Biology - GREECE

Correct answer: 3

Ages: 14-15 (C class Junior High School)

Humans will never be able to live without a protective suit on Mars because:

1. The temperature of Mars is very high
2. The atmosphere of Mars is very dense
3. The atmosphere of Mars has no ozone layer
4. The temperature of Mars is very cold

Hint

In the upper layers of the Earth's atmosphere, ozone naturally exists and plays a very important role. It forms a layer and absorbs a large percentage of UV radiation. The atmosphere of Mars does not have an ozone layer, as a result of which ultraviolet radiation passes to the surface of the planet and causes dangerous damage to cells, eg skin cancer, cell death, etc.

Ages: 15-16 (A class Senior High School)

Inside the spacecraft the air must:

1. Be constantly renewed by space
2. Be enriched with carbon dioxide and remove oxygen
3. Be enriched with oxygen and remove carbon dioxide
4. Be enriched with oxygen and carbon dioxide.

Hint

The human body needs energy, which it gets from the oxidation of food nutrients during cellular respiration. This energy is used to form adenosine triphosphate (ATP). For the oxidation of nutrients, the continuous supply of oxygen to the cells is necessary, and at the same time the continuous removal of the produced carbon

dioxide. Oxygen and carbon dioxide (respiratory gases) are transported in the blood to and from the lungs.

Ages: 16-17 (B class Senior High School)

Planet Mars is not a natural ecosystem because:

1. It has no atmosphere
2. It has no energy input
3. It has no biotic factors
4. It has no abiotic factors

Hint

The ecosystem is a system of study that includes the biotic factors of an area, i.e. the set of organisms that live in it, the abiotic factors of the area (temperature, sunshine, soil composition, etc.), as well as the set of interactions that develop between them.

Ages: 17-18 (C class Senior High School)

The very low temperatures on Mars affect the metabolism of human cells and require special thermal protective suits because:

1. The structure and function of cells requires water in liquid form and at temperatures below zero water freezes
2. Temperature affects the activity of enzymes and all metabolic processes of cells are enzymatic.
3. The body's homeostatic temperature regulation mechanism cannot cope with such low temperatures.
4. All of the above are correct

Hint

Human cells are surrounded by an aqueous solution, the intercellular fluid. From this liquid they draw all the necessary components for their survival and in it they excrete the

derivatives of their metabolism. But also 80% of their internal environment is water. Water in liquid form serves to dissolve and move chemicals inside cells.

For each enzyme of human cells there is a certain temperature at which the speed of the reaction becomes maximum. Most enzymes work optimally at temperatures between 36oC – 38oC which is also the temperature of the human body. At extreme temperature values, enzymes are denatured, their three-dimensional protein structure is destroyed and they lose their functionality. The homeostasis of the human organism includes a number of mechanisms that aim to keep the internal conditions of the organism stable despite external changes. In extreme environmental changes homeostatic mechanisms fail to maintain homeostasis, resulting in disease and, possibly, death.

Chemistry - GREECE

Correct answer: 3

Ages: 14-15 (C class Junior High School)

The trapped team of astronauts in their search for water discovers several bottles in the spaceship. Each had a label with a chemical formula on it. Which bottles contain water for the crew to survive?

1. Bottles labeled with the chemical: H_2O_2
2. Bottles labeled with the chemical: N_2H_4
3. Bottles labeled with the chemical: H_2O
4. Bottles labeled with the chemical: N_2O_4

Hint

They know that water consists of hydrogen and oxygen in a ratio of 2:1.

Ages: 15-16 (A class Senior High School)

The trapped crew discovers the bottles with water reserves. They find that on a bottle the label has been largely damaged and in its only visible place is the Mr of the compound it contains. The Mr of water is:

1. 19
2. 28
3. 18

4. 17

Hint

They know that ArH=1 and ArO=16 and that the Mr of a compound $A_\chi B_\psi$ is given by the formula Mr= χ ArA + ψArB. They calculate Mr to confirm that the bottle contains water.

