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Mathematics

9709/42

Paper 4 Mechanics

October/November 2020

Question No (1)

- 1** Two particles  $P$  and  $Q$ , of masses  $0.2\text{ kg}$  and  $0.5\text{ kg}$  respectively, are at rest on a smooth horizontal plane.  $P$  is projected towards  $Q$  with speed  $2\text{ m s}^{-1}$ .

(a) Write down the momentum of  $P$ .

- (b) After the collision  $P$  continues to move in the same direction with speed  $0.3\text{ m s}^{-1}$ .

Find the speed of  $Q$  after the collision.

**Solution:**

Given For  
particle P

$$m = 0.2 \text{ kg}$$

$$v = 2 \text{ m s}^{-1}$$

$$u_p = 2 \text{ m s}^{-1}$$

P

$$0.2 \text{ kg}$$

$$u_q = 0$$

Q

$$0.5 \text{ kg}$$

$$\begin{aligned} \therefore \text{momentum} &= mv \\ &= (0.2)(2) \\ &= 0.4 \text{ kg m s}^{-1} \end{aligned}$$

(b)

Given

$$m_p = 0.2 \text{ kg}, \quad m_q = 0.5 \text{ kg}$$

$$\text{Before collision } u_p = 2 \text{ m s}^{-1}, \quad u_q = 0 \text{ m s}^{-1} \text{ (at rest)}$$

$$\text{after collision } v_p = 0.3 \text{ m s}^{-1}, \quad v_q = ?$$

using law of conservation of momentum

$$m_p u_p + m_q u_q = m_p v_p + m_q v_q$$

$$\Rightarrow (0.2)(2) + (0.5)(0) = (0.2)(0.3) + (0.5) v_q$$

$$0.4 + 0 = 0.06 + 0.5 v_q$$

$$0.5 v_q = 0.34$$

$$\Rightarrow v_q = \frac{0.34}{0.5} = 0.68 \text{ m s}^{-1}$$

$$\Rightarrow v_q = 0.68 \text{ m s}^{-1}$$

