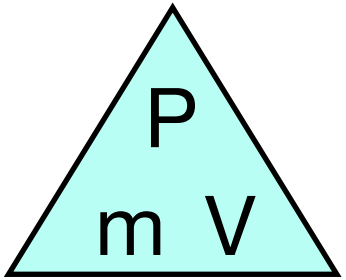
Momentum


Momentum

Momentum (P)



units: Kg x m/s = Kgm/s

velocity V = 20 m/s

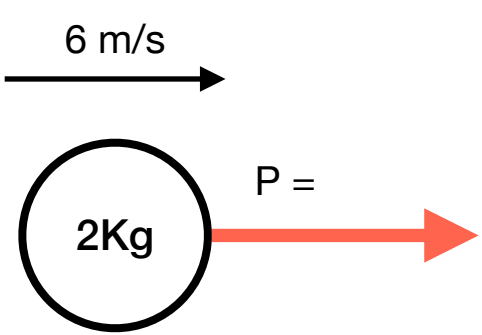
P = M x V
P = 4000 x 20
P = 80,000 Kgm/s

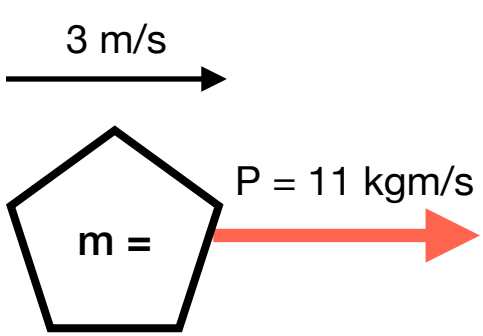
mass M = 4000 Kg

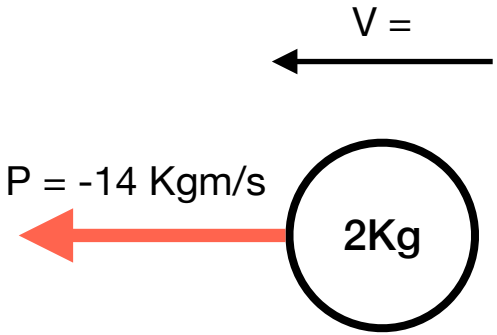
P = M x V
P = 4000 x -20
P = -80,000 Kgm/s

