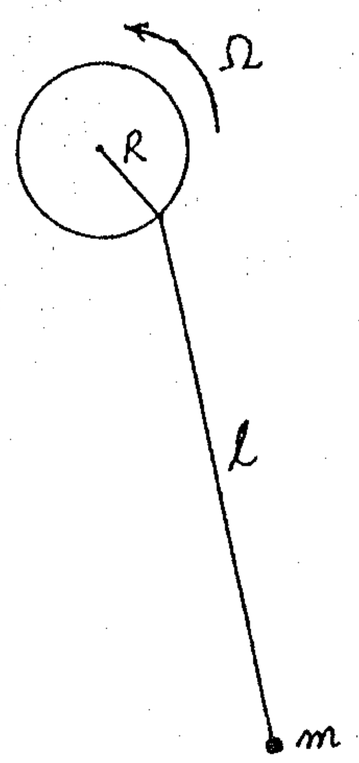
淡江大學八十八學年度碩士班招生考試試題

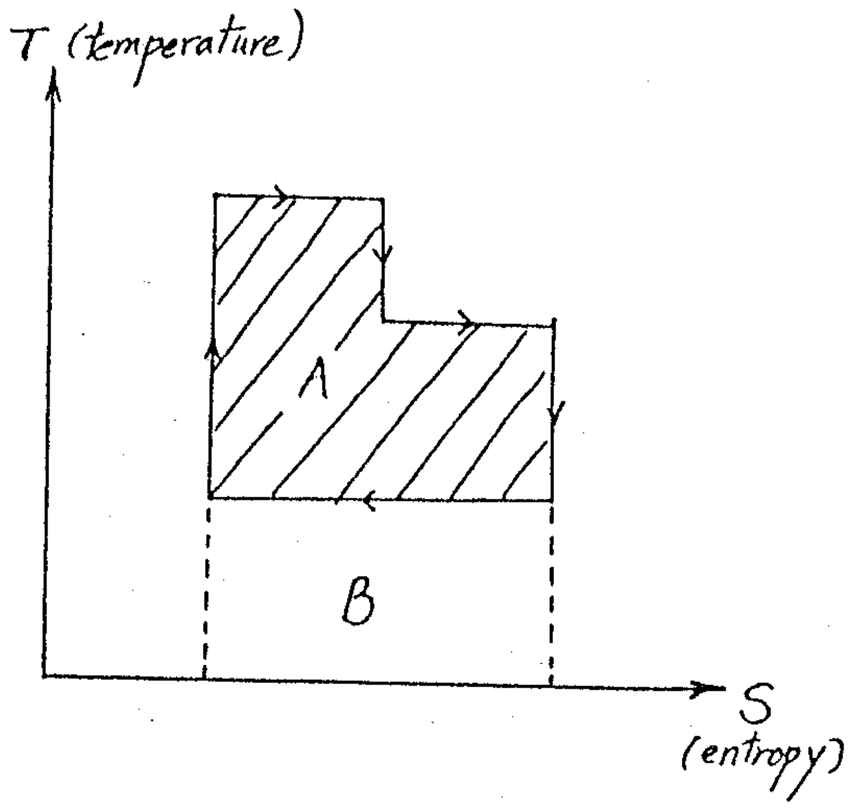
系別：物理學系　　科目：古典物理　　本試題共 2 頁

1. Determine the minimum distance between two particles, the one approaching from infinity with an impact parameter ρ and an initial velocity v and the other one at rest. The masses of the particles are m_1 and m_2, and the interaction between them is given by the potential $U(r) = \alpha/r$.

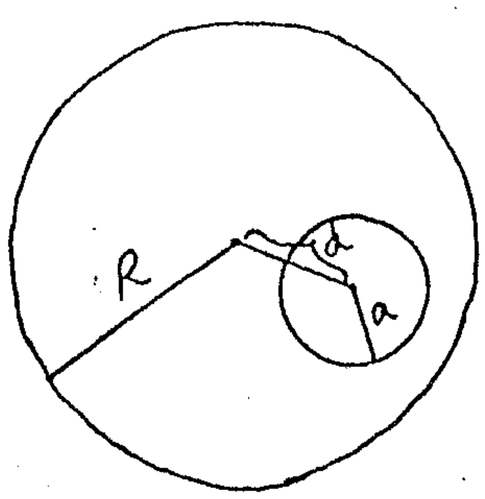
2. Find the frequency of small oscillations of a pendulum when its point of suspension moves uniformly along a circle of radius R and with frequency Ω as shown. The length of the pendulum is l with $l \gg R$.



3. An engine is represented by the cyclic process in the T-S diagram as shown, where A denotes the area of the shaded region and B the area of the region below it. (a) Find the efficiency of the engine. (b) Show that this engine is not as efficient as a Carnot engine operating between the highest and the lowest available temperatures.



4. A sphere of radius R has a uniform charge density ρ except for a spherical cavity of radius a as shown. Find the magnitude and direction of the electric field within the cavity.



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5. A thin metal wire ring, of mass m, radius a, and resistance R, rotates about an axis perpendicular to a uniform magnetic field B, as shown. Its inital angular frequency of rotation is ω_0. Find its subsequent angular frequency ω as a function of time t, under the assumption that energy is only dissipated by Joule heating.