

MIT Physics Graduate General Exams Part 1 Checklist

Classical Mechanics

Conservation of momentum, energy, and angular momentum.

Harmonic motion

Normal Modes

Coupled systems

Coriolis Effect

Central Force Motion

Rocket Motion

Wave Motion (group and phase velocities)

Resonance

Gyroscopes

Lagrange Equations

Hamiltons Equations

Fluid Dynamics

Electricity and Magnetism

Maxwell's Equations: Gauss, Ampere's and Faraday's Laws

Superposition

Boundary Conditions

Dielectrics

Radiation

Energy of Fields

LaPlace's Equation and the Wave Equation

Time relationship of $B(t)$ and $E(t)$

Circuits: RLC analog circuits

Poynting Vectors

Retarded Potentials

Waves: Interference, Wave guides, resonators

Quantum Mechanics

Manipulation of Schrodingers Equation

Expansions and Superpositions

Addition of Angular Momentum

Non-degenerate time independent perturbation theory

Degenerate time independent perturbation theory

Stark Shift, Zeeman effect, and S-O coupling

Quantum Statistics: Boson/Fermion properties

Adiabatic and Sudden Approximations

Reflection and Transmission

Bohr Model

Hydrogen Atomic structure

Atomic notation

Very basic scattering problems

General solutions to HO and Well problems

Probability Conservation

Stat Mech/Thermo

Maxwell's Relations

Laws of Thermodynamics

Microcanonical Ensemble

Canonical Ensemble

Grand Canonical Ensemble - chemical potential as a function of temperature

Partition Functions

Statistics

Global Entropy Problems

Partial Derivative Math

State Functions

Blackbody Radiation

Bose/Fermi/Maxwell Statistics

Carnot cycles

Ideal Gas

Specific Heat

Degrees of Freedom

Special Relativity

Four vectors

Lorentz Transformations

Doppler shift

Velocity Addition

Relativistic energy and Momentum

Optics

Geometrical Optics

Index of Refraction (n) and its physical origin

Interference and Diffraction (Huygen's Prin.)