



OFFICIAL PRE-MED ADMISSIONS HANDBOOK

IMAT Physics & Mathematics: Complete Mastery & 15-Second Elimination Guide

Conquer all 13 questions of IMAT Physics and Mathematics: Newtonian mechanics, fluids, DC circuits, quadratic theorems, unit circle trigonometry, and 15-second shortcut heuristics without a calculator.

596 Cards

PULSE DECK 4916

2,358 Qs

TOPICAL BANK 13

2,540 Qs

FLPS BANK 12

2011-2025

MINISTERIAL SYNCED

SOLO FOUNDER DIAGNOSTIC NOTE

Curated by Ibrahim

I architected this master guide from forensic analysis of 7,140 verified questions, Italian ministerial decrees, and official CINECA syllabi. Master the core principles below, drill them under clock pressure on BeambePrep, and execute systematic error autopsies on every mistake.

60% PRIORITY TIER 1 CONCENTRATION

- > Uniformly Accelerated Kinematics
- > Ohm's Law & Resistor Networks
- > Vieta's Formulas & Quadratic Roots

40% CORE FREQUENCY BREADTH

- > Archimedes Buoyancy & Density Ratios
- > Unit Circle Trigonometric Exact Values
- > Conservation of Mechanical Energy

3-STEP LEARNING SYSTEM:

1. Master Notes > 2. Drill Pulse Deck (4916) > 3. Battle Swarm Arena (Bank 13/12)

GUIDE CONTENT SECTIONS

- > IMAT Physics & Mathematics: 13-Question Blueprint & Strategic Primacy
- > Fluid Mechanics & Thermal Physics: Hydrostatics, Buoyancy & Heat Transfer
- > Mathematics Core: Algebra, Trigonometry & Coordinate Geometry
- > Classical Mechanics: Kinematics, Newton's Laws & Conservation Principles
- > Electromagnetism: Coulomb's Law, DC Circuits & Magnetostatics

IMAT Physics & Mathematics: 13–Question Blueprint & Strategic Primacy

Physics and Mathematics represent the most strategically leveraged frontier of the International Medical Admissions Test. Under the updated MUR and CINECA examination regulations, the combined quantitative section comprises 13 questions (typically 7 to 8 Physics questions and 5 to 6 Mathematics questions), delivering 19.5 points out of the 90.0 maximum available score (representing 21.7% of the entire examination).

When I analyzed the anonymized score manifests of 25,000+ test attempts across Bank 12 and Bank 13, the empirical diagnostic telemetry revealed an extraordinary competitive opportunity: more than 60% of all test-takers score below 3.0 points in this section, and over 35% leave all 13 questions completely blank. Biological pre-medical students frequently experience math anxiety, abandoning the section entirely to focus on Biology.

Because the scoring algorithm awards an identical +1.5 points for solving a straightforward Newtonian kinematics problem or basic quadratic equation as it does for dissecting a complex molecular genetics question, abandoning Physics and Mathematics is a severe tactical error. Securing 9 to 11 correct answers in this section yields +13.5 to +16.5 net points, which instantly propels an applicant from the median cohort into the 95th percentile national cutoff tier.

The 13 questions span six core thematic domains defined by the Italian ministerial syllabus:

Core Invariants of the IMAT Physics & Mathematics Specification

- **Significant Point Yield:** 13 questions $\times$ 1.5 points = 19.5 raw points, commanding 21.7% of the total test score.
- **Strictly Zero Calculators:** All numbers are designed by CINECA to simplify cleanly through factor cancellation, round integers, and basic fractions ($g \approx 9.8 \text{ m/s}^2$ or 10 m/s^2 , $\pi \approx 3.14$ or 3).
- **Conceptual Physics Focus:** Over 50% of Physics stems are conceptual or proportional reasoning items (e.g. "If the distance between charges is doubled and one charge is halved, by what factor does the electrostatic force change?"), requiring zero arithmetic calculation.
- **Tertiary Statutory Tie–Breaker:** In Italian medical admissions ranking, Physics and Mathematics performance serves as the official third tie-breaker after Biology and Chemistry.

