**5.** A particle $P$ of mass $m$ and a particle $Q$ of mass $2m$ are at rest on a smooth horizontal plane.

Particle $P$ is projected with speed $u$ along the plane towards $Q$ and the particles collide. The coefficient of restitution between the particles is $e$.

As a result of the collision, the direction of motion of $P$ is reversed.

(a) Find, in terms of $u$ and $e$, the speed of $P$ after the collision.

**(6)**

After the collision, $Q$ goes on to hit a vertical wall which is fixed at right angles to the direction of motion of $Q$. The coefficient of restitution between $Q$ and the wall is $\frac{1}{3}$

Given that there is a second collision between $P$ and $Q$

(b) find the full range of possible values of $e$.

**(5)**

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**Question 5 continued**

**(Total for Question 5 is 11 marks)**