

- 1) Which of these authors was awarded the Nobel Prize in Literature?**
A) Ungaretti
B) Montale
C) Saba
D) Pasolini
E) Pavese
- 2) In which year was fought the Battle of Caporetto?**
A) 1944
B) 1945
C) 1916
D) 1917
E) 1918
- 3) In which country was Skype invented?**
A) England
B) USA
C) Sweden
D) Estonia
E) Germany
- 4) In which year women's suffrage in Italy was achieved? (right of women to vote in elections)?**
A) 1945
B) 1948
C) 1861
D) 1946
E) 1871
- 5) Which of these countries is not an Italian border?**
A) Slovenia
B) Croatia
C) Austria
D) Switzerland
E) France
- 6) Which of these novels was written by the author Cesare Pavese?**
A) The Beautiful summer
B) The Pleasure
C) The Cloven Viscount
D) The Hills Have Eyes
E) Banality of Evil
- 7) Who was the first President of the Italian Republic?**
A) Luigi Einaudi
B) Enrico De Nicola
C) Sandro Pertini
D) Giorgio Napolitano
E) Giovanni Leone

- 8) **“Unique Forms of Continuity in Space” is:**
- A) a poem by Filippo Tommaso Marinetti
 - B) a sculpture by Umberto Boccioni
 - C) a painting by Giacomo Balla
 - D) a poem by Carlo Carrà
 - E) a sculpture by Giorgio Morandi
- 9) **In the last movie of the famous film saga by Marvel, Thanos the Destroyer of Worlds defines himself as “ineluctable”. What is the meaning of this word?**
- A) Incomparable
 - B) Irresistible
 - C) Unavoidable
 - D) Dauntless
 - E) Indestructible
- 10) **Which of these institutions of the European Union is directly elected by european citizens?**
- A) The Council of the EU
 - B) The Parliament
 - C) The Economic and Social Committee
 - D) The European Council
 - E) The European Commission
- 11) **What is the name of the main character of the novel “One, No one and One Hundred Thousand” by Luigi Pirandello?**
- A) Rosangelo Vitarda
 - B) Angelo Rosarda
 - C) Lino Banfi
 - D) Michelangelo Manarda
 - E) Vitangelo Moscarda
- 12) **What is the meaning of the acronym “www” present in the url of web sites?**
- A) Wild World Web
 - B) Word Wide Web
 - C) Where Why Who
 - D) Word Wild West
 - E) World Wide Web
- 13) **Five friends: Richi, Maddi, Lollo, Ale e Ceci had a reunion in Salento. They all come from different cities: Perugia, Bari, Catania, Genoa e Venice, not necessarily in the same order. They all have different ages: 28, 26, 25, 24 e 22 years of age, not necessarily in the same order. It is known that: Ale is the youngest and he was born in a city in the south of Italy; Lollo il the oldest and he was born in Venice; the one that was born in Catania is 2 years younger than Lollo and his name is not Richi; Maddi comes from Perugia and has an age which is a multiple of 5.**
- Given the previous information, how old is Richi and which is his hometown?**
- A) 24 years old and he was born in Genoa
 - B) 26 years old and he was born in Genoa
 - C) 24 years old and he was born in Bari

- D) 26 years old and it is not possible to determine his hometown
- E) 26 years old and he was born in Bari

14) Bolco cannot but go to the Stadium when Inter plays a Champions League's game. In fine weather it's not impossible that Bolco gives up taking an exam to take a ride on the motorcycle. If the previous information are true, which of the following cannot but be true?

