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淡江大學 103 學年度碩士班招生考試試題

系別：物理學系

科目：普通物理(含近代物理)

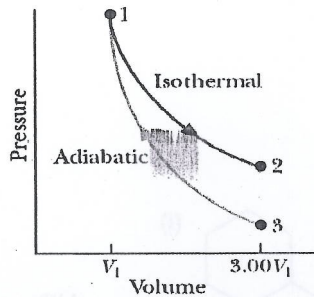
考試日期：3月2日(星期日) 第3節

本試題共 五 大題，一 頁

1. Suppose that an external force is applied at an angle θ on a block at rest as shown in below. The coefficient of kinetic friction between the block and surface is μ_k . At what angle should the force be applied to get the largest possible speed after the block has moved a distance d to the right? (20 points)



2. A horizontal rod of length L and mass M has a non-uniform linear density, $\lambda(x) = \lambda_0 x^2$, where $0 \leq x \leq L$ and λ_0 is a constant. (a) Find the center of mass of the non-uniform rod. (b) Compare your answer with that for a uniform cylindrical cone with height L and discuss their connection in details. (20 points)
3. One mole of diatomic ideal gas undergoes a cyclic path as shown in below. Determine (a) p_2 , p_3 , and T_3 in terms of p_1 , V_1 , T_1 , and R (gas constant). (b) Calculate W , Q , and ΔE_{int} for all three processes in terms of T_1 and R , where W is work done by the gas, Q is heat absorbed/emitted by the gas, and ΔE_{int} is the internal energy change of the gas. (20 points)



4. A disk of radius R has a uniform surface charge density σ . (a) Calculate the electric field at a point P that lies along the central perpendicular axis of the disk and a distance x from the center of the disk. (b) Justify your answer in the case of $x \gg R$. (20 points)
5. A photon with wavelength λ is absorbed by an electron confined to a one-dimensional box. As a result, the electron is excited from state $n = 1$ to $n = 4$, where n is a quantum number. (a) Find the length of the box. (b) Calculate the wavelength of the photon emitted in the transition of that electron from the state $n = 4$ to $n = 2$ in terms of the wavelength λ of the incoming photon. (20 points)