



IMAT 2026
PROGRAM

SEMESTRE FILTRO 2025 EXAM

Italian Version

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SEMESTRE FILTRO

The first Final Exam of the 2025 Filter Semester took place on **20 November 2025** for students applying to medical programs taught in Italian. After completing the mandatory preparation courses designed by the Ministry of Education, candidates sat for the first official assessment.

The exam consisted of three subjects — **Biology, Chemistry, and Physics** — each containing **31** questions divided into two formats:

- 15 single-answer multiple-choice questions
- 16 fill-in-the-blank questions

The full exam was published by official sources and has been translated into English by the LOCOMOTIVE Educational Group, **making it a new high-quality practice resource for IMAT candidates.**

Before each section, we provide:

- A detailed analysis of the topic distribution,
- A comparison with the IMAT format,
- and an evaluation of how relevant and useful each question is for IMAT preparation.

Students are strongly advised to read the section introductions **carefully** to understand which questions match the IMAT syllabus and how to use this exam effectively as part of their preparation strategy.

The logo for Locomotive, featuring the word "Locomotive" in a stylized, handwritten-style script font.

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IMAT 2026
PROGRAM

BIOLOGY

31 Questions - 45 Minutes



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BIOLOGY SECTION

The Filter Examination is designed for Italian-taught medical programs. It is created and administered by the same Italian Ministry that prepares the IMAT exam. Therefore, analysing the Filter Exam provides valuable insight into the Ministry's current thinking, question-writing tendencies, and the areas of physics they consider important.

While the IMAT will not necessarily replicate this difficulty level, understanding how the Ministry tests its own medical applicants can give IMAT students a strategic advantage. Studying these patterns can reveal potential shifts in emphasis—such as a renewed focus on fluids, electromagnetism, or conceptual reasoning—which may eventually appear in future IMAT sessions.

Semester Filter 2025 first final exam had 15 multiple-choice and 16 fill-in-the-blank questions, 31 in total for the biology section. The multiple-choice section included:

- 1 organelles question
- 1 cardiovascular system question
- 2 protein questions
- 1 cell division question
- 1 cell membrane question
- 1 transcription question
- 3 genetic molecule questions (DNA and RNA)
- 1 endocrine system question
- 1 translation question
- 1 tissue question
- 1 bacteria (prokaryotic cells) question
- 1 virus question

The 16 fill-in-the-blank items covered:

- 3 genetics questions
- 1 genetic molecules question
- 3 protein questions
- 2 DNA replication questions
- 1 tissue question
- 1 cell signaling question
- 1 cell division question
- 1 apoptosis question
- 1 cardiovascular system (blood) question

BIOLOGY SECTION

The exam closely mirrors the IMAT 2025 and IMAT 2024 Biology difficulty, emphasizing core concepts, precise definitions, and foundational mechanisms that serve as the basis for more advanced biological reasoning. This focus on fundamentals makes it highly relevant for students building the conceptual framework needed for higher-level IMAT questions.

While the majority of items fall squarely within the standard IMAT difficulty range, a few – particularly questions 3, 14, 18, and 21 – require a deeper conceptual understanding, especially in areas involving protein structure. Because of this, students should strengthen their knowledge of advanced protein interactions and cell-signaling pathways, as these topics often determine performance on more challenging items.

Although the Filter Exam is derived from the official university materials used for the Filter Semester – and therefore does not perfectly replicate the IMAT syllabus – its structure, logic, and question style are strongly aligned with IMAT thinking. As a result, it serves as an excellent practice resource, and we strongly recommend that IMAT candidates incorporate this exam into their preparation strategy.



1. Where are the hydrolases destined for the lysosomal compartment specifically recognized and modified?
- A) Multivesicular bodies
 - B) Intermediate compartment
 - C) Secretory granules
 - D) Rough endoplasmic reticulum
 - E) Cis-Golgi
2. The ABO blood group system is a classic example of:
- A) Incomplete dominance
 - B) X-linked inheritance
 - C) Codominance
 - D) Polygenic inheritance
 - E) Incomplete penetrance
3. Three classes of E proteins (E1, E2, E3) play a fundamental role in the ubiquitination pathway during the process of protein degradation. In particular, E3 proteins:
- A) Recognize the proteins to be degraded and bind them to ubiquitin, marking them for degradation in the proteasome
 - B) Act as activators of ubiquitin
 - C) Transport ubiquitinated proteins to lysosomes for degradation
 - D) Transport ubiquitin to the proteasome
 - E) Directly degrade proteins marked with ubiquitin
4. The stage of mitosis in which chromosomes align at the equatorial plate between the two poles of the spindle is called while the stage in which chromosomes begin to separate is called
- A) Prophase, telophase
 - B) Metaphase, prophase
 - C) Prophase, anaphase
 - D) Metaphase, telophase
 - E) Metaphase, anaphase
5. In the vast majority of somatic cells of an organism:
- 1. The plasma membrane is less extensive than the membrane of the endoplasmic reticulum
 - 2. The outer nuclear membrane is part of the endoplasmic reticulum
 - 3. The inner mitochondrial membrane is quantitatively more extensive than the outer mitochondrial membrane.
- A) All statements are correct
 - B) Only statements 1 and 2 are correct
 - C) Only statements 1 and 3 are correct
 - D) Only statement 2 is correct
 - E) Only statement 1 is correct



6. The maturation mechanisms of pre-mRNA in eukaryotes include:

- A) Splicing
- B) Addition of a poly(A) tail at the 3' end of the mRNA
- C) Addition of a 7-methylguanosine cap at the 5' end of the mRNA
- D) All the answers are correct
- E) Alternative splicing