- A) Any time that the sun shines, Bolco spends the day riding his motorcycle
- B) Bolco more often goes to the Stadium rather than to ride his motorcycle
- C) Bolco never failed to go to an Inter Champions League's game
- D) Bolco never took an exam in the summer session
- E) Any time that Inter plays a match Bolco goes to the stadium

15) If the sentence "The early bird catches the worm" is $[A \rightarrow [\sim B]]$ and the sentence "eats healthy" is $[C]$, then the sentence "The early bird catches the worm and eats healthy" is:

- A) $[[A] \rightarrow [B \wedge C]]$
- B) $[[A \wedge C] \rightarrow [\sim B]]$
- C) $[[\sim A \wedge C] \rightarrow [B]]$
- D) $[[\sim A] \rightarrow [C \wedge [\sim B]]]$
- E) $[[\sim A] \rightarrow [B \wedge C]]$

16) X : Sam as Y : Aleksej

- A) X = Frodo; Y = Dostoevskij
- B) X = Tolkien; Y = Tolstoj
- C) X = The Lord of the Rings; Y = The Brothers Karamazov
- D) X = Gandalf; Y = russian
- E) X = New Zealand; Y = South Africa

17) Fill with the two missing numbers in the sequence: 1-1-2-3-5-...-...

- A) 9-21
- B) 8-15
- C) 11-23
- D) 10-21
- E) 8-13

18) Marta has 45 pencils in her pencil case. Knowing that:

The green pencils are four times the brown ones

The yellow pencils are $\frac{1}{5}$ of the total number of pencils and $\frac{3}{4}$ of the green ones

The blue pencils are one less than the orange ones

The red pencils are double with respect to the blue ones

How many orange pencils has Marta in her pencil case?

- A) 6
- B) 4
- C) 5
- D) 7
- E) 10

19) 20 girls from Sacco decide to go on holidays in Puglia. To meet the needs of everyone, they decide to split in two groups: the first one, composed by 16

people, will stay in Puglia for 8 nights; the second one will arrive there two days later and will remain for 6 nights. To complicate the difficult situation, Scarry, who is part of the first group, decides to head back to Milan two days in advance, without considering the last two nights. In the meantime, Anna wins the lottery and pays the trip to the entire group, except Scarry who has to pay the airplane. The overall price of the trip is € 3000: knowing that any of the girls will pay the vacations proportionally to the number of nights she will spend in Puglia, how much will Mansu pay, considering she is part of the first group of girls?

- A) 20
- B) 160
- C) 120
- D) 150
- E) Nothing because Anna won the lottery

20) **John Snow and Daenerys Targaryen meet after the battle among the ruins of King's landing. As soon as they see each other they start running one towards the other; Daenerys keeps a constant velocity of 3 m/s, while John, being more athletic, runs at a velocity of 5 m/s. Considering that when they first saw each other in King's landing, 120 meters of ruins and flames were between them, how much time does it take for them to finally hug?**

- A) 30 seconds
- B) 20 seconds
- C) 1 min
- D) 15 second
- E) 8 seconds

21) **The sperm whales have the biggest brains on the planet, even if humans and dolphins have a bigger brain if compared to the size of their body. But should the relative size of the brain be important? Thinking at the brain as a computer, there's no reason in considering its abilities with respect to the size of the body to which it belongs. Indeed, as an example, why should a whale need a bigger brain while a nightingale - which has important tasks to perform - manages to achieve them with a smaller brain? which of the following conclusions can be drawn by this text?**

- A) the size of the brain and the ability to accomplish complex tasks are not necessarily connected
- B) nightingales and whales accomplish equally complex tasks, despite the consistent difference in the sizes of their brains
- C) dolphins are more intelligent than whales
- D) there's no consistent difference between brains and computers
- E) given their size, whales need bigger brains with respect to dolphins or humans

22) **The frequency of extreme precipitation - events that can cause landslides and floods, putting safety and public health at risk - has increased globally over the last fifty years, in parallel with the intensification of global warming. This was revealed by a new study published in the Water Resources Research Journal and carried out by scholars from the University of Saskatchewan (Canada) and the University of Bologna.**

Extreme rainfall - intense storms with heavy rainfall concentrated in a short time - can be particularly dangerous, causing landslides and flooding: events that

often also cause contamination of water systems with dramatic consequences on public health.

