CXTM	**Society of Chemists and Technologists of Macedonia** Chemistry competitions for elementary and high school students **CODE:** _____ (filled in by the jury)	FOR THE JURY ONLY Total points: _____ Checked by: _____ (Name Surname)

RULES FOR THE REGIONAL CHEMISTRY COMPETITION 2022

1) The competition **starts at 12 o'clock and lasts for 90 minutes**. The tests that are handed after the given time will not be considered for scoring.
2) The maximal score is 50 points (30 points from multiple choice questions and 20 points from the problems, as given in the test)
3) The tests are stapled with an envelope on the top. In the envelope there is piece of paper on which every competitor should fill in the requested data: name and surname, school, supervisor etc. and then close (seal) the envelope.
4) **No signature, or any mark is allowed on the envelope and on the test**. The code on the test, below and on the envelope, is filled in by the jury. If any signature or mark is found on the test or envelope, the competitor will be disqualified.
5) The competitors should bring a blue pen with them. The test should be solved by this pen only. **It is not allowed to use a pencil.**
6) Each competitor should leave the **cell phone** at the teacher's desk at the beginning and take it back at the end after handing over the test.
7) A calculator can be used for the numerical problems.
8) A conversation between the competitors during the competition is forbidden as well as using books, notebooks, any other paper, the periodic table of the elements etc. All necessary data are given in the test.
9) A competitor that does not follow any of these rules/recommendations shall be eliminated from the competition.

PART I. MULTIPLE CHOICE TEST WITH ONE CORRECT ANSWER
(Answer by circling just one of the answers marked with A, B, C or D)

1. Which of the following statements is correct about what happens when a certain volume of gas is compressed?

A. The volume of the gas particles increases.
B. The space between the gas particles increases.
C. The volume of the gas particles decreases.
D. The distance between the gas particles decreases.

2. Which of the statements, about the following figures, is correct:

А Б В

A.Figure Б represents water in a liquid state.
B. Figure B represents ice.
C. Figure A represents an elemental substance in a gaseous state.
D. Figure B represents an elemental substance in a liquid state.

3. Martin got a task to determine the melting point of a solid substance. He made measurements on two samples of the substance, one of which (X) had a mass of 10 mg and the other (Y) of 5 mg. The melting point of the sample X is

A. the same as the melting point of the sample Y.
B. twice as higher as the melting point of the sample Y.
C. twice as lower as the melting point of the sample Y.
D. 5 ˚C higher than the melting point of the sample Y.

4. Which of the following alloys contains nonmetal?

A. Brass.
B. Bronze.
C. Steel.
D. Amalgam.

5. The procedure for separating the components from a mixture based on the different boiling temperatures of the components is called

A. filtration.
B. distillation.
C. evaporation.
D. chromatography.

6. What is correct for the elemental substances?

A. Some elemental substances can be represented by chemical formulas.
B. At room temperature, there are no elemental substances in a liquid state.
C. There are no elemental substances built up of molecules.
D. Some elemental substances are built up of molecules consisting of two chemically different atoms.

7. How many oxygen atoms, in total, are contained in 3 molecules of carbon dioxide and two molecules of sulfur trioxide?

A. 5. B. 10. C. 4. D. 12.

8. In which of the following sequences are all formulae of magnesium compounds correct?
I. $Mg(OH)_2$ $MgNO_3$ $MgSO_4$ $MgCl_2$ MgO
II. $Mg(OH)_2$ $Mg(NO_3)_2$ MgS $MgCl_2$ $MgCO_3$
III. MgBr $MgSO_4$ MgO Mg_2S $MgCl_2$
IV. $MgBr_2$ $Mg(NO_3)_2$ MgS $MgCO_3$ $Mg(OH)_2$
A. Only in I.
B. Only in II and in IV.
C. Only in III.
D. Only in II and in III .

9. In which of the following pairs of compounds, the iron is of the same valence?
A. $FeSO_4$ and Fe_2O_3.
B. $Fe(OH)_3$ and $FeCO_3$.
C. FeO and $FeCl_2$.
D. Fe_2O_3 and $FeCO_3$.

10. The solution of calcium hydroxide (lime water) is used for identification of
A. hydrogen. B. carbon dioxide. C. oxygen. D. nitrogen.

