

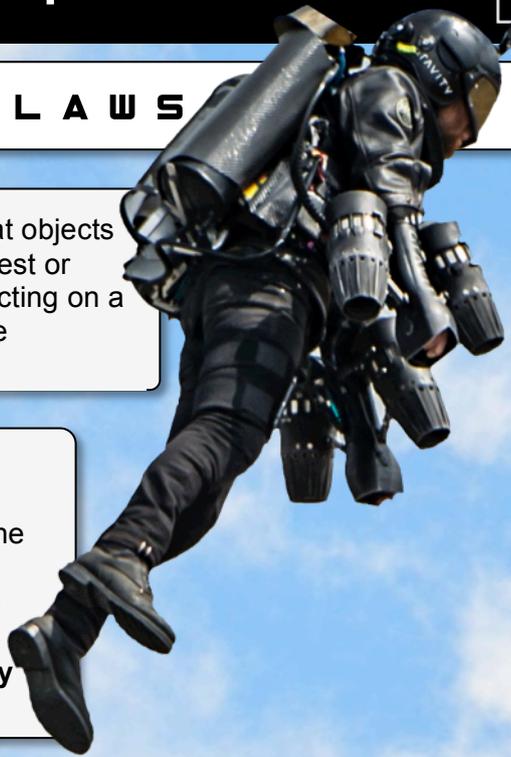


## FORCES AND NEWTON'S LAWS

**Newton's First Law of Motion** states that objects with **balanced forces** acting on them will stay at rest or stay in constant motion. This means that forces acting on a Jet Suit pilot can change his or her **speed**, and the **direction** in which he or she is moving.

**Newton's Second Law of Motion** states that when an **unbalanced force** acts on an object:

- the direction of the object's **acceleration** is the same as the direction of the unbalanced force
- the **magnitude** of the object's acceleration is the same as the direction of the unbalanced force
- the magnitude of the object's acceleration varies **inversely** with the mass of the object



The unit of force is called the **newton (N)**

1 newton is defined as that unbalanced force which produces an acceleration of  $1 \text{ m/s}^2$  when it acts on a mass of 1kg.



Newton's Second Law of Motion can be written as the following relationship:

$$F = ma$$

where:  $F$  = unbalanced force  
 $m$  = mass  
 $a$  = acceleration

### Weight and Mass

Weight is not the same as mass. In physics, the term weight has a specific meaning - which is the force that acts on a mass due to gravity. **Weight is measured in newtons. Mass is measured in kilograms.**

Weight is the result of **gravity**. The gravitational field strength of Earth is  $10 \text{ N/kg}$  (ten newtons per kilogram). This means a pilot weighing 82kg would be attracted towards the centre of the Earth by a force of 820 N. To accelerate away from the Earth and **fly**, the Jet Suit has to have thrust of more than 820 N

Several different forces act on a Jet Suit pilot; these forces have different strengths and directions. But they can be added together to give the **resultant force**. This is a single force that has the same effect on the Jet Suit pilot as all the individual forces acting together.



### Types of Forces

A force is any influence that causes an object to undergo a specific change. Related concepts include:

- thrust** - increases the **velocity** of an object
- air resistance** - decreases the velocity of an object
- torque** - changes the **rotation** of an object.

