Ministero dell'Università e della Ricerca

CALL FOR APPLICATIONS FOR ADMISSION TO THE NATIONAL RESTRICTED ACCESS SINGLE-CYCLE DEGREE PROGRAMMES IN MEDICINE AND SURGERY AND IN DENTISTRY AND DENTAL PROSTHODONTICS REFORMATTED BY ACADIMAT

Academic Year 2024/2025

Reading skills and knowledge acquired during studies

1. **Who is the author of the famous novel *To the Lighthouse*?**

A) Emily Dickinson
B) Virginia Woolf
C) Jane Austen
D) Agatha Christie
E) Mary Shelley

2. ***Based on historical records, we can say that many ancient societies devised symbols to represent numbers and solutions to mathematical problems. Although thinkers began to take the first steps towards mathematics early on, it can be asserted that only with Greek civilisation did this discipline acquire the abstract and general characteristics that render it distinct and render it a unique science. It is noteworthy that mathematics evolved into an abstract and general science at a deliberate pace. Documents from pre-Greek civilisations indicate that solutions to mathematical problems were confined to specific, tangible cases. These documents convey the impression that mathematical concepts were communicated sporadically and non-methodically (occasionally even fortuitously), and were treated as useful information geared towards practical outcomes.***

MANARA, LUCCHINI *Momenti del pensiero matematico* - Mursia

Which of the following CANNOT be inferred from the text?

A) Symbols representing numbers had already been adopted in antiquity.
B) In antiquity, mathematical notions were not communicated in a methodical manner.
C) Since antiquity, mathematics has been characterized by abstractness and generality.
D) The evolution of mathematics has been an extremely slow process.
E) In antiquity, mathematical notions were geared towards practical outcomes.

3. **The Hundred Years' War was principally a conflict between which of the following kingdoms?**

A) The Kingdom of Aragon and the Kingdom of France
B) The Kingdom of France and the Kingdom of England
C) The Kingdom of England and The Kingdom of Portugal
D) The Kingdom of Castile and the Kingdom of Portugal
E) The Kingdom of Aragon and the Kingdom of Castile

4. **In which of the following is the verb passive?**

A) In one of his works, Plato associates solid forms to the four elements: octahedron to air, tetrahedron to fire, cube to earth, and icosahedron to water.
B) In the Gallic Wars, Julius Caesar described in detail his military campaign to conquer Gaul.
C) Many students read Greek tragedies in high school.
D) In the Iliad, Homer sings the deeds of the Pelide Achilles.
E) The deeds of Aeneas were sung by Virgil.

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5. The following table shows the results of a test:

mark	0	1	2	3	4	5	6	7	8	9	10
frequency	1	4	4	6	2	1	1	2	2	1	0

To pass the test, a mark of higher than 5 is needed. What percentage of the candidates passed the test?

A) 20%
B) 25%
C) 50%
D) 30%
E) 24%

6. Shelly is one of 1500 participants in a Latin contest. 12% of the participants will receive as a prize either a silver-plated or gold-plated pen. If the number of silver-plated pens is twice the number of gold-plated ones, what is the probability that Shelly will receive a gold-plated one?

A) 8 %
B) 6 %
C) 67 %
D) 33 %
E) 4 %

7. Two consecutive discounts of 10% and 20% are equal to a single discount of:

A) 28%
B) 18%
C) 25%
D) 30%
E) 15%

8. Stacie builds a cube using 343 blocks of wood. She decides to paint the cube green. How many of the wooden blocks will have at least one side painted green?

A) 105
B) 238
C) 218
D) 245
E) 125

9. "When he takes the train, Marco always arrives at work on time."
Which of the following statements can be deduced from the preceding proposition?

A) Marco took his car; therefore he arrived on time.
B) Marco arrived late; therefore he took the train.
C) Marco did not take the train; therefore he arrived late.
D) Marco arrived on time; therefore he missed the train.
E) Marco arrived late; therefore he did not take the train.

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Biology

10. Which process occurs within mitochondria?

A) Photosynthesis
B) The formation of microbodies
C) Cellular respiration
D) The methylation of sugars
E) Glycolysis

11. What is a hydrogen bond?

A) It is a bond between a hydrogen atom and another strongly electronegative atom (such as oxygen or nitrogen) which is present in another molecule.
B) It is the bond which occurs between hydrogen and oxygen within a water molecule.
C) It is a covalent bond between hydrogen and oxygen.
D) It is the bond between hydrogen and ionised atoms (such as phosphorus).
E) It is a strong bond which allows bonding between non-polar molecules.

