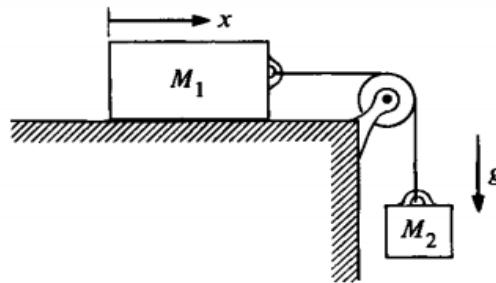


Academic Year 2022-23

Tutorial #02

PH100: Mechanics and Thermodynamics

1. A 5-kg mass moves under the influence of a force $\mathbf{F} = (4t^2 \mathbf{i} - 3t\mathbf{j}) \text{ N}$, where t is the time in seconds ($1 \text{ N} = 1 \text{ newton}$). It starts at rest from the origin at $t = 0$. Find (a) its velocity; (b) its position; and (c) $\mathbf{r} \times \mathbf{v}$, for any later time.
2. The two blocks shown in the sketch are connected by a string of negligible mass. If the system is released from rest, find how far block M_1 slides in time t . Neglect friction.



3. Two blocks are in contact on a horizontal table. A horizontal force is applied to one of the blocks, as shown in the drawing. If $m_1 = 2 \text{ kg}$, $m_2 = 1 \text{ kg}$, and $F = 3 \text{ N}$, find the force of contact between the two blocks.



4. Two particles of mass m and M undergo uniform circular motion about each other at a separation R under the influence of an attractive force F . The angular velocity is ω radians per second. Show that $R = (F/\omega^2)(1/m + 1/M)$.
5. In a concrete mixer, cement, gravel, and water are mixed by tumbling action in a slowly rotating drum. If the drum spins too fast the ingredients stick to the drum wall instead of mixing.

Assume that the drum of a mixer has radius R and that it is mounted with its axle horizontal. What is the fastest the drum can rotate without the ingredients sticking to the wall all the time? Assume $g = 32 \text{ ft/s}^2$.

6. The Atwood's machine shown in the drawing has a pulley of negligible mass. Find the tension in the rope and the acceleration of M .

