



Winter round 2020./2021.

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. Natural numbers a and b are coprime if:

A. both are prime	B. one of them is prime	C. one is divisible by the other	D. number one is their only common factor	E. We do not wish to answer
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M.2. How many of the statements below are incorrect?

- The diagonals of a parallelogram halve each other.
- The diagonals of a parallelogram are perpendicular.
- The diagonals of a parallelogram partition the parallelogram into four congruent triangles.
- The diagonals of a parallelogram partition the parallelogram into two pairs of congruent triangles.
- The area of a parallelogram is equal to one half of the product of the lengths of its diagonals.

A. 3	B. 2	C. 1	D. 0	E. We do not wish to answer
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M.3. Which one of the points listed below does not belong to the line $y = -\frac{2}{3}x + \frac{3}{4}$?

A. $A\left(5, -\frac{31}{12}\right)$	B. $B\left(-5, \frac{49}{12}\right)$	C. $C\left(-7, \frac{65}{12}\right)$	D. $D\left(7, \frac{47}{12}\right)$	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. Grandma picked some grapes, apricots and figs and placed them all out to dry. The percentages of water in fresh fruit are: grapes 83 %, figs 72 % and apricots 63 %, while the percentages of water in dried fruits are: grapes 13 %, figs 12 % and apricots 11 %. How much fruit did grandma pick if after drying she had 1.75 kg of dried grapes, 2.02 kg of dried figs and 2.85 kg of dried apricots?

A. between 20 kg and 21 kg	B. between 21 kg and 22 kg	C. between 22 kg and 23 kg	D. more than 23 kg	E. We do not wish to answer
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M.5. Determine the four-digit number which is 55 times greater than the two-digit number formed by the last two digits of the required number. What is the sum of the digits of the required number?

A. less than 10	B. between 10 and 15	C. greater than 15	D. it is impossible to determine	E. We do not wish to answer
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M.6. Ten workers need 33 days to build one floor of a building. After they have been working for 22 days, two workers have to self-isolate for 2 weeks. If the investor does not hire new workers, how many extra days will the construction of the floor take?

A. 14	B. 3	C. 7	D. 6	E. We do not wish to answer
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CORRECT ANSWER: 30 points	THE ANSWER "E" : 0 points	ELSE : -6 points
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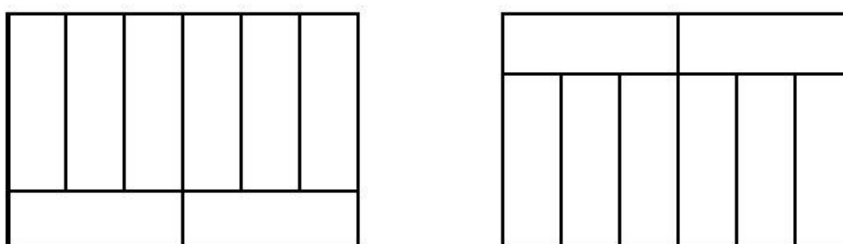
M.7. The side \overline{AB} of parallelogram $ABCD$ is 10 cm long. If the area of the triangle BCS is 100 cm^2 , where point S is the intersection of the diagonals of the parallelogram, what is the distance of point S from side \overline{CD} ?

A. 20 cm	B. 10 cm	C. $10\sqrt{3}$ cm	D. It cannot be determined	E. We do not wish to answer
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M.8. The sum of three different numbers $a < b < c$ is 2 880, and their greatest common factor is 240. How many triples (a, b, c) that satisfy the given property exist?

A. 5	B. 6	C. 7	D. 8	E. We do not wish to answer
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M.9. The terrace floor is 6 m long and 4 m wide. In how many different ways can it be tiled using 8 identical boards 3 m long and 1 m wide. (2 different tiling arrangements are shown on the image)



A. More than 12	B. 12	C. 11	D. Less than 11	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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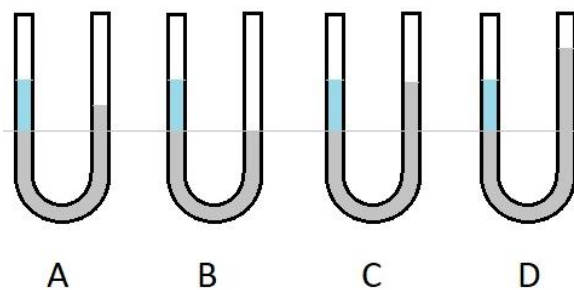
F.1. Marko drove his car over a nail and his left back tire was blown. To lift the car on that side by 10 cm he should use a force of 5000 N, and the work done would be 500 J. He tried, but he couldn't lift the car, so he decided to use a lever. Using a lever, Marko managed to lift his car by 10 cm because

