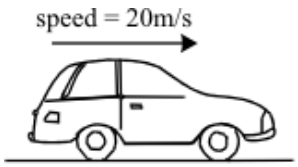
Q1. A car travels along a level road at 20 metres per second.



(a) Calculate the distance travelled by the car in 4 seconds.

(Show your working.)

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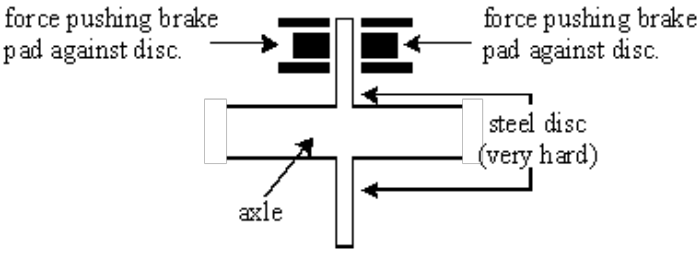
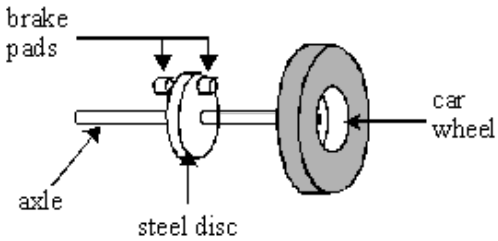
(3)

(b) When the brake pedal of the car is pushed, brake pads press against very hard steel discs.





The force of friction between the brake pads and the steel discs gradually stops the car.

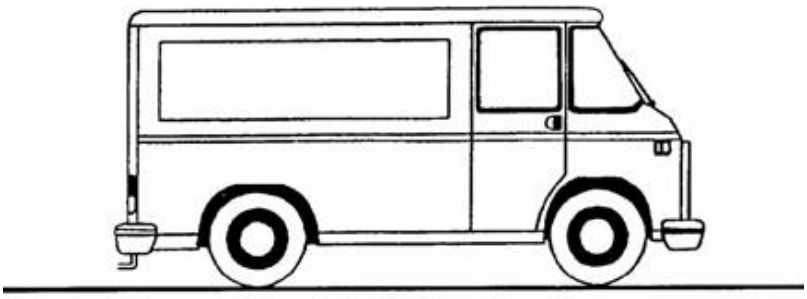
What **two** effects does using the brakes have on the **brake pads** and **wheel discs**?

1 .....

2 .....

(3)
(Total 6 marks)

Q2.



(a) The van shown above has a fault and leaks one drop of oil every second.

The diagram below shows the oil drops left on the road as the van moves from **W** to **Z**.

Describe the motion of the van as it moves from:

W to **X** .....

.....

X to **Y** .....

.....

Y to **Z** .....

.....

(3)

(b) The van was driven for 20 seconds at a speed of 30m/s.

Calculate the distance travelled.

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.....

Distance ..... m

(2)

(c) The van was travelling at 30m/s. It slowed to a stop in 12 seconds.

Calculate the van's acceleration.

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Acceleration ..... m/s^2

(3)

(d) The driver and passenger wear seatbelts. Seatbelts reduce the risk of injury.

Explain how seatbelts reduce the risk of injury.

