Newton first law

Everbody continues in its state of rest or uniform motion in a straight line unless it is compelled to change that state by forces impressed upon it

Also called law of inertia

For a body in equilibrium the net force on it is zero

`sum vec F = 0`

Newtons second law

If a net external force acts on a body of mass m , the body accelerates. The direction of acceleration is the same as the direction of the net force. The net force vector is equal to the mass of the body times the acceleration of the body

`Sum vec F = m vec a`

Newtons third law

To every action there is always opposed an equal reaction.theses twoforces have the same magnitude but are opposite in direction. These two forces act on different bodies

External force: are those which act from outside of the system , only action acts on the system, reaction of these forces are not utilized by the system

Internal forces: are those which are developed within the system bodies, hence both action and reaction of these forces are in system

Normal force: it is always perpendicular from the surface of origin

`tau = F xx r = Frsintheta`

R is the perpendicular distance from center to the point of action of force

(`theta` is the angle between r and F)

Pseudo force

Its an imaginary force considered to make the frame of reference at rest, for example a box on table , if the table is moving with an acceleration of 5 `m/s^2` and we are standing on it then to find the acceleration of the box with respect to table. we consider a force in opposite direction of movement of the table this force is called pseudo force with acceleration same as table(\*to understand\* so as to nullify the movement the table and it will be like we are on a table which is not moving)

Apply pseudo force on an object only if it is placed on another object (non-inertial frame  
) accelerating wih respect to some inertial reference frame(like earth)

Direction of this force is opposite to acceleration of non-inertial frame

Magnitude of this force is same as that of product of mass of body and acceleration of the non-inertial frame

Weight while free fall = 0

Normal force between two bodies

&image&

a

a

F1

F2

N

N

F2

F1

`N = (F\_{1}m\_{2} + F\_{2}m\_{1})/(m\_{1} + m\_{2}) = T`

(T is tension, N is the normal force)

Pully , string, constrained motion:

`Sum vec N \*vec s = 0`

`Sum vec N \*vec v = 0`

`Sum vec N \*vec a = 0`

`Sum vec T \*vec s = 0`

`Sum vec T \*vec v = 0`

`Sum vec T \*vec a = 0`

It means the sum of all T(tension) multiplied by the acceleration caused by it will be equal to zero

`T = ((n\_{1}F\_{1})/m\_{1} + (n\_{2}F\_{2})/m\_{2})/(n\_{1}^2/m\_{1} + n\_{2}^2/m\_{2})`

N = no of tensions on body

&image&

T

T

mg

here force is mg and n= 2

Friction

Viscous friction: occurs when objects move over liquid or gas

Sliding friction:one body slides over another

Rolling friction: one body rolls over another

Sliding friction > rolling friction

Pulling on a rough surface is easier than pushing

&image&

After limiting friction the value of friction decreses then attains constant value(real life experience in pushing or pulling objects, they become easy after a point because of this)

`f\_{L} = mu\_{s}N`

`f\_{k} = mu\_{k)N`

`mu\_{s}` static friction coefficient, `mu\_{k}` kinetic friction coefficient

static and kinetic friction are independent of area of contact between surfaces

friction between pulley and string

`T\_{2} = T\_{1}e^(mutheta)`

Condition for sliding friction

Friction can be calculated by

`F – f =ma ` and `f = mumg`

Trick:

Second method gives the maximum friction.

If the value from first method is greater than second then block will not be at rest relative to ground (in this take f from second method as it is the maximum value)

If the first value is less then second then there is no motion of the block on ground

(Detailed in book)

Spring force

`F = kx`

x is the elongation and kis the spring constant

`k propto 1/l `

L = length of spring

Potential energy of spring(U)

`U = 1/2kx^2`

Use energy conservation in problem solving will be useful

Spring in series

Springs are connected end to end, when acted by a force each spring receive different elongation

`1/k\_{eq} = 1/k\_{1} + 1/k \_{2} +…….`

Springs in parallel

N springs are kept parallel to each other , each spring receives same elongation

`k\_{eq} = k\_{1} + k\_{2} + …..`