## **1A Momentum in One Dimension**

Momentum:

Impulse:

- 1. Find the magnitude of the momentum of:
- a) A cricket ball of mass 400g moving at 18ms<sup>-1</sup>

b) A lorry of mass 5 tonnes moving at 12ms<sup>-1</sup>

- 2. A body of mass 2kg is initially at rest on a smooth horizontal plane. A horizontal force of magnitude 4.5N acts on the body for 6s. Find:
- a) The magnitude of the impulse given to the body by the force

b) The final speed of the body

3. A ball of mass 0.2kg hits a vertical wall at right angles with a speed of 3.5ms<sup>-1</sup>. The ball rebounds from the wall with speed 2.5ms<sup>-1</sup>. Find the magnitude of the impulse the ball exerts on the wall.

## **<u>1B Conservation of Momentum</u>**

- 1. A particle of mass 2kg is moving with speed 3ms<sup>-1</sup> on a smooth horizontal plane. Particle Q of mass 3kg is at rest on the plane. Particle P collides with Q and after the collision Q moves away with a speed of 2<sup>1</sup>/<sub>3</sub>ms<sup>-1</sup>. Find:
- a) The speed and direction of the motion of P after the collision

b) The magnitude of the impulse received by P and by Q in the collision

- 2. Two particles, P and Q of mass 2kg and 4kg respectively are moving towards each other along the same straight line on a smooth horizontal plane. The particles collide. Before the collision, the speeds of P and Q are 3ms<sup>-1</sup> and 2ms<sup>-1</sup>. Given that the magnitude of the impulse due to the collision is 7Ns, find:
- a) The speed and direction of P after the collision

b) The speed and direction of Q after the collision

- 3. Two particles, A and B, of masses 8kg and 2kg respectively, are connected by a light inextensible string. The particles are at rest on a smooth horizontal plane with the string slack. Particle A is projected directly away from B with speed 4ms<sup>-1</sup>.
- a) Find the speed of the particles when the string goes taut

b) Find the magnitude of the impulse transmitted through the string when it goes taut

## **<u>1C Momentum as a Vector (Not AS)</u>**

1. A particle of mass 0.2kg is moving with velocity  $(10i - 5j) ms^{-1}$  when it receives an impulse (3i - 2j) Ns. Find the new velocity of the particle.

2. An ice hockey puck of mass 0.17kg receives an impulse **Q** Ns. Immediately before the impulse the velocity of the puck is  $(10i + 5j) ms^{-1}$  and immediately afterwards its velocity is  $(15i - 7j) ms^{-1}$ . Find the magnitude of **Q** and the angle between **Q** and **i**.

3. A particle of mass 0.15kg is moving with velocity  $(20i - 10j) ms^{-1}$  when it collides with a particle of mass 0.25kg moving with velocity  $(16i - 8j) ms^{-1}$ . The two particles coalesce and form one particle of mass 0.4kg. Find the velocity of the combined particle.