

## **Physics - oral examination**

### **List of questions**

1. Mass point kinematics. Kinematic quantities and their relations. Mass point motion.
  2. Newton laws. Application of Newton laws. Motion Equations.
  3. Inertial and non-inertial coordinate systems.
  4. Linear momentum. Impulse of force. Conservation of linear momentum.
  5. Work and kinetic energy and potential energy.
  6. Field of forces (contacting and non-contacting forces). Scalar and vector field. Conservative and non-conservative field of force.
  7. Newton's law of gravitation. Field of gravitation and field of gravity.
  8. Potential energy. Conservation of energy.
  9. Undamped oscillations. Motion Equation. Displacement of amplitude.
  10. Damped oscillations, forced oscillations, resonance
  11. System of mass points. Centre of mass. Isolated and non-isolated physical system. Conservation of linear momentum.
  12. Mass points' collision. Mass centre of a collision. Stationary target collision.
  13. Rigid body. Linear and angular motion. Combined motion (rolling). Kinetic energy for angular and combined motion.
  14. Torque. Angular momentum. Moment of inertia. Force and linear momentum. Torque and angular momentum. Conservation of angular momentum.
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1. Physics of continuum. Lagrangian and Eulerian description of continuum. Local and convective derivative.
  2. Surface and volume forces. Stress and strain. Stress tensor. Hooke's law. Equations of static equilibrium.
  3. Elastic waves. Wave sources. Generation and propagation of waves. Wave equation.
  4. Huygens-Fresnel principle. Wave front. Wave properties (interference, standing waves). Doppler effect.
  5. Acoustic waves. Intensity of wave. Level of intensity. Energy of waves.
  6. Fluid mechanics. Basic properties of liquids and gases. Perfect fluid. Fluid motion. Classification of flow.
  7. Mass balance equation. Mass conservation law. Continuity equation.
  8. Euler equation. Balance equations of linear momentum and energy. Bernoulli's principle.
  9. Application of Bernoulli's principle. Real fluid. Viscosity. Laminar and turbulent flow. Reynolds criteria. Circumfluence of objects. Surface stress.
  10. State variables. Thermodynamic equilibrium. Heat and temperature. Zeroth law of thermodynamics.
  11. Ideal (perfect) gas. Equation of state.
  12. Kinetic theory of gases. Internal energy of the gas. Equipartition theorem.
  13. Heat and work. Heat capacity. First law of thermodynamics.
  14. Heat transfer (convection, conduction, radiation). Heat conduction equation. Law of radiation.
  15. Quasi-static processes of ideal gas.
  16. Second law of thermodynamics. Third law of thermodynamics.
  17. Reversible and irreversible processes. Entropy. Carnot cycle.
  18. State of matter. Phase and phase diagrams. Phase transitions (melting, solidification, evaporation, condensation).