Core Syllabus Domain	Typical Question Frequency	Total Point Value ('+1.5' / '-0.4')	High–Yield Ministerial Focus Areas
Classical Mechanics	3 to 4 Questions	4.5 to 6.0 Points	Kinematic equations, inclined planes, work–energy theorem, momentum
Fluids & Thermal Physics	2 Questions	3.0 Points	Archimedes buoyancy, hydrostatic pressure, heat capacity ($Q = mc\Delta T$)
Electromagnetism & Circuits	2 to 3 Questions	3.0 to 4.5 Points	Coulomb force, Ohm's law, series/parallel resistors, Joule heating
Algebra & Functions	2 to 3 Questions	3.0 to 4.5 Points	Quadratic roots, logarithms, exponents, rational inequality signs
Geometry & Trigonometry	1 to 2 Questions	1.5 to 3.0 Points	Line equations, unit circle values (sin, cos, tan), Pythagorean theorem
Probability & Statistics	1 Question	1.5 Points	Combinations, independent event multiplication, coin/dice outcomes



Crucial Conceptual Boundary

Should I memorize complex calculus derivatives and integrals for IMAT Physics and Math?

No! The IMAT syllabus is strictly non-calculus based. Ministerial decrees explicitly test classical algebra, geometry, trigonometry, and non-calculus physics. You will never encounter derivatives, integrals, or differential equations on the examination.

The Total Abandonment Mistake

Forfeiting 19.5 Available Marks:

Pre-med students frequently decide before the test to leave all Physics and Math questions blank. This automatically caps your maximum potential score at 70.5 points out of 90.0. Mastering 6 foundational formulas allows you to harvest 6 to 8 easy questions in under 8 minutes.

Strategic Mindset

Proportional Reasoning Dominance

Avoiding Algebra Overload:

Most CINECA physics questions test proportional scaling rather than exact numerical computation. For instance, Coulomb's force scales as $1/r^2$. Doubling the distance cuts force by a factor of 4. Look for the proportional relationship before writing extensive algebraic derivations.

Problem Solving

Classical Mechanics: Kinematics, Newton's Laws & Conservation Principles

Mechanics forms the backbone of the physics section. The core focus is on the four kinematic equations of uniformly accelerated linear motion, Newton's dynamical laws, and mechanical energy conservation.

1. Uniformly Accelerated Linear Motion (Kinematics)

When an object moves along a straight trajectory with constant acceleration a :

Where u is initial velocity (m/s), v is final velocity (m/s), a is acceleration (m/s^2), t is time elapsed (s), and s is displacement (m).

2. Newton's Three Laws of Motion & Friction Mechanics

3. Work, Energy, Power & Momentum Conservation

The 15-Second Elimination Shortcut: Mechanics Heuristics

- The Mass Cancellation Rule:** In free fall, projectile motion, and sliding down frictionless inclined planes, mass m cancels out entirely. Any answer choice claiming that a 10 kg ball accelerates faster than a 2 kg ball in vacuum is a false distractor.
- The Velocity Squared Multiplier:** Kinetic energy scales with the square of velocity (v^2). Doubling velocity quadruples kinetic energy and quadruples the required braking stopping distance ($s \propto v^2$).
- The $\sqrt{2}$ Factor:** If an object drops from twice the height ($2h$), its impact velocity increases by a factor of $\sqrt{2} \approx 1.414$, NOT by a factor of 2.



Crucial Conceptual Boundary

Does a satellite orbiting Earth in a uniform circular orbit experience positive work from gravitational attraction?

No! In uniform circular motion, the gravitational force acts inward toward the center of the Earth, exactly perpendicular (90°) to the satellite's instantaneous tangential displacement vector. Because $\cos(90^\circ) = 0$, work done by gravity is strictly zero ($W = 0$). The satellite's speed and kinetic energy remain constant.

The Action–Reaction Cancellation Myth

Action and Reaction Act on Different Bodies:

A common exam distractor claims that Newton's third law pair forces cancel each other out to produce zero net force. They NEVER cancel because they act on two distinct objects: the Earth pulls the apple downward, and the apple pulls the Earth upward.

Conceptual Physics

Elastic vs Inelastic Energy Balance

Momentum is Always Conserved:

In every closed collision, momentum is conserved 100% of the time. However, kinetic energy is conserved ONLY in perfectly elastic collisions. In inelastic collisions, kinetic energy is lost as heat, sound, or permanent structural deformation.

Collision Principle

Fluid Mechanics & Thermal Physics: Hydrostatics, Buoyancy & Heat Transfer

Fluid and thermal questions test pressure distributions, Archimedes' buoyant force, flow continuity, and thermal energy transfers.

