MOMENTUM 2

Q:1 (a)Complete the following sentence. The momentum of a moving object has a magnitude, in kg m/s, and a _____.

(1 mark)

(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. Use the equations in the box to calculate the average force exerted by the lorry on the car during the collision.

momentum=	mass	velocity
force =	change in momentum	
	time take for the change	

Show clearly how you work out your answer.

_____

_____

Force =. _____ N

(2 marks)

(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.

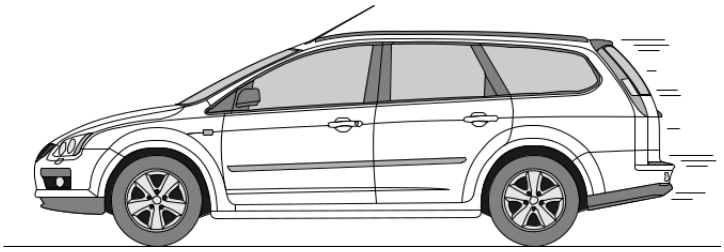
_____

_____

_____

(3 marks)

Q:2 (a)The diagram shows a car travelling at a speed of 12 m/s along a straight road.



(a)(i) Use the equation in the box to calculate the momentum of the car.

momentum = mass × velocity

Mass of the car = 900 kg

Show clearly how you work out your answer.

_____

Momentum = _____ kg m/s

(2 marks)

(a)(ii) Momentum has direction.

Draw an arrow on the diagram to show the direction of the car's momentum.

(1 mark)

(b) The car stops at a set of traffic lights.

How much momentum does the car have when it is stopped at the traffic lights?

_____

Give a reason for your answer.

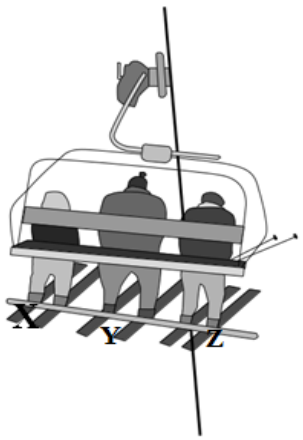
_____

_____

_____

(2 marks)

Q:3 (a) The diagram shows three skiers, X, Y and Z, on a moving chairlift. The mass of each skier is given in the table.



Skier	Mass in kg
X	65
Y	90
Z	80

Which one of the skiers, X, Y or Z, has the most momentum?

_____

Give the reason for your answer.

_____

_____

(2 marks)

(b) At one point in the journey, the chairlift accelerates to a higher speed.

What happens to the momentum of the three skiers as the chairlift accelerates?