Ages: 16-17 (B class Senior High School)

The crew wants to make more hydrazine(NH_2NH_2), propellant fuel for the missiles. They have a quantity of ammonia (NH3) and bleach (NaClO).They want to prepare 10.000 tn of hydrazine. The production of hydrazine using the above chemicals as raw materials is described by the reactions:

$$NH_3 + NaClO \longrightarrow NH_2Cl + NaOH$$

$$NH_2Cl + NH_3 \longrightarrow NH_2NH_2 + HCl$$

Given that Ar(N):14, Ar(H):1, Ar(Na):23, Ar(O):16, how much mass of bleach will be needed?

1. $4 \cdot 10^4$ g
2. $6{,}5 \cdot 10^5$Kg
3. $2{,}33 \cdot 10^7$Kg
4. 20 tn

Hint

They know that the mathematical formula for calculating mass is: m=n Mr. Where m is mass, n is mol and Mr is the relative molecular mass.

Ages: 17-18 (C class Senior High School)

The crew decided to check the pH of the soil so that they could grow potatoes. They know that the proper pH for growing potatoes is 6-6.8. After soil analysis the oxonium concentration should be:

1. $[H_3O^+]=10^{-4}$
2. $[H_3O^+]=10^{-8,5}$
3. $[H_3O^+]=10^{-6,5}$
4. $[H_3O^+]=10^{-3,5}$

Hint

The mathematical formula for calculating pH is: pH =-log[H

COMPUTER SCIENCE- GREECE

Correct answer: 4

Ages: 14-15 (C class Junior High School)

Astronauts have a storage unit with a capacity of 1 TeraByte. How many Bytes does that correspond to?

1) 10^{20}
2) 2^{20}
3) 10^{40}
4) 2^{40}

Hint

Byte is the basic unit of measurement of the amount of information in computer systems. Due to the increasing amount of digital data (texts, images, videos, sounds) stored in the computer's memory, Byte's multiple units were created. Therefore, when referring to the capacity of a particular storage unit, we can use one or more of the following multiples of bytein ascending order: KB, MB, GB, TB, PB.

Note that 1 KB=2^{10} Byte and the next multiples are 2^{10} times larger than the previous ones.

Ages: 15-16 (A class Senior High School)

Astronauts need to take a high-resolution printer with them. They have to choose one of the following printers:
E1: Ink spray printer (colour printer), 9 ppm, 600 dpi,
E2: Laser printer (colour printer), 16 ppm, 1200 dpi
E3: Laser printer (black and white printer), 20 ppm, 600 dpi
E4: Pin printer (black and white printer), 10 ppm, 120 dpi
Who has the greatest analysis and how much is that?

1) E1 because it has 600 dpi
2) E4 because it has 120 dpi
3) E3 because it has 20 ppm
4) E2 because it has 1200 dpi

Hint

Dense dots mean more detail, and thus better print quality. This feature is called print resolution and its measuring unit is dots per inch (dpi), i.e. the number of dots that the printer can print at a certain distance (1 inch=2.54 cm). Another key feature is print speed, usually measured on pages per minute (pages per minute, ppm).

Ages: 16-17 (B class Senior High School)

The astronauts took pictures of their journey and wanted to store them. What is the desired file type for storing them?

1) wav
2) doc
3) html
4) jpg

Hint

Some useful types of files are:

Hypertexts: htm, html
Text files: txt, doc, odt,
Audio files: mp3, wav, au
Images: jpg, gif,tiff

Ages: 17-18 (C class Senior High School)

They want to build a program in which astronauts' heartbeats are registered and if they exceed 120 or fall below 60, it will display the word danger. The command will be used to create this program.

1)if a> 120 and a <60 then write 'alarm'
2) if a=120 and a=60 then 'alarm'
3) if a=120 or a=60 then 'alarm'
4) if a> 120 or a <60 then write 'alarm'

Hint

If-then command
The command **if** generally is compiled as follows: **if** condition **then** execute
How it works:
Check the value of the condition and if it is **true**, then the orders are executed in the section of **then** (until **end_if**). If the condition is **false**, these orders are ignored and the execution of the program continues with the command following the **end_if** declaration.

