

Subtopic: Stopping distance and reaction times

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Q1.(2019)

a)

The driver of a vehicle sees a hazard on the road.

The driver uses the brakes to stop the vehicle.

Explain the factors that affect the distance needed to stop a vehicle in an emergency.

[6 marks]

b)

Write down the equation which links distance, force and work done.

[1 mark]

c)

The work done by the braking force to stop a vehicle was 900 000 J

The braking force was 60 000 N

Calculate the braking distance of the vehicle.

[3 marks]

Braking distance = _____ m

Q1.d)(2019)

The greater the braking force, the greater the deceleration of a vehicle.

Explain the possible dangers caused by a vehicle having a large deceleration when it is braking.

[2 marks]

Q2.(2021)

a)

The thinking distance and braking distance for a car vary with the speed of the car.

Explain the effect of **two** other factors on the **braking** distance of a car.

Do **not** refer to speed in your answer.

[4 marks]

b)

Which equation links acceleration (a), mass (m) and resultant force (F).

[1 mark]

Tick (✓) **one** box.

resultant force = mass $\times$ acceleration

☐

resultant force = mass $\times$ acceleration²

☐

resultant force = $\frac{\text{mass}}{\text{acceleration}^2}$

☐

resultant force = $\frac{\text{mass}}{\text{acceleration}}$

☐

c)

The mean braking force on a car is 7200 N.

The car has a mass of 1600 kg.

Calculate the deceleration of the car.

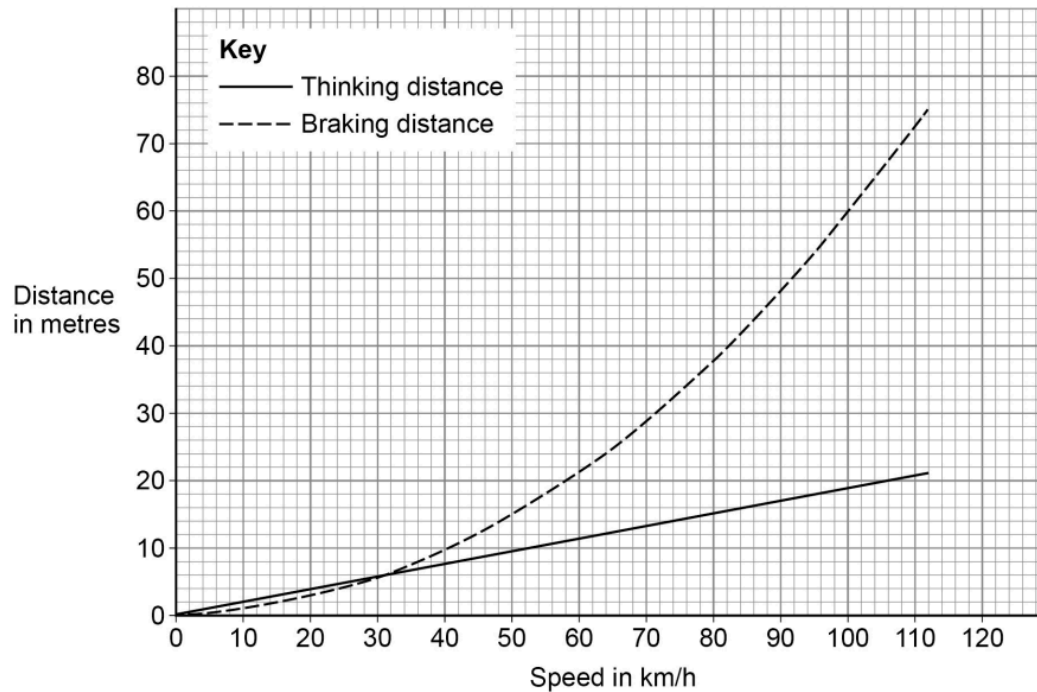
[3 marks]

Deceleration = _____ m/s²

d)

Figure 18 shows how the thinking distance and braking distance for a car vary with the speed of the car.

Figure 18



Determine the stopping distance when the car is travelling at 80 km/h.

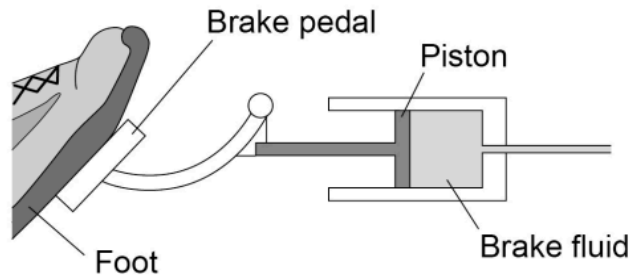
[2 marks]

Stopping distance = _____ m

e)

Figure 19 shows part of the braking system for a car.

Figure 19



Which equation links area of a surface (A), the force normal to that surface (F) and pressure (p)?

[1 mark]

Tick (✓) **one** box.