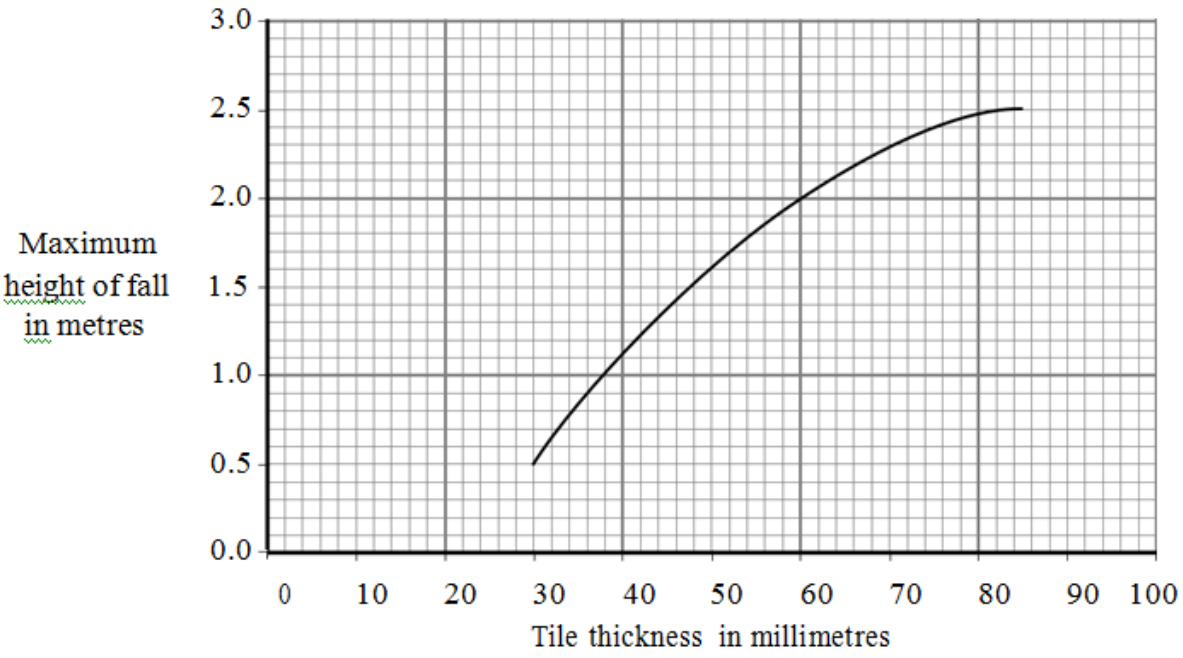
_____

(1 mark)

Q:4 The diagram shows a child on a playground swing.

(a) The playground surface is covered in rubber safety tiles. The tiles reduce the risk of serious injury to children who fall off the swing.

The graph gives the maximum height that a child can fall onto rubber safety tiles of different thicknesses and be unlikely to get a serious head injury.



(a) (i) Describe how the maximum height of fall relates to the thickness of the rubber safety tile.

_____

_____

(1 mark)

(a)(ii)The maximum height of any of the playground rides is 2 metres.

What tile thickness should be used in the playground?

_____

Give a reason for your answer.

_____

_____

(2 marks)

(b) Use phrases from the box to complete the following sentences.

the force on the work done to stop the time taken to stop

(b)(i)Falling onto a rubber surface compared to a hard surface increases

_____ the child.

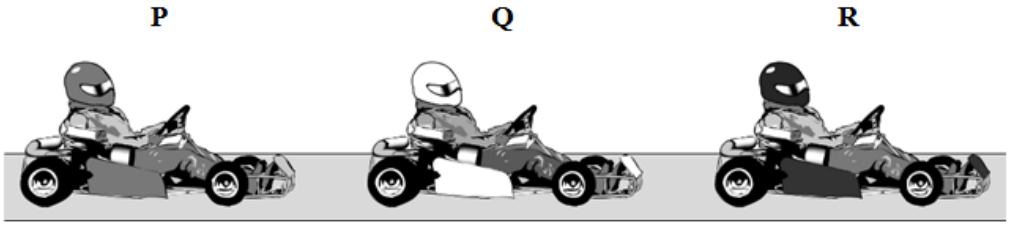
(1 mark)

(b)(ii) Momentum is lost more slowly falling onto a rubber surface than on a hard surface.

This reduces _____ the child.

(1 mark)

Q:5 (a) The diagram shows three identical go-karts, P, Q and R, travelling at different speeds along the straight part of an outdoor racetrack.



20 m/s 25 m/s 28 m/s

Which go-kart, P, Q or R, has the greatest momentum?

_____

Give the reason for your answer.

_____

_____

(2 marks)

(b) The total mass of go-kart Q and the driver is 130 kg.

(b) (i) Use the equation in the box to calculate the total momentum of go-kart Q and the driver.

momentum = mass × velocity

Show clearly how you work out your answer.

_____

_____

Momentum =_____

(2 marks)

(b) (ii) Which of the following is the unit of momentum?

Draw a ring around your answer.

