Motion/Kinematics – 2020 O Level 5054

1. Nov/2020/Paper_11/No.2

A car begins to move. It speeds up until it reaches a constant speed. It continues to travel at this constant speed for the rest of the journey.

What happens to the acceleration and what happens to the velocity of the car during the journey?

A Both the acceleration and the velocity change.

B Only the acceleration changes.

C Only the velocity changes.

D Neither the acceleration nor the velocity changes.

2. Nov/2020/Paper_12/No.2

A car begins to move. It speeds up until it reaches a constant speed. It continues to travel at this constant speed for the rest of the journey.

What happens to the acceleration and what happens to the velocity of the car during the journey?

A Both the acceleration and the velocity change.

B Only the acceleration changes.

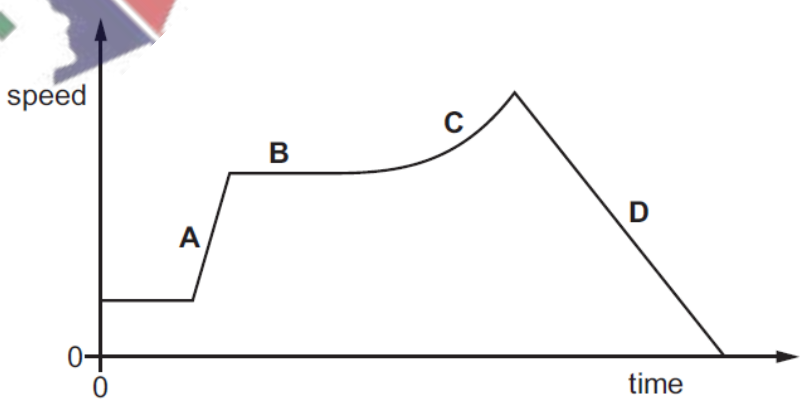
C Only the velocity changes.

D Neither the acceleration nor the velocity changes.

3. Nov/2020/Paper_12/No.3

The speed–time graph for a car's journey is shown.

During which part of the journey is the car moving with non-uniform acceleration?



4. Nov/2020/Paper_21/No.1

Fig. 1.1 is the distance–time graph for a skydiver who jumps from a balloon at time $t = 0$.

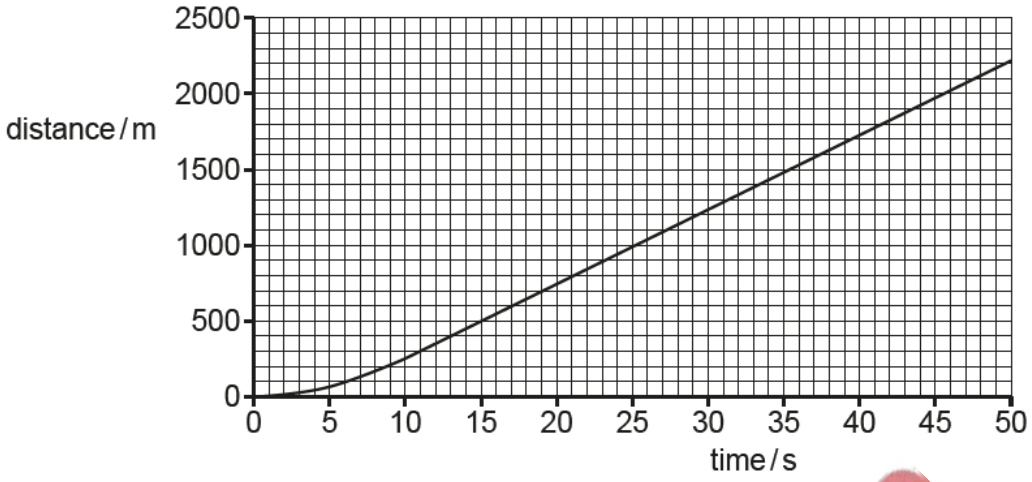


Fig. 1.1

(a) The first part of the graph shows the motion of the skydiver from when he jumps until he reaches terminal velocity.

(i) Describe the motion of the skydiver between $t = 0$ and $t = 20$ s.

.....

.....

