1) **Fill in the gaps with the correct sequence of words.**
There is something inexpressibly touching in nature round Petersburg, when at the approach of spring she puts forth all her might, all the powers bestowed on her by Heaven, when she breaks into _____, decks herself out and spangles herself with flowers... Somehow, I cannot help being reminded of a frail, consumptive _____, at whom one sometimes looks with compassion, sometimes with _____ love, whom sometimes one simply does not notice; though suddenly in one instant she becomes, as though by chance, _____lovely and exquisite, and, impressed and intoxicated, one cannot help asking oneself what _____made those sad, pensive eyes flash with such fire? What summoned the blood to those pale, wan cheeks? What bathed with passion those soft features?

A)   life - baby - strong - surely - nature
B)   fire - flower – passionate - beautifully - wizard
C)   earth - man - brotherly - poorly - goddess
D)   tears - bride - enthusiastic - very - frustration
E)   leaf - girl - sympathetic - inexplicably - power

2) **Which of the following terms can correctly complete the verbal proportion?**
HARAKIRI : GBQBJJQJ = X : Y

A)   X: UMINEKO ; Y: TNHODLN
B)   X: UMINEOK ; Y: THNODLN
C)   X: UMINEOK ; Y: TNHDOLN
D)   X: UIMNEKO ; Y: TNHODLN
E)   X: UMINEKO ; Y: THNODLN

3) **Which, among the following couples of terms, can logically complete the verbal proportion?**
Evanescent: X = Y: Foolish

A)   X = Imperishable; Y = Dumb
B)   X = Ephemeral; Y = Cultured
C)   X = Fleeting; Y = Dump
D)   X = Perennial; Y = Sage
E)   X = Talkative; Y = Obtuse

4) **People going to the gym have big biceps. All med students have big biceps. Pitti and Bombo go to the gym.**
If the stated conditions are true, which of the following is necessarily true?

A)   Pitti and Bombo have big biceps.
B)   Pitti and Bombo study medicine.
C)   Whoever has big biceps goes to the gym.
D)   Whoever goes to the gym studies medicine.
E)   All med students go to the gym.

5) **Guys from Monza have several passions. Some of those that like eating, love singing. Some of those that love going on a trip, like singing.**
If all the previous statements are true, for which of these deductions we cannot say it is not true?

A)   If Giorgi likes eating, he necessarily loves going on a trip
B)   If Giordi likes eating, he does not love going on a trip
C)   If Simo Sozzi is not a singer, he won't love going on a trip

D)   If Franci Paoli likes eating, it is possible that she likes going on a trip
E)   If MeriJ does not like eating, it is not possible that she likes going on a trip

6)   Complete the following proportion:
        William Turner: x = y : Cubism
A)   x = Impressionism, y = Georges Braque
B)   x = Romanticism, y = Egon Schiele
C)   x = Divisionism, y = Pablo Picasso
D)   x = Enlightment, y = Salvator Dalì
E)   x = Neoclassicism, y = Georges Braque

7)   All physiotherapy students like playing volleyball. Some people that do sports are also physiotherapy students. Chiara, Mati and Marta are 3 physiotherapy students. Let's suppose that the previous statements are true, which one among these deductions is surely true?
A)   Surely Mati does sport
B)   Chiara does sport, but she does not like playing volleyball
C)   There is at least a student of physiotherapy that does not like playing volleyball
D)   It might be that Marta does sport
E)   None of these answers is correct

8)   Complete the following numerical sequence: 1; 12; 35; ?; 110
A)   89
B)   38
C)   49
D)   12
E)   29

9)   If:
        Si + K2 + Cg = Fr + Il
        Si = K2 + 2
        Il = Si − Fr
        Then Cg equals:

A)   2Fr
B)   - K2
C)   K2 + 2
D)   0
E)   Il − 1

10)   Complete the following alphanumerical sequence: 4, 7, 21, 24, ...
A)   72
B)   28
C)   31
D)   34
E)   37

11)   Messi and Ronaldo are 2 painters: Messi has just started his career as a painter and in the same time in which Ronaldo paint 50m^2, he paints 30m^2. If they worked together to finish painting a whole 80m^2 room, how much space would Messi paint and how much Ronaldo, in percentage?

