THE PHYSICS

CLASS-9 FORCE AND ACCELERATION

For Session 2021-22

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Force and Acceleration

FORCE

- Force is that cause that causes which produce acceleration in the body on which it acts.
- Force can change speed,direction and shape of a body.

RESULTANT FORCE

- If a single force acting on a body produce same acceleration as produce by number of forces, than this single force is called resultant of these individuals forces.

BALANCE AND UNBALANCE FORCES

- If more than one forces acting on a body produce no acceleration in it, than the forces are said to be balanced.
- If more than one force acting on a body produce non-zero acceleration, than the forces are said to be unbalance.

SOME COMMON FORCES

- Contact force
- Normal force
- Frictional force
- Force exerted by spring
- Forces exerted by string
- Weight

NEWTON'S FIRST LAW OF MOTION

- A body at rest will remains at rest and a body in motion will remain in uniform motion unless acted upon by an unbalanced force.
- Acceleration will be zero, if and only if, resultant force is zero.

*Galileo's experiment.

INERTIA AND MASS

- The inability of a body to change its own state of rest or of uniform motion is known as inertia.
- A heavier body has greater inertia than a lighter body.
- more the mass more is inertia.

NEWTON'S SECOND LAW OF MOTION

- The magnitude of net force acting on a body is proportional to the product of the mass of the body and its acceleration. The direction of the force is same as that of acceleration.
- Force is vector quantity and unit is Newton or Kgm/s^2.

LINEAR MOMENTUM

- The product of mass and velocity of a body is called its linear momentum.
- Linear momentum or momentum is vector quantity and unit is kgm/s.

$$p = mv$$

p = Linear momentum or momentum
v = Velocity
m = Mass

NEWTON SECOND LAW IN TERMS OF MOMENTUM

- The rate of change of momentum of body is proportional to the net force applied on the body and direction of force is same as the direction of change of momentum.

$$F \propto \frac{p_2 - p_1}{t_2 - t_1} \Rightarrow F \propto \frac{m(v_2 - v_1)}{t_2 - t_1} \Rightarrow F \propto m\left(\frac{v_2 - v_1}{t}\right)$$

$$\Rightarrow F = kma \Rightarrow \boxed{F = ma} \quad k = 1$$

- Newton's first law is special case of Newton second law(When acceleration is zero).

NEWTON'S THIRD LAW OF MOTION

- In any interaction between two bodies, the force applied by the first body on the second is equal and opposite to the force applied by the second body on the first.
- Action-Reaction are always equal and opposite.
- Action and Reaction are two different forces that act on two different bodies.
- Any pair of equal and opposite force is not always action-reaction pair.
- Acceleration produce by an action-reaction pair on two bodies may be different due to their different masses.

CONSERVATION OF LINEAR MOMENTUM

- If the net external forces on a system of particle is zero, the linear momentum of the system remains constant.

i.e for two bodies

$$P_1 = P_2 \Rightarrow m_1u_1 + m_2u_2 = m_2v_1 + m_2v_2$$

INTERNAL AND EXTERNAL FORCES

- The force exerted by particles of the system on each other is called internal forces.
- The force exerted by an external agent on the particles of the system is called external forces.

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