



Spring round 2021./2022.

SCHOOL	
TEAM NUMBER	
YEAR	8.

NAME AND SURNAME OF STUDENT

NAME AND SURNAME OF MENTOR	
	M
	F
	K

Answers:

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.		

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MATHEMATICS

CORRECT ANSWER: 10 points	ANSWER „E“: 0 points	ELSE: -2 points
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M.1. What is $\sqrt{x^2}$ equal to for any real number x ?

A. $\pm x$	B. x	C. x i $-x$	D. $ x $	E. we do not wish to answer
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M.2. If $2x - y = 3$ and $x = -4y + 1$ what is the value of $x + y$?

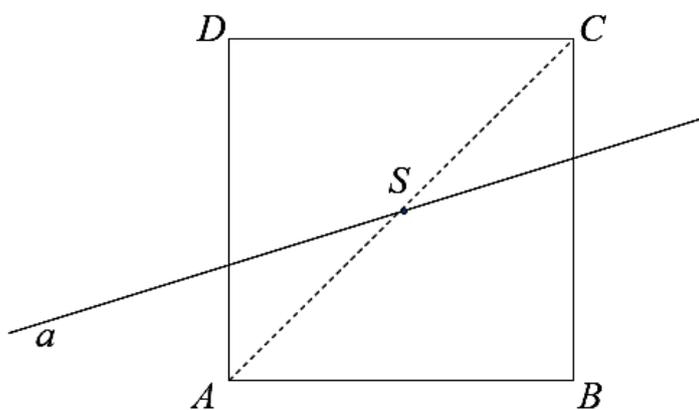
A. 4	B. $\frac{14}{9}$	C. $\frac{4}{3}$	D. none of the aforementioned	E. we do not wish to answer
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M.3. How much is $10^n + 10^n \cdot 10$?

A. $11 \cdot 10^n$	B. 10^{2n+1}	C. 10^{n^2+1}	D. none of the aforementioned	E. we do not wish to answer
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CORRECT ANSWER: 20 points	THE ANSWER “E” : 0 points	ELSE : -4 points
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M.4. Point S is the intersection of the diagonals of the square $ABCD$. Line a intersects the segment \overline{AD} in point M , and the segment \overline{BC} in point N . What can we conclude about triangles $\triangle SNC$ and $\triangle SMA$ without drawing extra segments or lines?

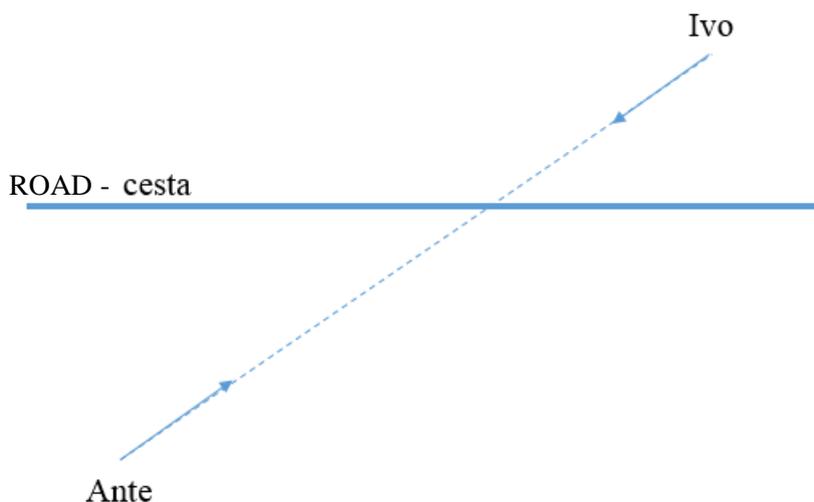


A. they are congruent because of the SSS theorem	B. they are congruent because of the SAS theorem	C. they are congruent because of the ASA theorem	D. none of the aforementioned	E. we do not wish to answer
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M.5. After drawing 10 balls out of a bag containing balls numbered using different natural numbers, Katie determined that it is not true that all numbers written on them are divisible by 3. Which of the statements must be true for the numbers she has drawn?