A) M: 37% and R: 63%
B) R: 37,5% and M: 62,5%
C) M: 38% and R: 63%
D) R: 37,5% and M: 62,5%
E) R: 25% and M: 75%

12) Sole has 10/13 of the age of her sister Luna; 24 years ago Luna had 7/4 of the age of Sole. How old is Sole now?
A) 52
B) 36
C) 50
D) 40
E) 42

13) In a hot summer day, Richi decides to go on a trip to the seaside with Paolino. As soon as he gets on the car, Paolino switches on the navigator. Since Paolino is afraid of cars, Richi drives at an average velocity of 50 km/h. After leaving home, they drive for 3 hours towards East, then they turn right. After 1,5 hours, at the roundabout, they take the exit at the left of the cars that are traveling in the opposite direction with respect to them. After 2 more hours of traveling, they turn left. After 4,5 more hours of traveling, Paolino becomes pale and says, with trembling voice, that they are traveling in the wrong direction. Richi gets angry, he makes a U turn and he starts proceeding at an average velocity of 75 km/h. After 2 hours he turns, and travels East for 3 hours and then North for 2 hours. At which distance are Richi and Paolino from the starting point?
A) 275 Km
B) 350 Km
C) 170,5 Km
D) 1250 Km
E) Paolino tells Richi that they are at the starting point. From that day on, no one ever heard again about Paolino

14) Frodo, Sam, Pipino and Merry start a journey towards Mordor. Frodo, who has to carry the ring, cannot carry the backpack with food provision and erba pipa, and subdivides the provisions in the backpacks of his 3 journey mates; the bundle has an overall weight of 182 pounds. The fearless Sam offers to carry himself the quintuple of the provisions carried by the lazy Pipino. Merry, instead, carries twice the provisions carried by Sam minus the triple of the provisions carried by Pipino.
Which is the weight of the backpack carried by Merry?
A) 15 pounds
B) 98 pounds
C) 78 pounds
D) 30 pounds
E) Sam, fearless but greedy, had breakfast before leaving, so the backpack of Merry is empty

15) Marta, Tecla, Margherita and Emma love going to the sushi restaurant; every time they go there, they order a boat of Nighiri and they eat it in 25 minutes. However, today they invited also Paolo and Riccardo. How long will it take for them to eat the same boat of Nighiri?
A) 10 minutes
B) 12,5 minutes

C)   17,5 minutes
D)   15 minutes
E)   None of the above

16) **Lucone is able to eat 4 chocolate cakes and 2 cakes with fruits in 1 hour. Chiara, instead, is able to eat 15 carrot cakes in 45 minutes. Chiara and Lucone decide to make a competition of resistance consisting in gorging themselves on their favorite cakes: at the end of the competition Chiara has eaten 20 carrots cakes, whereas Lucone was able to eat 10 chocolate cakes and 8 cakes with fruits. Knowing that Lucone took 10 minutes to eat a cake with fruits and that the competition established that the two competitors alternated themselves in eating their cake without making breaks between one competitor and the other, how long was the competition?**
A)   1 hour
B)   2 hour
C)   3 hour
D)   4 hour
E)   4 hour and 40 minutes

17) **A speeding ticket was delivered at Bianchi's house and the responsible car was the one driven by the 4 sons. The father doesn't know who was driving the car that day and so he starts asking questions to his sons:**
Marco "It wasn't me for sure, I always pay attention to the speed limits"
Riccardo "Considering the fearless driving of Dario, I'm sure that it was him"
Dario "I don't like being a spy, I have to blame Alessandro: it was him"
Alessandro "Dario is a liar, it was his fault"
Knowing that a son is lying while the others are telling the truth, who got the ticket?
A)   Marco
B)   Dario
C)   Alessandro
D)   Riccardo
E)   It is not possible to identify the culprit

