# BON SECOURS ARTS & SCIENCE COLLEGE FOR WOMEN MANNARGUDI

DEPARTMENT OF PHYSICS
MECHANICS

POINTS TO REMEMBER:

METACENTRE

If a floating body be slightly displaced such that the volume is liquid displaced by it remains the same, then the point in which the vertical line through the new centre buoyancy meets the line joining the centre of gravity of the body to the original centre of buoyancy is called meta centre.
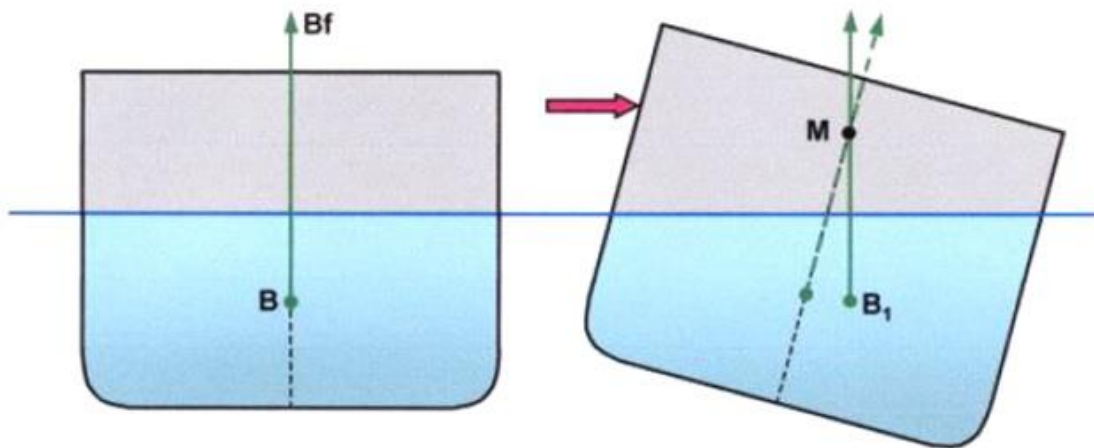
PROJECTILE

A projectile is any object thrown by the exertion of a force. It can also be defined has an object launched into the space and allow to move free under the influence of gravity and air resistance. Although any object in motion through space may be called projectiles, they are commonly found in warfare and sports.

"Inertial or gravity-free path"

Projectile's Path
"Parabolic Trajectory"
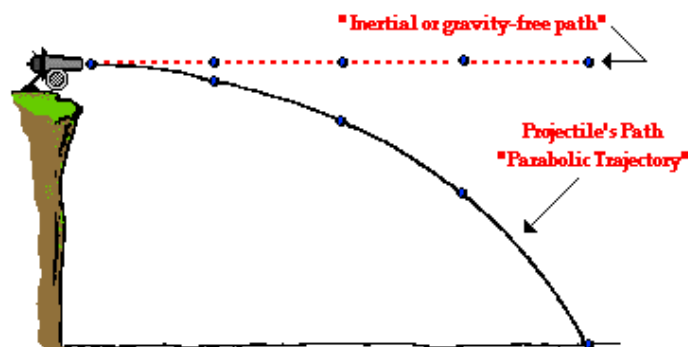
With gravity, a "projectile" will fall below its inertial path. Gravity acts downward to cause a downward acceleration. There are no horizontal forces needed to maintain the horizontal motion – consistent with the concept of inertia.

IMPULSE OF FORCE

The impulse I of a constant force F acting for a time t is defined as $F \times t$

I= $F \times t$

By Newton's second law, F= ma.

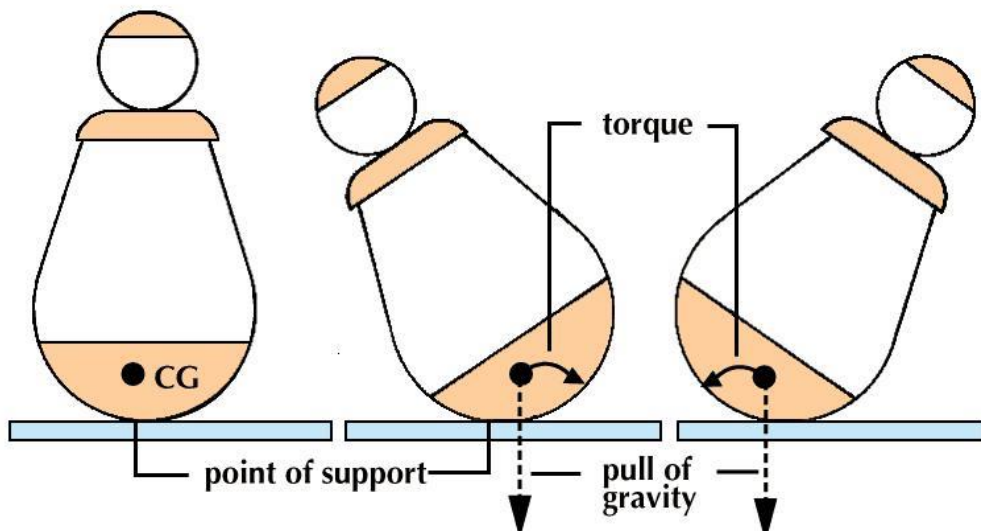If u and v are the initial and final velocities of the particle,