It is estimated that between 1980 and 2009 flooding due to rainfall affected nearly three billion people worldwide, causing over half a million deaths. And these phenomena are often also responsible for damage to agriculture, buildings, roads, and infrastructure, with extremely significant consequences on society and on the economy.

“Knowing that the frequency of extreme precipitation is on the rise can help us find effective solutions to adapt to climate change: we will increasingly need infrastructure capable of withstanding frequent shocks,” confirms Alberto Montanari, professor of Hydraulic Construction and Hydrology at the University of Bologna, one of the authors of the study.

In short, national governments, local authorities and those dealing with emergency management must include planning solutions to face extreme rains as a priority, limiting the dangerous consequences as much as possible.

What is the main message of the passage?

- A) Extreme precipitation can be dangerous; they can in fact lead to public health consequences
- B) Infrastructures able to withstand frequent shocks constitute a new building frontier
- C) Extreme rains have steadily increased globally over the past 50 years
- D) Governments must implement plants to limit the consequences of extreme precipitation
- E) Information should be communicated to make citizens aware of this problem

23) Griffith experiment demonstrated:

- A) the existence of circulating DNA
- B) that heat denatures DNA
- C) the existence of harmless strains of bacteria
- D) the existence of resistance factors of bacteria
- E) the existence of transforming factor

24) Teo Reda, after a crazy night at the disco, wakes up with a bad headache and decides to take 4000 mg of paracetamol (toxic dose). At the level of Kupffer cells (liver) the drug is uptaken and degraded. Which cellular organelle will be the most involved?

- A) Mitochondria
- B) Golgi apparatus
- C) SER
- D) RER
- E) None of the above

25) What would my name be if I happened to work as a protein modification site?

- A) Esophagus
- B) Endoplasmic reticulum
- C) Spleen
- D) Taico
- E) Golgi apparatus

26) Annie, during a journey to North Africa, was infected by HIV. This virus:

- A) is always identical to itself (belongs to the same viral strain)

- B) has Reverse Transcriptase in its cytoplasm
 - C) has DNA polymerase I enzyme
 - D) contains small DNA fragments
 - E) preferentially affects specific cell types, among which Th lymphocytes
- 27) DNA histones:**
- A) have the function of supercoiling and compacting the double stand
 - B) have negative charge
 - C) are not part of the nucleosome
 - D) form histone complexes made of 4 histones
 - E) have also an enzymatic function
- 28) Which among the following statements is correct:**
- A) the Anticodon is a specific 3 nucleotide sequence on the mRNA
 - B) almost all AA are specified (coded) by more than a codon
 - C) the translation phase begins within the nucleus
 - D) during the translation phase the ribosome moves in 3' → 5' direction
 - E) all of above
- 29) Which among the following doesn't have a role in the Transcription process?**
- A) DNA
 - B) RNA polymerase
 - C) messenger RNA
 - D) general transcription factors
 - E) ribosomal RNA
- 30) Regarding meiosis:**
- A) the first meiotic division is a reduction type
 - B) in prophase II crossing-over occurs
 - C) the first meiotic division is of additional type
 - D) it can never cause aneuploidy
 - E) occurs in cells of somatic and sexual lineage
- 31) What types of fermentation occur in bacterial metabolism?**
- A) Acetic
 - B) Lactic
 - C) Alcoholic
 - D) A+B+C
 - E) B+C
- 32) Which among the following statements regarding Krebs cycle is false:**
- A) occurs in the mitochondrial matrix
 - B) main reactions require the reduction of intermediate compounds
 - C) has a yield of 12 ATP/cycle
 - D) occurs only in aerobiotic conditions
 - E) Acetyl-CoA is necessary for its occurrence
- 33) Mendel and his friend Monk Charles A. Q. studied a rare form of genetic malnutrition called "Yuri-Cali-Giuri", which leads to mental illness.**

