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Where Minds Pollinate

**Class 9
Physics**

Chapter 4

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Chapter: 4

L/Q/Ans

DYNAMIC II

3 Define CM. what is effect of mass distribution in a body on it's CM?

Ans / CM: CM is a system such a point where an applied force causes the system to move without Rotation-
Effect of mass distribution in a body in it's CM: The distribution of mass throughout the body directly effects the position of body's CM, If the mass distribution in a body is uneven or asymmetrical, CM will not be located in geometric center of object, CM will shift towards region with higher mass concentration. The mass distribution in a body directly impacts the location of it's CM, which plays a vital role in determining the body's over all motion and stability -

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Ans An Objects Stability can be improved by

- a- lowering the center of mass
- b- Increasing The area support
- c- By both (a) and (b)

a- The center of mass is the average location of an object's weight

By lowering The center of mass, The object is more stable, as it has lower tendency to tip over. If the center of Mass is closer to the base, The object is more stable as The weight is more evenly distribute.

b) A larger support or Base area provides greater stability, making it harder for object to tip over. longer area of support reduce pressure on the base, making it less likely to sink or lose balance.

c. when an object is placed on a surface, The force of gravity acts through its Center of mass, trying to tip it over. If the center of mass is high or far from the base, The object is more likely to tip, By lowering The Center of mass or increasing The base area, making the object more stable.

Stability has numerous application in real life

Building design- wide foundations and low Centers of gravity ensure stability and prevent collapse

Ship building- Ships are designed with low centers of gravity and ballast tanks to maintain stability in rough seas.

Heavy machinery- cranes, excavators and bulldozers use stabilizers to prevent tipping

Aerospace engineering-

Air craft & Space

Crafts require Precise Stability control for safe flight & navigation.

Automotive design:-

Cars are designed with stability in mind, including electronic stability control.

Civil engineering:-

Bridges, dams other structures requires stability to ensure safety.

9.

Sliding

Sliding friction is defined as resistance that is created b/w any 2 objects.

Rolling

Rolling friction is defined as force that resists motion of ball or wheel on surface.

2	It takes place due to interlocking of microscopic surface	It takes place due to deformation of surface.
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3	Sliding friction is much at higher than Rolling friction	Rolling friction is much less than sliding friction.
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4	High amount of heat generates due to high opposite force	Lower amount of heat generates due to low opposite force.
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Sliding and Rolling friction differ in following ways-

Contact Surfaces:

• Sliding Friction:-

Larger ^{area} contact between the two surfaces, where the entire surface is in contact.

Rolling Friction:-

Smaller contact area,
Where only a small patch meet the surface

Motion:-

Sliding friction:-

It involves translation motion, where one surface slides over the other.

Rolling Friction:

It involves rotational motion, where a wheel rotates on the other surface.

Force involved:-

Sliding Friction

- 1- Normal force (N)
- 2- Sliding friction force (F_s)
- 3- Applied force (F_a)

Rolling Friction

- 1- Normal force (N)
- 2- Rolling friction force (F_r)
- 3- Tangential force (F_t)

Example:-

Sliding friction:-

A block of wood (10kg) is pushed across a table with force of 50N. The block experiences sliding friction with larger contact area & translation motion.

Rolling friction:-

A bicycle wheel (50kg) rolls on the road with normal force of 100N. The wheel experiences rolling friction with a smaller contact path and rotational motion.

II.

Centripetal force: The force that pulls an object out of its straight line path called centripetal force.

The speed of object moving in a circular path under action of centripetal force may remain constant however the direction is continuously changing.

giving rise to a change in velocity and acceleration, This acceleration is perpendicular to velocity, In uniform circular motion it is towards center of circle called Centripetal acceleration

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Orbital Velocity:

Orbital velocity is speed of object revolving around another heavy object in an orbit.

To put an object artificial satellite into orbit, first we move it to high altitude and then accelerate it to a required tangential speed using rockets. If speed is too high the space craft is either move in elliptical orbit or will escape, never to return. if speed is too low it will

fall back to earth, satellite are put into circular orbits

The factors on which satellite depends is the radius of orbit and mass of central body

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Gravity:- The force that keeps earth in a orbit around sun is centripetal force, which in this case is G force i.e. Moon orbiting around sun.

Friction:- A car moving on a circular track, The necessary centripetal force is provided by force of friction b/w spinning wheel and road.

Electromagnetic force: The charged particles in magnetic field and electrons orbiting nucleus in an atom, In these cases necessary centripetal force is provided by electromagnetic force -

Air resistance: A plane flying in a circular path or helicopter blade rotating while moving in a circular path necessary centripetal force is provided by air resistance.

Tension: The motion of object tied to string moving in a circular path in such case necessary centripetal force is provided by tension.

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- Maximum tension at top of circle where ball is moving towards fastest and centrifugal force is max
 - Minimum tension at bottom of circle where ball is moving slowest and centrifugal force is minimum.
 - Intermediate tension at sides of circle, where ball's velocity is constant and centripetal force is equal to centrifugal forces
- ∴ The forces involved are centripetal force, tension and centrifugal force -



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