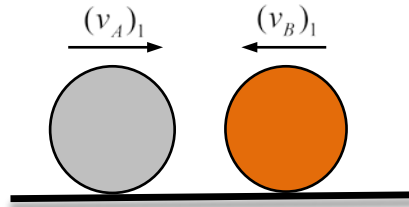


2-24. Two balls A and B are moving on a smooth ground in opposite directions. They collide with initial velocities $(v_A)_1 \sim N(4, 0.4^2)$ m/s and $(v_B)_1 \sim N(5, 0.5^2)$ m/s . If $m_A = 2$ kg and $m_B = 4$ kg , and the coefficient of restitution between the two balls is $e = 0.6$, determine the velocity of A just after collision. $(v_A)_1$ and $(v_B)_1$ are independent.



$$m_A(v_A)_1 + m_B(v_B)_1 = m_A(v_A)_2 + m_B(v_B)_2$$

$$e = \frac{(v_B)_2 - (v_A)_2}{(v_A)_1 - (v_B)_1}$$

$$(v_B)_2 = (v_A)_2 + e[(v_A)_1 - (v_B)_1]$$

$$m_A(v_A)_1 + m_B(v_B)_1 = m_A(v_A)_2 + m_B(v_A)_2 + m_B e[(v_A)_1 - (v_B)_1]$$

$$(v_A)_2 = \frac{(m_A - m_B e)(v_A)_1 + (1 + e)m_B(v_B)_1}{m_A + m_B}$$

$$\mu_{(v_A)_2} = \frac{(m_A - m_B e)\mu_{(v_A)_1} + (1 + e)m_B\mu_{(v_B)_1}}{m_A + m_B} = -5.6 \text{ m/s} = 5.6 \text{ m/s} \leftarrow$$

$$\sigma_{(v_A)_2} = \sqrt{\left(\frac{m_A - m_B e}{m_A + m_B}\right)^2 \sigma_{(v_A)_1}^2 + \left(\frac{(1 + e)m_B}{m_A + m_B}\right)^2 \sigma_{(v_B)_1}^2} = 0.53 \text{ m/s}$$

Therefore, $(v_A)_2 \sim N(5.6, 0.53^2)$ m/s .

Ans.