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 bromine atom is equal to the number of neutrons which are contained in the nucleus of the atom ^{64}Cu. 2) **T F** The chemical element with the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^4$ in the higher oxide has the oxidation degree +4. 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** The higher hydroxide of the chemical element, which is situated in the 4th period, group 5, main subgroup, can be neutralized with sodium hydroxide. 5) **T F** The number of atoms contained in 6,4 g of sulfur is greater than the number of molecules in 2,24 *l* (STP) of oxygen.	L 0 1 2 3 4 5	L 0 1 2 3 4 5
2	*Molecular cuisine*, one of the most exotic trends in modern culinary art, focuses on creating unique combinations of flavors, tastes, and textures by applying specific technologies of food preparation: dehydration, foaming, and processing at low temperatures. The following substances may be used to carry out these processes: *calcium chloride, nitrogen, ammonia, carbon (IV) oxide.* For each proposed characteristic select a substance from those used in molecular gastronomy and write its chemical formula in the reserved space. | | *Caracteristic of the substance* | *Chemical formula* | | 1 | non-polar covalent bonds are formed between the particles of the substance | | | 2 | the substance contains particles with the electronic configuration of an inert gas | | | 3 | a triple bond is formed between the particles of the substance | | | 4 | hydrogen bonds are formed between molecules of a substance | | | 5 | it is a gas heavier than air | | | 6 | at the interaction with water, form a solution with pH > 7 | | | 7 | it is one of the products of the limestone decomposition reaction | |	L 0 1 2 3 4 5 6 7	L 0 1 2 3 4 5 6 7
3	Seafood, on the packaging of which the "clear smoke" mark is indicated, maintains its fresh appearance and natural aroma for a long time due to the prior treatment with carbon monoxide. Monitoring of carbon monoxide content in these products can be done according to the following reaction scheme: $CO + KMnO_4 + H_2SO_4 \rightarrow CO_2 + MnSO_4 + K_2SO_4 + H_2O$ 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 One of the innovations in the field of clean energy aims to replace diesel with dimethyl ether - a more efficient, greener fuel with a 90% lower content of pollutants in the exhaust gases. The industrial production of this compound can be carried out according to the chemical equation:

$$3H_{2\,(g)} + 3CO_{(g)} \overset{[Cr_2O_3]}{\rightleftarrows} CH_3 – O – CH_{3\,(g)} + CO_{2\,(g)} + Q$$

Indicate in which direction the chemical equilibrium will shift in this reagent system under the action of the following factors using the expressions *on the right, on the left, it will not shift,*:

a) increasing the hydrogen concentration ……

b) catalyst change ……

c) increasing the temperature ……

d) decreasing pressure ……

e) removing carbon (IV) oxide from the reaction medium ……

L
0
1
2
3
4
5

L
0
1
2
3
4
5

5 Accessories made of *argintal*, an alloy of silver and aluminum, do not darken over time and stand out for their finesse and aesthetic refinement. For accessories with a minimalist design, alloys with an aluminum content of 5-8% can be used, and for those with detailed ornaments, the realization of which requires increased plasticity - not less than 10%.

Solve the problem.

For the chemical analysis of a silver and aluminum alloy with a mass of 45 g, 588 ml of sulfuric acid solution with a density of 1 g/ml and a mass fraction of the acid of 5% were consumed.

a) Calculate the mass fraction of silver in this alloy.

b) Give arguments if the alloy with this composition will be suitable for making a bracelet with a detailed floral design.

It is given: *Solution:*

……

……

……

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……

……

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……

……

……

……

……

……

Answer: a) …… ; b) ……

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 There are given the substances:
potassium hydroxide, carbon (IV) oxide, ammonium chloride, hydrogen, aluminum oxide.
For each type of reaction indicated, select from the proposed line a substance that can be used as reagent or reaction product. Write the corresponding reaction equations provided that each selected substance is *used only once.*

a) combination reaction: ..... → .....

b) substitution reaction: ..... → .....

c) decomposition reaction: ..... → .....

d) exchange reaction: ..... → .....

