A Level · OCR · Physics

7 mins 7 questions

Multiple Choice Questions

Newton's Laws of Motion & Momentum

Newton's Three Laws of Motion / Linear Momentum / Impulse / Impulse on a Force-Time Graph / Conservation of Momentum / Collisions

Medium (4 questions)	/4
Hard (3 questions)	/3
Total Marks	**/7**

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Medium Questions

1 A puck of mass 0.16 kg is sliding on ice with a constant velocity of 11.0 m s^{-1}. A hockey stick exerts a force on the puck, for a short period of time, in the **opposite** direction to the velocity of the puck. The momentum of the puck changes by 2.0 kg m s^{-1}.

Ignore friction.

What is the speed of the puck when it leaves the hockey stick?

A. 1.5 m s^{-1}

B. 3.8 m s^{-1}

C. 12.5 m s^{-1}

D. 23.5 m s^{-1}

(1 mark)

2 An electron moves in a circle of radius 2.0 cm in a uniform magnetic field of flux density 170 mT.

What is the momentum of this electron?

A. 3.4×10^{-3} kg m s^{-1}

B. 5.4×10^{-17} kg m s^{-1}

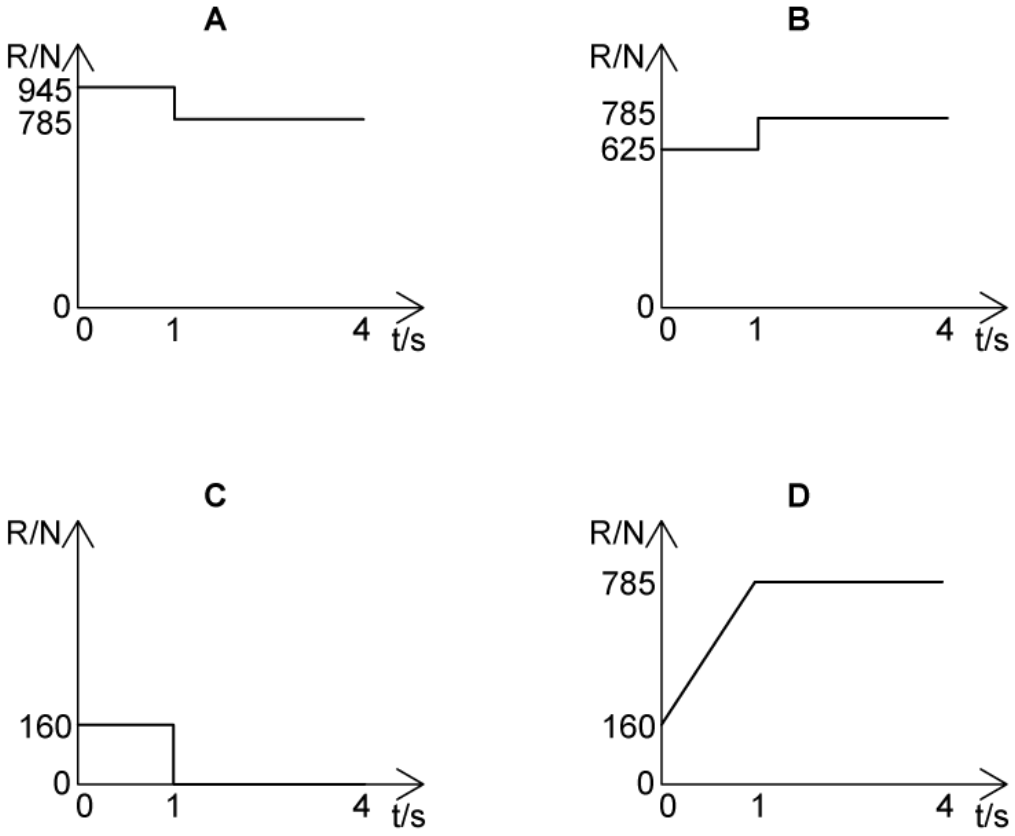
C. 1.4×10^{-18} kg m s^{-1}

D. 5.4×10^{-22} kg m s^{-1}

(1 mark)

3 A person of mass 80 kg is standing in a lift which is initially at rest. The lift accelerates upwards at 2.0 ms^{-2} for 1 s and then continues to move upwards with a constant velocity for 3 s.