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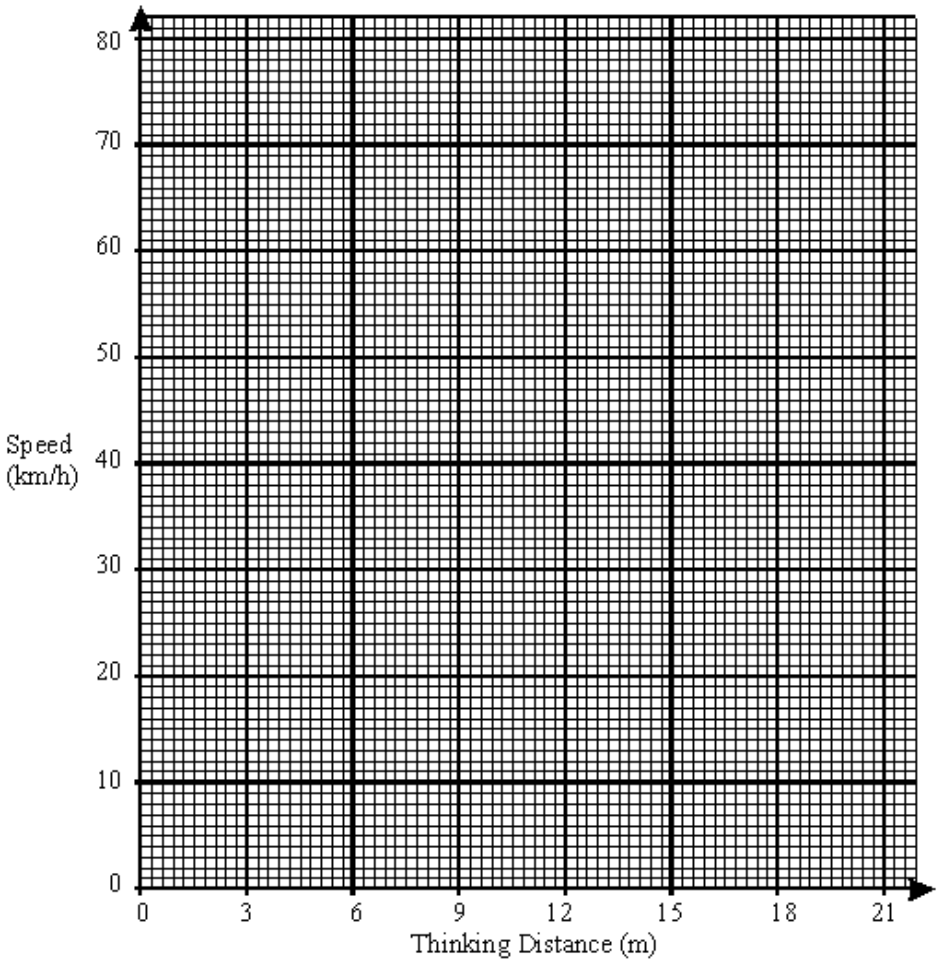
(4)
(Total 12 marks)

Q3. When a car driver has to react and apply the brakes quickly, the car travels some distance before stopping. Part of this distance is called the “thinking distance”. This is how far the car travels while the driver reacts to a dangerous situation.

The table below shows the thinking distance (m) for various speeds (km/h).

Thinking distance (m)	0	9	12	15
Speed (km/h)	0	48	64	80

(a) On the graph paper below, draw a graph of the thinking distance against speed.



(2)

(b) Describe how thinking distance changes with speed.

.....

.....

(1)

(c) The time the driver spends thinking before applying the brakes is called the "thinking time".

A driver drank two pints of lager. Some time later the thinking time of the driver was measured as 1.0 seconds.

(i) Calculate the thinking distance for this driver when driving at 9 m/s.

.....

.....

Answer ..... m

(1)

(ii) A speed of 9 m/s is the same as 32 km/h. Use your graph to find the thinking distance at 32 km/h for a driver who has not had a drink.

.....

Answer ..... m

(1)

(iii) What has been the effect of the drink on the thinking distance of the driver?

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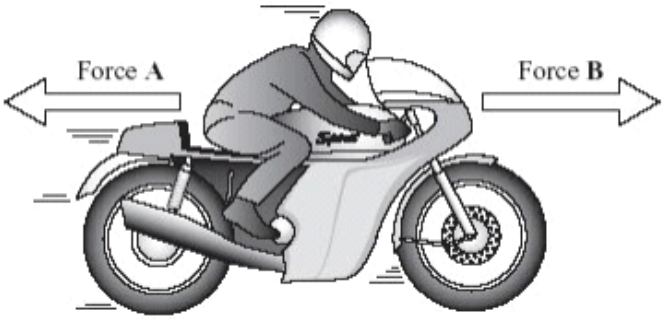
.....

