

Two uniform small spheres  $A$  and  $B$  have equal radii and masses  $4m$  and  $m$  respectively. Sphere  $A$  is moving with speed  $u$  on a smooth horizontal surface when it collides directly with sphere  $B$  which is at rest. The coefficient of restitution between the spheres is  $e$ .

- (i) Show that after the collision  $A$  moves with speed  $\frac{1}{5}u(4 - e)$  and find the speed of  $B$ . [4]

Sphere  $B$  continues to move until it collides with a fixed smooth vertical barrier which is perpendicular to the direction of motion of  $B$ . The coefficient of restitution between  $B$  and the barrier is  $\frac{3}{4}e$ . After this collision, the speeds of  $A$  and  $B$  are equal.

- (ii) Find the value of  $e$ . [3]

The spheres  $A$  and  $B$  now collide directly again.

- (iii) Determine whether sphere  $B$  collides with the barrier for a second time. [2]