



Winter round 2019./2020.

SCHOOL	
TEAM NUMBER	
YEAR	8

NAME AND SURNAME OF STUDENT

NAME AND SURNAME OF MENTORS	
	M
	P
	C

ANSWERS:

Mathematics		Physics		Chemistry	
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.	
M.10.		F.10.		K.10.	

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MATHEMATICS

CORRECT ANSWER: 10 bodova	ANSWER „E“: 0 bodova	OTHER: -2 boda
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M.1. In how many different ways can we mix up the letters of the word ATOM so that the letter O is neither at the beginning nor at the end of the word?

A. 24	B. 18	C. 12	D. 6	E. We do not wish to answer.
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M.2. Which of the points listed below is not on the line $y = -\frac{13}{18}x + 23$?

A. A (180, -107)	B. B (648, -445)	C. C (-810, 585)	D. All the points are on the line	E. We do not wish to answer.
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M.3. What is the ratio of the number of prime and the number of composite natural numbers smaller than 51?

A. 3 : 10	B. 8 : 25	C. 3 : 7	D. 15: 34	E. We do not wish to answer.
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CORRECT ANSWER: 20 bodova	ANSWER „E“: 0 bodova	OTHER: -4 boda
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M.4. If the statement “All the balls in the bag are numbered and green” is not true, how many of the statements listed below can be true:

- All the balls in the bag are not numbered and are not green
- All the balls in the bag are not numbered or are not green
- There is a ball in the bag that is not numbered and is not green
- There is a ball in the bag that is not numbered or is not green

A. 4	B. 3	C. 2	D. 1	E. We do not wish to answer.
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M.5. The price of renting a car is made up of a fixed amount for each day of renting it, increased by 2.40 kn for each covered kilometre. The price of renting for up to three days is 150 kn per day, and for periods longer than three days 100 kn per day. If Robert paid 2784.80 kn for 5 days of using the rental car, how much would he pay if he covered half the kilometres in half the number of days.

A. 1 592,40 kn	B. 1 492,40 kn	C. 1 442,40 kn	D. 1 342,40 kn	E. We do not wish to answer.
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M.6. Grandma picked 13 kg of grapes, 5 kg of figs and 7 kg of apricots and she dried all those fruits. The percentage of water in the fresh fruits is: grapes 83 %, figs 72 % and apricots 63 %, while the percentage of water in the dried fruits is: grapes 13 %, figs 12 % and apricots 11 %. What is the total mass of grandma's dried fruit?

A. Between 10 kg and 11 kg	B. Between 8 kg and 10 kg	C. Between 6 kg and 8 kg	D. Between 4 kg and 6 kg	E. We do not wish to answer.
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M.7. Which of the following equations does not have a solution in the set of natural numbers?

A. $n(n + 3) = 24\,804$	B. $n(n + 3) = 24\,178$	C. $n(n + 3) = 22\,950$	D. $n(n + 3) = 25\,599$	E. We do not wish to answer.
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CORRECT ANSWER: 30 bodova	ANSWER „E“: 0 bodova	OTHER: -6 bodova
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M.8. From a class of 26 students, 2 students need to be chosen to attend a lecture. In how many ways is it possible to do this?

A. 650	B. 325	C. 51	D. 676	E. We do not wish to answer.
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M.9. What is the area of the sector of a circle such that its arc length is equal to the radius r ?

A. $\frac{r^2 \pi}{6}$	B. $\frac{r^2 \pi}{4}$	C. $\frac{r^2}{3}$	D. $\frac{r^2}{2}$	E. We do not wish to answer.
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M.10. In the trapezium $ABCD$ such that the angle at vertex A is a right angle, the diagonal \overline{AC} is twice as long as the leg \overline{AD} and it is perpendicular to the leg \overline{BC} of that trapezium. What is the ratio of the base lengths of the trapezium?

A. 2 : 1	B. 3 : 2	C. 4 : 3	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.

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F.1. Objects resist the change between the states of motion or rest. This property of physical objects is called:

A.	B.	C.	D.	E. We do not wish to answer.
Mass	Inertia	Force	Density	

F.2. Which statement about the force of friction is incorrect?

