### **Momentum and Impulse**

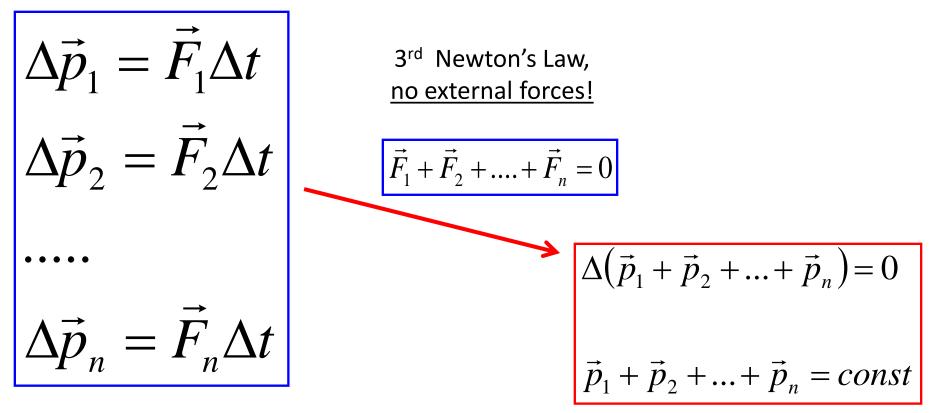
$$\vec{F} = ma = m\frac{\Delta \vec{v}}{\Delta t},$$

$$\Delta \vec{p} = \vec{F} \Delta t$$

 $\vec{p} = m\vec{v}$  called Momentum  $\vec{F}\Delta t$  called Impulse

## **Conservation of Momentum**

2<sup>nd</sup> Newton's Law for *n* objects:



**Total Momentum of Isolated System is Conserved** 

# Homework

### **Problem 1**

A block of mass **M=100g** moves with speed of **v=10m/s** on a frictionless flat surface. A bullet of mass m=8g that moves with speed **u=700 m/s** in the opposite direction, hits the block and gets stuck in it. What will be the velocity of the block after this collision (include direction in your response)?

#### Problem 2

An empty bottle rocket has mass  $M=100 \ g$ . It is filled with m=800g of water. During the lunch, the water quickly jets out of the nozzle with average speed v=5m/s (in the reference frame of the ground). Find the speed of the rocket after it empties.