11. Which of the following reactants, in reaction with each other, form salt and water?
I. metal + acid II. acid + base III. metal oxide + acid
A. Only II.
B. Only III.
C. Only II and III.
D. All of them.

12. All nitrates contain a group that can be written as:
A. NO B. NO_4 C. NO_2 D. NO_3

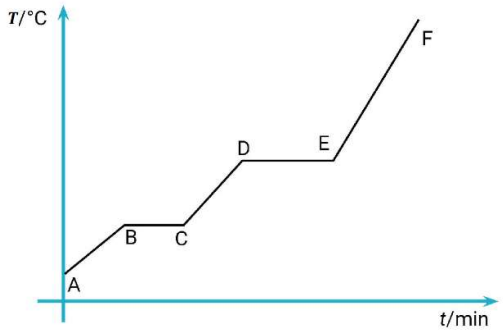
13. In a reaction of hydrochloric acid with a certain substance, one of the obtained products was a gas. The gas was collected in a test tube, and when a burning match was inserted into the test tube, a crackling was heard. The substance that reacted with hydrochloric acid might be
A. magnesium.
B. sodium hydroxide.
C. calcium carbonate.
D. calcium oxide.

14. Which is NOT correct about the hydroxides?
A. Some of the hydroxides can be obtained in a reaction of salt and base.
B. The hydroxide solutions exhibit pH > 7.
C. All of the hydroxides can be obtained in a reaction of metal and water.
D. When a hydroxide reacts with an acid, the products are salt and water.

15. The solution of a substance had pH = 6. When a solution of some other substance was added to initial solution, the pH value decresed. What could be the added substance?
A. Potassium hydroxide.
B. Ammonia.
C. Sodium chloride.
D. Nitric acid.

PART II.
Write your answer at the designated place.

1. The following graph shows the changes that occur in a solid substance during heating, at certain time intervals, at atmospheric pressure.



Based on the data given in the graph, fill in the blanks in the following statements with the corresponding letter in the graph.

1. In point ___C___ the melting of the substance ends.
2. In point ___D___ the boiling of the substance starts.
3. The evaportaion of the substance ends in point ___E__.
4. The melting of the substance starts in point ___B__.
5. The segment from ___A__ to ___B___ represents the existance of the substance in a solid state.

(**5** points in total, one point for each correct answer)

2. Mihaela got a task to determine the density of five different solid substances. Substances A, Б, and B were of prismatic form with the following dimensions: length 5 cm, width 3 cm, and height 2 cm. Substances Г and Д were in the form of a cube with an edge of 3 cm. Mihaela measured the masses of these five substances and obtained the following values:

Substance	A	Б	B	Г	Д
Mass, *m*/g	156,0	46,5	340,5	94,5	48,6

Arrange the substances according to the increasing density, so that you will write the corresponding letter on the blank lines.

___Б___ < __Д____ < __Г____ < __A____ < ___B___ (5 points)

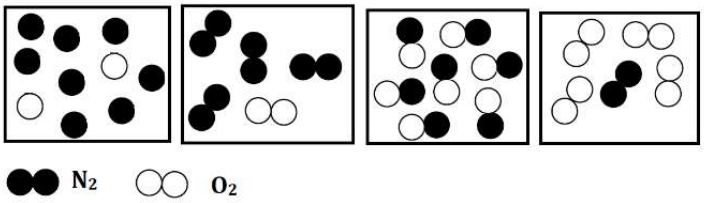
3. Fill the blanks in the following table:

The formula of the compound	The names of the consisting elements in the compound	The name of the compound
LiOH	lithium, oxygen, hydrogen	lithium hydoxide
$CaSO_4$	calcium, sulphur, oxygen	calcium sulphate
KCl	potassium and chlorine	potassium chloride
Na_2CO_3	sodium, carbon, oxygen	sodium carbonate
Fe_2O_3	iron, oxygen	iron(III) oxide

(**5** points in total, 0,5 point for each correct answer)

4. Air is a mixture of gases, which consists, in general, of 21 % oxygen and 78 % nitrogen. The oxygen and the nitrogen in the air are built up of diatomic molecules. Determine in which of the following graphical presentations is approximately shown the composition of the air. Encircle the correct answer.

А Б В Г



(5 points)