Practise Test 2

Momentum and Impulse

Q1

A white snooker ball travelling at 3m/s hits into a stationary red ball and then moves in the same direction with a speed of 1 m/s what is the speed of the red ball after the collision? Each ball has a mass of 0.2Kg.

Q2

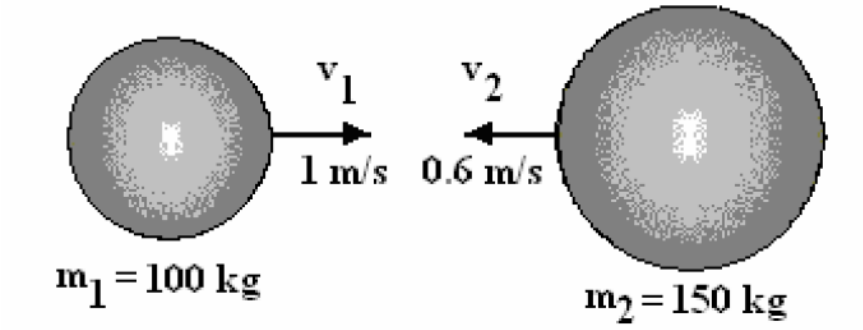
A 0.5kg cannon ball is fired from a 500kg cannon with a velocity of 25 m/s. What is the recoil velocity of the cannon?

Q3

A loose train carriage of 5000Kg traveling at 5m/s couples with a second carriage at rest of mass 8000Kg. What is the final speed of the combined carriages?

Q4

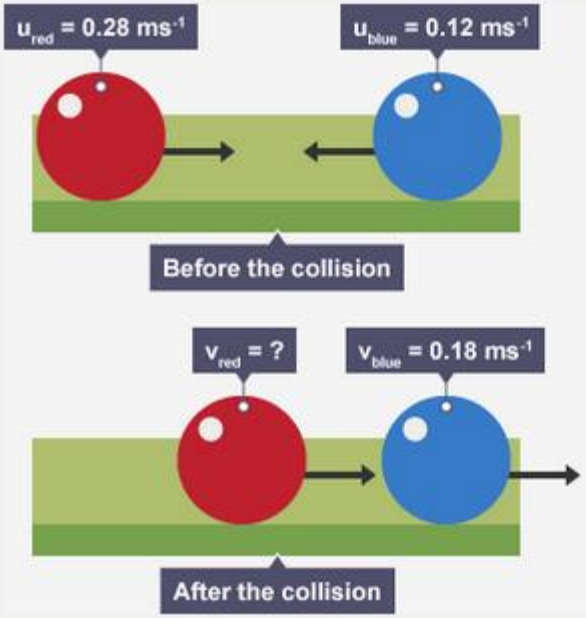
A mass of 100 kg moves along a straight line at 1 m/s. It collides with a mass of 150 kg moving the opposite way along the same straight line at 0.6 m/s. The two masses join together on colliding to form one mass. Determine the velocity of the joint mass.



Q5

A red and a blue snooker ball both having a mass of 160 g collide with speeds and directions as shown in the diagram below.

Before and after collision.



