F7AMBAF – Examination: Items (2021/2022)

1. Fundamentals of thermodynamics, Thermodynamic systems. State variables.
2. Heat. Thermal equilibrium. Temperature. Zeroth law of thermodynamics.
3. Thermal expansion and contraction.
4. Phase change and heat capacity. Specific and molar heat capacity.
5. Mechanisms of heat transfer: conduction, convection, radiation.
6. Ideal gases and the kinetic theory model.
7. Equipartition of energy
8. The first law of thermodynamics.
9. Internal energy (for an ideal gas). Heat capacities of an ideal gas (c_p, c_V).
10. Thermodynamic processes: isochoric, isobaric, isothermal, adiabatic.
11. Reversible and Irreversible processes.
12. The second law of thermodynamics. Entropy.
13. Heat engines. Efficiency.
14. The Carnot cycle. Efficiency of a Carnot engine.

15. Black body radiation.
16. Photoelectric effect.
17. Line Spectra. Diffraction grating.
18. Electron: Determination of electron (elementary) charge and mass.
19. X-ray Production: X-ray tube. X-ray spectra. Duane-Hunt rule.
20. Compton effect.
21. Pair production and annihilation.
22. X-Ray Scattering. Bragg's law.
23. Wave properties of particles.
24. Wave function. Monochromatic wave. Superposition of waves. Wave packets. Phase and group velocity.
25. Rutherford's experiment and model of the atom.
26. Bohr's model of the hydrogen-like atom.
27. Quantum theory of the hydrogen-like atom. Energy levels. Quantum numbers.
28. Spin.
29. Many-electron atoms. Atomic structure. Periodic table. Exclusion principle. Quantum numbers.
30. Charged particle in external magnetic field. Zeeman effect. Stern-Gerlach experiment.
31. Spectra of many-electron atoms. Characteristic X-ray spectra.