Dynamics continued

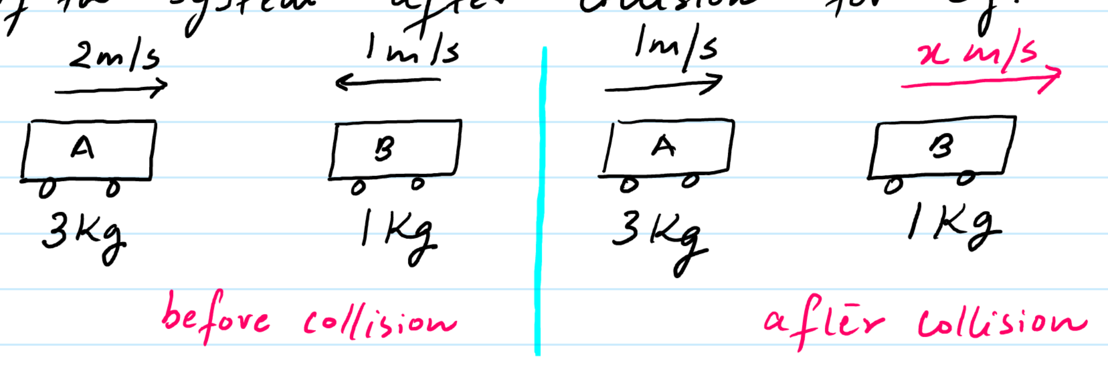
02 November 2020 08:35

Slide ②

Principle of Conservation of Momentum / Law of Conservation of Momentum.

• According to this principle, the total momentum of the system always remains CONSTANT or CONSERVED provided that there is no external force acting on the system

• This principle is also applicable for colliding bodies, in case of collision, the total momentum of the system before collision must be equal to the total momentum of the system after collision. for eg.



Apply principle of Conservation of momentum to find x ?

Ans.

Total momentum before collision = Total momentum after collision

$\xrightarrow{+}$ $(3)(2) + (1)(-1) = (3)(1) + (1)(x)$

$6 - 1 = 3 + x$

$\boxed{x = 2 \text{ m/s}}$

• The nature of collision b/w two bodies can be classified either as

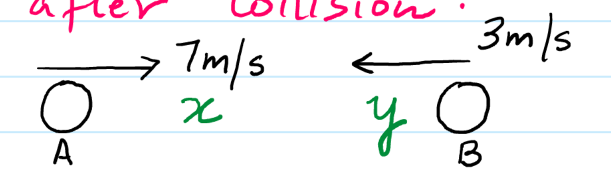
① elastic collision

② In elastic collision

① Elastic collision (properties)

- The momentum of the system remains conserved
- The Kinetic Energy of the system remains conserved
- The Total Energy of the system remains conserved
- The speed of approach before collision = speed of seperation after collision.

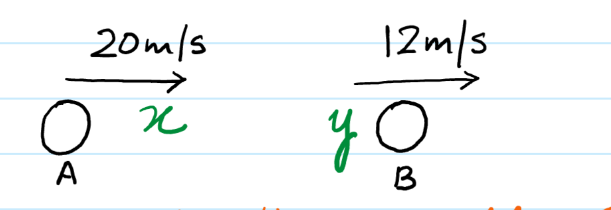
①



$S.O.A = 7 + 3 = 10$

$S.O.A = x + y$.

②

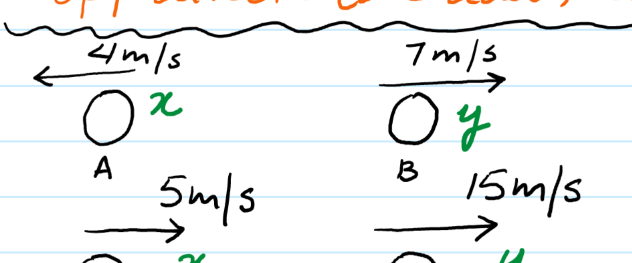


$S.O.A = 20 - 12 = 8$

$S.O.A = x - y$.

opp directions = add, same dir = subtract.

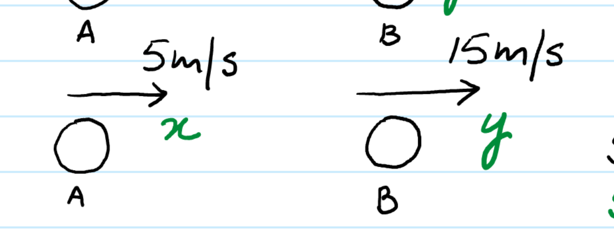
③



$S.O.S = 4 + 7 = 11$

$S.O.S = x + y$.

