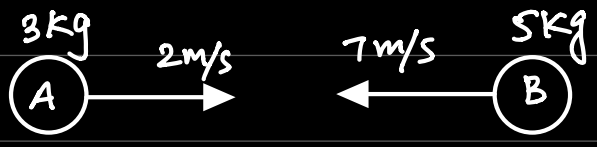
MOMENTUM = PRODUCT OF MASS AND VELOCITY.

$$P = mv$$

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

IMP: DIRECTION WITH VELOCITY.



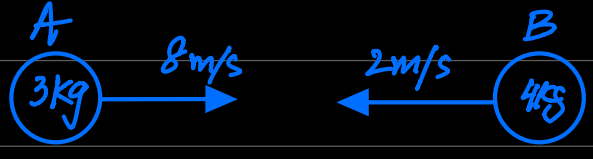
$P_A = (3)(2)$
$= 6\ kgms^{-1}$

$P_B = (5)(-7)$
$-35\ kgms^{-1}$

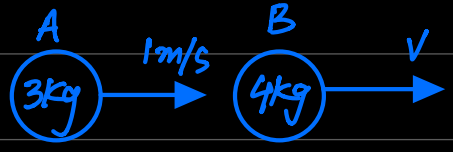
COLLISIONS

TOTAL MOMENTUM BEFORE COLLISION = TOTAL MOMENTUM AFTER COLLISION

Q: Before



After.



, Find V.

TOTAL MOMENTUM BEFORE = TOTAL MOMENTUM AFTER

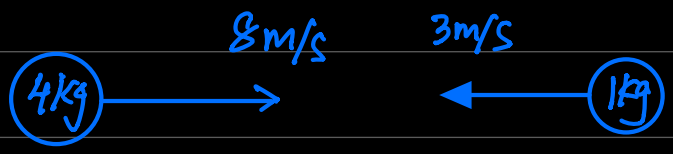
$(3)(8) + (4)(-2) = (3)(1) + (4)(v)$

$24 - 8 = 3 + 4v$

$16 - 3 = 4v$

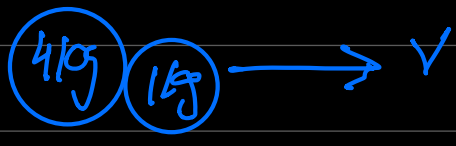
$v = 3.25$

Q:



After the collision, Both boxes coalesce.

Coalesce = join together



TOTAL MOMENTUM BEFORE = TOTAL MOMENTUM AFTER.

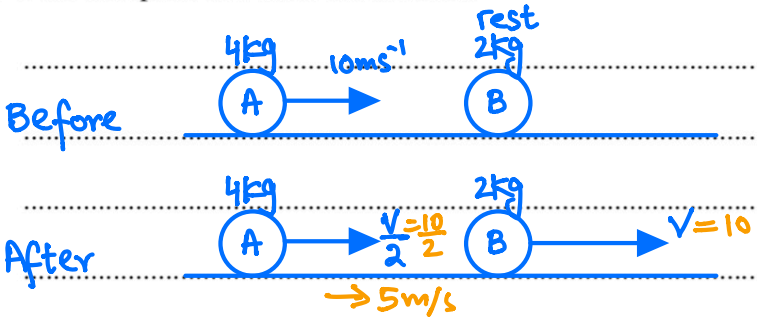
$(4)(8) + (1)(-3) = (4+1)(v)$

$32 - 3 = 5v$

$v = 5.8$

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

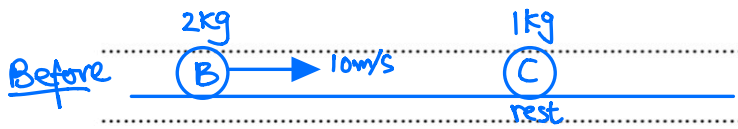
$(4)(10) + (2)(0) = 4\left(\frac{v}{2}\right) + (2)(v)$

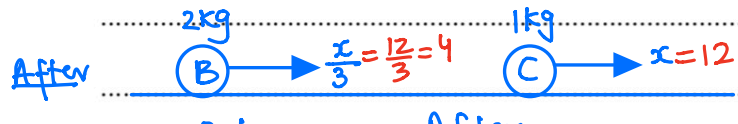
$40 = 2v + 2v$

$v = 10$

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

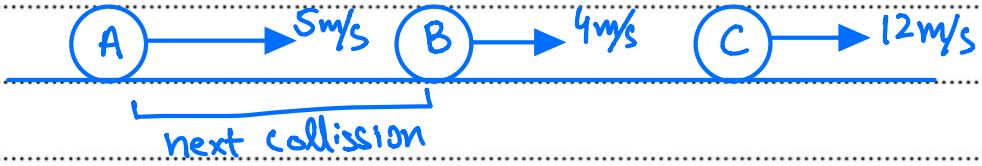
$(2)(10) + (1)(0) = 2\left(\frac{x}{3}\right) + 1(x)$

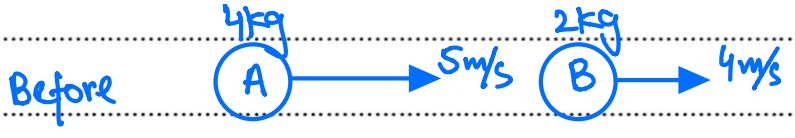
$x = 12$

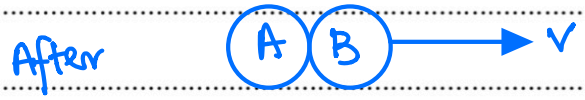
Since speed of A = 5 and speed of B = 4, A will catch up and there will be another collision.

(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

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

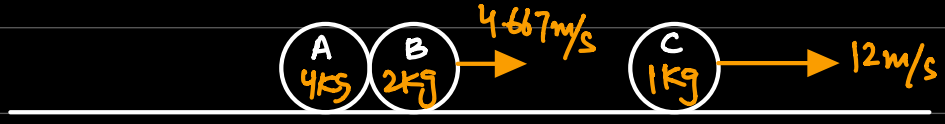
$28=6v$

$v=4.667$

START

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

END



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

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