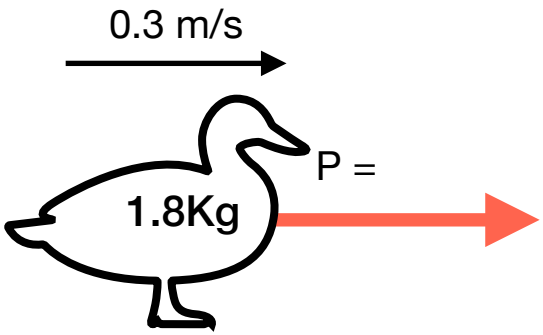
velocity V = -20 m/s

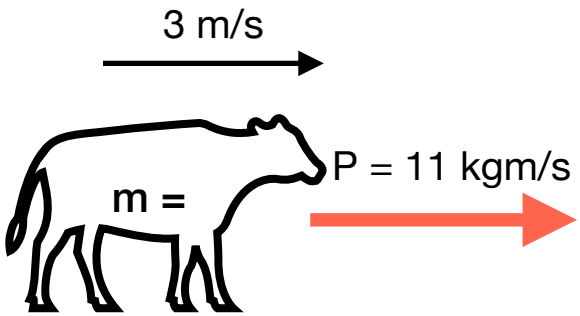
mass M = 4000 Kg

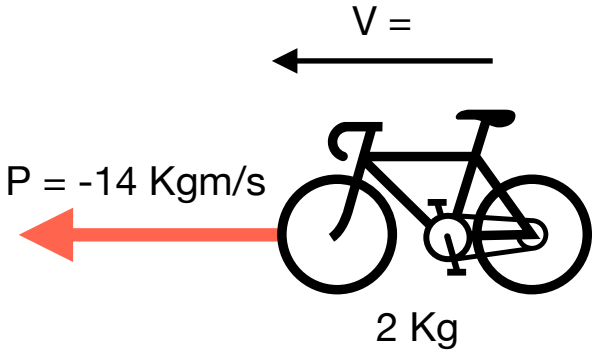

6 m/s
2Kg
P =


3 m/s
m =
P = 11 kgm/s

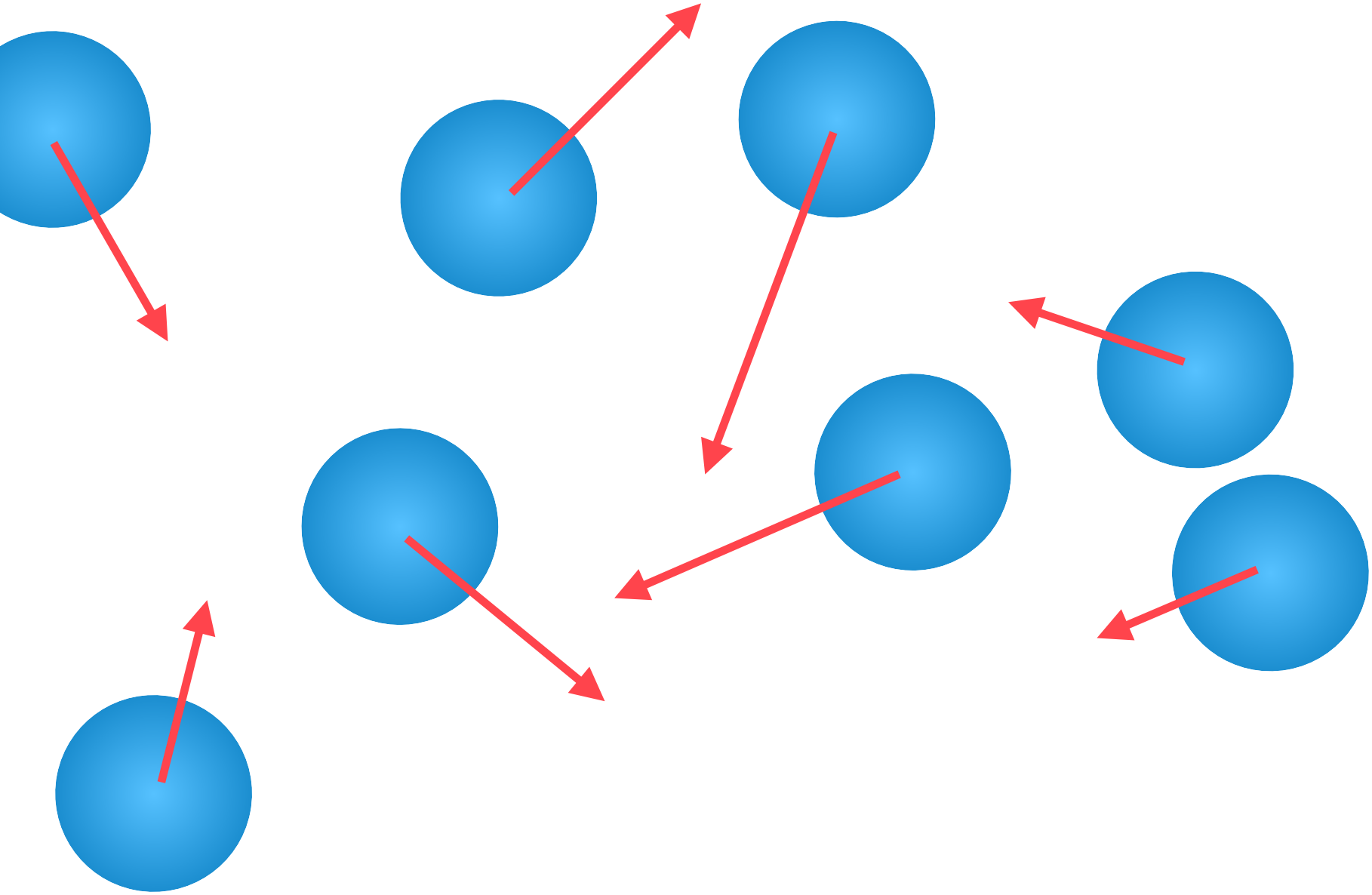

V =
P = -14 Kgm/s
2Kg


0.3 m/s
1.8Kg
P =


3 m/s
m =
P = 11 kgm/s

