

# Forces and Braking

## Question Paper

Level	IGCSE
Subject	Physics (4403)
Exam Board	AQA
Unit	P2
Topic	Currents in Electrical Circuits
Sub-Topic	Forces and Braking
Booklet	Question Paper

**Time Allowed:** 44 minutes

**Score:** /44

**Percentage:** /100

**Grade Boundaries:**

**Q1.** A number of different forces act on a moving vehicle.

(a) A car moving at a steady speed has a driving force of 3000 N.

(i) What is the value of the resistive force acting on the car?

Tick (✓) **one** box.

	Tick (✓)
2000 N	
3000 N	
4000 N	

(1)

(ii) What causes most of the resistive force?

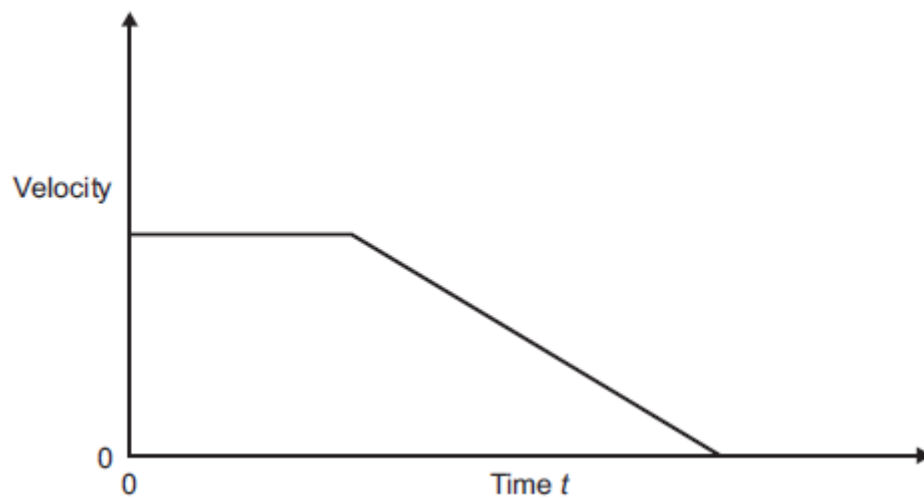
Tick (✓) **one** box.

	Tick (✓)
Air resistance	
Faulty brakes	
Poor condition of tyres	

(1)

(b) A car is moving along a road. The driver sees an obstacle in the road at time  $t = 0$  and applies the brakes until the car stops.

The graph shows how the velocity of the car changes with time.



- (i) Which feature of the graph represents the negative acceleration of the car?

Tick (✓) **one** box.

	Tick (✓)
The area under the graph	
The gradient of the sloping line	
The intercept on the y-axis	

(1)

- (ii) Which feature of the graph represents the distance travelled by the car?

Tick (✓) **one** box.

	Tick (✓)
The area under the graph	
The gradient of the sloping line	
The intercept on the y-axis	

(1)

- (iii) On a different journey, the car is moving at a **greater** steady speed.

The driver sees an obstacle in the road at time  $t = 0$  and applies the brakes until the car stops.

The driver’s reaction time and the braking distance are the same as shown the graph above.

On the graph above draw another graph to show the motion of the car.

(3)

- (c) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Thinking distance and braking distance affect stopping distance.

Explain how the factors that affect thinking distance and braking distance affect stopping distance.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6)  
(Total 13 marks)

**Q2.**An investigation was carried out to show how thinking distance, braking distance and stopping distance are affected by the speed of a car.

The results are shown in the table.

Speed in metres	Thinking distance	Braking distance in	Stopping distance
-----------------	-------------------	---------------------	-------------------

per second	in metres	metres	in metres
10	6	6	12
15	9	14	43
20	12	24	36
25	15	38	53
30	18	55	73

- (a) Draw a ring around the correct answer to complete each sentence.

As speed increases, thinking distance

decreases.
increases.
stays the same.

As speed increases, braking distance

decreases.
increases.
stays the same.

(2)

- (b) One of the values of stopping distance is incorrect.

Draw a ring around the incorrect value in the table.

Calculate the correct value of this stopping distance.

