

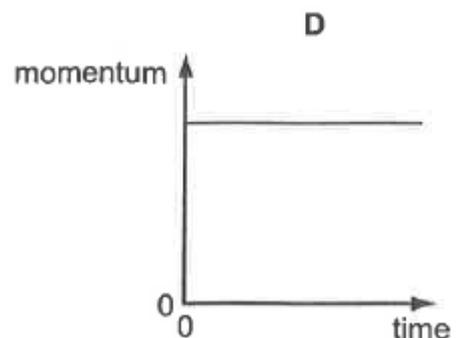
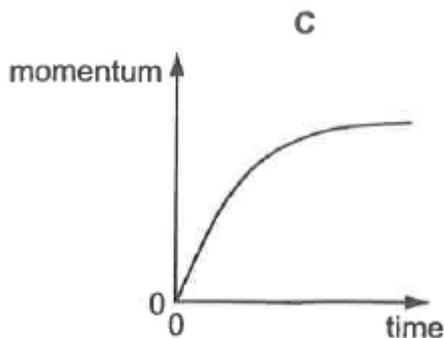
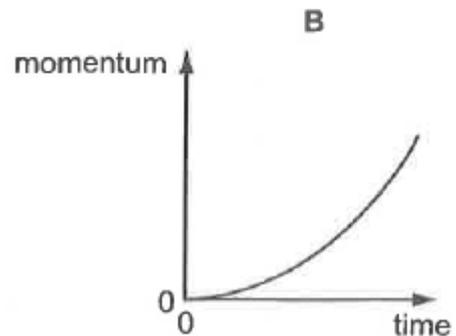
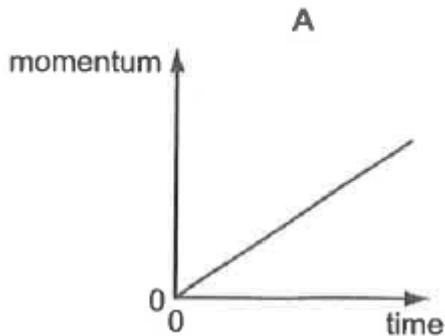


## 2023 Sec 3 Advanced Physics Exercise 4

### Dynamics: Linear Momentum

Name: \_\_\_\_\_ ( ) Class: 3 / \_\_\_\_

- 1 Which graph best shows the variation with time of the momentum of a body accelerated by a constant force?



- 2 An object of mass  $m$  is travelling with velocity  $v$ . Which equation gives the momentum  $p$  of the object in terms of either  $m$  or  $v$  and its kinetic energy  $E_k$ ?

A  $p = \frac{2E_k}{m}$

B  $p = 2E_k v$

C  $p = \sqrt{\frac{2E_k}{v}}$

D  $p = \sqrt{2E_k m}$

- 3 A car of mass 1200 kg is accelerated by a resultant force of 3000 N for a time of 5.0 s. What is the gain in momentum of the car?

A  $2.5 \text{ kg m s}^{-1}$

B  $6.0 \times 10^2 \text{ kg m s}^{-1}$

C  $6.0 \times 10^3 \text{ kg m s}^{-1}$

D  $1.5 \times 10^4 \text{ kg m s}^{-1}$

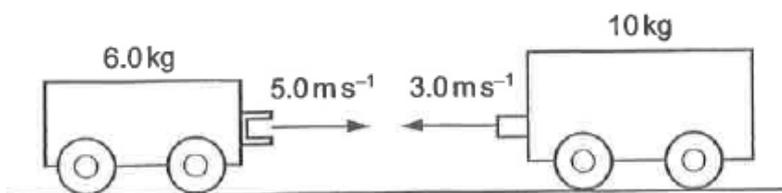
- 4 An object of mass  $M$  travelling to the right with velocity  $2v$  collides with another object of mass  $2M$  travelling to the left with velocity  $v$ . After the collision, the objects stick together.