12. In eukaryotic cells, Krebs cycle reactions occur:

A) Close to the plasma membrane
B) In the large ribosomal subunit
C) In the mitochondrial matrix
D) In the cytoplasm
E) On the internal membrane of the mitochondria

13. What kind of monosaccharide is glucose?

A) triose
B) tetrose
C) hexose
D) pentose
E) nonose

14. Which pentose sugar is present in RNA nucleotides?

A) Glycerol
B) Glucose
C) Fructose
D) Lactose
E) Ribose

15. What are carrier proteins?

A) They are the proteins that transfer molecules and ions across the plasma membrane
B) They are proteins that break down phospholipids in the plasma membrane.
C) They are proteins that phosphorylate enzymes in the plasma membrane.
D) They are proteins that transport mRNA in the nucleus.
E) They are proteins that transport tRNA in the nucleolus.

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16. What is the cell's energy currency?

A) NADPH
B) $FADH_2$
C) ATP
D) NADH
E) Creatine

17. Which kind of reaction is ATP hydrolysis?

A) exergonic
B) Oxidation-reduction
C) endergonic
D) Lipolysis
E) condensation

18. The presence of intracellular compartmentalisation is a characteristic of which organisms?

A) Only of algae
B) Of eukaryotes
C) Of viruses
D) Of bacteria
E) Of prokaryotes

*The original question 18 by MUR had a typo, using the word "intercellular."

19. Which intracellular structure is composed of microtubules?

A) The nucleolus
B) The Golgi apparatus
C) The centriole
D) The nucleus
E) The endoplasmic reticulum

20. Mitochondria have:

A) A very selective membrane in which no proteins are present
B) Only a very selective outer membrane
C) An outer membrane, an intermediate membrane, and a very selective inner membrane
D) An outer membrane consisting of a phospholipid monolayer
E) An outer membrane and a very selective inner membrane

21. What is an anticodon?

A) A sequence three nucleotides transcribed from the mRNA and translated by rRNA
B) The sequence of three nucleotides found on the tRNA corresponding to a codon on the mRNA
C) The sequence of three mRNA nucleotides corresponding to a DNA codon
D) A terminal triplet of rRNA that binds a specific amino acid
E) A part of the DNA that codes for a specific amino acid

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22. What are ribosomes made of?

A) DNA and lipids
B) RNA and DNA
C) RNA, DNA, and proteins
D) RNA and proteins
E) DNA and proteins

23. The cell membrane consists of:

A) A double layer of triglycerides and cholesterol
B) Cholesterol and phospholipid molecules enclosing a protein layer
C) A layer of fatty acids and globular proteins containing phospholipids and cholesterol
D) A glycoprotein layer containing phospholipids and cholesterol
E) A double phospholipid layer with hydrophobic tails facing inward and the presence of integral and peripheral proteins

24. In protein synthesis, what is translation?

A) It is the process in which DNA is read and the corresponding mRNA produced.
B) It is the process by which mRNA is read and converted into a specific sequence of amino acids.
C) It is the process of transcribing the mRNA sequence into a corresponding DNA molecule.
D) It is the process of pairing between DNA codons and tRNA anticodons.
E) It is the process of specific recognition of rRNA by amino acids.

25. What are the principal components of the cytoskeleton?

A) Microtubules, microfilaments, and intermediate filaments
B) Microtubules, myosin, and filamin
C) Collagen fibres and reticular fibres
D) Microtubules, dynein, and myosin
E) Actin, myosin and dynein

26. The term "allele" defines:

A) A set of coding DNA triplets for a specific amino acid
B) A hereditary trait only found in haploid cells
C) one of several alternative forms of a gene
D) A coding DNA base for a specific amino acid
E) The phenotypic manifestation of a given gene

27. In a heterozygous condition, an allele can certainly express itself when:

A) multiple
B) associated
C) recessive
D) mutated
E) dominant

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28. What are mutations?

A) Alterations in the genetic information of a cell
B) Alteration in the energy metabolism of a cell
C) Alterations in the mechanism of cell division.
D) Alterations in enzyme functionality during zygote formation
E) Alterations in the active transport system of biological membranes

29. Translation is a process which:

A) Is exclusively eukaryotic
B) leads to the synthesis of polypeptide chains from mRNA
C) occurs in the nucleus of eukaryotic cells
D) is very similar to transcription
E) leads to the synthesis of RNA from DNA

30. If the sequence CCGTTATTGA is found on a strand of DNA helix, what sequence will be found on the complementary strand?

A) GGCAATTAAT
B) CGCACCTCCT
C) GGCAATAACT
D) AGTTATTGCC
E) GGACATCCCT

31. Replication is the process through which:

A) DNA is used as a template to synthesise new RNA molecules
B) RNA is used as a template to synthesise proteins
C) Daughter cells are formed from a mother cell
D) DNA is used as a template to synthesise new DNA molecules
E) RNA is used as a template to synthesise new RNA molecules

32. The prokaryotic operon is:

A) A functional unit composed of a group of adjacent genes, co-ordinately controlled, and of DNA sequences with regulatory functions.
B) An RNA complex that is involved in the replication of DNA
C) a protein complex that catalyses the process of protein synthesis
D) A DNA sequence element without any type of regulatory function
E) A group of adjacent genes independent from each other

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33. A mixture of 0.3 mol of N_2, 0.5 mol of CO, and 0.4 mol of O exerts a pressure of 2.4 atm 222 on the walls of the vessel that contains it. What is the pressure exerted by the nitrogen?