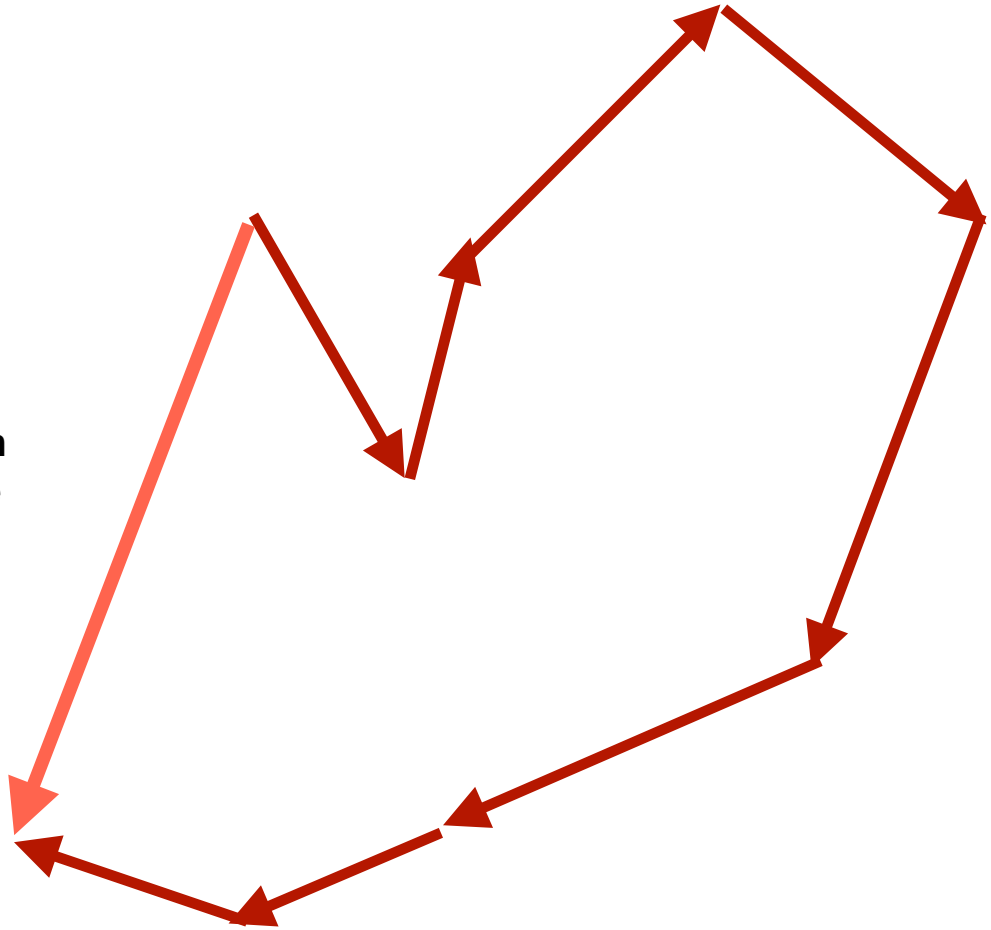

V =
P = -14 Kgm/s
2 Kg

Conservation of momentum



Conservation of momentum

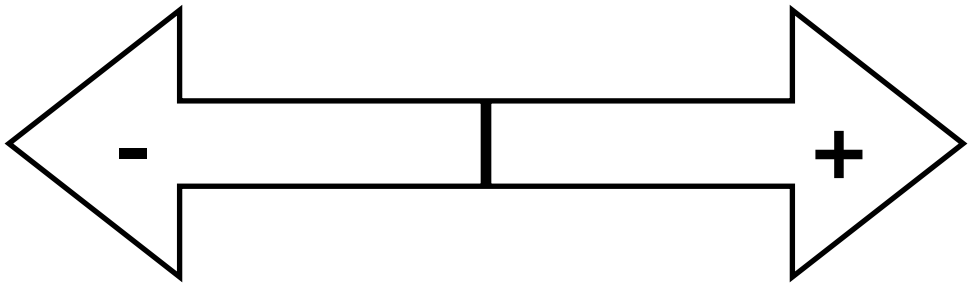
The total momentum of a system only changes if an external force acts on the system.



Collisions between objects in the system doesn’t affect the total momentum of that system