18) **I want to thank you for the great confidence you have placed in me, but I cannot discuss your verses; for any attempt at criticism would be foreign to me. Nothing touches a work of art so little as words of criticism: they always result in more or less fortunate misunderstandings. Things aren't all so tangible and sayable; most experiences are unsayable, and more unsayable than all other things are works of art.** *[Adapted from "Letters to a young poet", Rilke]*
Which of the following statements is completely supported by the text?
A)   It is not possible to critique works of art because this could hurt someone's feelings
B)   Works of art are the most valuable things on Earth
C)   Words are not able to capture the totality of a work of art
D)   Works of art elevate the human soul
E)   The author is a literary critic

19) **The "Ragù alla Bolognese" recipe is known worldwide, but is also one of the most "maltreated" recipes. For this reason, and in order to protect and perpetuate the "sacred dressing", in 1982 the recipe was codified and deposited at the Chamber of Commerce in Bologna. Every family within the years has modified by little the original recipe. What is unknown to most is that Bolognese granmothers use a secret ingredient in order to**

make it unique: love. A recent research has demonstrated that love indeed is the distinctive factor of a good Ragù.

Which of the following statements is completely supported by the text?
A) "Ragù alla Bolognese" is the best dish of the Italian tradition
B) "Ragù alla Bolognese" is a "maltreated" recipe
C) All the Italian mothers should make Ragù to their children
D) It is impossible to cook Ragù alla Bolognese without love
E) Ragù made with love is better than the one made without love

20) **The ogres obey to Sauron and Saruman. Less than half of the ogres are Urukai. The majority of Urukai obey to Saruman. Thus, there must be some Urukai who have obey to Sauron.**
Which of the following sentences reproduces the logic structure of the above reasoning?
A) Bobo Vieri eats cookies or brioche for breakfast; therefore, if he had breakfast today, he couldn't have eaten a slice of cake.
B) The future freshmen of Medicine are divided in two categories: those super excited about the test and those super anxious. The majority of the anxious ones are women. Thus, men are not anxious for the test.
C) More than half of Luigi's friends are studying for the Histology exam and the majority are studying for the Biology exam. Thus, there must be some of Luigi's friends who are studying for Biology and Chemistry exams at the same time.
D) Many doctors work at Sacco hospital. Their chiefs are doctor Mariani and doctor Ainio. Slightly less than half of doctors are infectious disease specialists, and the majority of them obey to doctor Ainio. Thus, few infectious disease specialists listen to doctor Mariani.
E) About half of smokers are men. Since a consistent proportion of smokers has started using the electronic cigarette, some men probably smoke both normal and electronic cigarettes.

21) **Where and when was the first Oscar Academy Awards ceremony held?**
A) Los Angeles, 1929
B) New York, 1935
C) Los Angeles, 1923
D) New York, 1964
E) Las Vegas, 1932

22) **Which of the following nations is not currently part of the EU?**
A) Romania
B) Montenegro
C) Cyprus
D) Estonia
E) Bulgaria

23) **A single-filament DNA chain has a 27% thymine composition, what will the cytosine percentage be?**
A) 23%
B) 46%
C) 54%
D) We cannot calculate it
E) 73%

24) **Which of the following sentences on meiosis are incorrect?**
I. Meiosis is a process of cell division, through which a diploid eukaryotic cell gives rise to two haploid cells
II. Prophase II is divided in 5 sub-phases: leptotene, zygotene, pachytene, diplotene, diakinesis
III. It is made of an equational phase followed by a reduction phase
A)   I
B)   II, III
C)   I, II
D)   I, II, III
E)   None of the above

25) **In which of these phases of the cell cycle does the cell contain 46 chromatids?**
I. Telophase of mitosis
II. Telophase of meiosis I
III. Telophase of meiosis II
IV. Prophase of meiosis II
V. Prophase of mitosis
A)   Only I and IV
B)   Only III
C)   Only III and IV
D)   Only I, II and IV
E)   Only II, IV and V

