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

CODE:

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

REGIONAL CHEMISTRY COMPETITION

April 6, 2019

1) The tests are stapled with an envelope on the top. In the envelope there is piece of paper on which you should fill in the requested data: name and surname, school, supervisor etc. and then close and **seal the envelope!**
2) Do not put any signature, or a mark on the envelope and on the test (the code should be filled in by the jury). If any signature or mark is found on the test or envelope, the competitor will be disqualified.
3) You should write on the test using a **blue pen**, answers written with pencil will not be considered.
4) A calculator can be used for the numerical problems. It is not allowed to use textbooks, any other book, notebook, paper, the periodic table, cell phone etc. Cell phones should be left on the teacher's desk or out of the test room.
5) All necessary data are provided in the test.
6) Any conversation between the competitors is forbidden. If you have any question, then the teacher in the room should call the responsible teacher for the competition.
7) Read the test carefully and answer the questions following the instructions by: encircling, writing down the solution and answer in the designated space in the test. The jury **will evaluate only the answers written in the designated space for it**, and the procedures for solving the problems will be checked. The back of every page of the test, that is empty, can be used for free writing and it will not be checked and evaluated!
8) The maximal number of points is **50**. In the first part of the test with multiple choice questions, each correct answer brings 2 points (maximum 30). The correct answers to the problems in the second part brings maximum 20 points.
9) The competition lasts **90 minutes**. The tests that are handed after the given time will not be considered for scoring.

We wish you a successful work!

For the jury only

Part I: _____

Part II: _____

Total points:_____

Checked by (Name and Surname)

_____

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

1. At room temperature, **NONE** of the metals is:
   A. Soft.
   B. Liquid.
   C. Malleable.
   D. Gaseous.

2. In which case the density increases?
   A. A sample of gaseous chlorine is compressed.
   B. The lead object is transported from a place with a smaller to a place with a higher altitude.
   C. A sample of water is frozen.
   D. The diamond is put in water.

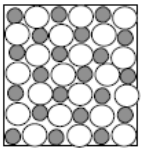
3. Andrej had one bag of flour and one bag of feathers. He wanted to examine which material was softer and therefore asked ten friends to touch the materials in both bags and say which one is softer. The results of this study are: seven said the feathers were softer, two thought the flour was softer, and one of the friends replied that both materials were equally soft. What conclusion can Andrej take?
   A. Flour is probably softer than feathers.
   B. Feathers are probably softer than flour.
   C. Both flour and feathers are equally soft.
   D. Feathers are soft.

4. Which characteristics of porcelain make it suitable material for making cups for tea?
   A. It is a brittle, porous and a good electric insulator.
   B. It is a shiny, transparent and good heat conductor.
   C. It is hard, waterproof and good heat insulator.
   D. It is dense, opaque and good electric conductor.

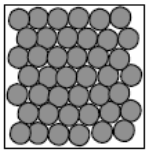
5. What of the following is **NOT** an alloy?
   A. Amalgam.
   B. Tin.
   C. Brass.
   D. Steel

6. How many atoms of oxygen are there in one formula unit of magnesium nitrate?
   A. 1
   B. 2
   C. 3
   D. 6

7. The following illustrations refer to two different substances at room temperature and atmospheric pressure. The substances could be:



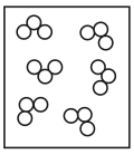
X



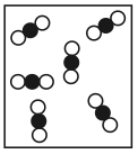
Y

   A. X: hydrogen bromide, Y: elemental bromine
   B. X: carbon monoxide, Y: carbon
   C. X: potassium chloride, Y: potassium
   D. X: solution of sodium chloride, Y: solid sodium chloride

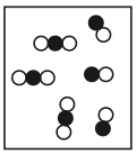
8. Which illustration represents the molecules of one compound in the gaseous aggregate state?



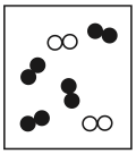
A.



B.



C.



D.

9. The separation of the components from the mixture by distillation is possible due to the differences in:
   A. Boiling temperatures.
   B. The size of the particles.
   C. Solubility in water.
   D. Melting temperatures.

10. What is **NOT** true?
   A. Experiments with toxic substances should be performed in a fume hood.
   B. Corrosive substances are substances that damage the tissues or material in contact.
   C. In order to avoid injuries that could occur when working with corrosive substances, beside labcoat and protective goggles, gloves should be worn as well.
   D. Working with glassware does not require special precautions when removing broken laboratory equipment.