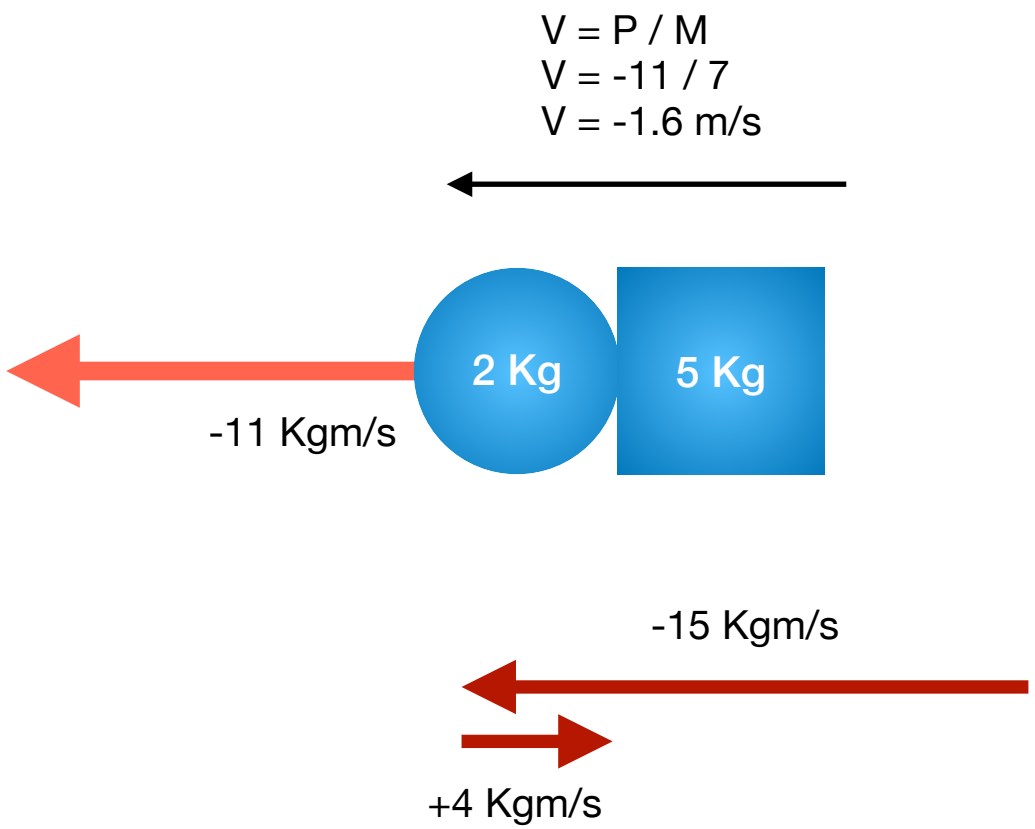
Momentum before = momentum after

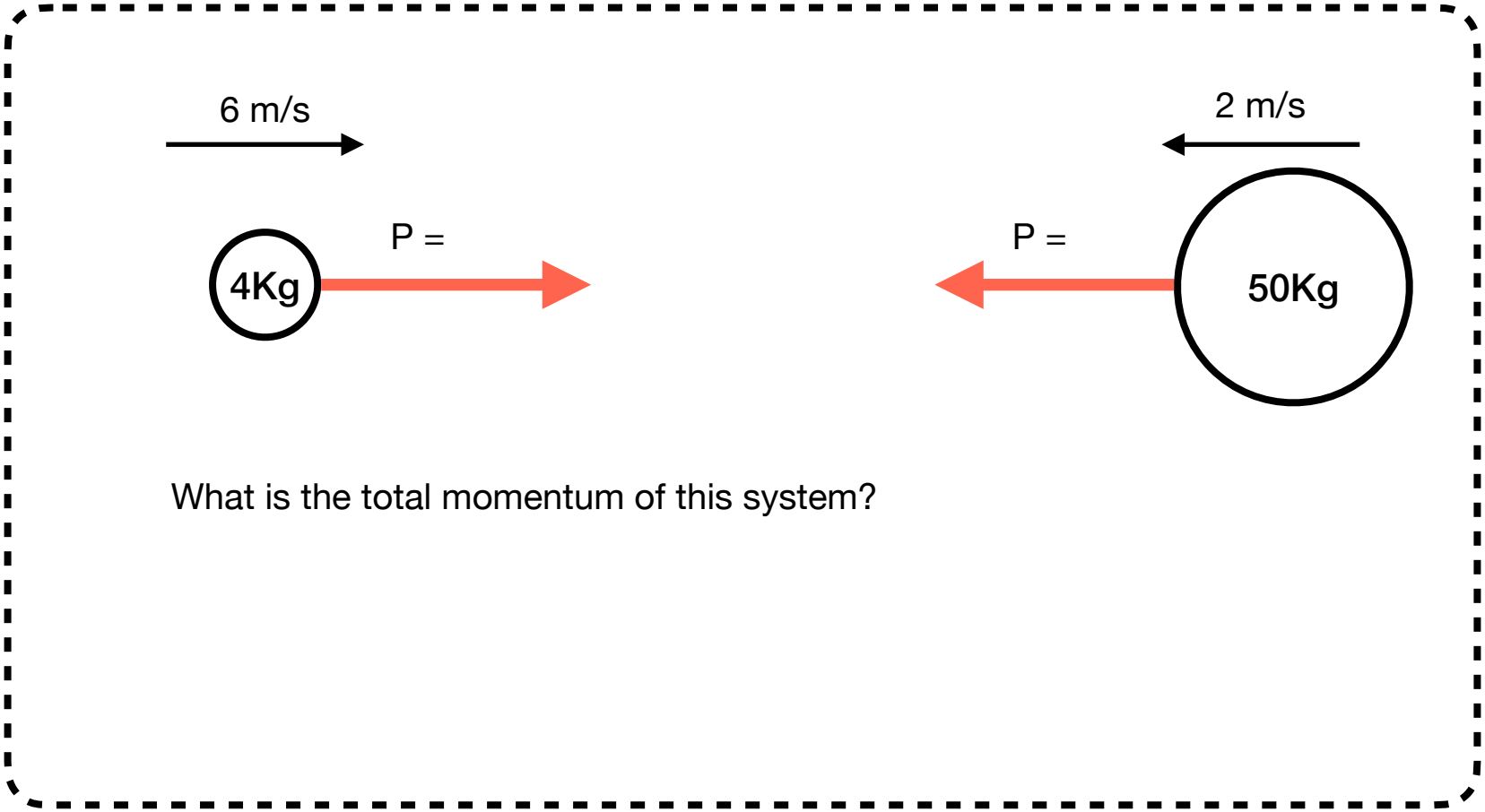
We decide that velocity to the right is positive. We could just as easily have chosen left.