<p>A.</p> <p>there is at least one number that has a remainder equal to 0 after dividing by 3</p>	<p>B.</p> <p>there is at least one number that has a remainder equal to 1 after dividing by 3</p>	<p>C.</p> <p>there is at least one number that has a remainder equal to 2 after dividing by 3</p>	<p>D.</p> <p>there is at least one number that has a remainder not equal to 0 after dividing by 3</p>	<p>E. we do not wish to answer</p>
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M.6. Ante and Ivo are across the street from each other, at a distance of 20 m. Ivo is 3 m from the road and Ante's distance from the road is 2 m more than Ivo's. They are walking towards each other and they will meet on the road. By how much is the distance Ante covers greater than the distance Ivo will cover?



<p>A.</p> <p>5 m</p>	<p>B.</p> <p>7,5 m</p>	<p>C.</p> <p>2,5 m</p>	<p>D.</p> <p>it cannot be determined</p>	<p>E. we do not wish to answer</p>
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CORRECT ANSWER: 30 points THE ANSWER "E" : 0 points ELSE : -6 points

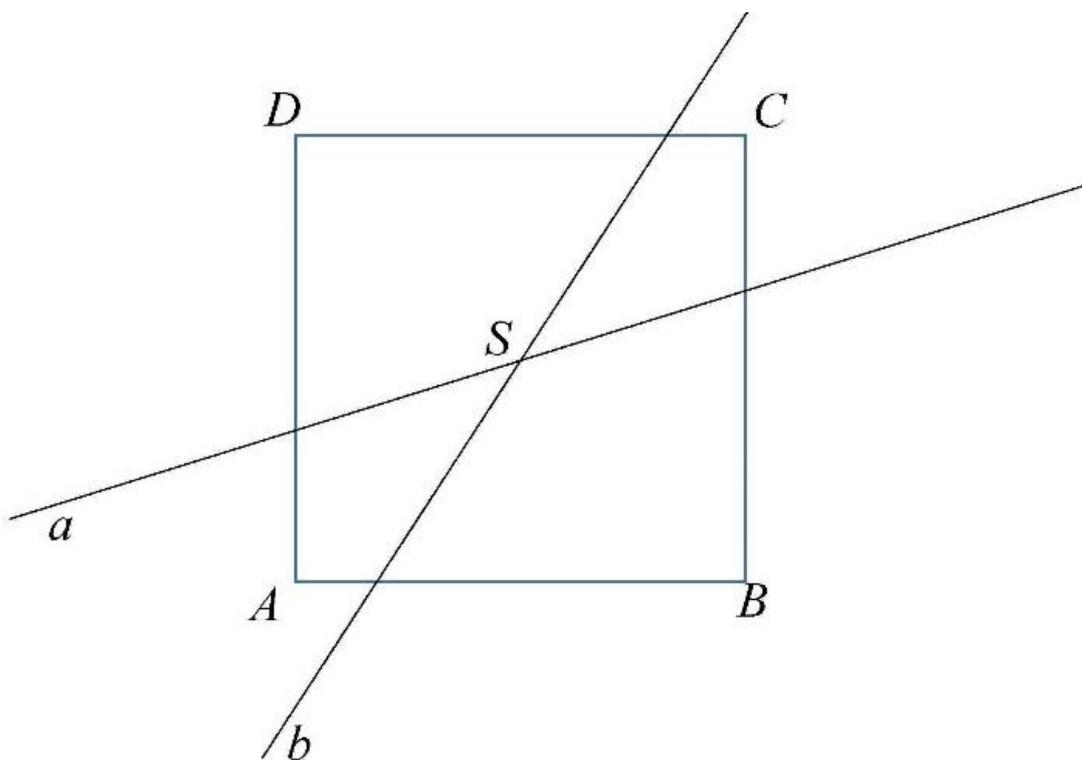
M.7. If a and b are real numbers different from 9 for which $\frac{(a+b)^2}{ab} = 5$, how much is $\frac{(a-b)^2}{ab}$?

<p>A.</p> <p>1</p>	<p>B.</p> <p>2</p>	<p>C.</p> <p>3</p>	<p>D.</p> <p>it cannot be determined</p>	<p>E. we do not wish to answer</p>
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M.8. A fishing boat went out at 9 AM from our farthest island Palagruža in the northeast direction towards the island Lastovo. After the 48 km sail to Lastovo, the boat started in the northwest direction sailing 72 km to Komiža, then 80 km in the southwest direction towards the open sea, and then 50 km in the southeast direction. The boat had a constant speed of 50 km/h. At that moment they saw the distant lighthouse on Palagruža and remembered they have to be back by 2:40 PM. What is the least speed they must sail at to reach Palagruža on time?

