6. Two particles A and B, of mass m and $2m$ respectively, are moving in the same direction along the same straight line on a smooth horizontal surface, with B in front of A.

Particle A has speed $3\,\text{m s}^{-1}$ and particle B has speed $2\,\text{m s}^{-1}$.

Particle A collides directly with particle B.

The coefficient of restitution between A and B is $\frac{2}{3}$.

The direction of motion of both particles is **not** changed by the collision.

Immediately after the collision, A has speed $v\,\text{m s}^{-1}$ and B has speed $w\,\text{m s}^{-1}$.

(a) (i) Show that $w = \frac{23}{9}$

(ii) Find the value of v.

(7)

When A and B collide they are 3 m from a smooth vertical wall which is perpendicular to their direction of motion.

After the collision with A, particle B hits the wall and rebounds.

The coefficient of restitution between B and the wall is $\frac{1}{2}$

There is a second collision between A and B at a point d m from the wall.

(b) Find the value of d.

(7)

(Total for Question 6 is 14 marks)