$p = F \times A$

☐

$p = F \times A^2$

☐

$p = \frac{F}{A}$

☐

$p = \frac{A}{F}$

☐

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f)

When the brake pedal is pressed, a force of 60 N is applied to the piston.

The pressure in the brake fluid is 120 000 Pa.

Calculate the surface area of the piston.

Give your answer in standard form.

Give the unit.

[5 marks]

Surface area (in standard form) = _____ Unit _____

Q3.(2023)

a)

The stopping distance of a car is the braking distance added to the thinking distance.

Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	electrostatic	kinetic
nuclear		thermal

A driver applies the brakes to a moving car.

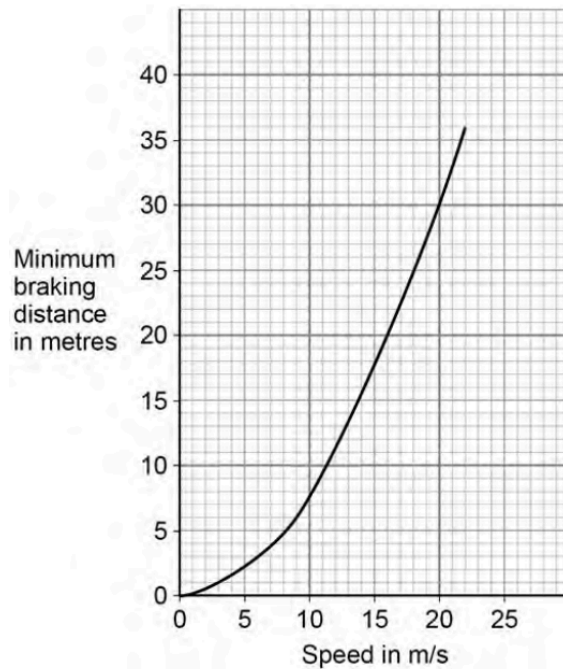
As the car slows down, there is a decrease in the _____
energy of the car.

The work done by friction causes an increase in the _____
energy store of the brakes.

b)

Figure 3 shows how the speed of the car affects the minimum braking distance of the car.

Figure 3



Describe the relationship between the speed of the car and the minimum braking distance of the car.

[1 mark]

c)

Complete the sentence.

Choose the answer from the box.

[1 mark]

decreases	stays the same	increases
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When the road becomes icy, the braking distance _____.

d)

A car driver applies the brakes to decelerate the car as it approaches a road junction.

The car decelerates at 0.25 m/s^2 .

mass of the car = 1600 kg

Calculate the time taken for the velocity of the car to decrease from 12.5 m/s to 5.0 m/s .

Use the equation:

$$\text{time taken} = \frac{\text{change in velocity}}{\text{deceleration}}$$

[3 marks]

Time taken = _____ s

e)

Calculate the resultant force causing the car to decelerate.

Use the equation:

$$\text{resultant force} = \text{mass} \times \text{deceleration}$$

[2 marks]

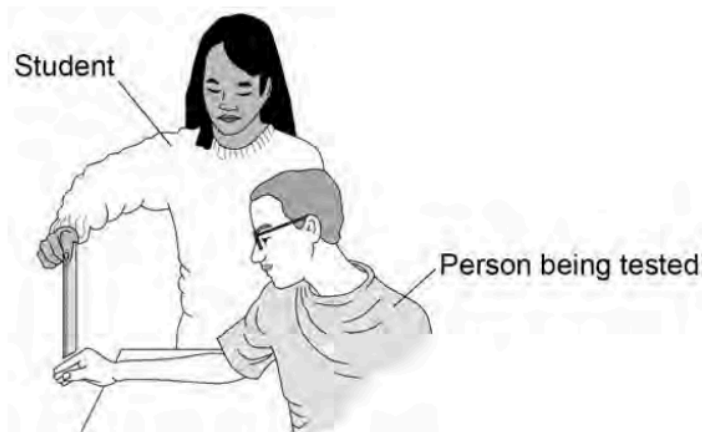
Resultant force = _____ N

f)

Thinking distance is affected by the reaction time of the driver.

Figure 4 shows how a student tested a person's reaction time.

Figure 4



The student held a ruler and then released it.

The person being tested closed his hand to catch the ruler as quickly as possible.

The further the ruler fell the greater the person's reaction time.

The student wanted to test the reaction time of the people in her class.

Which of the following could have been a control variable in this investigation?

[1 mark]

Tick (✓) **one** box.

Distance fallen by the ruler before being caught

☐

Initial height of the ruler above the person's hand

☐

Reaction time of the person being tested

☐

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g)

The student tested three people in her class.

The mean distance that the ruler fell before being caught was 18.2 cm.

If all of the people in her class were tested, the mean distance may not be 18.2 cm.

Suggest why.

[1 mark]

Q3.h)(2023)

Describe how this investigation could be changed to find out how listening to music affects reaction time.

[2 marks]