

Q 3 Answer carefully, with reasons:

- a. In an elastic collision of two billiard balls, is the total kinetic energy conserved during the short time of collision of the balls (i.e. when they are in contact)?
- b. Is the total linear momentum conserved during the short time of an elastic collision of two balls?
- c. What are the answers to (a) and (b) for an inelastic collision?
- d. If the potential energy of two billiard balls depends only on the separation distance between their centres, is the collision elastic or inelastic?

(Note, we are talking here of potential energy corresponding to the force during collision, not gravitational potential energy)

Sol.

- a. In an elastic collision of two billiard balls, the total kinetic energy is not conserved during the short time of collision of the balls. During this period, the kinetic energy of the balls is zero. All the energy is stored in the form of potential energy.
- b. The total linear momentum is always conserved during the entire duration of collision. The individual linear momenta change but the total linear momentum always remains constant.
- c. For an inelastic collision, kinetic energy is not conserved but the total linear momentum is conserved.
- d. The collision is elastic in nature. The forces involved are conservative in nature since potential energy depends on the separation of the centres.