(1)

(Total 6 marks)

Q4. (a) The diagram shows the horizontal forces that act on a **moving** motorbike.



(i) Describe the movement of the motorbike when force **A** equals force **B**.

.....

.....

(2)

(ii) What happens to the speed of the motorbike if force **B** becomes smaller than force **A**?

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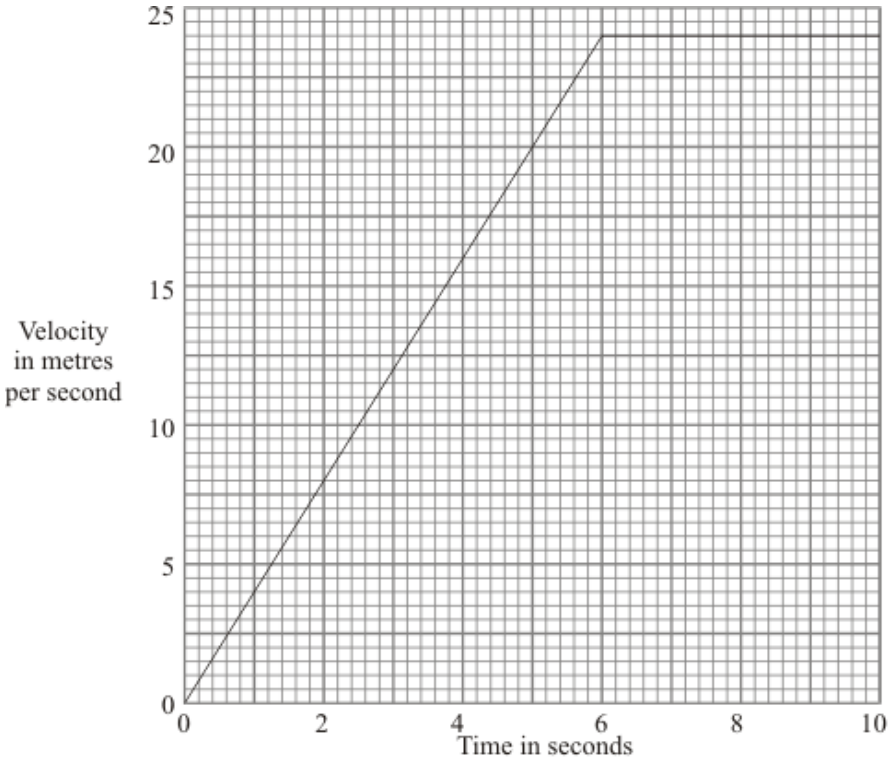
(1)

(b) The graph shows how the velocity of a motorbike changes when it is travelling along a straight road.



(i) What was the change in velocity of the motorbike in the first 5 seconds?

.....

(1)

(ii) Write down the equation which links acceleration, change in velocity and time taken.

.....

(1)

(iii) Calculate the acceleration of the motorbike during the first 5 seconds.
Show clearly how you work out your answer and give the unit.

.....

.....

Acceleration = ...

(3)

(c) A car is travelling on an icy road.

Describe and explain what might happen to the car when the brakes are applied.

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(2)

(d) Name **three** factors, other than weather conditions, which would increase the overall stopping distance of a vehicle.

1 .....

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2 .....

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3 .....

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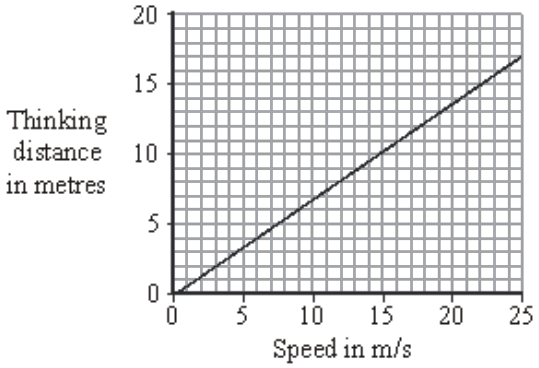
(3)
(Total 13 marks)

Q5. (a) A car driver takes a short time to react to an emergency before applying the brakes. The distance the car will travel during this time is called the 'thinking distance'.

