IMAT Guide

IMAT 2024 Past Paper

Exam Structure

- Reading skills and knowledge acquired during studies - 4 questions
- Logical reasoning and problem-solving - 5 questions
- Biology - 23 questions
- Chemistry - 15 questions
- Physics and Mathematics - 13 questions

IMAT Scoring System

Correct answer	: +1.5 points
Wrong answer	: −0.4 points
No answer	: 0 points
Maximum score	: 90 points

Duration:
100 minutes

Questions:
60

Answer Key:
Provided after the exam questions

START TESTING
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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

Academic Year 2024/2025

Reading skills and knowledge acquired during studies

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

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

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

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

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

A) Many students read Greek tragedies in high school.
B) In *the Gallic Wars*, Julius Caesar described in detail his military campaign to conquer Gaul.
C) 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.
D) The deeds of Aeneas were sung by Virgil.
E) In *the Iliad*, Homer sings the deeds of the Pelide Achilles.

Logical reasoning and problem-solving

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) 24%
C) 25%
D) 30%
E) 50%

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

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

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

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) 125
C) 218
D) 238
E) 245

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 arrived on time; therefore he missed the train.
D) Marco did not take the train; therefore he arrived late.
E) Marco arrived late; therefore he did not take the train.

Biology

10. Which process occurs within mitochondria?

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

11. What is a hydrogen bond?

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

12. In eukaryotic cells, Krebs cycle reactions occur:

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

13. What kind of monosaccharide is glucose?

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

14. Which pentose sugar is present in RNA nucleotides?

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

15. What are carrier proteins?

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

16. What is the cell's energy currency?

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

17. Which kind of reaction is ATP hydrolysis?

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

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

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

19. Which intracellular structure is composed of microtubules?

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

20. Mitochondria have:

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

21. What is an anticodon?

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

22. What are ribosomes made of?

A) RNA, DNA, and proteins
B) DNA and proteins
C) DNA and lipids
D) RNA and DNA
E) RNA 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 double phospholipid layer with hydrophobic tails facing inward and the presence of integral and peripheral proteins
D) A glycoprotein layer containing phospholipids and cholesterol
E) A layer of fatty acids and globular proteins containing phospholipids and cholesterol

24. In protein synthesis, what is translation?

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

25. What are the principal components of the cytoskeleton?

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

26. The term "allele" defines:

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

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

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

28. What are mutations?

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

29. Translation is a process which:

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

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

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

31. Replication is the process through which:

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

Chemistry

33. A mixture of 0.3 mol of N_2, 0.5 mol of CO_2, and 0.4 mol of O_2 exerts a pressure of 2.4 atm on the walls of the vessel that contains it. What is the pressure exerted by the nitrogen?

A) 0.3 atm
B) 0.8 atm
C) 0.5 atm
D) 0.6 atm
E) 0.75 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) 9.6 atm
B) −81 atm
C) 8.1 atm
D) 10 atm
E) 12.5 atm

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

A) Cl_2O
B) BaO
C) SO_3
D) SiO_2
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) 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.
B) From 4 mol of O_2 and 11 mol of FeS_2, 8 mol of SO_2 can be obtained.
C) To obtain 1 mol of Fe_2O_3, 2 mol of FeS_2 and 5 mol of O_2 are necessary.
D) From 10 mol of O_2 and 1 mol of FeS_2, 3 mol of SO_2 can be obtained.
E) From 2 mol of FeS_2 and 11 mol of O_2, 1 mol of Fe_2O_3 can be obtained.

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

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

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

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

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

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

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) $H^+_{(aq)}$
B) $Zn^{2+}_{(aq)}$
C) $Zn_{(s)}$
D) $Zn(NO_3)_{2(aq)}$
E) $HNO_{3(aq)}$

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

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

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

A) Acetone
B) Acetaldehyde
C) Dimethyl ether
D) Acetic acid
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) 760 torr
B) 101325 Pa
C) 1013 millibar
D) 760 mmHg
E) 1013.25 kPa

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

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

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) 1 mL
B) 2 mL
C) 24 mL
D) 49 mL
E) 99 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) $\sqrt{2}$
B) $2\sqrt{2}$
C) $\sqrt[3]{4}$
D) $\sqrt[6]{2}$
E) $2\sqrt[6]{2}$

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

A) 2
B) 4
C) $\frac{1}{4}$
D) 6
E) $\frac{1}{2}$

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) $\frac{9}{100}$

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

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

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

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

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 $x \neq -\frac{3}{4} \wedge x \neq 0$

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

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

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

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

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

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

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

A) 70π cm^3
B) 105π cm^3
C) 175π cm^3
D) 245π cm^3
E) This cannot be calculated with these data

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

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

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

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

A) 2922 Ω
B) 29.22 Ω
C) 2.922 Ω
D) 292.2 Ω
E) 29220 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 electron continues to move with a constant velocity $\vec{v}$
B) The trajectory of the electron is a circle with a radius of $\frac{m_e v}{eB}$
C) The motion of the electron is uniformly circular with a period of $\frac{2\pi\, m_e}{eB}$
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 25,1 m/s
B) approximately −4 m/s
C) approximately 8,5 m/s
D) approximately 4,2 m/s
E) 0 m/s

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

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

********** FINE DELLE DOMANDE **********

IMAT 2024 PAST PAPER
ANSWER KEY

Reading skills and knowledge acquired during studies

01. C
02. B
03. E
04. D

Logical reasoning and problem-solving

05. C
06. A
07. D
08. C
09. E

Biology

10. B
11. E
12. C
13. C
14. A
15. C
16. D
17. D
18. B
19. E
20. B
21. A
22. E
23. C
24. B
25. D
26. C
27. E
28. D
29. E
30. C
31. D
32. E

Chemistry

33. D
34. D
35. B
36. E
37. C
38. C
39. A
40. C
41. B
42. C
43. E
44. D
45. B
46. E
47. D

Physics and Mathematics

48. B
49. C
50. E
51. B
52. A
53. C
54. E
55. C
56. E
57. B
58. A
59. E
60. C