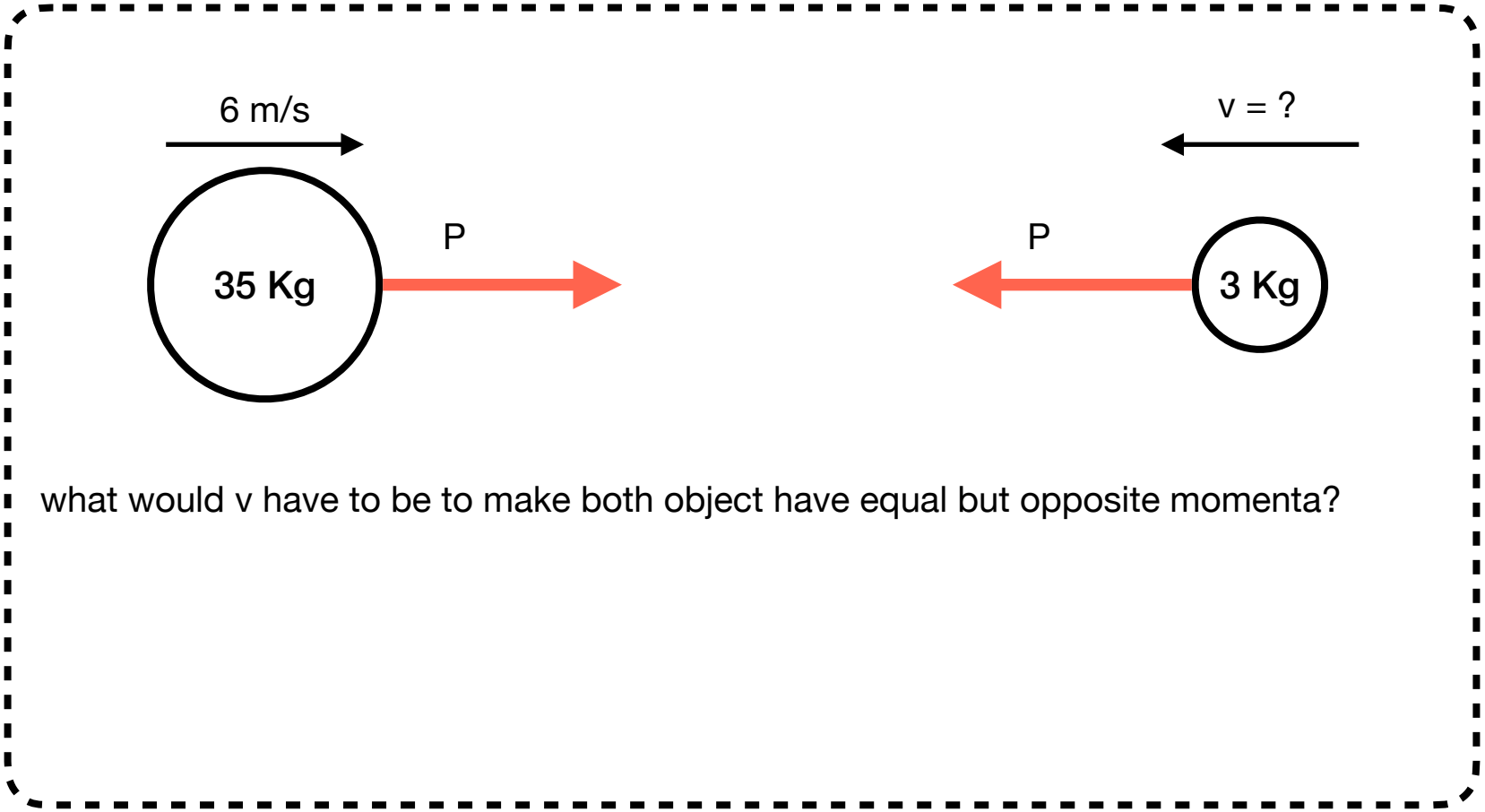
Momentum before = -11 Kgm/s

Momentum after = -11 Kgm/s



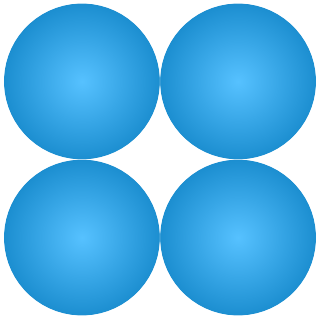


What is the total momentum of this system?



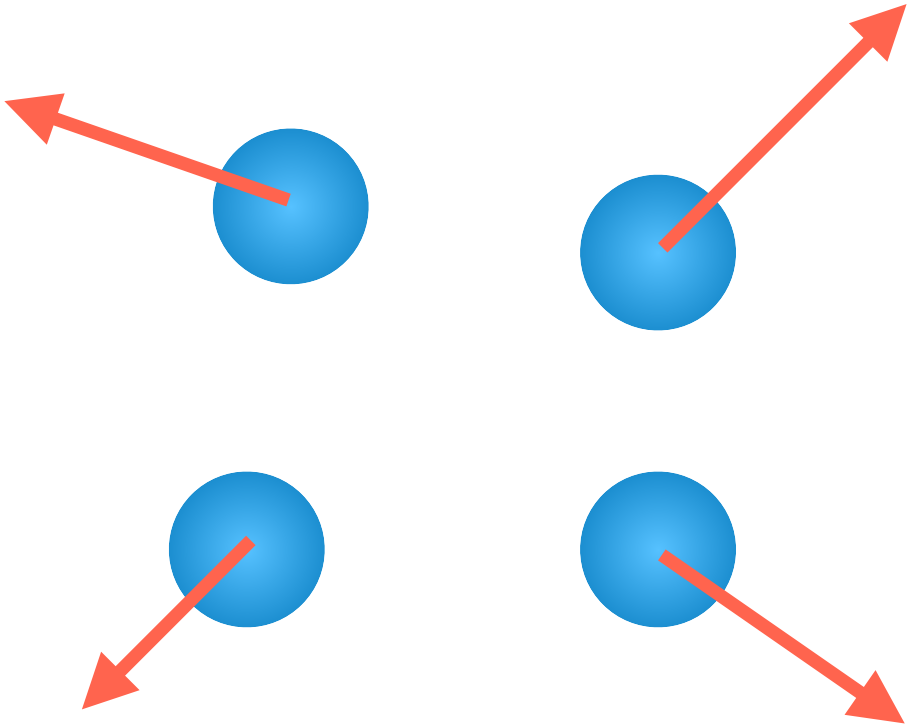
what would v have to be to make both object have equal but opposite momenta?

