

QQQ – Mechanics Year 1 – Chapter 9 – Time-Series Graphs (Version 1)

Total Marks: 23

(23 = Platinum, 21 = Gold, 18 = Silver, 16 = Bronze)

1. The displacement–time graph, **Figure 1**, shows the first 5 seconds of the motion of a car which starts from rest and travels 12 metres.

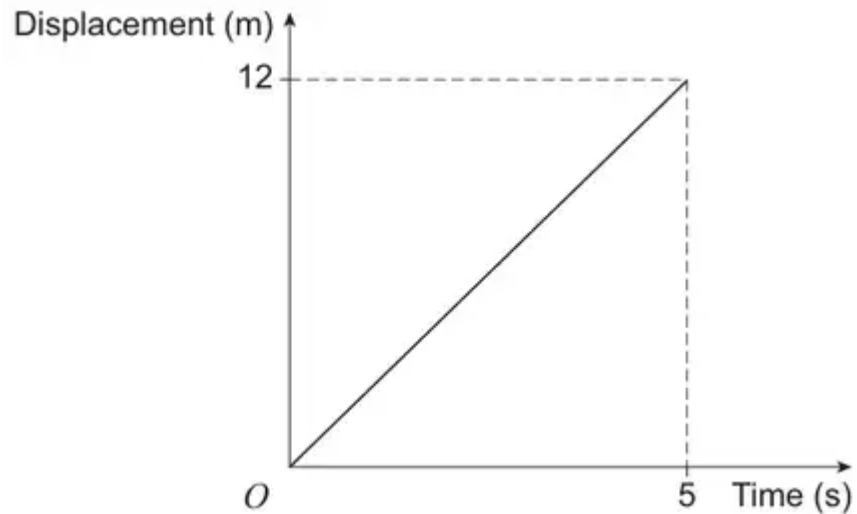


Figure 1

- (a) Find the speed of the car. **[1 mark]**
- (b) On **Figure 2**, draw a more realistic displacement–time graph to show the first 5 seconds of motion of the car. **[1 mark]**

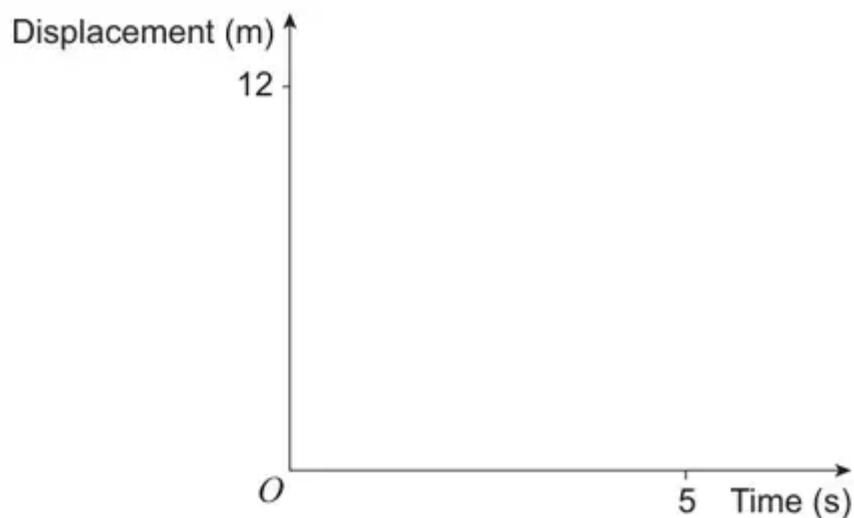


Figure 2

(Total 2 marks)

2. A car, initially at rest, moves with constant acceleration along a straight horizontal road.

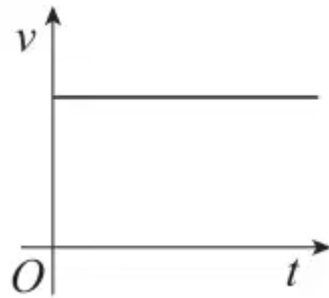
One of the graphs below shows how the car's velocity, $v \text{ m s}^{-1}$, changes over time, t seconds.

Identify the correct graph.

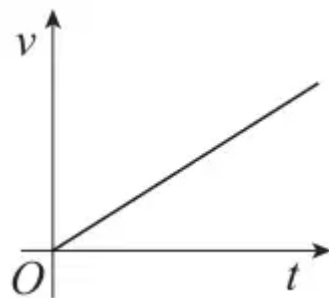
Tick (✓) **one** box.

