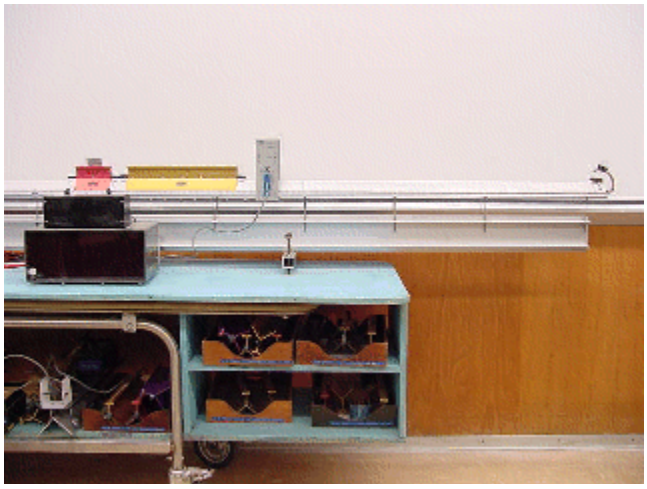
Answer #155

The answer is (b): the large glider will stop and the small glider will move to the left with twice its original speed, as seen in an mpeg video by clicking your mouse on the photograph below.



The digital display in the video shows the time taken for a 5cm tab on the smaller glider to pass through a photocell gate, labeled "A." Going to the right, its initial time is 78ms; on return, its time is 41 ms. The time approximately halved, so the speed is about doubled. The rest of the energy is lost in the collision (Well, it's ALMOST elastic!). There are a large number of cases in which an approximately 3:1 mass ratio of the colliding objects results in transfer of (almost) ALL of the energy to the smaller object.

This problem can easily be solved using conservation of energy and momentum; we will simply state the results here and leave the mathematics to the interested student.

Two collisions occur when the gliders approach the end of the air track (assume the initial speed of the gliders is V):

1. The large glider has an elastic collision with the end of the air track, and leaves with a speed of V to the left.
2. The two gliders then collide going with the same speed V in opposite directions.
3. The large glider stops and the small glider leaves the collision with all of the momentum and kinetic energy:

$$-MV + 3MV = M(2V) = 2MV$$

$$M V^2/2 + 3M V^2/2 = M (2V)^2/2 = 4M V^2/2.$$

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