

# PGRE: Studying for Death?

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Attempting to avoid death by making a big study guide!

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## I. VARIABLE DEFINITIONS

$a \rightarrow$  acceleration

$c \rightarrow$  speed of light:  
standard  $\approx 3 * 10^8 \frac{m}{s}$

## II. CLASSICAL MECHANICS (20%)

Such as kinematics, Newton's laws, work and energy, oscillatory motion, rotational motion about a fixed axis, dynamics of systems of particles, central forces and celestial mechanics, three-dimensional particle dynamics, Lagrangian and Hamiltonian formalism, noninertial reference frames, elementary topics in fluid dynamics.

## III. ELECTROMAGNETISM (18%)

Such as electrostatics, currents and DC circuits, magnetic fields in free space, Lorentz force, induction, Maxwell's equations and their applications, electromagnetic waves, AC circuits, magnetic and electric fields in matter.

## IV. QUANTUM MECHANICS (12%)

Such as fundamental concepts, solutions of the Schrödinger equation (including square wells, harmonic oscillators, and hydrogenic atoms), spin, angular momentum, wave function symmetry, elementary perturbation theory.

## V. THERMODYNAMICS AND STATISTICAL MECHANICS (10%)

Such as the laws of thermodynamics, thermodynamic processes, equations of state, ideal gases, kinetic theory, ensembles, statistical concepts and calculation of thermodynamic quantities, thermal expansion and heat transfer.

## VI. ATOMIC PHYSICS (10%)

Such as properties of electrons, Bohr model, energy quantization, atomic structure, atomic spectra, selection rules, black-body radiation, x-rays, atoms in electric and magnetic fields.

## VII. OPTICS AND WAVE PHENOMENA (9%)

Such as wave properties, superposition, interference, diffraction, geometrical optics, polarization, Doppler effect.

## VIII. SPECIALIZED TOPICS (9%)

Nuclear and Particle physics (e.g., nuclear properties, radioactive decay, fission and fusion, reactions, fundamental properties of elementary particles), Condensed Matter (e.g., crystal structure, x-ray diffraction, thermal properties, electron theory of metals, semiconductors, superconductors), Miscellaneous (e.g., astrophysics, mathematical methods, computer applications)

## IX. SPECIAL RELATIVITY (6%)

Such as introductory concepts, time dilation, length contraction, simultaneity, energy and momentum, four-vectors and Lorentz transformation, velocity addition.

**X. LABORATORY METHODS (6%)**

Such as data and error analysis, electronics, instrumentation, radiation detection, counting statistics, interac-

tion of charged particles with matter, lasers and optical interferometers, dimensional analysis, fundamental applications of probability and statistics.