..... [2]

(ii) Explain the motion of the skydiver between $t = 0$ and $t = 20$ s in terms of the forces acting on him.

.....

.....

.....

..... [3]

(b) Using Fig. 1.1, determine the terminal velocity of the skydiver.

On Fig. 1.1, indicate any values used for your calculation.

terminal velocity = ... [3]

5. Nov/2020/Paper_22/No.7

A bus leaves a bus-stop at time $t = 0$ and travels along a horizontal road until it reaches a second bus-stop. Fig. 7.1 is the distance-time graph for the bus between $t = 0$ and $t = 60$ s.

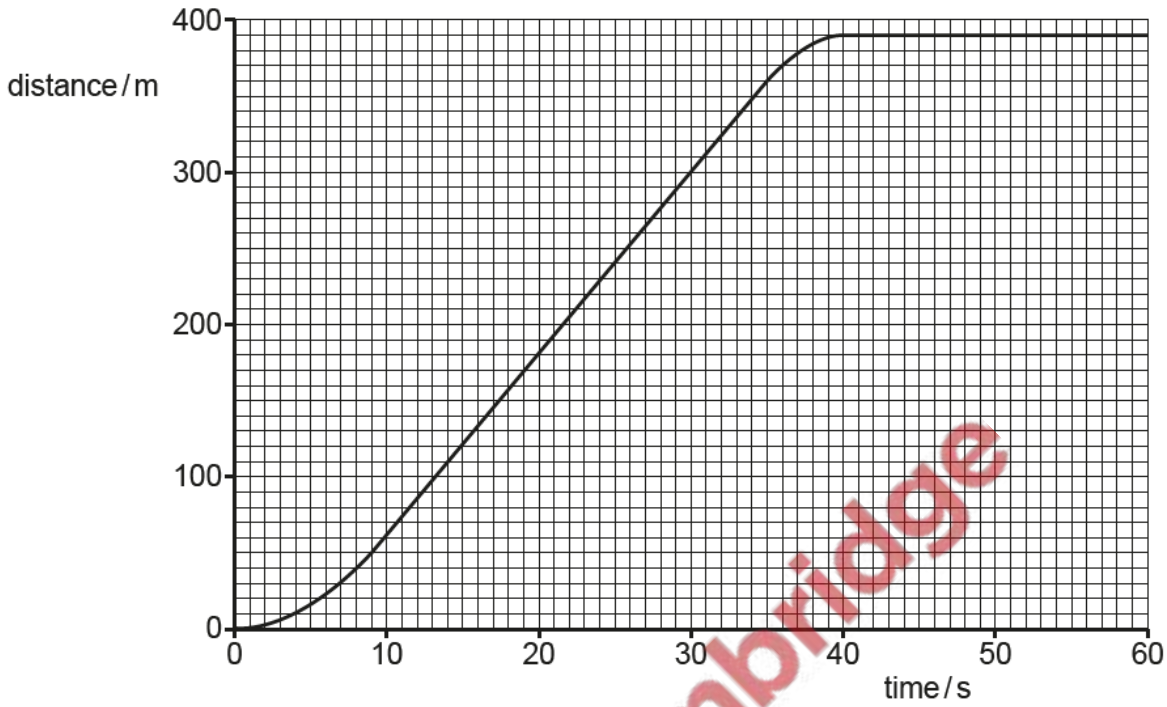


Fig. 7.1

The road on which the bus is travelling is straight except for a short, curved section. The bus travels around this circular curve between $t = 21$ s and $t = 24$ s.

(a) Describe how the motion of the bus between $t = 0$ and $t = 10$ s differs from its motion between $t = 35$ s and $t = 40$ s.

.....

.....

.....

.....

..... [3]

(b) Determine:

(i) the maximum speed of the bus during these 60 s

maximum speed = ... [3]

(ii) the average speed of the bus between leaving the first bus-stop and arriving at the second bus-stop.

average speed = ... [2]

(c) **(i)** State how *velocity* differs from *speed*.

.....

..... [1]

(ii) There are **three** periods during the 60 s when there is a non-zero resultant force acting on the bus.

Complete the statements to indicate these three time periods and state the direction of the resultant force in that period.

1. Between t = ... and t = ... the direction of the resultant force is

.....

