Quick Review

$p = mv$

Momentum = mass × velocity

Impulse momentum theorem

$\Delta p = Ft$

Δ momentum = Force × time

momentum is a vector

measured in kgm/s

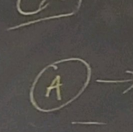
Conservation of momentum

The total momentum of a system is conserved unless there is a net external force

$p_0 = p_f$

initial momentum = final momentum

Ex) Pool



$p_0 = 0.72\ kgm/s$ to the right

$p_F = 0.72\ kgm/s$ to the right

Before collision

Mass A	velocity A	momentum A
0.16 kg	4.5 m/s	0.72 kgm/s
Mass B	velocity B	momentum B
0.16 kg	0 m/s	0 kgm/s

$p_0 = 0.72\ kgm/s$ to the right

After collision

Mass A	Velocity A	Momentum A
0.16 kg	0.11 m/s	0.0176 kgm/s

Mass B	velocity B	Momentum B
0.16 kg	4.39 m/s	0.7024 kgm/s

$p_f = 0.72 \frac{kg\,m}{s}$ to the right

$0.01762 \frac{kgm}{s} + 0.7024 \frac{kgm}{s} = 0.72 \frac{kgm}{s}$

$p = mv$ $\quad p_0 = p_f$

2 objects

$m_1v_{1_0} + m_2v_{2_0} = m_1v_{1_f} + m_2v_{2_f}$

50 kg, 2 kg $\quad p_0 = 0$

v_i $\quad \rightarrow 2\,m/s$

$p_f = 0$

$m_1v_1 = m_2v_2$

$(50kg)v_1 = (2kg)(2\,m/s) = 4\,kgm/s$

$v_1 = \frac{4\,kgm/s}{50\,kg} = 0.08\,m/s$

Classwork

1) A 63.0 kg astronaut is stuck in space. He throws a 10.0 kg oxygen tank away from the spacecraft with a velocity of 12.0 m/s, propelling the astronaut back to the shuttle. If the astronaut starts from rest, what is the final speed of the astronaut?

2) A boy stands on a raft at rest. He then starts to walk to the right. Does the raft move? What is the total momentum of system?