The two monks suspected that the cause could be a mutation in a mitochondrial gene; in that case, what would happen if an unhealthy male married a healthy woman:

- A) the whole progeny would be ill
- B) the whole progeny would be healthy
- C) sons would be ill
- D) daughters would be ill
- E) 50% of the progeny will be ill

34) Janitor John Verjel is affected by G6PD deficiency, a recessive condition associated with red blood cells alterations; in this disease, caused by an abnormality in a gene located in Xq28 locus, the levels of an important antioxidant are diminished and the cell is more susceptible to metabolic oxidative products such as those coming from fava beans. The consequence is an abnormal oxidation of Hemoglobin chains, which precipitate bound to the membrane forming the so called "Heinz bodies". Which is going to be the most probable genotype of Verjel's parents?

- A) aa and aa
- B) XX and X[']Y
- C) Aa and aa
- D) X[']X and X[']Y
- E) X[']X and XY

35) Which of the following is not a disease with autosomal recessive inheritance?

- A) Phenylketonuria
- B) Klinefelter Syndrome
- C) Albinism
- D) Thalassemia
- E) Sickle cell anemia

36) A man who has never received a blood transfusion is blood type AB. Which of the following statements describes this individual correctly?

1. He has Anti-A and Anti-B antibodies
2. He has a phenotype indicating codominance
3. He has some red blood cells with only the A antigen and some with only the B antigen

- A) Only 2
- B) Only 1 and 2
- C) Only 1
- D) Only 2 and 3
- E) 1, 2 and 3

37) Which of the following receptors is not a sensory receptor of the nervous system?

- A) Cones
- B) Nociceptors
- C) Pacinian corpuscles
- D) Renshaw receptors
- E) Ruffini corpuscle

38) In humans, the saphenous vein collects venous blood coming from:

- A) Brain
- B) Abdomen
- C) Upper limbs
- D) Lower limbs
- E) Orofacial zone

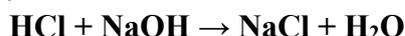
39) Cortisol

- A) Peaks at night
- B) Is released as a response to hypoglycemia
- C) Is regulated by the hypothalamic-pituitary-adrenal axis of the adrenal gland
- D) Exerts a pro-inflammatory effect
- E) Is deficient in Cushing's disease

40) Which of the following is not a renal function?

- A) Blood pressure regulation
- B) Immune response regulation
- C) Regulation of body fluids and electrolytes
- D) Production of erythropoietin
- E) Urine production

41) Marta's mother, a science teacher, enjoys performing chemical reactions. She decides that she won't use water and salt to cook her pasta, but instead Hydrochloric Acid (HCl) and Caustic Soda (NaOH). Being a very qualified expert, she knows that these two substances react to give her water and salt, according to the reaction:



She is well aware of the fact that, if she made the slightest mistake in calculating the doses of reagents to be used, and one of them was in excess, her delicious dish would become highly toxic.

She has 432g of HCl and an abundance of NaOH. How many grams of NaOH will she need to use? How many grams of water and how many NaCl will be produced?

(Ar Cl = 35, Ar Na = 23)

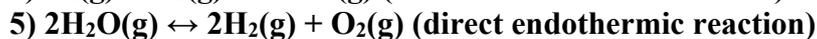
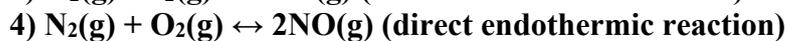
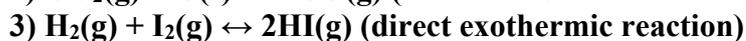
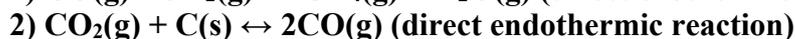
- A) 480g of NaOH; 216g of H₂O; 348g of NaCl
- B) 3.2g of NaOH; 1.44g of H₂O; 25.8g of NaCl
- C) 480g of NaOH; 216g of H₂O; 696g of NaCl
- D) 500g of NaOH; 225g of H₂O; 725g of NaCl
- E) In any case, she will not get enough water to cook the pasta.

