	Items	Score	
1	Circle the letter **T**, if the statement is true and the letter **F**, if it is false. 1) **T F** The number of electrons on the last energy level coincides with the atomic number of the element in the periodic table. 2) **T F** The chemical element which contains 35 protons in the nucleus is of *„p”* - element. 3) **T F** The chemical element with the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^4$ is the strongest oxidizing agent than the chemical element with the relative atomic mass of 32. 4) **T F** In the solution of the higher hydroxide of the chemical element situated in the periodic table in the 3rd period, group 5, the litmus is colored in blue. 5) **T F** The mass of $12{,}04 \cdot 10^{23}$ nitrogen molecules is greater than the mass of ammonia with the volume of 44,8 *l* (STP).	L 0 1 2 3 4 5	L 0 1 2 3 4 5
2	Blue clay is a natural product with antiseptic, antimicrobial and regenerative action, used efficiently in both cosmetic and medical treatment. Complete the proposed statements for the chemical elements contained in essential quantities in the blue clay. *Chemical element* / *Characteristics* *Zinc*: a) the electronic configuration of the atom ……; b) the type of chemical bond in the simple substance ……; c) a physical property of the simple substance …… *Potassium*: a) the type of crystalline lattice in the oxygen compound ……, the electronic configuration of a particle that is part of this compound ……; b) the chemical symbol of a chemical element with less pronounced reducer properties …… *Chlorine*: a) a concrete field of use of a simple substance …… ……; b) the chemical formula of a compound in which the chemical bond is formed at the intertwine of *s-p* type electrons clouds is ……, chemical formula of higher oxide is ……	L 0 1 2 3 4 5 6 7 8 9	L 0 1 2 3 4 5 6 7 8 9
3	Pure metal zinc is used in manufacturing medical implants that have a high biological compatibility and do not cause allergic reactions. The purity of the zinc can be determined according to the following scheme: $Zn + KMnO_4 + H_2SO_4 \rightarrow ZnSO_4 + MnSO_4 + K_2SO_4 + H_2O$ 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. …… ……	L 0 1 2 3 4 5 6 7	L 0 1 2 3 4 5 6 7

4 Carbon monoxide is characterized by a wide range of uses: from the production of pure metals and oxygenated organic compounds in the chemical industry to the commercial aspect of meat in the food industry.
For each characteristic in column **B**, select from the column **A** the corresponding reagent system and indicate that figure in the reserved space.

L
0
1
2
3
4

L
0
1
2
3
4

A	**B**
1) $CH_{4(g)} + CO_{2(g))} \rightleftarrows 2H_{2(g)} + 2CO_{(g)} - Q$	…. a) presents a heterogeneous system
2) $CO_{(g)} + 2H_{2(g)} \overset{[Cr_2O_3]}{\rightleftarrows} CH_3OH_{(g)} + Q$	…. b) increasing pressure does not influence the chemical balance
3) $Fe_2O_{3(s)} + 3CO_{(g)} \rightleftarrows 2Fe_{(s)} + 3CO_{2(g)} + Q$	…. c) decreasing the temperature shifts chemical equilibrium to the left
	….d) increasing the concentration of hydrogen increases the yield of the direct reaction

5 Prior treatment of apples with calcium chloride solutions significantly reduces losses when stored for a long time. According to the research, optimal results are obtained when using solutions with a mass of calcium chloride of 8%.
Solve the problem. The precipitate, obtained at the complete interaction of 328 g of calcium nitrate solution with the mass part of $Ca(NO_3)_2$ of 20% with a solution of potassium carbonate solution, was treated with excess of hydrochloric acid.
a) Calculate the mass of calcium chloride obtained from these reactions.
b) Give arguments by calculation, if the solution with a mass of 1,11 kg, obtained from this amount of calcium chloride, may be recommended for the treatment of apples which will be stored for the long term.

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

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

It is given: *Solve:*

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

6 Potassium phosphate is used to produce instant coffee as a flavor and color fixer.

I. Write the equations of obtaining reactions of potassium phosphate according to the type of reaction proposed:

a) combination reaction ……

b) substitution reaction ……

II. Write the equations of reactions that characterize the chemical properties of potassium phosphate, 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 semi-developed formulas of the corresponding organic substances, and in column **II** complete the sentences corresponding to these substances.

I	**II**
1) It is a component of natural gas:	1) Belongs to the homologous series with the general formula: .....
2) Hydroxylic compound which contains the same number of carbon atoms as the pentene:	2) A semi-developed formula of a homologue: .....
3) It is a product of photosynthesis:	3) A physical property of this substance: .....
4) Corresponds to the molecular formula $C_2H_4O_2$ and does not undergo hydrolysis reaction:	4) A concrete field of use of this compound: .....

L
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L
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8 **I**. Complete the blank spaces in the table:

	Structural semi-developed formula of substance	*Name of substance according to systematic nomenclature*
1	$HC\equiv C-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-CH_2-CH_3$	
2		2-methylbutanal

L
0
1
2
3
4
5
6

L
0
1
2
3
4
5
6

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 hex-2-yne.

b) **T F** Substance number *2* is a homologue of the propanal.

c) **T F** When hydrating substance number *1*, an isomer of pentane is obtained.

d) **T F** Both substances can be identified with copper (II) hydroxide.

9 There are given the subtances:

ethanol, buta-1,3-diene, propanoic acid, benzene, ethyl methanoate.

Write the reactions equations respecting the condition that in each case the reagent belongs to the indicated class of organic compounds and the reaction product is one of the substances in the proposed row. For the organic substances use the semi-developed structure formulas.

a) of alkene .....

b) of alkyne.....

c) of aldehyde .....

d) of carboxylic acid.....

L
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6
7
8

L
0
1
2
3
4
5
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10 The E-270 additive is a natural organic compound that favoring the process of skin regeneration due to a mild exfoliating effect. In the case of minor dermatological problems, cosmetics with an E-270 content of 5-10% are recommended, and to prevent deep wrinkles, preparations that are more concentrated are needed, containing 30% additive.

Solve the problem.

a) Determine the molecular formula of the additive E-270, if when burning a sample of this compound with a mass of 18 g, 13,44 *l* (STP) of carbon dioxide (IV) and 10,8 g of water were obtained. The vapor density of this substance after hydrogen is equal to 45.

b) Give arguments by calculations, if the cosmetic preparation with a mass of 200 g which contains 0,2 moles of this additive can be effective in preventing deep wrinkles.

It is given: *Solution:*

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

L
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13

L
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11 The aroma and taste of tomatoes are influenced by the acidity of the soil: if the medium is too acidic, tomatoes can become woody, while at too low an acidity, they lose flavor. In order to ensure an optimal medium with pH = 4,5, it is recommended to regulate soil acidity with the help of fertilizers with basic medium or acidic medium.

Solve the problem. For the preparation of a solution with a volume of 400 *l*, 73 ml of hydrochloric acid solution with a density of 1 g/ml and a mass fraction of 2% HCl were used.

a) Calculate the pH of the prepared solution.

b) Give arguments whether the use of alkaline fertilizers can be beneficial for tomatoes grown on the soil with the same pH value.

It is given: *Solution:*

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

L
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10

L
0
1
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4
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12 Solutions to the following substances are proposed:

ammonium sulphate, hydrochloric acid, barium nitrate,
silver nitrate, potassium 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)

L
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L
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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 Stronțiu **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 – substanță solubilă, I – insolubilă, P – puțin solubilă; «-» substanța nu există sau se descompune în apă; ↑ - substanța 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