7. Particle P has mass m and particle Q has mass $5m$.

The particles are moving in the same direction along the same straight line on a smooth horizontal surface.

Particle P collides directly with particle Q.

Immediately **before** the collision, the speed of P is $6u$ and the speed of Q is u.

Immediately **after** the collision, the speed of P is x and the speed of Q is y.

The direction of motion of P is reversed as a result of the collision.

The coefficient of restitution between P and Q is e.

(a) Find the complete range of possible values of e.

(7)

Given that $e = \frac{3}{5}$

(b) find the total kinetic energy lost in the collision between P and Q.

(4)

After the collision, Q hits a smooth fixed vertical wall that is perpendicular to the direction of motion of Q.

Particle Q rebounds.

The coefficient of restitution between Q and the wall is f.

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

(c) find the complete range of possible values of f.

(3)

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Question 7 continued

(Total for Question 7 is 14 marks)