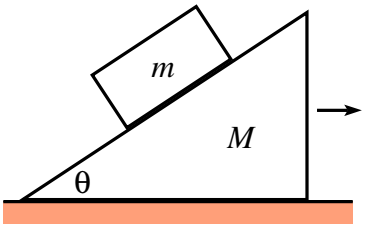
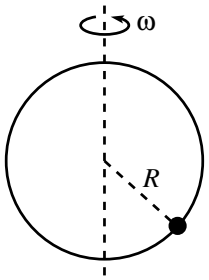
1 Newtonian or Lagrangian

A block of mass m is held at rest on a frictionless plane of mass M, angle of incline θ. The plane rests on a frictionless horizonal surface. Find the acceleration of m and M after the block is released.



2 Small oscillations

A bead is free to move without friction along a circular wire hoop of radius R, which rotates with constant angular speed ω about a vertical diameter. What is the minimum value of ω for which the bead will remain at a fixed θ_0? For a sufficiently large ω, what is θ_0 (as a function of ω)? What is the frequency of small oscillations about θ_0?



3 Coupled oscillations

Two masses are connected to each other by a massless spring of spring constant κ_{12} and to fixed walls by springs of spring constant κ. Find the characteristic frequencies of longitudinal modes.