42) What are the values to be attributed to a, b, c, and d to balance the following decomposition reaction?



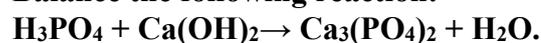
- A) a=4, b=1, c=2, d=2
- B) a=2, b=2, c=4, d=1
- C) a=2, b=2, c=3, d=2
- D) a=8, b=2, c=4, d=4
- E) a=2, b=1, c=1, d=1

43) Consider the reactions shown below. In which cases does a temperature increase favor product formation?



- A) 2, 4 and 5
- B) 1 and 4
- C) 1, 3 and 5
- D) 2 and 3
- E) 1, 2 and 4

44) Balance the following reaction:



- A) 4, 6, 12, 2
- B) 1, 3, 1, 2
- C) 4, 6, 2, 12
- D) 2, 3, 6, 1
- E) 2, 3, 1, 6

45) The reaction: $2\text{NO(g)} + \text{O}_2\text{(g)} \leftrightarrow 2\text{NO}_2\text{(g)}$ is exothermic, so its K_{eq} varies if you:

- A) Increase the pressure at constant temperature
- B) Increase concentration of reagents at constant temperature
- C) Add a constant temperature catalyst
- D) Increase the temperature allowing the pressure to vary
- E) Increase the $p(\text{O}_2)$ at constant temperature

46) The following elements are in the fourth group of the periodic table: C, Li, N, O, B.

What is the descending order of atomic radius size?

- A) N, C, Li, O, B
- B) O, N, C, B, Li
- C) B, O, Li, C, N
- D) Li, C, N, O, B
- E) Li, B, C, N, O

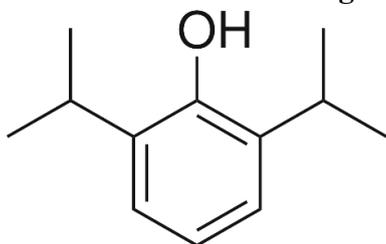
47) Which of the following statements about an atom with $Z=20$ is correct?

- A) It belongs to the second period
- B) Its external electronic configuration is $3s^2$
- C) It is a semimetal
- D) It has a higher ionization energy than Sulfur
- E) It is an alkaline earth metal

- 48) The table shows the ionization energies of a Y element of the third period. Identify the Y element.

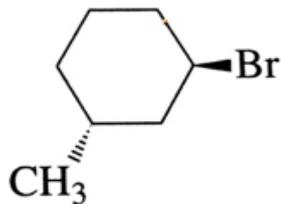
Ionization Number	1	2	3	4	5	6	7	8
Energy of ionization	1000	2260	3390	4540	6990	8490	27100	31700

- A) Al
 B) Si
 C) S
 D) Cl
 E) P
- 49) Calculate the pH of the solution you get by mixing 0.04 mol of propionic acid (K_a 1.34×10^{-5}) with 0.03 moles of sodium propionate and adding water to obtain 1L of solution.
- A) 4
 B) 7
 C) 2
 D) 12
 E) 10
- 50) Order the following solutions from the most acidic to the most basic: NaOH 0,00000015M, HClO₄ 0,0000003 M, H₂SO₄ 0,010M, KOH 0,5M, HCl 0,010M.
- A) HCl, H₂SO₄, HClO₄, NaOH, KOH
 B) H₂SO₄, HCl, HClO₄, NaOH, KOH
 C) HCl, H₂SO₄, NaOH, HClO₄, KOH
 D) H₂SO₄, HCl, NaOH, HClO₄, KOH
 E) KOH, HCl, H₂SO₄, NaOH, HClO₄
- 51) The following image shows the structure of propofol, a traditional name for a drug used for the induction of general anesthesia. What is its IUPAC name?



