1st Round 2022./2023.

SCHOOL	
TEAM NUMBER	
YEAR	**8.**

NAME AND SURNAME OF STUDENT	NAME AND SURNAME OF MENTOR	
		M
		F
		K

ODGOVORI:

Mathematics (M)		Physics (F)		Chemistry (K)		M-F-K
M.1.		F.1.		K.1.		
M.2.		F.2.		K.2.		
M.3.		F.3.		K.3.		
M.4.		F.4.		K.4.		
M.5.		F.5.		K.5.		
M.6.		F.6.		K.6.		
M.7.		F.7.		K.7.		
M.8.		F.8.		K.8.		
M.9.		F.9.		K.9.		

MATHEMATICS

CORRECT ANSWER: 10 points	ANSWER „E": 0 points	ELSE: –2 points

M.1. We randomly draw balls out of a bag containing identical balls numbered 1 to 30. What is the least number of balls we must draw to be sure that we drew all the prime numbers?

A.	B.	C.	D.	E. we do not wish to answer
22	21	30	23	

M.2. What is the area of parallelogram $ABCD$ if the coordinates of its three vertices are $A(-8,2)$, $B(-8,1)$ i $C(4,10)$?

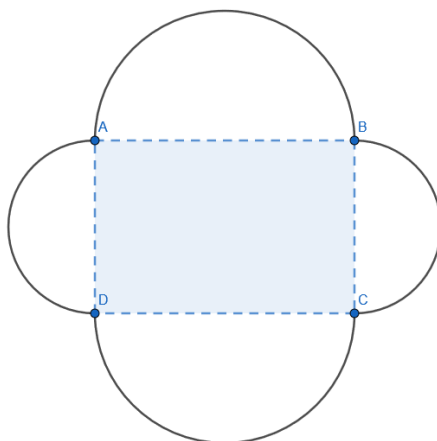| A.	B.	C.	D.	E. we do not wish to answer
8	12	16	it cannot be determined	

M.3. By how much is the least common multiple of 12, 30 and 50 greater than the largest common factor of those same numbers?

A.	B.	C.	D.	E. we do not wish to answer
298	150	294	58	

CORRECT ANSWER: 20 points	THE ANSWER "E" : 0 points	ELSE : –4 points

M 4. Semicircles have been circumscribed upon the sides of rectangle $ABCD$ as shown on the image. What is the perimeter of this figure if the perimeter of the rectangle is 20 cm?

A.	B.	C.	D.	E. we do not wish to answer
20π cm	15π cm	40π cm	10π cm	

M.5. The sizes of two angles in a triangle are 23° and 134°. Determine the size of the angle formed by the bisector of the third angle and the height at the third angle.

A.	B.	C.	D.	E. we do not wish to answer
0°	55,5°	57°	78,5°	

M.6. Ivica the handyman invested 12 350 kn into materials. During the first 10 days his average daily profit was 850 kn. If Ivica works 1 h longer every day, his daily profit will be 80 kn higher. What is the least number of days Ivica must still work to make up for the investment?
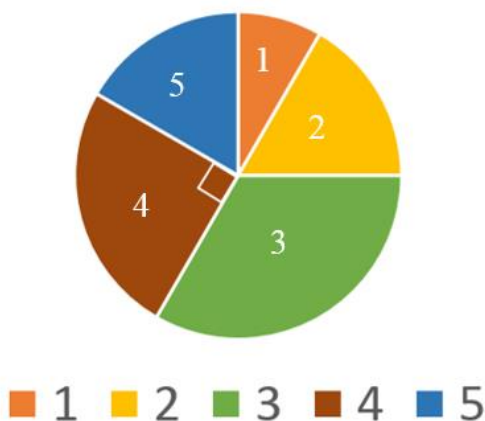
A.	B.	C.	D.	E. we do not wish to answer
3	4	5	6	

CORRECT ANSWER: 30 points	THE ANSWER "E" : 0 points	ELSE : –6 points

M.7. During the switch from Croatian kuna to euro, the conversion rate of kuna is fixed at 7,53450 kuna for 1 euro. By how many percent should the price of an item costing 1 250 kn increase, if it needs to cost 169,99 euro after the switch?

A.	B.	C.	D.	E. we do not wish to answer
Less than 2 %	between 2 and 2,5 %	between 2,5 and 3 %	More than 3 %	

M.8. The chart shows the relationship of the numbers of students that applied to 1, 2, 3, 4 or 5 high schools during enrolment. The number of students that applied to 5 schools is equal to the number of students that applied to 2 schools, and double the number of students that applied to 1 school. If 17 500 students applied to at leaat 4 schools, how many students applied to exactly 2 schools?

