Physics on the Move (F)

1. A car travels at a speed of 60 mph (miles per hour).

1 mph = 0.45 m / s.

Convert 60 mph into m / s (metres per second).

A 0.45 m / s
B 7.5 m / s
C 27 m / s
D 130 m / s

Your answer ☐ **[1]**

2. Estimate the typical cruising speed of a jet airliner.

A 25 m/s
B 250 m/s
C 2 500 m/s
D 25 000 m/s

Your answer ☐ **[1]**

3. A student experiments with a model parachute and collects some results.

She drops the parachute from a height of 4 m three times and takes three results of the time taken.

The three results are:

3.25 s
3.00 s
3.08 s

What is the mean of the three results?

A 3.00 s
B 3.08 s
C 3.11 s
D 3.25 s

Your answer ☐ **[1]**

4. This question is about force, mass and acceleration.

A car starts from rest and accelerates at 3 m/s^2.

Use the equation: Acceleration = Change in velocity ÷ Time taken

Calculate the **velocity** of the car after 4 s.

Answer = _____ m/s **[2]**

5 (a).

Children in cars use special seats with their own seatbelts.

The seatbelts for children are narrower than adult seatbelts.

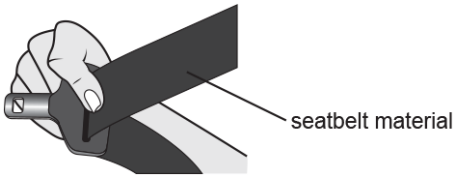
Why is it safe for children's seatbelts to be **narrower** than adult seatbelts?

_____

_____

_____ **[2]**

(b). Seatbelts in cars are made of a wide material that stretches in a crash.



i. Explain why it is important that the material is **wide.**

_____

_____ **[1]**

ii. Explain why it is important that the material is **stretchy.**

_____

_____ **[1]**

6. Fig. 20.1 shows thinking, braking and stopping distances for the same car travelling at different speeds.

Speed (m/s)	Thinking distance (m)	Braking distance (m)	Stopping distance (m)
8	6	6	12
16	12	24	36
32	24	96	120

Fig. 20.1

Calculate the reaction time of the person driving the car.

Answer = _____ s **[3]**

7. A domestic wind turbine has a power rating which varies from 1.0 kW to 3.0 kW.

i. The domestic wind turbine has an electrical resistance of 23 Ω.

It generates a current of 11 A on a windy day.

Calculate the **power** output in kW of the turbine on this day.

Answer = _____ kW **[4]**

ii. Suggest why the manufacturer gives a range for the power rating of the wind turbine.

_____

_____ **[1]**

iii. Using just **one** domestic wind turbine may be an unreliable source of power for a house.

State a reason why.

_____

_____ **[1]**

8. This question is about force, mass and acceleration.

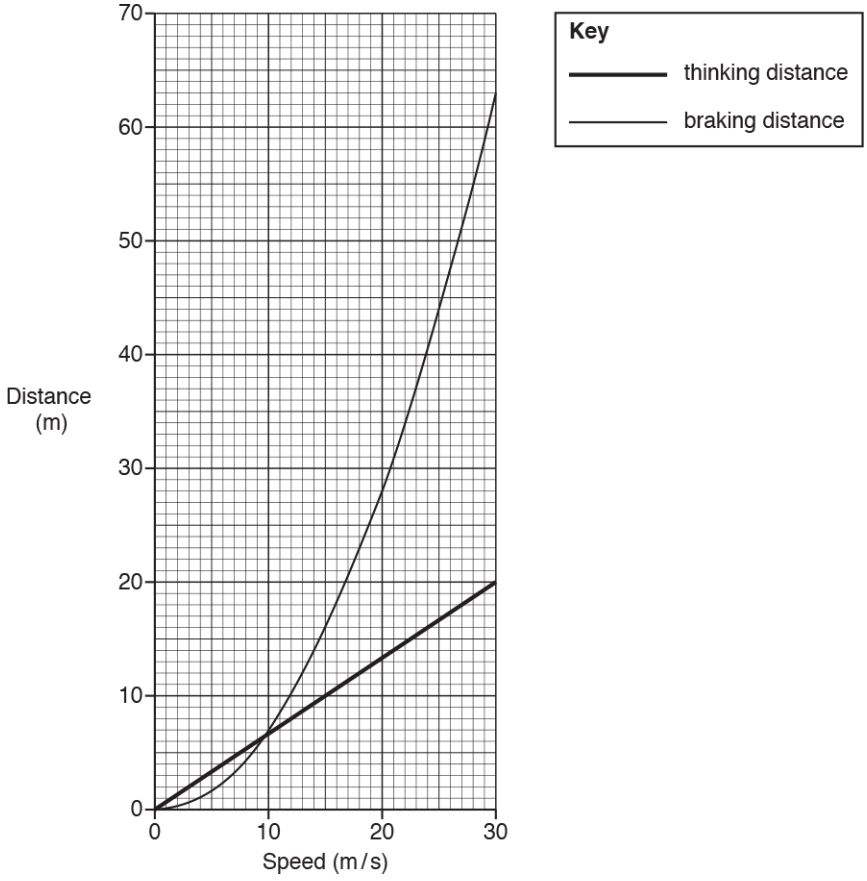
A roller coaster car moves down a slope with an acceleration of 5 m/s^2.