A. more than 50 km/h and less than 55 km/h	B. more than 55 km/h and less than 60 km/h	C. more than 60 km/h and less than 70 km/h	D. more than 70 km/h	E. we do not wish to answer
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M.9. Point S is the intersection of the diagonals of the square $ABCD$. Line a intersects the segment \overline{AD} at point M , and line b intersects the segment \overline{AB} at point N . If the side length of $ABCD$ is three times longer than $|MA| + |AN|$, what is the ratio of the area of quadrilateral $MANS$ to the area of square $ABCD$?



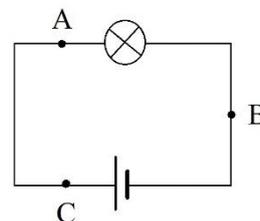
A. 1 : 9	B. 1 : 12	C. 1 : 6	D. it cannot be determined	E. we do not wish to answer
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PHYSICS

Use the approximate value $g = 10 \text{ m/s}^2$ for gravitational acceleration.

CORRECT ANSWER : 10 points	THE ANSWER "E" : 0 points	ELSE : -2 points
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F.1. What can we say about the electrical current in the circuit shown on the image?



A. it is greatest at point A	B. it is greatest at point B	C. it is greatest at point C	D. equal current passes at all the points	E. we do not wish to answer
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F.2. An object is accelerating on a horizontal surface under the influence of a horizontal force of magnitude 50 N. Friction is neglectable. At some moment another force of 50 N starts acting on the object so that the forces cancel each other out. From that moment the object:

A. is still	B. slows down till it becomes still	C. continues to move at constant speed	D. stops and then accelerates in the direction of the other force	E. we do not wish to answer
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F.3. We usually don't notice the electric force between the objects we use every day (e.g. between a cell phone and a calculator). This is because:

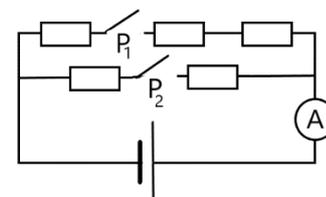
A. the electric force is the weakest in nature	B. the electric force is the outcome of the actions of very tiny particles	C. the electric force is invisible	D. most objects contain equal amounts of positive and negative charge	E. we do not wish to answer
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TOČAN ODGOVOR: 20 bodova	ODGOVOR „E“ : 0 bodova	OSTALO : -4 boda
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F.4. A bowl contains 2,5 decilitres of water. An electric heater with resistance 6Ω through which a current of 4 A is passing, is submerged into the water. In one minute, the temperature rises from $25 \text{ }^\circ\text{C}$ to $30 \text{ }^\circ\text{C}$. What is the percentage of the energy that passed onto the bowl and the surroundings during the heating process? The specific heat capacity of water is 4200 J/(kgK) , and the density of water is 1000 kg/m^3 .

A. 91,14 %	B. 8,85 %	C. 81,14 %	D. 18,86 %	E. we do not wish to answer
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F.5. In an electric circuit there are 5 equal resistors, each of resistance 4Ω as shown. The switches P_1 and P_2 can be open or closed. Consider in which combination of the open/closed switches will the ammeter A show the greatest electric force and determine the magnitude of the electric current in that case. The voltage of the power source is 24 V.



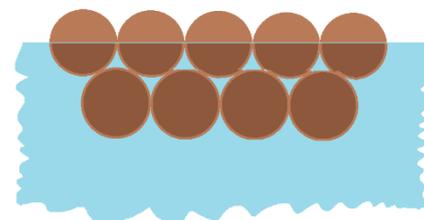
A.	B.	C.	D.	E. we do not wish to answer
2 A	3 A	4 A	5 A	

F.6. A triathlon consists of swimming 1500 m, riding a bicycle 40 km and running. The winner finished the race after 1 hour, 56 minutes and 40 seconds. He swam at speed 1,5 m/s, rode the bicycle at 36 km/h and ran at 5 m/s. What was the distance covered during the run?

A.	B.	C.	D.	E. we do not wish to answer
11 km	10 km	9 km	8 km	

TOČAN ODGOVOR: 30 bodova **ODGOVOR „E“ : 0 bodova** **OSTALO : -6 bodova**

F.7. A raft consists of 9 identical wooden logs tied as shown on the image. While there is no weight on it, the raft is submerged till exactly one half of the top row of logs. The greatest mass we can place on the raft so that the cargo stays dry is 707 kg. What is the volume of one log?