The **and** operator combines two conditions into one, which will be true if both sides are true, and false otherwise.

The logical **or** operator returns the boolean value true if either or both operands is true and returns false otherwise.

Mathematics - GREECE

Correct answer: 1

Ages: 14-15 (C Class - Junior High School)

The astronauts who are trained to take part in the journey are more than those who will eventually take part in the mission. If the probability of someone taking part in this voyage is twice the probability of not participating in the mission, estimate the probability of someone not taking part in the mission.

1) 1/3
2) 2/3
3) 1/4
4) 3/4

Hint

If the probability of **going is R(A**) then the probability of not going is R(A)=1-R(A) since the possibility A occurs when A is not realised. I.e. P(A)=2*[1-P(A)]. By solving the equation we find the possibility of going on this journey.

Ages: 15-16 (A class Senior High School)

In order to turn on the computer, you need a two-digit number that is the solution of the following problem.

If we divide the two-digit number by the sum of its digits, the quotient of the division is 4 and the remainder 6. If we alter the sequence of the number's digits and divide the resulting number by the sum of its digits, the quotient of this division is 6 and the remainder 1. Find the two-digit number so that the computer turns on.

1) 10*X+Ψ=4*(X+Ψ)+6 and 10* Ψ+X =6*(X+Ψ)+1
2) 10*(X+Ψ)=4*(X+Ψ)+6 and 10* (Ψ+X) =6*(X+Ψ)+1
3) 10*X+Ψ=6*(X+Ψ)+4 and 10* Ψ+X =1*(X+Ψ)+6
4) 10*X+Ψ=X+Ψ*4+6 and 10* Ψ+X = X+Ψ *6 +1

Hint

A two-digit number, which digits are: x – the tens digit and ψ- the units digit, is written as 10*x+ψ.

If we denote by Δ the divident, δ the divisor, π the quotient and υ the remainder, then according to the Euclidian division: Δ =δ*π+υ.

Ages: 16-17 (B class of Senior High School)

Astronauts need to cover with insulating material a string AB of a circle (O,R) of radius R=2m, which appeared during the collision of the spacecraft with meteorites. The string corresponds to a bow of 120^o. Calculate the length of the string.

1) $2*\sqrt{3}$
2) $2*\sqrt{\frac{3}{2}}$
3) $2*\sqrt{\frac{5}{2}}$
4) 2

Hint

The two radii of the circle OA and OB and the string AB form an isosceles triangle. The angle opposite the AB string is a central angle and has a value of 120^o as is the value of the corresponding arc.

With the law of cosines, if in a triangle we know the two sides and their contained angle, then we can calculate the third side, that is, i.e. $a^2=b^2+ c^2-2*b*c*$ cos 120^o.

For supplementary angles, the following applies: cos(180^o-ϕ)=-cosϕ

cos60^0=1/2

Ages: 17-18 (C class of Senior High School)

Astronauts have an 80 m long cable and they want to fence an area in the shape of a rectangle that has the maximum surface area, when they reach their destination. Find the maximum area that can be fenced

1) 400 m^2
2) 300 m^2
3) 600 m^2
4) 375 m^2

Hint

A rectangle with sides x and ψ has a perimeter of Π=2*x +2*ψ, while the area of the rectangle is E=x*ψ. The length of the cable should be equal to the perimeter of the rectangle. Using the known perimeter P, ψ can be deleted from the function of the Area so that the function of the Area becomes a function of a variable of x.

To find the extremities of a function (maximum or minimum), we find the derivative, and at the points that zero it has a maximum or minimum.

To find the extremities of a function (maximum or minimum), we find the derivative, and the points at which the derivative equals zero are the ones with maximum or minimum.

PHYSICS- GREECE

The correct answer: 3

Ages: 14-15 (C class Junior High School)

The ship had a meteorite collision and the empty boxes of the serums were confused with the full ones. How will astronauts recognize which boxes are full and which are empty without having to open them all?