7. Aminoacyl-tRNA synthetases:

- A) Hydrolyze GTP to catalyze the bond between the amino acid and its tRNA
- B) Are present in a number equal to the various tRNAs synthesized in the cell
- C) Are processive enzymes
- D) Catalyze the bonding of the NH₂ group of a specific amino acid to the 3'-OH end of the CCA sequence of the tRNA
- E) Catalyze the bonding of the COOH group of a specific amino acid to the 3'-OH end of the CCA sequence of the tRNA

8. The “beads-on-a-string” structure shows:

- A) Naked DNA (20 nm thick)
- B) DNA wrapped around nucleosomes (30 nm thick)
- C) DNA wrapped around nucleosomes (11 nm thick)
- D) DNA wrapped around histone H1 (5 nm thick)
- E) Naked DNA (30 nm thick)

9. Paracrine is defined as:

- A) The exchange of electrical signals between neurons through synapses
- B) Intercellular communication based on signaling molecules acting on cells close to the cell that releases them
- C) Communication between viruses and bacteria
- D) Intercellular communication based on signaling molecules acting on cells much farther away than the cell that releases them
- E) Communication based on signaling molecules acting on the same cell that releases them

10. A mutation that changes the codon UCA to UGA is called:

- A) Transition
- B) Translocation
- C) Missense mutation
- D) Silent mutation
- E) Transversion



11. The extracellular matrix is composed of:

- A) Histone proteins
- B) Proteoglycans, glycosaminoglycans, structural proteins, and adhesion proteins
- C) Phospholipids and cholesterol
- D) Tubulin molecules
- E) Actin filaments

12. Considering the main structural differences between the cell walls of Gram-positive and Gram-negative bacteria, which of the following statements is correct?

- A) The arrangement of flagella and pili
- B) The presence of lipopolysaccharides in Gram-positive bacteria and teichoic acids in Gram-negative bacteria
- C) None of the stated answers is correct
- D) The different thickness of the peptidoglycan layer and the absence of the outer membrane in Gram-positive bacteria, and its presence in Gram-negative bacteria
- E) The absence of pili and flagella in Gram-negative bacteria and their presence in Gram-positive bacteria

13. All viruses...

- A) Have DNA as their nucleic acid
- B) Infect cells
- C) Infect only eukaryotic cells
- D) Have RNA as their nucleic acid
- E) Infect only animal cells

14. The signals that determine the import and export of proteins into and out of the nucleus

- A) Form amphipathic alpha-helices with negative charges
- B) Are not removed at the end of the process
- C) Bind GF sequences of the nuclear pore proteins
- D) Involve, respectively, RAN-GAP and RAN-GEF
- E) Are recognized by proteins of the nuclear lamina

15. Chromosomes are made of

- A) Only DNA
- B) Only RNA
- C) DNA and lipids
- D) RNA and proteins
- E) DNA and proteins



