Focus - Analysing motion graphs, understanding momentum and using conservation of momentum in closed system

Learning goals - Students should be able to analyse speed - time graphs,

- Comfortably calculate momentum using the formula momentum p = mxv , where p is momentum, m is mass of an object and v is the velocity of the moving object.
- Students should be able to figure out that stationary objects have zero momentum.
- Students should be able apply the law of conservation of momentum in a closed system.

ATL skills - Critical thinking skills

- Students will draw reasonable conclusions
- students will use known concepts in unfamiliar situations.

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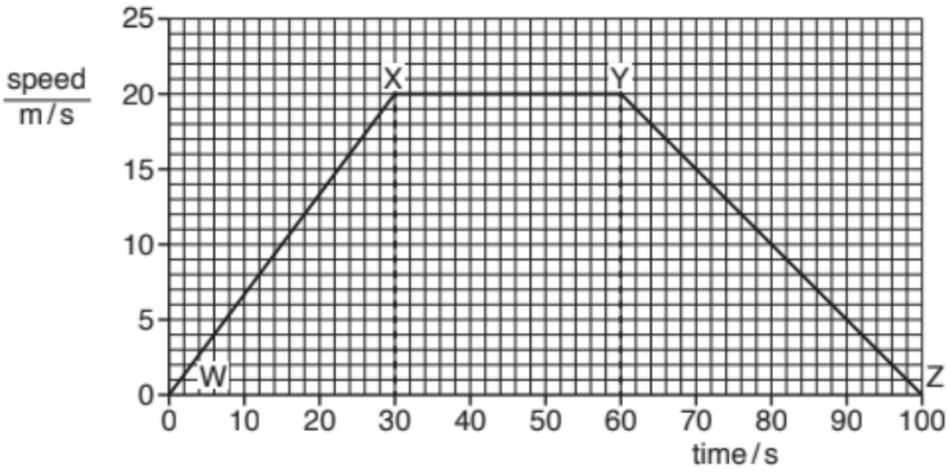
1. A person on roller skates makes a journey as shown in figure. Figure shows speed-time graph for the journey.



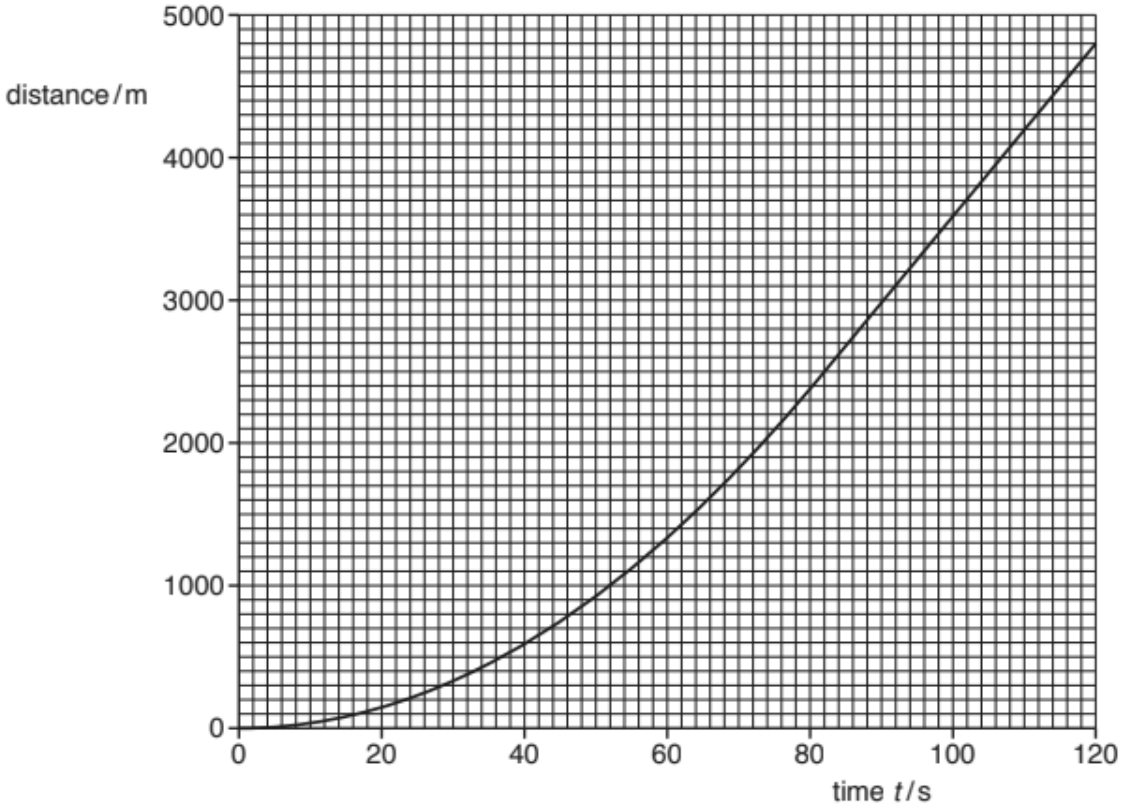
a.Complete the table below. First row is done for you