J/s kg m/s Nm

(1 mark)

(c) To race safely at high speed, a go-kart driver must have fast reaction times and the outdoor racetrack should be dry.

(c)(i) How would being tired affect a driver's reaction time?

_____

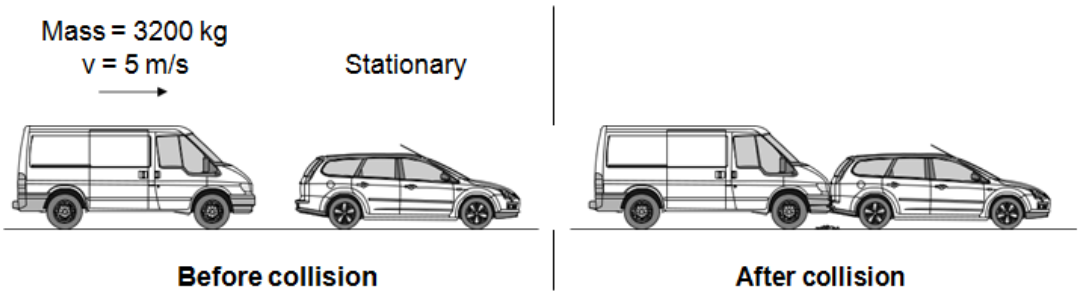
(1 mark)

(c)(ii) How would a wet track affect the braking distance of a go-kart?

_____

(1 mark)

Q:5 (a)A van has a mass of 3200 kg. The diagram shows the van just before and just after it collides with the back of a car.



Just before the collision, the van was moving at 5 m/s and the car was stationary.

(a) (i) Use the equation in the box to calculate the momentum of the van just before the collision.

momentum = mass × velocity

Show clearly how you work out your answer.

_____

_____

Momentum =_____ kg m/s

(2 marks)

(a) (ii) The collision makes the van and car join together. What is the total momentum of the van and the car just after the collision?

Momentum =_____ kg m/s

(1 mark)

(a) (iii) Complete the following sentence by drawing a ring around the correct line in the box.

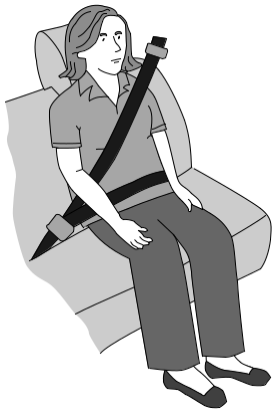
The momentum of the car before the collision is

more than
the same as
less than.

the momentum of the car after the collision

(1 mark)

(b) A seat belt is one of the safety features of a car.



In a collision, wearing a seat belt reduces the risk of injury.

Use words or phrases from the box to complete the following sentences.

decreases	stays the same	increases

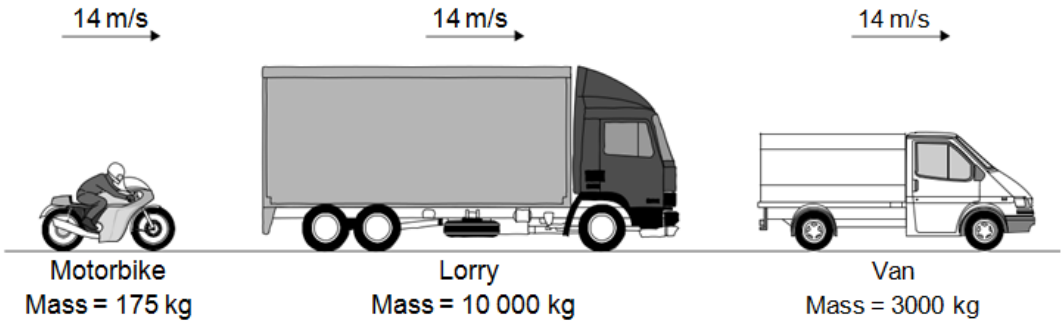
In a collision, the seat belt stretches. The time it takes for the person held by the seat belt to lose momentum compared to a person not wearing a seat belt,

_____

The force on the person's body_____ and so reduces the risk of injury.

