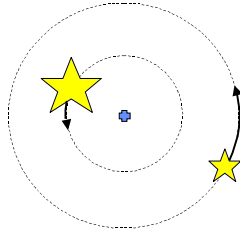## Problems Class 9

A binary star system consists of two stars of masses m_1 and m_2 each orbiting in a circle around their common centre of mass. Show that the orbital period of the system is:

$$T = 2\pi\sqrt{\frac{d^3}{G(m_1 + m_2)}},$$

where d is the separation of the two stars and G is the gravitational constant.


Problems Class 9

A uniform rod of length 1 metre, mass 2.5 kg, is suspended vertically from a smooth peg inserted in a small hole drilled 10 cm from the upper end. When the rod is displaced, the period of the resulting oscillations is 1.57 seconds. Use this observation to determine the moment of inertia about the point of suspension. Calculate the period when the rod is suspended from a hole that is 40 cm from its upper end. (You will need the formula $T = 2\pi\sqrt{\frac{I}{mgh}}$.)

Problems Class 9

Draw a phase diagram of the motion of
a pendulum consisting of a light rigid
rod connected to a massive bob. A
phase diagram, in this case, is a plot of
the angular displacement (abscissa)
against the angular velocity (ordinate).
Draw your diagram for various sets of
initial conditions. Do not restrict yourself
to small amplitude oscillations.
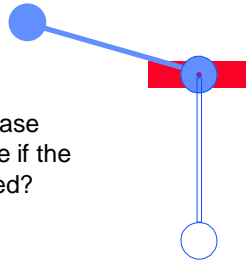
What will the phase
diagram look like if the
motion is damped?