4.2 Linear Momentum & Conservation

Question Paper

Course	CIE A Level Physics (9702) 2019-2021
Section	4. Dynamics
Topic	4.2 Linear Momentum & Conservation
Difficulty	Hard

Time allowed: **10**

Score: **/10**

Percentage: **/100**

Question 1

A body, initially at rest, explodes into two masses M_1 and M_2 that move apart with speeds v_1 and v_2 respectively.

What is the ratio $\frac{v_1}{v_2}$?

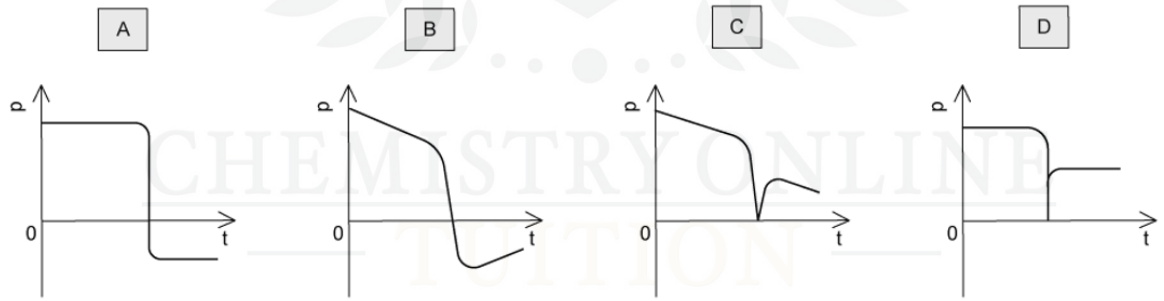
A $\frac{M_2}{M_1}$ **B** $\frac{M_1}{M_2}$ **C** $\sqrt{\frac{M_2}{M_1}}$ **D** $\sqrt{\frac{M_1}{M_2}}$

[1 mark]

Question 2

An ice-hockey puck slides along a horizontal, frictionless ice-rink surface. It collides inelastically with a wall at right angles to its path, and then rebounds along its original path.

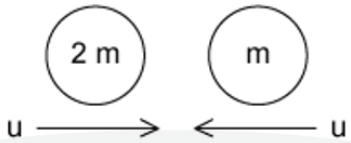
Which graph shows the variation with time *t* of the momentum *p* of the puck?



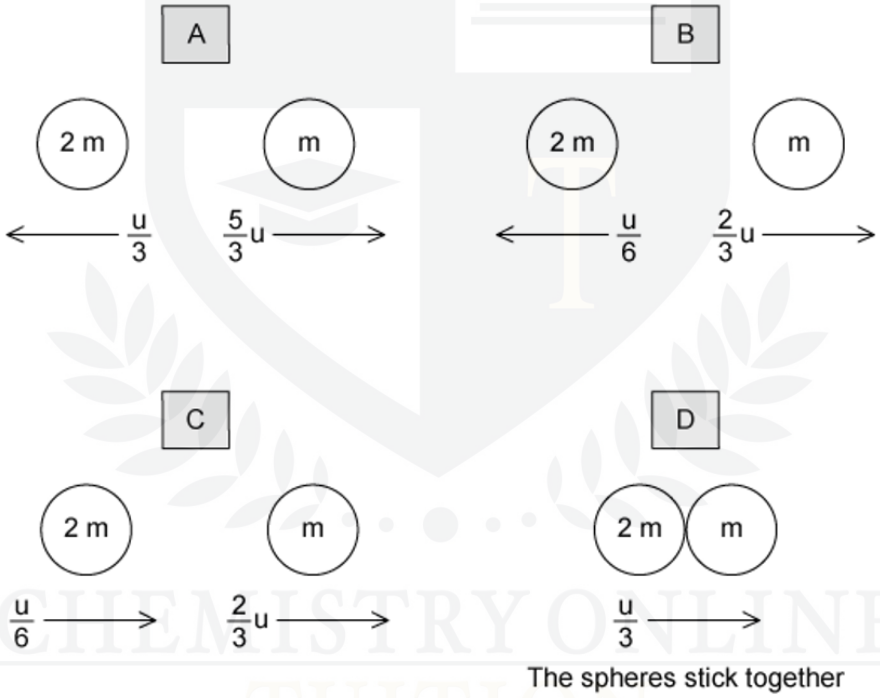
[1 mark]

Question 3

The diagram shows two spherical masses approaching each other head-on at an equal speed *u*. One is of mass *m* and the other of mass 2*m*.



Which diagram, showing the situation after the collision, is not consistent with the principle of conservation of momentum?



[1 mark]

Question 4

A particle X has speed *v* and collides with a stationary identical particle Y.
The collision is perfectly elastic.

What are the speed and direction of motion of each of the two particles after the collision?

	X	Y
A	stationary	v to the right
B	$\frac{v}{2}$ to the right	$\frac{v}{2}$ to the right
C	$\frac{v}{2}$ to the left	$\frac{v}{2}$ to the right
D	*v* to the left	stationary

[1 mark]

Question 5

A stationary nucleus has nucleon number *A*.

The nucleus decays by emitting a proton with speed *v* to form a new nucleus with speed *u*. The new nucleus and the proton move away from one another in opposite directions.

Which equation gives *v* in terms of *A* and *u*?