A) 0.3 atm
B) 0.5 atm
C) 0.75 atm
D) 0.6 atm
E) 0.8 atm

34. A gas, confined in a rigid cylinder and maintained at a temperature of −3 °C exerts a pressure of 9 atm. What pressure would the same gas exert if it were heated to 27 °C?

A) 8.1 atm
B) 10 atm
C) 9.6 atm
D) 12.5 atm
E) −81 atm

35. Which of the following compounds forms a hydroxide when reacting with water?

A) SiO_2
B) SO_3
C) BaO
D) Cl_2O
E) N_2O_3

36. Given the theoretical reaction yield of $4\ FeS_2 + 11\ O_2 \rightarrow 2\ Fe_2O_3 + 8\ SO_2$ which of the following statements is correct?

A) From 2 mol of FeS_2 and 11 mol of O_2, 1 mol of Fe_2O_3 can be obtained.
B) From 10 mol of O_2 and 1 mol of FeS_2, 3 mol of SO_2 can be obtained.
C) To obtain 1 mol of Fe_2O_3 and 6 mol of SO_2, 2 mol of FeS_2 and 9 mol of O_2 are necessary.
D) From 4 mol of O_2 and 11 mol of FeS_2, 8 mol of SO_2 can be obtained.
E) To obtain 1 mol of Fe_2O_3, 2 mol of FeS_2 and 5 mol of O_2 are necessary.

37. How many mL of water must be added to 15mL of a 0.25M solution of H_2SO_4 to obtain a 0.05 M solution?

A) 30 mL
B) 60 mL
C) 120 mL
D) 75 mL
E) 50 mL

38. How many Na^+ ion moles can be found in 250 mL of a 1.2 M solution of Na_2SO_4?

A) 0.4
B) 0.6
C) 0.3
D) 1.8
E) 1.2

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39. **In the reaction $NH_3 + BF_3 \rightleftarrows NH_3BF_3$ the ammonia behaves as a:**

A) Lewis acid
B) Arrhenius base
C) Lewis base
D) Brönsted base
E) Brönsted acid

40. **Zinc nitrate, nitrogen dioxide, and water are obtained from the reaction of metallic zinc and nitric acid in an aqueous solution. What is the reducing species?**

A) $Zn(NO_3)_2(aq)$
B) $Zn^{2+}(aq)$
C) $HNO_3(aq)$
D) $Zn(s)$
E) $H^+(aq)$

41. **Which of the following compounds contains the most hydrogen atoms?**

A) 2,3-Dimethylpentane
B) 1,2-Dimethylcyclobutane
C) 2-Hexanol
D) Cyclohexane
E) 2,3-Dimethyl-2-butene

42. **A carbon-oxygen double bond is NOT present in which of the following molecules?**

A) Acetic acid
B) Dimethyl ether
C) Acetaldehyde
D) Acetone
E) Methyl acetate

43. **Various units of measurement can be used to express the value of pressure. Which of the following values of pressure does NOT correspond to 1 atm?**

A) 1013.25 kPa
B) 760 torr
C) 1013 millibar
D) 101325 Pa
E) 760 mmHg

44. **Given that the relative atomic mass of nitrogen is 14 u, how many nitrogen atoms are present in 0.7 g of gaseous nitrogen?**

A) 6.02×10^{22}
B) 2.01×10^{-23}
C) 3.01×10^{22}
D) 1.51×10^{22}
E) 3.01×10^{23}

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45. **Carbon and oxygen can react at high temperatures to form CO_2. Assuming that the relative atomic mass of the carbon is 12 u, the relative atomic mass of the oxygen is 16 u and the yield of the reaction is 100%, what happens when 9 g of carbon reacts with 36 g of oxygen?**

A) 18 g of oxygen remain.
B) 45 g of CO_2 are produced.
C) 4 g of oxygen remain.
D) 9 g of oxygen remain.
E) 33 g of CO_2 are produced.

