Keynotes. Dec 10, 2017

Continue with the Newton's laws. Before applying the Newton's laws we have to define conditions at which the laws are valid. Example of a tea spilled on a train. You cannot explain it while sitting on a train. The frame (coordinate system) is not inertial. The laws work only in inertial systems!

The 1st law gives a definition of the inertial system. Inertial system a frame of reference in which a body remains at rest or moves with constant linear velocity unless acted upon by forces: any frame of reference that moves with constant velocity relative to an inertial system is itself an inertial system.

The 2nd law does not show how to calculate forces. Here comes the field concept.

There are two types of fields (or types of interactions): gravitational and electromagnetic. The mass and the charge are properties that responsible for the fields. Massive objects generate gravitational field, while charges generate electromagnetic field. All other forces are products of these two.

Gravitation Field:
Gravitational constant $6.674\times10^{-11}\ m^3\cdot kg^{-1}\cdot s^{-2}$
Symmetrical with respect to masses.
A special case of the gravitation field is the field at the Earth surface.
Acceleration g is the strength of gravitational field.

Spring forces:
Springs are special devices used to generate force.
There is no filed associated to these devices. Hook's law.

Friction forces (this is special case of spring-type forces)
There are static and kinetic friction forces. A car is forced to move by the friction force.
Definition of the object weight: the weigh is force (measured in kg) with which the object pushes on support or stretch/squeeze the spring. For weight we need both the gravity and the "spring"-scale. Weightlessness.

Sentimental problem (from R. Feynman lectures) ☺

This is a difficult problem but you have a complete knowledge to solve it: draw all the forces and write the questions for Paolo, Francesca, and the Paolo's pulley.

9-9. None of the identical gondolas on the Martian canal Rimini is quite able to support the load of both Paolo and Francesca, two affectionate marsupials who refuse to go in separate boats. The enterprising gondolier, Guiseppi, collects their fare by rigging them up from the mast as in the figure, using the massless ropes and massless, frictionless pulleys characteristic of Martian construction. Giuseppi ferries them across before they hit either the mast or the deck. How much load does he save? Hint: Remember that the tension in a massless cord that passes over a massless, frictionless pulley is the same on both sides of the pulley.