whats the difference between inertial mass and gravitational mass? and what's the unit of both?

Answer

Gravitational mass is measured with the use of a double-pan or triple-beam balance. It is a **static measurement** - that is, a measurement that can only be accurately recorded when the system is in a state of rest. This type of measurement only works in the presence of gravity.

Inertial mass is measured with the use of an inertial balance, or spring-loaded pan. It is a **dynamic measurement** - that is, a measurement that can only be accurately recorded while the system is in a state of motion. This method capitalizes on an object's inertia, or its tendency to continue in its current state of motion, as a means of quantifying the amount of matter present.

A dramatic use of these two definitions of mass can be illustrated when we state that all freely falling bodies experience the same acceleration. When you use **net F = ma** for a projectile in freefall, **net F** equals the force of gravitational attraction between the object and the Earth; that is, the object's weight. Weight is calculated as the product of the object's gravitational mass and the Earth's gravitational field strength, **g**.

wt = mg

When we look at the other side of the equation, ma, then we are talking about the object's inertial mass - its resistance to a change in its state of motion, that is, its resistance to being accelerated. This mass is a measure of how much inertia must be accelerated.

net F = ma

$$-m_{gravitational}g = m_{inertial}a$$

Since we can experimentally determine that all freely-falling bodies experience the same acceleration, that is, **a = -g**, we have proof that

$m_{gravitational} = m_{inertial}$

and there is no need to distinguish between the two definitions. The value of an object's mass is unique, independent of its method of measurement. The SI unit of both masses is the kilogram (kg).