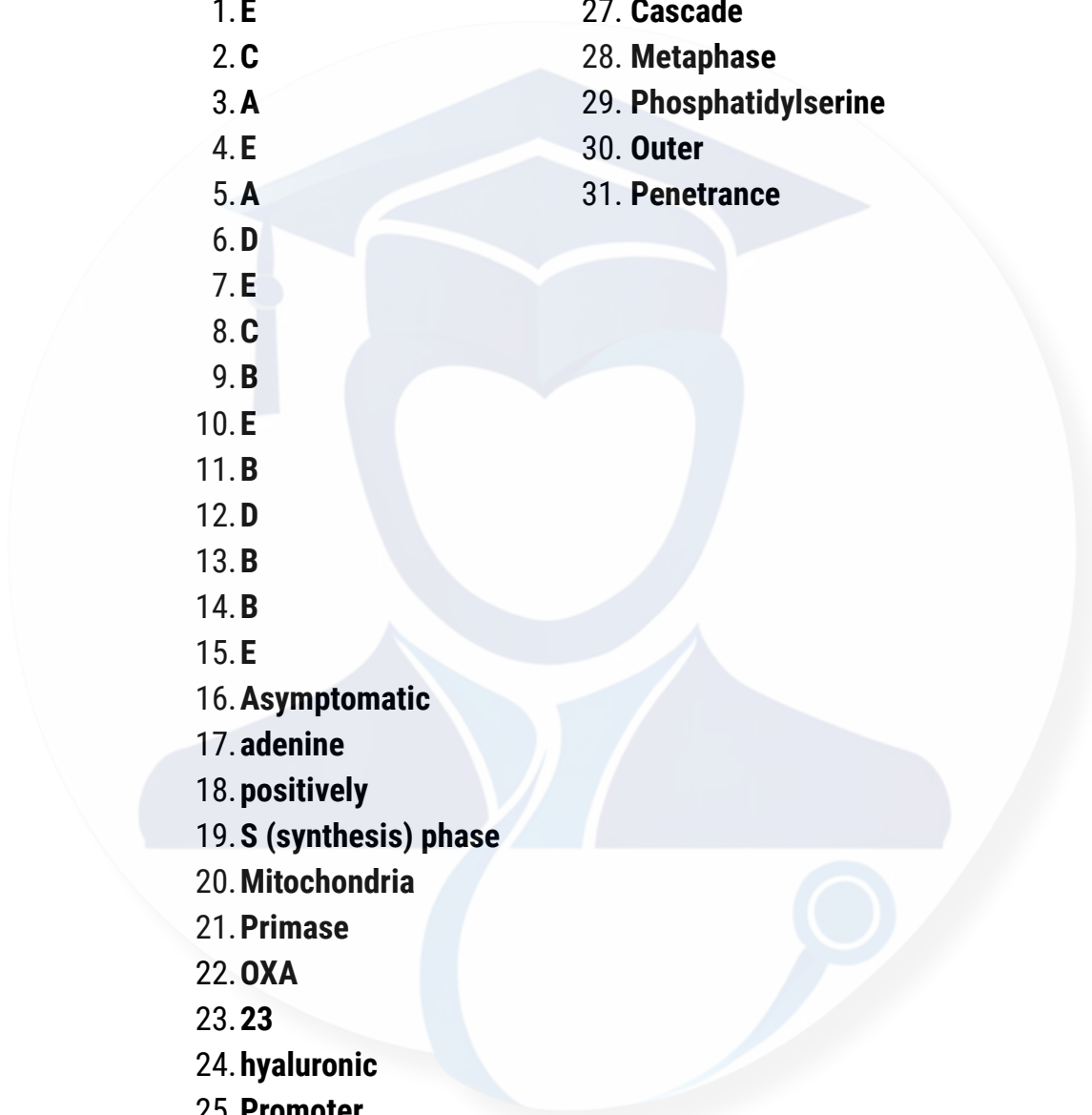
16. In the species *Homo sapiens*, disomy of chromosome Y (47,XYY) is generally associated with a male phenotype.
17. The nucleotide named dAMP is composed of a molecule of 2'-deoxy-D-ribose, a molecule of and a phosphate group.
18. The translocation of proteins through the mitochondrial inner membrane by the TIM23 complex is favoured by the membrane potential of the inner mitochondrial membrane because charged amino acids are present in the signal sequence of the proteins to be translocated.
19. In eukaryotic cells, DNA duplication occurs during the phase of the cell cycle.
20. Newly synthesised proteins destined for are translocated once their synthesis is completed but before they acquire their correct three-dimensional structure.
21. In DNA replication, the enzyme that synthesises short RNA fragments, called primers, which serve as primers for the action of DNA polymerase, is
22. Many membrane proteins encoded by mitochondrial DNA and translated in the mitochondrial matrix are inserted into the inner mitochondrial membrane thanks to the translocation complex (write the acronym).
23. In mature germ cells there are monochromatic chromosomes.
24. The acid is a macromolecule of the extracellular matrix belonging to the glycosaminoglycan family.
25. The signal sequence typically located upstream of a gene, which allows transcription to begin, is the
26. In eukaryotes, the promoter region of a gene that provides a binding site for general transcription factors, facilitating recruitment of RNA polymerase II, is called the box.
27. In the process of signal transduction, an extracellular ligand binds to a specific receptor, triggering a of intracellular events that convert the external signal into a specific biological response.
28. A cell is said to be in when the chromosomes are aligned at the equatorial plate.
29. During apoptosis, the cell destined to die is recognized and removed by macrophages thanks to the exposure, on the external surface of the plasma membrane, of , an “eat me” signal.
30. Phosphatidylcholine and sphingomyelin are lipids highly enriched in the leaflet of red blood cell membranes.
31. The frequency with which a genotype determines expression of the corresponding phenotype is defined



• Answer

BIOLOGY

1 point is awarded for each correct answer, 0 for each unanswered question, and -0.25 for each wrong answer.

- 
- | | |
|--------------------------------|-------------------------------|
| 1. E | 27. Cascade |
| 2. C | 28. Metaphase |
| 3. A | 29. Phosphatidylserine |
| 4. E | 30. Outer |
| 5. A | 31. Penetrance |
| 6. D | |
| 7. E | |
| 8. C | |
| 9. B | |
| 10. E | |
| 11. B | |
| 12. D | |
| 13. B | |
| 14. B | |
| 15. E | |
| 16. Asymptomatic | |
| 17. adenine | |
| 18. positively | |
| 19. S (synthesis) phase | |
| 20. Mitochondria | |
| 21. Primase | |
| 22. OXA | |
| 23. 23 | |
| 24. hyaluronic | |
| 25. Promoter | |
| 26. TATA | |

- Total Points: / 31
- Correct answers: / 31
- Wrong answers: / 31
- Unanswered: / 31



IMAT 2026
PROGRAM

CHEMISTRY

31 Questions - 45 Minutes



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CHEMISTRY SECTION

The Filter Examination is developed for Italian-taught medical programs and produced by the same Ministry responsible for the IMAT. For this reason, the Chemistry section of the Filter Exam provides meaningful insight into the Ministry's current approach to question design and the specific areas of chemistry they consider essential for medical applicants. While IMAT will not necessarily mirror the exact difficulty of this exam, analysing these trends offers IMAT candidates a strategic advantage, especially in identifying shifts in emphasis—such as thermodynamics, bonding, or organic chemistry—that may influence future IMAT sessions.

The Semester Filter 2025 Chemistry Exam consisted of 15 multiple-choice questions and 16 fill-in-the-blank questions, for a total of 31 items.

Multiple-Choice (15 Questions). The topics included:

- 1 question on basic chemical concepts
- 2 on atomic structure
- 3 on organic molecules
- 1 equation-balancing question
- 1 general thermodynamics question
- 2 on acids and bases
- 1 on solutions
- 1 on chemical bonding
- 3 distributed across fundamentals of general chemistry

Fill-in-the-Blank (16 Questions). The distribution was:

- 3 questions on organic chemistry
- 1 on solutions
- 4 on organic molecules
- 1 gas law question
- 1 oxidation reaction
- 1 chemical equilibrium
- 2 questions on bonding
- 1 additional solutions question
- 2 on acids and bases

CHEMISTRY SECTION

Overall, the Chemistry section was easier than the typical IMAT Chemistry level, especially compared with recent IMAT sessions. However, it covered a broader range of topics, ensuring that students were tested on a wide conceptual foundation rather than complex calculations.

