



**Topic Test: OxfordAQA**  
**International GCSE Physics 9203**  
Forces and their effects

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

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Time: **35 minutes**

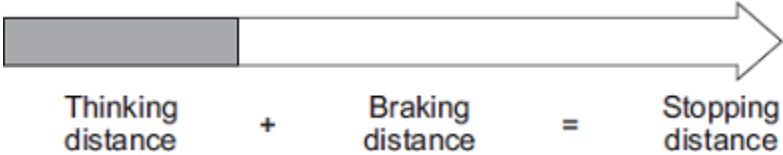
Marks: **35 marks**

Comments:

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1

The diagram shows how the thinking distance and braking distance of a car add together to give the stopping distance of the car.



(a) Use words from the box to complete the sentence.

distance	energy	force	time
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The stopping distance is found by adding the distance the car travels during the driver's reaction \_\_\_\_\_ and the distance the car travels under the braking \_\_\_\_\_ .

(2)

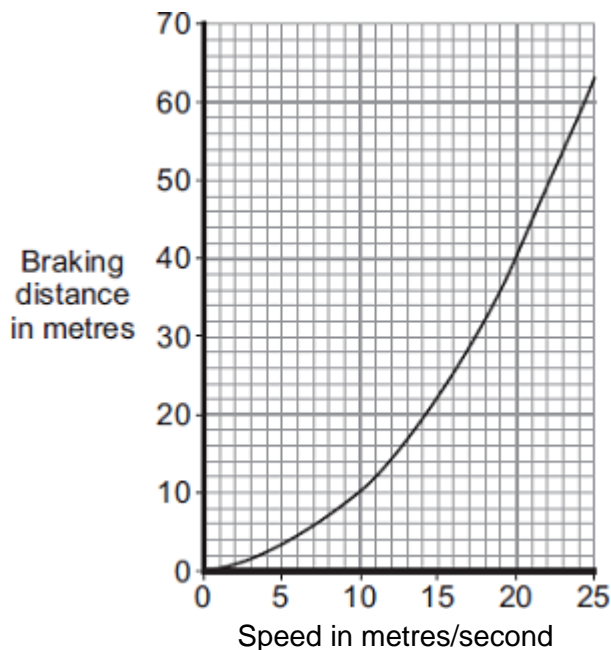
(b) Which **one** of the following would **not** increase the thinking distance?

Tick (✓) **one** box.

- The car driver being tired.
  
- The car tyres being badly worn.
  
- The car being driven faster.

(1)

- (c) The graph shows how the braking distance of a car changes with the speed of the car. The force applied to the car brakes does not change.



- (i) What conclusion about braking distance can be made from the graph?

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(2)

- (ii) The graph is for a car driven on a dry road.

Draw a line on the graph to show what is likely to happen to the braking distance at different speeds if the same car was driven on an icy road.

(1)

- (d) A local council has reduced the speed limit from 30 miles per hour to 20 miles per hour on a few roads. The reason for reducing the speed limit was to reduce the number of accidents.

- (i) A local newspaper reported that a councillor said:

“It will be much safer because drivers can react much faster when driving at 20 miles per hour than when driving at 30 miles per hour.”

This statement is wrong. Why?

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(1)

- (ii) The local council must decide whether to introduce the lower speed limit on a lot more roads.

What evidence should the local council collect to help make this decision?

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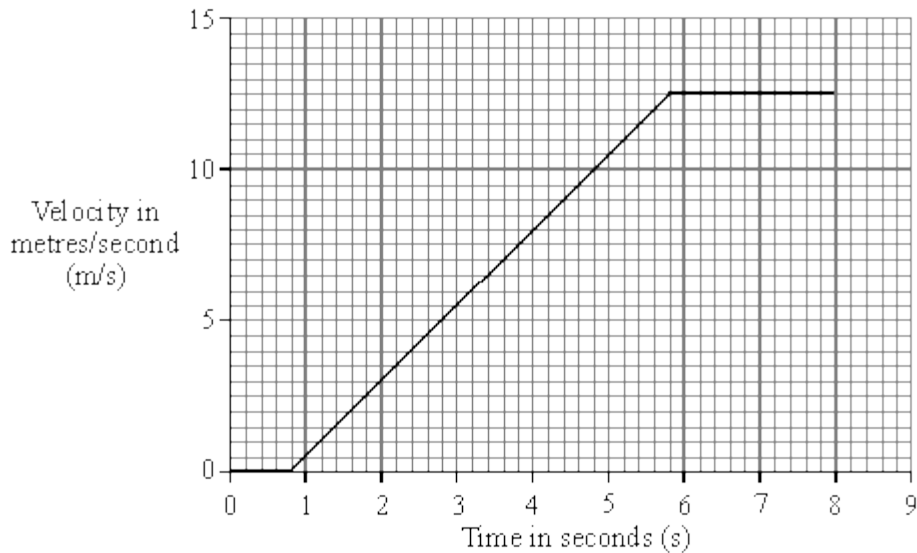
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(2)

(Total 9 marks)

2

A car travelling along a straight road has to stop and wait at red traffic lights. The graph shows how the velocity of the car changes after the traffic lights turn green.



