$\sum \vec{F} = 0N$ = Balanced Forces → equilibrium

$\sum \vec{F} \neq 0N$ = Unbalanced Forces

Newton's First Law

An object will remain at rest or continue moving at constant velocity if and only if the net force acting on the object is zero.

- Constant velocity means constant speed and constant direction, that is the object has zero acceleration and moves along a straight line.

In other words, an object will remain at rest or continue moving at constant velocity if and only if it is not acted upon by an unbalanced force.

- Newton's First Law is also called **The Law of Inertia**

INERTIA = is the natural tendency of an object to resist change – if an object is at rest, it tends to remain at rest. If it is moving at constant speed, it tends to remain moving at constant speed. In other words: objects are lazy and prefer doing what they are already doing. The more an object resists change, the higher its inertia.

- Inertia is given in kg. The mass of an object is a quantitative measure of inertia

The larger the mass, the greater the inertia

Equilibrium

If an object is not acted upon by an unbalanced force then vector addition all the forces acting on the object is equal to zero:

$\sum \vec{F} = 0$ or $\vec{F}_{net} = 0$

Such object is then said to be in equilibrium.

translational eq.

Textbook: p95 #9-13, + Copy the chart on page 94

Check Your Understanding

1. Imagine a place in the *cosmos* far from all gravitational and frictional influences. Suppose that you visit that place (just suppose) and throw a rock. The rock will

a. gradually stop.
b. continue in motion in the same direction at constant speed.

2. A 2-kg object is moving horizontally with a speed of 4 m/s. How much net force is required to keep the object moving at this speed and in this direction?

→ constant speed ⇒ $a = 0\ m/s^2$

$F_{net} = 0N$

3. Mac and Tosh are arguing in the cafeteria. Mac says that if he flings the Jell-O with a greater speed it will have a greater inertia. Tosh argues that inertia does not depend upon speed, but rather upon mass. Who do you agree with? Explain why.

Tosh is right as inertia is quantitively expressed as mass. Both in kilograms

4. Supposing you were in space in a *weightless environment*, would it require a force to set an object in motion?

↳ no gravity

↳ implies rest ⇒ $v_i = 0\ m/s$; $v_f \neq 0\ m/s$ ⇒ $v_f - v_i \neq 0$

⇒ $a \neq 0$ ⇒ $F_{net} \neq 0N$ ⇒ Force is required.

5. Fred spends most Sunday afternoons at rest on the sofa, watching pro football games and consuming large quantities of food. What effect (if any) does this practice have upon his inertia? Explain.

His inertia will eventually increase when his mass increases.

6. Ben Tooclose is being chased through the woods by a bull moose that he was attempting to photograph. The enormous mass of the bull moose is extremely intimidating. Yet, if Ben makes a zigzag pattern through the woods, he will be able to use the large mass of the moose to his own advantage. Explain this in terms of inertia and Newton's first law of motion.

Due to its large mass (= large inertia), the moose will have a greater tendency to continue moving without a change in its velocity (speed and direction).

7. Two bricks are resting on edge of the lab table. Shirley Sheshort stands on her toes and spots the two bricks. She acquires an intense desire to know which of the two bricks are most massive. Since Shirley is vertically challenged, she is unable to reach high enough and lift the bricks; she can however reach high enough to give the bricks a push. Discuss how the process of pushing the bricks will allow Shirley to determine which of the two bricks is most massive. What difference will Shirley observe and how can this observation lead to the necessary conclusion?

• The greater the Fpush is required to start the motion the greater the inertia of the object. The greater the inertia, the greater the mass.