1) They will hold them up and whichever feels heavier will be the one with the full boxes while the other which feels lighter will be the one with the empty ones.
2) There's no way to find out which one is which, without opening the boxes.
3) They will push them forwards and the ones which are empty will move with greater acceleration
4) They will use electronic scales to weigh them

Hint

The mass of a body is the measure of its inertia, meaning that the mass of the body is the resistance that the body presents to the change of its kinetic state. Large mass means large inertia, that **is, the greater the mass** of a body, the **more difficult its speed can be changed**.

Ages: 15-16 (A class Senior High School)

Astronauts before entering the spacecraft must be trained in conditions of weightlessness. But you can't just "disable" gravity. So, how would you choose to train the astronauts in conditions of weightlessness?

1) The zones with which gravity is eliminated exist only in films or comics, so no such training can be done.
2) By the use of a device that achieves the simulation of absence of gravity by accelerating upwards with g acceleration.

3) By the use of a device that achieves the simulation of absence of gravity by performing free fall.
4) By the use of a device that achieves the simulation of absence of gravity by descending with a g/2 acceleration.

Hint

Newton's 2nd Law expresses the relationship between the resulting force exerted in a body and the acceleration it acquires. The acceleration is proportional to the resultant force and inversely proportional to its mass: ΣF=m*a

The force by which the earth attracts bodies is called "weight" of the body and we symbolise it by $\vec{w}$, where: $\vec{w} = m \cdot \vec{g}$.

A body performs free fall if we let it fall only under the influence of its weight (considering that there is no resistance from the air), in which case it falls with the acceleration of gravity$\vec{g}$.

Ages: 16-17 (B class Senior High School)

The presence of atmosphere on a planet depends on its escape velocity. To assess the possibility of the presence of atmosphere on an exoplanet (a planet that does not belong to the solar system) that has nine times the mass of the Earth and four times the radius of Earth, we investigate its escape velocity. If the escape velocity from the Earth's surface is $u_{\delta} = 11{,}2\frac{km}{s}$, find out how much the escape velocity from the surface of this planet is.

1) $5{,}6\frac{km}{s}$
2) $11{,}2\frac{km}{s}$
3) $16{,}8\frac{km}{s}$
4) $22{,}4\frac{km}{s}$

Hint

The speed at which an object of mass m must be launched from the Earth's surface to escape the Earth's gravitational field is called escape velocity. Ignoring the gravitational effects of other celestial bodies and the resistance of atmospheric air, we can apply maintenance of the mechanical energy of the body during its movement between two positions and conclude that the escape velocity from Earth is given by the formula:

$$\upsilon_{\delta} = \sqrt{\frac{2GM_{\Gamma}}{R_{\Gamma}}}$$

Ages: 17-18 (C class Senior High School)

Our spacecraft initially has a mass of M=6,000.000kg and moves vertically away from Earth at a speed of v=500m/s. At some point it is divided into two pieces. One part of the spacecraft now has a mass m = 4 500 000kg and its velocity immediately after decay is υ= 1.000 m/s, in the same direction as velocity v. Find the velocity of the detachable piece immediately after decay.

1) 3 000 m/s
2) 2 000 m/s
3) 1 000 m/s
4) 2 500 m/s

Hint

Momentum is a vector size that is directed in the direction of the velocity of the body and is defined as follows: $\vec{p} = m \cdot \vec{v}$

In an insulated body system (i.e. a system in which the sum of the external forces is zero) the total momentum is kept constant.

In other words: $\Sigma \vec{F}_{ext} = 0 \leftrightarrow \vec{p}_{o\lambda}$ = constant

The momentum is maintained:

- In a system that external forces are not exerted.
- In a system that external forces are exerted but their resultant is zero.
- On every collision.
- Every explosion.

