Forces and Vectors

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In physics, a force is any interaction that, when unopposed, will change the motion of an object. A force can cause an object with mass to change its velocity (which includes to begin moving from a state of rest), i.e., to accelerate. Force can also be described intuitively as a push or a pull. A force has both magnitude and direction, making it a vector quantity. It is measured in the SI unit of newtons and represented by the symbol F.

What is a Vector and a Scalar value?

A vector is a quantity that has both a magnitude (how "powerful" the vector is) and a direction (where that power is pointing towards). This is an important difference from a Scalar value which only has magnitude. For example: If I said I was in my car moving at 10m/s, i would be providing you with a "speed" which is a scalar value since I haven't told you which direction my speed is in. If I told you I was driving at 10m/s due North, then I have provided a "velocity" vector since I have given you both magnitude and direction. Force is a "vector" quantity, therefore we need to know how much force and the direction the force is applied to be able to call it a force. Acceleration is also a vector quantity. Typically in an equation a vector quantity is denoted by a small arrow above the letter that represents a vector quantity. If there is no arrow it is assumed to be scalar. In the following example notice that mass (m) has no arrow, this is because mass is a scalar quantity, not a vector.

Vectors have a property of "superposition". Essentially this means that the effect of each vector can be added to the effect of other vectors leaving us with one resultant vector. In more mathematical terms if V1 produces X output on a linear system and V2 produces Y output on a linear system, then the output of (V1 + V2) = (X + Y).

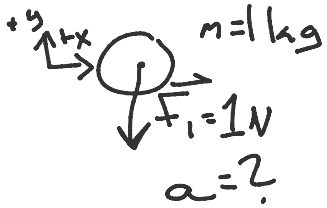
Newton's 1st Law:

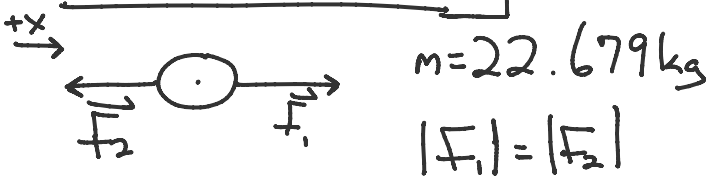
A body at rest will stay at rest. A body in motion will stay in motion. This is true unless the body is acted on by a force.
This is the property of intertia.

Newton's 2nd Law:

The sum of all forces on a body must equal its mass times its acceleration.

$$\sum_{i=0}^{n} \vec{F}_i = m \cdot \vec{a}$$





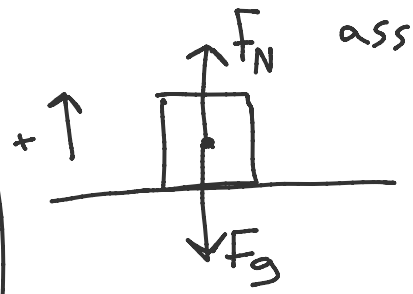
m=22.679kg

$|F_1| = |F_2|$

a=?

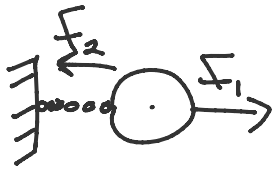
Newton's 3rd Law:

When one body exerts a force on a second body, the second body simultaneously exerts a force equal in magnitude and opposite in direction on the first body



assume@rest

$\sum \vec{F} = m\vec{a} = m(0)$


F_2
F_1