1. Two particles P and Q have mass 0.4 kg and 0.6 kg respectively. The particles are initially at rest on a smooth horizontal table. Particle P is given an impulse of magnitude 3 N s in the direction PQ.

(a) Find the speed of P immediately before it collides with Q.

(3)

Immediately after the collision between P and Q, the speed of Q is 5 m s^{-1}.

(b) Show that immediately after the collision P is at rest.

(3)
(Total 6 marks)

2. 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.

(2)

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

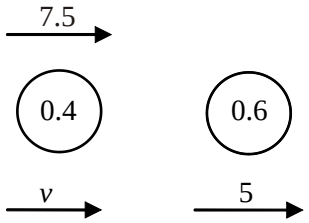
(b) Find the value of m.

(4)
(Total 6 marks)

1. (a) $I = mv \Rightarrow 3 = 0.4 \times v$ M1 A1

$v = 7.5(\text{m s}^{-1})$ A1 3

(b)

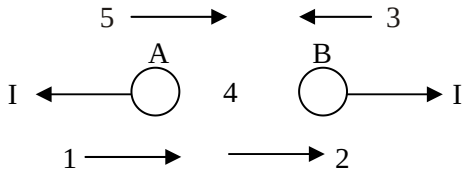


LM $0.4 \times 7.5 = 0.4v + 0.6 \times 5$ M1A1

$0 = 0.4v \Rightarrow v = 0$ ***** cso A1 3

[6]

2. (a)



$I = 4(5 - 1) = \underline{16 \text{ Ns}}$ M1 A1 2

(b) CLM: $4 \times 5 - m \times 3 = 4 \times 1 + m \times 2$ M1A1

$\Rightarrow m = \underline{3.2}$ DM1A1 4

or

$16 = m(3 + 2)$ M1A1

$\Rightarrow m = \underline{3.2}$ DM1A1 4

[6]

1. This was done well by the majority of candidates. Part (a) was a straightforward opening question, almost always correctly answered. A few candidates wrote $3 = 0.4(0 – v)$, thus only gaining the method mark. In the second part most knew and could apply appropriately the conservation of momentum principle, with only occasional sign errors. Drawing a clear velocity diagram would have helped candidates who confused 'before' and 'after' velocities. Since it was a 'show that' question it was important that full working was seen in order to achieve full marks. Wordy explanations involving impulses with no equation, tended to achieve no marks.

2. A good starter question enabling most candidates to obtain marks. A significant number of candidates gave an answer of –16 in part (a) rather than giving the magnitude of the impulse and lost a mark.

In part (b) 16 was a common incorrect answer resulting from an incorrect direction of motion for particle *B* i.e. $4 \times 5 – m \times 3 = 4 \times 1 – m \times 2$. A few candidates seemed unconcerned with a negative mass obtained from using $(+ m \times 3)$ on the L.H.S. and there were also a few instances of candidates quoting and using the "formula" $m_1u_1 + m_1v_1 = m_2u_2 + m_2v_2$. It was rare to see correct solutions using Impulse and many included g in their Impulse-Momentum equation.