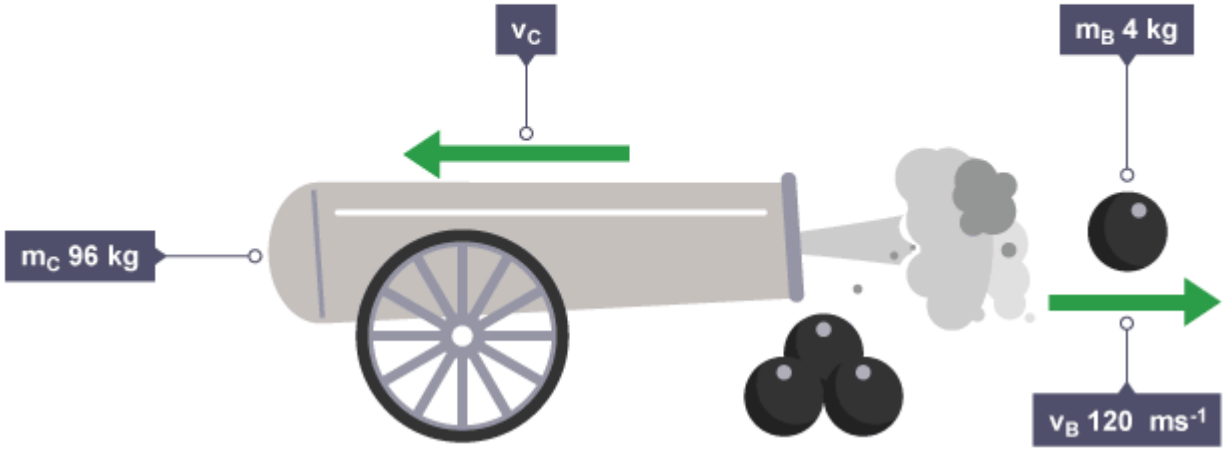
Calculate the velocity of the red ball after the collision and use kinetic energy to determine whether the collision was elastic or not.

Q6

If two bumper cars collide head-on in a fairground and both cars come to a stop due to the collision, kinetic energy is obviously not conserved. Is momentum conserved even though both cars stop?

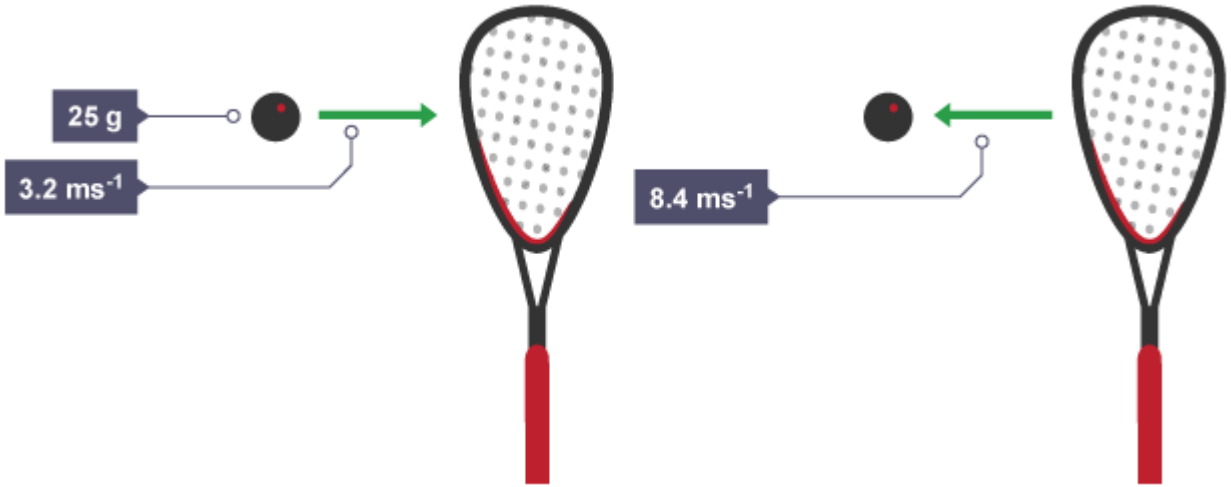
Q7

Consider a cannon ball of mass m_B 4 kg fired at velocity v_B 120 ms^{-1} from a cannon of mass m_C 96 kg. This allows determination of the recoil **speed** of the cannon v_C.



Q8

During a friendly Scotland verse South African game a squash ball of mass 25 g is moving from left to right at 3.2 ms^{-1}. It is hit by a squash racquet which applies a force for 4 milliseconds, so that the ball leaves the racquet at 8.4 ms^{-1} moving from right to left. Impulse-momentum can be used to calculate the average force on the ball.