A $v = \left(\frac{A}{4} - 1\right)u$

B $v = (A - 1)u$

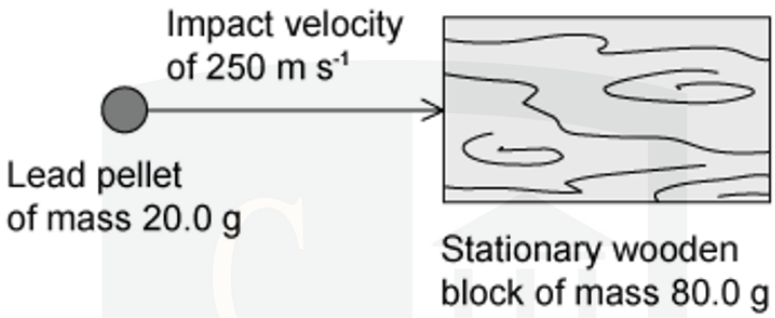
C $v = Au$

D $v = (A + 1)u$

[1 mark]

Question 6

A lead pellet of mass 20.0g is shot horizontally into a stationary wooden block of mass 80.0g. The pellet hits the block with an impact velocity of 250 m s^{-1}. It embeds itself in the block and it does not emerge.



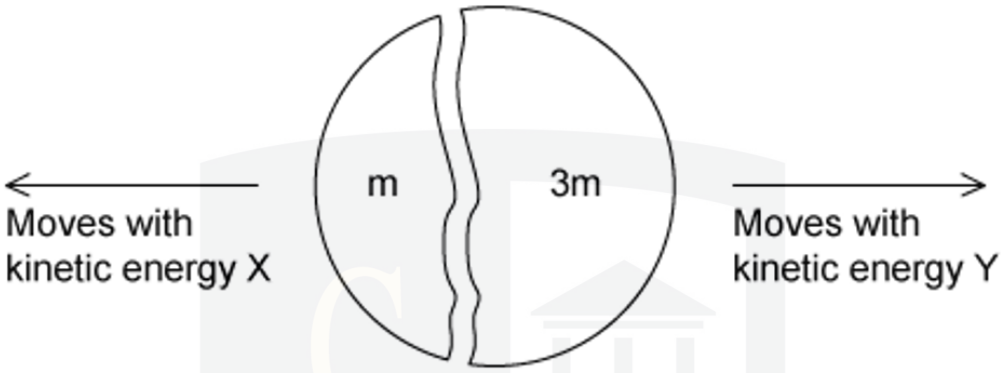
After the impact, the block and the pellet continue to move for 8.4 s, how far do they travel in this time?

A 175 m **B** 210 m **C** 260 m **D** 525 m

[1 mark]

Question 7

A stationary body explodes into two components of masses *m* and 3*m*.
The components gain kinetic energies X and Y respectively.



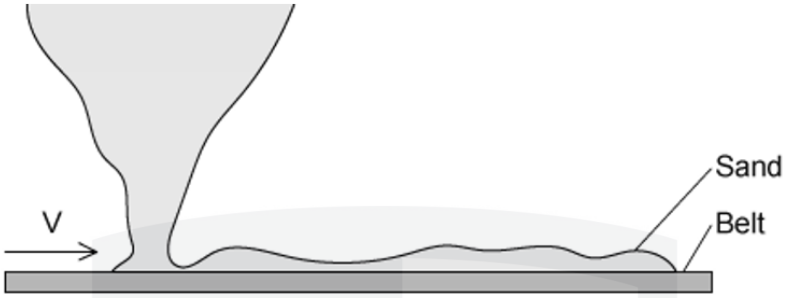
What is the value of the ratio $\frac{X}{Y}$?

A $\frac{6}{1}$ **B** $\frac{3}{1}$ **C** $\frac{1}{3}$ **D** $\frac{1}{6}$

[1 mark]

Question 8

Sand falls vertically on a conveyor belt at a rate of m kg s^{-1}



In order to keep the belt moving at constant speed v, the horizontal force that must be exerted is equal to

A Mv

B $\frac{1}{2} mv$

C mv^2

D $\frac{1}{2} mv^2$

[1 mark]

Question 9

Two railway trucks of masses m and $5m$ move towards each other in opposite directions with speeds $3u$ and u respectively. These trucks collide and stick together.

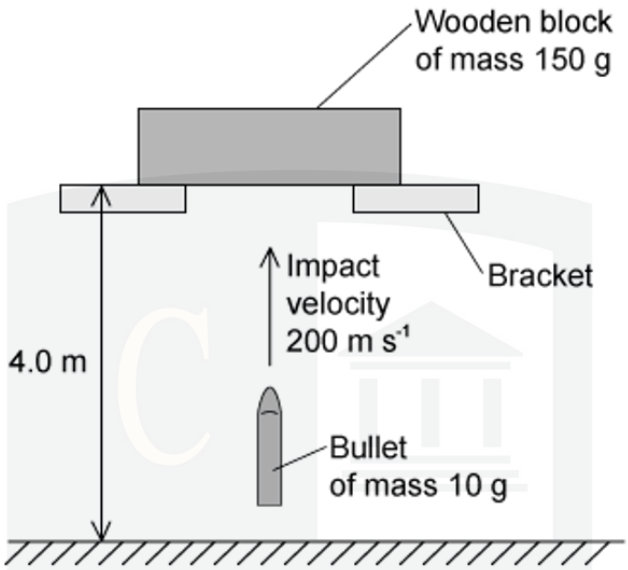
What is the speed of the trucks after the collision?

A $\frac{u}{6}$ **B** $\frac{3u}{4}$ **C** $\frac{u}{3}$ **D** $\frac{5u}{3}$

[1 mark]

Question 10

A wooden block is freely supported on brackets at a height of 4.0 m above the ground, as shown



A bullet of mass 10.0 g is shot vertically upwards into the wooden block of mass 150g. It embeds itself in the block. The impact causes the block to rise above its supporting brackets.

The bullet hits the block with a velocity of 200 m s^{-1}. How far above the ground will the block be at the maximum height of its path?

A 8.0 m **B** 10.0 m **C** 12.0 m **D** 14.0 m

[1 mark]