Answer on Question #71678-Physics-Other

Object A is moving due east, while object B is moving due north. They collide and stick together in a completely inelastic collision. Momentum is conserved. Object A has a mass of mA = 16.6 kg and an initial velocity of 0A = 8.72 m/s, due east. Object B, however, has a mass of mB = 29.8 kg and an initial velocity of 0B = 5.07 m/s, due north. Find the (a) magnitude and (b) direction of the total momentum of the two-object system after the collision.

Solution

The x-component (East) of the total momentum is

$$p_x = m_a v_a = (16.6\,)(8.72) = 144.752\,\frac{kgm}{s}$$

The y-component (North) of the total momentum is

$$p_y = m_b v_b = (29.8)(5.07) = 151.086\,\frac{kgm}{s}$$

(a) The magnitude of the total momentum of the two-object system after the collision is

$$p = \sqrt{p_x^2 + p_y^2} = \sqrt{(144.752)^2 + (151.086)^2} = 209\,\frac{kgm}{s}.$$

(b) The direction of the total momentum of the two-object system after the collision is

$$\theta = \tan^{-1}\left(\frac{p_y}{p_x}\right) = \tan^{-1}\left(\frac{151.086}{144.752}\right) = 46.2°\ north\ of\ east.$$

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