

Momentum

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.5 Forces
Sub-Topic	Momentum
Difficulty Level	Gold Level
Booklet	Question Paper 1

Time Allowed: 60 minutes

Score: /59

Percentage: /100

Grade Boundaries:

Q1.A swimmer dives off a boat.

Look at **Figure 1**.

Figure 1



(a) What **two** factors determine the momentum of the swimmer?

1

2

(2)

(b) What is the unit of momentum?

Tick **one** box.

J / s

☐

kg m / s

☐

N m

☐

m / s²

☐

(1)

(c) The boat was stationary.

As the swimmer dives forwards, the boat moves backwards.

Use the idea of conservation of momentum to explain why the boat moves backwards.

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(4)

- (d) Explain what would happen to the motion of the boat if there were more people on the boat when the swimmer dived off.

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(2)

- (e)



The swimmer's speed increases as she swims away from the boat.

The swimmer has a top speed.

Explain why.

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(5)
(Total 14 marks)

Q2.A paintball gun is used to fire a small ball of paint, called a paintball, at a target.

The figure below shows someone just about to fire a paintball gun.

The paintball is inside the gun.



(a) What is the momentum of the paintball before the gun is fired?

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Give a reason for your answer.

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(2)

(b) The gun fires the paintball forwards at a velocity of 90 m / s .

The paintball has a mass of 0.0030 kg .

Calculate the momentum of the paintball just after the gun is fired.

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Momentum = kg m / s

(2)

- (c) The momentum of the gun and paintball is conserved.

Use the correct answer from the box to complete the sentence.

equal to	greater than	less than
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The total momentum of the gun and paintball just after the gun is fired
will be the total momentum of the gun and
paintball
before the gun is fired.

(1)
(Total 5 marks)

Q3. The figure below shows a skateboarder jumping forwards off his skateboard.

The skateboard is stationary at the moment the skateboarder jumps.



- (a) The skateboard moves backwards as the skateboarder jumps forwards.

Explain, using the idea of momentum, why the skateboard moves backwards.

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(3)

- (b) The mass of the skateboard is 1.8 kg and the mass of the skateboarder is 42 kg.

Calculate the velocity at which the skateboard moves backwards if the skateboarder jumps forwards at a velocity of 0.3 m / s.

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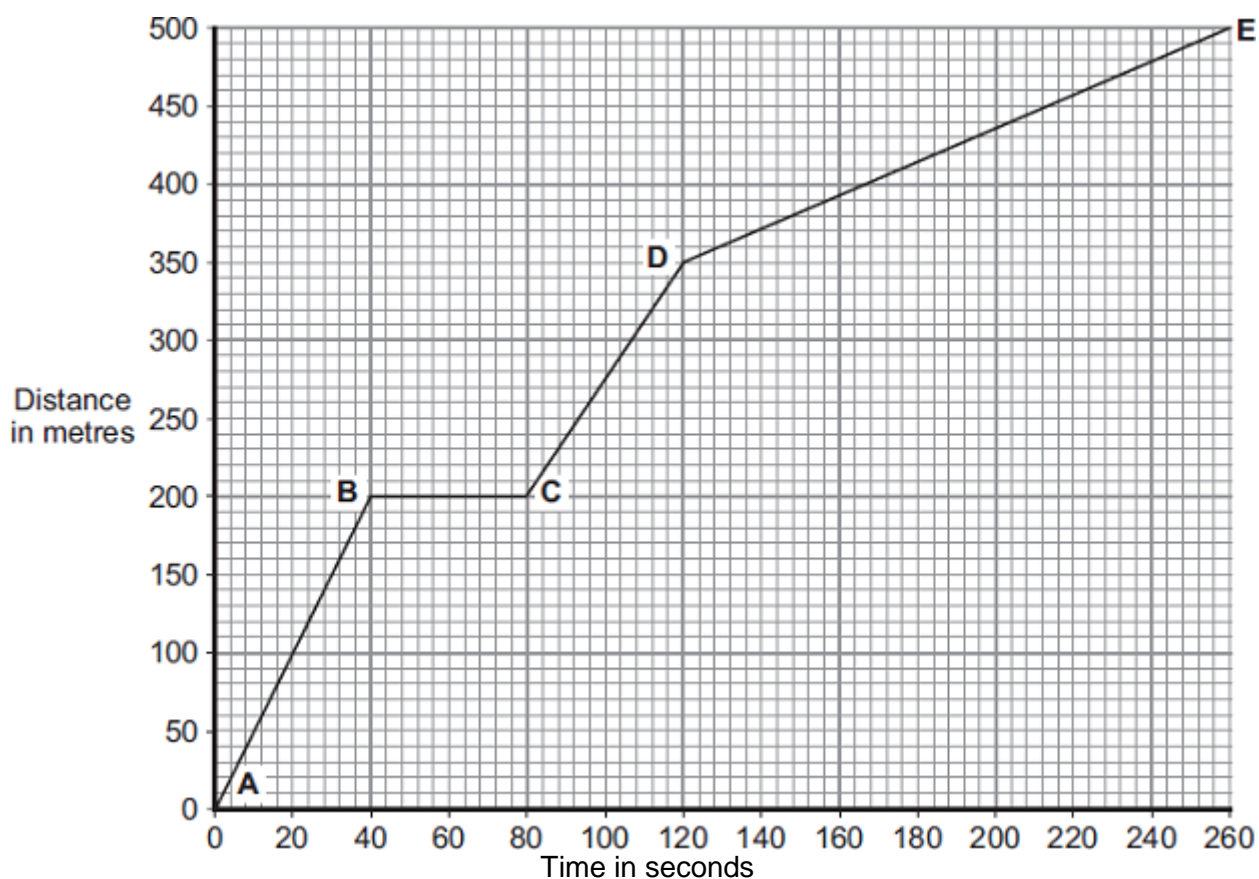
Velocity of skateboard = m / s