The exam did not contain any true chemistry problem-solving questions; instead, it focused entirely on definitions, fundamental principles, and straightforward applications. Students with a strong command of the basics could score highly with minimal difficulty.

This heavy emphasis on fundamentals makes the exam particularly valuable for IMAT candidates who are still building their conceptual framework before tackling higher-level IMAT-style reasoning questions.

Although the Filter Exam is based on the specific study materials provided to Filter Semester students – and therefore does not perfectly match the IMAT syllabus – its structure, clarity, and questioning logic align closely with IMAT-style thinking. Because of this, the Chemistry section serves as an excellent practice resource, and we strongly recommend that IMAT candidates include it in their preparation plan.



1. Which of the following is the chemical formula of barium sulfate?

- A) BaS
- B) BaSO₄
- C) BaHSO₄
- D) BaSO₃
- E) Ba₂SO₄

2. The atomic number of an element is:

- A) The sum of the number of protons and electrons
- B) The sum of the number of protons and neutrons
- C) The total number of electrons
- D) The number of protons contained in the nucleus
- E) The number of neutrons contained in the nucleus

3. Acyclic alkanes are molecules that are:

- A) Branched
- B) Characterized by geometric isomerism
- C) Aromatic
- D) Linear
- E) In which all carbon atoms are sp³ hybridized

4. 2-propanol, in acidic environment, can be oxidized by potassium dichromate forming:

- A) Acetone
- B) Propylene oxide
- C) Acetaldehyde
- D) 1-propanol
- E) Ethanol

5. Which of the following amino acids is the most abundant in collagen?

- A) Glycine
- B) Alanine
- C) Serine
- D) Tryptophan
- E) Histidine



6. After balancing the following reaction



one can state that:

- A) $b = 6$
- B) $e = 4$
- C) $c = 6$
- D) $a = 2$
- E) $d = 2$

7. In 2,3-dimethyl-1-butene there are:

- A) Four methyl groups
- B) Two double bonds
- C) Five carbon atoms
- D) Twelve hydrogen atoms
- E) Four carbon atoms

8. The relationship between Gibbs free-energy change (ΔG) and the electrochemical potential (E) of a cell is:

- A) $\Delta G = E/nF$
- B) $\Delta G = -nFE$
- C) $\Delta G = nFE$
- D) $\Delta G = -nF E^\circ$
- E) $\Delta G = R t \ln E$

9. The maximum number of electrons present in an orbital with quantum number ($l = 1$) is:

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

10. Which of the following saline solutions will have a pH higher than 7?

- A) KClO_4
- B) NaHCO_3
- C) NaCl
- D) KHSO_4
- E) NH_4NO_3



11. Omega-3 and omega-6 fatty acids:

- A) Are all saturated
- B) Are synthesized by the liver
- C) Are all polyunsaturated
- D) Are essential components of glycerophospholipids
- E) Include oleic acid, linoleic acid, and arachidonic acid

12. Which of the following saline solutions will have a pH lower than 7?

- A) NaCl
- B) KNO₃
- C) KClO₄
- D) NaHCO₃
- E) NH₄Cl

13. A nucleotide is composed of:

- A) A nitrogenous base covalently linked to a pentose and to three phosphate groups
- B) A pentose linked to three phosphate groups
- C) A nitrogenous base linked to a pentose through a hydrogen bond
- D) A nitrogenous base linked to three phosphate groups
- E) A nitrogenous base covalently linked to a pentose

14. Arachidonic acid:

- A) Is an omega-6 unsaturated fatty acid
- B) Has 24 carbon atoms
- C) Derives from cholesterol
- D) Is synthesized by the liver
- E) Is an omega-3 unsaturated fatty acid

15. What effect does an INCREASE in temperature have on the solubility of oxygen in water?

- A) Solubility decreases
- B) Solubility increases
- C) The effect depends on the initial temperature
- D) No effect on solubility
- E) In the presence of other gases it increases