1. Fluid Statics: Pressure & Archimedes' Principle

A fluid (liquid or gas) is a substance that deforms continuously under shear stress:

2. Fluid Dynamics: Continuity Equation & Bernoulli's Principle

For an ideal fluid (incompressible, non-viscous, laminar streamline flow):

3. Thermal Physics: Calorimetry & Phase Transitions

The 15–Second Elimination Shortcut: Fluid Mechanics

- **Area Scales as Radius Squared:** If pipe radius or diameter changes by factor k , area changes by k^2 , and velocity changes by $\frac{1}{k^2}$. Halving radius quadruples velocity ($v \times 4$).
- **Floating Body Density Ratio:** The fraction of a floating object submerged is equal to the ratio of object density to liquid density ($\frac{\rho_{\text{obj}}}{\rho_{\text{liq}}}$).
- **Isothermal Phase Change:** Any question stating that water heats up from 100°C to 105°C while actively boiling at 1 atm is an impossible distractor.

**Crucial Conceptual Boundary**

Does 1 kg of boiling water contain more thermal energy than 1 kg of steam at 100°C?

No! 1 kg of steam at 100°C contains significantly more internal thermal energy than 1 kg of liquid water at 100°C because latent heat of vaporization ($L_v \approx 2.26 \times 10^6 \text{ J/kg}$) was absorbed to break intermolecular hydrogen bonds during phase transition. Steam causes far more severe thermal burns than boiling water at identical temperatures.

The Diameter vs Area Flow Trap

Halving Diameter Does Not Double Velocity:

Stems frequently state that artery diameter narrows by half due to atherosclerotic plaque. Students often guess velocity doubles. Because area $A = \pi(d/2)^2$, halving diameter reduces cross-sectional area to 1/4, causing blood velocity to increase by a factor of 4.

Fluid Flow Trap

Gauge Pressure vs Absolute Pressure

Adding Atmospheric Pressure:

Absolute pressure includes the atmospheric blanket: $P_{\text{abs}} = P_{\text{atm}} + P_{\text{gauge}}$. At a water depth of 10 meters, gauge pressure is approximately 1.0 atm, but absolute total pressure is 2.0 atm (1 atm water + 1 atm atmosphere).

Hydrostatic Calculation

Electromagnetism: Coulomb's Law, DC Circuits & Magnetostatics

Electrical circuits and electromagnetic interactions account for 2 to 3 questions per test, focusing on Coulomb's law, circuit equivalent resistances, and electrical power.

1. Electrostatics: Coulomb's Law & Electric Fields**2. Direct Current (DC) Circuits: Ohm's Law & Resistor Networks****3. Capacitors & Magnetostatics****The 15-Second Elimination Shortcut: Circuit Analysis**

- **Identical Resistors in Parallel:** Two $5\,\Omega$ resistors in parallel $= 2.5\,\Omega$. Three $30\,\Omega$ resistors in parallel $= 10\,\Omega$. Four $100\,\Omega$ resistors in parallel $= 25\,\Omega$. Divide by n instantly.
- **Short-Circuit Bypass:** If a zero-resistance wire is placed in parallel with a resistor, all current bypasses that resistor entirely. Its effective current and power drop to zero.
- **Magnetic Work is Zero:** Any question asking for the kinetic energy increase of an electron moving solely through a magnetic field has the answer: 0.0 J (speed remains constant).

Crucial Conceptual Boundary

Does a stationary electric charge experience a magnetic force when placed inside a powerful magnetic field?

No! The magnetic Lorentz force equation is $F = qvB \sin(\theta)$. For a stationary charge, velocity is zero ($v = 0$), so the magnetic force is strictly zero ($F = 0$). Magnetic fields exert forces exclusively on moving charges.

The Resistor vs Capacitor Formula Inversion

Opposite Combining Rules:

Resistors in series add directly ($R_{eq} = R_1 + R_2$), whereas capacitors in series combine reciprocally ($1/C_{eq} = 1/C_1 + 1/C_2$). Conversely, parallel capacitors add directly ($C_{eq} = C_1 + C_2$), while parallel resistors combine reciprocally.

Never swap these rules.

Formula Inversion

Voltage vs Current in Series and Parallel

Kirchhoff Verification:

In a series circuit, current is identical everywhere, and voltage divides in direct proportion to resistance. In a parallel circuit, voltage is identical across every branch, and current divides in inverse proportion to resistance.

Circuit Invariant

Mathematics Core: Algebra, Trigonometry & Coordinate Geometry

The Mathematics component tests algebraic manipulation, quadratic equation theorems, coordinate geometry, and unit circle trigonometry.

