Questions for the oral exam

1) Basic notions of thermodynamics: intensive and extensive quantities, heat, work, temperature, equation of state, ideal gas, zeroth principle of thermodynamics, thermodynamic processes, perfect differential, state function
2) The first and second laws of thermodynamics, temperature as a integrating factor
3) Thermodynamic proof of independence of energy of an ideal gas on the system's volume, entropy change of isothermal decompression of an ideal gas
4) The heat capacity and Mayer equation
5) Adiabatic processes of an ideal gas
6) The third law of thermodynamics and its consequences
7) Free energy, free enthalpy and their properties
8) Fundamentals of classical Gibbs mechanics: ergodic hypothesis, microcanonical ensemble
9) Classical ideal gas in microcanonical ensemble, Gibbs paradox
10) Canonical ensemble, energy fluctuations
11) Real classical gases
12) Classical model of a crystal
13) Grand canonical ensemble, example of ideal gas, energy and particle number fluctuations
14) Fundamentals of quantum Gibbs mechanics, quantum ensembles
15) Quantum model of a crystal
16) Thermodynamic functions of quantum ideal gases
17) Quantum ideal gases in classical limit
18) Degenerated gas of fermions
19) Bose-Einstein condensation
20) Photon gas
21) Basic notions of kinetic theory of gases: distribution function and macroscopic quantities, equilibrium distribution function, interpretation of a pressure
22) Collisionless transport equation and Boltzmann collision term
23) H theorem
24) Collisional invariants and definition of thermodynamic equilibrium
25) Molecular chaos, Ehrenfests' model of dogs and fleas
26) Hydrodynamics of ideal fluid
27) Collision term in relaxation time approximation
28) Quasiequilibrium solutions of transport equation
29) Matching conditions and macroscopic quantities in quasiequilibrium
30) Dissipative energy flow and heat conductivity
31) Dissipative momentum flow and viscosity
32) Hydrodynamics of viscous fluid
33) Einstein approach to Brownian motion
34) Langevin formalism