Motion	Start of motion	End of motion
acceleration	W	X
deacceleration		
Constant speed		

b. Calculate the distance travelled between 60s and 100s

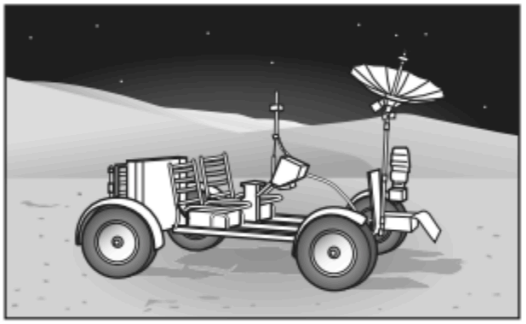
c. Describe how the figure shows that the size of acceleration is greater than the deceleration.

2. Below is the distance time graph of the journey of a train



a. Calculate the average speed of the journey
b. Mass of the train is 2.5 x 10^5 kg. If the acceleration of the train is 0.75 m/s^2. Calculate the resultant force that acts on the train at this time

3. Loot at the figure that shows the vehicle designed to be used on Moon.



The brakes of the vehicles are tested on Earth.

a. The acceleration of free fall on the Moon is one sixth (⅙) of its value on Earth. Tich one box in each column of the table below, that predicts the value of that quantity when the vehicle is used on the Moon.

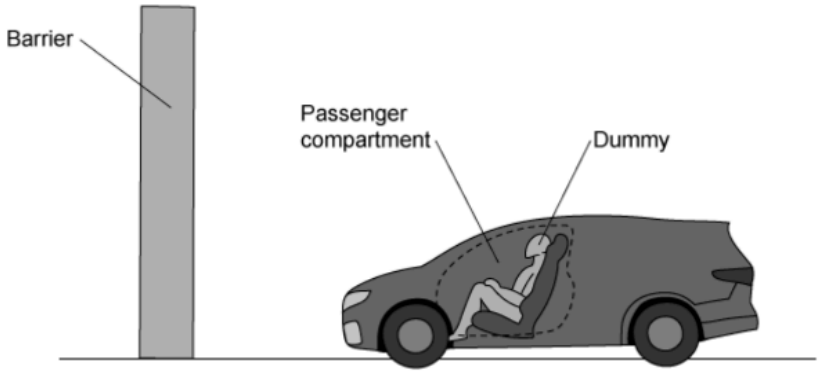
	Mass of vehicle on moon	Weight of the vehicle on Moon	Deceleration of the vehicle on Moon with the same braking force.
10 x value on Earth			
6 x value on Earth			
Same as value on earth			
⅙ x value on earth			
1/10 x value on earth			

4. Select one

Which of these is the correct definition for momentum and its unit?

	definition	unit
A	p = m ÷ v	N/m
B	v = p × m	kgm/s
C	v = p ÷ m	kgm/s
D	p = m × v	N/kg

5. Look at the fig below



The deceleration of the dummy is less than the deceleration of the passenger compartment.
Why is this benefit for the safety of the passenger ?
Select one from the options below.

a. Seat belts, crumple zones and airbags all absorb energy from the crash.
b. The crash happens quickly so the passenger doesn't feel anything.
c. The force of impact on the passenger, and therefore harm, is reduced.
d. The time over which the collision happens is elongated for the passenger.

