

Department of Physics

Baba Ghulam Shah Badshah University Rajouri

Syllabus for M. Sc. Physics Entrance Examination - 2020

Electricity and Magnetism

Alternating currents, Ampere's law, Biot-Savart law, Capacitors, Conductors, Coulomb's law, Dielectric polarization, Dielectrics, Displacement current, Electric field and potential, Electrostatic boundary conditions, Electrostatic energy, Faraday's law of electromagnetic induction, Gauss's law, Lorentz Force and motion of charged particles in electric and magnetic fields, Maxwell's equations and plane electromagnetic waves, Poynting's theorem, Reflection and refraction at a dielectric interface, Self and mutual inductance, Simple DC and AC circuits with R, L and C components, Solution of Laplace's equation for simple cases, Transmission and reflection coefficients, Volume and surface charges

Kinetic Theory and Thermodynamics

Reversible, irreversible and quasi-static processes, Carnot cycle, Elements of Kinetic theory of gases, First law and its consequences, Ideal gas, Isothermal and adiabatic processes, Laws of thermodynamics, Maxwell's thermodynamic relations and simple applications, Mean free path, Phase transitions and Clausius-Clapeyron equation, Second law and entropy, Specific heat of Mono-, di- and tri-atomic gases, Thermodynamic potentials and their applications, Van-der-Waals gas and equation of state, Velocity distribution and Equipartition of energy, Zeroth law and concept of thermal equilibrium

Oscillations, Waves and Optics

Damped and forced oscillators, Differential equation for simple harmonic oscillator and its general solution, Diffraction gratings, Doppler Effect, Double refraction and optical rotation. Energy density and energy transmission in waves, Fermat's Principle, Fraunhofer diffraction. General theory of image formation, Group velocity and phase velocity, Interference of light, optical path retardation, Linear, circular and elliptic polarization, Rayleigh criterion and resolving power, Resonance, Sound waves in media, Superposition of two or more simple harmonic oscillators, Thick lens, thin lens and lens combinations, Traveling and standing waves in one-dimension, Wave equation

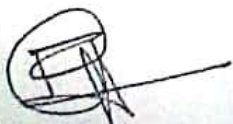
Mechanics and General Properties of Matter

Bernoulli's theorem, Capillarity, Centre of mass, Centrifugal and Coriolis forces, Conservation of energy, Conservation of linear and angular momentum, Conservative and non-conservative forces, Elastic and inelastic collisions, Elasticity, Equation of continuity, Equation of motion of the CM, Euler's equation, Gravitational Law and field, Hooke's law and elastic constants of isotropic solid, Kepler's laws, Kinematics of moving fluids, Moments of Inertia and products of Inertia, Motion under a central force, Newton's laws of motion and applications, Principal moments and axes, Rigid body motion, fixed axis rotations, Rotation and translation, Stress energy, Surface tension and surface energy, System of particles, Uniformly rotating frame, Variable mass systems, Velocity and acceleration in Cartesian, polar and cylindrical coordinate systems, Viscous fluids

Solid State Physics, Devices and Electronics

Crystal structure, Bravais lattices and basis, Miller indices, X-ray diffraction and Bragg's law, Einstein and Debye theory of specific heat, Free electron theory of metals, Fermi energy and

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density of states, Origin of energy bands, Concept of holes and effective mass, Elementary ideas about dia-, para- and ferromagnetism, Langevin's theory of paramagnetism, Curie's law, Intrinsic and extrinsic semiconductors, Fermi level, OR, AND, NOR and NAND gates, Transistors, P-N junctions, Amplifier circuits with transistors, Transistor circuits in CB, CE, CC modes, Operational amplifiers

Mathematical Methods

Calculus of single and multiple variables, Divergence theorem, First and linear second order differential equations, Green's theorem, Jacobian, imperfect and perfect differentials, Matrices and determinants, Multiple integrals, Partial derivatives, Stokes' theorem, Vector algebra & calculus

Modern Physics

Blackbody radiation, Bohr's atomic model and X-rays, Compton Effect, Inertial frames and Galilean invariance, Length contraction and time dilation, Lorentz transformations, Mass energy equivalence, Photoelectric effect, Postulates of special relativity, Relativistic velocity addition theorem, Uncertainty principle, Wave-particle duality, Schrödinger equation and its solution for one, two and three dimensional boxes, Reflection and transmission at a step potential, tunnelling through a barrier, Pauli Exclusion Principle, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics, Structure of atomic nucleus, mass and binding energy, Radioactivity and its applications, Laws of radioactive decay, Fission and fusion



Model Question Paper

M.Sc. Physics Entrance Test

Note: Attempt all questions. Each question carries 1 mark.

1. Which of the following is not a Lorentz Transformation

- (a). $x' = Y(x + vt)$ (b). $y = y'$
(c). $z = z'$ (d). $t' = Y(t - vx/c^2)$

Where $Y = (1 - v^2/c^2)^{-1/2}$

2. Landé's g-factor is given by the relation

- (a). $1 + [j(j+1) + s(s+1) - l(l+1)] / [(2j(j+1))]$ (b). $1 - [j(j+1) + s(s+1) - l(l+1)] / [(2j(j+1))]$
(c). $1 + [j(j+1) + s(s+1) + l(l+1)] / [(2j(j+1))]$ (d). $1 + [j(j+1) + s(s+1) - l(l+1)] / [(2j(j-1))]$

3. In Stern-Gerlach experiment _____ atom beam was used

- (a). Gold (b). Silver
(c). Argon (d). Carbon

4. The term symbol in which S is the total electron spin, L is the orbital angular momentum, and J the total angular momentum is given by

- (a). $2S-1L_J$ (b). $2J+1L_S$
(c). $2S+1L_J$ (d). $2S+1L_S$

5. The group velocity (v_g) and the phase velocity (v_p) are related by

- (a). $v_p v_g = c^2$ (b). $v_p v_g = c$
(c). $v_p v_g = 2c^2$ (d). $2v_p v_g = c^2$

6. The radius of the hydrogen atom is

- (a). 5.28 nm (b). 15.28 nm
(c). 528 nm (d). 0.528 nm

7. The electron wave function is

- (a). Symmetric (b). Antisymmetric
(c). Negative (d). Positive

8. Betatron is a

- (a). Machine (b). Detector



- (c). Particle accelerator (d). None of the above

9. Positron is a

- (a). Anti- electron (b). Anti- proton
(c). Anti-neutron (d). None of the above

10. The de-Broglie wavelength of an electron accelerated to a potential of 10kV is

- (a). 12.4 Å (b). 0.124 Å
(c). 14 Å (d). 2.4 Å

11. Matter waves are _____ in nature.

- (a). Longitudinal (b). Transverse
(c). Electromagnetic (d). Probabilistic

12. A particle with energy E is incident on a potential given by

$$V(x) = \begin{cases} 0, & x < 0 \\ V_0, & x \geq 0 \end{cases}$$

The wave function of the particle for $E < V_0$ in the region $x > 0$ (in terms of positive constants A , B and k) is

- (a) $Ae^{+kx} + Be^{-kx}$ (b) Be^{-kx}
(c) $Ae^{+kx} - Be^{-kx}$ (d) Zero

13. The internal energy of real gas

- (a). Volume (b). Pressure
(c). Temperature (d). Temperature & Volume both

14. The entropy of reversible process

- (a). Increases (b). Decreases
(c). Remains constant (d). None of the above

15. Diffusion is mainly due to

- (a). Temperature Gradient (b). Pressure Gradient
(c). Velocity Gradient (d). Concentration Gradient.

