Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Q1.

(a) The total stopping distance of a car has two parts. One part is the distance the car travels during the driver's reaction time. This distance is often called the 'thinking distance'.

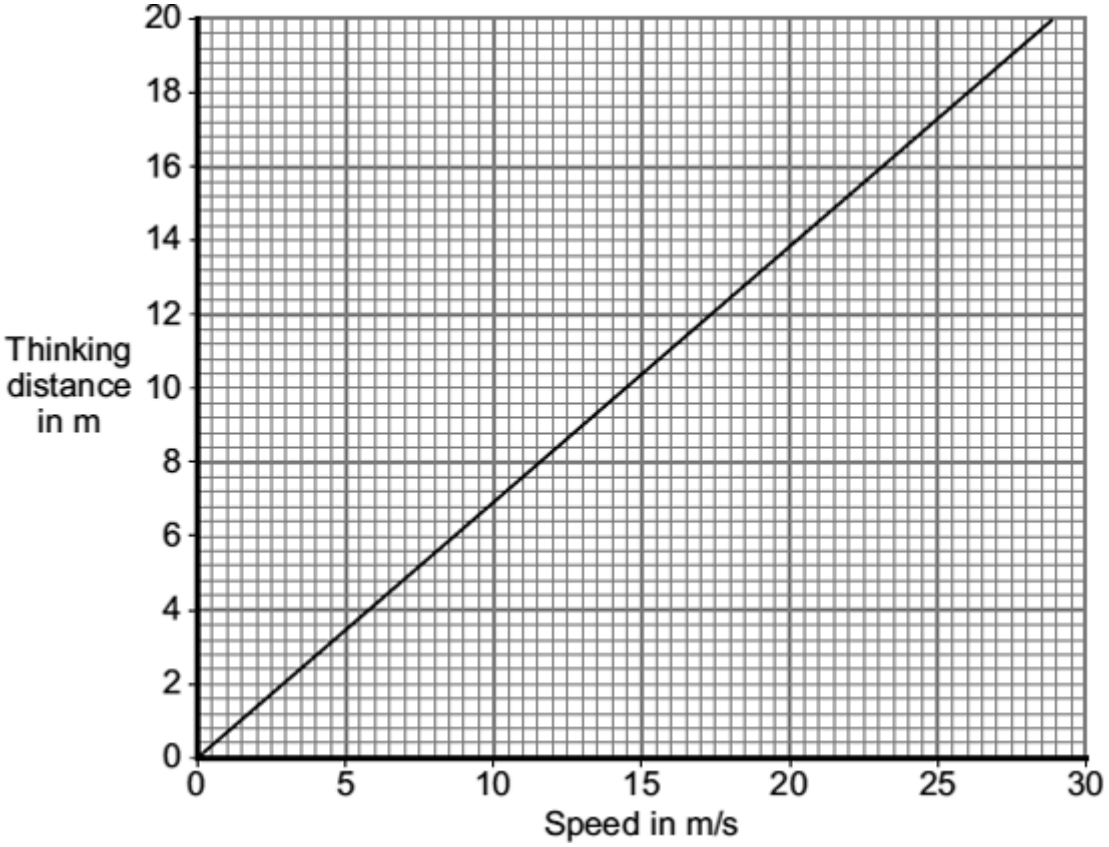
What distance is added to the 'thinking distance' to give the total stopping distance?

_____

_____

(1)

(b) The graph shows the relationship between the speed of a car and the thinking distance.



Describe the relationship between speed and thinking distance.

