

51. Suppose the objects enter the collision along lines that make the angles $\theta > 0$ and $\phi > 0$ with the x axis, as shown in the diagram below. Both have the same mass m and the same initial speed v .

We suppose that after the collision the combined object moves in the positive x direction with speed V . Since the y component of the total momentum of the two-object system is conserved, $mv \sin \theta - mv \sin \phi = 0$. This means $\phi = \theta$. Since the x component is conserved, $2mv \cos \theta = 2mV$. We now use $V = v/2$ to find that $\cos \theta = 1/2$. This means $\theta = 60^\circ$. The angle between the initial velocities is 120° .