Which graph shows how the reaction force, *R*, from the floor of the lift on the person varies during this motion?



(1 mark)

4 A trolley P of mass 5 kg travelling at 2 ms^{-1} collides head-on with a trolley Q of mass 3 kg traveling at a speed *v*.

The impulse applied to trolley P in the collision is 6.3 N s.

As a result of the collision, trolley Q's direction is reversed and its speed is halved.

Find *v*.

A. 0.7 ms^{-1}

B. 1.4 ms^{-1}

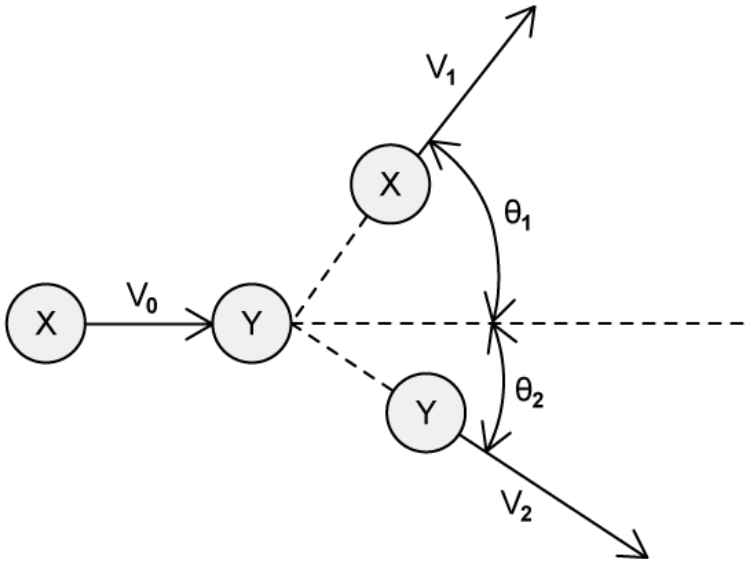
C. 1.5 ms^{-1}

D. 4.2 ms^{-1}

(1 mark)

Hard Questions

1 Below is a diagram of two identical particles, **X** and **Y** which have masses m_X and m_Y respectively. Particle **X** collides into Particle **Y** with a velocity of v_0 and they move off in different directions. Particle **X** moves off with a velocity of v_1 at an angle of θ_1 to the original direction of motion. Particle **Y** moves off with a velocity of v_2 at angle θ_2.



Which **one** of the following equations is correct?

A. $m_X v_1 \cos\theta_1 = m_Y v_2 \cos\theta_2$

B. $\frac{m_X v_1}{m_Y v_2} = \frac{\sin\theta_2}{\sin\theta_1}$

C. $m_X v_0 = m_X v_1 \sin\theta_1 - m_Y v_2 \sin\theta_2$

D. $(m_X + m_Y)v_0 = m_X v_1 \cos\theta_1 + m_Y v_2 \cos\theta_2$

(1 mark)

2 Snooker ball **P** traveling at speed $3v$ hits an identical Snooker ball **Q** which is moving in the opposite direction at speed v. After the collision Snooker ball **P** has speed $\frac{v}{2}$ and Snooker ball **Q** has speed x and move off in the direction Snooker ball **P** was originally traveling in.

Which statement is **true**?

A. The collision is elastic

B. Speed x is equal to $\frac{3}{2}v$

C. The initial kinetic energy is $\frac{5}{2}mv^2$

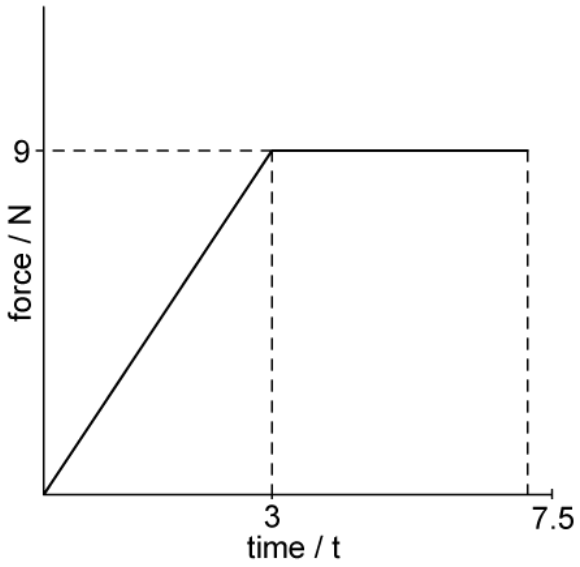
D. None of the statements are true

(1 mark)