$$a = (v - u)/t$$

$$\therefore \; I = Ft = mat = m\left(\frac{v-u}{t}\right)t = m(v - u)$$

Thus the impulse of a force is equal to the change in momentum produced.

CENTRE OF GRAVITY

The centre of gravity of a body may therefore be defined as a point through which the line of action of the weight of the body always passes in whatsoever manner the body is placed.


BAROMETER

The atmospheric pressure at any place is measured by an instrument called a barometer.

FORCE OF FRICTION

If two bodies which are perfectly smooth rest again each other, the only force between them is along the common normal at the point of contact. In practice it is not possible to have two perfectly smooth surfaces in contact, and so there will always exist a force between them which tends to resist the sliding's one surface over another. The force is called the friction of force.
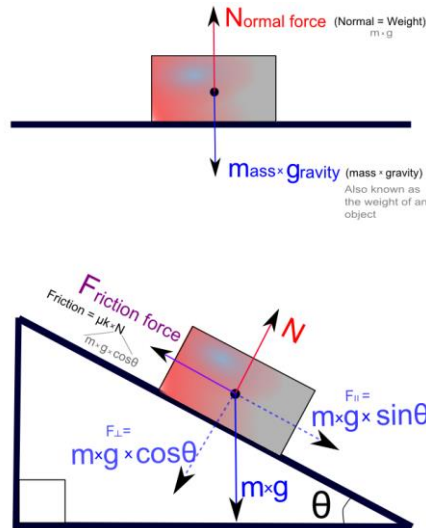
IMPULSIVE FORCE

An impulsive force is an infinity great force acting for a very short interval of time, such that their product is finite.

COEFFICIENT OF RESTITUTION

The ratio, with a negative sign, of the relative velocity of two bodies after impact to their relative velocity before impact is called the coefficient of restitution.

HODOGRAPH

A path described by the extremity of a vector drawn from a fixed origin and representing the linear velocity of a moving point.

GRAVITATIONAL MASS

The mass of a body may also be determined by measuring the gravitational force exerted on it by earth.

$$F = \frac{GMm}{R^2} \text{ or } m = \frac{FR^2}{GM}$$

The mass m thus determined is gravitational mass.

INERTIAL MASS

The mass of a body may be determined by measuring the acceleration a produced on it by a known force F.

Thus, $m = \frac{F}{a}$ The mass m thus determined is called inertial mass.

CENTRE OF PRESSURE

The liquid pressure acts normally at every point of the immersed area. The force acting on an elementary area like dS is $h\rho g\, dS$. The thrusts on different elements of the plane form a set of like parallel forces. All these parallel forces can be compounded into a resultant acting at some definite point on the plane area. This point is called the centre of pressure.
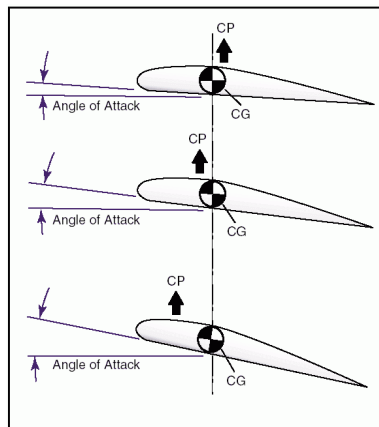

NEWTON'S LAW OF GRAVITATION

Every particle of matter in the universe attracts every other particle with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

If m_1 and m_2 are the masses of two particles situated at a distance r apart, the force of attraction between them is given by

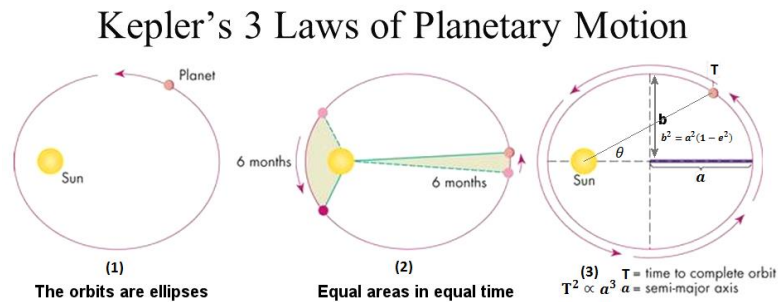$$F \propto \frac{m_1 m_2}{r^2} \quad \text{or } F = \frac{G m_1 m_2}{r^2}$$