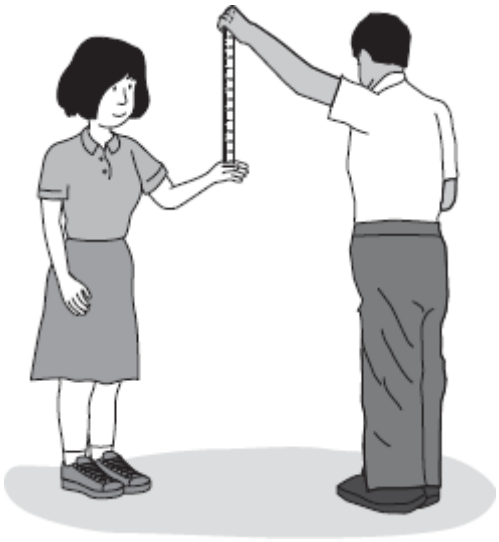
_____

_____

(2)

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(c) The diagram shows two students investigating reaction time.



One student holds a 30 cm ruler, then lets go. As soon as the second student sees the ruler fall, she closes her hand, stopping the ruler. The further the ruler falls before being stopped, the slower her reaction time.

(i) One student always holds the ruler the same distance above the other student's hand. In this experiment, what type of variable is this?

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

independent variable ☐

dependent variable ☐

control variable ☐

(1)

(ii) Describe how this experiment could be used to find out whether listening to music affects reaction time.

_____

_____

_____

_____

(2)

(d) The following information is written on the label of some cough medicine.

WARNING: Causes drowsiness. Do not drive or operate machinery.

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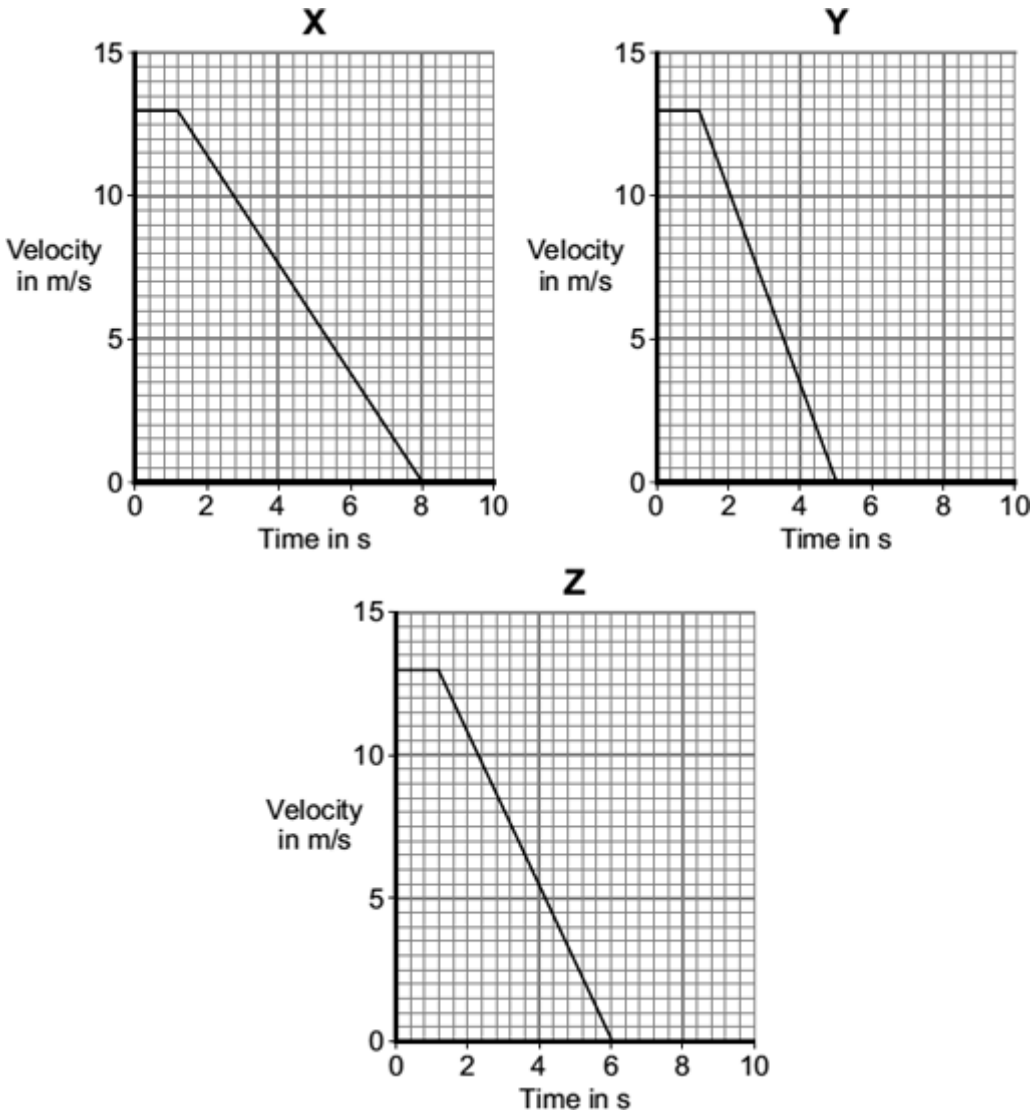
How is feeling drowsy (sleepy) likely to affect a driver's reaction time?