The graph shows how the thinking distance of a driver depends on the speed of the car.



(i) What is the connection between thinking distance and speed?

.....

(1)

(ii) Many people drive while they are tired.

Draw a new line on the graph to show how thinking distance changes with speed for a tired driver.

(1)

(iii) The graph was drawn using data given in the Highway Code.

Do you think that the data given in the Highway Code is likely to be reliable?

Draw a ring around your answer.

Yes **No** **Maybe**

Give a reason for your answer.

.....

.....

(1)

(b) The distance a car travels once the brakes are applied is called the 'braking distance'.

(i) What is the relationship between thinking distance, braking distance and stopping distance?

.....

(1)

(ii) State **two** factors that could increase the braking distance of a car at a speed of 15 m/s.

1 .....

2 .....

(2)
(Total 6 marks)

Q6. (a) A car is being driven along a straight road. The diagrams, **A**, **B** and **C**, show the horizontal forces acting on the moving car at three different points along the road.

Describe the motion of the car at each of the points, **A**, **B** and **C**.

A

.....

.....

B

.....

.....

C

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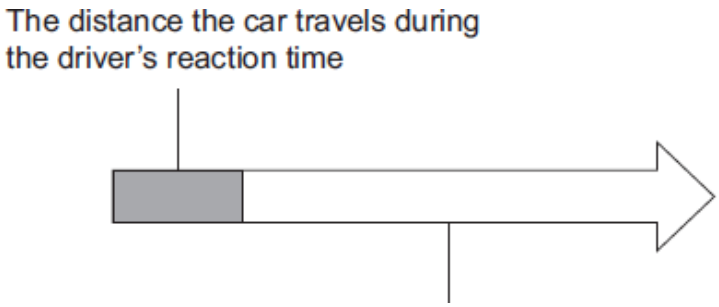
.....

(3)

(b) The diagram below shows the stopping distance for a family car, in good condition, driven at 22 m/s on a dry road. The stopping distance has two parts.

(i) Complete the diagram below by adding an appropriate label to the second part of the stopping distance.



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(1)

(ii) State **one** factor that changes both the first part **and** the second part of the stopping distance.

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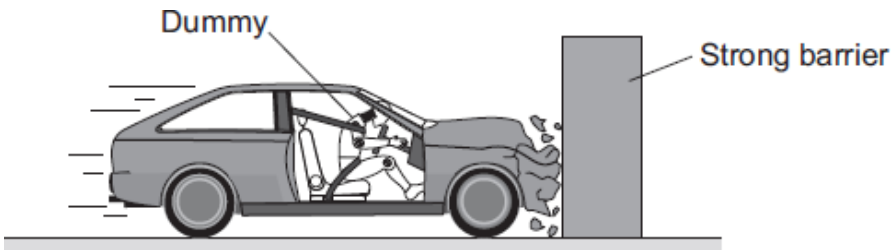
(1)

(c) The front crumple zone of a car is tested at a road traffic laboratory. This is done by using a remote control device to drive the car into a strong barrier. Electronic sensors are attached to the dummy inside the car.



(i) At the point of collision, the car exerts a force of 5000 N on the barrier.

State the size and direction of the force exerted by the barrier on the car.

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(1)

(ii) Suggest why the dummy is fitted with electronic sensors.

