AQA – Momentum and collisions – AS Further Mathematics Mechanics

1. June/2020/Paper_2/No.4

A particle P, of mass m kg, collides with a particle Q, of mass 2 kg

Immediately before the collision the velocity of *P* is $\begin{bmatrix} 4 \\ -2 \end{bmatrix}$ m s⁻¹ and the velocity of *Q* is $\begin{bmatrix} -3 \\ -2 \end{bmatrix}$ m s⁻¹

is
$$\begin{bmatrix} -3\\5 \end{bmatrix}$$
 m s⁻¹

As a result of the collision the particles coalesce into a single particle which moves with velocity $\begin{bmatrix} k \\ 0 \end{bmatrix}$ m s⁻¹, where *k* is a constant.

Find the value of k.

[4 marks



2. June/2020/Paper_2/No.8

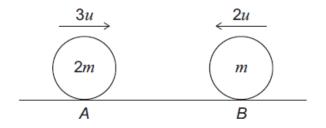
Two smooth spheres A and B have the same radius and are free to move on a smooth horizontal surface.

The masses of A and B are 2m and m respectively.

Both A and B are initially at rest.

The sphere A is set in motion directly towards B with speed 3u and at the same time B is set in motion directly towards A with speed 2u.

Subsequently A and B collide directly.



The coefficient of restitution between the spheres is *e*.

(a) Show that the speed of *B* after the collision is given by

$$\frac{2u(2+5e)}{3}$$

[4 marks]

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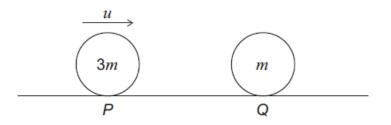
3. June/2019/Paper_2/No.7

Two smooth spheres, *P* and *Q*, of equal radius are free to move on a smooth horizontal surface.

The masses of P and Q are 3m and m respectively.

P is set in motion with speed *u* directly towards *Q*, which is initially at rest.

P subsequently collides with Q.



Immediately after the collision, P moves with speed v and Q moves with speed w.

The coefficient of restitution between the spheres is e.

(a) (i) Show that

$$v=\frac{u(3-e)}{4}$$

[4 marks]

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