_____

_____

(1)

(e) Three cars, **X**, **Y** and **Z** , are being driven along a straight road towards a set of traffic lights. The graphs show how the velocity of each car changes once the driver sees that the traffic light has turned to red.



Which one of the cars, **X**, **Y** or **Z** , stops in the shortest distance?

_____

(1)

(Total 8 marks)

Q2.

Motorway accidents have many causes.

(a) Which **one** of the following is most likely to increase the chance of a car being in an accident?

Tick (✓) the box next to your answer.

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The car has just had new tyres fitted. ☐

The driver has been drinking alcohol. ☐

A road surface in dry conditions ☐

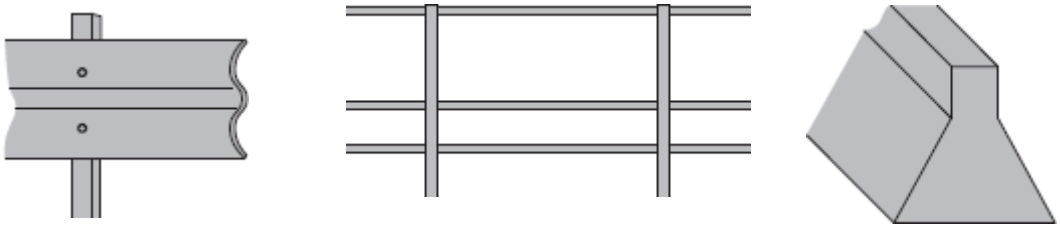
Give a reason for your answer.

_____

_____

(2)

(b) The diagram shows three designs of motorway crash barriers.



Steel sheets | Steel 'ropes' | Solid concrete

Before a new design of barrier is used, it must be tested.
A car of mass 1500 kg is driven at 30 m/s to hit the barrier at an angle of 20 degrees.
This barrier must slow the car down and must not break.

Explain why the mass of the car, the speed of the car and the angle at which the car hits the barrier must be the same in every test.

_____

_____

_____

_____

_____

(2)

(c) A group of scientists has suggested that new designs of crash barriers should be first tested using computer simulations.

Which **two** statements give sensible reasons for testing new barrier designs using a computer simulation?

Put a tick (✓) in the box next to each of your answers.

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The design of the barrier can be changed easily. ☐

Data for different conditions can be obtained quickly. ☐

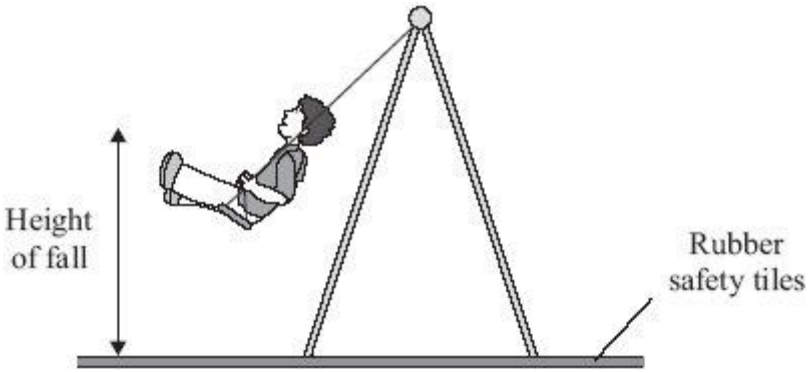
Simulations are more realistic than using cars and barriers. ☐