A.	B.	C.	D.	E. we do not wish to answer
$0,432 \text{ m}^3$	$0,413 \text{ m}^3$	$0,392 \text{ m}^3$	$0,283 \text{ m}^3$	

F.8. Tin and Luka started running at the same time from point A to B. Tin ran at 3 m/s and Luka at 4 m/s. Marta started from point B to A by bicycle, on the same road at speed 8 m/s. What is the distance between the positions at which Marta met Luka and Tin? The distance between A and B is 3 km.

A.	B.	C.	D.	E. we do not wish to answer
428,6	181,8 m	375 m	250 m	

F.9. Mia measured a force using a dynamometer. When she put a mass of 1,6 kg on the dynamometer, the length of the elastic spring of the dynamometer was 36 cm, and when she put a mass of 1 kg, the length was 27 cm. What is the length of the spring without any weight?

A.	B.	C.	D.	E. we do not wish to answer
12 cm	11 cm	10 cm	9 cm	

Chemistry

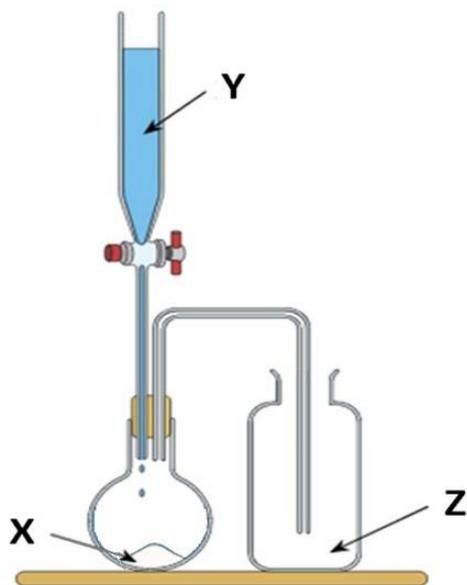
Note: In all tasks, follow the data from the obtained periodic table of elements.

CORRECT ANSWER: 10 points

ANSWER „E“: 0 points

OTHER: -2 points

C.1. What statement is showing the correct conclusion about the experiment shown in the figure?



A. if substance **X** is calcium carbonate, substance **Y** is sulfuric acid, then substance **Z** will be a gas that will cloud the clear solution of calcium hydroxide

B. if substance **X** is quicklime, substance **Y** is hydrochloric acid, then substance **Z** will be a yellow-green gas, which is denser than air

C. if substance **X** is baking soda, substance **Y** is water, then substance **Z** will be a colorless gas that plants use in the process of photosynthesis

D. if substance **X** is sodium chloride, substance **Y** is sulfuric acid, then substance **Z** will be the gas that will cause the red litmus paper to turn blue

E. we do not want to answer the question.

C.2. In which of the following pairs of chemical reactions, along with other substances, water is formed as a product?

A. burning of carbon monoxide and pyrolysis of mercury(II) oxide	B. oxidation of sulfur dioxide and synthesis of copper(II) chloride from elemental substances	C. alcoholic fermentation reaction and obtaining slaked lime from quicklime	D. reaction of calcium hydroxide with carbon dioxide and neutralization of formic acid with potassium hydroxide	E. we do not want to answer the question.
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C.3. The table shows the molecular formulas of various organic compounds. Which of the following compounds has the smallest number of oxygen atoms in their empirical formula?

A. $C_4H_8O_6$	B. $C_6H_9O_6$	C. $C_9H_{24}O_6$	D. $C_{18}H_{36}O_6$	E. we do not want to answer the question.
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CORRECT ANSWER: 20 points**ANSWER „E“: 0 points****OTHER: -4 points**

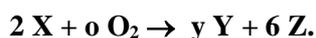
C.4. Sodium ascorbate is a form of synthetic vitamin C that is suitable for consumption in people with sensitive stomachs. The relative molecular mass of one formula unit of sodium ascorbate is 198. The mass fraction of carbon in this compound is 36.37 %, hydrogen 3.56 %, oxygen 48.51 %, and the rest is sodium. Determine the exact formula of the described form of vitamin C.

A. $C_3H_7O_3Na$	B. $C_6H_7O_6Na$	C. $C_7H_6O_7Na$	D. $C_{12}H_{14}O_{12}Na_2$	E. we do not want to answer the question.
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K.5. Which of the following chemical substances will have the same number of electrons as the chloride ion?

