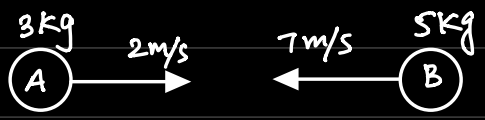
MOMENTUM = PRODUCT OF MASS AND VELOCITY.

$$P = mv$$

Units = $kg\,m/s$ or $kg\,ms^{-1}$

IMP: DIRECTION WITH VELOCITY.



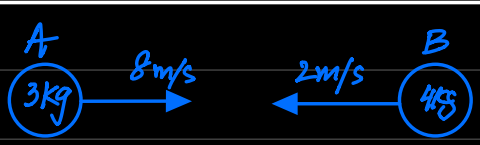
$P_A = (3)(2)$ $\quad P_B = (5)(-7)$

$= 6\ kgms^{-1}$ $\quad -35\ kgms^{-1}$

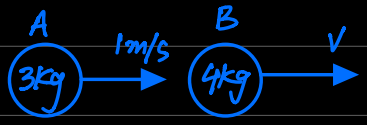
COLLISIONS

TOTAL MOMENTUM BEFORE COLLISION = TOTAL MOMENTUM AFTER COLLISION

Q. Before



After.



, Find V.

TOTAL MOMENTUM BEFORE = TOTAL MOMENTUM AFTER

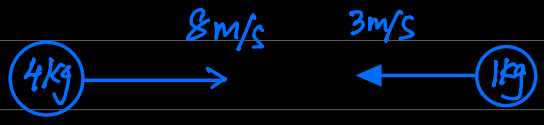
$$(3)(8) + (4)(-2) = (3)(1) + (4)(v)$$

$$24 - 8 = 3 + 4v$$

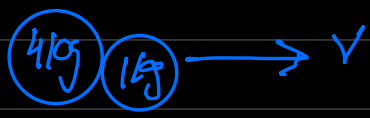
$$16 - 3 = 4v$$

$$v = 3.25$$

Q:



After the collision, Both boxes coalesce,



Coalesce = Join together

TOTAL MOMENTUM BEFORE = TOTAL MOMENTUM AFTER.

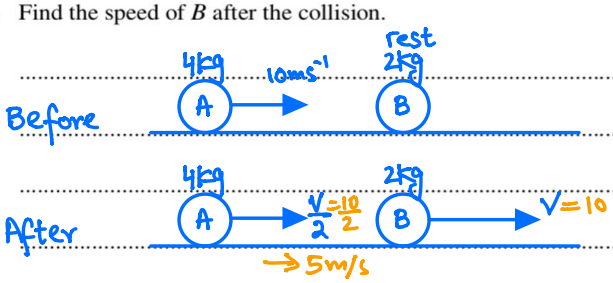
$$(4)(8) + (1)(-3) = (4+1)(v)$$

$$32 - 3 = 5v$$

$$v = 5.8$$

4 Small smooth spheres A and B, of equal radii and of masses 4 kg and 2 kg respectively, lie on a smooth horizontal plane. Initially B is at rest and A is moving towards B with speed $10\,\text{m s}^{-1}$. After the spheres collide A continues to move in the same direction but with half the speed of B.

(a) Find the speed of B after the collision. [2]



Before = After

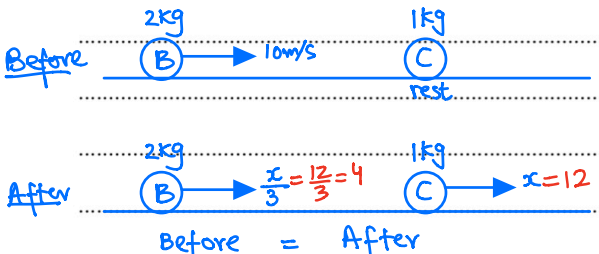
$(4)(10) + (2)(0) = 4\left(\frac{v}{2}\right) + (2)(v)$

$40 = 2v + 2v$

$v = 10$

A third small smooth sphere C, of mass 1 kg and with the same radius as A and B, is at rest on the plane. B now collides directly with C. After this collision B continues to move in the same direction but with one third the speed of C.

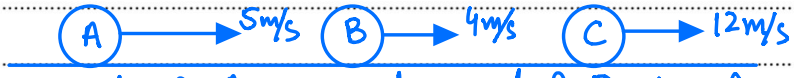
(b) Show that there is another collision between A and B. [3]



Before = After

$(2)(10) + (1)(0) = 2\left(\frac{x}{3}\right) + 1(x)$

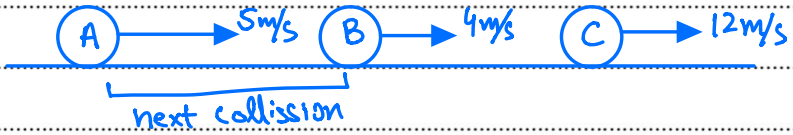
$x = 12$

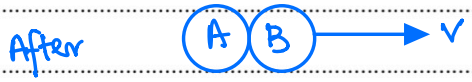


Since speed of A = 5 and speed of B = 4, A will catch up and there will be another collision.

(c) *A* and *B* coalesce during this collision.

Find the total loss of kinetic energy in the system due to the three collisions. [5]





Before = After

$(4)(5)+(2)(4) = (4+2)v$

$28 = 6v$

$v = 4.667$

START

TOTAL KE $= \frac{1}{2}(4)(10)^2 + \frac{1}{2}(2)(0)^2 + \frac{1}{2}(1)(0)^2 = 200\,J$

END

TOTAL KE $= \frac{1}{2}(4+2)(4.667)^2 + \frac{1}{2}(1)(12)^2 = 137.15\,J$

LOSS IN KE $= 200 - 137.15 = 62.85\,J$.