(1)

(Total 5 marks)

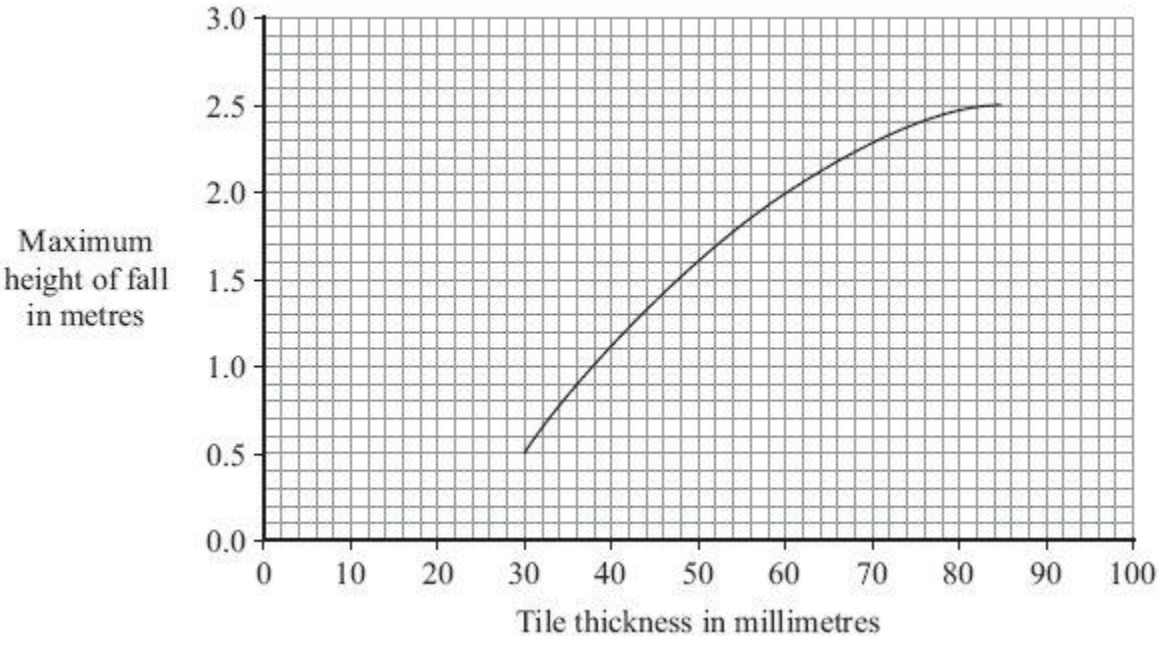
Q3.

The diagram shows a child on a playground swing.



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.



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

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_____

_____

(1)

(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)

(Total 3 marks)

Q4.

The diagram shows an adult and a child pushing a loaded shopping trolley.



(a) (i) What is the *total force* on the trolley due to the adult and child?

_____

(1)

(ii) Which **one** of the terms in the box means the same as *total force*?

Draw a ring around your answer.

answer force	**mean force**	**resultant force**

(1)

(iii) The trolley is pushed at a constant speed for 80 metres.

Calculate the work done to push the trolley 80 metres.

Show clearly how you work out your answer.

_____

_____

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Work done = _____

(2)

(b) Complete the following sentences by drawing a ring around the correct word in each of the boxes.

(i) The unit of work done is the

joule
newton
watt

.

(1)

(ii) Most of the work done to push the trolley is transformed into

heat
light
sound

.

(1)

(Total 6 marks)

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