2. Between t = ... and t = ... the direction of the resultant force is

.....

3. Between t = ... and t = ... the direction of the resultant force is

.....

[4]

(d) During the journey, the air resistance acting on the bus varies.

(i) State why the air resistance changes during the journey.

.....

..... [1]

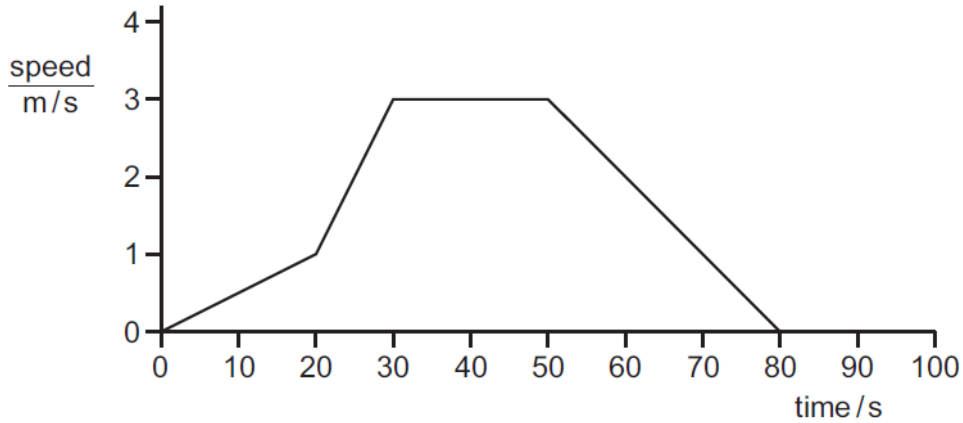
(ii) On Fig. 7.1, mark and label with an M a time when the air resistance is a maximum value.

[1]

[Total: 15]

6. June/2020/Paper_11/No.3

The graph shows a short journey. It is a speed–time graph.



What is the greatest speed reached?

A 1 m/s **B** 2 m/s **C** 3 m/s **D** 4 m/s

7. June/2020/Paper_12/No.4

Stop-watches are used to time the runners in a race.

The stop-watches show the times recorded for the winner and another runner.

What is the difference in time between the winner and the other runner?

A 0.4608 s **B** 6.08 s **C** 46.08 s **D** 608 s

8. June/2020/Paper_12/No.5

Two cameras are a known distance apart. The exact time that a vehicle passes each of the cameras is recorded.

What can be obtained from the information?

A average acceleration of the vehicle

B average speed of the vehicle

C maximum acceleration of the vehicle

D maximum speed of the vehicle

9. June/2020/Paper_21/No.1

Fig. 1.1 shows the thinking distance and the braking distance for a car being driven along a dry road and along a wet road at the same speed.

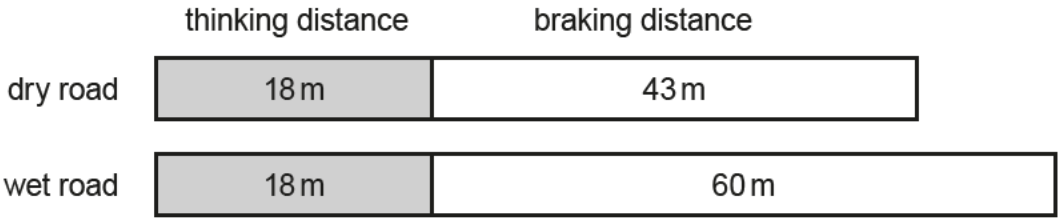


Fig. 1.1

(a) Calculate the total stopping distance for the car on the wet road.

distance = ... [1]

(b) Complete the sentence.

The thinking distance is the distance travelled between seeing a hazard and .....

..... [1]

(c) **(i)** Suggest why the thinking distance is the same on both roads.

.....

.....

..... [1]

(ii) Explain why the braking distance is larger when the road is wet.

.....

.....

.....

..... [2]

[Total: 5]

10. June/2020/Paper_22/No.1

Fig. 1.1 shows part of the speed–time graph for an athlete in a race.