- A) 2,6-dimethylphenol
 B) 1,3-diisopropyl-2-hydroxybenzene
 C) 1,3-dimethylphenol
 D) 2,6-diisopropylphenol
 E) 2,6-dimethyl-1-hydroxyphenol

52) How many stereoisomers does the following compound have?



- A) None
 B) 1
 C) 2
 D) 4
 E) 5

53) Find the values for which the following system is verified $\begin{cases} x - 2\sqrt{2}y = \sqrt{2} \\ 2x - 2\sqrt{2}y = 8\sqrt{2} \end{cases}$?

- A) $x = 4\sqrt{2}$; $y = 2$
 B) $x = 7\sqrt{2}$; $y = 3$
 C) $x = 0$; $y = -\frac{1}{2}$
 D) $x = 0$; $y = -4$
 E) There are no solutions

54) Find $n \in \mathbb{Z}$ value so that the following equation is verified $n^3 \cdot n^4 - n = 0$.

- A) $n = 0 \vee n = \pm 1$
 B) $n = 0$
 C) $n = 1$
 D) $n = -1$
 E) $n = \pm 1$

55) Ste is a poker enthusiast and decides to organize a game with two friends Capo and Nico. In the first round, Capo and Nico received 2 cards drawn from a deck of 54 cards:

- Capo has a Jack and a Three

- Nico has a Queen and an Ace

Ste still has to receive his cards. What is the probability that he is given 2 Aces?

- A) $6/50^2$
 B) $3/50 + 2/49$
 C) $1/(50 \cdot 49)$
 D) $2/50$
 E) $6/(50 \cdot 49)$

56) A triangle ABC is given; the line r parallel to AB intersects CA and CB respectively in D and E. Which of the following statements is true?

1) $AB:DE=DC:AC$

2) $\widehat{DEC} = \widehat{ABC}$

3) The triangles ABC and CED are congruent

- A) Only 1
 B) Only 2
 C) Only 3
 D) None of the above

E) 1 and 2

57) Three electrolytic capacitors connected in series have the following capacities: 3F, 4F, 12F. The system equivalent capacitor is connected in parallel with another capacitor of 1/2F of capacity. What is the equivalent capacity of the final system?

- A) 19 F
- B) $\frac{1}{2}$ F
- C) 2 F
- D) $\frac{5}{3}$ F
- E) $\frac{39}{19}$ F

58) Teone is the gas wizard. One day, he was so inspired that he decided to make a gas undergo an isocor transformation from state S_A ($P_A = 1$ atm; $T_A = 200$ K) to state S_B ($V_B = 5$ L; $T_B = 127^\circ\text{C}$), and then an isothermal transformation that brings it to state S_C ($V_C = 8$ L). Which value would Teone find if he measures the value of P_C ?

- A) 2 atm
- B) 1.25 atm
- C) 0.4 atm
- D) 1.1 atm
- E) 0.6 atm

59) James, after having stolen a sandwich from Teone, runs away with a yellow submarine in Lambro, but he doesn't take into account the pressure exerted on the bottom of the river. Considering that his submarine can withstand a total pressure of 2atm, after reaching a depth of 12 m, what will happen?

- A) The submarine won't be affected due to Archimede law.
- B) It will explode due to the elevated pressure ($2,2 \cdot 10^5$ Pa)
- C) He will escape from Teone because $P = 1.2$ atm won't be sufficient to destroy the submarine.
- D) It will depend on the submarine diameter
- E) He will escape from Teone because $P = 1,2 \cdot 10^4$ Pa won't be sufficient to destroy the submarine.

60) Chicco, a daredevil, weighs 75 kg and dives from an 18 meter trampoline. How fast will he enter the water? (Consider that $g = 10$ m / s²)

- A) 15 m/s
- B) 19 m/s
- C) 23 m/s
- D) 32 m/s
- E) 60 m/s