A. atom of argon and sulfide ion	B. fluoride ion and oxide ion	C. sodium ion and potassium ion	D. atom of neon and oxide ion	E. we do not want to answer the question.
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C.6. Incomplete combustion of hydrocarbons with four carbon atoms can be represented by the chemical reaction equation:

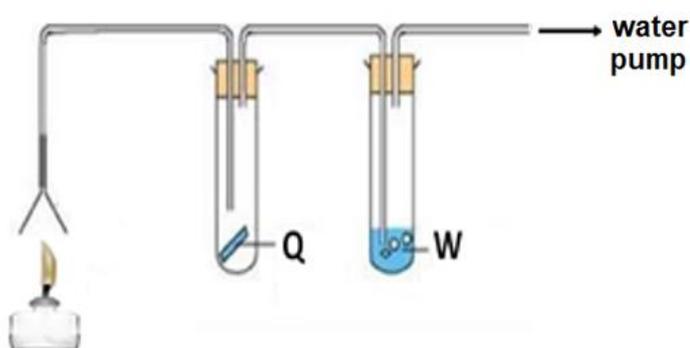


In which sequence are the chemical formulas of substances **X** and **Y** and the stoichiometric numbers **o** and **y** correctly stated, for the shown chemical equation?

A. X: C_4H_8 Y: CO o: 4 y: 4	B. X: C_4H_8 Y: CO_2 o: 6 y: 4	C. X: C_4H_6 Y: CO o: 7 y: 8	D. X: C_4H_6 Y: CO_2 o: 7 y: 11	E. we do not want to answer the question.
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CORRECT ANSWER: 30 points **ANSWER „E“: 0 points** **OTHER: -6 points**

C.7. The figure shows the apparatus in which the products of complete combustion of the organic compound were demonstrated. Products are present in the spirit heater.



Substance **Q** is known to be an ionic compound whose cation has charge +2 and the sum of protons and electrons is 52. The anion of compound **Q** is formed by ionization of hydrochloric acid.

Compound **Q** in the shown experiment changes color from blue to pink to form a hydrate of relative molecular mass 237.95, and a colorless clear solution of substance **W** becomes cloudy during the experiment.

What sequence is correctly stating the chemical formula of the hydrate of substance **Q** and the equation of the chemical reaction of a solution of substance **W** with one of the combustion products of an organic compound?

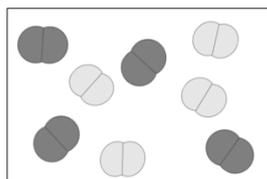
A. Q: $\text{CoCl}_2 \times 2\text{H}_2\text{O}$	$\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2$
B. Q: $\text{CoCl}_2 \times 6\text{H}_2\text{O}$	$\text{CO}_2 + \text{Ca}(\text{OH})_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
C. Q: $\text{CuSO}_4 \times 2\text{H}_2\text{O}$	$\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2$
D. Q: $\text{CuSO}_4 \times 6\text{H}_2\text{O}$	$\text{CO}_2 + \text{Ca}(\text{OH})_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
E. we do not want to answer the question.	

C.8. A mixture of sodium and calcium chloride was made in which the mass fraction of sodium chloride was 38.8 %. 3.55 g of sodium chloride were subsequently added to the salt mixture, after which the mass fraction of calcium chloride in the new mixture was 37.2 %.

What is the mass of calcium chloride in the mixtures?

A.	B.	C.	D.	E. we do not want to answer the question.
1,32 g	2,23 g	3,37 g	5,50 g	

C.9. The reaction of nitrogen and oxygen produces nitrogen dioxide. The figure shows the mixture of reactant molecules before the chemical reaction starts.



Which figure shows the composition of the mixture after the chemical reaction is complete?

A.	B.	C.	D.	E. we do not want to answer the question.

M - F - K**CORRECT ANSWER: 30 points****ANSWER „E“ : points****ELSE: -6 POINTS**

M-F-K. In a glass of mass 250 g there is calcium carbonate (CaCO_3). If we push the glass on the table with force of magnitude 5 N (parallel to the table) the glass accelerates at rate 2 m/s^2 . The friction factor between the table and the glass is 0,3. How many formula units of calcium carbonate are in the glass?

(Author: *Jakov Budić*)

A. $4,51 \times 10^{24}$	B. $6,64 \times 10^{24}$	C. $1,24 \times 10^{25}$	D. $2,86 \times 10^{25}$	E. we do not wish to answer
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