A stationary object…



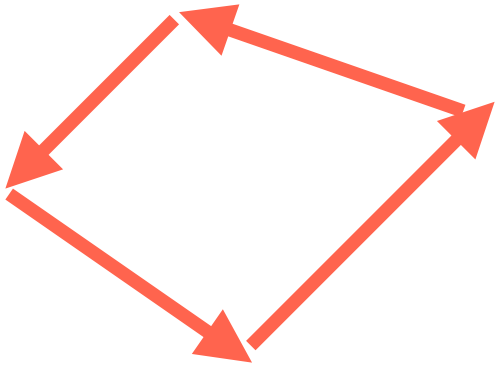
P before = 0

explodes



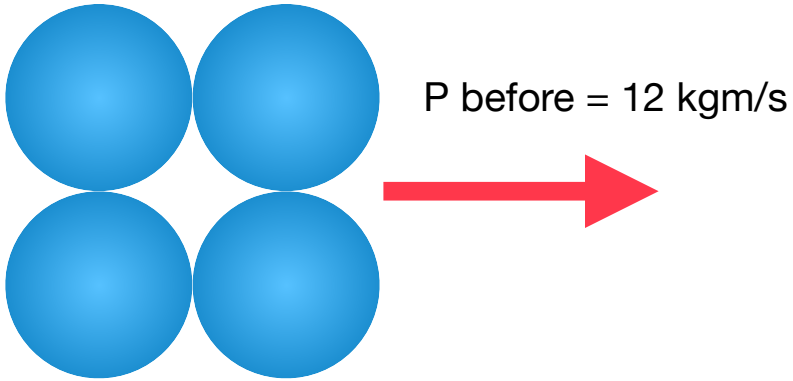
P before = 0

explodes

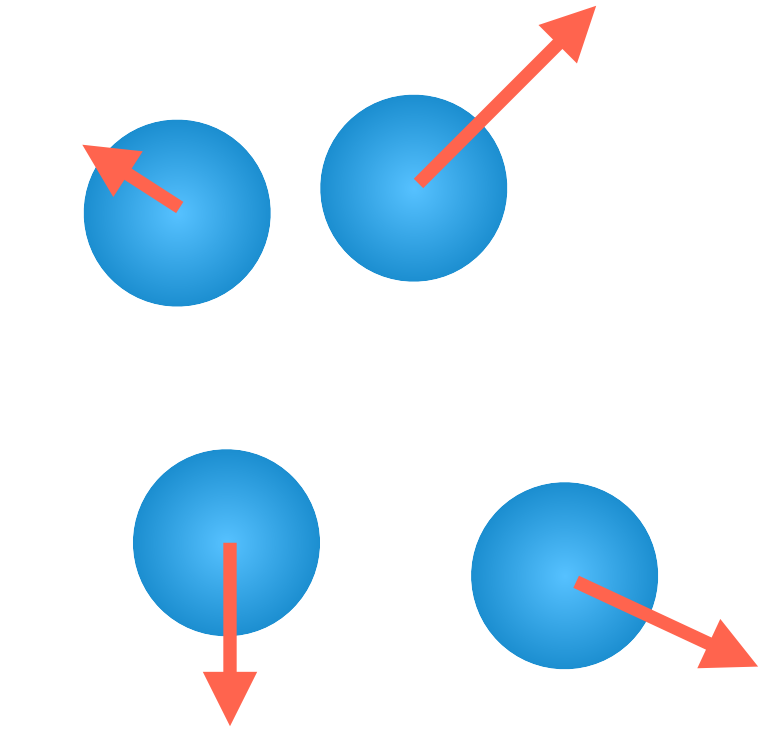


P after = 0

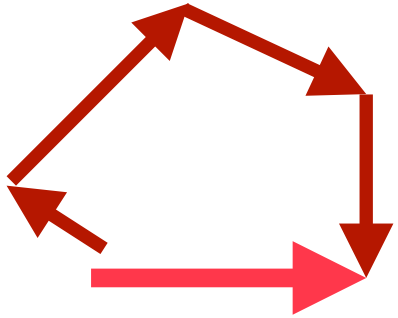
What if the object had been moving?



What if the object had been moving?

