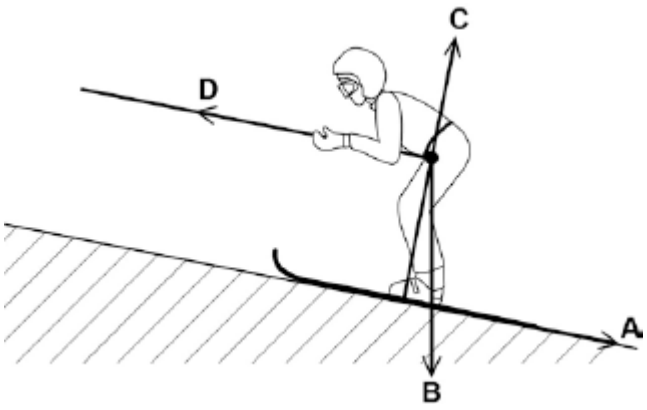
Q1.Figure 1 shows a skier using a drag lift.

The drag lift pulls the skier from the bottom to the top of a ski slope.

The arrows, **A**, **B**, **C** and **D** represent the forces acting on the skier and her skis.

Figure 1



(a) Which arrow represents the force pulling the skier up the slope?

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

(1)

(b) Which arrow represents the normal contact force?

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

(1)

(c) The drag lift pulls the skier with a constant resultant force of 300N for a distance of 45 m.

Use the following equation to calculate the work done to pull the skier up the slope.

work done = force × distance

.....

.....

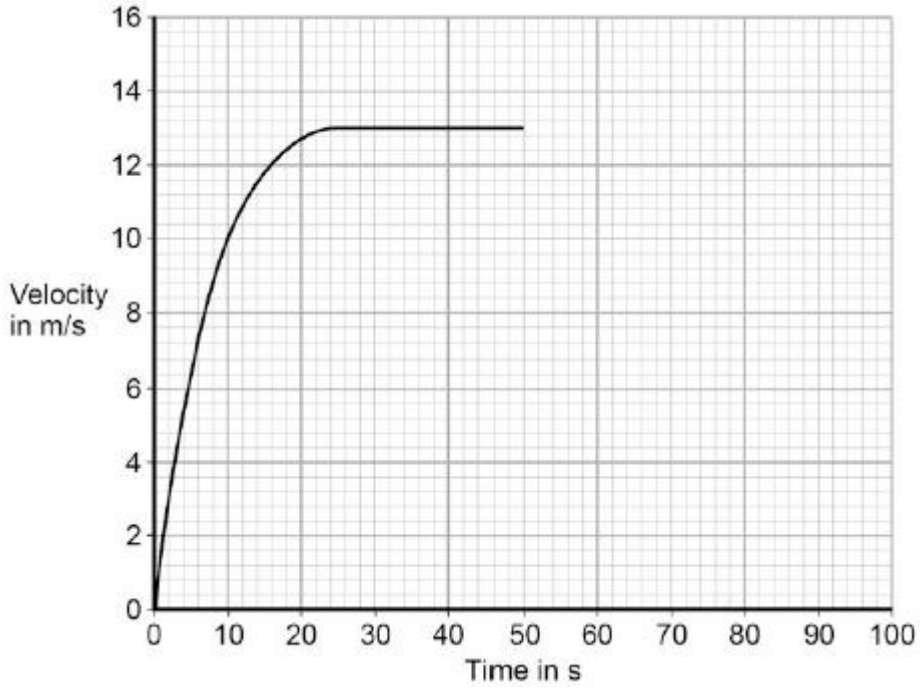
Work done = ... J

(2)

(d) At the top of the slope the skier leaves the drag lift and skis back to the bottom of the slope.

Figure 2 shows how the velocity of the skier changes with time as the skier moves down the slope.

Figure 2



After 50 seconds the skier starts to slow down.

The skier decelerates at a constant rate coming to a stop in 15 seconds.

Draw a line on **Figure 2** to show the change in velocity of the skier as she slows down and comes to a stop.

(2)
(Total 6 marks)

Q2. (a) The total stopping distance of a car has two parts. One part is the distance the car travels during the driver's reaction time. This distance is often called the 'thinking distance'.