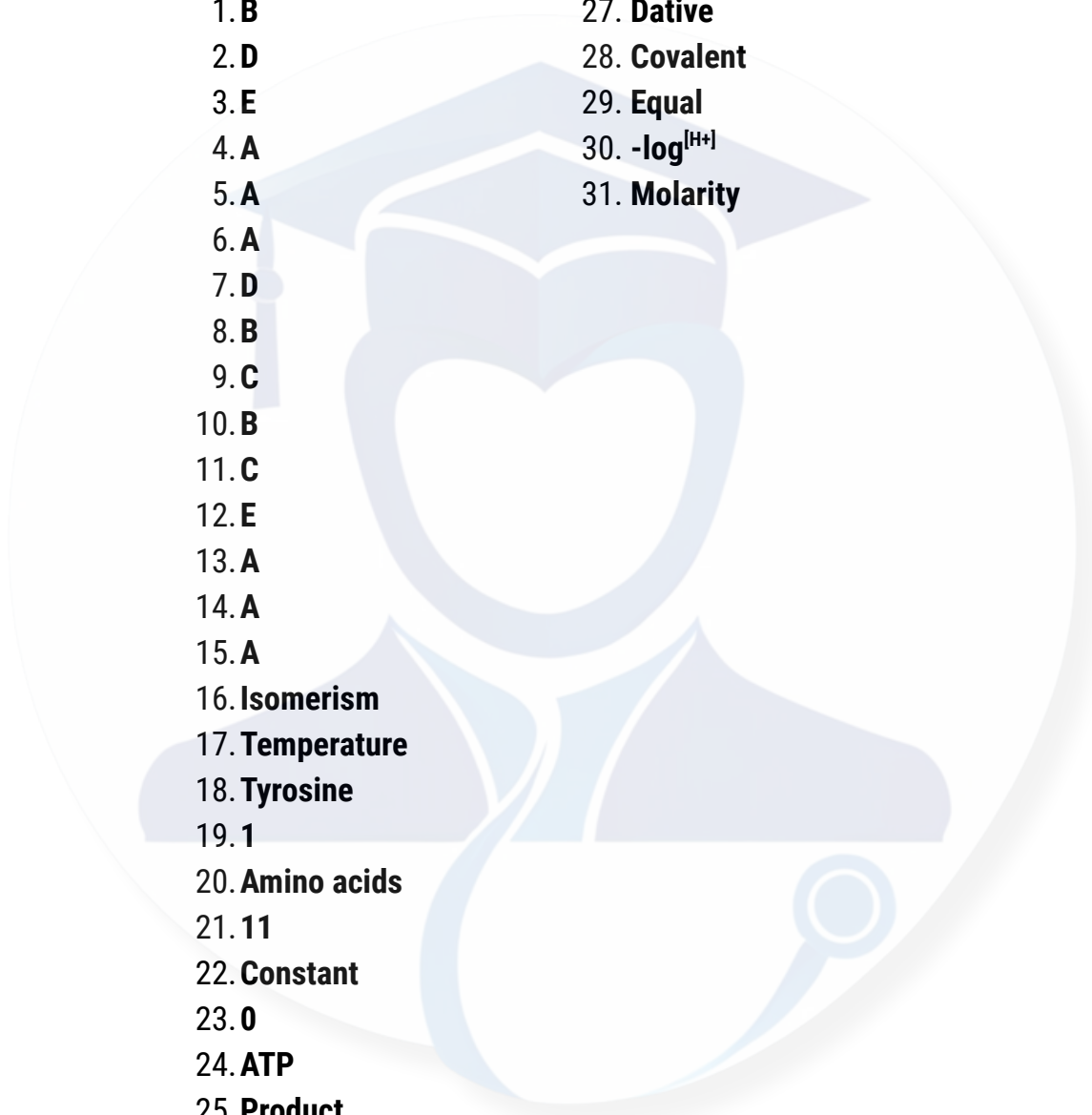
16. With identical substituents on an unsaturated carbon atom, 1-butene does not show configurational.
17. As increases, the vapor pressure of a liquid increases.
18. Tyrosine can be synthesized from phenylalanine through an enzymatic reaction. Therefore, among these amino acids, ... is not an essential amino acid.
19. The number of free amino groups present in the dipeptide Aspartic acid – Glycine is
20. Natural proteins are polymers of linked by peptide bonds.
21. In 4-ethyl-2,2-dimethylheptane there are carbon atoms.
22. According to Boyle–Mariotte’s law for an ideal gas, $P_1V_1 = P_2V_2$, so the product $P \cdot V$ is always
23. In a neutral compound, the algebraic sum of the oxidation numbers of the different elements is
24. The (use the acronym) is a nucleotide composed of adenine, ribose, and three phosphate groups.
25. According to the law of mass action, the equilibrium constant K_c for the reaction
- $$aA + bB \rightleftharpoons cC + dD$$
- is defined as the ratio between of the molar concentrations of the products and that of the molar concentrations of the reagents, each raised to its stoichiometric coefficient.
26. In proteins, the formation of disulfide bridges can occur due to the presence of multiple residues of the amino acid
27. Ammonia forms the ammonium ion through a covalent bond with a proton.
28. A molecule is defined as a permanent assembly of identical or different atoms connected by bonds
29. Buffering power is maximal when the pH of the solution is to the pK of the weak acid.
30. pH is the logarithm of the of the molar concentration of hydrogen ions (hydronium ions, H_3O^+).
31. The concentration measure that indicates the moles of solute present in one liter of solution is called



• Answer

CHEMISTRY

1 point is awarded for each correct answer, 0 for each unanswered question, and -0.25 for each wrong answer.

- 
- | | |
|------------------------|--------------------------------------|
| 1. B | 27. Dative |
| 2. D | 28. Covalent |
| 3. E | 29. Equal |
| 4. A | 30. $-\log^{[H+]}$ |
| 5. A | 31. Molarity |
| 6. A | |
| 7. D | |
| 8. B | |
| 9. C | |
| 10. B | |
| 11. C | |
| 12. E | |
| 13. A | |
| 14. A | |
| 15. A | |
| 16. Isomerism | |
| 17. Temperature | |
| 18. Tyrosine | |
| 19. 1 | |
| 20. Amino acids | |
| 21. 11 | |
| 22. Constant | |
| 23. 0 | |
| 24. ATP | |
| 25. Product | |
| 26. Cysteine | |

- Total Points: / 31
- Correct answers: / 31
- Wrong answers: / 31
- Unanswered: / 31



IMAT 2026
PROGRAM

PHYSICS

31 Questions - 45 Minutes



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PHYSICS SECTION

The Filter Examination is created for Italian-taught medical programs and administered by the same Ministry responsible for the IMAT. Analysing this exam offers direct insight into the Ministry's current priorities, question style, and the physics concepts they consider essential. Although IMAT will not copy this difficulty exactly, understanding these patterns provides IMAT candidates with a real strategic advantage—especially if the Ministry shifts emphasis toward areas such as fluids, electromagnetism, or conceptual reasoning.

The Physics section included 31 questions: 15 multiple-choice and 16 fill-in-the-blank. This high number allowed the exam to cover a broad range of classical physics, including areas not commonly tested in IMAT.