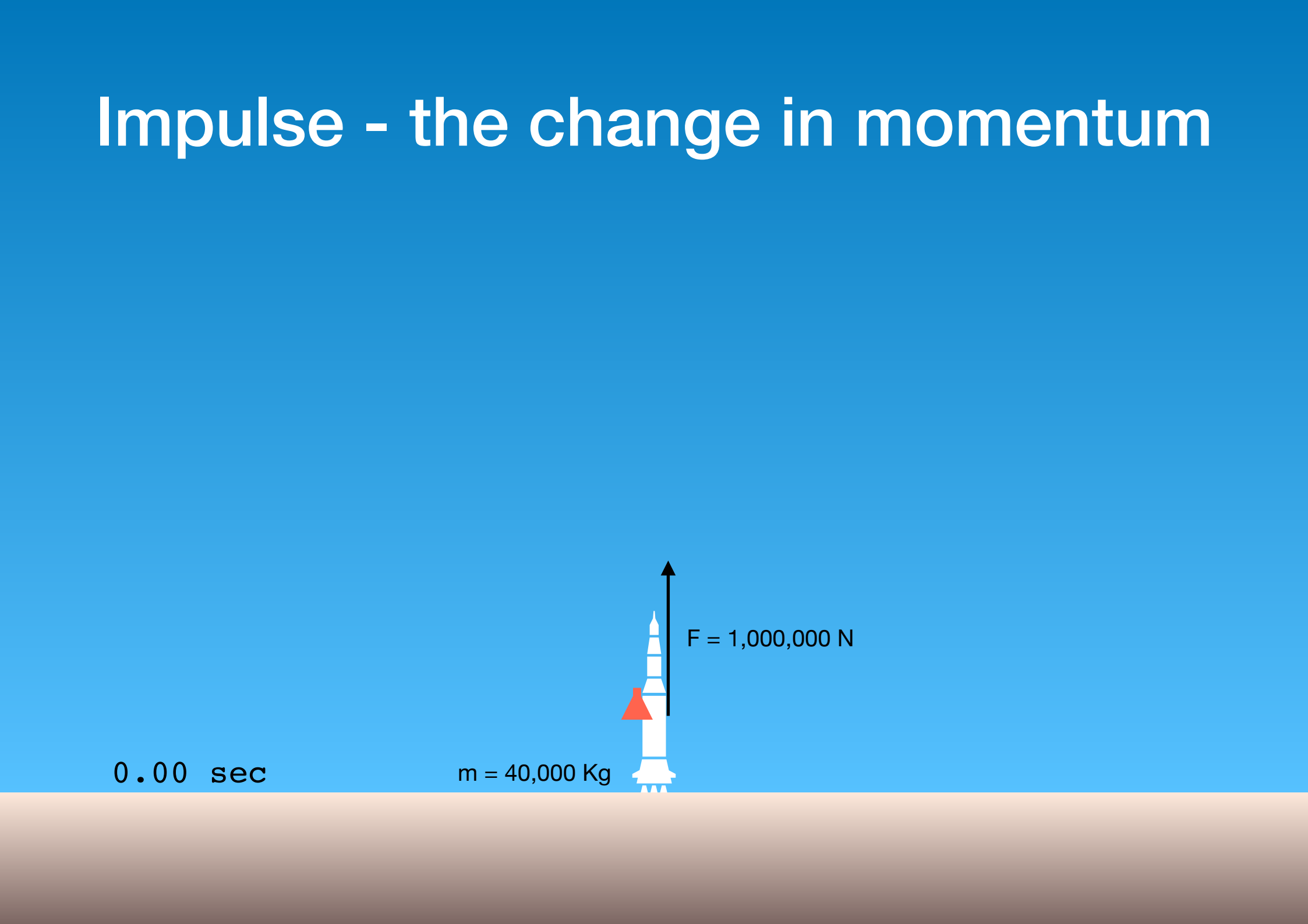


What if the object had been moving?



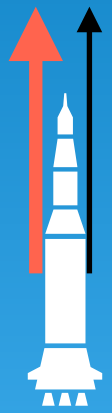
P after = 12 kgm/s

Impulse - the change in momentum



Impulse - the change in momentum

The momentum increases as the rocket speeds up over time

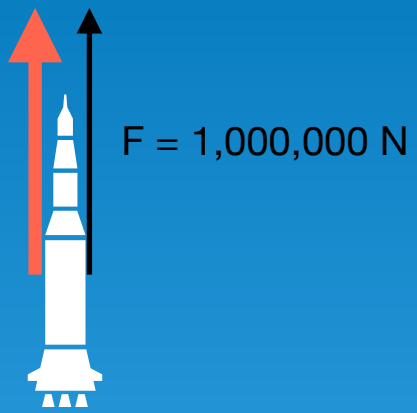


F = 1,000,000 N

m = 40,000 Kg

12.00 sec

so
P = 1,000,000 x 12
P = 12,000,000 Kgm/s



$$F = ma$$ Newton's second law

$$F = m\frac{\Delta V}{\Delta t}$$ the definition of acceleration

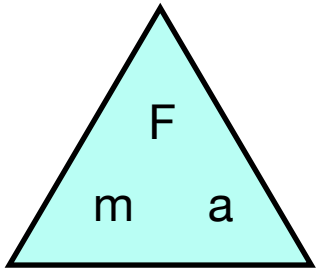
$$F\Delta t = m\Delta V$$ multiply by delta t

$$F\Delta t = \Delta P$$ impulse

12.00 sec

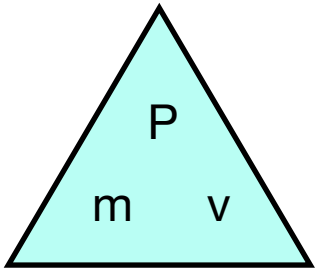
useful equations

Newton's second law



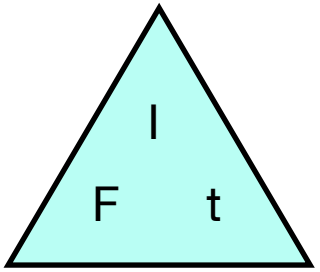
Force = mass * acceleration

N Kg m/s^2



momentum = mass * velocity

Kgm/s Kg m/s



Impulse = force * time

Ns N s