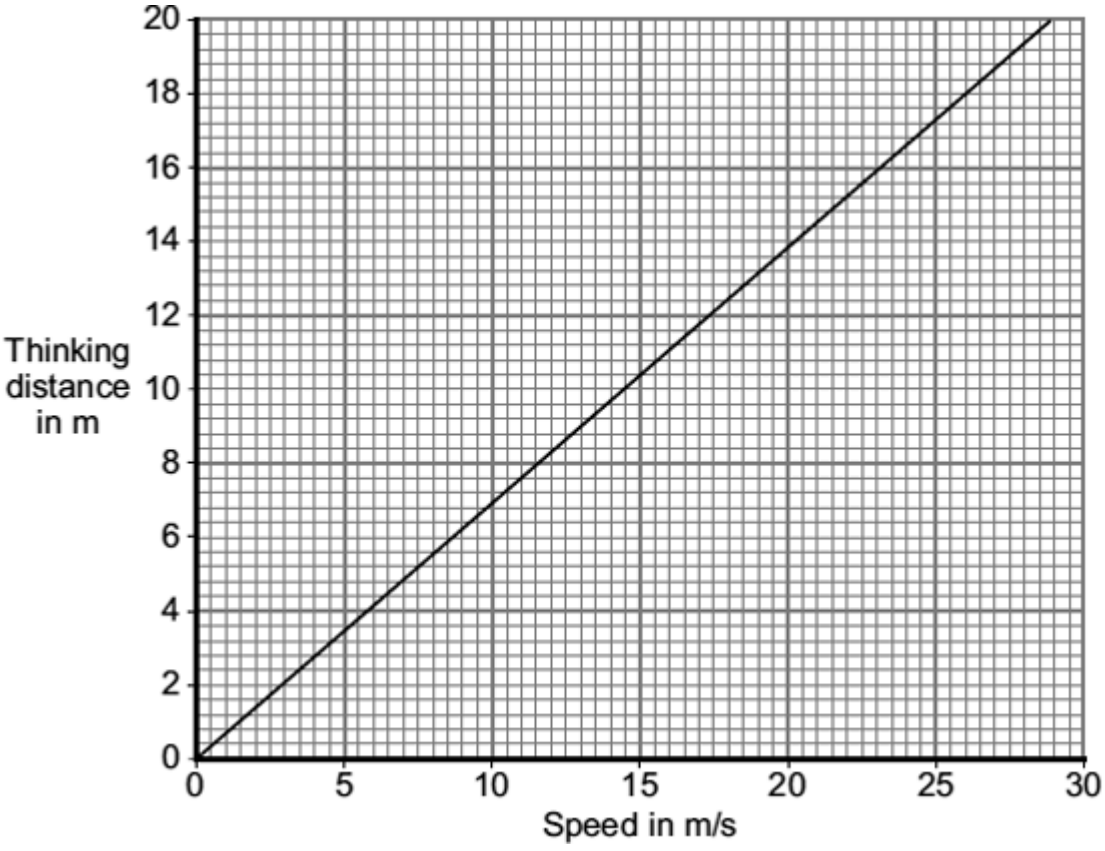
What distance is added to the 'thinking distance' to give the total stopping distance?

.....

.....

(1)

(b) The graph shows the relationship between the speed of a car and the thinking distance.



Describe the relationship between speed and thinking distance.

.....

.....

(2)

(c) The diagram shows two students investigating reaction time.

One student holds a 30 cm ruler, then lets go. As soon as the second student sees the ruler fall, she closes her hand, stopping the ruler. The further the ruler falls before being stopped, the slower her reaction time.

(i) One student always holds the ruler the same distance above the other student's hand.
In this experiment, what type of variable is this?

Put a tick (✓) in the box next to your answer.

☐ dependent variable

☐ control variable

(1)

(ii) Describe how this experiment could be used to find out whether listening to music affects reaction time.

.....

.....

.....

.....

(2)

(d) The following information is written on the label of some cough medicine.

WARNING: Causes drowsiness. Do not drive or operate machinery.