Multiple questions focused on fluid mechanics, unit conversions, waves, and electromagnetism, while non-IMAT topics such as refractive index, photon physics, geometrical optics, wave theory, and curved-path motion also appeared. This reflects a more rigorous and comprehensive approach than standard IMAT physics.

Many questions required combining conceptual understanding, mathematical reasoning, proportionality, and unit analysis. The exam rewarded genuine physics thinking rather than simple formula recall—contrasting sharply with IMAT, where most problems rely on a single direct equation.

Let's first look at the QUESTION-BY-QUESTION TOPIC CLASSIFICATION

- 1.Oscillations: Spring – Mass System (SHM)
- 2.Refractive index (not in IMAT syllabus)
- 3.Fluid Mechanics: Viscosity (Poiseuille's Law)
- 4.Units & Dimensions: Unit Conversion
- 5.Newton's Laws of Motion: Force
- 6.Fluid Mechanics: Definition of Incompressible Fluid
- 7.Fluid Mechanics: Archimedes' Principle
- 8.Units & Dimensions: Dimensions of Force
- 9.Current Electricity: Power & Current ($P = VI$)
- 10.Thermal Physics: Kinetic Theory of Gases
- 11.Motion in Curved Path (not in IMAT syllabus)
- 12.Waves (not in IMAT syllabus)
- 13.Thermal Physics: Heat Engines (Carnot Cycle)
- 14.Electromagnetic Waves (not in IMAT syllabus)

PHYSICS SECTION

- 15. Current Electricity: Capacitance
- 16. Work, Energy & Power: Work (Dot Product)
- 17. Electromagnetism: Moving electric charge
- 18. Photons (not in IMAT syllabus)
- 19. Magnetism: Motion of Charge in Magnetic Field
- 20. Oscillations: Damped Oscillations
- 21. Geometrical Optics (not in IMAT syllabus)
- 22. Thermal Physics: Isochoric Process
- 23. Waves (not in IMAT syllabus)
- 24. Waves (not in IMAT syllabus)
- 25. Work, Energy & Power: Inelastic Collision
- 26. Units & Dimensions: Unit Conversion of Pressure
- 27. Fluid Mechanics: Pressure in Fluids
- 28. Fluid Mechanics: Flow Rate + Bernoulli's Equation
- 29. Units & Dimensions: Unit Conversion
- 30. Current Electricity: Ohm's Law
- 31. Current Electricity: Series & Parallel Resistances

Notable Observations from Topic Distribution

1. Kinematics, Dynamics & Work-Energy: These questions required more than basic formula substitution. Students had to understand forces, oscillations, damping, and inelastic collisions in real scenarios. This is more detailed than the typical IMAT approach, where such topics usually appear as shorter, more direct questions.

2. Electricity & Magnetism: This was one of the hardest parts of the exam. Questions were asked at a high conceptual level. The magnetism-based questions were particularly challenging—comparable to IMAT 2024 Q58.

3. Fluid Mechanics: Fluid Mechanics has historically appeared in IMAT. The Filter Semester also contains several questions on Fluid Mechanics. This parallel is important: both the IMAT and the Italian-taught medical school exams—now created by the same Italian Ministry—treat Fluid Mechanics as a legitimate and testable physics topic, even though it is not included in the Cambridge IGCSE, AS, or A-Level physics syllabus. This shows a meaningful overlap in the conceptual priorities of both exams and suggests that IMAT students should not ignore Fluid Mechanics simply because Cambridge textbooks do not emphasise it.

PHYSICS SECTION

4.Units, Dimensions & Basic Definitions: Unlike IMAT, which has not yet tested students on dimensions, this exam included a question on the topic. It also featured multiple unit conversion questions. The emphasis on prefixes, nano-scaling, and dimensional analysis suggests that the Ministry expects mastery of fundamental physics literacy.

5.Thermal Physics: Thermodynamics questions were similar in style to IMAT but required more mathematical reasoning.

6.Wave Theory & Optics: These topics are almost never tested in IMAT, so students do not need to worry about them unless the IMAT syllabus changes. Any such update would be officially announced by the Ministero dell'Università e della Ricerca (MUR) – the Italian Ministry of University and Research – before the exam.

Difficulty Level

The overall difficulty of the Filter Exam was considerably high, primarily because the questions demanded far more than simple formula recall. Many problems required multi-step reasoning, where students had to interpret a physical scenario, identify the relevant principles, and then combine multiple ideas before arriving at an answer.

Even the fill-in-the-blank questions tested deep theoretical understanding rather than basic definitions. For example, students were expected to know that work is defined as the dot product of force and displacement, and that dissipative (non-conservative) forces are responsible for damping in oscillatory motion. This elevated the difficulty of the exam compared to the more predictable and formula-based style typically seen in IMAT.

Student Performance

IMAT students relying only on past papers or formula sheets would find this exam highly challenging. Importantly, the exam did not include “free points” often seen in IMAT, such as extremely direct resistance or power problems.

Students who:

- understand why physics works
- can manipulate equations
- can solve integrated problems
- covered the entire syllabus and not just the past trends

will score significantly higher.

