



Society of Chemists and Technologists of Macedonia
Chemistry competitions for elementary and high school students

CODE: [REDACTED]

(to be filled in by the jury at the end of the test here and on the envelope)

FOR THE JURY ONLY

Total points: _____

Checked by (Name Surname): _____

RULES FOR THE LOCAL CHEMISTRY COMPETITION 2019

- 1) The competition **starts at 10 o'clock and lasts for 60 minutes**. The tests that are handed after the given time will not be considered for scoring.
- 2) 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.
- 3) **No signature, or a mark is allowed on the envelope and on the test**. The code on the test, below and on the envelope, should be filled in by the jury after the test time is over. If any signature or mark is found on the test or envelope, the competitor will be disqualified.
- 4) 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.**
- 5) 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.
- 6) A calculator can be used for the numerical problems.
- 7) 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.
- 8) The maximal possible number of points is **50**.
- 9) 2 points are awarded for every correct answer, and for a non-answered or not correctly answered question (more than one answer or crossed-out answer) no points are awarded.
- 10) If the competitor has a question then he calls the responsible teacher in the classroom (testator), who then calls the coordinator by cell phone. The coordinator, in presence of one more teacher, decides if he/she should answer the question of the contestant. The question should be asked quietly and be short and clear. If both teachers decide that the question should be answered, then the coordinator loudly repeats the question and the answer so all contestants in the classroom can hear it. If not, the coordinator loudly says "That is not relevant for the competition".
- 11) A competitor that does not follow any of these rules/recommendations shall be eliminated from the competition.



Answer by circling the letter in front of the given answers. Each correct answer is worth 2 points. Writing with a pencil, circling two or more answers or crossing over the answer will be penalized by 0 points.

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

- The atomic number of potassium is 19, and its mass number is 39. Which of the following propositions is correct?
 - The potassium atom has 19 neutrons and 20 electrons.
 - The potassium atom has 19 electrons and 20 neutrons.
 - The potassium atom has 19 electrons and 20 protons.
 - The potassium atom has 19 neutrons and 20 protons.
- In which period of the Periodic table is located the element with atomic number 20?
 - In the first period.
 - In the second period.
 - In the third period.
 - In the fourth period.
- From the results of his experiment J.J. Tomson concluded that:
 - electrons are particles with negative charge and mass about 2000 times smaller than the mass of the hydrogen atom.
 - the electrons orbit around the nucleus in specific energy levels.
 - the diameter of an electron is almost equal to the diameter of the nucleus.
 - the positive charge in the atom is located in a small volume around the centre of the nucleus.
- The elements in the Periodic table are arranged by:
 - atomic mass.
 - atomic number.
 - mass number.
 - molar mass.
- The element with electron configuration 2,8,8,2 is:
 - an alkali metal.
 - an alkaline earth metal.
 - a halogen.
 - a noble gas.
- The state of matter of chlorine, bromine and iodine, at room temperature, respectively are:
 - Solid, liquid, gas.
 - Liquid, gas, solid.
 - Gas, solid, liquid.
 - Gas, liquid, solid.
- For which of the given elements are the following characteristics true:
 - it belongs in the third period in the Periodic table.
 - it is a nonmetal.
 - with hydrogen it forms a compound consisting of a diatomic molecule?
 - ${}_{15}\text{E}$
 - ${}_{16}\text{E}$
 - ${}_{17}\text{E}$
 - ${}_{18}\text{E}$
- How many covalent bonds are there in one molecule of hydrogen sulfide?
 - One single covalent bond.
 - Two single covalent bonds.
 - Three single covalent bonds.
 - Four single covalent bonds.
- The valency of nitrogen in N_2O_3 is:
 - 6
 - 5
 - 2
 - 3
- Covalent substances are often composed of:
 - only non-metal atoms.
 - only metal atoms.
 - a metal atom and a non-metal atom.
 - an alkali metal atom.
- The chemical formula of magnesium nitrate is:
 - MgNO_3
 - MgNO_2
 - $\text{Mg}(\text{NO}_3)_2$
 - $\text{Mg}(\text{NO}_2)_2$
- Two oxides with chemical formulae XO and X_2O_3 are obtained from the element X. Which are the chemical formulae of the chlorides of the metal X?
 - XCl and XCl_2
 - XCl and X_2Cl_3
 - XCl_2 and XCl_3
 - X_2Cl and X_3Cl
- The electron configuration of ${}_{16}\text{S}^{2-}$ is:
 - 2,8,2
 - 2,8,4
 - 2,8,6
 - 2,8,8

14. During some chemical reaction 100 cm^3 gas is generated for 40 s. What is the reaction rate?
- $0,4 \text{ cm}^3/\text{s}$
 - $2,5 \text{ cm}^3/\text{s}$
 - $25 \text{ cm}^3/\text{s}$
 - $4000 \text{ cm}^3/\text{s}$
15. A group of pupils examined the surface area effect on the reaction rate. They used pieces of marble with equal mass (small, medium and large). The reaction took place into three separate bottles, with a large volume of diluted hydrochloric acid. Which pieces of marble are first exhausted?
- The small pieces of marble.
 - The medium pieces of marble.
 - The large pieces of marble.
 - All pieces of marble are exhausted for the same period of time.
16. Ionic bonding is characteristic for the following compound:
- HBr
 - H_2
 - Br_2
 - CaBr_2
17. What is correct?
- The rate of reaction doubles for every 10°C rise in temperature.
 - A catalyst is a substance that accelerates a chemical reaction and it is exhausted.
 - The rate of reaction decreases when more reactants are added to the reaction mixture in constant volume.
 - The concentration of acid increases if equal volume of water is added.
18. The charge of ions composed from atoms from the 16th group is:
- 1-
 - 2-
 - 1+
 - 2+
19. How many atoms of copper are there in 4 formula units of copper(I) sulfate?
- 8
 - 4
 - 12
 - 16
20. Which equation describes the following chemical reaction: iron grains combusted in the flame?
- $2\text{Fe} + 2\text{CO}_2 + \text{O}_2 = 2\text{FeCO}_3$
 - $4\text{Fe} + 3\text{O}_2 = 2\text{Fe}_2\text{O}_3$
 - $3\text{Fe} + 4\text{H}_2\text{O} = \text{Fe}_3\text{O}_4 + 4\text{H}_2$
 - $\text{Fe} + \text{CO} = \text{FeO} + \text{C}$
21. What is the name of the compound with a chemical formula HNO_2 ?
- Hydrogen cyanide.
 - Nitric acid.
 - Nitrous acid.
 - Ammonia.
22. How many protons, neutrons and electrons does an ion with charge 3- have:
- $p=17, n=20, e=17$
 - $p=13, n=14, e=10$
 - $p=7, n=7, e=7$
 - $p=15, n=16, e=18$
23. A solution of phosphoric acid is neutralised by a solution of sodium hydroxide and the products are sodium phosphate and water. The sum of the coefficients of the balanced chemical equation is:
- 5
 - 6
 - 7
 - 8
24. Which of the following metals is of highest reactivity in reaction with acids?
- Magnesium.
 - Aluminium.
 - Iron.
 - Zinc.
25. If you know that X_2O is a basic oxide, what of the following is correct:
- element X is a metal.
 - X_2O reacts with water and forms corresponding salt.
 - X_2O reacts with bases and forms corresponding salt.
 - X_2O reacts with acids and forms corresponding salt.
- Only I.
 - Only II.
 - I and III.
 - I and IV.