

Free-Fall and Packaging of Tennis Balls in Containers.

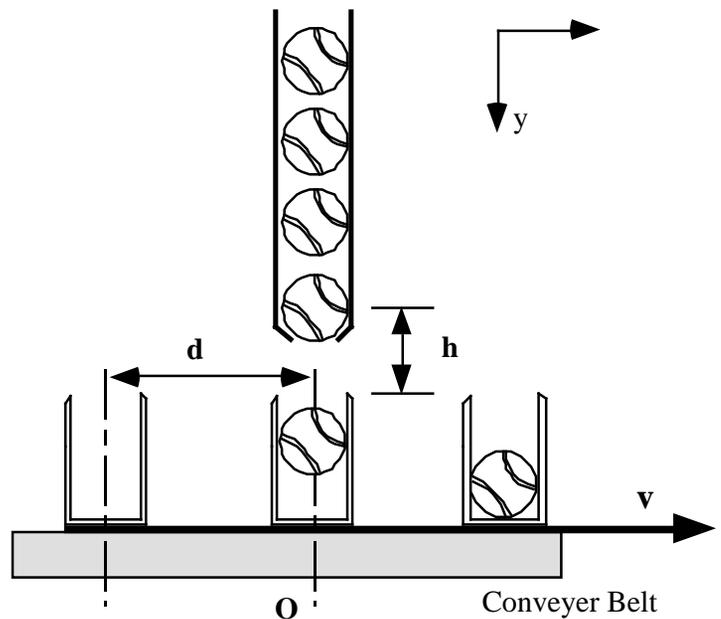
You are asked to help design the packaging system for tennis balls in containers on a conveyor belt and, for this mechanism to work efficiently, you need to have a complete understanding of the motion of the objects in a 2-D plane. The following problem illustrates this.

In this machine, similar to another you may have seen before, tennis balls are dropped into containers on a conveyor belt moving with a constant horizontal velocity “ v ”. The balls are released from rest at a height “ h ” above the opening of the container. Neglect the dimensions of the ball compared to the distance it travels.

Assume that the balls do not bounce out of the container.

Note that we chose the downward direction as positive.

- Determine the **distance** “ d ” from the container to the point O where the balls enter the container if the speed of the conveyor belt is 1.5 m/s and balls are released from a height of $h = 0.784 \text{ m}$.
- Assuming that the belt moves at 1.5 m/s , find the **height** from which balls must be released so they enter the containers separated by a distance $d = 0.45 \text{ m}$?
- If the ball is released from rest from a height $h = 0.784 \text{ m}$, find its **velocity** relative to the moving container at the instant it enters the container? Express your answer in **i** and **j** components.



- What is the **acceleration** of the ball relative to the container at the instant it enters the container?