

3. Dynamics

Definitions

Newton's First Law of Motion: A body continues in its state of rest or uniform motion in a straight line unless a resultant external force acts on it.

Newton's Second Law of Motion: The rate of change of momentum of a body is directly proportional to the resultant force acting on it and occurs in the direction of the force.

Newton's Third Law of Motion: If a body A exerts a force on body B, then body B exerts an equal but opposite force on body A. (must be same **type** of force and must act on **different** bodies and therefore **do not cancel** each other out)

Impulse: Defined as the product of a force F acting on an object and the time for which the force acts.

Momentum: Defined as the product of a body's mass and its velocity.

Principle of Conservation of Momentum: The total momentum of a system remains constant, provided no net external force acts on it.

- Average force is given by the rate of change of momentum, i.e. momentum change over time interval.
- In elastic collision, E_k of the system is conserved.
- In inelastic collision, E_k of the system is not conserved as some of the E_k is converted into internal energy or sound when the objects deform.
- For elastic collisions, **relative speed of approach = relative speed of separation**
- For **completely** inelastic collisions, the bodies coalesce and move off with a common velocity.

Questions

1. State the transfers of momentum and kinetic energy of the plasticine which occur as a result of the collision.

Ans: Momentum of the plasticine is transferred to momentum of the earth. KE is not conserved but total energy is conserved such as the WD in deforming the plasticine and conversion to thermal energy.