A.2

Conservation of Momentum

IB PHYSICS - MOTION

What is Momentum??

A.2

"Inertia in Motion"

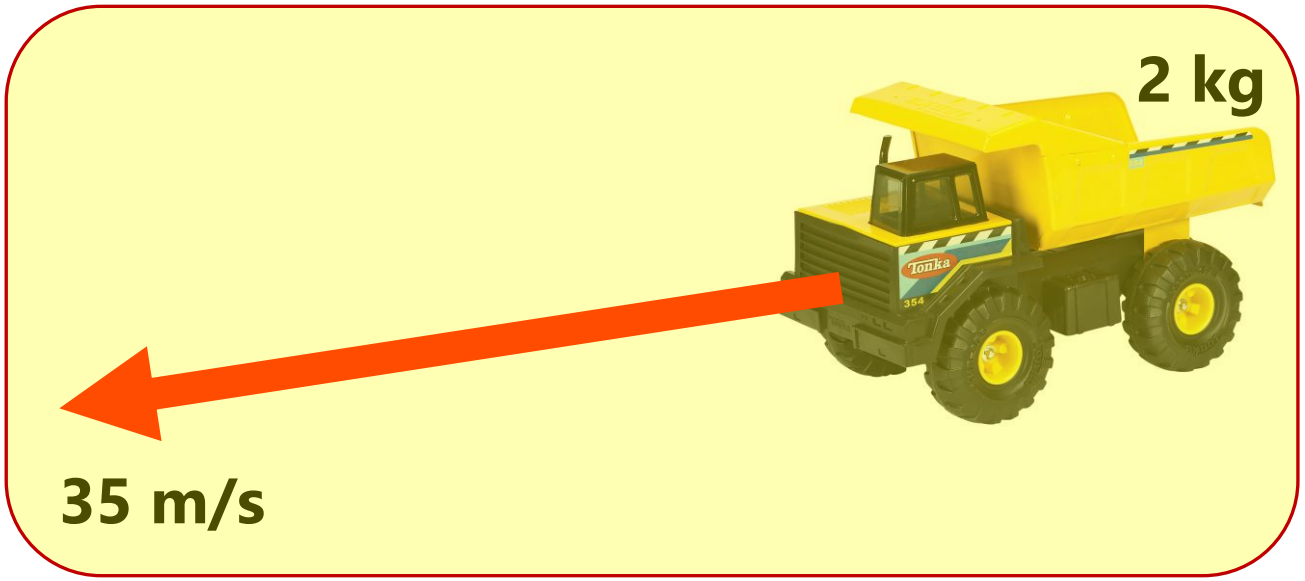
Which has more Momentum??

A.2

Why?

More mass

Which has more Momentum??



Why?

More velocity

A.2

Momentum Equation

Momentum = mass × velocity

Symbols

$$p = m \times v$$

Units

$$kg\ m\ s^{-1} = kg \times m\ s^{-1}$$

IB Physics Data Booklet

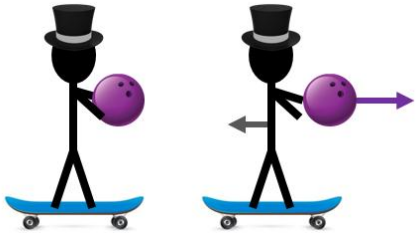
A.2

A.2 Forces and momentum	
	$F_f \leq \mu_s F_N$
	$F_f = \mu_d F_N$
	$F_H = -kx$
	$F_d = 6\pi\eta rv$
	$F_b = \rho Vg$
	$F_g = mg$
	$p = mv$
	$J = F\Delta t$
	$F = ma = \frac{\Delta p}{\Delta t}$
	$a = \frac{v^2}{r} = \omega^2 r = \frac{4\pi^2 r}{T^2}$
	$v = \frac{2\pi r}{T} = \omega r$

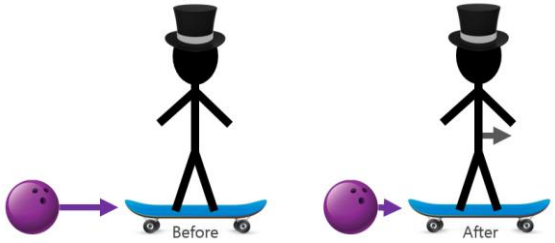
Conservation of Momentum

A.2

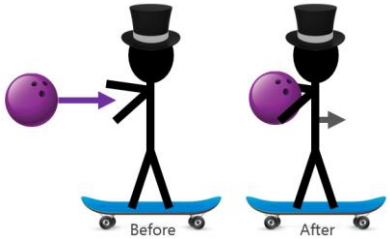
The total momentum of a system is constant



"Explosion"



"Hit and Bounce"