[1 mark]

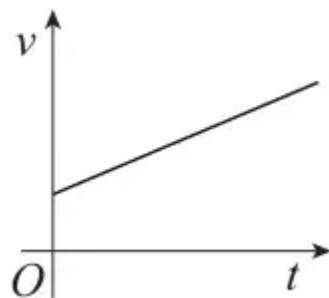
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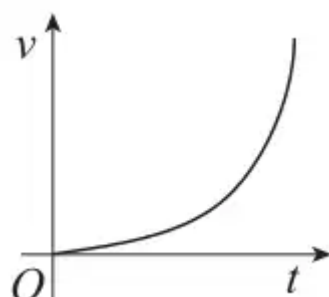
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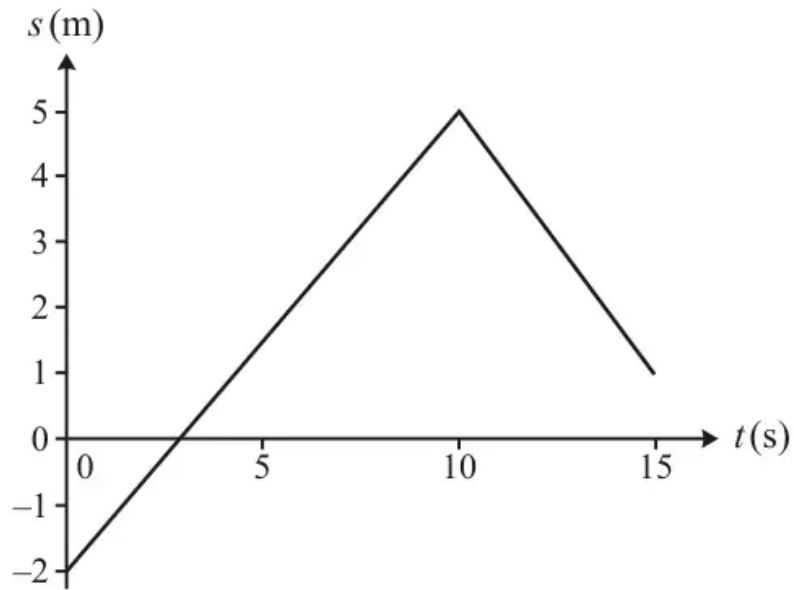


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(Total 1 marks)

3. A particle moves along a straight line. The displacement s m at time t s is shown in the displacement-time graph below. The graph consists of straight line segments joining the points $(0, -2)$, $(10, 5)$ and $(15, 1)$.

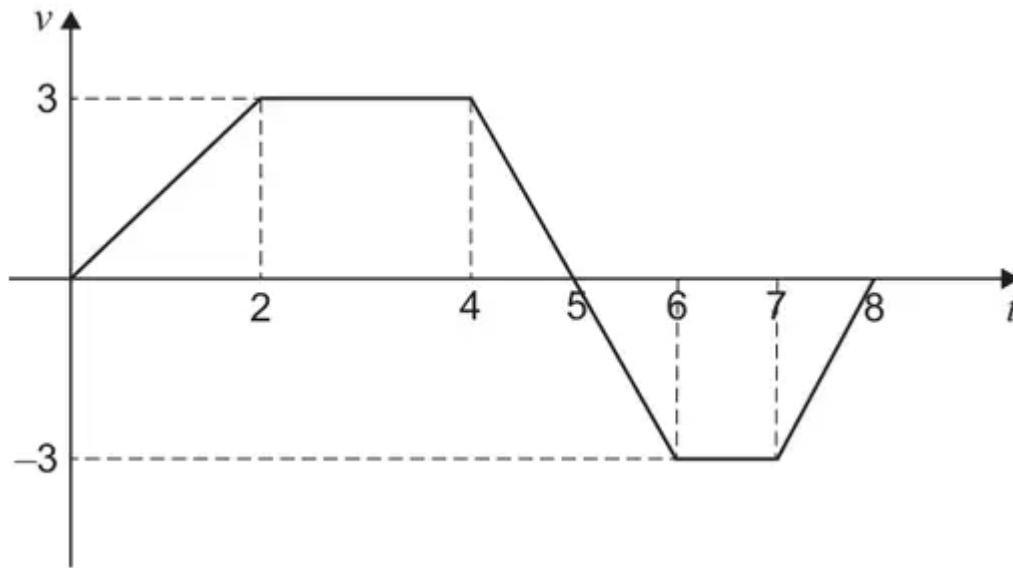


(a) Find the distance travelled by the particle in the first 15 s. **[2]**

(b) Calculate the velocity of the particle between $t = 10$ and $t = 15$. **[2]**

(Total 4 marks)

4. A graph indicating how the velocity, $v \text{ m s}^{-1}$, of a particle changes with respect to time, t seconds, is shown below.



(a) Find the total distance travelled by the particle over the 8 second period shown.

[3 marks]

(b) A student claims that

“The displacement of the particle is less than the distance travelled.”

State the range of values of t for which this claim is true.

[1 mark]

(Total 4 marks)

5.