The force on the roller coaster car is 4000 N.

Calculate the **mass** of the roller coaster car.

Answer = _____ kg **[2]**

9(a). The graph shows thinking and braking distances for a car at different speeds.



i. Use the graph to find the **thinking distance** at 24 m / s.

Thinking distance = ... m **[1]**

ii. Calculate the **thinking time** at 24 m / s.

Use your answer to **(i)** and the equation: distance travelled = speed × time

Give your answer to **2** decimal places.

Thinking Time = ... s **[3]**

(b). How does the speed affect the **kinetic energy** and **braking distance** of the car?

Use the graph in your answer.

_____

_____

_____

_____

_____ **[3]**

(c).

i. State **one** factor that could **increase** thinking distance.

_____ **[1]**

ii. Calculate the **stopping distance** at 15 m / s.

Use the graph to help you.

Stopping distance = ... m **[2]**

10 (a).

i. A car travels at a speed of 13 m / s. The car takes 4 s to stop after the brakes are applied.

Calculate the deceleration of the car.

Use the equation: acceleration = change in velocity ÷ time

Deceleration = ...m / s^2 **[3]**

ii. The braking system of the car in **(i)** is changed. The same car travelling at 13 m / s now takes 0.4 s to stop after the brakes are applied.

The driver says, 'The new braking system is ten times safer.'

Do you agree with the driver? Explain your answer.

Yes ☐

No ☐

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[2]

iii. Suggest **one** safety feature in a car that can reduce injury in a crash.

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[1]

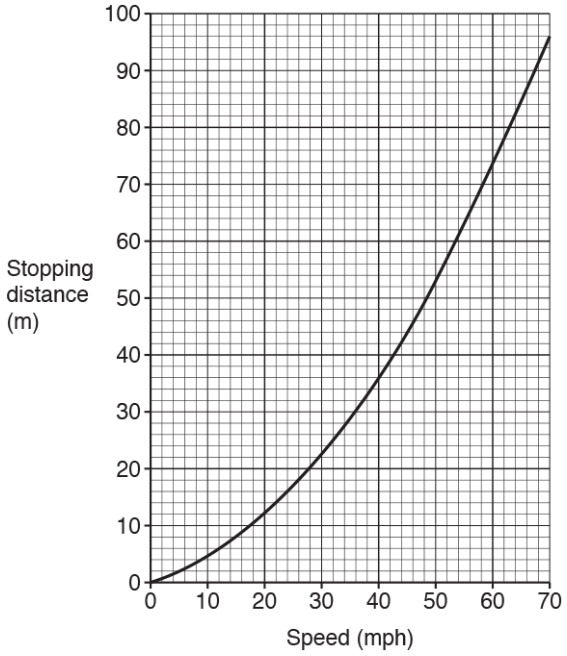
(b). The driver of a car makes an emergency stop.

The thinking distance is 9 m. The braking distance is 14 m.

i. Calculate the total stopping distance of the car.

Stopping distance = ... m **[1]**

ii. This graph shows how this driver's stopping distance changes with speed.



- A car is travelling at 50 mph.
- There is a barrier in the road 40 m in front of the car.
- The driver makes an emergency stop.

Use the graph to work out if the car hits the barrier.
Explain how you obtained your answer.

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[2]

iii. State one factor, other than speed, that affects braking distance.

Explain how this factor changes braking distance.

Factor

Explanation

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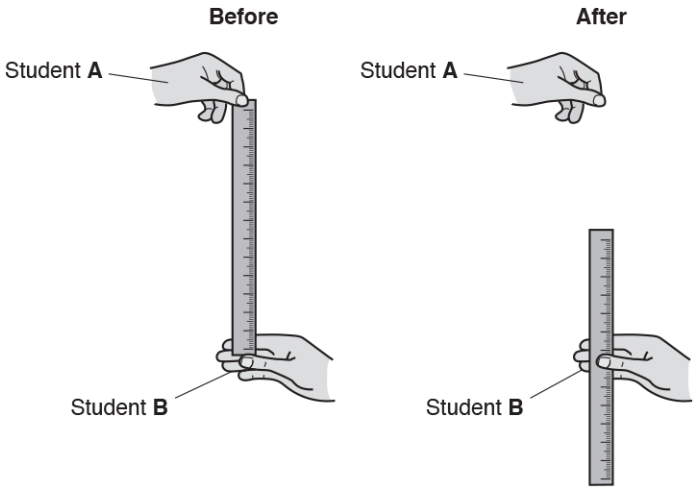
[3]

(c). The diagram shows a ruler being used to estimate a student's reaction time.



i. Describe how the ruler can be used to estimate student **B**'s reaction time.

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[2]

ii. Why do the students repeat the experiment several times?

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[1]

iii. Student **B** is very tired when they try this experiment.

Suggest how this might affect student **B**'s reaction time.

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[1]

END OF QUESTION PAPER