(3)

(Total 6 marks)

Q4.Part of a bus route is along a high street.

The distance-time graph shows how far the bus travelled along the high street and how long it took.



- (a) Between which two points was the bus travelling the slowest?

Put a tick (✓) in the box next to your answer.

Points	Tick (✓)
A – B	
C – D	
D – E	

Give a reason for your answer.

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(2)

- (b) The bus travels at 5 m/s between points **A** and **B**.
The bus and passengers have a total mass of 16 000 kg.

Use the equation in the box to calculate the momentum of the bus and passengers

between points **A** and **B**.

$\text{momentum} = \text{mass} \times \text{velocity}$
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Show clearly how you work out your answer.

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Momentum = kg m/s

(2)

- (c) A cyclist made the same journey along the high street.
The cyclist started at the same time as the bus and completed the journey in 220 seconds. The cyclist travelled the whole distance at a constant speed.

- (i) Draw a line on the graph to show the cyclist's journey.

(2)

- (ii) After how many seconds did the cyclist overtake the bus?

The cyclist overtook the bus after seconds.

(1)

(Total 7 marks)

Q5.(a) In any collision, the total momentum of the colliding objects is usually conserved.

- (i) What is meant by the term 'momentum is conserved'?

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(1)

- (ii) In a collision, momentum is **not always** conserved.

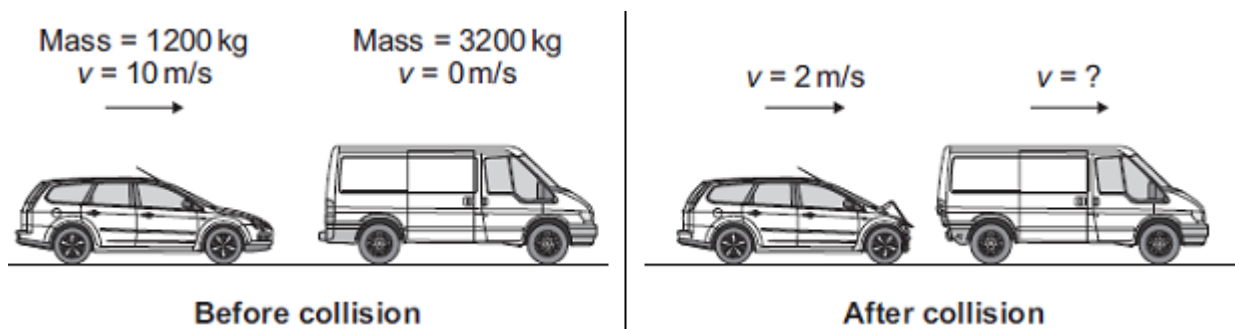
Why?

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(1)

- (b) The diagram shows a car and a van, just before and just after the car collided with the van.



- (i) Use the information in the diagram to calculate the **change** in the momentum of the car.

Show clearly how you work out your answer and give the unit.

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Change in momentum =

(3)

- (ii) Use the idea of conservation of momentum to calculate the velocity of the van when it is pushed forward by the collision.