Which line in the table shows the total momentum and the total kinetic energy of the two objects after the collision?

	momentum	kinetic energy
<b>A</b>	0	0
<b>B</b>	$4Mv$	0
<b>C</b>	0	$3Mv^2$
<b>D</b>	$4Mv$	$3Mv^2$

- 5 A trolley of mass  $6.0 \text{ kg}$  travelling at a speed of  $5.0 \text{ m s}^{-1}$  collides head-on and locks together with another trolley of mass  $10 \text{ kg}$  which is travelling in the opposite direction at a speed of  $3.0 \text{ m s}^{-1}$ . The collision lasts for  $0.20 \text{ s}$ .



What is the total momentum of the two trolleys before the collision and the average force acting on each trolley during this collision?

	total momentum before collision / $\text{kg m s}^{-1}$	average force on each trolley / N
<b>A</b>	0	300
<b>B</b>	60	150
<b>C</b>	0	150
<b>D</b>	60	300

- 6 A ball of mass 80 g collides with a vertical wall. The ball has a velocity of  $23 \text{ m s}^{-1}$  in a horizontal direction. After hitting the wall, the ball moves with a velocity of  $18 \text{ m s}^{-1}$  in the opposite direction.  
What is the impulse provided by the wall?
- A 0.40 Ns in a direction away from the wall
  - B 3.3 Ns in a direction away from the wall
  - C 33 Ns in a direction towards the wall
  - D 3300 Ns in a direction towards the wall

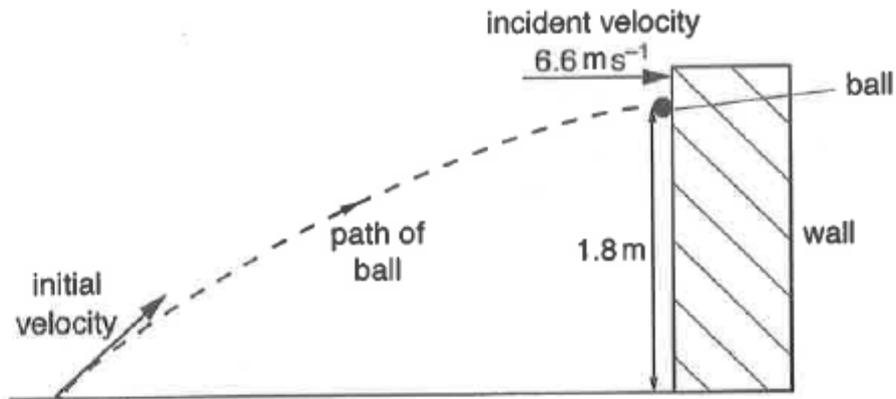
- 7 A golfer hits a ball of mass 45 g at a speed of  $40 \text{ m s}^{-1}$ . The golf club is in contact with the ball for 3.0 ms. Calculate the average force exerted by the club on the ball.

average force = .....[2]

- 8 A stationary snooker ball of mass 0.21 kg is struck by a cue (long tapered stick) which exerts an average horizontal force of 70 N on it. The cue is in contact with the ball for 8.0 ms. Calculate the speed of the ball after the impact.

speed = .....[2]

- 9 Fig. 9.1 shows the path of a ball that is kicked off the ground at P towards a vertical wall.



**Fig. 9.1**

The ball of mass 0.45 kg hits the wall when it reaches its maximum height of 1.8 m. The ball is incident with a horizontal velocity of  $6.6 \text{ m s}^{-1}$  and rebounds in a horizontal direction with a velocity of  $5.2 \text{ m s}^{-1}$ . The ball is in contact with the wall for 0.22 s.

- (a) Calculate the vertical component of the ball's initial velocity.

vertical component of initial velocity = .....[2]

- (b) Calculate the average force acting on the ball due to its collision with the wall.

magnitude of the force = .....

direction of force on the ball = .....[3]

<b>Answers:</b>	1. A	2. D	3. D	4. A	5. C	6. B
	7. 600 N	8. $2.7 \text{ m s}^{-1}$	9(a) $6.0 \text{ m s}^{-1}$	9(b) 24 N towards the left		