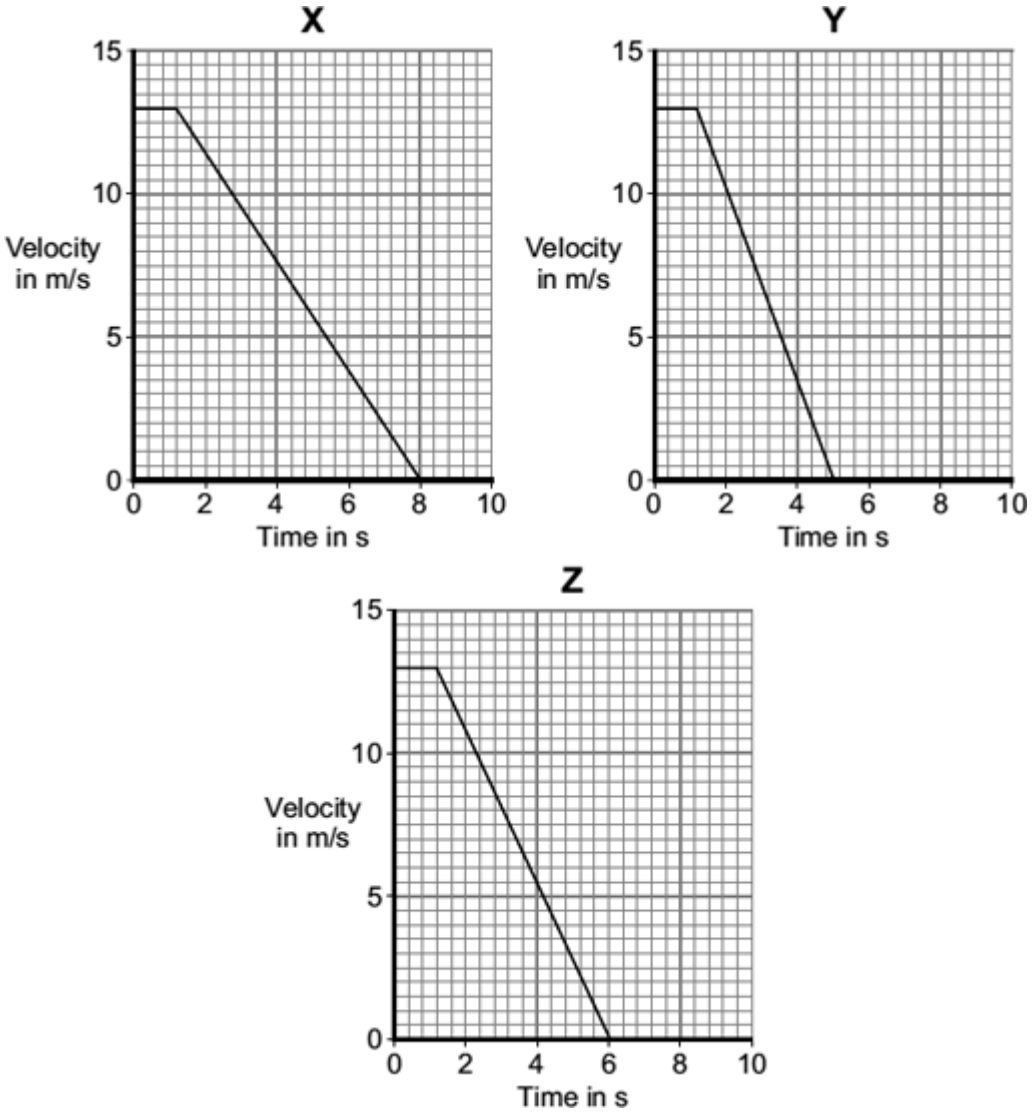
How is feeling drowsy (sleepy) likely to affect a driver's reaction time?

.....

.....

(1)

(e) Three cars, **X**, **Y** and **Z** , are being driven along a straight road towards a set of traffic lights.
The graphs show how the velocity of each car changes once the driver sees that the traffic light has turned to red.



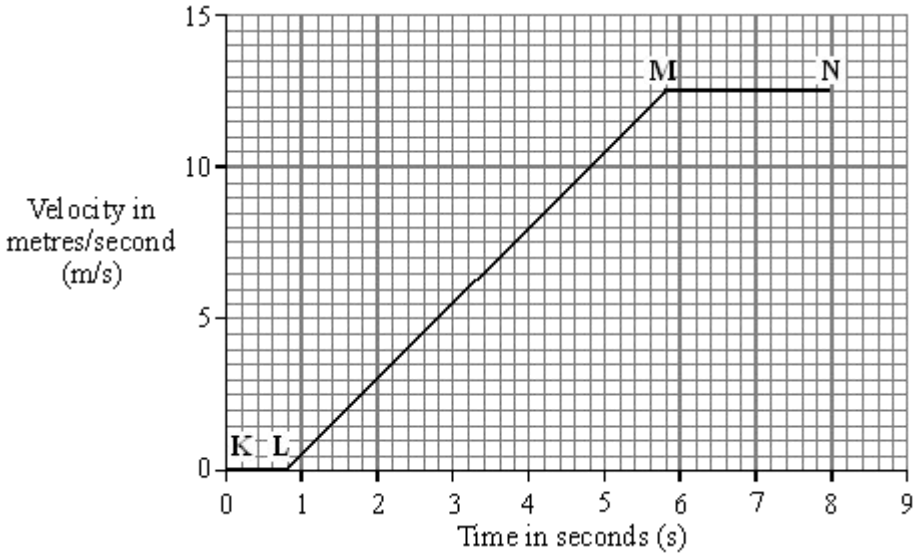
Which one of the cars, **X**, **Y** or **Z** , stops in the shortest distance?

