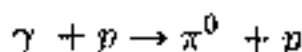


八十四學年度 物理研究 所 物理 組碩士班研究生入學考試

科目 古典物理 科號 0402 共 二 頁第 一 頁 *請在試卷【答案卷】內作答

1. The mass of the π^0 meson is 135 MeV. What is the minimum-energy γ -ray that can produce in the laboratory the reaction



when the initial proton is at rest? The mass of the proton is 938 MeV. (7 %)

2. A solid cylinder, a thin-walled cylindrical shell, a solid sphere, and a thin-walled spherical shell are all rolled down an inclined plane sloped at angle θ , each object has the same radius R . Find the acceleration of each. (14 %)
3. A particle of mass m_1 , having a velocity v_1 , is scattered by a particle of mass m_2 at an angle θ . Find the scattering angle Φ in the center-of-mass frame, the energy transfer, and the mass ratio for which the energy transfer is maximal. (12 %)
4. Find the potential of the electric field produced by a charge distribution in an infinite medium given by

$$\rho = \rho_0 \sin ax \sin by \sin cz .$$

(8 %)

5. A perfectly conducting spherical shell of radius R rotates about the z axis with angular velocity ω , in a uniform magnetic field $\mathbf{B} = B_0 \mathbf{k}$, where \mathbf{k} is a unit vector along the z axis. Calculate the emf developed between the "north pole" and the equator. (8 %)
6. Show that the electrostatic potential ϕ in a charge free region has no maximum or minimum. (8 %)
7. Consider a sphere that sinks into a liquid to a depth less than half its diameter when it is not charged. What should be the charge of the sphere so that it sinks to a depth exactly half its diameter? The mass of the sphere is M , its radius is R , and the liquid has a density μ and a permittivity ϵ . (10 %)
8. A system as a whole revolves with an angular velocity Ω . Find the canonical distribution in the revolving system of coordinates. (11 %)

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科目 古典物理 科號 0402 共一頁第二頁 *請在試卷【答案卷】內作答

9. A cylinder of height h and base radius R is filled with a perfect gas. The cylinder rotates with the angular velocity Ω about an axis perpendicular to the base and passing through its center. Determine the pressure of the gas on the surface of the cylinder if the number of particles in the gas is n and the mass of an individual particle is m . (11 %)
10. What amount of heat must be transferred to one mole of a real gas for it to expand from volume V_1 to volume V_2 if pressure p is kept constant. The equation of state is

$$\left(p + \frac{a}{V^2}\right)(V - b) = RT.$$

(11 %)