

AP Collisions 1

1. A 100 kg running back jumps to score a touchdown. He is traveling 8 m/s just before the goal line when he is hit by a 115 kg linebacker traveling 7 m/s in the opposite direction. They stick together following the collision.

- a. What is the final speed of the combination?
- b. What direction do they travel after the collision? (Does he score a touchdown?)
- c. What type of collision is this?

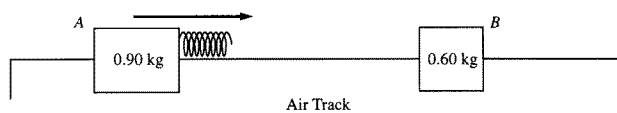
2. A 4 kg block is sliding along a frictionless surface at 5 m/s when it hits a 3 kg block that is traveling in the opposite direction at 2 m/s. After the collision, the 4 kg block is traveling 1 m/s in its original direction.

- a. What is the initial momentum of the system?
- b. What is the initial kinetic energy of the system?
- c. What is the final velocity of the 3 kg block?
- d. What is the final kinetic energy of the system?
- e. What type of collision is this?

3. Two 1.5 kg blocks are traveling toward each other when they collide elastically. One is traveling 4 m/s to the right, while the other is traveling 3 m/s to the left.

- a. What is the initial momentum of the system?
- b. What is the initial kinetic energy of the system?
- c. What is the final momentum of the system?
- d. What is the final kinetic energy of the system?
- e. What is the final velocity (speed and direction) of each block?

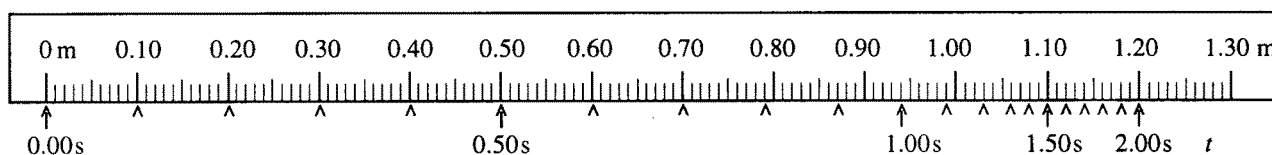
4. Two gliders move freely on an air track with negligible friction, as shown. Glider A has a mass of 0.90 kg and glider B has a mass of 0.60 kg. Initially, glider A moves toward glider B, which is



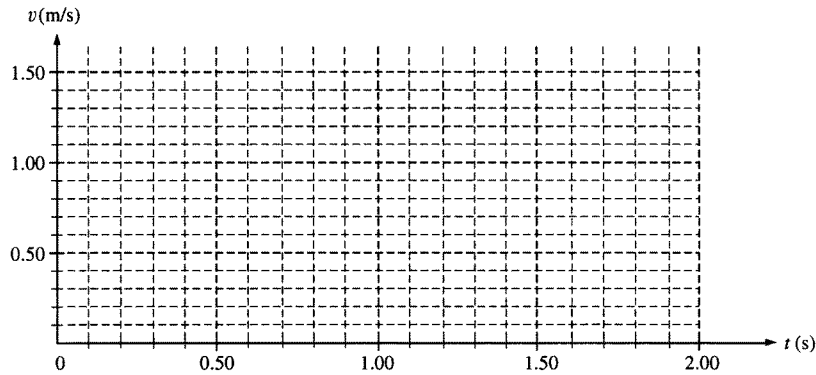
at rest. A spring of negligible mass is attached to the right side of glider A. Strobe photography is used to record successive positions of glider A at 0.10 s intervals over a total time of 2.00 s, during which time it collides with glider B.

The following diagram represents the data for the motion of glider A. Positions of glider A at the end of each 0.10s interval are indicated by the symbol A against a metric ruler. The total elapsed time t after each 0.50 s is also indicated.

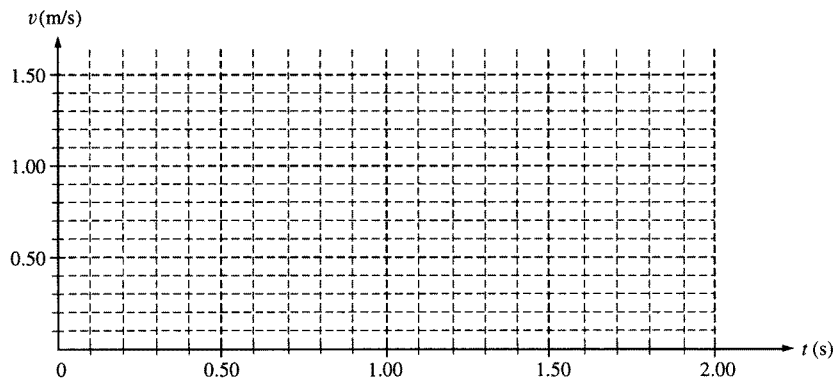
- a. Determine the average speed of glider A for the following time intervals.
 - i. 0.10 s to 0.30 s
 - ii. 0.90 s to 1.10 s
 - iii. 1.70 s to 1.90 s



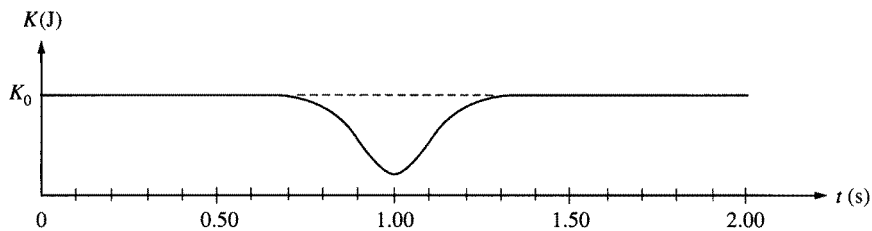
- b. On the axes below, sketch a graph, consistent with the data above, of the speed of glider A as a function of time t for the 2.00 s interval.



- c. i. Use the data to calculate the speed of glider B immediately after it separates from the spring.
 ii. On the axes below, sketch a graph of the speed of glider B as a function of time t .



A graph of the total kinetic energy K for the two-glider system over the 2.00 s interval has the following shape. K_0 is the total kinetic energy of the system at time $t = 0$.



- d. i. Is the collision elastic? Justify your answer.
 ii. Briefly explain why there is a minimum in the kinetic energy curve at $t = 1.00$ s.