A. he used a greater force and the work done increased	B. he used a greater force and the work done remained the same	C. he used a lesser force and the work done increased	D. he used a lesser force and the work done remained the same	E. We do not wish to answer
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F.2. In the physics classroom we have two electric cookers. We turn the cookers on, so they are at the same power. At the same time we place a bowl on each cooker, containing equal amounts of water, and one bowl is copper, and the other is glass. The specific heat capacity of glass is 840 J/(kgK) , and the specific heat capacity of copper is 380 J/(kgK) . In which bowl will the temperature of water rise from room temperature to $60 \text{ }^\circ\text{C}$ sooner?

A. in the copper bowl	B. in the glass bowl	C. water in both bowls will reach $60 \text{ }^\circ\text{C}$ at the same time	D. there isn't enough information to answer the question	E. We do not wish to answer
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F.3. The image shows four situations in which a blue and a grey liquid are in a U-shaped tube. In one of the situations it is impossible for the liquids to be balanced. Which situation is it?



A. <div style="text-align: center;">A</div>	B. <div style="text-align: center;">B</div>	C. <div style="text-align: center;">C</div>	D. <div style="text-align: center;">D</div>	E. We do not wish to answer
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CORRECT ANSWER: 20 points**THE ANSWER "E" : 0 points****ELSE : -4 points**

F.4. Petar's mass is 40 kg, his mother's mass 65 kg and his father's mass is 95 kg. They made a 4 m long see-saw in the garden. It is supported in the middle. Two seats for mom and dad are placed at the ends of the seesaw (2 m from the middle), and Petar's is movable. At which spot should Petar's seat be fixed to achieve balance?

A. on dad's side, 1.2 m from the middle	B. on mom's side, 1.2 m from the middle	C. on dad's side, 1.5 m from the middle	D. on mom's side, 1.5 m from the middle	E. We do not wish to answer
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F.5. Stipe had a lot of luck while fishing, so he decided to weigh his catch using a spring scale shown on the image. The scale works using an elastic spring with the elasticity index of 2000 N/m. What is the mass of the fish that Stipe caught if the spring elongated by 1.75 cm when Stipe hung the fish?



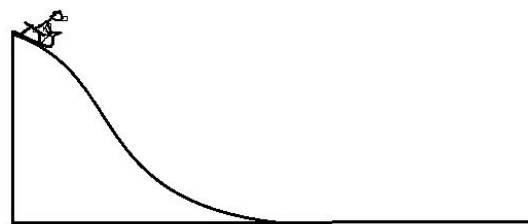
A. 3,55 kg	B. 3,50 kg	C. 3,45 kg	D. 3,40 kg	E. We do not wish to answer
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F.6. The pressure in car tires is 210 kPa. The area of contact of one tire with the surface is 1,4 dm². What is the mass of the car?

A. 1376 kg	B. 1276 kg	C. 1176 kg	D. 1076 kg	E. We do not wish to answer
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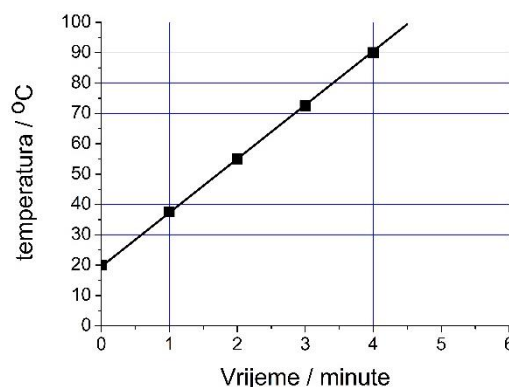
CORRECT ANSWER: 30 points	THE ANSWER "E" : 0 points	ELSE : -6 points
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F.7. Ivica went down a frozen hill on a sled. The height of the hill is 50 m from top to bottom. The friction is neglectable. When he reaches the bottom of the hill, where there is no ice, only snow, he stops because of friction at a distance of 60 m from the bottom of the hill. Ivica's mass is 70 kg, and the mass of the sled is 20 kg. What was the magnitude of the force of friction that stopped him on the horizontal part of his ride?