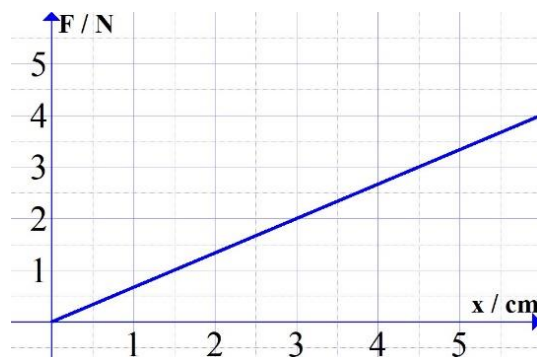
A. The force of friction depends on the surface area of the contact of the two objects.	B. The force of friction depends on the type of the materials in contact.	C. The force of friction depends on the weight of the object.	D. The force of friction opposes the sliding of an object on the surface.	E. We do not wish to answer.
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F.3. A crane lifts a weight of 600 kg onto a building that is 15 m tall in 10 seconds. What is its power?

A.	B.	C.	D.	E. We do not wish to answer.
400 W	4000 W	900 W	9000 W	

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F.4. The graph shows how the force F used to stretch the spring changes as the length of the spring, x , increases. By how much will the length of the spring increase if we hang a weight with a mass of 850 g onto it?



A.	B.	C.	D.	E. We do not wish to answer.
12.75 cm	12.25 cm	8.5 cm	8.25 cm	

F.5. A man pushes a wardrobe horizontally on the floor of a room with constant speed and moves it by 4 m. The mass of the wardrobe is 80 kg, The coefficient of friction between the wardrobe and the floor is 0.2. What is the work done by the man?

A. 64 J	B. 640 J	C. 6400 J	D. 64000 J	E. We do not wish to answer.
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F.6. Using the heater, whose efficiency is 60 %, we can heat up 40 litres of water from 15 °C to 333 K in an hour. What is the power of the heater? The specific heat capacity of water is 4200 J/(kgK).

A. 4667 W	B. 24733 W	C. 1260 W	D. 3500 W	E. We do not wish to answer.
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F.7. A lever is 320 cm long. On the left end there is a weight of 10 kg, and on the right end, there is a weight of 6 kg. Where does the pivot have to be so that the lever is in balance?

A. At a point 200 cm from the left end.	B. At a point 220 cm from the left end.	C. At a point 200 cm from the right end.	D. At a point 220 cm from the right end.	E. We do not wish to answer.
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F.8. The area of the pointy end of a nail is 0.2 mm², and the area of the other end is 0.64 cm². What is the amount of pressure that needs to be exerted onto the thicker end of the nail so that the pointy end exerts a pressure that is 100 times greater than the atmospheric pressure, onto the board? The atmospheric pressure is 100 000 Pa.

A. 3125000 Pa	B. 31250 Pa	C. 32000 Pa	D. 32000000 Pa	E. We do not wish to answer.
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F.9. A man pushes an object with a mass of 300 kg up a smooth slope that is 10 m long and 4 m high (there is no friction). What is the least force the man must use to push the object so that he would push it at a constant speed?

A. 800 N	B. 1200 N	C. 1600 N	D. 2000 N	E. We do not wish to answer.
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F.10. In one container, we have cold water at a temperature of 14 °C, and in another container we have hot water at a temperature of 80 °C. How much cold and how much hot water do we need to pour into a third container so that we would get 85.16 litres of water at a temperature of 45 °C? Do not take into consideration the change in temperature of the container.

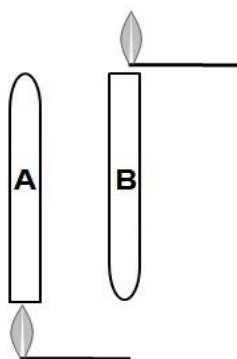
A. 40 litres of cold and 45.16 litres of hot water	B. 42 litres of cold and 43.16 litres of hot water	C. 45.16 litres of cold and 40 litres of hot water	D. 43.16 litres of cold and 42 litres of hot water	E. We do not wish to answer.
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CHEMISTRY

In all tasks use the values from the table in the received periodic table of elements.

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K.1. Two test tubes were filled with gas, which was formed by the chemical reaction of zinc and hydrochloric acid. Test tubes are turned in opposite directions and the burning splints are held near the openings of the test tubes. The picture shows the described experiment.



Which of the following statements accurately describes the observations made during the experiment?

A. In test tube A a “pop” sound can be heard and the splint is extinguished.
B. In test tube B a “pop” sound can be heard and the splint is extinguished.
C. The flame of the splint in test tube A burns even more.
D. The flame of the splint in test tube B burns even more.
E. We do not wish to answer.

K.2. The following substances were mixed in the beaker: water, sand, blue vitriol and table salt. The filtration apparatus was then prepared, and the mixture of the above substances was filtered. Which of the following statements about the described experiment is correct?

