Momentum

1. True or false:

a) Linear momentum is **always** conserved in a collision or explosion.

b) Kinetic energy is **never** conserved in a collision.

c) Kinetic energy is **always** conserved in an explosion.

[3]

2. Given the expression:

$M_1v_1 + M_2v_2 = M_1v_3 + M_2v_4$ (Conservation of momentum)

Show that in an explosion involving two masses, the momentum of the two parts must be equal.

[3]

3. Using Newton's Second Law, show that the average force on an object is equal to its rate of change of momentum.

[2]

4. A spaceship has a mass of 3000kg. It is at rest when it ejects a capsule of mass 450kg. The capsule moves away with velocity 55m/s.

Show that the new velocity of the main spaceship is 8.3m/s

[2]

5. Car A travelling east collides with car B travelling west. Car A has a mass of 1000kg and an initial velocity of 13m/s. Car B has a mass of 1300kg an a velocity of 8m/s. The two cars stick together after the collision.

a) Calculate the velocity at which they move off. Give both magnitude and direction

[2]

[continued overleaf]
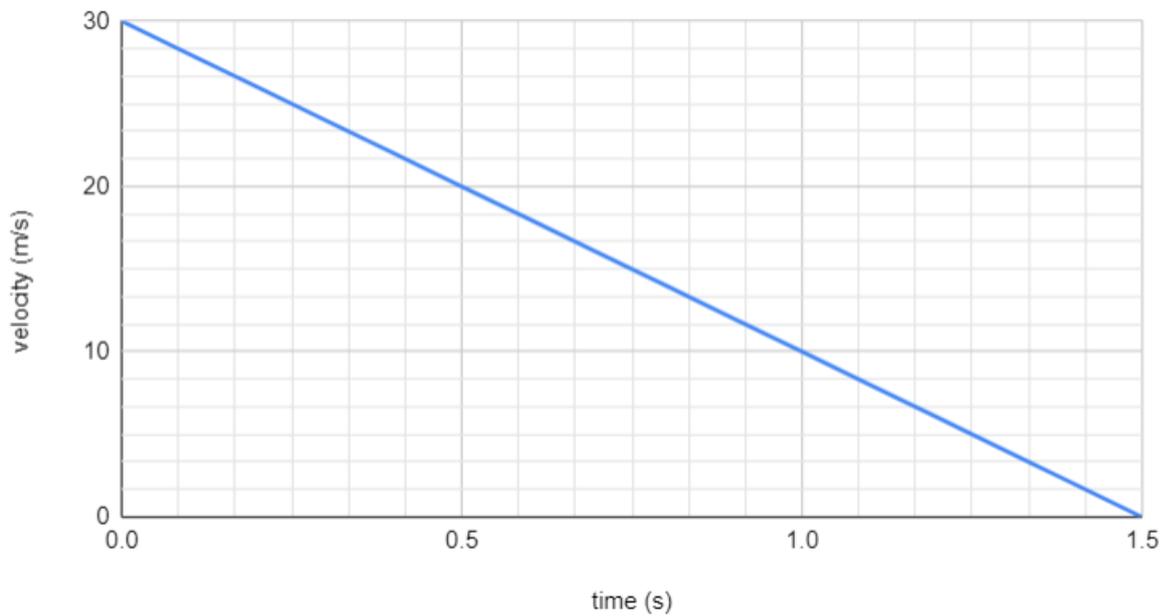
b) Show that this collision is inelastic.

[4]

c) It takes 0.6s for the collision to occur and the cars to move off at their new velocity. Calculate the average force exerted by car B on car A throughout this collision.

[3]

6. A trolley undergoes deceleration. A graph is shown of its velocity vs time.

Velocity (m/s) vs. Time (s)

a) What is the deceleration of the trolley?

[2]

b) If the average force on the trolley is 250N, what is the mass of the trolley?

[2]