11. Which of the following word equations correctly represent the reaction of metals from the first group with water?
   A. Potassium + water → potassium hydroxide + oxygen
   B. Aluminum + water → aluminum hydroxide + hydrogen
   C. Lithium + water → lithium hydroxide + hydrogen
   D. Magnesium + water → magnesium hydroxide + hydrogen

12. Which word equation of the reaction between metal and acid is correct?
   A. Copper + sulfuric acid → copper sulphite + hydrogen
   A. Zinc + hydrochloric acid → zinc chlorate + hydrogen
   B. Sodium + nitric acid → sodium nitrate + oxygen
   C. Magnesium + sulfuric acid → magnesium sulphate + hydrogen

13. To test the presence of carbon dioxide, we use a solution of:
   A. Calcium carbonate.
   B. Calcium hydroxide.
   C. Potassium carbonate.
   D. Potassium hydroxide.

14. If pH = 6, the substance may be:
   A. Weak acid.
   B. Strong acid.
   C. Weak base.
   D. Strong base.

15. The pH value of a rainwater sample may be significantly increased if you add:
   A. Gaseous sulfur dioxide.
   B. Gaseous carbon dioxide.
   C. Calcium carbonate.
   D. Sulfuric acid

II. PROBLEMS

Answer in accordance with the requirements in the question.

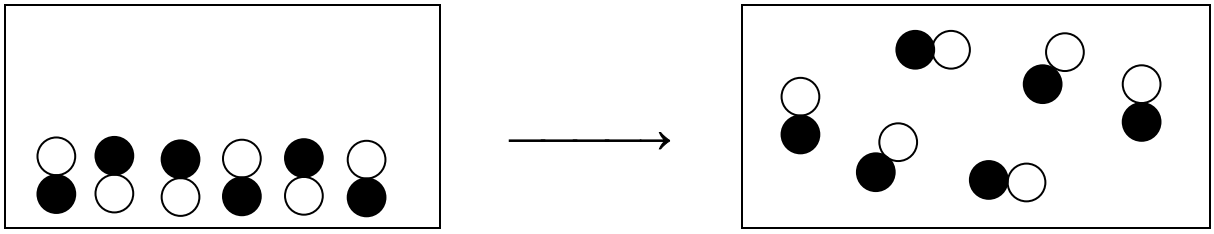
1. Four pure substances (iron, sodium chloride, carbon and sulfur) and three statements (1, 2 and 3) are given. Every statement describes "unknown substance". Each statement is **false** for one of the substances offered, the **name** of which should be written on the line. **Firstly,** answer the first statement, then the second and finally the third statement. Once you have written down the name of one substance as an answer, it can not be used again. The substance that remains is the correct solution for the unknown substance. **4 points**

   1) It is not salty. _____
   2) It is not yellow. _____
   3) It is not a metal. _____

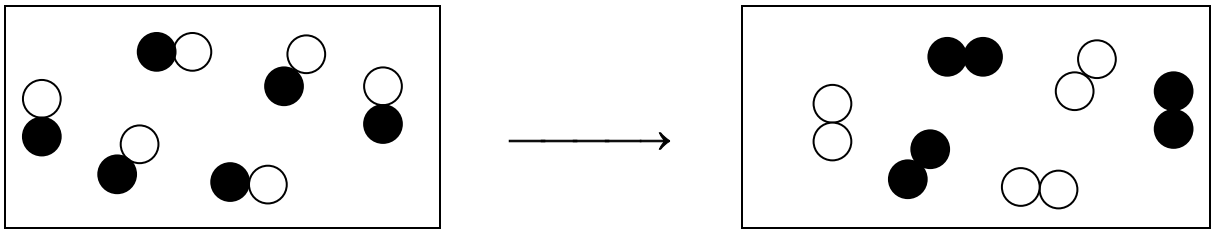
   The unknown substance is: _____

2. The following illustrations represent changes in matter at the molecular level. Based on these illustrations, answer the following requests. **4 points**

A



B



   1) A represents _____ change. (physical/chemical)
   2) B represents _____ change. (physical/chemical)
   3) If we mark dark circles with X, and bright with Y, write down the chemical equation of the reaction/s that represent/s chemical change using the smallest possible stoichiometric coefficients.

3. Write X in the appropriate field in the table by connecting the acidity of the medium (marked with letter) with the concrete example (marked with number) that corresponds to the given acidity of the medium. Then, write the color of the universal indicator (UI) at that pH value. **6 points**

A. acidic
B. alkaline
C. neutral

1. acid from the accumulator
2. salt in water
3. blood
4. soap in water
5. carbonated water
6. bleach

Acidity of the medium	Concrete example					
	1	2	3	4	5	6
A						
B						
C						
Color of UI						

4. Write down the chemical formulae or the names of the following entities: **6 points**

Manganese(II) iodide _____

Calcium cyanide _____

Ammonium nitrite _____

SO_3^{2-} _____

SnS_2 _____

P_4O_{10} _____