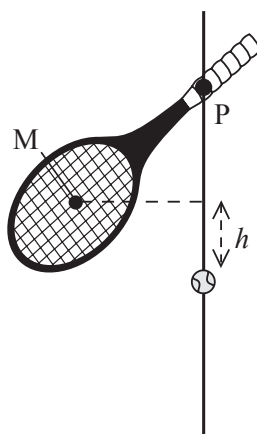
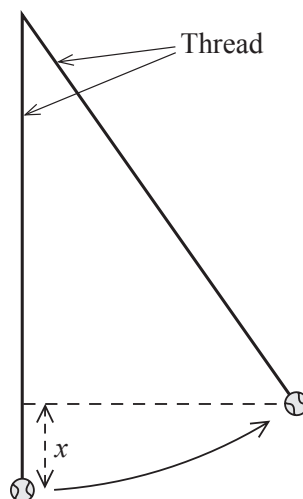


6 A student is carrying out an investigation into collisions between a bat and a ball.

The bat is pivoted at a point P so that it can swing freely. The centre of mass M of the bat swings through an arc and hits the ball. M moves through a height h as shown below.



The ball is suspended vertically by a thread. The bat hits the ball which swings to a maximum height x .



One set of measurements is $h = 0.030 \text{ m}$ $x = 0.10 \text{ m}$

(a) Show that the speed of M just before the collision is about 0.8 m s^{-1} .

(2)

- (b) The student calculates the speed of the ball just after the collision to be 1.4 m s^{-1} .
The mass of the bat is 320 g and the ball is 55 g.

Calculate the speed of the bat just after the collision and state one assumption you make.
(4)

Speed of bat =

Assumption:

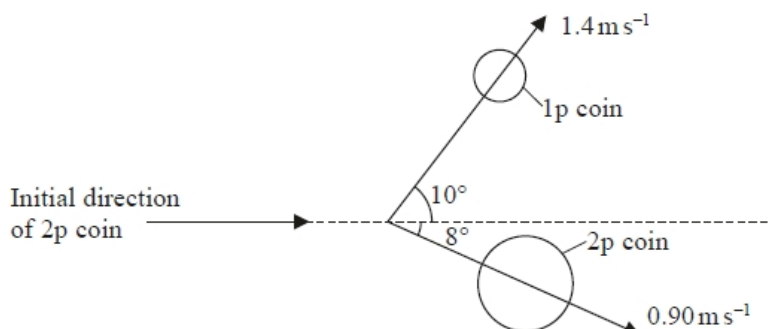
- (c) Determine whether the collision was elastic or inelastic.
(3)

- (d) Discuss your conclusion with reference to possible uncertainties in the measurements of x .
(2)

Q7.

A student carried out an experiment with coins.

She arranged a collision between a 2p coin and a stationary 1p coin. She noted the directions in which the coins moved after the collision and determined their velocities.



- (i) Show that the velocity of the 2p coin just before the collision was about 2 m s^{-1} .

mass of 2p coin = 7.1 g

mass of 1p coin = 3.6 g

(4)

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- (ii) Show that the collision was inelastic.

(2)

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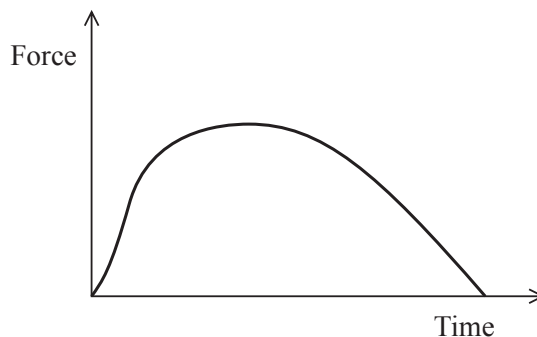
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(Total for question = 6 marks)

- 1 A student throws a ball horizontally. The graph shows how the force from the student's hand on the ball varies with time during the throw.



Which of the following quantities is given by the area under the graph?