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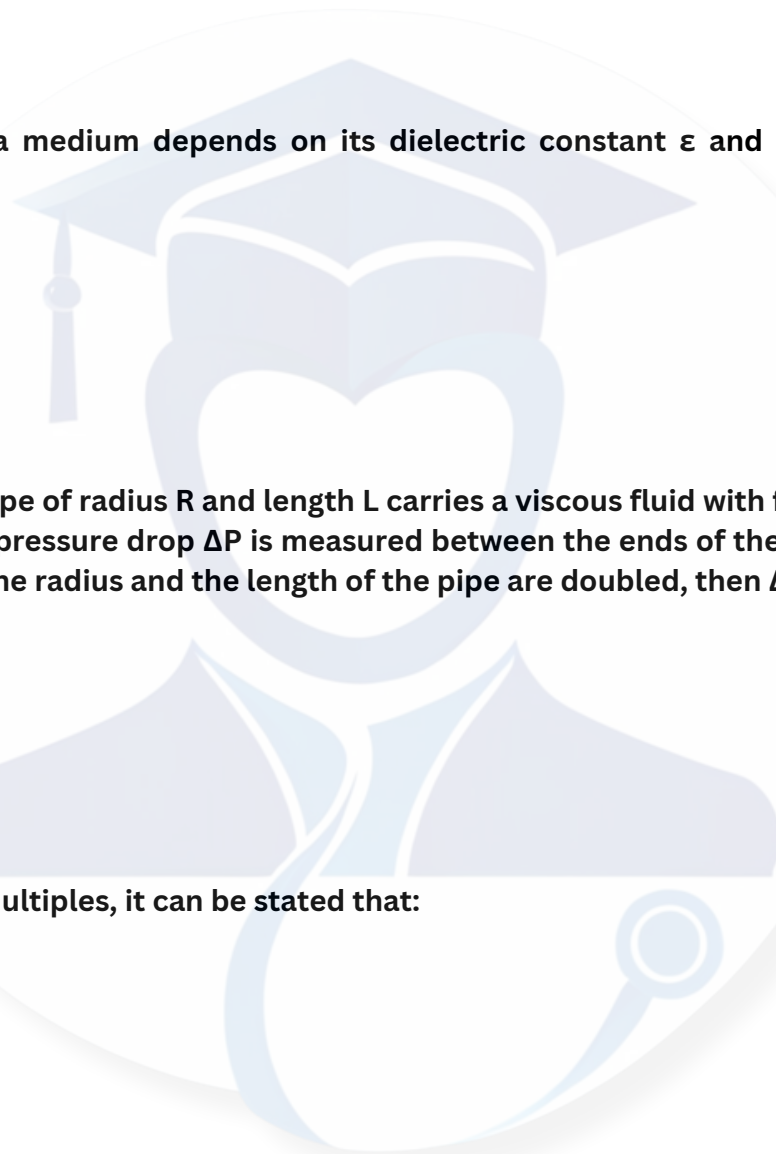
PHYSICS SECTION

CONCLUSION

While IMAT may not suddenly become as hard as the Filter Exam, the Ministry's trend indicates that future IMAT papers may cover a broader range of topics rather than repeating the same limited set of predictable areas. Therefore, students should aim to cover the entire syllabus, without leaving out any topic simply because it appeared rarely in past papers.

A strong preparation strategy must include not only understanding theoretical concepts but also practising a large number of questions and taking as many mock exams as possible to test and reinforce their knowledge. Students should ensure they are studying from reliable and accurate sources, and they must plan their preparation timeline carefully, organising topics in advance, dividing the syllabus strategically, and giving themselves enough time to revise such a vast subject effectively.

For IMAT students, this exam serves as a valuable preview of what the Italian Ministry is capable of asking – and possibly the direction IMAT may move toward in future years.



1. A horizontal spring (of negligible mass) has attached to it a wooden block of mass $m = 7 \text{ kg}$ that oscillates with a period of $\pi/3$ seconds. What is the spring constant k in SI units?

- A) 252π
- B) 126
- C) 28
- D) 252
- E) 4

2. The refractive index of a medium depends on its dielectric constant ϵ and magnetic permeability μ , according to the law:

- A) $n = 1/(\epsilon \mu)$
- B) $n = \epsilon/\mu$
- C) $n = \sqrt{\epsilon \mu}$
- D) $n = \epsilon \mu$
- E) $n = 1/\sqrt{\epsilon \mu}$

3. A horizontal cylindrical pipe of radius R and length L carries a viscous fluid with flow rate Q , under laminar flow. In these conditions, a pressure drop ΔP is measured between the ends of the pipe. If, keeping all other conditions the same, both the radius and the length of the pipe are doubled, then ΔP :

- A) Becomes double
- B) Becomes one eighth
- C) Remains unchanged
- D) Becomes one quarter
- E) Becomes quadruple

4. Using multiples and submultiples, it can be stated that:

- A) $10^{-9} \text{ km} = 1 \text{ dm}$
- B) $10^{-9} \text{ km} = 1 \text{ nm}$
- C) $10^{-9} \text{ km} = 1 \mu\text{m}$
- D) $10^{-9} \text{ km} = 1 \text{ mm}$
- E) $10^{-9} \text{ km} = 1 \text{ cm}$

5. Applying the same force to two different bodies, the two bodies acquire:

- A) The same acceleration
- B) This question has no unique or correct solution
- C) Accelerations directly proportional to the masses
- D) The same velocity
- E) Accelerations inversely proportional to the masses



6. A fluid is defined as incompressible:

- A) When inside it, at the same height, pressure does not depend on position
- B) When its density does not depend on temperature
- C) When its density remains constant even when subjected to pressure variations
- D) When the principle of conservation of kinetic energy applies to it
- E) When its viscosity coefficient is negligible

7. A wooden raft (density of wood: 0.8 g/cm^3) with a square base of side 4 m and height 50 cm floats on water. What percentage of the total height of the raft is submerged?

- A) 10%
- B) 80%
- C) 50%
- D) None of the proposed answers is correct
- E) 20%

8. Indicating by [M] a quantity with dimensions of mass, [L] a quantity with dimensions of length, and [T] a quantity with dimensions of time, what are the dimensions of a force?

