

Begin your response to **QUESTION 5** on this page.

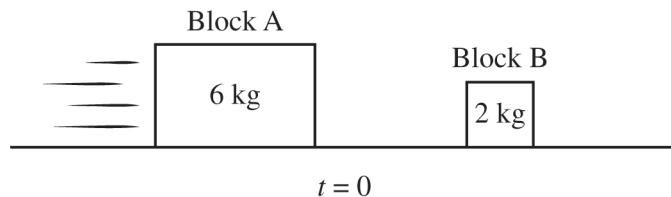


Figure 1

5. (7 points, suggested time 13 minutes)

At time $t = 0$, Block A slides along a horizontal surface toward Block B, which is initially at rest, as shown in Figure 1. The masses of blocks A and B are 6 kg and 2 kg, respectively. The blocks collide elastically at $t = 1.0\text{ s}$, and as a result, the magnitude of the change in kinetic energy of Block B is 9 J. All frictional forces are negligible.

- (a) **Determine** the speed of Block B immediately after the collision.

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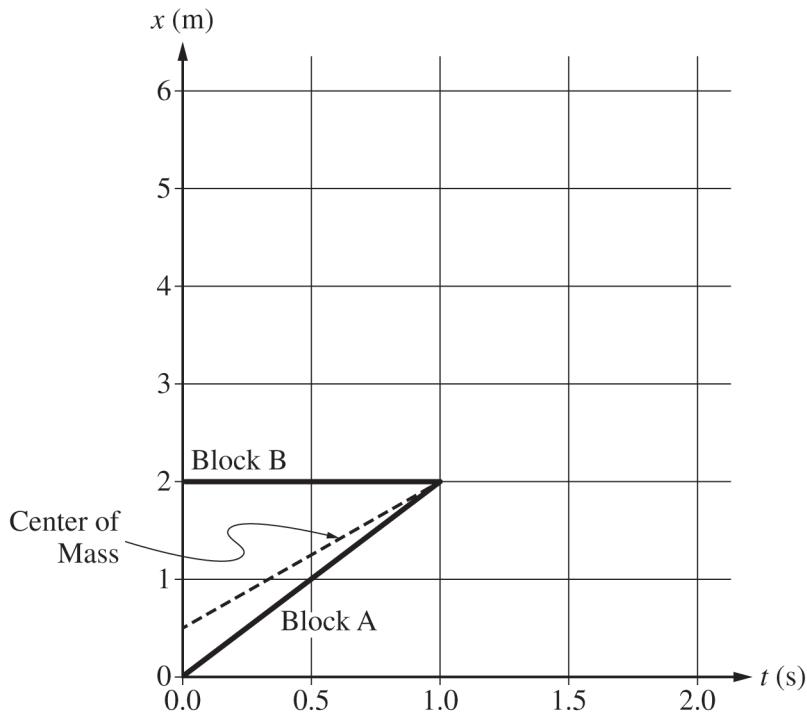


Figure 2

The graph shown in Figure 2 represents the positions x of Block A, Block B, and the center of mass of the two-block system as functions of t between $t = 0$ and $t = 1.0$ s.

- (b) On the graph in Figure 2, **draw and label** three lines to represent the positions of Block A, Block B, and the center of mass of the two-block system as functions of t between $t = 1.0$ s and $t = 2.0$ s. Each line should be distinctly labeled.
- (c) Consider if in the original scenario, instead of colliding elastically, the blocks collided and stuck together. **Describe** how the line drawn for the center of mass in part (b) would change, if at all. Briefly **justify** your response.

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Question 5: Short Answer**7 points**

- (a) For determining the speed of Block B to be 3 m/s 1 point

Example Response

$$\frac{1}{2}(2 \text{ kg})v_f^2 = 9 \text{ J}$$

$$v_f = 3 \text{ m/s}$$

Total for part (a) **1 point**

- (b) For drawing and labeling a straight line for the position of Block A with a lesser positive slope than the slope of its pre-collision line 1 point

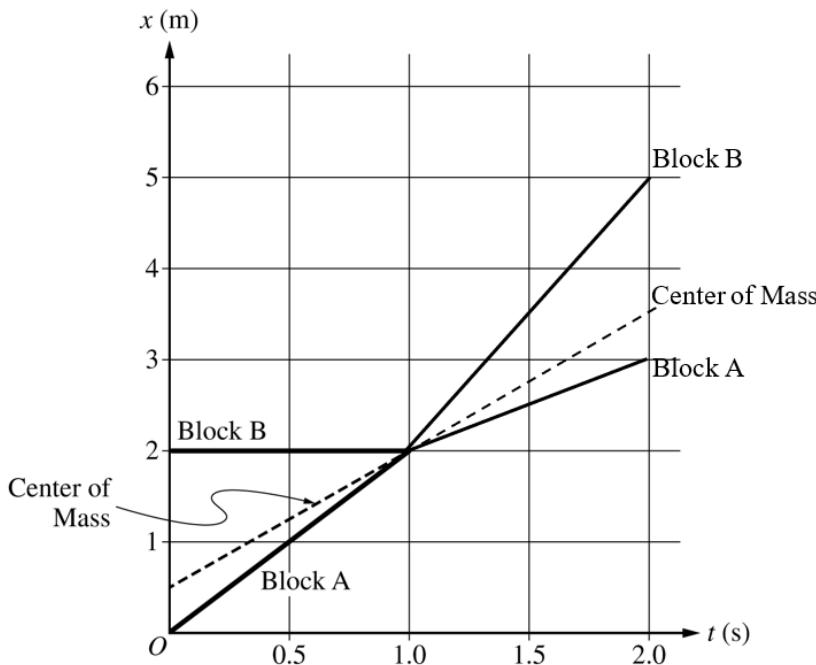
Scoring Note: The correct slope is not required to earn this point.

For drawing and labeling a straight line for the position of Block B with a positive, nonvertical slope **1 point**

Scoring Note: The correct slope is not required to earn this point.

For drawing a straight line for the center of mass of the two-block system position with the same slope as the pre-collision line **1 point**

For drawing lines for Block A and Block B with the correct slopes, 1 m/s and 3 m/s, respectively, that begin at $t = 1.0$ s and $x = 2$ m **1 point**

Example Response**Total for part (b)** **4 points**

(c)	For indicating the line drawn for the center of mass of both two-block systems is the same	1 point
	For an explanation that indicates one of the following:	1 point
	<ul style="list-style-type: none">• Momentum is conserved in an inelastic collision• No external forces exerted on the two-block system	

Example Response

The slope of the line drawn for the center of mass would remain the same as the that of the elastic collision because momentum is conserved. The lines for Block A and Block B would lie along the center of mass line because the blocks slide together.

Total for part (c) 2 points

Total for question 5 7 points