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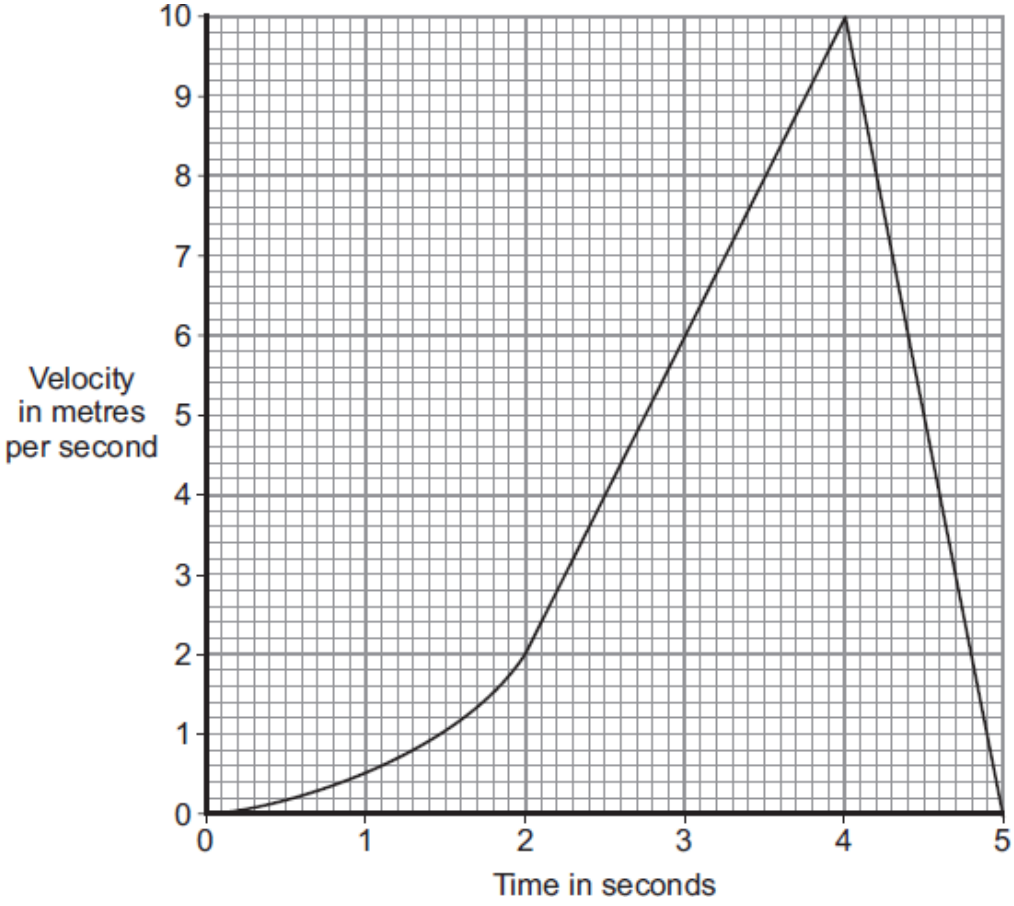
(1)

(iii) The graph shows how the velocity of the car changes during the test.



Use the graph to calculate the acceleration of the car just before the collision with the barrier.

Show clearly how you work out your answer, including how you use the graph, and give the unit.

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.....

Acceleration = ...

(3)
(Total 10 marks)

Q7. A car has an oil leak. Every 5 seconds an oil drop falls from the bottom of the car onto the road.

(a) What force causes the oil drop to fall towards the road?

.....

(1)

(b) The diagram shows the spacing of the oil drops left on the road during part of a journey

Describe the motion of the car as it moves from **A** to **B**.

.....

Explain the reason for your answer.

.....

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.....

.....

(3)

(c) When the brakes are applied, a braking force slows down and stops the car.

(i) The size of the braking force affects the braking distance of the car.

State **one** other factor that affects the braking distance of the car.

.....

(1)

(ii) A braking force of 3 kN is used to slow down and stop the car in a distance of 25 m.

Calculate the work done by the brakes to stop the car and give the unit.

Use the correct equation from the Physics Equations Sheet.

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Work done =.....

(3)
(Total 8 marks)