Show clearly how you work out your answer.

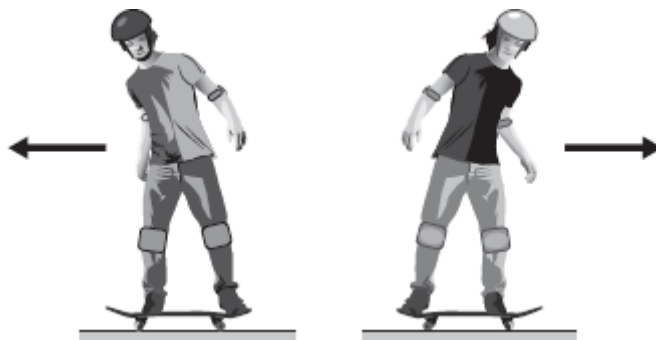
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Velocity = m/s forward

(2)

(Total 7 marks)

- Q6.(a)** The picture shows two teenagers riding identical skateboards.
The skateboards are moving at the same speed and the teenagers have the same mass.



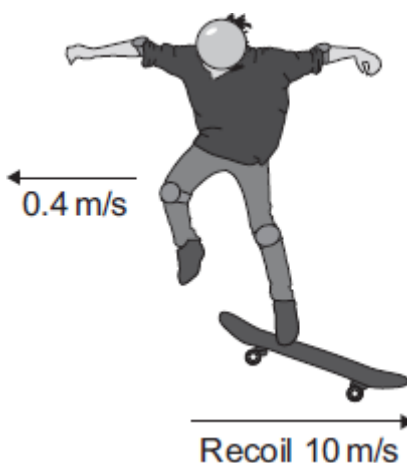
Why do the teenagers **not** have the same momentum?

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(1)

- (b) One of the skateboards slows down and stops. The teenager then jumps off the skateboard, causing it to recoil and move in the opposite direction.



The momentum of the teenager and skateboard is conserved.

- (i) What is meant by 'momentum being conserved'?

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(1)

- (ii) The teenager, of mass 55 kg, jumps off the skateboard at 0.4 m/s causing the skateboard to recoil at 10 m/s.

Calculate the mass of the skateboard.

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Mass = kg

(3)

- (c) Once the skateboard starts to recoil, it soon slows down and its kinetic energy decreases.

Explain why.

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(2)

(Total 7 marks)

- Q7.** (a) Complete the following sentence.

The momentum of a moving object has a magnitude, in kg m/s,
and a

(1)

- (b) A car being driven at 9.0 m/s collides with the back of a stationary lorry.
The car slows down and stops in 0.20 seconds. The total mass of the car and driver is 1200 kg.

Calculate the average force exerted by the lorry on the car during the collision.

Show clearly how you work out your answer.

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Force = N

(2)

- (c) Within 0.04 s of the car hitting the back of the lorry, the car driver's airbag inflates. The airbag deflates when it is hit by the driver's head.



Use the idea of momentum to explain why the airbag reduces the risk of the driver sustaining a serious head injury.

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(3)

(Total 6 marks)

- Q8.** (a) In any collision, the total momentum of the colliding objects is usually conserved.

- (i) What is meant by the term ‘momentum is conserved’?

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(1)

- (ii) In a collision, momentum is **not** always conserved.

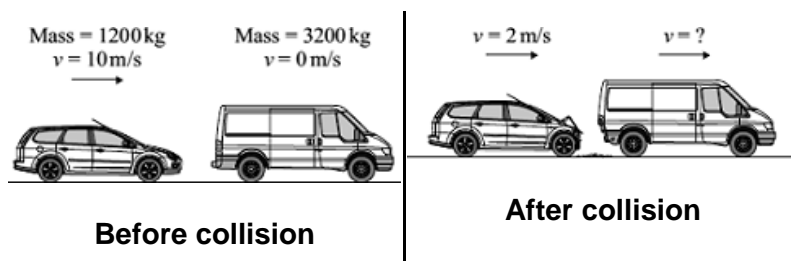
Why?

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(1)

- (b) The diagram shows a car and a van, just before and just after the car collided with the van.



- (i) Use the information in the diagram to calculate the **change** in the momentum of the car.

Show clearly how you work out your answer and give the unit.

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Change in momentum =

(3)

- (ii) Use the idea of conservation of momentum to calculate the velocity of the van

when it is pushed forward by the collision.

Show clearly how you work out your answer.

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Velocity =..... m/s forward

(2)
(Total 7 marks)