

TOPIC

Engineering Mechanics (Statics and Dynamics) – Section VII – Question 14

QUESTION

Object A has a mass of 3 kg and is moving to the right with a speed of 10m/s. Object B has a mass of 5 kg and is moving to the left with a speed of 8 m/s. If the coefficient of restitution is 0.8, the speed in m/s of A and B just after impact most nearly is



- A) $V_{Af} = 9.75, V_{Bf} = 9.35$
- B) $V_{Af} = 10.25, V_{Bf} = 4.15$
- C) $V_{Af} = 16.6, V_{Bf} = 31$
- D) $V_{Af} = 2.25, V_{Bf} = 3.35$

HINT:

- (1) This is a direct central impact problem. You need two equations.
 - a) Momentum in x -direction
 - b) Coefficient of restitution (e)
- (2) Be careful with signs, since momentum is a vector.

SOLUTION

a) Momentum in x -direction

$$\begin{aligned} \left(\overset{+}{\rightarrow}\right) m_A V_{Ai} + m_B V_{Bi} &= m_A V_{Af} + m_B V_{Bf} \\ 3(10) + 5(-8) &= 3V_{Af} + 5V_{Bf} \\ 3V_{Af} + 5V_{Bf} &= -10 \end{aligned} \quad (1)$$

b) Coefficient of restitution

$$\begin{aligned} e &= \frac{V_{Bf} - V_{Af}}{V_{Ai} - V_{Bi}} \\ 0.8 &= \frac{V_{Bf} - V_{Af}}{10 - (-8)} \\ V_{Bf} - V_{Af} &= 14.4 \end{aligned} \quad (2)$$

Solving (1) and (2) yields

$$\begin{aligned} V_{Af} &= -10.25 \text{ or } V_{Af} = \underline{10.25\text{m/s}} \leftarrow \\ V_{Bf} &= +\underline{4.15\text{m/s}} \rightarrow \end{aligned}$$

ANSWER

(A)

CONTRIBUTOR

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