- ☐ A acceleration
- ☐ B change in momentum
- ☐ C change in velocity
- ☐ D rate of change of momentum

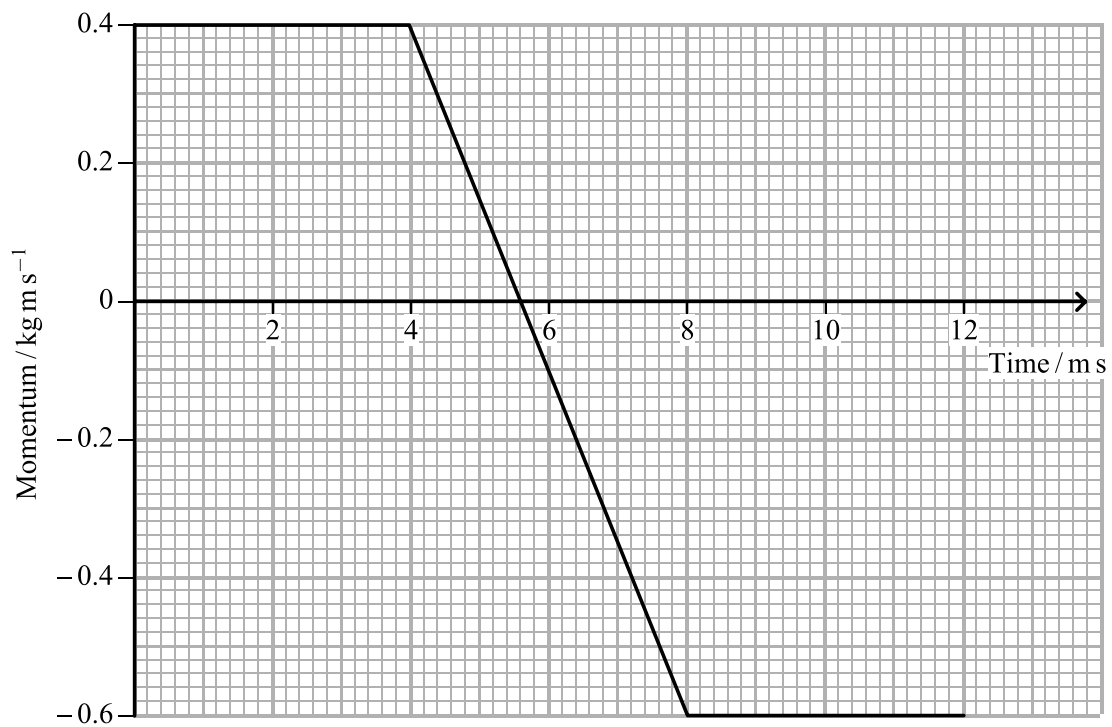
(Total for Question = 1 mark)

- 2 Particle A of mass m has kinetic energy E_k . Particle B of mass $3m$ has kinetic energy $2E_k$. The ratio of the momentum of particle A to the momentum of particle B is given by

- ☐ A $\frac{1}{6}$
- ☐ B $\frac{1}{\sqrt{6}}$
- ☐ C $\sqrt{6}$
- ☐ D 6

(Total for Question = 1 mark)

- 12 A tennis ball is travelling horizontally with a momentum of 0.4 kg m s^{-1} just before it is hit with a tennis racket. It rebounds horizontally from the tennis racket with a momentum of -0.6 kg m s^{-1} . The graph shows the variation in the momentum of the ball during this process.

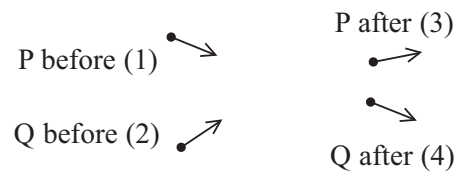


The force exerted by the tennis ball on the racket is

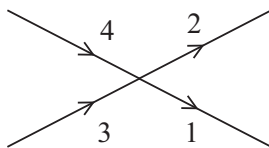
- ☐ A 12 N
- ☐ B 100 N
- ☐ C 250 N
- ☐ D 1000 N

(Total for Question = 1 mark)

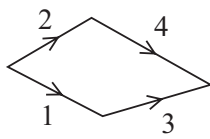
- 17 The diagram represents the collision between two sub-atomic particles P and Q moving with momenta 1 and 2 respectively. After the collision they have momenta 3 and 4 respectively.



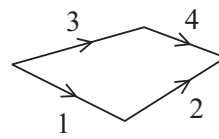
Which vector diagram best shows the correct relationship for the momenta of P and Q?



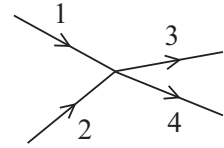
A



B



C



D

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

(Total for Question 1 mark)

- 18 The area under a force-time graph represents

- ☐ **A** acceleration.
- ☐ **B** change in momentum.
- ☐ **C** displacement.
- ☐ **D** kinetic energy.

(Total for Question 1 mark)