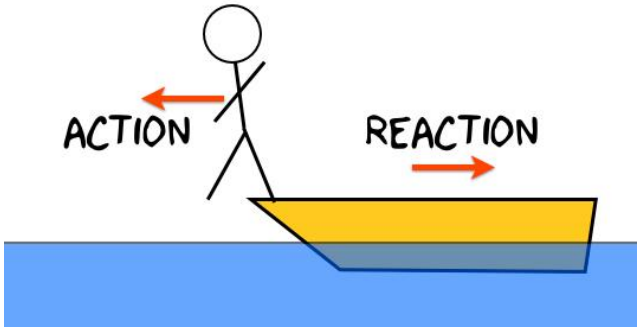


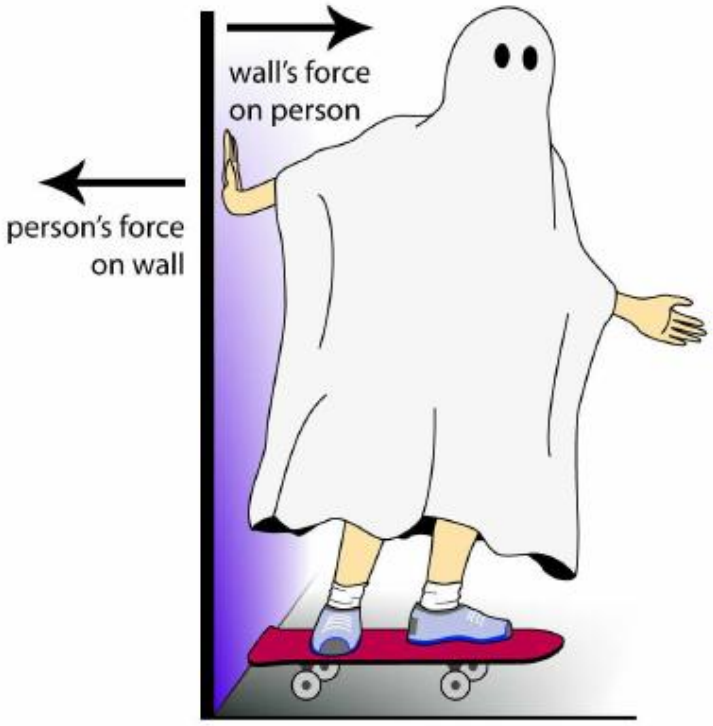
"Hit and Stick"

Newton's Third Law

A.2

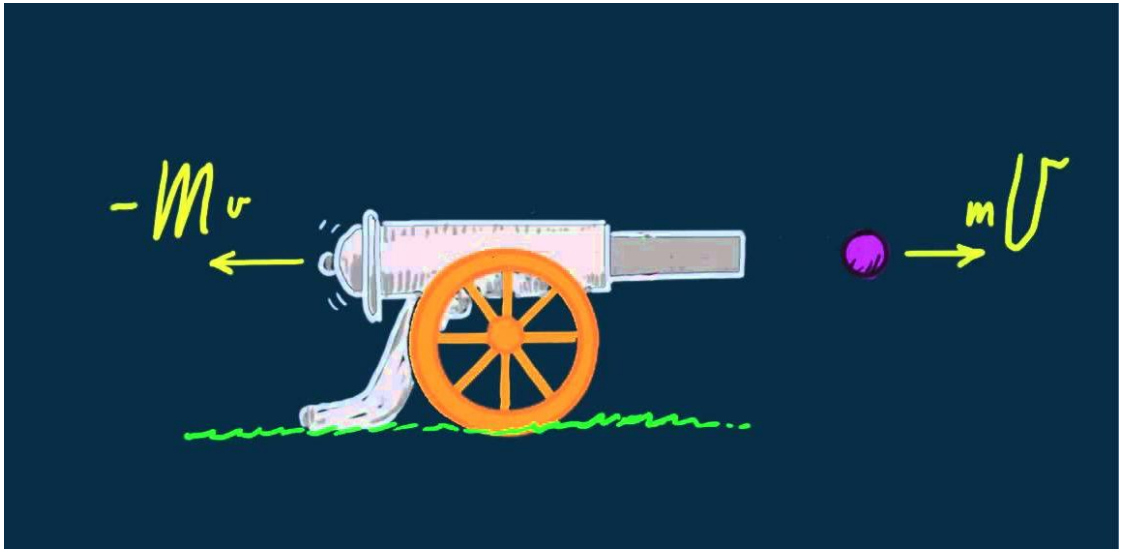
For every action, there is an equal and opposite reaction