6. A roller coaster speeds along a track with considerable momentum.
If a different roller coaster travels at four times the speed but has half as much mass, its momentum would be:
Select one option from below

a. Zero
b. Twice as much
c. Four times as much
d. Unchanged

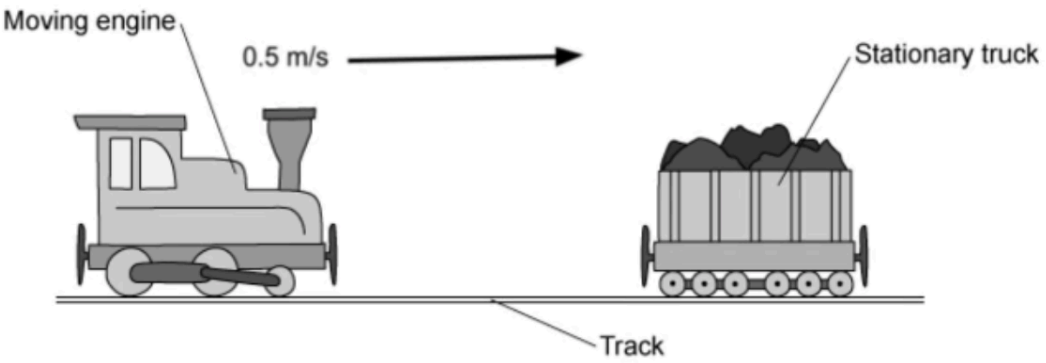
7. Two identical balls move at the same speed as shown in the diagram.

What momentum does the ball possess ?
Select one option from below

	Ball 1	Ball 2
a.	mv	mv
b.	-mv	-mv

c.	mv	-mv
d.	0	0

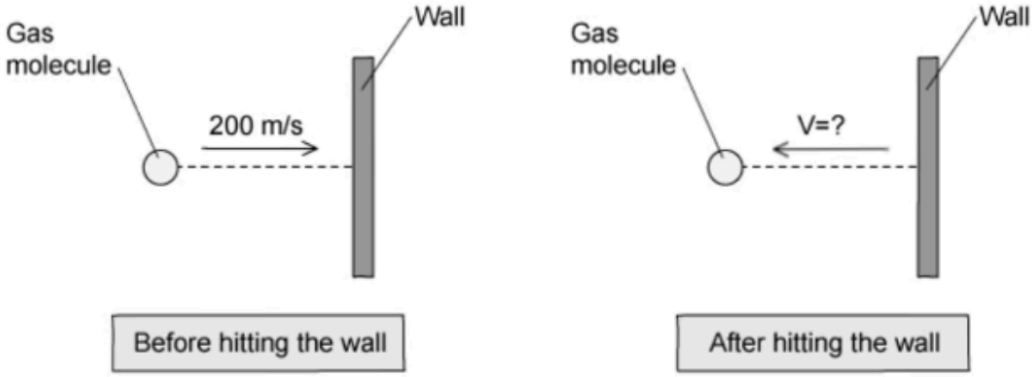
8. A toy train is rolling at a constant speed on a level track. The train collides with a stationary toy truck and joins it.



Before the collision, the toy train is travelling at 0.5 ms^{-1}. The train and the stationary truck both have a mass of 0.75 g.
Calculate and select the momentum of the toy train before the collision.

a. 37.5 kg m s^{-1}
b. 0.04 kg m s^{-1}
c. 0.38 kg m s^{-1}
d. 0.08 kg m s^{-1}

9. A gas molecule strikes the wall of a container with the speed of 200 m s^{-1}. It rebounds with the same kinetic energy as it had before striking the wall.



Calculate and select the final velocity

a. 100 m s^{-1}
b. -100 m s^{-1}
c. 200 m s^{-1}
d. -200 m s^{-1}

References :
Exam style questions from Cambridge IGCSE physics books.
Physics MYP 4 and 5 - Hodder
Physics MYP 4 and 5 - Oxford