

Nov 17 (9702/21) Question 2

2 The variation with time t of the velocity v of two cars P and Q is shown in Fig. 2.1.

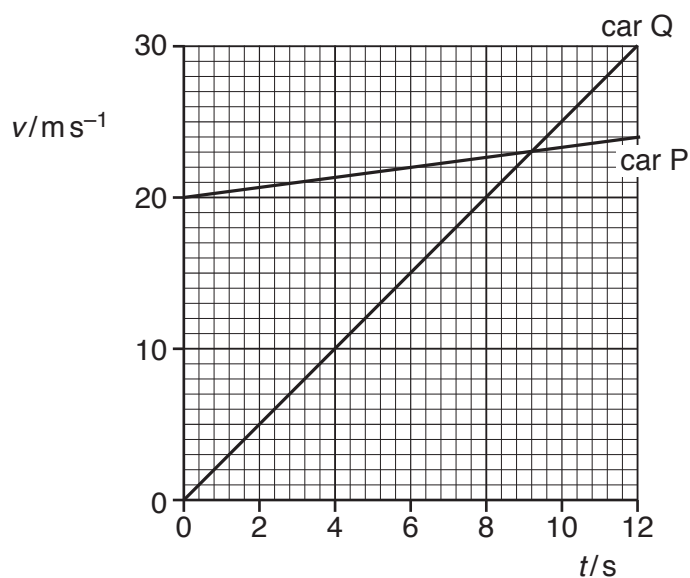


Fig. 2.1

The cars travel in the same direction along a straight road.
Car P passes car Q at time $t = 0$.

- (a) The speed limit for cars on the road is 100 km h^{-1} . State and explain whether car Q exceeds the speed limit.

.....[1]

- (b) Calculate the acceleration of car P.

acceleration = m s^{-2} [2]

- (c) Determine the distance between the two cars at time $t = 12\text{ s}$.

distance = m [3]

- (d) From time $t = 12\text{ s}$, the velocity of each car remains constant at its value at $t = 12\text{ s}$.

Determine the time t at which car Q passes car P.

$t =$ s [2]

[Total: 8]

Question	Answer	Marks
2(a)	$30 \text{ ms}^{-1} = 108 \text{ km h}^{-1}$ or $100 \text{ km h}^{-1} = 28 \text{ ms}^{-1}$ and so exceeds speed limit	B1
2(b)	acceleration = gradient or $\Delta v / (\Delta)t$ or $(v - u)/t$	C1
	e.g. acceleration = $(24 - 20) / 12$ [other points on graph line may be used] $= 0.33 \text{ ms}^{-2}$	A1
2(c)	distance travelled by Q = $\frac{1}{2} \times 12 \times 30$ (= 180 m)	C1
	distance travelled by P = $\frac{1}{2} \times (20 + 24) \times 12$ (= 264 m)	C1
	distance between cars = $264 - 180$ $= 84 \text{ m}$	A1
2(d)	$30 - 24 = 6 \text{ ms}^{-1}$ 'extra' time $T = 84/6$ (= 14 s) or $180 + 30T = 264 + 24T$ 'extra' time $T = 84/6$ (= 14 s)	C1
	$t = 12 + 14 = 26 \text{ s}$	A1