46. **How much water needs to be added to 1 mL of an HCl solution with a pH of 2 to obtain a solution with a pH of 4?**

A) 99 mL
B) 24 mL
C) 49 mL
D) 1 mL
E) 2 mL

47. **According to the Brønsted−Lowry theory:**

A) a base is a compound which can donate OH− ions
B) the conjugate base is formed by an acid that has acquired an OH− ion
C) the conjugate acid is the product of the bonding of the base with an OH− ion
D) a strong acid forms a conjugate with a weak base
E) an acid is a substance which can provide a pair of electrons

Physics and Mathematics

48. **The expression $(512^{1/3})^{1/2}$ is equivalent to:**

A) $\sqrt[6]{2}$
B) $\sqrt{2}$
C) $\sqrt[3]{4}$
D) $2\sqrt{2}$
E) $2\sqrt[6]{2}$

49. **If $f(x) = \log_2(x^2 + 12)$**
What is the reciprocal of $f(2)$?

A) 1/4
B) 2
C) 6
D) 1/2
E) 4

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50. **In a bag are 3 red balls and 7 green balls, indistinguishable by touch. Two extractions are made, with the first ball being returned to the bag before the second extraction. What is the probability of extracting 2 green balls?**

A) $\frac{49}{100}$

B) $\frac{7}{10}$

C) $\frac{9}{100}$

D) $\frac{51}{100}$

E) $\frac{42}{90}$

51. **Which of the following is the solution of the inequality** $\frac{x^2 + |4x + 3|}{4 - 3x} \geq 0$ **?**

A) each real *x* with $x < -\frac{3}{4} \wedge x \neq 0$

B) each real *x* with $x > \frac{4}{3}$

C) each real *x* with $x \geq \frac{4}{3}$

D) each real *x* with $x \leq \frac{4}{3}$

E) each real *x* with $x < \frac{4}{3}$

52. **Let θ be the acute angle formed between the tangent at point A to a circle and one of its chords, AB. Considering any point D on the larger of the arcs AB, denoted by φ as the angle ADB, what relationship exists between the angles φ and θ?**

A) They are complementary.
B) They are supplementary.
C) They are equal.
D) They are explementary.
E) There is no relationship between the two angles.

53. **Given a cylinder with a base radius of 5 cm and a height of 7 cm, what is its volume?**

A) This cannot be calculated with these data
B) 105π cm³
C) 70π cm³
D) 245π cm³
E) 175π cm³

54. **In a right triangle, let *a* and *b* represent the legs and *c* the hypotenuse. If α is the angle opposite *a*, which of the following relations is true?**

A) $c = a\cos(\alpha)$
B) $a = b\cos(\alpha)$
C) $c = a\sin(\alpha)$
D) $a = c\sin(\alpha)$
E) $a = c\cos(\alpha)$

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55. **A boat is moving in a uniform straight motion at a certain speed *v*. If a braking force of 210 *N* is applied for a distance of 5 *m*, how much power is developed by the braking force?**

A) 105*v W*
B) 210*v W*
C) 420*v W*
D) 8,4*v W*
E) 1050*v W*

**The original question 55 by MUR was unsolvable. AcadIMAT has corrected it for this paper.*

56. **An ideal gas is in a container placed on a thermostat at temperature *T* and occupies volume *V* at pressure *P*. If the volume occupied by the gas is tripled while keeping the temperature constant, its pressure ...**

A) becomes *P*/3
B) changes, depending on *T*
C) becomes 3*P*
D) becomes *P*/2
E) does not change

57. **In a conductor, when a current of 10A flows, 2922*W* are dissipated. What is the resistance value of the conductor?**

A) 292.2 Ω
B) 29220 Ω
C) 2922 Ω
D) 2.922 Ω
E) 29.22 Ω

58. **An electron in motion with a constant velocity $\vec{v}$, enters a uniform magnetic field B perpendicularly. Given that m_e , e, v represent the mass, charge, and magnitude of the electron's velocity respectively, which of the following statements is false?**

A) The motion of the electron is uniformly circular with a period of $\frac{2\pi m_e}{eB}$
B) The trajectory of the electron is a circle with a radius of $\frac{m_e v}{eB}$
C) The electron continues to move with a constant velocity $\vec{v}$
D) The motion of the electron is circular with constant angular velocity
E) The motion of the electron is uniformly circular with a frequency $\frac{eB}{2\pi m_e}$

59. **A point particle moves along a given x-axis with the law of motion x(t) = 4 cos(ωt) where x is in metres, t in seconds and ω = 2π rad/s. The velocity of the point particle at the instant t*=1/2s equals:**

A) approximately −4 m/s
B) approximately 4,2 m/s
C) approximately 8,5 m/s
D) approximately 25,1 m/s
E) 0 m/s

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60. A pendulum rod moves from the vertical position. Which of the following statements is false?

A) In the absence of friction, the pendulum tends to come to a stop after a certain time
B) The pendulum describes a circular arc during its motion.
C) In the presence of friction oscillatory motion is damped.
D) The pendulum stops after reaching a certain height and then swings back.
E) In the absence of friction, the motion is simple harmonic oscillation.

********** END OF QUESTIONS **********

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