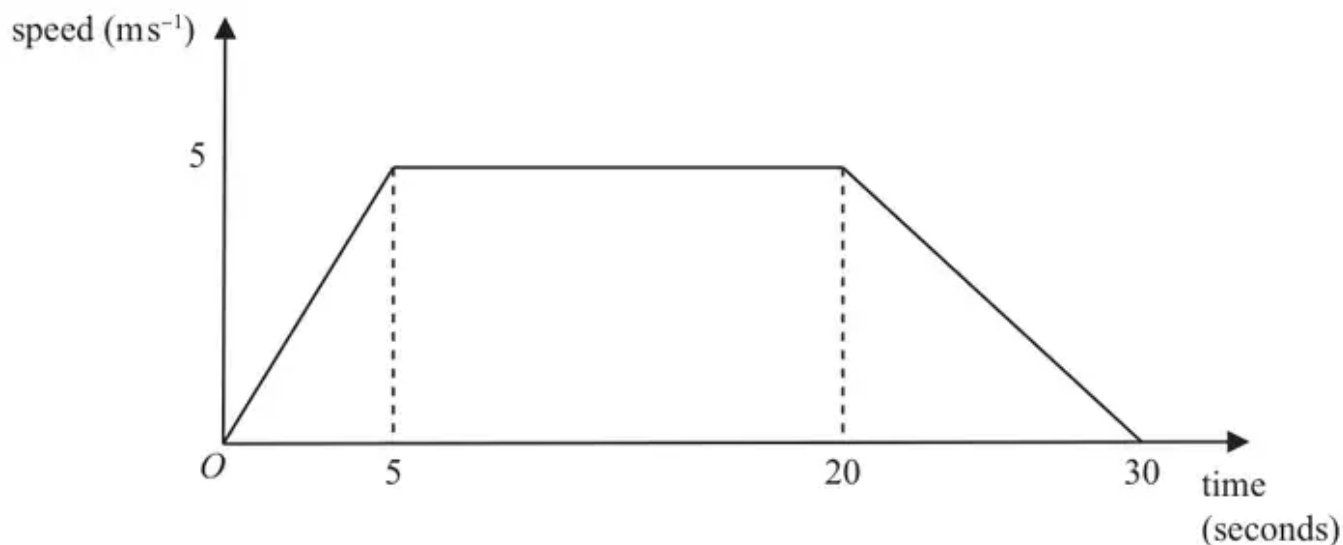


Figure 1

Figure 1 shows the speed-time graph for the journey of a car moving in a long queue of traffic on a straight horizontal road.

At time $t = 0$, the car is at rest at the point A .

The car then accelerates uniformly for 5 seconds until it reaches a speed of 5 m s^{-1}

For the next 15 seconds the car travels at a constant speed of 5 m s^{-1}

The car then decelerates uniformly until it comes to rest at the point B .

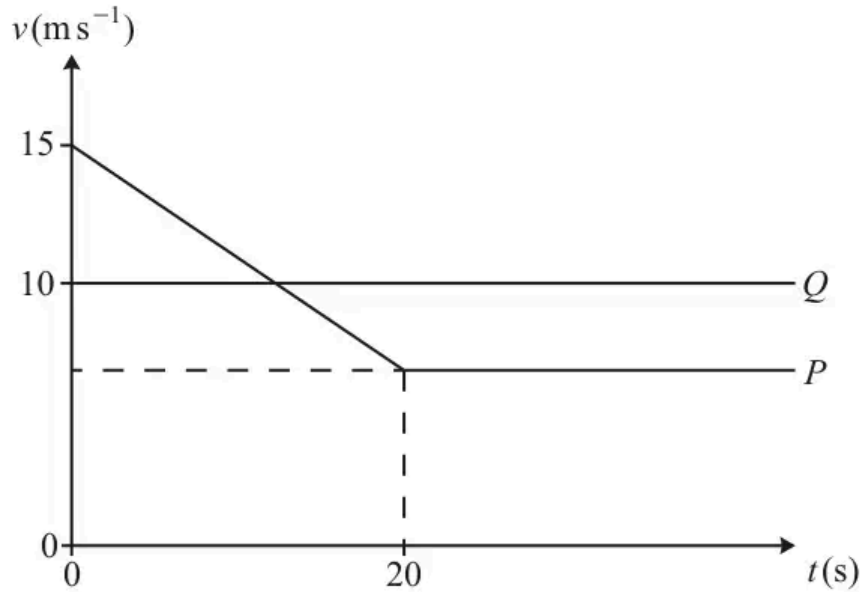
The total journey time is 30 seconds.

(a) Find the distance AB . (3)

(b) Sketch a distance-time graph for the journey of the car from A to B . (3)

(Total 6 marks)

6.



The velocity-time graph represents the motion of two cyclists P and Q who are travelling along a straight, horizontal road. At time $t = 0$, the cyclists pass the same point on the road with P cycling at 15 m s^{-1} and Q cycling at 10 m s^{-1} .

From time $t = 0$, P cycles with constant deceleration 0.4 m s^{-2} for 20 seconds and Q cycles at a constant velocity of 10 m s^{-1} . From $t = 20$ onwards, P 's velocity remains constant.

- (a) Find the value of t when P and Q have the same velocity. [2]
- (b) Determine the value of t when Q overtakes P . [4]

(Total 6 marks)