

# Linear Momentum and Impulse

## Question Paper

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| Level      | Pre U                                  |
| Subject    | Maths                                  |
| Exam Board | Cambridge International Examinations   |
| Topic      | Mechanics- Linear Momentum and Impulse |
| Booklet    | Question Paper                         |

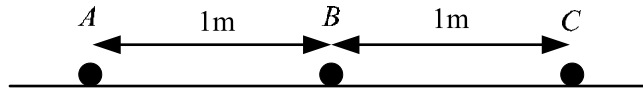
**Time Allowed:** 34 minutes

**Score:** /28

**Percentage:** /100

**Grade Boundaries:**

1



Three particles  $A$ ,  $B$  and  $C$ , having masses of 1 kg, 2 kg and 5 kg respectively, are placed 1 metre apart in a straight line on a smooth horizontal plane (see diagram). The particles  $B$  and  $C$  are initially at rest and  $A$  is moving towards  $B$  with speed  $14 \text{ ms}^{-1}$ . The coefficient of restitution between each pair of particles is 0.5.

- (i) Find the velocity of  $B$  immediately after the first impact and show that  $A$  comes to rest. [4]
- (ii) Show that  $B$  reversed direction after the impact with  $C$ . [3]
- (iii) Find the distances between  $B$  and  $C$  at the instant that  $B$  collides with  $A$  for the second time. [3]

2

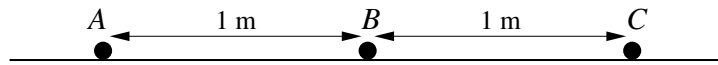
A particle  $A$  of mass  $4m$ , on a smooth horizontal plane, is moving with speed  $u$  directly towards another particle  $B$ , of mass  $2m$ , which is at rest. The coefficient of restitution between the two particles is  $e$ .

- (i) Show that, after the collision, the velocity of  $A$  is  $\frac{1}{3}(2 - e)u$  and find the velocity of  $B$ . [4]
- (ii) Hence write down their velocities in the case when  $e = \frac{1}{2}$ . [1]

Particle  $B$  now collides directly with a third particle  $C$ , of mass  $m$ , which is at rest. The coefficient of restitution in both collisions is  $\frac{1}{2}$ .

- (iii) Use your answers to part (ii) to find the velocities of  $A$ ,  $B$  and  $C$  after the second collision has taken place. [2]
- (iv) Explain briefly whether any further collisions take place. [1]

3



Three particles  $A$ ,  $B$  and  $C$ , having masses  $1\text{ kg}$ ,  $2\text{ kg}$  and  $5\text{ kg}$ , respectively, are placed  $1\text{ metre}$  apart in a straight line on a smooth horizontal plane (see diagram). The particles  $B$  and  $C$  are initially at rest and  $A$  is moving towards  $B$  with speed  $14\text{ m s}^{-1}$ . The coefficient of restitution between each pair of particles is  $0.5$ .

- (i) Find the velocity of  $B$  immediately after the first impact and show that  $A$  comes to rest. [4]
- (ii) Show that  $B$  reverses direction after an impact with  $C$ . [3]
- (iii) Find the distance between  $B$  and  $C$  at the instant that  $B$  collides with  $A$  for the second time. [3]