- (a) Between the traffic lights changing to green and the car starting to move there is a time delay. This is called the reaction time. Write down **one** factor that could affect the driver's reaction time.

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(1)

- (b) Calculate the distance the car travels while accelerating. Show clearly how you work out your answer.

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Distance = \_\_\_\_\_ metres

(3)

- (c) Calculate the acceleration of the car. Show clearly how you work out your final answer and give the units.

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Acceleration = \_\_\_\_\_

(4)

- (d) The mass of the car is 900 kg.

- (i) Write down the equation that links acceleration, force and mass.

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(1)

- (ii) Calculate the force used to accelerate the car. Show clearly how you work out your final answer.

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Force = \_\_\_\_\_ newtons

(2)

(Total 11 marks)

3

Forces have different effects.

- (a) (i) Use the correct answer from the box to complete the sentence.

slowing	stretching	turning
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The moment of a force is the \_\_\_\_\_ effect of the force.

(1)

- (ii) What is meant by the centre of mass of an object?

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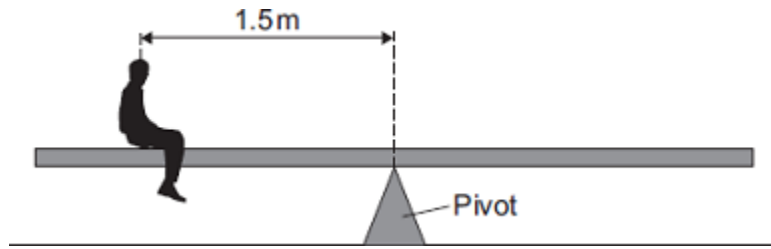
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(1)

- (b) Some children build a see-saw using a plank of wood and a pivot. The centre of mass of the plank is above the pivot.

**Figure 1** shows a boy sitting on the see-saw. His weight is 400 N.

**Figure 1**



Calculate the anticlockwise moment of the boy in Nm.

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

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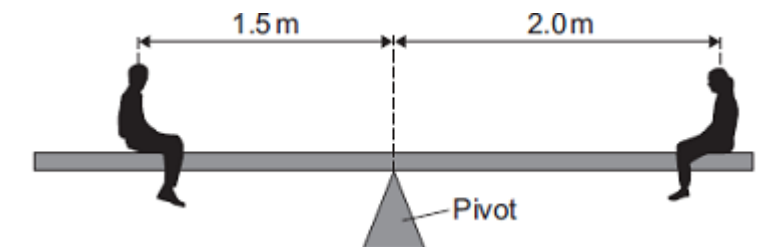
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Anticlockwise moment = \_\_\_\_\_ Nm

**(2)**

(c) **Figure 2** shows a girl sitting at the opposite end of the see-saw. Her weight is 300 N.

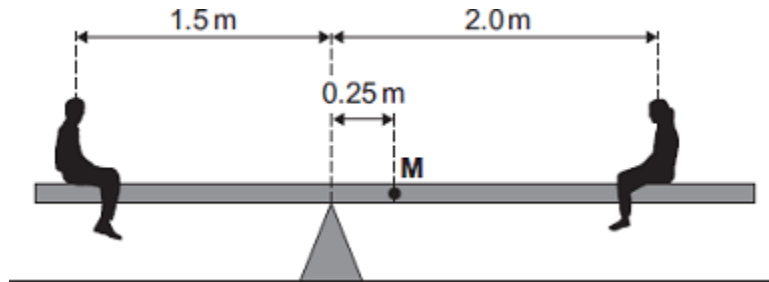
**Figure 2**



The see-saw is now balanced.

The children move the plank. Its centre of mass, **M**, is now 0.25 m from the pivot as shown in **Figure 3**.

**Figure 3**



The boy and girl sit on the see-saw as shown in **Figure 3**.

- (i) Describe **and** explain the rotation of the see-saw.

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**(3)**

- (ii) The boy gets off the see-saw and a bigger boy gets on it in the same place. The girl stays in the position shown in **Figure 3**. The plank is balanced. The weight of the plank is 270 N.

Calculate the weight of the bigger boy.