Where G is a universal constant, called the Universal gravitational constant.
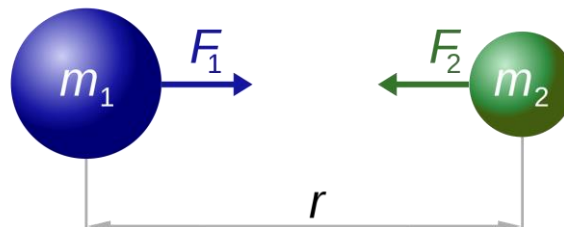

$$F_1 = F_2 = G\frac{m_1 \times m_2}{r^2}$$

KEPLER'S LAW OF PLANETARY MOTION

a) Every planet moves in an elliptical orbit around the sun, the sun being at one of the foci.
b) The radius vector, drawn from the sun to a planet sweeps out equal areas in equal times i.e, the areal velocity of the radius vector is constant.
c) The square of the period of revolution of the planet around the sun is proportional to the cube of the semi-major axis of the ellipse.

Kepler's 3 Laws of Planetary Motion

(1) The orbits are ellipses

(2) Equal areas in equal time

(3) $T^2 \propto a^3$ T = time to complete orbit a = semi-major axis

GRAVITATIONAL FIELD

The space around a body within which its gravitational force of attraction is perceptible is called its gravitational field.
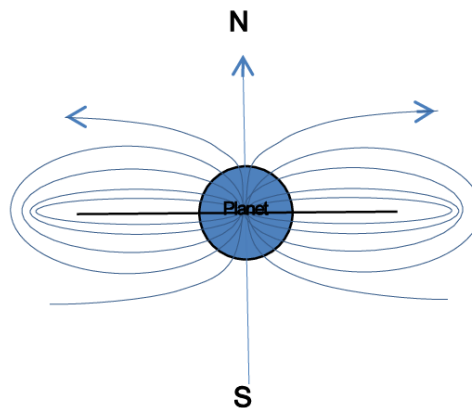

GRAVITATIONAL POTENTIAL

The work done is moving a unit mass from infinity to a point in a gravitational field is called the gravitational potential at that point.

MOMENT OF INERTIA

A rigid body rotating about an axis has always a tendency to oppose its state of rotation exactly in the same way as the mass of a particle opposes the tendency to its state of translatory motion. This property of a rotating body is called its Moment of inertia.

CENTRE OF PERCUSSION

When a body capable of rotation about a fixed axis is given blow at a suitable point such that there is no impulsive force exerted on the fixed axis, that point is known as the Centre of percussion.
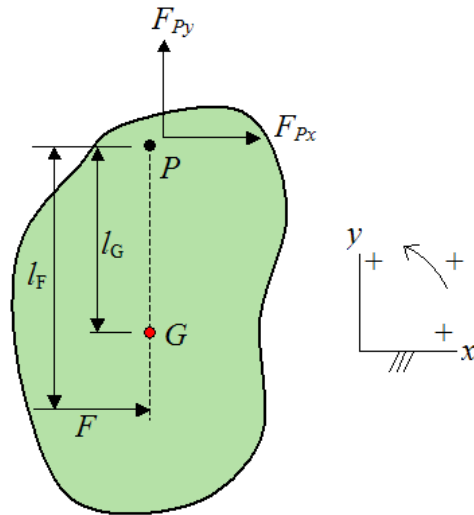
CENTRE OF OSCILLATION

Centre of oscillation is obviously a point at which the mass of the body may be considered to be concentrated without any change in the periodic time.

I, Radius of Oscillation

C, Center of Oscillation
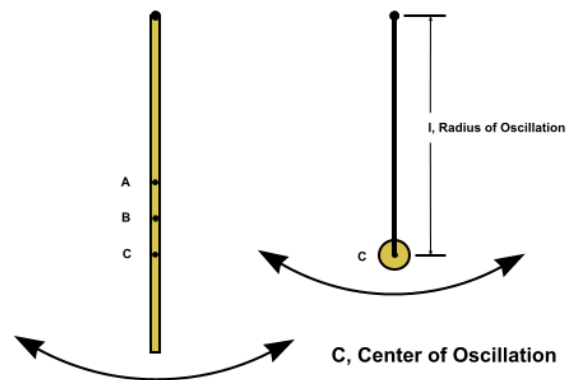
STATIC FRICTION

The frictional forces acting between surfaces at rest with respect to each other are called forces of static friction.