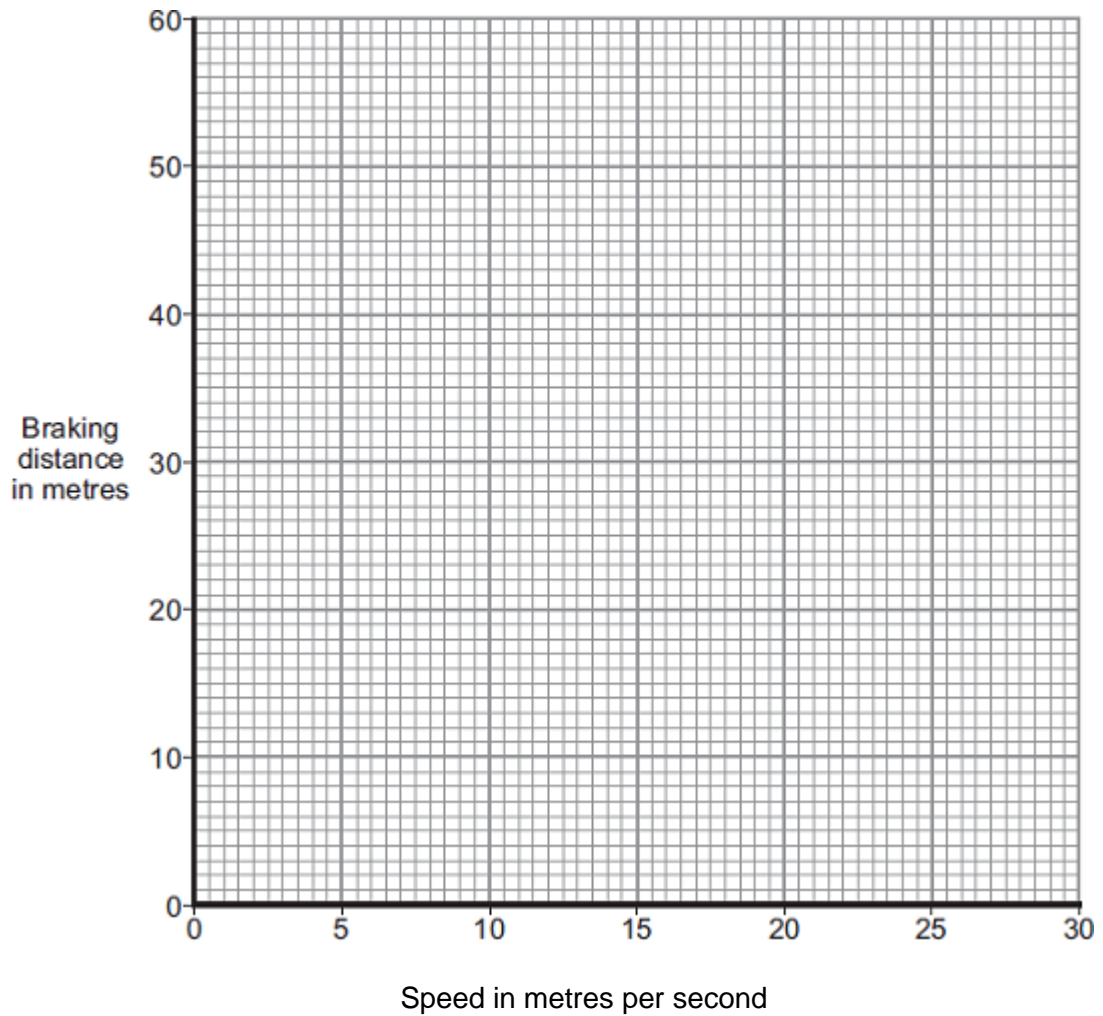
.....

Stopping distance = ..... m

(2)

- (c) (i) Using the results from the table, plot a graph of braking distance against speed.

Draw a line of best fit through your points.



(3)

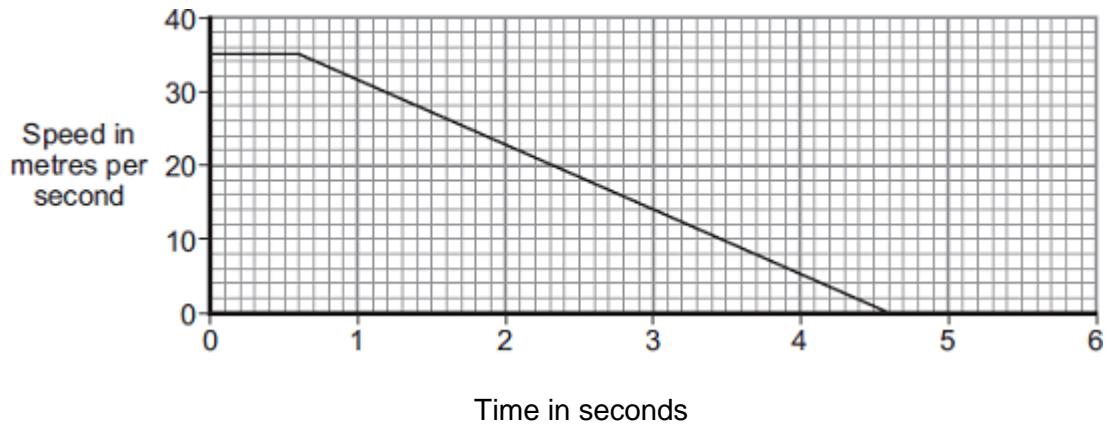
- (ii) Use your graph to determine the braking distance, in metres, at a speed of 22 m / s.

Braking distance = ..... m

(1)

- (d) The speed–time graph for a car is shown below.

While travelling at a speed of 35 m / s, the driver sees an obstacle in the road at time  $t = 0$ . The driver reacts and brakes to a stop.



- (i) Determine the braking distance.

.....  
 .....  
 .....  
 .....