26) **The cell membrane allows**
A)   separation of charges with the formation of a membrane potential
B)   the exit of the nucleus during meiosis through membrane pores
C)   formation of pseudopods made of aggregates of lysosomes for the process of diapedesis
D)   the exchange of organic and high molecular weight molecules through free passage across the lipid bilayer
E)   the passage of water only across specific channels called aquaporins

27) **Select the wrong answer regarding enzymes:**
1. **They are organic catalysts made of proteins or RNA**
2. **Enzymes with higher substrate affinity saturate slower than the ones with low affinity**
3. **They act lowering the activation energy for the reaction for which they are specific**
4. **Their action is independent from the pH of the environment in which they act**
5. **The interaction with the substrate occurs through weak bonds such as Van der Waals forces**
A)   1+2
B)   1+4
C)   2 + 4
D)   3+5
E)   3+4

28) **Which of the following is not a characteristic of the internal membrane of mitochondria?**
A)   the presence of crests with alignment perpendicular to the long axis of the organelle
B)   it allows transport of electrons
C)   it presents a transmembrane protein called ATP synthase

D)   It's not semi-permeable
E)   It delimits the matrix

29)   Regarding the rough endoplasmic reticulum, it is true that:
A)   it is made of multiple separated cisterns
B)   it does not have ribosomes bound to the membrane
C)   it works in re-elaborating polypeptides
D)   it is almost never communicating with the nucleus
E)   it is present only in glandular cells

30)   ATP is a highly energetic molecule that has:
A)   3 anhydrade bonds
B)   3 ester bonds
C)   2 anhydrade bonds and an ester bond
D)   2 ester bonds and an anhydride bond
E)   none of the above

31)   Lysozymes
A)   digest carbohydrates
B)   digest proteins in the mouth
C)   hydrolyse peptidoglycans in the bacterial cell wall
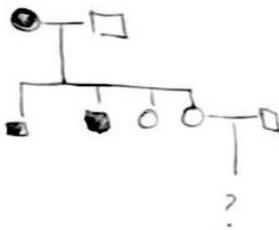D)   digest proteins in the stomach
E)   digest lipids

32)   In anaerobic metabolism, the net yield of complete oxidation of glucose is:
A)   36 ATP
B)   34 ATP
C)   38 ATP
D)   2 ATP
E)   none of the previous

33)   Color blindness is a sex-linked disease. Indicate the correct sentence:
A)   not all males who have the allele for color blindness are affected
B)   it is a sexually transmitted disease
C)   only females can be healthy carriers
D)   it can manifest in a heterozygous individual
E)   it is Y-linked

34)   A family has familiarity for cystic fibrosis, as the family tree shows; what is the probability that the individual in the second generation is a carrier?

A)   0%
B)   25%
C)   50%

D) ¼
E) 75%

35) **What is the probability of Silviuti to have genotype AaBBCCDd, if he is born from parents AABBCCdd and AaBbCcDD?**
A) 1/2
B) 5/2
C) 1/8
D) It is impossible to know with certainty
E) 1

36) **During muscle contraction:**
A) the filaments of contractile proteins shorten
B) actin filaments slide over titin filaments
C) the sarcomere does not shorten
D) the distance between two Z lines shortens
E) none of the previous

37) **In the first day of the ovarian cycle there is:**
A) LH surge
B) FSH surge
C) proliferative phase
D) estrogen peak
E) none of the previous

38) **Restriction enzymes:**
A) recognize specific sequences of nitrogen bases along the DNA filament and they cut it at those locations
B) cut DNA in fragments of 3 nucleotides
C) copy a small portion of DNA
D) participate in the process of cell replication
E) join two complementary fragments of DNA

39) **Which of the following vascular structures transport non-oxygenated blood?**
A) Vena cava and aorta
B) Portal vein and pulmonary veins
C) pulmonary arteries and aorta
D) splenic vein and pulmonary arteries
E) pulmonary veins and vena cava

40) **During the process of PCR, which of these sequences is the correct one?**
A) annealing 94°C, denaturation 72°C, extension 64°C
B) extension 72°C, annealing 94°C, denaturation 64°C
C) denaturation 94°C, extension 64°C, annealing 72°C
D) denaturation 72°C, extension 64°C, annealing 94°C
E) denaturation 94°C, annealing 64°C, extension 72°C

