MNS Department
Semester: Summer-2025; Course ID: PHY 111
Course Title: Principles of Physics I; Total Marks: 15

Assignment-1

Instructions and information:

- Assignment submission last date: 21 July, 2025.
- Five marks will be reduced if you submit the assignment after the last date of submission.
- Solution of the assignment will be given 5 days after the last date of submission.
- We will not accept any assignment once the solution is provided.
- If anyone miss the assignment due to serious illness or emergency, he or she must has to inform the faculty immediately. We will give new assignment for him or her once he recovers from the emergency.
- We will call for conversation if we find any copy in assignment and necessary steps will be taken according to university policy.
- Average of the all given assignments will be counted (e.g. 3 out of 3).
- No extra assignment will be given (e.g. 2 out of 3).

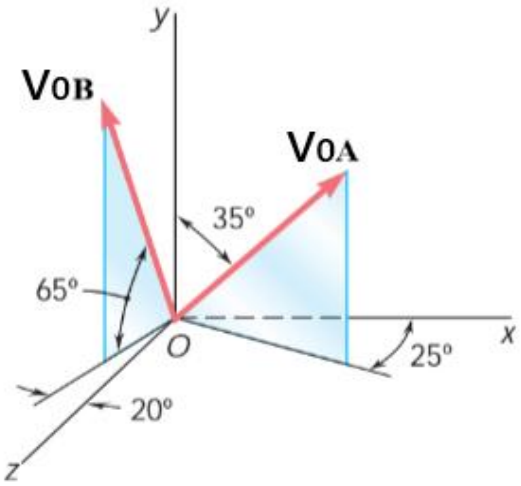

Fig. 1

1. Two particles A and B are projected from point O at the same time with the magnitude of initial velocities $\overrightarrow{V_{0A}} = 32\ m/s$ and $\overrightarrow{V_{0B}} = 40\ m/s$ as shown in Fig. 1. Consider vertical direction as Y axis and horizontal direction as XZ plane. Initial velocities and their components are make some angles with the Cartesian coordinate as shown in the Fig. 1. Both particles strike the ground in different location and embedded into the ground. Neglect the air resistance for the following calculations.

   (a) (2 marks) Calculate the time of flight of the particles.

   (b) (3 marks) Calculate the velocities of the particles at $t = 2\ sec$.

   (c) (3 marks) Find the final position of the particles with respect to point O and calculate the displacement of the particles after being striking the ground.

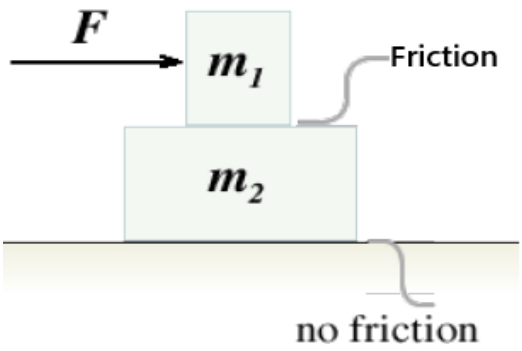

Fig. 2

2. Two blocks of masses $m_1 = 2.2\ kg$ and $m_2 = 4.8\ kg$ are stacked on top of each other and start at rest on the surface of a frictionless table as shown in Fig. 2. A force $\overrightarrow{F}$ is applied on block m_1 and coefficient of frictions between the blocks are $\mu_s = 0.4$ and $\mu_k = 0.3$.

   (a) (2 marks) Draw force diagrams for each of the blocks, clearly indicating all horizontal and vertical forces acting on them.

   (b) (3 marks) Find $\overrightarrow{F}_{max}$, the maximum value of $\overrightarrow{F}$ for which the upper block can be pushed horizontally so that the two blocks move together without slipping and find the acceleration of the system in this condition.

   (c) (2 marks) Assume that the magnitude of the force $\overrightarrow{F}$ is changed to $2\overrightarrow{F}_{max}$ and blocks do slip relative to each other. Determine each block's acceleration.