- A) $[M][L][T]^{-1}$
- B) $[M][L]^2[T]^{-2}$
- C) $[L][T]^{-2}$
- D) $[M][L]^{-1}$
- E) $[M][L][T]^{-2}$

9. The power used by household appliances is:

- P (clothes iron) = 1 kW
- P (television) = 150 W
- P (washing machine) = 2.5 kW
- P (electric oven) = 1500 W

If they are connected to the home electric system (220 V), which appliance draws the largest current?

- A) The clothes iron
- B) The electric oven
- C) The washing machine
- D) The television
- E) They all draw the same current



10. According to the kinetic theory of gases, if the temperature of the molecules of a gas triples, then:

- A) It is impossible to answer if initial and final pressures are unknown
- B) It is impossible to answer if the initial temperature is unknown
- C) The molecules' average kinetic energy doubles
- D) The molecules' average kinetic energy triples
- E) The molecules' average kinetic energy becomes nine times the initial value

11. The motion of a point mass in which the curvature of the trajectory and scalar velocity remain constant is:

- A) Uniformly accelerated motion
- B) Helicoidal motion
- C) Harmonic motion
- D) This question has no unique or correct solution
- E) Uniform circular motion

12. Which of these physical quantities is NOT transported by a sound wave propagating in a material medium?

- A) Information
- B) Power
- C) Momentum
- D) Mass
- E) Energy

13. Given T_1 and T_2 respectively the temperature of the cold reservoir and the hot reservoir, in a Carnot cycle, the efficiency:

- A) Equals $1 - T_1/T_2$, with T_1 and T_2 expressed in $^{\circ}\text{C}$
- B) Equals $1 - T_2/T_1$, with temperatures expressed in K
- C) Is greater than 1
- D) Is a negative number
- E) Equals $1 - T_1/T_2$, with temperatures expressed in K

14. The propagation speed of electromagnetic waves:

- A) 350.209 km/s
- B) Is constant
- C) Depends on the refractive index of the medium in which they travel
- D) None of the previous answers is correct
- E) Depends on the wave frequency



15. What is the potential difference between two points inside an isolated conductor charged with 10 nC and with a capacitance of 5 nF?

- A) 0 V
- B) 2 mV
- C) 50 mV
- D) 10 mV
- E) 2 V





16. The mechanical work of a force is defined as the product between the force vector and the displacement vector.
17. A moving electric charge generates an electromagnetic field in which the electric-field vector and magnetic-field vector are always to each other.
18. The energy of a photon is directly proportional to its
19. An electric charge enters a region of space where a uniform magnetic field is present, with velocity orthogonal to the direction of the field. The charge will describe a orbit.
20. When a pendulum is pushed by an external force, it begins to oscillate. Its oscillations quickly die out once the external force stops. This happens because forces of type act on the pendulum.
21. If an object is placed between the center and the focal point of a converging lens, the resulting image is and magnified.
22. In an isochoric transformation, the change in internal energy ΔU coincides with the exchanged by the system.
23. A sound wave of frequency f propagates in a medium with speed v . Its wavelength λ is
24. In wave physics, the frequency f is calculated as the inverse of the of a wave.
25. A wax sphere of mass 20 g slides on a frictionless surface at a constant speed of 2 m/s and collides, sticking to it, with a steel sphere of mass 40 g. After the collision, the two spheres move together with a speed of m/s
26. To convert a pressure from Pascal (Pa) to nanoPascal (nPa), multiply the value in Pascal by 10 raised to the power of
27. For a fluid with density $\rho = 1000 \text{ kg/m}^3$ and $g = 9.81 \text{ m/s}^2$ at a height of 5 m, the gauge pressure at the bottom is Pa.
28. In a horizontal pipe flows a fluid of density $\rho = 10^3 \text{ kg/m}^3$ which, for this problem, can be considered ideal. The flow rate is $Q = 100 \text{ cm}^3/\text{s}$. At point 1 the pipe section is $S_1 = 1 \text{ cm}^2$, while at point 2 the section is $S_2 = 2 \text{ cm}^2$. What is the pressure difference $P_2 - P_1$, expressed in N/m^2 ?
29. There are 4 μg of a certain protein dissolved in 1 mm^3 of blood. In one liter of blood, ... g of that protein will be dissolved.
30. The law that states that voltage is proportional to the current through a conductor, with a proportionality constant called, is known as Ohm's law.
31. Two identical conductors of 1000 Ohm each are connected in parallel, and their combination is then placed in series with a 500 Ohm conductor. The total resistance of the connection is Ohm.



• Answer

PHYSICS

1 point is awarded for each correct answer, 0 for each unanswered question, and -0.25 for each wrong answer.

- | | |
|---------------------------------------|-----------------------|
| 1. D | 27. 49050 |
| 2. C | 28. 375 |
| 3. B | 29. 4 |
| 4. C | 30. Resistance |
| 5. E | 31. 1000 |
| 6. C | |
| 7. B | |
| 8. E | |
| 9. C | |
| 10. D | |
| 11. E | |
| 12. D | |
| 13. E | |
| 14. C | |
| 15. A | |
| 16. Scalar | |
| 17. Perpendicular - Orthogonal | |
| 18. Frequency | |
| 19. Circular | |
| 20. Resistive - Dissipative | |
| 21. Real and Inverted | |
| 22. Heat | |
| 23. V/f | |
| 24. Period | |
| 25. 0.667 | |
| 26. 9 | |

- Total Points: / 31
- Correct answers: / 31
- Wrong answers: / 31
- Unanswered: / 31