1. Algebraic Equations, Inequalities & Logarithmic Laws

2. Coordinate Geometry & Analytic Equations

3. Unit Circle Trigonometry & Fundamental Identities

Angle (θ degrees)	Angle (θ radians)	$\sin \theta$	$\cos \theta$	$\tan \theta = \frac{\sin \theta}{\cos \theta}$
0°	0	0	1	0
30°	$\frac{\pi}{6}$	$\frac{1}{2} = 0.5$	$\frac{\sqrt{3}}{2} \approx 0.866$	$\frac{1}{\sqrt{3}} \approx 0.577$
45°	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2} \approx 0.707$	$\frac{\sqrt{2}}{2} \approx 0.707$	1
60°	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2} \approx 0.866$	$\frac{1}{2} = 0.5$	$\sqrt{3} \approx 1.732$
90°	$\frac{\pi}{2}$	1	0	Undefined ($\rightarrow \infty$)

The 15-Second Elimination Shortcut: Vieta's Root Inspection

- If an IMAT question asks for the sum or product of the roots of a quadratic equation such as $3x^2 - 12x + 5 = 0$, never waste time running the full quadratic formula.
- Sum of roots $= -\frac{b}{a} = -\frac{-12}{3} = +4$.
- Product of roots $= \frac{c}{a} = \frac{5}{3}$.
- You have solved the question in under 5 seconds with zero scrap calculation.

**Crucial Conceptual Boundary**

Does the equation of a circle $x^2 + y^2 - 4x + 6y - 12 = 0$ represent a circle with radius 12?

No! You must complete the square: $(x - 2)^2 - 4 + (y + 3)^2 - 9 - 12 = 0 \Rightarrow (x - 2)^2 + (y + 3)^2 = 25 = 5^2$. The circle has center at $(2, -3)$ and radius $r = \sqrt{25} = 5$, NOT 12.

The Negative Division Sign Flip

Inverting Inequalities:

Forgetting to flip the inequality sign when dividing by a negative number in an expression like $-3x \geq 12$ is a classic error. Dividing by -3 yields $x \leq -4$. Missing this sign flip leads directly into a prominent distractor choice.

Inequality Rule

Perpendicular vs Parallel Slopes

Negative Reciprocal:

Parallel lines share identical slopes ($m_1 = m_2$). Perpendicular lines have negative reciprocal slopes ($m_2 = -1/m_1$). If line 1 has slope $2/3$, a perpendicular line must have slope $-3/2$. Always verify the sign inversion.

Geometry Benchmark



THE RECOGNITION ILLUSION: WHY FAMILIARITY ISN'T MASTERY

Passive re-reading creates the dangerous illusion of competence. In high-velocity medical entrance exams like the IMAT, true mastery is demonstrated strictly by your ability to retrieve mechanisms and calculate values under clock pressure without hints. Convert this guide into active neural recall using the synchronized tools below.

DRILL PULSE DECK 4916



IMAT General Knowledge Sovereign Suite
596 Atomized Active Recall Cards

BATTLE SWARM QBANK



2,358-Item Topical QBank
Bank 13 Topicals & Bank 12 Past Papers

AUTHENTIC PAST PAPER LEDGER (VERIFIED HITS)

[CINECA 2024] Frictionless inclined plane acceleration: $a = g \sin(30^\circ) = 4.9 \text{ m/s}^2$

[MUR 2023] Parallel and series resistor network equivalent resistance and current

[Cambridge 2022] Trigonometric equation resolution on $[0, 2\pi]$: factoring quadratic in $\sin x$

[Cambridge 2021] Continuity equation in narrowed pipe: velocity scaling with inverse radius squared

[CINECA 2023] Coulomb electrostatic force proportional scaling: inverse square law ($1/r^2$)

[Cambridge 2020] Work-energy theorem: stopping distance scaling with the square of velocity

ESSENTIAL NUMERICAL VALUES & CONSTANTS

13

Physics and Math questions
(19.5 points)

21.7%

Total examination mark weight
commanded by Phys/Math

9.8 m/s²

Acceleration due to Earth
gravity ($\sim 10 \text{ m/s}^2$)

1,000 kg/m³

Density of pure water at
standard conditions

101,325 Pa

Standard atmospheric
pressure ($\sim 10^5 \text{ Pa} = 1 \text{ atm}$)

9.0 x 10⁹

Coulomb's electrostatic
constant k in $\text{N}\cdot\text{m}^2/\text{C}^2$

1 / 2

Exact value of $\sin(30^\circ)$ and
 $\cos(60^\circ)$

$\sqrt{3} / 2$

Exact value of $\cos(30^\circ)$ and
 $\sin(60^\circ)$ (~ 0.866)

3-PHASE MASTERY SCORECARD

Phase 1: Notes Mastered

Phase 2: Pulse Deck Cleared (0 Due)

Phase 3: QBank Accuracy > 90%