1. Nov/2022/Paper_9709_41/No.2

Small smooth spheres A and B, of equal radii and of masses 6 kg and 2 kg respectively, lie on a smooth horizontal plane. Initially A is moving towards B with speed $5\,\text{m s}^{-1}$ and B is moving towards A with speed $3\,\text{m s}^{-1}$. After the spheres collide, both A and B move in the same direction and the difference in the speeds of the spheres is $2\,\text{m s}^{-1}$.

Find the loss of kinetic energy of the system due to the collision. [5]

2. Nov/2022/Paper_9709_42/No.6

Three particles A, B and C of masses 0.3 kg, 0.4 kg and m kg respectively lie at rest in a straight line on a smooth horizontal plane. The distance between B and C is 2.1 m. A is projected directly towards B with speed $2\,\text{m s}^{-1}$. After A collides with B the speed of A is reduced to $0.6\,\text{m s}^{-1}$, still moving in the same direction.

(a) Show that the speed of B after the collision is $1.05\,\text{m s}^{-1}$. [2]

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After the collision between A and B, B moves directly towards C. Particle B now collides with C. After this collision, the two particles coalesce and have a combined speed of $0.5\,\text{m s}^{-1}$.

(b) Find m. [2]

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(c) Find the time that it takes, from the instant when B and C collide, until A collides with the combined particle. [5]