A.	B.	C.	D.	E. we do not wish to answer
More than 8 500	between 8 500 and 7 500	between 7 500 and 6 500	Less than 6 500	

M.9. Let a, b and c be some numbers from the set $\{1,2,3,4,5\}$. How many ordered triples (a, b, c) are there for which the number $2ab + 3bc + 4ca$ is even?
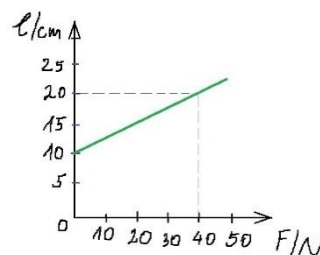
A.	B.	C.	D.	E. we do not wish to answer
20	40	80	100	

PHYSICS

Use the approximate value *g* = 10 m/s² for gravitational acceleration.

CORRECT ANSWER : 10 points	THE ANSWER "E" : 0 points	ELSE : –2 points

F.1. Mislav measured how the length of the spring *l* depends on the amount of force *F* he used to stretch the spring. The image shows a graph of his results. What is the elasticity coefficient of the spring?

A.	B.	C.	D.	E. we do not wish to answer
100 N/m	200 N/m	300 N/m	400 N/m	

F.2. An astronaut, when on Earth, has the weight of 850 N. When he landed on the surface of the Moon, his measured weight was approximately 138 N. What is his mass on the Moon?

A.	B.	C.	D.	E. we do not wish to answer
850 kg	85kg	138 kg	13,8 kg	

F.3. When we want to charge a plastic rod, we rub it with a wool cloth. The total charge of the wool cloth and the plastic rod together after the rubbing will:

A.	B.	C.	D.	E. we do not wish to answer
Be greater than before	Be the same as before	Be less than before	Depend on the duration of the rubbing	

CORRECT ANSWER: 20 points	THE ANSWER "E" : 0 points	ELSE : –4 points

F.4. A wooden kitchen table has four legs, and every leg has the contact surface with the floor in the shape of a rectangle 6 cm wide and 8 cm long. When Marko placed a pot with soup on the table, the pressure the table exerts on the floor increased by 1041,7 Pa. The mass of the pot is 0,5 kg. What is the mass of the soup in the pot?

A.	B.	C.	D.	E. we do not wish to answer
2,5 kg	2 kg	1,5 kg	1 kg	

F.5. A big balloon, whose mass, with the gas it's filled with, is 20 kg, falls through the air with constant speed vertically towards the ground. The force of air resistance is 60 N. What is the volume of the balloon? The density of air is 1,29 kg/m^3.
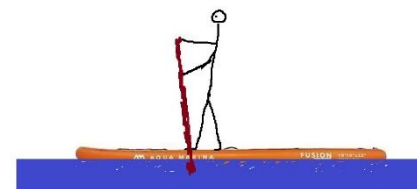
A.	B.	C.	D.	E. we do not wish
15,5 m^3	13,9 m^3	12,1 m^3	10,9 m^3	to answer

F.6. A boy of mass 25 kg went down a 3 m tall slide. He started from rest at the top, and his speed at the bottom was 3,5 m/s. How much thermal energy was generated due to friction during the slide?

A.	B.	C.	D.	E. we do not wish
750 J	597 J	396 J	153 J	to answer

CORRECT ANSWER: 30 points	**THE ANSWER "E" : 0 points**	**ELSE : –6 points**

F.7. Ana is paddling on a board in the sea so that 20 % of the volume of the board is underwater. The length of the board is 2,7 m, it is 15 cm thick, and the average width is 75 cm. What is the mass of the board if Ana has a mass of 55 kg? The density of water is 1000 kg/m^3.