④

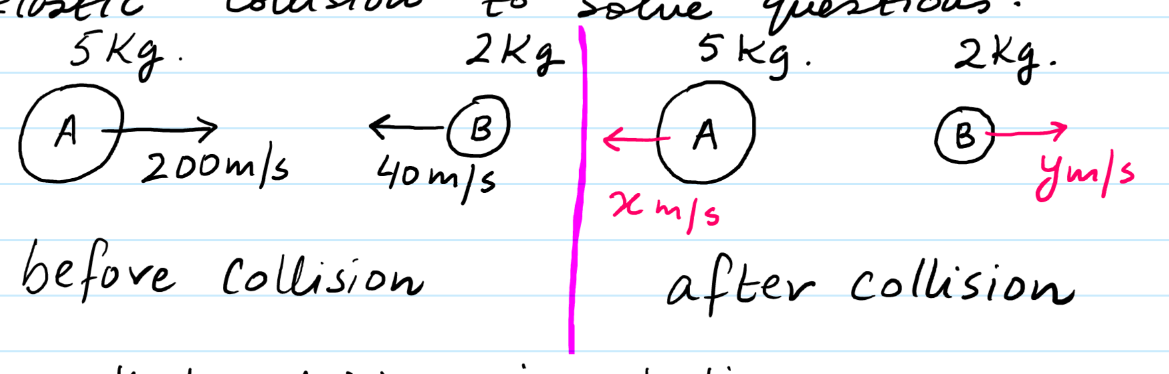


$S.O.S = 15 - 5 = 10$

$S.O.S = y - x$

opp direction = add, same dir = subtract.

Q Example of how to apply property of Elastic collision to solve questions.



Given that collision is elastic

① form an equation based on

speed of approach before collision = speed of seperation after collision

$200 + 40 = x + y$.

$\boxed{240 = x + y} \longrightarrow ①$.

② form an equation based on Principle of Conservation of momentum

$\xrightarrow{+}$ $(5)(200) + (2)(-40) = (5)(-x) + (2)(y)$.

$1000 - 80 = -5x + 2y$.

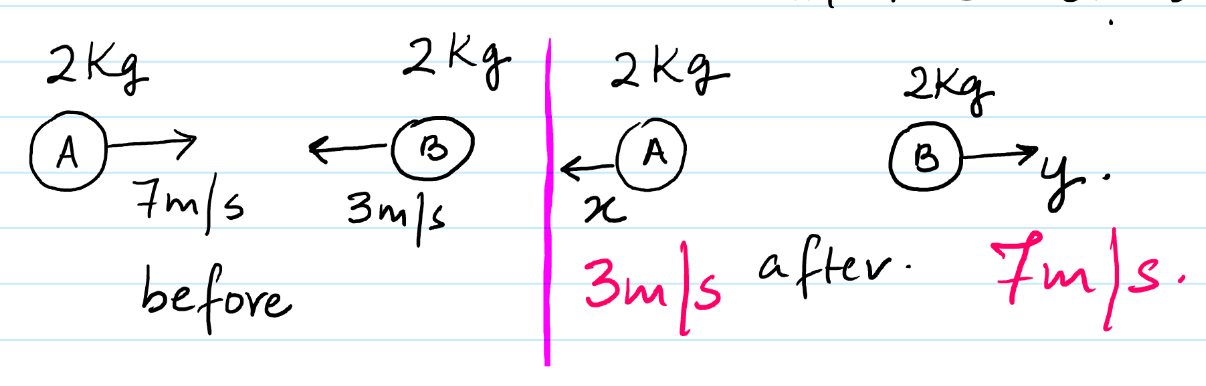
$\boxed{920 = -5x + 2y} \longrightarrow ②$

$x = -63$ m/s $y = 303$ m/s

negative answer implies that A is travelling opposite to the direction originally marked on the diagram.

positive answer implies that B goes in the same direction as marked on diag.

Q:



Elastic collision. Form 2 equations to find x and y.

$S.O.A = S.O.S$

$7 + 3 = x + y$.

$\boxed{10 = x + y} \longrightarrow ①$.

Principle of Conservation of momentum

$\xrightarrow{+}$ $(2)(7) + (2)(-3) = (2)(-x) + (2)(y)$

$14 - 6 = -2x + 2y$.