Braking distance = ..... m

(3)

- (ii) If the driver was driving at 35 m / s on an icy road, the speed–time graph would be different.

Add another line to the speed–time graph above to show the effect of travelling at 35 m / s on an icy road and reacting to an obstacle in the road at time  $t = 0$ .

(3)

- (e) A car of mass 1200 kg is travelling with a velocity of 35 m / s.

- (i) Calculate the momentum of the car.

Use the correct equation from **Section A** of the Physics Equations Sheet.

Give the unit.

.....  
 .....

.....

Momentum = .....

(3)

- (ii) The car stops in 4 seconds.

Calculate the average braking force acting on the car during the 4 seconds.

Use the correct equation from **Section A** of the Physics Equations Sheet.

.....

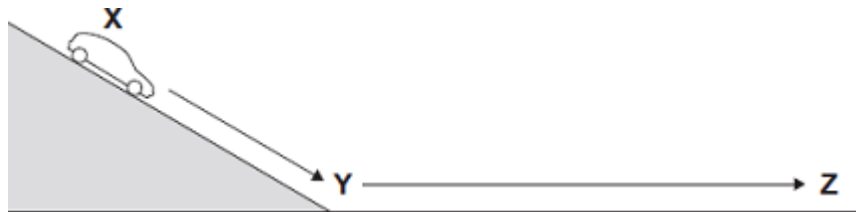
.....

Force = ..... N

(2)

(Total 19 marks)

- Q3.(a) The diagram shows a car at position X.



The handbrake is released and the car rolls down the slope to Y.  
The car continues to roll along a horizontal surface before stopping at Z.  
The brakes have **not** been used during this time.

- (i) What type of energy does the car have at X?

.....

(1)

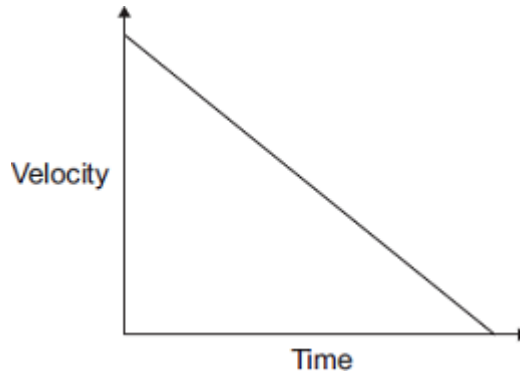
- (ii) What type of energy does the car have at Y?

.....

(1)



- (b) The graph shows how the velocity of the car changes with time between **Y** and **Z**.



- (i) Which feature of the graph represents the negative acceleration between **Y** and **Z**?

.....

(1)

- (ii) Which feature of the graph represents the distance travelled between **Y** and **Z**?

.....

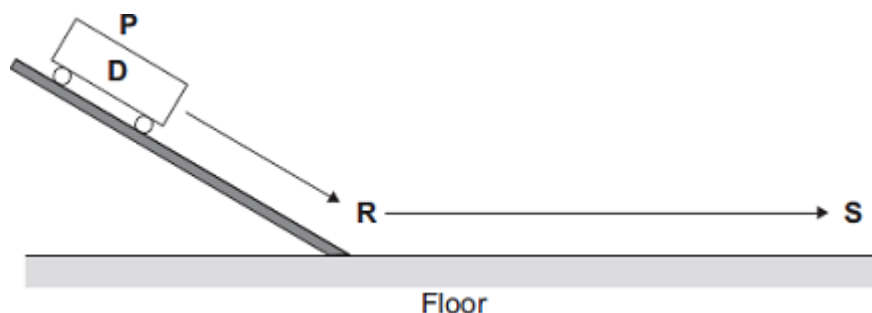
(1)

- (iii) The car starts again at position **X** and rolls down the slope as before. This time the brakes are applied lightly at **Y** until the car stops.

Draw on the graph another straight line to show the motion of the car between **Y** and **Z**.

(2)

- (c) Three students carry out an investigation. The students put trolley **D** at position **P** on a slope. They release the trolley. The trolley rolls down the slope and along the floor as shown in the diagram.



The students measure the distance from **R** at the bottom of the slope to **S** where the trolley stops. They also measure the time taken for the trolley to travel the distance **RS**.

They repeat the investigation with another trolley, **E**.

Their results are shown in the table.

Trolley	Distance RS in centimetres	Time taken in seconds	Average velocity in centimetres per second
<b>D</b>	65	2.1	
<b>E</b>	80	2.6	

- (i) Calculate the average velocity, in centimetres per second, between **R** and **S** for trolleys **D** and **E**. Write your answers in the table.

Use the correct equation from **Section A** of the Physics Equations Sheet.

.....

.....

.....

(3)

- (ii) Before the investigation, each student made a prediction.

- Student **1** predicted that the two trolleys would travel the same distance.
- Student **2** predicted that the average velocity of the two trolleys would be

the same.

- Student 3 predicted that the negative acceleration of the two trolleys would be the same.

Is each prediction correct?

Justify your answers.

.....

.....

.....

.....

.....

.....

(3)  
(Total 12 marks)