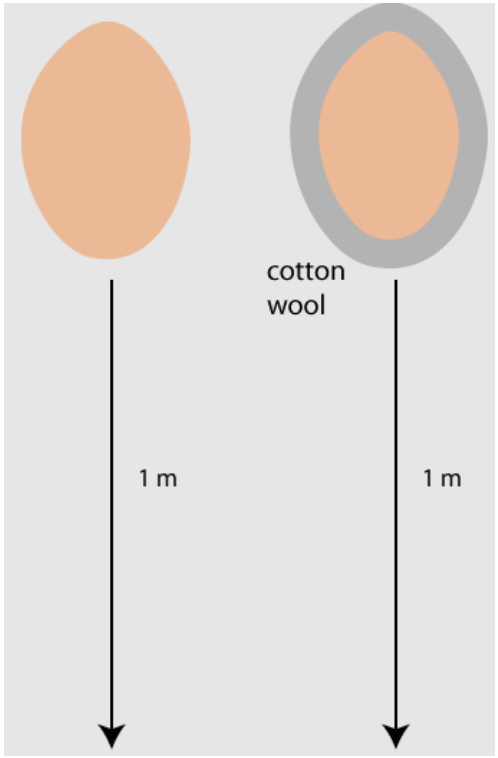


Q9

Suppose two eggs of mass 60 g fall 1 m to the ground and come to rest. One egg is covered in cotton wool of neglible mass. Suppose the egg shell will crack if it experiences a force of 20 N. Calculate the change in momentum of each egg.

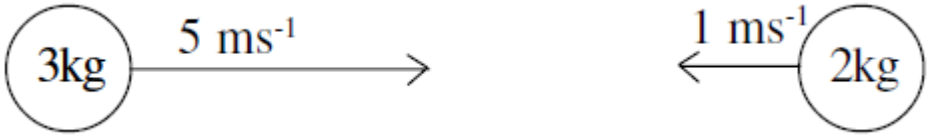
What impulse did the ground exert on each egg.

Suppose the egg with no cotton wool came to rest in 0.02 s and the egg in cotton wool came to rest on 0.5s Calculate, F_{EG} the force exerted on each egg by the ground and state which egg, if any, crack.



Q10

The two balls shown stick together when they **collide. Work out their momentum and the type of collision.**



Q11

A 50g shell is fired from a gun of mass 12 kg. The initial velocity of the shell is 220 ms-1 in the direction shown.

Find the recoil velocity of the gun.

Q12

Two particles A and B have masses 4 kg and m kg respectively. They are moving towards each other in opposite directions on a smooth horizontal table when they collide directly. Immediately before the collision, the speed of A is 5 m s^{-1} and the speed of B is 3 m s^{-1}. Immediately after the collision, the direction of motion of A is unchanged and the speed of A is 1 m s^{-1}.

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

Q12 continued

(*b*) Find the value of m.

Immediately after the collision, the speed of B is 2 m s^{-1}.

Q13

Two particles A and B, of mass 0.3 kg and m kg respectively, are moving in opposite directions along the same straight horizontal line so that the particles collide directly. Immediately before the collision, the speeds of A and B are 8 m s^{-1} and 4 m s^{-1} respectively. In the collision the direction of motion of each particle is reversed and, immediately after the collision, the speed of each particle is 2 m s^{-1}.

(*a*) the magnitude of the impulse exerted by B on A in the collision,

Q13 continued

(*b*) the value of m.

Q14

Two particles A and B, of mass 3 kg and 2 kg respectively, are moving in the same direction on a smooth horizontal table when they collide directly. Immediately before the collision, the speed of A is 4 m s^{-1} and the speed of B is 1.5 m s^{-1}. In the collision, the particles join to form a single particle C.

(*a*) Find the speed of C immediately after the collision.

Q14 continued

Two particles P and Q have mass 3 kg and m kg respectively. They are moving towards each other in opposite directions on a smooth horizontal table. Each particle has speed 4 m s^{-1}, when they collide directly. In this collision, the direction of motion of each particle is reversed. The speed of P immediately after the collision is 2 m s^{-1} and the speed of Q is 1 m s^{-1}.

(b) Find

(i) the value of m,

(ii) the magnitude of the impulse exerted on Q in the collision.