NAME: Key

U3:L1 The Physics of Collisions

Physics is the science of matter and motion.

What comes to mind when you think about physics?

Write or draw:

cars
space
motion
electricity
magnets
quantum

In physics, the study of forces and their effect on motion is called Dynamics.

What could a physicist specifically study in sports?

motion
shooting
Running
pass angles
injuries

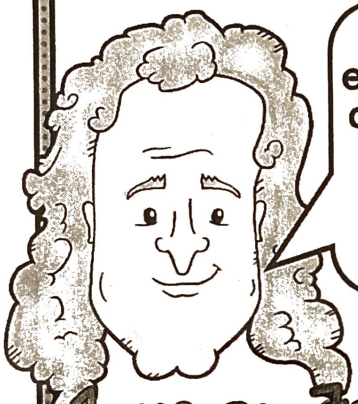
The study of dynamics is centered on Newton's 3 Laws:

1. Inertia
2. F=ma
3. Forces come in Pairs

Newton's 1st Law

The Law of Inertia

net force: The sum of all of the forces acting on an object.



If the net external force on an object is zero, the object's velocity will remain unchanged.

Implications

- A non-zero net force will change the velocity.
- A net force is not required to maintain the velocity.
- External forces change the motion, not internal forces.

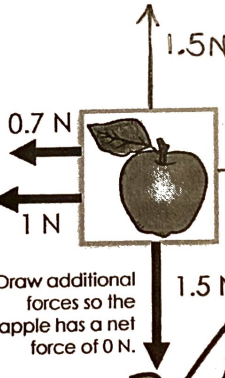
True or False?

If an object is stationary, it must have no external forces acting on it.
TRUE FALSE There may be some external forces, but they would be balanced

If you throw a ball in space the ball will keep going in the same direction at the same speed.
TRUE FALSE There is no force to change the velocity.

While sitting in a moving bus you throw an apple up into the air. The apple will land back in your hand.
TRUE FALSE The apple, you & the bus all have the same horizontal velocity, with no forces changing it.

A bus accelerates forward. If an apple were on the floor of the bus it would move forward.
TRUE FALSE The apple would appear to move toward the back of the bus



Draw additional forces so the apple has a net force of 0 N.

Buckle up!

If you are riding in a car and the speed suddenly decreases...

No seatbelt

You keep moving until something exerts a force to stop you (dashboard)

With seatbelt

Seatbelt exerts a force to stop you.

Name: Solutions

Newton's 2nd Law

The Law of Motion

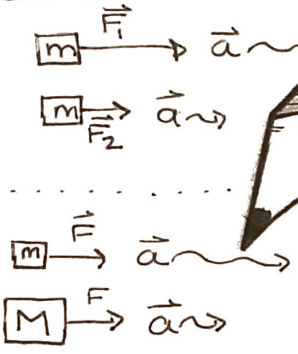
If you're wearing a hat, you're going places. Vectors have direction.

$\vec{F}_{net} = m\vec{a}$ (sum of ALL forces; N; kg; m/s^2)

The net force acting on an object is equal to the product of its mass and its acceleration.

equation

draw it



write it

$a \propto F$

if the force increases so does the acceleration

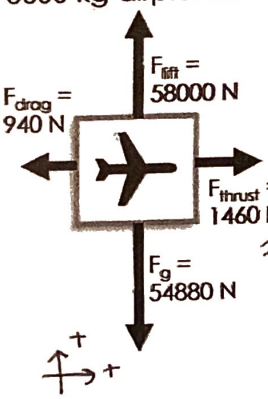
$a \propto \frac{1}{m}$

if the mass increases the acceleration decreases

An object will accelerate in the direction of the net force; the magnitude of the acceleration is proportional to the force and inversely proportional to the mass

use it

Use the FBD and Newton's 2nd Law to determine the acceleration of a 5600 kg airplane.



$\vec{F}_{netx} = \vec{F}_{thrust} + \vec{F}_{drag}$

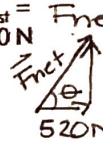
$\vec{F}_{netx} = 1460N - 940N$

$\vec{F}_{netx} = 520N$

$\vec{F}_{nety} = \vec{F}_{lift} + \vec{F}_g$

$F_{nety} = 58000N - 54880N$

$F_{nety} = 3120N$



$F_{net}^2 = 3120^2 + 520^2$

$F_{net} = 3163\ N$

$\tan\theta = \frac{3120N}{520N}$

$\theta = 80.5^\circ$

$\vec{a} = \frac{\vec{F}_{net}}{m}$

$\vec{a} = \frac{3163N}{5600kg}$

$\vec{a} = 0.56 \frac{m}{s^2}$

∴ The acceleration of the plane is $0.56\ m/s^2$ [81° ATH].

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