A. 1080 N	B. 880 N	C. 750 N	D. 550 N	E. We do not wish to answer
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F.8. The power of the electric heater Katarina is using is 280 W. She heats up 0.5 litres of liquid of density 900 kg/m³. Katarina recorded the temperature at equal intervals, and she plotted the data graphically (image on the right). What is the specific heat capacity of the liquid that Katarina heated? Loss of thermal energy and the increase of temperature of the bowl can be neglected.



A. 2133,33 $\frac{J}{kgK}$	B. 1920 $\frac{J}{kgK}$	C. 1659,25 $\frac{J}{kgK}$	D. 1560 $\frac{J}{kgK}$	E. We do not wish to answer
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F.9. Curious Petra found a bottle with a liquid in the basement. She wanted to know which liquid it was, so she decided to find out by determining the density of the liquid. When she determines the density of the liquid, she will search the internet to find which liquid might have that density. She took a spring scale (dynamometer) and she hung an object. The dynamometer showed 30 N. When she completely submerged this object (still hung on the dynamometer), the dynamometer showed 20 N. When she submerged the object into the unknown liquid in the same way, the dynamometer showed 22 N. Which value did she get for the density of the unknown liquid from the given data?

A. 900 kg/m ³	B. 800 kg/m ³	C. 700 kg/m ³	D. 600 kg/m ³	E. We do not wish to answer
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CHEMISTRY

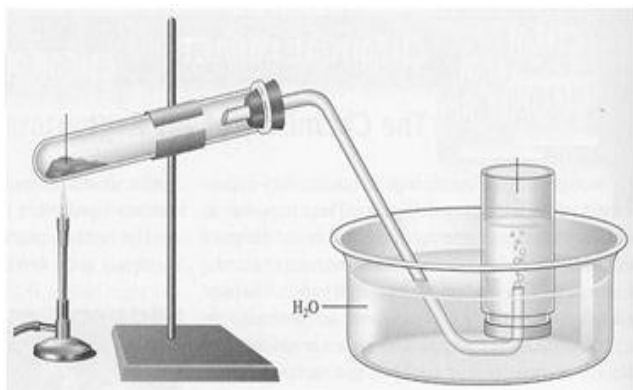
Note: In all tasks, follow the data from the obtained periodic table of elements.

CORRECT ANSWER : 10 points

THE ANSWER "E" : 0 points

ELSE : -2 points

K.1. What statement is the correct conclusion about the experiment shown on the figure?



A. The product of heating a solid is a gas that is soluble in water.

B. The product of heating a solid is a gas that is insoluble in water.

C. The product of heating a solid is a gas that chemically reacts with water.

D. The product of heating a solid is a gas whose density is higher than the density of water.

E. We do not wish to answer

K.2. $\frac{1}{4}$ of the test tube was filled with hydrochloric acid, a zinc granule was inserted and the following observations were recorded:

- a) formation of numerous colorless bubbles
- b) fogging of the walls of the test tube from the inside
- c) the measured temperature increase in the test tube for 34°C
- d) the zinc granule has shrunk and become less shiny.

Which of the following can be concluded based on what has been observed?

A. An endothermic physical change occurred in the test tube in which the products are zinc chloride and water.

B. An endothermic chemical change occurred in the test tube in which the products are only gaseous substances.

C. An exothermic physical change occurred in the test tube in which the products are gas and water.

D. An exothermic chemical change occurred in the test tube in which the products are zinc chloride and hydrogen.

E. We do not wish to answer

K.3. Heating chemical compounds in the absence of oxygen will reduce the mass of chemical compound due to the release of the gaseous component. Which of the following samples of chemical compounds will reduce their mass when they are heated in the absence of oxygen?