Technology - Engineering- GREECE

Correct answer: 1

Ages: 14-15 (C class Junior High School)

When the astronauts arrive on the new planet, they will use a hydraulic press to move objects. The ratio of the area S_2 of the large piston to the area S_1 of the small piston is 5, i.e. $S_2/S_1=5$. The ratio of forces F_2 and F_1 exerted to the surfaces S_2 and S_1 correspondingly is:

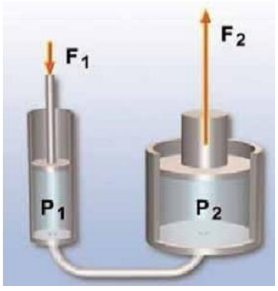
1) $F_2/F_1=5$
2) $F_1/F_2=5$
3) $F_2/F_1=10$
4) $F_1/F2=10$

Hint

Pascal's Principle: any change in pressure at any point in a limited fluid that is stationary causes an equal change in pressure at all points.

Hydraulic Press: the main parts of a hydraulic press are two cylindrical containers that communicate with each other by a thin tube. Within the two vessels, two pistons with different areas move. When we apply a force F_1 to the piston having an area of A_1, then an additional pressure is applied to the liquid: $p_1=\frac{F_1}{A_1}$. Therefore, according to Pascal's principle, this pressure is transmitted unchanged at all points of the liquid, so on the surface of the piston having an area of A_2 will be, also, applied a pressure p_2 equal to p_1. The liquid exerts a force F_2 on the piston:

$$p_2 = p_2, \qquad \frac{F_2}{A_2}=\frac{F_1}{A_1}, \qquad F_2 =\frac{A_2}{A_1}\cdot F_1$$



Ages: 15-16 (A class Senior High School)

In the spacecraft, astronauts have a 1:1000 scale design of the spacecraft. Find the volume of the oxygen tank if it is known that the drawing of the tank shows that the tank is a cube with acne 2 cm.

1) 8 000 m^3
2) 2 000 m^3
3) 8 m^3
4) 8 000 000 m^3

Hint

It would be convenient to design each object at its actual size, i.e. its graphic size (length on the paper) to coincide with its physical (real) size. Due to the fact that this is not always possible, a scale has been adopted for each project. Scale is the fixed relationship between the graphic length and the actual length.

Scale = Graphic length (length on paper)/Natural length (actual length)

Volume of the cube is $V=\alpha^3$.

Ages: 16-17 (B class Senior High School)

Astronauts want to use a heater to warm up. The heater's normal operation data are "1000W-100V" according to what is written on it. Help astronauts find the resistance of the resistor they need to connect in series to the heater to operate on a 220V voltage grid.

1) R=12Ω
2) R=10Ω
3) R=5Ω
4) R=20Ω

Hint

The power of the device is P=$1000W$ when it operates at a voltage of V = 100V. Power is given by the relation P=V.I. So, in order for the device to work properly, the current that flows through the device must be equal to I=10A. Therefore we need to connect a resistance that will drop the given voltage by 120V and the current that must flow through it should be equal to I=10A, since it will be in series with the heater. Finally, using Ohm's law V=I*R we find the resistance of the resistor.

Ages: 17-18 (C class Senior High School)

Astronauts have to turn a wheel to open a door. The wheel has a radius of R = 0.2 m and it can rotate around an axle passing through the centre of O which is perpendicular to its surface. The wheel will have an inertia torque of 0.4kg.m^2. If a force F = 20N is exerted tangentially to the wheel, how much will the torque of this force be and how much is its angular acceleration?

1) Its torque is $4N.m$ and its angular acceleration is 4 rad/s^2
2) Its torque is $6N.m$ and its angular acceleration is 10 rad/s^2
3) Its torque is $6N.m$ and its angular acceleration is 8 rad/s^2
4) Its torque is $4N.m$ and its angular acceleration is 10 rad/s^2

Hint

Torque is a physical quantity that produces an angular acceleration in a body about the axis of rotation. It is a vector quantity. Torque is the product of force F and the perpendicular distance r between the line of action of force and the axis of rotation. Its direction is defined by the right-hand rule. According to this rule, the direction of the torque is perpendicular to the plane containing r and F. The magnitude of torque is denoted by τ is given by τ=r x F

Newton's 2nd Law for rotation: If more than one torque acts on a rigid body about a fixed axis, then the sum of the torques equals the moment of inertia I times the angular acceleration a: Στ= I*a