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Weight of the bigger boy = \_\_\_\_\_ N

(3)

(Total 10 marks)

4

A paintball gun is used to fire a small ball of paint, called a paintball, at a target.

The figure below shows someone just about to fire a paintball gun.

The paintball is inside the gun.



- (a) What is the momentum of the paintball before the gun is fired?

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Give a reason for your answer.

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(2)

(b) The gun fires the paintball forwards at a velocity of 90 m / s.

The paintball has a mass of 0.0030 kg.

Calculate the momentum of the paintball just after the gun is fired.

Use the correct equation from the Physics Equations Sheet.

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Momentum = \_\_\_\_\_ kg m / s

**(2)**

(c) The momentum of the gun and paintball is conserved.

Use the correct answer from the box to complete the sentence.

<b>equal to</b>	<b>greater than</b>	<b>less than</b>
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The total momentum of the gun and paintball just after the gun is fired

will be \_\_\_\_\_ the total momentum of the gun and

paintball before the gun is fired.

**(1)**

**(Total 5 marks)**

## Mark schemes

1

(a) time

*correct order only*

1

force

1

(b) The car tyres being badly worn

1

(c) (i) braking distance increases with speed

*accept positive correlation*

*do **not** accept stopping distance for braking distance*

1

relevant further details, eg

- but not in direct proportion
- and increases more rapidly after 15 m/s  
*accept any speed between 10 and 20*  
*accept numerical example*
- double the speed, braking distance increases  $\times 4$

1

(ii) line drawn above existing line starting at the origin

*as speed increases braking distance must increase*

*each speed must have a single braking distance*

1

(d) (i) reaction time / reaction (of driver) does not depend on speed (of car)

1

(ii) (on the reduced speed limit roads) over the same period of time

*accept a specific time, eg 1 year*

1

monitor number of accidents before and after (speed limit reduced)

*allow 1 mark only for record number of vehicles / cars using the (20*

*mph) roads **or** collect data on accidents on the (20 mph) roads*

*to score both marks the answer must refer to the roads with the*

*reduced speed limit*

1

[9]

2

(a) concentration / tiredness / drugs / alcohol

*accept any reasonable factor that could affect a driver's reactions*

*do **not** accept speed or any physical condition unrelated to the driver*

1

(b) 31.25

credit for 1 mark correct attempt to calculate the area under the slope **or** for using the equation  
distance = average velocity (speed) × time  
credit for 1 mark use of correct velocity change (12.5) and correct time (5) **or** answer of 62.5

3

(c) 2.5

credit for 1 mark triangle drawn on slope **or** correct equation **or** two correct pairs of coordinates  
credit for 1 mark use of correct velocity change (12.5) and correct time (5)  
accept time = between 4.8 and 5.2 if used in (b)  
do not accept an attempt using one pair of coordinates taken from the slope

3

metres / second / second **or** metres / second / squared **or** m/s<sup>2</sup> **or** ms<sup>-2</sup>

1

(d) (i) force = mass × acceleration

accept correct transformation

accept  $F = m \times a$

accept  provided subsequent use of  $\Delta$  is correct

do **not** accept an equation in units

1

(ii) 2250

credit their (c) × 900 for 2 marks

credit 1 mark for correct substitution

2

[11]

3

(a) (i) turning

accept turning ringed in the box

1

(ii) point at which mass (or weight) may be thought to be concentrated

accept the point from which the weight appears to act

allow focused for concentrated

do **not** accept most / some of the mass

do **not** accept region / area for point

1

- (b) 600 (Nm)  
*400 × 1.5 gains 1 mark provided no subsequent steps shown* 2
- (c) (i) plank rotates clockwise  
*accept girl moves downwards*  
*do **not** accept rotates to the right* 1
- (total) CM > (total) ACM  
*accept moment is larger on the girl's side* 1
- weight of see-saw provides CM  
*answer must be in terms of moment*  
*maximum of 2 marks if there is no reference to the weight of the see-saw* 1
- (ii)  $W = 445 \text{ (N)}$   
 *$W \times 1.5 = (270 \times 0.25) + (300 \times 2.0)$  gains 2 marks*  
*allow for 1 mark:*  
*total CM = total ACM either stated or implied*  
**or**  
 *$(270 \times 0.25) + (300 \times 2.0)$*   
*if no other marks given* 3

[10]

- 4** (a) Zero / 0  
*Accept none*  
*Nothing is insufficient* 1
- velocity / speed = 0  
*accept it is not moving*  
*paintball has not been fired is insufficient* 1

- (b) 0.27  
*allow 1 mark for correct substitution, ie  $p = 0.003(0) \times 90$  provided no subsequent step* 2

- (c) equal to 1

[5]