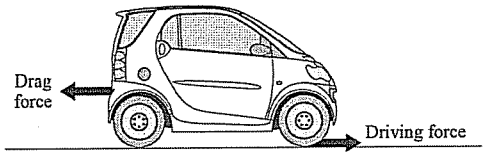
Forces and braking

1. The diagram shows the horizontal forces acting on a car travelling along a straight road.



(a) Complete the following sentences by drawing a ring around the correct word in each box.

(i) When the driving force equals the drag force, the speed of the car is

decreasing
constant
increasing

(1)

(ii) Putting the brakes on transforms the car's kinetic energy mainly into

heat
light
sound

(1)

(b) The charts, **A**, **B** and **C** give the thinking distance and the braking distance for a car driven under different conditions.

(i) Draw straight lines to match each chart to the correct conditions.

Draw only **three** lines.

Conditions	Charts
Speed = 22 m/s driver wide awake	A
Speed = 13 m/s driver wide awake	B
Speed = 13 m/s driver very tired	C

Key
- Thinking distance
- Braking distance

(2)

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(ii) The three charts above all apply to dry road conditions.

How would the braking distances be different if the road were wet?

.....

.....

(1)

(Total 5 marks)

2. (a) A car driver makes an emergency stop.

The chart shows the 'thinking distance' and the 'braking distance' needed to stop the car.

Thinking distance 15 m	Braking distance 38 m

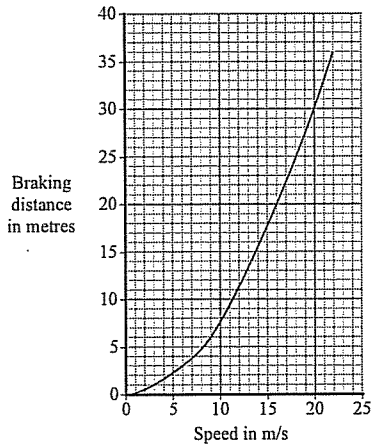
Calculate the total stopping distance of the car.

.....

Stopping distance = ... m

(1)

(b) The graph shows how the braking distance of a car driven on a dry road changes with the car's speed.



The braking distance of the car on an icy road is longer than the braking distance of the car on a dry road.

(i) Draw a new line on the graph to show how the braking distance of the car on an icy road changes with speed.

(2)

(ii) Which **two** of the following would also increase the braking distance of the car?
Put a tick (✓) next to each of your answers.

rain on the road ☐

the driver having drunk alcohol ☐

car brakes in bad condition ☐

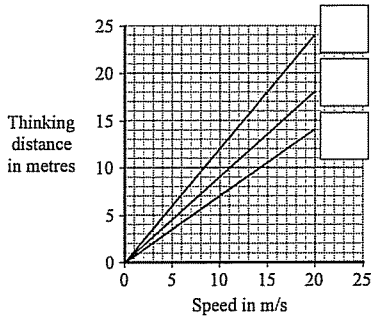
the driver having taken drugs ☐

(2)

(c) The thinking distance depends on the driver's reaction time.
The table shows the reaction times of three people driving under different conditions.

Car driver	Condition	Reaction time in seconds
A	Wide awake with no distractions	0.7
B	Using a hands-free mobile phone	0.9
C	Very tired and listening to music	1.2

The graph lines show how the thinking distance for the three drivers, **A**, **B** and **C**, depends on how fast they are driving the car.



(i) Match each graph line to the correct driver by writing **A**, **B** or **C** in the box next to the correct line.

(2)

(ii) The information in the table cannot be used to tell if driver **C**'s reaction time is increased by being tired or by listening to music.

Explain why.

.....

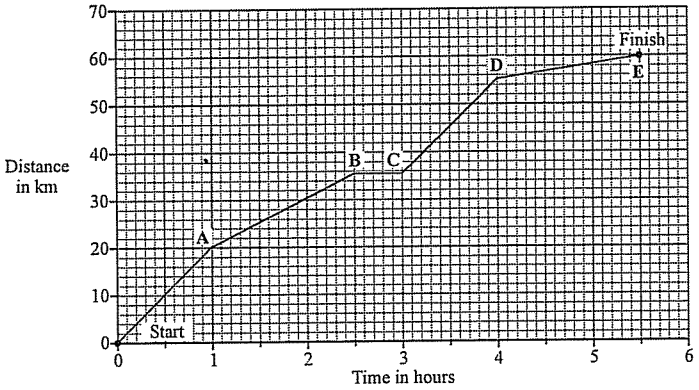
.....

.....

(2)
(Total 9 marks)

Forces and motion

1. A horse and rider take part in a long distance race. The graph shows how far the horse and rider travel during the race.



(a) What was the distance of the race?

distance = ... km

(1)

(b) How long did it take the horse and rider to complete the race?

.....

(1)

(c) What distance did the horse and rider travel in the first 2 hours of the race?

distance = ... km

(1)

(d) How long did the horse and rider stop and rest during the race?

.....

(1)

(e) Not counting the time it was resting, between which two points was the horse moving the slowest?

..... and .....

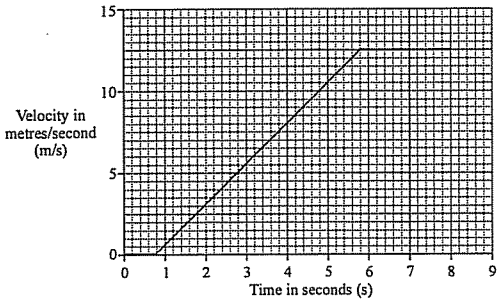
Give a reason for your answer.

.....

.....

(2)
(Total 6 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.

.....

(1)

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

.....

.....

Distance = ...metres

(3)

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

.....

.....

Acceleration = ...

(4)

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

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

.....

(1)

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

.....

.....

Force = ... newtons

(2)
(Total 11 marks)