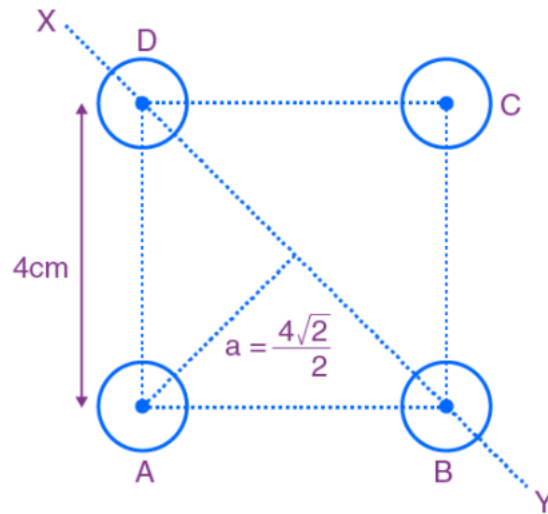


Question 6) Four solid spheres each of diameter  $\sqrt{5}$  cm and mass 0.5 kg are placed with their centres at the corners of a square of side 4 cm. The moment of inertia of the system about the diagonal of the square is  $N \times 10^{-4} \text{ kgm}^2$ , then N is

Solution:



$$I_{xy} = I_A + I_B + I_C + I_D$$

By symmetry

$$I_A = I_C$$

$$I_B = I_D$$

$$I_{xy} = 2I_A + 2I_B$$

$$I_{xy} = 2 \left[ \frac{2}{5} MR^2 + Ma^2 \right] + 2 \left[ \frac{2}{5} MR^2 \right]$$

$$I_{xy} = 4 \times \frac{2}{5} MR^2 + 2Ma^2$$

$$I_{xy} = M \times \left[ \frac{8}{5} MR^2 + 2Ma^2 \right]$$

$$I_{xy} = \left[ \frac{8}{5} \times 0.5 \times \left( \frac{\sqrt{5}}{2} \right)^2 + 2 \times (0.5) \times (4 \times 2)^2 \right] \times 10^{-4}$$

$$= 9 \times 10^{-4}$$

$$= N \times 10^{-4}$$

Therefore,  $N = 9$