.....

(1)
(Total 8 marks)

Q3. A car and a bicycle are travelling along a straight road. They have stopped at road works.

The graph shows how the velocity of the car changes after the sign is changed to GO.



(a) Between which two points on the graph is the car moving at constant velocity?

.....

(1)

(b) Between which two points on the graph is the car accelerating?

.....

(1)

(c) Between the sign changing to GO and the car starting to move, there is a time delay. This is called the reaction time.

(i) What is the reaction time of the car driver?

Reaction time = ... seconds

(1)

(ii) Which **one** of the following could increase the reaction time of a car driver? Tick the box next to your choice.

Drinking alcohol ☐

Wet roads ☐

Worn car brakes ☐

(1)

(d) The cyclist starts to move at the same time as the car. For the first 2 seconds the cyclist's acceleration is constant and is greater than that of the car.

Draw a line on the graph to show how the velocity of the cyclist might change during the first 2 seconds of its motion.

(2)

(Total 6 marks)

Q4. On 14 October 2012, a skydiver set a world record for the highest free fall from an aircraft.

After falling from the aircraft, he reached a maximum steady velocity of 373 m / s after 632 seconds.

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

This maximum steady velocity is called the [frictional / initial / terminal] velocity.

(1)

(b) The skydiver wore a chest pack containing monitoring and tracking equipment. The weight of the chest pack was 54 N.

The gravitational field strength is 10 N / kg.

Calculate the mass of the chest pack.

.....

.....

Mass of chest pack = ... kg

(2)

(c) During his fall, the skydiver's acceleration was not uniform.

Immediately after leaving the aircraft, the skydiver's acceleration was 10 m / s^2.

(i) Without any calculation, estimate his acceleration a few seconds after leaving the aircraft.

Explain your value of acceleration in terms of forces.

Estimate .....

Explanation .....

.....

.....

.....

.....

.....

(3)

(ii) Without any calculation, estimate his acceleration 632 seconds after leaving the aircraft.

Explain your value of acceleration in terms of forces.

Estimate .....

Explanation .....

.....

.....

.....

.....

.....

(3)
(Total 9 marks)

Q5. A high-speed train accelerates at a constant rate in a straight line.

The velocity of the train increases from 30 m/s to 42 m/s in 60 seconds.

(a) (i) Calculate the change in the velocity of the train.

.....

Change in velocity = ... m/s

(1)

(ii) Use the equation in the box to calculate the acceleration of the train.

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken for change}}$$

Show clearly how you work out your answer and give the unit.
Choose the unit from the list below.

m/s **m/s²** **N/kg** **Nm**

.....

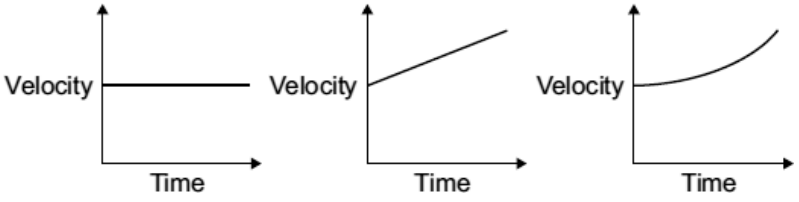
.....

Acceleration = ...

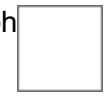
(2)

(b) Which **one** of the graphs, **A**, **B** or **C**, shows how the velocity of the train changes as it accelerates?

Write your answer, **A**, **B** or **C**, in the box.



A **B** **C**

Graph 

(1)
(Total 4 marks)