**1A Momentum in One Dimension**

Momentum:

Impulse:

1. Find the magnitude of the momentum of:
2. A cricket ball of mass 400g moving at 18ms-1
3. A lorry of mass 5 tonnes moving at 12ms-1
4. 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:
5. The magnitude of the impulse given to the body by the force
6. The final speed of the body
7. A ball of mass 0.2kg hits a vertical wall at right angles with a speed of 3.5ms-1. The ball rebounds from the wall with speed 2.5ms-1. Find the magnitude of the impulse the ball exerts on the wall.

**1B Conservation of Momentum**

1. A particle of mass 2kg is moving with speed 3ms-1 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 21/3ms-1. Find:
2. The speed and direction of the motion of P after the collision
3. The magnitude of the impulse received by P and by Q in the collision
4. 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-1 and 2ms-1. Given that the magnitude of the impulse due to the collision is 7Ns, find:
5. The speed and direction of P after the collision
6. The speed and direction of Q after the collision
7. 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-1.
8. Find the speed of the particles when the string goes taut
9. Find the magnitude of the impulse transmitted through the string when it goes taut

**1C Momentum as a Vector (Not AS)**

1. A particle of mass 0.2kg is moving with velocity $\left(10i-5j\right) ms^{-1}$ when it receives an impulse $\left(3i-2j\right) Ns$. 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 $\left(10i+5j\right) ms^{-1}$ and immediately afterwards its velocity is $\left(15i-7j\right) ms^{-1}$. Find the magnitude of **Q** and the angle between **Q** and **i**.
3. A particle of mass 0.15kg is moving with velocity $\left(20i-10j\right) ms^{-1}$ when it collides with a particle of mass 0.25kg moving with velocity $\left(16i-8j\right) ms^{-1}$. The two particles coalesce and form one particle of mass 0.4kg. Find the velocity of the combined particle.