A.
calcium carbonate

B.
magnesium oxide

C.
sodium chloride

D.
iron (II) sulfide

E. We do not wish to answer

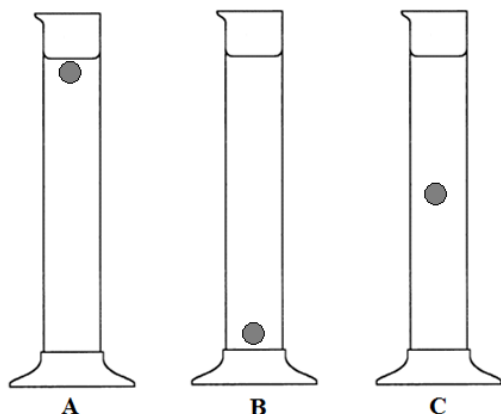
CORRECT ANSWER: 20 points THE ANSWER "E" : 0 points ELSE : -4 points

K.4. Based on the data in the table below, determine in what kind of aggregation state will be substances X and Y at Standard Ambient Temperature and Pressure?

SUBSTANCE	$T_m/^\circ\text{C}$	$T_b/^\circ\text{C}$
X	-218,4	183
Y	97,6	877,5

A. Substance X(g) Substance Y(l)	B. Substance X(l) Substance Y(s)	C. Substance X(s) Substance Y(g)	D. Substance X(g) Substance Y(s)	E. We do not wish to answer
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K.5. The figure shows an experiment in which the same ball is immersed in three different liquids, A, B and C.



What is the correct order of fluids by increasing density, from lowest to highest?

A. A, C, B
B. B, A, C
C. B, C, A
D. C, B, A
E. We do not wish to answer

K.6. Which of the following stoichiometric coefficients should be written in front of the chemical formulas of the products in the chemical equation for the analysis reaction of hydrogen peroxide? The first coefficient refers to a compound and the second one refers to a molecular element.

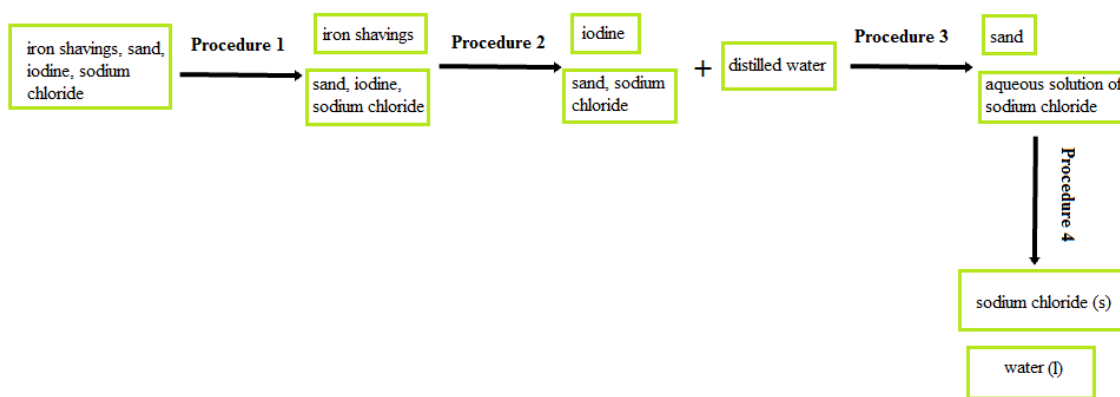
A. 2 and 1	B. 2 and 2	C. 4 and 1	D. 4 and 2	E. We do not wish to answer
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CORRECT ANSWER: 30 points	THE ANSWER "E" : 0 points	ELSE : -6 points
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K.7. For the preparation of winter stores, housewife often use the so-called acetic essence, i.e. 25% aqueous solution of acetic acid. By diluting the acetic acid with water, vinegar is obtained in which the mass fraction of acetic acid is usually 3-9%. What mass of water should be added to 1 kg of acetic essence to get 9% vinegar?

A. 0,25 kg	B. 0,75 kg	C. 1,8 kg	D. 2,5 kg	E. We do not wish to answer
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K.8. The diagram below shows the sequence of procedures for separating the individual components from the mixture.



- a) Which of the following answers contains the exact sequence of procedures for separating the ingredients from the described mixture?
- b) Which of the ingredients at the end of the separation can still be chemically decomposed into two gaseous substances?

