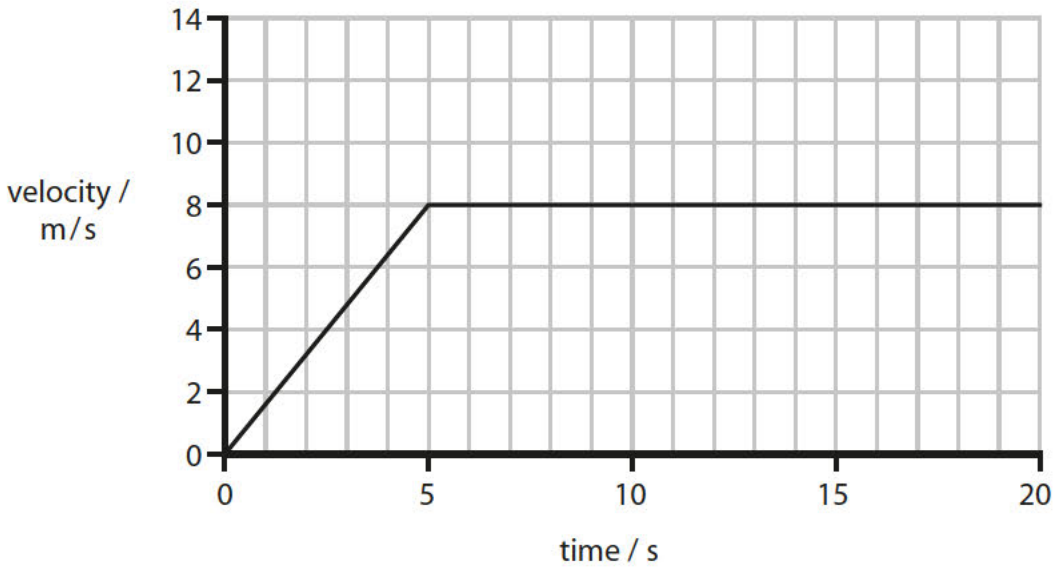
1 (a) Here is the velocity-time graph for a car for the first 20 s of a journey.



(i) Calculate the change in velocity of the car during the first 5 s.

(1)

change in velocity = ... m/s

(ii) Calculate the acceleration of the car during the first 5 s.

(2)

acceleration = ... m/s^2

(iii) State the size of the resultant force between 10 s and 15 s

(1)

resultant force = ... N

(b) The mass of a c

Calculate the resultant force on the car required to produce an acceleration of 0.8 m/s^2.

(2)

resultant force = ... N

*(c) A car, travelling at 20 m/s, with just the driver inside takes 70 m to stop in an emergency.
The same car is then fully loaded with luggage and passengers as well as the driver.

Explain why it will take a different distance to stop in an emergency from the same speed.

(6)

(Total for Question 5 = 12 marks)

Going downhill

2 Andrew skis down a hill.



(a) Andrew starts from the top of the hill and his speed increases as he goes downhill.

He controls his speed and direction by using his skis.

He brings himself to a stop at the bottom of the hill.

Describe the energy changes that happen between starting and stopping.

(3)

.....

.....

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.....

(b) Andrew returns to the top of the hill and starts again.

(i) His mass is 67 kg.

Show that his momentum is about 2000 kg m/s when his velocity is 31 m/s.

(2)

(ii) He falls over when his momentum is 2000 kg m/s.

After he falls over, he slows down by sliding across the snow.

It takes 2.3 s for his momentum to reduce to zero.

Calculate the average force on Andrew as he slows down.

(2)

force = ... N

(iii) Andrew is not injured by the fall even though he was moving quickly.

Use ideas about force and momentum to explain why he is not injured.

(2)

.....

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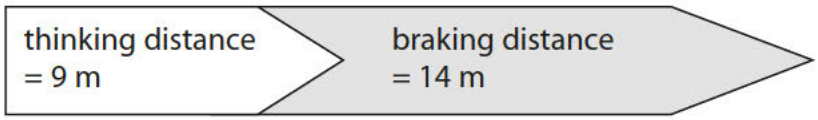
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(Total for Question 2 = 9 marks)

Speed and safety

3 The Highway Code gives this information about the stopping distance of a car.

speed = 30 miles per hour



(a) (i) What is the stopping distance?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** 5 m
- ☐ **B** 9 m
- ☐ **C** 14 m
- ☐ **D** 23 m

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The driver's **thinking** distance is most likely to increase when

(1)

- ☐ **A** the driver is tired
- ☐ **B** there is ice on the road
- ☐ **C** the car is heavier
- ☐ **D** the car moves at a slower speed

(b) A car has a mass of 800 kg.
It has a velocity of 3.0 m/s.

Calculate the momentum of the car.

(2)

momentum of car = ... kg m/s

(c) (i) The braking force on another car is 600 N.
The force acts for a distance of 15 m.

Calculate the work done by the braking force.

(2)

work done by braking force = ... J

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The work done by the brakes during braking is equal to

(1)

☐ **A** the energy transferred

☐ **B** the stopping distance

☐ **C** the acceleration

☐ **D** the thinking distance plus braking distance

(Total for Question 1 = 7 marks)