41) **The third period of the periodic table is made of the following elements: Na, Mg, Al, Si, P, S, Cl, Ar. Indicate the sequence in which the elements are placed correctly according to increasing ionization energy.**
A) Na, Mg, Al, Si, P, Cl, Ar

B)   Ar, Cl, S, P, Si, Al, Mg, Na
C)   Na, Al, Mg, Si, S, P, Cl, Ar
D)   Na, Mg, Al, P, Si, Cl, Ar
E)   Ar, Cl, S, P, Si, Mg, Al, Na

42)   Which of the following regarding chlorine is correct?
A)   it has greater electronegative value than oxygen
B)   its external configuration is $[Ne]3s^2 3p^5$
C)   it has an atomic radius greater than magnesium
D)   it has electron affinity greater than sulphur
E)   it is lacking two electrons to complete its outer ring
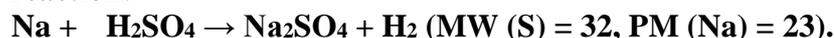
43)   Sodium has an atomic radius greater than lithium because it has:
A)   greater energy of first ionization
B)   larger mass number
C)   fuller electron energy levels
D)   larger nuclear charge
E)   superior electron affinity

44)   Which of the following sentences is false?
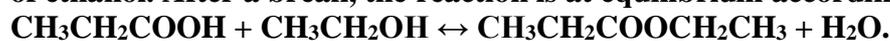A)   the lesser the affinity for electrons of an element, the greater its tendency of forming anions
B)   the greater the first ionization energy of an element, the lesser the tendency of an atom to become a cation
C)   electronic affinity is a periodic property
D)   sodium is present in nature as an element, as it is poorly reactive
E)   elements in group VII form various ionic compounds with elements in group I

45)   Calculate how many grams of sodium react with 49g of H_2SO_4 according to the reaction:
Na + $H_2SO_4 \rightarrow Na_2SO_4 + H_2$ (MW (S) = 32, PM (Na) = 23).
A)   23 g
B)   49 g
C)   52,5 g
D)   11,5 g
E)   24,5g

46)   Professor Jordi Alba prepared a mixture using one mole of propanoic acid and 2 moles of ethanol. After a break, the reaction is at equilibrium according to the reaction:
$CH_3CH_2COOH + CH_3CH_2OH \leftrightarrow CH_3CH_2COOCH_2CH_3 + H_2O$.
At equilibrium the solution contains 0,5M of di-ester-ethyl-propanoate. Find the moles of the other molecules at equilibrium.
A)   0,5; 1,5; 0,5; 0,5
B)   1,5; 2,5; 0,5; 0,5
C)   1, 2, 0,5; 0,5
D)   1,5; 2; 1; 0,5
E)   2,25; 3,25; 0,5; 0,5

47)   Teone is trying to cook pasta with 40 cm^3 of H_2O and adding a handful of salt (MW NaCl = 58) it reaches 4.5M molarity. Doctor Ghidini, worried about his hypertension, told Teone to cook his pasta in a 0,25M solution. What is the volume of solution in which the pasta needs to be cooked to meet the doctor's indication?

A) 280 ml
B) 12.4 g/ml
C) 36 dm^3
D) 720 ml
E) 7.2 *10^{-5} cm^3

48) **Adding 18g of HCl and 22g of NaOH to a litre of water (MW Cl= 35 e MW Na= 23), the resulting pH will be:**
A) 5
B) alkaline
C) between 2 and 5
D) acid
E) neutral