Conservation of Momentum

A.2



When a cannonball is fired out of a cannon, there is a recoil…

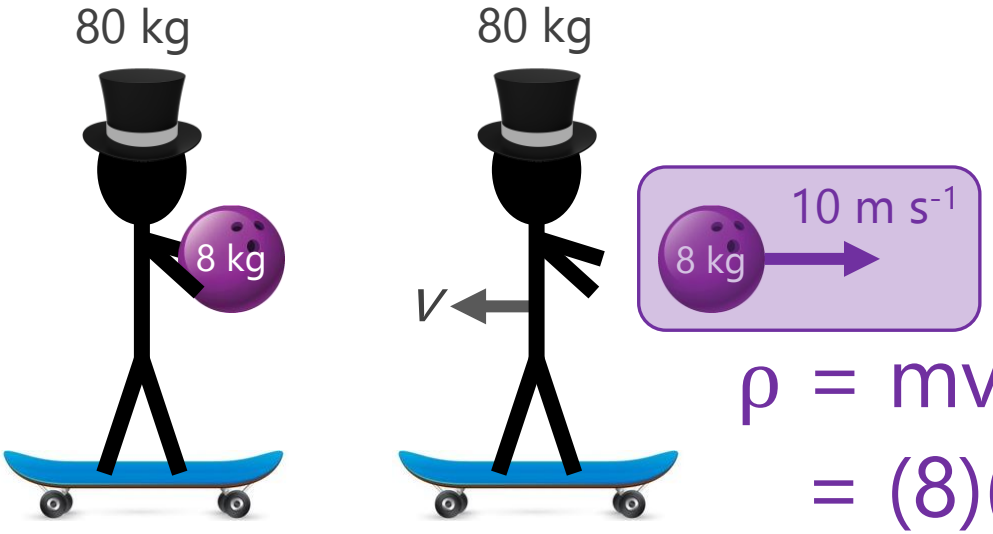
Equal and Opposite…

More mass → Less velocity

Less mass → More velocity

Explosion

A.2

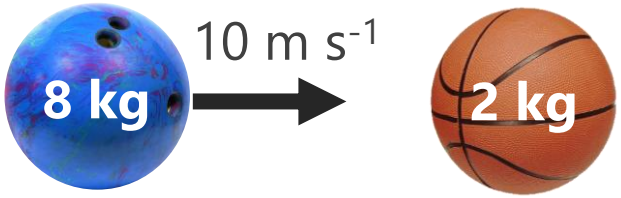


$$\rho = mv$$
$$= (8)(10)$$
$$= 80 \text{ kg m s}^{-1}$$

$$mv = mv$$
$$(80)(v) = (8)(10)$$
$$\boxed{\mathbf{v = 1 \text{ m s}^{-1}}}$$

Hit and Bounce #1

A.2



Before After

$(8)(10) + (2)(0) = (8)(2) + (2)(v)$

$80 + 0 = 16 + 2v$

$v = 32\ m\ s^{-1}$

Hit and Bounce #2

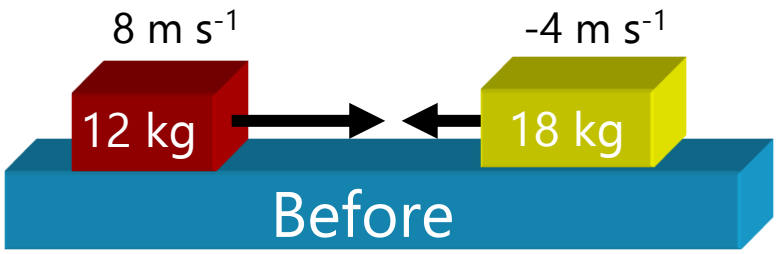
A.2

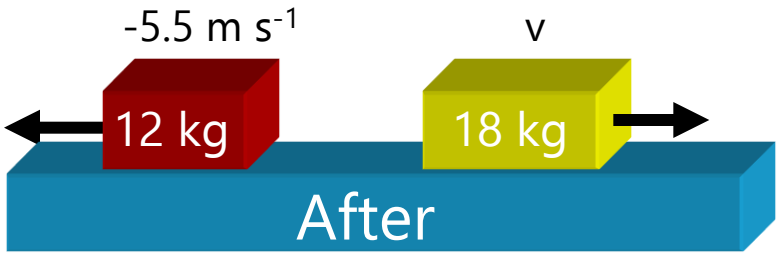
Before | After

$$(12)(8) + (18)(-4) = (12)(-5.5) + (18)(v)$$

$$96 + -72 = -66 + 18v$$

$$\mathbf{v = 5\ m\ s^{-1}}$$





Hit and Stick

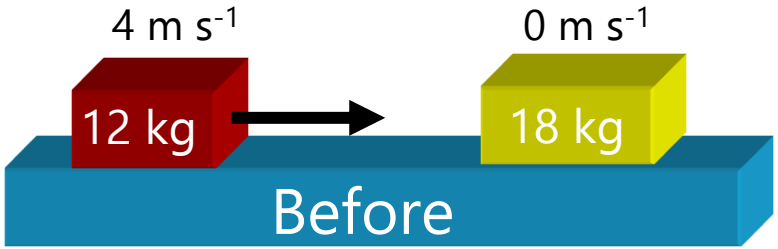
A.2

Before After

$(12)(4) + (18)(0) = (30)(v)$

$96 + 0 = 30v$

$$\mathbf{v = 1.6\ m\ s^{-1}}$$



Lesson Takeaways

A.2

- ❑ I can define and calculate momentum
- ❑ I can calculate “before” and “after” momentums for multiple objects
- ❑ I can use the conservation of momentum to solve for missing variables in linear collisions
- ❑ I can describe the process required for explosion, hit and bounce, and hit and stick scenarios