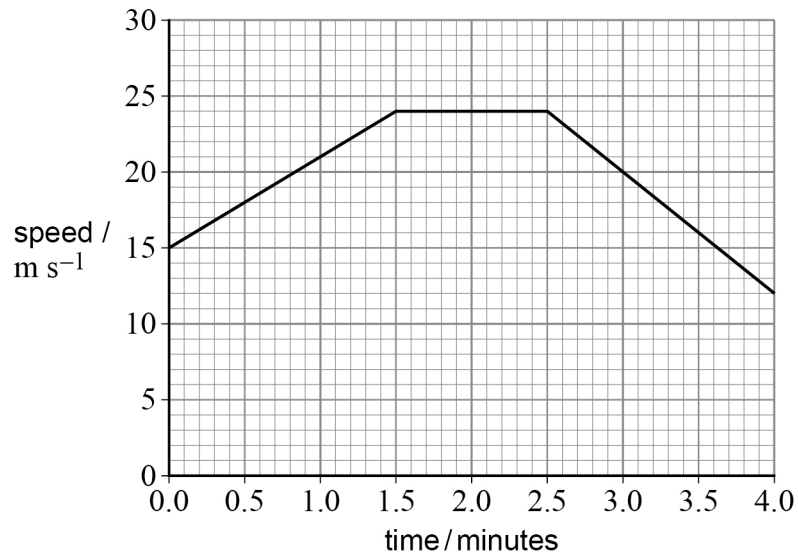


0 4

A pair of cameras is used on a motorway to help determine the average speed of vehicles travelling between the two cameras.

Figure 5 shows the speed–time graph for a car moving between the two cameras.

Figure 5



0 4 . 1

The speed limit for the motorway between the two cameras is 22 m s^{-1} .

Determine whether the average speed of the car exceeded this speed limit.

[3 marks]

Question 4 continues on the next page

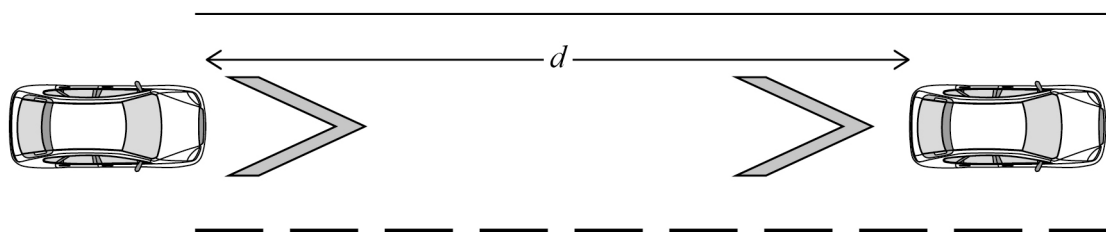
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0 4 . 2 Markings called chevrons are used on motorways.

The chevron separation is designed to give a driver time to respond to any change in speed of the car in front. The driver is advised to keep a minimum distance d behind the car in front, as shown in **Figure 6**.

Figure 6



not to scale

Government research suggests that the typical time for a driver to respond is between 1.6 s and 2.0 s.

Suggest a value for d where the speed limit is 31 m s^{-1} .

[2 marks]

$d =$ _____ m



0 4 . 3

The chevron separation is based on the response time, not on the time taken for a car to stop.

The brakes of a car are applied when its speed is 31 m s^{-1} and the car comes to rest. The total mass of the car is 1200 kg.

The average braking force acting on the car is 6.8 kN.

Calculate the time taken for the braking force to stop the car **and** the distance travelled by the car in this time.

[4 marks]

time = _____ s

distance = _____ m

0 4 . 4

Suggest why the chevron separation on motorways does not take into account the distance travelled as a car comes to rest after the brakes are applied.

