

FM1 – Mechanics Chapter 1

Exam Questions: Momentum and Impulse (Non-Vector Questions)

Q1.

Particle P has mass 3 kg and particle Q has mass 2 kg. The particles are moving in opposite directions on a smooth horizontal plane when they collide directly. Immediately before the collision, P has speed 3 m s^{-1} and Q has speed 2 m s^{-1} . Immediately after the collision, both particles move in the same direction and the difference in their speeds is 1 m s^{-1} .

(a) Find the speed of each particle after the collision.

(5)

(b) Find the magnitude of the impulse exerted on P by Q .

(3)

(Total 8 marks)

Q2.

A particle A of mass $3m$ and a particle B of mass m are moving along the same straight line on a smooth horizontal surface. The particles are moving in opposite directions towards each other when they collide directly.

Immediately before the collision, the speed of A is ku and the speed of B is u .
Immediately after the collision, the speed of A is v and the speed of B is $2v$.

The magnitude of the impulse received by B in the collision is $\frac{3}{2}mu$.

(a) Find v in terms of u only.

(3)

(b) Find the two possible values of k .

(5)

(Total for question = 8 marks)

Q3.

Two particles A and B are moving on a smooth horizontal plane.

The mass of A is km , where $2 < k < 3$, and the mass of B is m .

The particles are moving along the same straight line, but in opposite directions, and they collide directly.

Immediately before they collide the speed of A is $2u$ and the speed of B is $4u$.

As a result of the collision the speed of A is halved and its direction of motion is reversed.

(a) Find, in terms of k and u , the speed of B immediately after the collision.

(3)

(b) State whether the direction of motion of B changes as a result of the collision, explaining your answer.

(3)

Given that $k = \frac{7}{3}$,

(c) find, in terms of m and u , the magnitude of the impulse that A exerts on B in the collision.

(3)

(Total 9 marks)

Q4.

Two particles, P and Q , have masses $2m$ and $3m$ respectively. They are moving towards each other in opposite directions on a smooth horizontal plane when they collide directly. Immediately before they collide the speed of P is $4u$ and the speed of Q is $3u$. As a result of the collision, Q has its direction of motion reversed and is moving with speed u .

(a) Find the speed of P immediately after the collision.

(3)

(b) State whether or not the direction of motion of P has been reversed by the collision.

(1)

(c) Find the magnitude of the impulse exerted on P by Q in the collision.

(3)

(Total for question = 7 marks)

Q5.

Particle P of mass m and particle Q of mass km are moving in opposite directions on a smooth horizontal plane when they collide directly. Immediately before the collision the speed of P is $5u$ and the speed of Q is u . Immediately after the collision the speed of each particle is halved and the direction of motion of each particle is reversed.

Find

(a) the value of k ,

(3)

(b) the magnitude of the impulse exerted on P by Q in the collision.

(3)

(Total for question = 6 marks)

Q6.

Two particles A and B , of mass 2 kg and 3 kg respectively, are moving towards each other in opposite directions along the same straight line on a smooth horizontal surface. The particles collide directly. Immediately before the collision the speed of A is 5 m s^{-1} and the speed of B is 6 m s^{-1} . The magnitude of the impulse exerted on B by A is 14 N s . Find

(a) the speed of A immediately after the collision,

(3)

(b) the speed of B immediately after the collision.

(3)

(Total 6 marks)

Q7.

Particle P has mass 3 kg and particle Q has mass m kg. The particles are moving in opposite directions along a smooth horizontal plane when they collide directly. Immediately before the collision, the speed of P is 4 m s^{-1} and the speed of Q is 3 m s^{-1} . In the collision the direction of motion of P is unchanged and the direction of motion of Q is reversed. Immediately after the collision, the speed of P is 1 m s^{-1} and the speed of Q is 1.5 m s^{-1} .

(a) Find the magnitude of the impulse exerted on P in the collision.

(3)

(b) Find the value of m .

(3)

(Total 6 marks)