A.	B.	C.	D.	E. we do not wish
5,75 kg	6,75 kg	7,75 kg	8,75 kg	to answer

F.8. A beam of mass 40 kg is 4 m long. It is supported on the left side and 2,5 m from the left end. Tina, whose mass is 55 kg, walks on the beam from the left end towards the right end. What is the greatest distance from the left end she can reach without the beam tipping over?
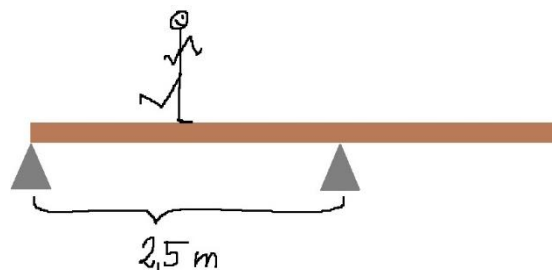
A.	B.	C.	D.	E. we do not wish
1,14 m	1,64 m	2,36 m	2,86 m	to answer

F.9. Each of four discs of the brakes of a car has a mass of 4,5 kg and the specific heat capacity 230 J/(kgK). A driver starts to brake while driving 108 km/h. The temperature of the discs before the braking was 20 °C. What will be the temperature of the discs at the moment the car stops if 50 % of the mechanical energy transforms into internal energy of the discs during the braking? The mass of the car is 1000 kg.

A.	B.	C.	D.	E. we do not wish
74,3 °C	128,7 °C	183,5 °C	237,4 °C	to answer

CHEMISTRY

Note: In all tasks, follow the data from the obtained periodic table of elements.

CORRECT ANSWER: 10 points	ANSWER „E ": 0 points	OTHER: –2 points

K.1. Two test tubes, X and Y are filled with gas produced by heating potassium permanganate. The test tubes are turned in opposite directions and after a short time burning splints are inserted into the openings of each test tube.

Which statement accurately describes the observations made during the performance of the described experiment?

A. in test tube **X** you will hear pop sound, a splint will go up
B. in test tube **Y** you will hear pop sound, a splint will go up
C. smoldering splint will reignite in test tube **X**
D. smoldering splint will reignite in test tube **Y**
E. we do not want to answer the question

K.2. Ivano made an experiment by pouring a colorless liquid into a test tube and adding a powdery white substance. When he put cap on the test tube and shake the mixture, the cap suddenly flew out of the test tube!

Which statement accurately describes Ivan's experiment?

| **A.** he poured vinegar into the test tube and added baking soda |
|---|
| **B.** he poured hydrochloric acid into the test tube and added table salt |
| **C.** he poured water into the test tube and added potassium permanganate |
| **D**. he poured sulfuric acid into the test tube and added blue vitriol |
| **E** we do not want to answer the question |

K.3. To determine the mass of substances while working in the laboratory, the student used a classic technical balance.

He compared the mass of the weights he placed on the right arm of the scale with the mass of the cup containing the substance he needed in the experiment. The technical balance acts as a lever and when it is in balance, the mass of the object and the weights are equal.

During the weighing he used:

two 20 g weights, one 10 g weight, one 5 g weight, two 2 g weights, one 500 mg weight, two 200 mg weights, two 20 mg weights and one 10 mg.
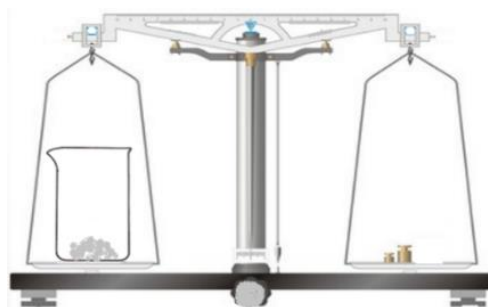
What is the correct mass of the weighed cup with a substance?

| A.	B.	C.	D.	E. we do not want to answer the question
59,55 g	59,75 g	59,95 g	60,00 g	

CORRECT ANSWER: 20 points	ANSWER „E ": 0 points	OTHER: –4 points

K.4. Substances **M**, **F** and **K** have different densities. Substance **M** has the lowest and the substance **F** has the highest density. Mixing substance **F** and substance **M** creates a heterogeneous mixture, and mixing substance **F** and substance **K** creates a homogeneous mixture.

In which order are substances **M**, **F** and **K** listed correctly?

A. **M**: oil **F**: water **K**: sodium chloride	B. **M**: oil **F**: sodium chloride **K**: water	C. **M**: sodium chloride **F**: water **K**: oil	D. **M**: water **F**: oil **K**: sodium chloride	E. we do not want to answer the question

