

No.	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 protons in the nucleus of the atom of ^{56}Fe is less than the number of neutrons in the nucleus of the atom of ^{52}Cr . 2) T F The number of electrons on the last energy level of the atom of the chemical element situated in the 4 th period, group 7, secondary subgroup is equal to 7. 3) T F The most active non-metal in the 4 th period forms a simple substance with a molar mass greater than 80 g/mol. 4) T F The chemical element with the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^3$ in the higher oxide has an oxidation degree greater than +3. 5) T F The mass of methane with a volume of 44.8 l (STP) is equal to the mass of $3.01 \cdot 10^{23}$ copper atoms.	L	L
		0	0
		1	1
		2	2
		3	3
		4	4
		5	5
2	For the packaging of high-quality spices, intelligent packaging is used, which ensures both the creation of an inert atmosphere and the reduction of chemical factors that can affect the properties of the product. The following substances are used as active components of this packaging: <i>nitrogen, carbon (IV) oxide, calcium chloride, iron, silicon (IV) oxide.</i> For each proposed characteristic, select one substance from the given row and write its chemical formula in the reserved space.	L	L
		0	0
		1	1
		2	2
		3	3
		4	4
		5	5
		6	6
		7	7
3	The high concentration of iron ions gives groundwater a pronounced metallic taste and leads to the formation of significant deposits in pumping installations. To bring them within regulated quality parameters, it is treated with potassium permanganate, according to the following reaction scheme: $\text{FeCl}_2 + \text{KMnO}_4 + \text{H}_2\text{O} \rightarrow \text{MnO}_2 + \text{Fe}(\text{OH})_3 + \text{KCl} + \text{HCl}$ 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	L
		0	0
		1	1
		2	2
		3	3
		4	4
		5	5
		6	6
		7	7

[illegible]

6	There are given the substances: <i>sulfur (IV) oxide, barium carbonate, copper (II) hydroxide, hydrogen, iron (III) chloride, aluminum oxide.</i> Write the equations of chemical reactions according to the types indicated, using each substance in the proposed row <u>only once</u> as an initial substance or as a reaction product. <i>a) decomposition</i> reaction: <i>b) exchange</i> reaction: <i>c) combination</i> reaction: <i>d) substitution</i> reaction:	L	L
		0	0
		1	1
		2	2
		3	3
		4	4
		5	5
		6	6
		7	7
		8	8
7	Complete the statements by writing in the reserved space the structural semi-developed formula of an <u>organic substance</u> that corresponds to the proposed characteristic. 1) Corresponds to the general formula C_nH_{2n} and contains no π - bonds 2) Corresponds to the molecular formula $C_4H_9NO_2$ and participates in the polycondensation reaction 3) It is obtained from the dehydrogenation of 2-methylbutane 4) It is used in the production of ethanol 5) Can be identified with copper (II) hydroxide	L	L
		0	0
		1	1
		2	2
		3	3
		4	4
		5	5
8	Two organic substances are given that contain the <u>same number</u> of hydrogen atoms. One of these substances is a homologue of <u>methanol</u> . Complete the blank spaces in the table in accordance with the indicated requirements.	L	L
		0	0
		1	1
		2	2
		3	3
		4	4
		5	5
		6	6
		7	7

	Organic substance 1	Organic substance 2
Structural semi-developed formula	$HC \equiv C - CH_2 - \underset{\substack{ \\ CH_3}}{CH} - CH_3$	
Name according to systematic nomenclature		
Structural semi-developed formula	<i>a chain isomer</i>	<i>a position isomer</i>
Name according to systematic nomenclature		

[illegible]

11	Modern PET plastic recycling technologies are aimed at converting the polymer material into soluble products that can be separated and reused. The process is carried out at elevated temperatures and pressures through hydrolysis in an alkaline medium with a pH equal to 13. Solve the problem. To conduct an experimental investigation, a laboratory technician is required to prepare a potassium hydroxide solution with a volume of 8 l with a pH equal to 13. Give arguments by calculations, if 8 ml of a potassium hydroxide solution with a density of 1.4 g/ml and a mass fraction of 40% of base is sufficient to prepare the required solution. <i>It is given:</i> <i>Solution:</i> <i>Answer:</i>	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	As part of a water quality monitoring program, solutions of the following substances were proposed for analysis: <i>barium chloride, iron (III) nitrate, ammonium sulfate, sodium carbonate.</i> To identify <u>three</u> of the proposed substances, <u>only two reagents</u> from the available set were used: H₂SO₄, Pb(NO₃)₂, NaOH, CaCl₂. I. Complete the blank spaces in the table presenting the results of the chemical analysis performed. <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 25%;">Formula of the identified salt</th> <th style="width: 25%;">Formula of the identification reagent</th> <th style="width: 45%;">Analytic signal</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1.</td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">2.</td> <td></td> <td style="text-align: center;">NaOH</td> <td></td> </tr> <tr> <td style="text-align: center;">3.</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> 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)		Formula of the identified salt	Formula of the identification reagent	Analytic signal	1.				2.		NaOH		3.				L	L
	Formula of the identified salt	Formula of the identification reagent	Analytic signal																
1.																			
2.		NaOH																	
3.																			
		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																

SISTEMUL PERIODIC AL ELEMENTELOR CHIMICE

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

*Lantanide

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

90 Th 232,0381 Toriu	91 Pa 231,0359 Protactiniu	92 U 238,0389 Uranu	93 Np 237,0482 Neptuniu	94 Pu [244] Plutoni	95 Am [243] Americiu	96 Cm [247] Curium	97 Bk [247] Berkelium	98 Cf [251] Californiu	99 Es [252] Einsteinium	100 Fm [257] Fermium	101 Md [258] Mendeleviu	102 No [255] Nobelium	103 Lr [260] Lawrenciu
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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 ₃ COO ⁻	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 ELECTRONEGATIVITĂȚII

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