

Exam questions on discipline: Selected chapters of theoretical physics

Part (Блок) № 1

1. Laws of Thermodynamics.
2. Thermodynamic Potentials.
3. Operators and inverse operators, the uncertainty principle and the principle of superposition, matrices.
4. Schrödinger equation, flux density, linear oscillator, potential box, the transmission coefficient.
5. Energy and momentum.
6. Transformation matrices, matrix density.
7. Angular momentum, eigenvalues and eigen functions, parity states.
8. Motion in a centrally symmetric field.
9. Spherical coordinates, decomposition in plane waves.
10. Electrostatic and Gravitational Fields.
11. Conductors, Semiconductors, Isolators.
12. Gauss's Law for Electric Fields.
13. Gauss's Law for Magnetism.
14. Maxwell's Equations.
15. Lorentz Force.
16. Fields in a Medium.
17. Magnetic Properties.
18. Diamagnetism, Paramagnetism and Ferromagnetism.
19. Phase Transitions, Spontaneous Symmetry Breaking.
20. Black Body Radiation.
21. Dispersion of Light.
22. Reflection and Refraction.
23. Wave Function.
24. Operators and States in Quantum Mechanics.
25. Harmonic Oscillator. Ladder Operators.
26. Emission and Absorption of Radiation. Tunnel.
27. Exchange Interaction.
28. Exchange Energy and Ferromagnetism.
29. Paradoxes in Quantum Mechanics.
30. Schrodinger Cat.
31. Quantized Fields and Particles.
32. Dirac Equation.
33. Natural Units and the Metric Used in Particle Physics.
34. Quantum Electrodynamics. Unitarity.
35. Feynman Diagrams.
36. Real and Virtual Particles in Feynman Diagrams.
37. Compton Scattering, the formation of electron-positron pairs.
38. Quantum Vacuum and Casimir Effect.
39. Principle of Gauge Invariance. CPT Symmetry.
40. Electron Self-energy. Vacuum Polarization.
41. Theory of Weak Interactions.
42. YangMills Fields.
43. Nambu-Goldstone Theorem.
44. Electroweak Phase Transition. Diagram techniques.
45. Quantum numbers. Parity. C, P and T transformations.
46. Higgs Mechanism, Glashow Salam-Weinberg Model.
47. Neutrino Oscillations and Masses.

48. Hadrons and Quarks, Quantum Chromodynamics.
49. Grand Unification.
50. Inflation, Supersymmetry, Superstrings.