K.5. Classic thermometers for measuring temperature are filled with alcohol. The picture shows thermometer **T1**, which measured the temperature of a healthy person, and thermometer **T2**, which measured the temperature of a sick person. Which statement accurately describes the change in physical quantities of alcohol in thermometer **T2** compared to alcohol in thermometer **T1**?
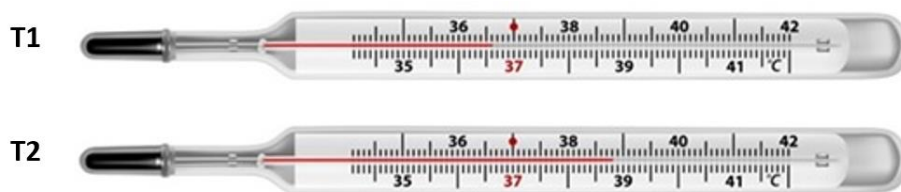
A. mass increased and alcohol density decreased
B. the mass increased, and the alcohol volume decreased
C. the volume increased and the alcohol density decreased
D. the volume increased, and the mass of alcohol decreased
E. we do not want to answer the question

K.6. The pictures show the way to form chemical bonds for the atoms of the four elements whose chemical symbols are replaced by the letters **X**, **Y**, **Z** and **Q**.
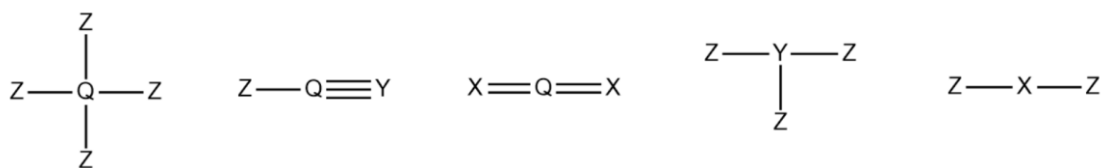
Which of the following statements is correct?

A. The atom of element X is divalent and Y is monovalent
B. The atom of element Z is trivalent and Q is tetravalent
C. The atom of element X is monovalent and Z is divalent
D. atom of element Y is trivalent and Q is tetravalent
E. we do not want to answer the question

CORRECT ANSWER: 30 points	ANSWER „E": 0 points	OTHER: –6 points

K.7. Two metals **X** and **Y** react with oxygen to form oxides with the formula **XO** and **YO**. An atom of metal **X** has a proton number which is for 5 less than that of metal **Y**. The total number of protons in one formula unit of oxide **XO** and one formula unit of oxide **YO** is 61. Which of the following are the correct formulas of the oxides of metals **X** and **Y**?

| **A.**	VO, NiO
B.	TiO, CoO
C.	CrO, CuO
D.	CaO, MnO
E.	we do not want to answer the question

K.8. A mixture of sodium and potassium nitrate was made, in which the mass fraction of potassium nitrate is 72.7%. 29.3 g of potassium nitrate was subsequently added to the salt mixture, after which the mass fraction of sodium nitrate in the new mixture was 21.9%.

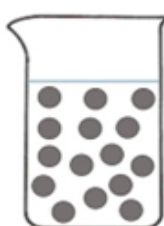What is the mass of potassium nitrate in the first mixture?

A.	**B.**	**C.**	**D.**	**E.** we do not want to answer the question
6,42 g	22,9 g	86,4 g	118,9 g	

K.9. Three beakers contain aqueous solutions of substance **X**. Solution **X$_1$** is saturated and contains 72 g of substance **X**. In which of the beakers is the solution also saturated and what is the mass of dissolved substance **X** in it?
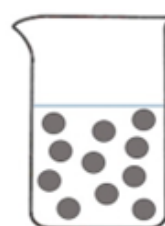
Substance **X:**
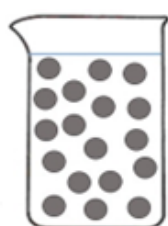
| V(solution **X$_1$**) = 600 mL | V(solution **X$_2$**) = 500 mL | V(solution **X$_3$**) = 400 mL |

A.	**B.**	**C.**	**D.**	**E.** we do not want to answer the question
solution **X$_2$** m(**X**) = 60 g	solution **X$_2$** m(**X**) = 56 g	solution **X$_3$** m(**X**) = 48 g	solution **X$_3$** m(**X**) = 44 g	

M– F - K

CORRECT ANSWER : 30 points	ANSWER „E" : 0 points	ELSE: –6 points

M-F-K. As the weather got colder, Maja wanted to drink some forest fruit tea. To successfully extract the tea from the teabag, the water we prepare the tea with must be boiling, but to drink it, the temperature should ideally be 57° C. Maja is impatient, so after the extraction of the tea, she pours cold water from the tap, which has the temperature 10° C, into the cup. What must the volume fraction of cold water be so that Maja has the tea at ideal temperature for drinking?

(*Author: Jakov Budić*)

A.	B.	C.	D.	E. we do not wish to answer
8,5 %	47,8 %	52,2 %	91,5 %	