

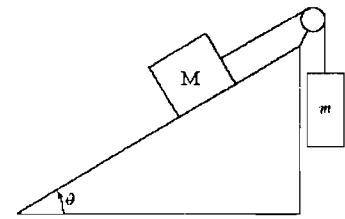
中國文化大學 99 學年度轉學招生考試

系組：物理學系三年級

日期節次：7 月 27 日第 4 節 15:20-16:40

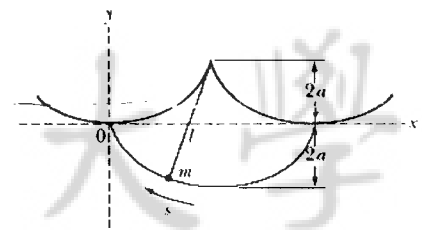
科目：力學 (135-77)

1. (20%) Two blocks of unequal mass (M and m) are connected by a string over a smooth pulley. If the coefficient of kinetic friction is μ_k , what angle θ of the incline allows the mass m (a) to move down at a constant speed (10%), and (b) to move up at a constant speed.(10%)



2. (20%) The position vector of a particle is given by $\vec{r} = \cos(\omega t)\hat{i} + \sin(\omega t)\hat{j}$. Show that
- (a) the velocity of the particle,(5%)
- (b) its velocity is perpendicular to position vector,(5%)
- (c) the acceleration of the particle,(5%)
- (d) the angular velocity.(5%)

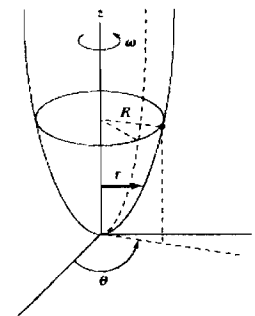
3. (30%) A pendulum is suspended from the cusp of a cycloid cut in a rigid support. The path described by the pendulum bob is cycloidal and is given by $x = a(\phi - \sin \phi)$, $y = a(\cos \phi - 1)$ where the length of the pendulum is $l = 4a$. (a) According to the figure to find the relationship of angle ϕ and the period T of oscillation.(10%) (b) By the conservation of energy, showing the speed is $v = \sqrt{-2gy}$.(10%) (c)



Using (a) and (b) to show the period of this oscillation will be

$$T = 2\pi\sqrt{4a/g} \text{ like a simple pendulum.}(10\%)$$

4. (15%) A bead slides along a smooth wire bent in the shape of a parabola $z = cr^2$. The bead rotates in a circle of radius R when the wire is rotating about its vertical symmetry axis with constant angular velocity ω . (a) Write down the Lagrangian L depends only on r .(10%) (b) Find the value of c .(5%)



5. (15%) A particle of mass m constrained to move on the surface of a cylinder defined by $x^2 + y^2 = R^2$. The particle is subject to a force $\vec{F} = -k\vec{r}$. Describe the motion of the particle.