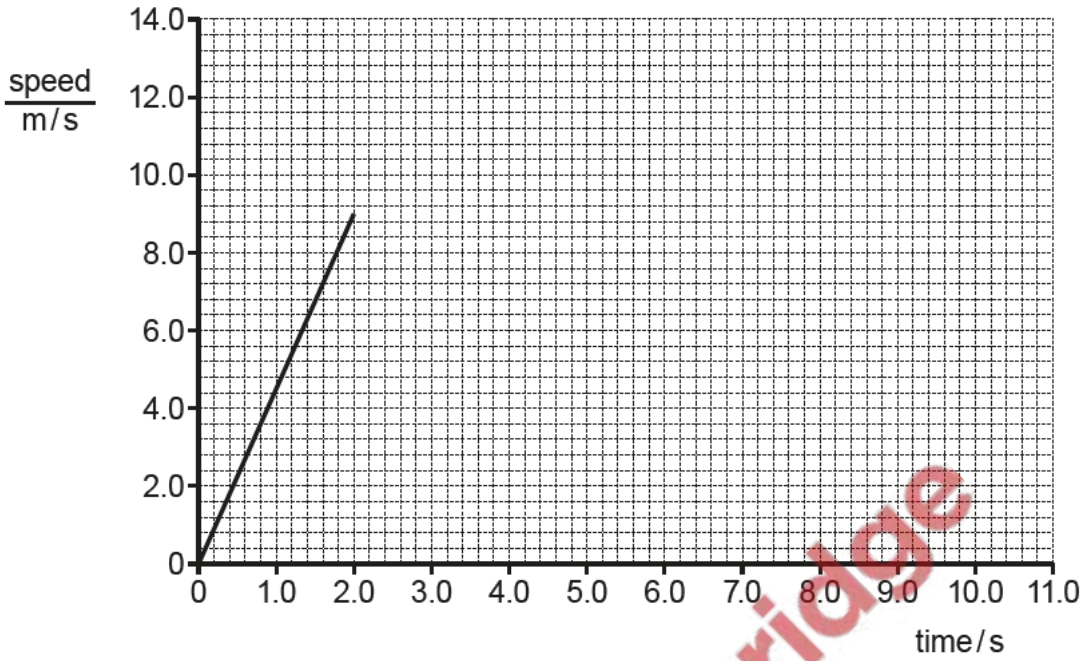


Fig. 1.1

(a) During the race, the acceleration of the athlete is uniform in the first 2.0 s.

State how the graph shows that the acceleration is uniform.

.....

..... [1]

(b) Determine the distance travelled by the athlete in the first 2.0 s.

distance = ... [2]

(c) During the rest of the race:

- from 2.0 s to 5.5 s, the acceleration of the athlete decreases
- at 5.5 s, the athlete reaches a maximum speed of 12 m/s
- from 5.5 s to 8.0 s, the athlete travels at a speed of 12 m/s
- from 8.0 s to 11.0 s, the athlete decelerates, finishing the race at a speed of 10 m/s.

On Fig. 1.1, complete the speed–time graph for times between 2.0 and 11.0 s. [3]

[Total: 6]

11. June/2020/Paper_22/No.2

Fig. 2.1 shows the thinking distance and the braking distance for a car driven at 100 km/h.

The car has old, smooth tyres.

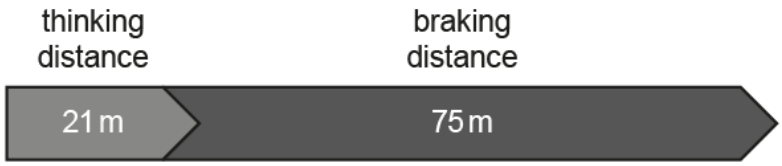


Fig. 2.1

(a) Calculate the total stopping distance for the car.

stopping distance = ... [1]

(b) The car is now fitted with new tyres.

At a speed greater than 100 km/h, the total stopping distance is the same as in **(a)**.

(i) State and explain the effect that the increase in speed and the use of new tyres have on the thinking distance.

effect .....

explanation .....

.....

..... [2]

(ii) State and explain the effect that the increase in speed and the new tyres have on the braking distance.

effect .....

explanation .....

.....

..... [2]

[Total: 5]