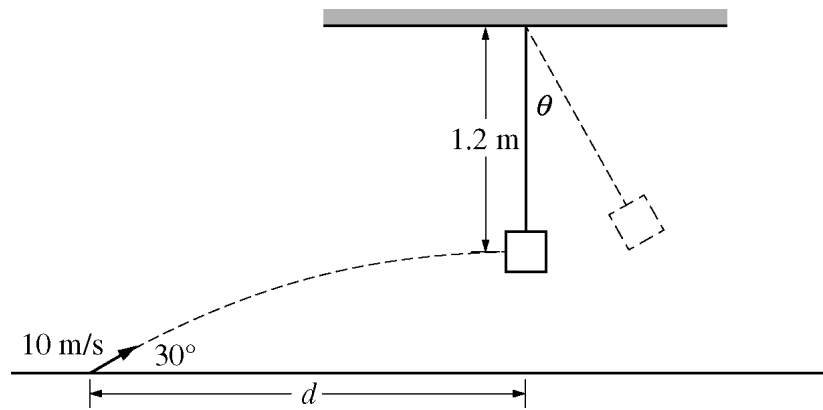




Mech.2.

A small dart of mass 0.020 kg is launched at an angle of 30° above the horizontal with an initial speed of 10 m/s . At the moment it reaches the highest point in its path and is moving horizontally, it collides with and sticks to a wooden block of mass 0.10 kg that is suspended at the end of a massless string. The center of mass of the block is 1.2 m below the pivot point of the string. The block and dart then swing up until the string makes an angle θ with the vertical, as shown above. Air resistance is negligible.

- Determine the speed of the dart just before it strikes the block.
- Calculate the horizontal distance d between the launching point of the dart and a point on the floor directly below the block.
- Calculate the speed of the block just after the dart strikes.
- Calculate the angle θ through which the dart and block on the string will rise before coming momentarily to rest.
- The block then continues to swing as a simple pendulum. Calculate the time between when the dart collides with the block and when the block first returns to its original position.
- In a second experiment, a dart with more mass is launched at the same speed and angle. The dart collides with and sticks to the same wooden block.
 - Would the angle θ that the dart and block swing to increase, decrease, or stay the same?
 _____ Increase _____ Decrease _____ Stay the same
 Justify your answer.
 - Would the period of oscillation after the collision increase, decrease, or stay the same?
 _____ Increase _____ Decrease _____ Stay the same
 Justify your answer.