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Mathematics 9709/42

Paper 4 Mechanics May/June 2023

Question No (2)

- 2 Two particles A and B , of masses 3.2kg and 2.4kg respectively, lie on a smooth horizontal table. A moves towards B with a speed of $v\text{ms}^{-1}$ and collides with B , which is moving towards A with a speed of 6ms^{-1} . In the collision the two particles come to rest.

(a) Find the value of v .

(b) Find the loss of kinetic energy of the system due to the collision.

Solution:

(a) Find the value of v

Solution given data

$m_1 = 3.2\text{kg}$	$m_2 = 2.4\text{kg}$
$u_1 = v\text{ms}^{-1}$	$u_2 = 6\text{ms}^{-1}$

after collision

$v_1 = 0$	$v_2 = 0$
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as initial momentum = final momentum

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$3.2(v) + 2.4(6) = 3.2(0) + 2.4(0) \quad (\text{-ve due to opposite direction})$$

$$3.2v - 14.4 = 0$$

$$3.2v = 14.4$$

$$v = \frac{14.4}{3.2}$$

$$v = 4.5\text{ms}^{-1}$$

HERO NOTES

b) Find the loss of kinetic energy of the system due to the collision

Solution

Initial kinetic energy

$$= \frac{1}{2} m v^2$$

$$= \frac{1}{2} (3.2)(4.5)^2$$

$$= 32.4$$

Final kinetic energy

$$= -\frac{1}{2} (2.4)(6)^2$$

$$= -43.2$$

(-ve due to opposite direction)

$$\text{Loss in K.E} = \text{Final K.E} - \text{Initial K.E}$$

$$= -43.2 - 32.4$$

$$= -75.6 \text{ J}$$

$$\text{or } 75.6 \text{ J}$$