**5C Oblique Impacts with Two Smooth Spheres**

1. A smooth sphere A, of mass 2kg and moving with speed 6ms-1 collides obliquely with a smooth sphere B of mass 4kg. Just before the impact B is stationary and the velocity of A makes an angle of 60˚ with the lines of centres of the two spheres. The coefficient of restitution between the spheres is $\frac{1}{4}$. Find the magnitudes and directions of the velocities of A and B immediately after the impact.
2. A small smooth sphere A of mass 1kg collides with a small smooth sphere B of mass 2kg. Just before the impact A is moving with a speed of 4ms-1 in a direction of 45˚ to the line of centres and B is moving with speed 3ms-1 at 60˚ to the line of centres. Given that the coefficient of restitution between the spheres is $\frac{3}{4}$ and that the spheres collide, find:
3. The kinetic energy lost in the impact
4. The magnitude of the impulse exerted on A by B
5. A smooth sphere $A$ of mass 5kg is moving on a smooth horizontal surface with velocity $\left(2i+3j\right)ms^{-1}$. Another smooth sphere $B$ of mass 3kg and the same radius as $A$ is moving on the same surface with velocity $\left(4i-2j\right)ms^{-1}$. The spheres collide when their line of centres is parallel to $j$. The coefficient of restitution between the spheres is $\frac{3}{5}$. Find the velocities of both spheres after the impact.
6. Two small smooth spheres $A$ and $B$ have equal radii. The mass of $A$ is $2m$ kg and the mass of $B$ is $3m$ kg. The spheres are moving on a smooth horizontal plane and they collide. Immediately before the collision the velocity of $A$ is $5j ms^{-1}$ and the velocity of $B$ is $\left(3i-j\right) ms^{-1}$. Immediately after the collision the velocity of $A$ is $\left(3i+2j\right) ms^{-1}$. Find:
7. The speed of $B$ immediately after the collision
8. A unit vector parallel to the line of centres of the spheres at the instant of collision