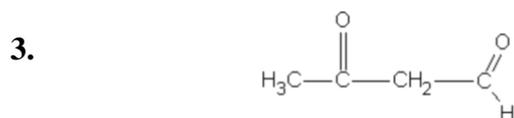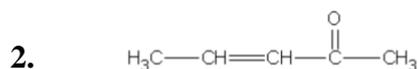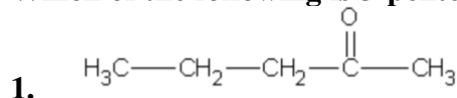**49)** **Find the correct sequence, in order of increasing pH, the following solutions:**
   a) NH$_3$ 0,1 M
   b) HNO$_3$ 0,1 M
   c) KOH 0,1 M
   d) HNO$_3$ 0,001 M
   e) HCl 1 M
A) e, b, d, c, a
B) e, b, a, c, d
C) e, b, d, a, c
D) c, a, b, d, e
E) c, a, d, b, e

50) **Nitric acid is a strong acid; nitrous acid is a weak acid; the pH of a solution of nitrous acid will surely be greater than the one of a solution of nitric acid if:**
A) the two solutions have the same concentration
B) always
C) the solution of nitrous acid is more concentrated than the one of nitric acid
D) never
E) only if the two solutions are at the same temperature

51) **Which of the following is 3-penten-2-one:**

1. $H_3C\text{---}CH_2\text{---}CH_2\text{---}C(=O)\text{---}CH_3$

2. $H_3C\text{---}CH=CH\text{---}C(=O)\text{---}CH_3$

3. $H_3C\text{---}C(=O)\text{---}CH_2\text{---}C(=O)H$

A) Only 1
B) Only 2
C) Only 3
D) Both 1 and 2
E) none of the previous

52) **A carbon atom is defined as chiral:**
A) if it binds to 4 different substituents

B)   if it binds to 4 equal substituents
C)   if it binds only with one carbon
D)   if it binds only with hydrogen ions
E)   none of the previous

53)   **Teo and Ale have a clinical oncology exam, they haven't been studying very hard so they need to copy from Giulio's paper. Since only few students are enrolled in the exam, the professor makes them seat around a rectangular table with 10 seats. In how many different combinations can the 3 friends seat, in order to let both Teo and Ale copy from Giulio? (Giulio needs to stay in the middle).**

A)   5
B)   10
C)   15
D)   20
E)   40

54)   **In a right triangle, the hypotenuse is 9 and the projection of one of the two legs (catheti) on the hypotenuse is long 4. What's the perimeter of the triangle?**

A) $3 + \sqrt{5}$
B)   15
C)   18
D) $15 + \sqrt{5}$
E) $3(5 + \sqrt{5})$

55)   **Given a family of straight lines of equation $(k + 1)x + (2 - 3k)y - 7 + 3k = 0$, find the k corresponding to the straight line of the family which is parallel to *r: y = x - 3*.**

A) $k = \frac{2}{3}$
B) $k = \frac{1}{4}$
C) $k = \frac{3}{2}$
D)   None of the straight lines of the family is parallel to r.
E) $k = -\frac{3}{2}$

56)   **Given the function $\sqrt{\frac{1-x}{2x-1}}$ calculate the domain of the function.**

A) $x < 1$
B) $\frac{1}{2} < x \leq 1$
C) $x \geq \frac{1}{2}$
D) $R - \left\{\frac{1}{2}\right\}$
E) $x \neq 0, x \neq 1$

57)   **Heat can be transferred from through the mechanism of:**
        1) Conduction
        2) Diffusion
        3) Irradiation
        4) Convection

5) Phlogosis

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

58) **An aortic valve stenosis reduces the valvular section to 1 cm². If the normal section is 4 cm², with a blood speed of 50 cm/s, what is going to be the speed of blood passing through the diseased valve?**

A) 2 m/s^2
B) 100 cm/s
C) 4 m/s
D) 2 m/s
E) Speed remains constant

59) **Two points, A and B, of a DVD turning around its central axis with a constant angular velocity, are respectively located at a 4R and R distance from the center. What's the ratio between the two frequencies F_A and F_B?**

A) 1
B) 0.5
C) 2
D) 4
E) None of the above

60) **Marco is playing basketball during one of a thousand breaks from studying. He hits the ball sending it vertically up in the air with a speed of 7.2 km/h.**
How long after would the ball return to Marco's hand?

A) 0.4 s
B) 0.2 s
C) 0.8 s
D) 0,75 s
E) 0,25 s