(2 marks)

Q:6 (a) (i) The diagram shows three vehicles travelling along a straight road at 14 m/s.



Which vehicle has the greatest momentum?

_____

Give the reason for your answer.

_____

_____

_____

(2 marks)

(a) (ii) Use the equation in the box to calculate the momentum of the motorbike when it travels at 14 m/s.

momentum = mass × velocity

Show clearly how you work out your answer.

_____

_____

Momentum = _____ kg m/s

(2 marks)

(b) The motorbike follows the lorry for a short time, and then accelerates to overtake both the lorry and van.

(b) (i) Complete the following sentence by drawing a ring around the correct line in the box.

When the motorbike starts to overtake, the kinetic energy

decreases
stays the same.
increases.

of the motorbike

(1 mark)

(b) (ii) Give a reason for your answer to part (b)(i).

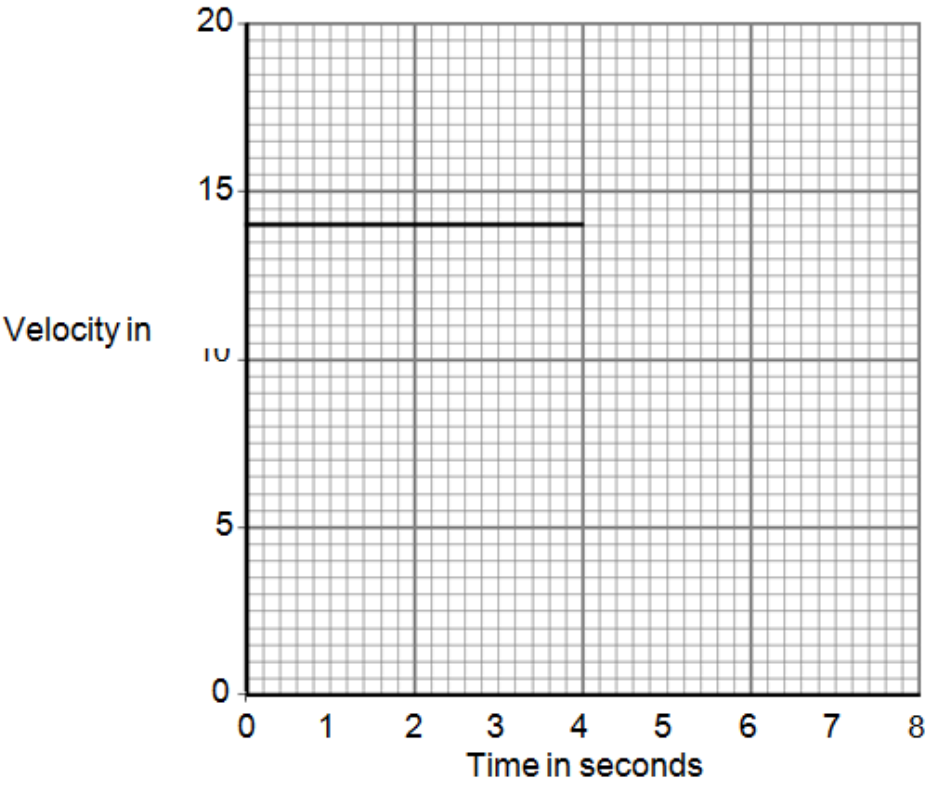
_____

_____

(1 mark)

(b) (iii) The graph shows the velocity of the motorbike up to the time when it starts to accelerate. The motorbike accelerates constantly, going from a speed of 14 m/s to a speed of 20 m/s in a time of 2 seconds. The motorbike then stays at 20 m/s.

Complete the graph to show the motion of the motorbike over the next 4 seconds.



(3 marks)

TOTAL MARKS= 41 MARKS