

Forces: what makes objects move

Newton I: objects with constant mass

not acted upon by forces conserve \vec{v}

Newton II: law stating how the net force affects \vec{v}

Four fundamental forces in nature:

gravity, electromagnetism, [strong, weak].

They act over some range (non-contact).

Manifestations of electrostatic (and magnetic) forces:

friction, bonding, drag, restoring spring force,

tension force (rope), normal force ('solid' surfaces), ...

These are typically contact forces.

Forces in Classical Mechanics

The box is moved by the tension force

Idealize the box as a point mass

(centre of mass to be defined later = CM)

Move the tail of the force vector to the CM

Orientation of rope: \rightarrow force vector

A compressed spring pushes(!) the box

Well-defined contact between spring and box:

force vector has horizontal orientation

(what could happen if the spring applied at top?)

Objects near earth's surface experience weight

Box is a rigid body (no tidal forces)

Weight is a force ($m\vec{g}$), mass m is a scalar.

This is a simplified view of gravity which follows an inverse distance squared force law.

Distance between CM of box and CM of earth!