A. a) 1 – filtration 2 – sublimation 3 – magnet 4 – distillation b) sodium chloride(s)	B. a) 1 – magnet 2 – sublimation 3 – filtration 4 – distillation b) water(ℓ)	C. a) 1 – magnet 2 – sublimation 3 – filtration 4 – crystallization b) iodine(s)	D. a) 1 – filtration 2 – magnet 3 – sublimation 4 – distillation b) sand	E. We do not wish to answer
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K.9. Figures (1-4) show the possible particle composition of different mixtures under different conditions.

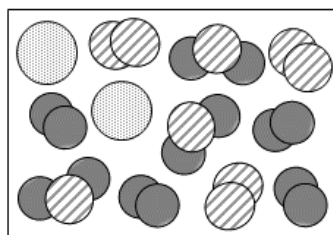


Fig. 1

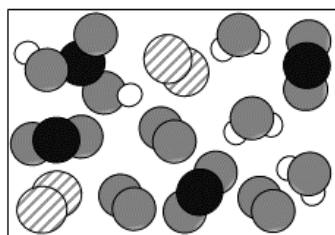


Fig. 2

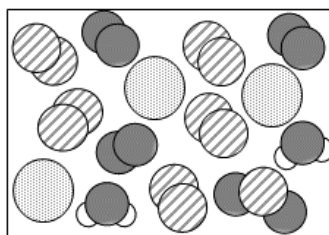


Fig. 3

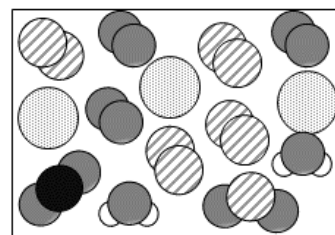


Fig. 4

Which of the following answers accurately describes the composition of all mixtures shown by the particle drawings?

<p>A.</p> <p>Fig. 1– 2Ar, 3N₂, 4O₂, 3NO₂</p> <p>Fig. 2– 3Ar, 5N₂, 3O₂, NO₂, 2H₂O</p> <p>Fig. 3 – 2N₂, 3O₂, 3H₂O, 3CO₂, H₂CO₃</p> <p>Fig. 4 – 3Ar, 4N₂, 3O₂, NO₂, CO₂, 2H₂O</p>	<p>B.</p> <p>Fig. 1– 2N₂, 3O₂, 3H₂O, 3CO₂, H₂CO₃</p> <p>Fig. 2– 2Ar, 3N₂, 4O₂, 3NO₂</p> <p>Fig. 3 – 3Ar, 4N₂, 3O₂, NO₂, CO₂, 2H₂O</p> <p>Fig. 4– 3Ar, 5N₂, 3O₂, NO₂, 2H₂O</p>	<p>C.</p> <p>Fig. 1 – 2Ar, 3N₂, 4O₂, 3NO₂</p> <p>Fig. 2 – 2N₂, 3O₂, 3H₂O, 3CO₂, H₂CO₃</p> <p>Fig. 3 – 3Ar, 5N₂, 3O₂, NO₂, 2H₂O</p> <p>Fig. 4 – 3Ar, 4N₂, 3O₂, NO₂, CO₂, 2H₂O</p>	<p>D.</p> <p>Fig. 1 – 3Ar, 5N₂, 3O₂, NO₂, 2H₂O</p> <p>Fig. 2– 2N₂, 3O₂, 3H₂O, 3CO₂, H₂CO₃</p> <p>Fig. 3– 3Ar, 4N₂, 3O₂, NO₂, CO₂, 2H₂O</p> <p>Fig. 4– 2Ar, 3N₂, 4O₂, 3NO₂</p>	<p>E. We do not wish to answer</p>
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M - F - K**CORRECT ANSWER : 30 points****THE ANSWER "E" : 0 points****ELSE : -6 points**

M-F-K. The excellent chemist Mile found a bottle of gunpowder in his laboratory. Mile knows that gunpowder is a mixture of three powders in which the mass fraction of potassium nitrate is 75 %, charcoal 15 %, while the rest is sulfur. As his scale broke down, Mile used a lever whose arm ratio was 2: 3. He poured all the powder from bottle on the longer end of the lever, and on the shorter end of lever he placed a weight of 30 g to achieve balance. What is the mass of sulfur in his gunpowder?

A. 1,5 g	B. 2 g	C. 4 g	D. 4,5 g	E. We do not wish to answer
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