A. The filtrate is a colorless homogeneous mixture.
B. The filtrate is a colorless heterogeneous mixture.
C. The filtrate is a light blue, homogeneous mixture.
D. The filtrate is a light blue, heterogeneous mixture.
E. We do not wish to answer.

K.3. The molecules of which of the following compounds do not contain oxygen atoms?

A.	B.	C.	D.	E.
glucose	ammonia	Blue vitriol	sulfuric acid	We do not wish to answer.

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K.4. Let X be an element from group 15 of the periodic table of elements. What type of compound cannot be made from element X?

A. Na_3X	B. Mg_3X_2	C. XH_3	D. X_3O_2	E. We do not wish to answer.
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K.5. The incomplete table shows the approximate composition of inhaled air. Predict whether the volume fraction of each component in the exhaled air (φ_2) is higher, lower or equal to the volume fraction of the inhaled air (φ_1)?

composition of air	N_2	O_2	Ar	CO_2	other gases
φ_1 (gas, inhaled air)	X %	Y %	0,9 %	Z %	0,06 %
φ_2 (gas, exhaled air)			$\varphi_2 = \varphi_1$		$\varphi_2 = \varphi_1$

Which answer will correctly complete the table?

A. N_2 : X=78; $\varphi_2 = \varphi_1$ O_2 : Y=21; $\varphi_2 < \varphi_1$ CO_2 : Z=0,04; $\varphi_2 > \varphi_1$	B. N_2 : X=78; $\varphi_2 = \varphi_1$ O_2 : Y=21; $\varphi_2 > \varphi_1$ CO_2 : Z=0,04; $\varphi_2 < \varphi_1$	C. N_2 : X=0,04; $\varphi_2 > \varphi_1$ O_2 : Y=78; $\varphi_2 = \varphi_1$ CO_2 : Z=21; $\varphi_2 < \varphi_1$	D. N_2 : X=0,04; $\varphi_2 < \varphi_1$ O_2 : Y=78; $\varphi_2 > \varphi_1$ CO_2 : Z=21; $\varphi_2 = \varphi_1$	E. We do not wish to answer.
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K.6. A series of particles is listed below; they belong to atoms of the same or different chemical element.



Which statement is correct for the specified series of particles?

A. Particles that do not belong to the same chemical element are: ${}_{26}^{58}\text{L}^{2+}$ i ${}_{26}^{56}\text{X}^{3+}$.	B. Particles that are isotopes of the same element are: ${}_{28}^{63}\text{Q}$ i ${}_{29}^{63}\text{M}$.	C. Particles which have the same number of nucleons are: ${}_{16}^{35}\text{Y}$ i ${}_{17}^{35}\text{Z}^-$.	D. Particles of different chemical elements belonging to the same period are: ${}_{17}^{37}\text{W}$ i ${}_{35}^{79}\text{N}$.	E. We do not wish to answer.
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K.7. An experiment was made to determine the density of copper. Three equal copper nails with a total mass of 12.90 g were put into the graduated cylinder with 20.0 cm³ of water, increasing the volume of water to 21.45 cm³. What is the density of one nail?

A. 2,966 kg/m ³	B. 8,897 kg/m ³	C. 2966 kg/m ³	D. 8897 kg/m ³	E. We do not wish to answer.
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K.8. Penicillin is the first antibiotic to be discovered and used. Thanks to its discovery by Alexander Fleming, millions of lives were saved. Chemical analysis has determined that in one penicillin molecule the total mass of hydrogen atoms is 18.18 Da, the total mass of sulphur atoms is 32.07 Da, the number of oxygen atoms is twice the number of nitrogen atoms, and the number of carbon atoms is four times greater than the number of oxygen atoms. The weight of one molecule of penicillin is 334.43 Da. What is the chemical formula of the penicillin molecule?

A. $C_8H_{64}NO_2S_4$	B. $C_{12}H_{20}N_3O_6S$	C. $C_{16}H_{18}N_2O_4S$	D. $C_{24}H_{28}N_3O_6S_2$	E. We do not wish to answer.
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K.9. How many litres of water are lost in one household over the course of a year because of a dripping tap, if 1 drop of water is assumed to drip per second and one drop has a volume of 0.05 ml?

A. 4,32 L	B. 26,28 L	C. 1576,8 L	D. 65 700 L	E. We do not wish to answer.
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K.10. By dissolving sodium chloride in 300 g of water, we will get a solution of sodium chloride with a mass fraction of 25%. What mass of water should be added to this solution to obtain a more dilute solution of sodium chloride with a mass fraction of 15%?

A. 100 g	B. 266,7 g	C. 400 g	D. 666,7 g	E. We do not wish to answer.
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