L
0
1
2
3
4
5
6
7
8

L
0
1
2
3
4
5
6
7
8

7 Natural masks have a beneficial effect on damaged hair: they moisturize it, strengthen it, restore its shine. One of the most affordable masks can be homemade by using affordable components as: *ethanoic acid, glycerol, 2-aminopropanoic acid.*

Complete the blank spaces from the proposed statements:

I. *Ethanoic acid* belongs to the homologous series with the general formula .....; is used in the food industry as ..... .

II. *Glycerol* has the molecular formula .....; can be identified with ..... .

III. *2-Aminopropanoic acid* has amphoteric properties, so it reacts both with ..... and with .....; the structural semi-developed formula of a homologue of this compound is .....

L
0
1
2
3
4
5
6
7

L
0
1
2
3
4
5
6
7

8 There are given two organic substances that contain the *same number* of carbon atoms. One of these substances has a *branched chain* and contains *two π bonds*.
Complete the blank spaces in the table in accordance with the indicated requirements.

	Organic substance 1	*Organic substance 2*
Structural semi-developed formula		$CH_3-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-\underset{\displaystyle OH}{\underset{\vert}{CH}}-CH_2-CH_3$
Name according to systematic nomenclature		
Structural semi-developed formula	*a chain isomer*	*a position isomer*
Name according to systematic nomenclature		

L
0
1
2
3
4
5
6
7

L
0
1
2
3
4
5
6
7

9 There are given the substances:

bromoethan, propen, glucose, methyl ethanoate, butanoic acid.

Write the reactions equations according to the proposed schemes, using in each case one of the substances in the given line as reagent or reaction product. For the organic substances use the structural semi-developed formulas.

1) ……..…… + Na → ……..……..……

2) ……..…… + Br_2 → ……..……..……

3) ……..…… → ……..…… + Ag

4) ……..……..…… → ……..…… + HOH

L
0
1
2
3
4
5
6
7
8

L
0
1
2
3
4
5
6
7
8

10 "Smart packaging" contains active substances that, acting on the atmosphere indoors, create an ideal environment for maintaining the quality of the products. According to the conducted research, the incorporation of 0,1 moles of active substance in the contents of a package with a volume of 1 *l* allows to increase the shelf life of the packaged product by at least 5 times.

Solve the problem. a) Determine the molecular formula of saturated monoalcohol, used as an active substance in the production of packaging for confectionery products, if at the interaction of 18,4 g of this alcohol with excess metallic sodium, a gas with a volume of 4,48 *l* (STP) was eliminated.

b) Give arguments, if the use of the 1 *l* volume package, which contains 4,6 g of this alcohol, will allow extending the shelf life of the cookies from 72 hours to 15 days.

It is given: *Solution:*

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……

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……

……

Answer: a) …… ; b) ……

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

11 The orchid is considered "a queen of ornamental plants" due to its wide spectrum of colors, shapes and aromas. To stimulate abundant flowering, it is recommended to maintain an optimal soil pH of 5,5 by irrigating with green tea extract in the case of a more acidic soil or by adding a coconut fiber substrate in the case of a less acidic soil.

Solve the problem.

To prepare a solution, 50 ml of hydrochloric acid solution with a molar acid concentration of 0,001 *mol/l* was added to 4950 ml of water.

a) Calculate the pH of the final solution.

b) Give arguments about which of the recommended remedies you will use to stimulate the flowering of orchids growing in soil with the same pH.

It is given: *Solution:*

.....

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.....

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.....

.....

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

L	L
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

12 In a practical work, solutions of the following substances were proposed for identification:

iron (III) chloride, ammonium sulphate, silver nitrate, potassium carbonate.

A student managed to identify <u>*three of the proposed substances*</u>, using only <u>*two identification reagents*</u> from the available set: HCl, KSCN, NaOH, $Ba(NO_3)_2$.

I. Complete the blank spaces in the table presenting the results of the chemical analysis performed.

	Formula of the identified salt	*Formula of the identification reagent*	*Analytic signal*
1.			
2.			
3.			brown precipitate, soluble in acids

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	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

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