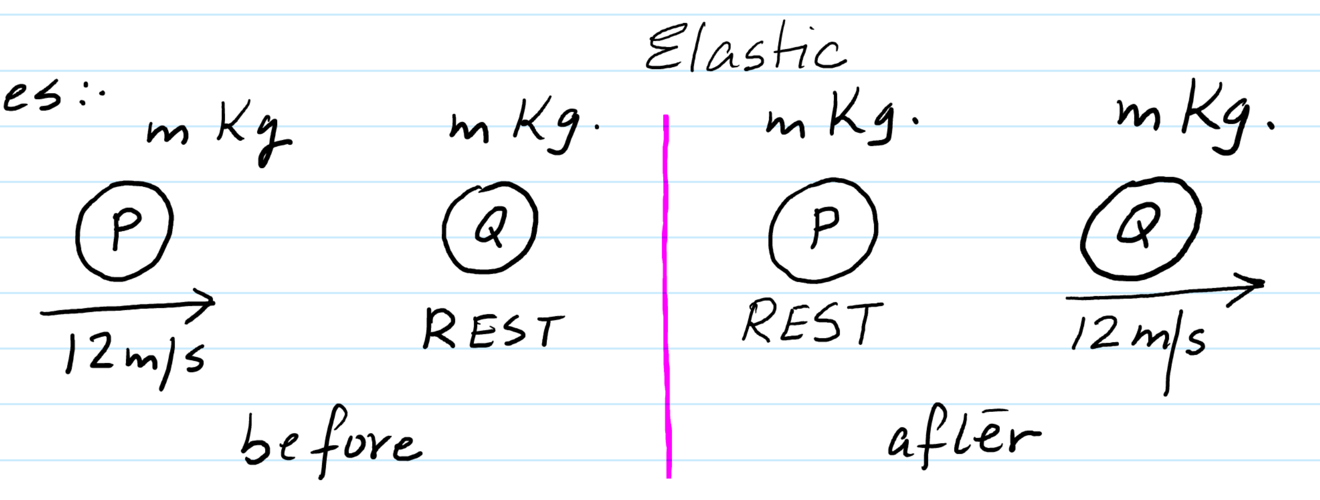
$\boxed{8 = -2x + 2y} \longrightarrow ②$.

$x = 3$ m/s $y = 7$ m/s

Conclusion :: For identical masses performing Elastic collision, the speeds will get "interchanged"

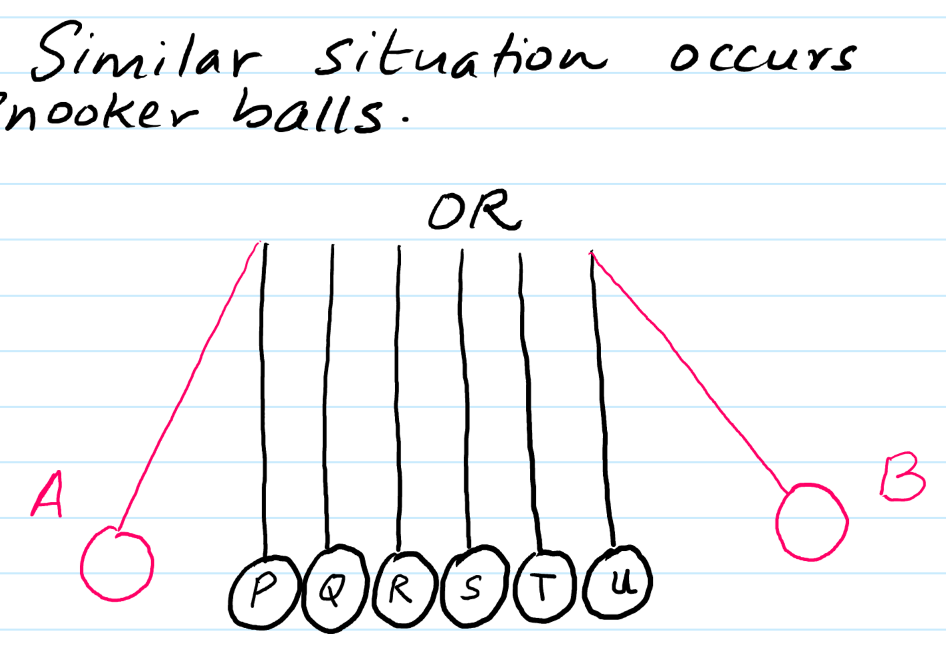
i.e Initial speed of A becomes final speed of B
OR
Initial speed of B becomes final speed of A.

Ques::



Note :: Similar situation occurs with snooker balls.

OR



Note :: momentum of first ball transfers into the last ball hence all balls in the middle remain at rest, only the first & last ball moves back and forth. [This is called newton cradle].

before after collision