	3 Litiu **Li** 6,941	4 Beriliu **Be** 9,01218	5 Bor **B** 10,81	6 Carbon **C** 12,011	7 Azot **N** 14,0067	8 Oxigen **O** 15,9994	9 Fluor **F** 18,9984	10 Neon **Ne** 20,179		
3	11 Sodiu **Na** 22,98977	12 Magneziu **Mg** 24,305	13 Aluminiu **Al** 26,98154	14 Siliciu **Si** 28,0855	15 Fosfor **P** 30,97376	16 Sulf **S** 32,06	17 Clor **Cl** 35,453	18 Argon **Ar** 39,948		
4	19 Potasiu **K** 39,0983	20 Calciu **Ca** 40,08	21 Scandiu 44,9559 **Sc**	22 Titan 47,88 **Ti**	23 Vanadiu 50,9415 **V**	24 Crom 51,996 **Cr**	25 Mangan 54,938 **Mn**	26 Fier 55,847 **Fe**	27 Cobalt 58,9332 **Co**	28 Nichel 58,69 **Ni**
	29 Cupru 63,546 **Cu**	30 Zinc 65,38 **Zn**	31 Galiu **Ga** 69,72	32 Germaniu **Ge** 72,59	33 Arsen **As** 74,9216	34 Seleniu **Se** 78,96	35 Brom **Br** 79,904	36 Kripton **Kr** 83,80		
5	37 Rubidiu **Rb** 85,4678	38 Stronţiu **Sr** 87,62	39 Ytriu 88,9059 **Y**	40 Zirconiu 91,22 **Zr**	41 Niobiu 92,9064 **Nb**	42 Molibden 95,94 **Mo**	43 Tehneţiu [98] **Tc**	44 Ruteniu 101,07 **Ru**	45 Rodiu 102,9055 **Rh**	46 Paladiu 106,42 **Pd**
	47 Argint 107,868 **Ag**	48 Cadmiu 112,41 **Cd**	49 Indiu **In** 114,82	50 Staniu **Sn** 118,69	51 Stibiu **Sb** 121,75	52 Telur **Te** 127,60	53 Iod **I** 126,9045	54 Xenon **Xe** 131,29		
6	55 Ceziu **Cs** 132,9054	56 Bariu **Ba** 137,33	57* Lantan 138,9055 **La**	72 Hafniu 178,49 **Hf**	73 Tantal 180,948 **Ta**	74 Volfram 183,85 **W**	75 Reniu 186,207 **Re**	76 Osmiu 190,2 **Os**	77 Iridiu 192,22 **Ir**	78 Platina 195,08 **Pt**
	79 Aur 196,9665 **Au**	80 Mercur 200,59 **Hg**	81 Taliu **Tl** 204,383	82 Plumb **Pb** 207,2	83 Bismut **Bi** 208,9804	84 Poloniu **Po** [209]	85 Astatiniu **At** [210]	86 Radon **Rn** [222]		
7	87 Franciu **Fr** [223]	88 Radiu **Ra** 226,0254	89** Actiniu 227,0278 **Ac**	104 Rutherfordium [261] **Rf**	105 Dubnium [262] **Db**	106 Seaborgium [263] **Sg**	107 Bohrium [262] **Bh**	108 Hassium [267,13] **Hs**	109 Meitnerium [268,14] **Mt**	110 Darmstadtium [281] **Ds**

*Lantanide

58 **Ce** Ceriu 140,12	59 **Pr** Praseodim 140,9077	60 **Nd** Neodim 144,24	61 **Pm** Prometiu [145]	62 **Sm** Samariu 150,36	63 **Eu** Europiu 151,96	64 **Gd** Gadoliniu 157,25	65 **Tb** Terbiu 158,9254	66 **Dy** Disprosiu 162,50	67 **Ho** Holmiu 164,9304	68 **Er** Erbiu 167,26	69 **Tm** Tuliu 168,9342	70 **Yb** Yterbiu 173,04	71 **Lu** Luteţiu 174,967

**Actinide

90 **Th** Toriu 232,0381	91 **Pa** Protactiniu 231,0359	92 **U** Uraniu 238,0389	93 **Np** Neptuniu 237,0482	94 **Pu** Plutoniu [244]	95 **Am** Americiu [243]	96 **Cm** Curiu [247]	97 **Bk** Berkeliu [247]	98 **Cf** californiu [251]	99 **Es** Einsteiniu [252]	100 **Fm** Fermiu [257]	101 **Md** Mendeleviu [258]	102 **No** Nobeliu [255]	103 **Lr** Lawrenciu [260]

SOLUBILITATEA ACIZILOR, BAZELOR, SĂRURILOR ÎN APĂ

	H^+	NH_4^+	Li^+	Na^+	K^+	Ba^{2+}	Ca^{2+}	Mg^{2+}	Al^{3+}	Cr^{3+}	Zn^{2+}	Mn^{2+}	Fe^{2+}	Fe^{3+}	Pb^{2+}	Cu^{2+}	Ag^+
OH^-		S↑	S	S	S	S	P	I	I	I	I	I	I	I	I	I	-
F^-	S	S	P	S	S	P	I	I	P	I	S	S	I	I	I	S	S
Cl^-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P	S	I
Br^-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P	S	I
I^-	S	S	S	S	S	S	S	S	S	S	S	S	S	-	I	-	I
S^{2-}	S↑	S	S	S	S	S	S	S	-	-	I	I	I	-	I	I	I
SO_3^{2-}	S↑	S	S	S	S	I	I	I	-	-	I	-	I	-	I	I	I
SO_4^{2-}	S	S	S	S	S	I	P	S	S	S	S	S	S	S	I	S	P
CO_3^{2-}	S↑	S	S	S	S	I	I	I	-	-	I	I	I	-	I	-	I
SiO_3^{2-}	I	-	S	S	S	I	I	I	-	-	I	I	I	-	I	-	-
NO_3^-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
PO_4^{3-}	S	S	I	S	S	I	I	I	I	I	I	I	I	I	I	I	I
CH_3COO^-	S	S	S	S	S	S	S	S	-	S	S	S	S	-	S	S	S

Notă: S – substanţă solubilă, I – insolubilă, P – puţin solubilă; «-» substanţa nu există sau se descompune în apă; ↑ - substanţa se degajă sub formă de gaz sau se descompune cu degajare de gaz

SERIA ELECTRONEGATIVITĂŢII

F	O	N	Cl	Br	I	S	C	Se	P	H	As	B	Si	Al	Mg	Ca	Li	Na	K
4,0	3,5	3,07	3,0	2,8	2,5	2,5	2,5	2,4	2,1	2,1	2,0	2,0	1,8	1,5	1,2	1,04	1,0	0,9	0,8

SERIA TENSIUNII METALELOR

Li K Ba Ca Na Mg Al Mn Zn Cr Fe Ni Sn Pb (H) Cu Hg Ag Pt Au