

PHYS 350: HOMEWORK ASSIGNMENT No. 1
(Sept. 14th, 2004)

HOMEWORK DUE: TUESDAY, SEPT. 21ST 2004
To be handed in during class- Late Homework will not be accepted

Question (1)

For the following problems, find the Lagrangian:

(i) A particle of mass M moves without friction on a massless circular wire of radius R , which is mounted so as to lie in a vertical plane; at the same time the plane of the wire rotates at an angular velocity Ω about a vertical axis through the centre of the circle. Assume a gravitational potential energy Mgz , where z is the height.

Draw a diagram of the problem, and find the Lagrangian in terms of the the 2 "generalised coordinates" ϕ and $\dot{\phi}$ (the angular displacement, and angular velocity, respectively, around the wire).

(ii) A particle of mass M_1 is connected by a rigid massless rod of length L to another particle of mass M_2 . The latter particle moves on a circular massless wire of radius R . Assume the wire and the rod are fixed to be in the same vertical plane, and that this plane cannot rotate.

Draw a diagram, and now find the Lagrangian in terms of the generalised coordinates of the system (of which there are now 4).

(iii) A particle of mass M moves in a gravitational field on a curve $z(x)$, where x is the horizontal displacement, and z the vertical displacement. Find the Lagrangian.

Question (2)

For each of the 3 problems introduced above in question (1), write down Lagrange's equations, starting from the Lagrangians you have already derived.