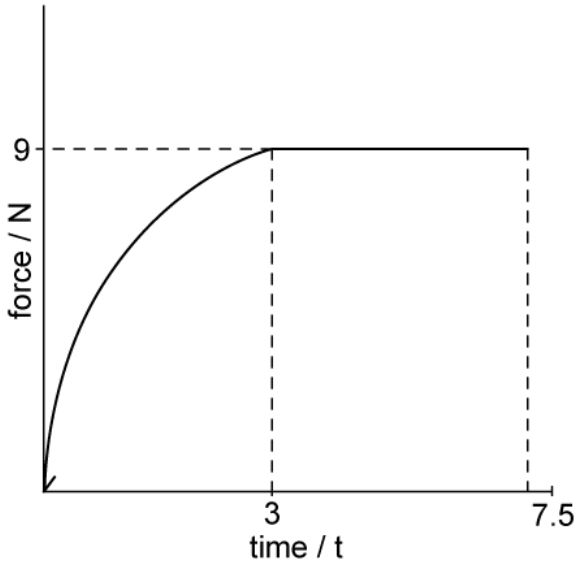
3 A particle increases in acceleration at a constant rate for 3 s. It then has constant acceleration for a further 4.5 s. The total impulse of the object is 54 N s.

Which graph correctly describes the force of the particle?

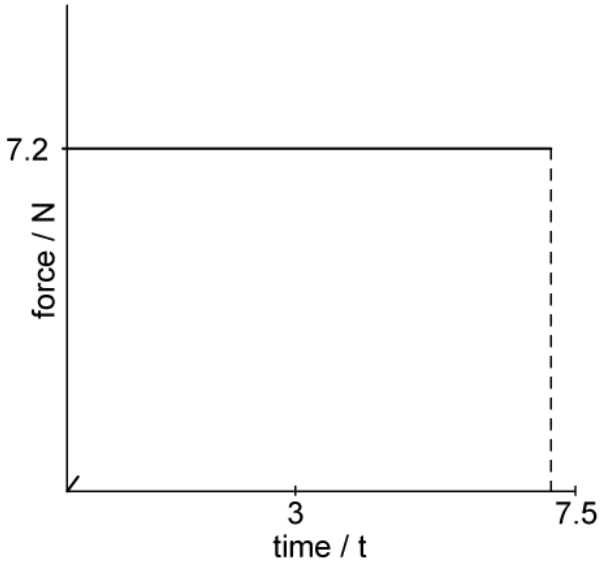
A.



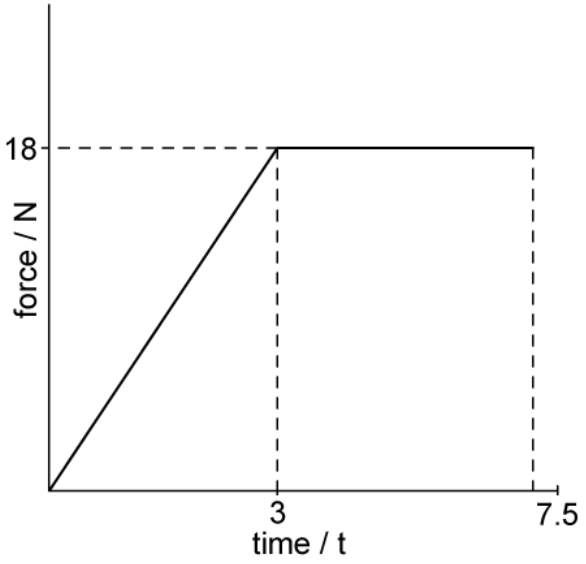
B.



C.



D.



(1 mark)