**The Ministry of Education of the Republic of Azerbaijan**
**Baku State University**

**Head of department: Rena Kasumova**

**Signature:**

**Date: March 17, 2022**

**Department: Optics and molecular physics**
**Faculty: Physics**
**Program: Bachelor**

**The Exam questions in specialization of Physics and Physics teacher on the subject of "Molecular Physics" for the 2021/2022 academic semester (spring)**

1. The subject and methods of molecular physics.
2. Basic postulates of molecular kinetic theory. Mass and size atoms and molecules.
3. The basic equation of molecular kinetic theory.
4. Main conclusions from basic equation of molecular kinetic theory. Absolute temperature. Boltzmann constant.
5. Ideal gas model.
6. Equation of state of an ideal gas. Ideal gas laws.
7. Properties of the gas mixture. Partial pressure. Dalton's law.
8. Brownian motion.
9. Properties of molecular motions. The mean free path and average run time.
10. Characteristics of molecular movements. The average number of collisions.
11. Barometric formula.
12. Boltzmann distribution.
13. Perrin's experiment.
14. Experimental ways for measuring velocities of molecules.
15. Distribution of molecules according to velocities. Distribution function.
16. Distribution of molecules according to velocity components.
17. Distribution of molecules according to velocity values. Maxwell distribution.
18. Maxwell's distribution, expressed in relative velocities.
19. The Lammert-Eldridge experiment.
20. System and its state. Process.
21. Thermodynamic equilibrium. Temperature.
22. Internal energy.
23. The amount of Heat.
24. Work in thermodynamics.
25. The first law of thermodynamics. Application of the first law of thermodynamics to various processes.
26. Entalpy. Heat capacity.
27. Internal energy and heat capacity of monoatomic ideal gas. Mayer's formula.
28. The law of equal distribution of energy according to degrees of freedom.

29. Ideal gas heat capacity. Comparison of theoretical and experimental values of heat capacity.
30. Adiabatic process. Adiabatic equation.
31. Polytropic process. Polytropic equation.
32. The work done by the ideal gas in various processes.
33. Expansion of ideal gases to vacuum. Work done by ideal gas during isochoric, isobaric and polytopic process.
34. Comparison of the isotherm curve with the adiabat on PV diagram. Work done by ideal gas during isothermic and adiabatic processes.
35. Reversible and irreversible processes.
36. Cyclic process. The thermal efficiency.
37. The second law of thermodynamics.
38. The ideal heat engine. Carnot cycle.
39. The ideal Carnot machine efficiency. Carnot theorems.
40. Reduced heat capacity. Clausius inequality.
41. Entropy. Entropy change at reversible and irreversibly processes.
42. Expression for calculating entropy change for an ideal gas and its application to isothermal, isobaric and isochoric processes.
43. Calculation of the change in entropy of an ideal gas in different processes.
44. Expansion of an ideal gas into vacuum and calculation of the change in entropy of an isolated system during heat transfer between two bodies with temperature $T_1$ and $T_2$.
45. Entropy. Properties of entropy.
46. Entropy and thermodynamic probability. Boltzmann formula.
47. The third law of thermodynamics. Nernst theorem.
48. Conclusions from the third law of thermodynamics.
49. Intermolecular interactions.
50. The equation of state for real gases. Van der Waals equation.
51. Van der Waals isotherms. Critical point.
52. The reduced van der Waals equation of state
53. Internal energy of real gases.
54. Surface tension phenomenon in liquids.
55. Wetting and non-wetting liquids.
56. Additional pressure under the curved surface of the fluid. Laplace formula.
57. Capillarity.
58. Thermal conductivity of gases.
59. Diffusion in gases. Stationary diffusion.
60. Internal friction in gases. Viscosity.

**Instructor name: Irada Aliyeva**

**Signature:**

**Date: 17/03/2022**