

GENERAL PHYSICS QUESTIONS

1. Newton's laws of motion, limits of their applicability, relativistic dynamics.
2. Law of universal gravitation, Kepler's laws.
3. Conservation laws in physics.
4. Mechanical properties of material media: liquids, elastic media, mechanical waves.
5. Laws of thermodynamics.
6. Phase transitions, classification of phase transitions, examples.
7. Statistical description of many-body systems, statistical ensembles.
8. Electromagnetic field, Maxwell's equations of the electromagnetic field.
9. Invariance of electrodynamics under Lorentz transformations, fundamentals of the special theory of relativity.
10. Electric and magnetic fields in material media, dielectric polarization, conductivity, magnetization.
11. Electromagnetic waves, dispersion, polarization, reflection and refraction of waves, diffraction and interference of waves, coherence.
12. Doppler effect for acoustic and electromagnetic waves.
13. Experimental basis of quantum mechanics, the uncertainty principle and its consequences.
14. Schrödinger equation, quantum harmonic oscillator, single-electron atom.
15. Approximate methods in quantum mechanics: perturbation theory, variational approach.
16. Periodic table of elements, chemical bonds, basic properties of molecules.
17. Electronic structure of solids, semiconductors, conductors, insulators.
18. Physical underpinnings of optical spectroscopy; atomic spectra, molecular spectra.
19. Black-body radiation.
20. Indistinguishability of elementary particles; spin-statistics relation. Ideal gas of bosons or fermions.
21. Structure of atomic nuclei and nuclear reactions; binding energy of a nucleus, radioactive decay.
22. Classification of elementary particles; quarks and leptons, structure of hadrons.