[1 mark]

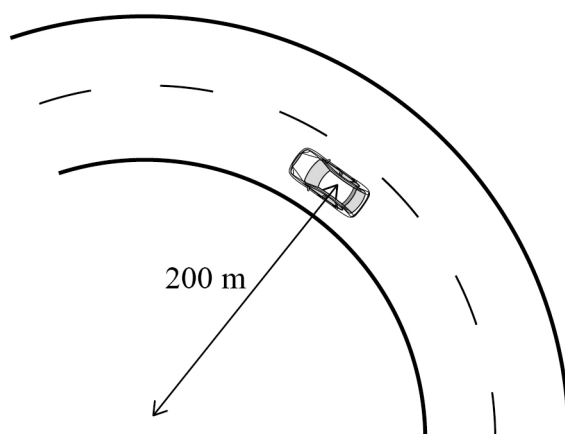
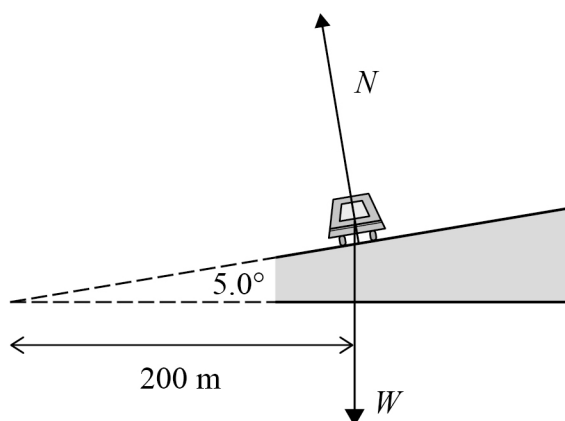
Question 4 continues on the next page**Turn over ►**

0 4 . 5

At bends on motorways the road is sloped so that a car is less likely to slide out of its lane when travelling at a high speed.

Figure 7 shows a car of mass 1200 kg travelling around a curve of radius 200 m. The motorway is sloped at an angle of 5.0° .

Figure 8 shows the weight W and reaction force N acting on the car. The advisory speed for the bend is chosen so that the friction force down the slope is zero.

Figure 7**Figure 8**

Suggest an appropriate advisory speed for this section of the motorway.

[4 marks]

advisory speed = _____ m s^{-1}

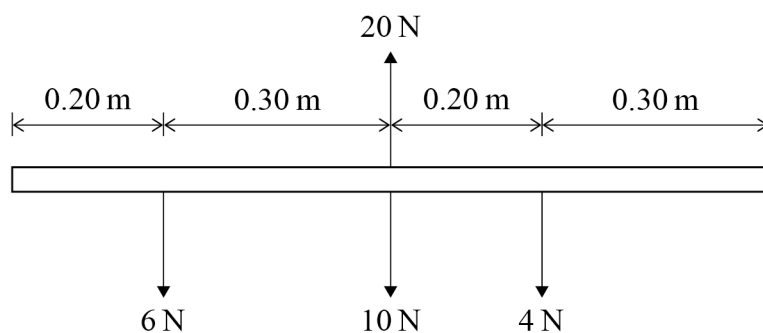
14

Turn over for the next question

Turn over ►



2 | 0 The diagram shows the forces acting on a uniform rod.



Which statement is correct?

[1 mark]

- A** The rod is in equilibrium.
- B** For equilibrium, an anticlockwise moment of 1.0 N m is needed.
- C** For equilibrium, a clockwise moment of 1.0 N m is needed.
- D** For equilibrium, the 10 N force should be increased to 20 N.



2 1

Small water drops leave a tap with zero velocity at intervals of 0.20 s. They then fall freely 0.80 m to reach a horizontal surface.

How far has a drop fallen when the previous drop hits the surface?

[1 mark]

A 0.16 m

B 0.20 m

C 0.40 m

D 0.60 m

2 2

A pellet with velocity 200 m s^{-1} and mass 5.0 g is fired vertically upwards into a stationary block of mass 95.0 g. The pellet remains in the block. The impact causes the block to move vertically upwards.

What is the maximum vertical displacement of the block?

[1 mark]

A 5.1 m

B 10 m

C 51 m

D 100 m

Turn over ►