Uniform Accelerated Linear Motion

2011

1. The points P and Q lie on a straight level road.
A car passes P with a speed of 10 m s^{-1} and accelerates uniformly for 6 seconds to a speed of 22 m s^{-1}.
The car then decelerates uniformly to a speed of 18 m s^{-1} and travels 80 m during this deceleration.
The car now maintains a constant speed of 18 m s^{-1} for 3 seconds and then passes Q.

Find **(i)** the acceleration

(ii) the deceleration

(iii) $|PQ|$, the distance from P to Q

(iv) the average speed of the car, correct to one decimal place, as it moves from P to Q.

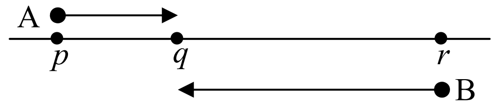
2010

1. A car travels along a straight level road.
It passes a point P at a speed of 12 ms^{-1} and accelerates uniformly for 6 seconds to a speed of 30 ms^{-1}.
It then travels at a constant speed of 30 ms^{-1} for 15 seconds.
Finally the car decelerates uniformly from 30 ms^{-1} to rest at a point Q.
The car travels 45 metres while decelerating.

Find **(i)** the acceleration
(ii) the deceleration
(iii) $|PQ|$, the distance from P to Q
(iv) the average speed of the car as it travels from P to Q.

2009

1. 3 points p, q and r lie on a straight level road.



Two cars, A and B, are moving towards each other on the road.

Car A passes p with speed 3 m/s and uniform acceleration of 2 m/s^2 and at the same instant car B passes r with speed 5 m/s and uniform acceleration of 4 m/s^2.

A and B pass each other at q seven seconds later.

Find **(i)** the speed of car A and the speed of car B at q.

(ii) $|pq|$ and $|rq|$, the distances A and B have moved in these 7 s.

Car A stops accelerating at q and continues on to r at uniform speed.

(iii) Find, correct to one place of decimals, the total time for car A to travel from p to r.

2008

1. Four points a, b, c and d lie on a straight level road.
A car, travelling with uniform retardation, passes point a with a speed of 30 m/s and passes point b with a speed of 20 m/s.
The distance from a to b is 100 m. The car comes to rest at d.

Find **(i)** the uniform retardation of the car

(ii) the time taken to travel from a to b

(iii) the distance from b to d

(iv) the speed of the car at c, where c is the midpoint of $[bd]$.

2007

1. A car travels from p to q along a straight level road.
It starts from rest at p and accelerates uniformly for 5 seconds to a speed of 15 m/s.
It then moves at a constant speed of 15 m/s for 20 seconds.
Finally the car decelerates uniformly from 15 m/s to rest at q in 3 seconds.

(i) Draw a speed-time graph of the motion of the car from p to q.
(ii) Find the uniform acceleration of the car.
(iii) Find the uniform deceleration of the car.
(iv) Find $|pq|$, the distance from p to q.
(v) Find the speed of the car when it is 13.5 metres from p.

2006

1. A car travels along a straight level road.
It passes a point p at a speed of 10 m/s and accelerates uniformly for 5 seconds to a speed of 30 m/s.
It then moves at a constant speed of 30 m/s for 9 seconds.
Finally the car decelerates uniformly from 30 m/s to rest at point q in 6 seconds.

Find **(i)** the acceleration

(ii) the deceleration

(iii) $|pq|$, the distance from p to q

(iv) the average speed of the car as it travels from p to q.

2005

1. A particle travels from p to q in a straight line. It starts from rest at p and accelerates uniformly to its maximum speed of 20 m/s in 10 seconds. The particle maintains this speed of 20 m/s for 15 seconds before decelerating uniformly to rest at q in a further 20 seconds.

(i) Draw a speed-time graph of the motion of the particle from p to q.
(ii) Find the uniform acceleration of the particle.
(iii) Find the uniform deceleration of the particle.
(iv) Find $|pq|$, the distance from p to q.
(v) Find the average speed of the particle as it moves from p to q, giving your answer in the form $\frac{a}{b}$, where $a, b \in \mathbf{N}$.

2004

1. Three points a, b and c, lie on a straight level road such that $|ab| = |bc| = 100$ m.
A car, travelling with uniform retardation, passes point a with a speed of 20 m/s and passes point b with a speed of 15 m/s.

(i) Find the uniform retardation of the car.
(ii) Find the time it takes the car to travel from a to b, giving your answer as a fraction.
(iii) Find the speed of the car as it passes c, giving your answer in the form $p\sqrt{q}$, where $p, q \in \mathbf{N}$.
(iv) How much further, after passing c, will the car travel before coming to rest? Give your answer to the nearest metre.

2003

1. A car travels from p to q on a straight level road. It passes p with a speed of 4 m/s and accelerates uniformly to its maximum speed of 8 m/s in 4 seconds. The car maintains this speed of 8 m/s for 6 seconds before decelerating uniformly to rest at q. The car takes 12 seconds to travel from p to q.

(i) Draw a speed-time graph of the motion of the car from p to q.
(ii) Find the uniform acceleration of the car.
(iii) Find the uniform deceleration of the car.
(iv) Find $|pq|$, the distance from p to q.

Another car travels the same distance from p to q in the same time of 12 seconds. This car starts from rest at p and accelerates uniformly to its maximum speed of v m/s and then immediately decelerates uniformly to rest at q.

(v) Find v, the maximum speed of this car, giving your answer as a fraction.

2002

1. A train stops at stations P and Q which are 2000 metres apart.
The train accelerates uniformly from rest at P, reaching a speed of 20 m/s in 10 seconds.
The train maintains this speed of 20 m/s before decelerating uniformly at 0.5 m/s^2 , coming to rest at Q.

(i) Find the acceleration of the train.

(ii) Find the time for which the train is decelerating.

(iii) Find the distance and the time for which the train is travelling at constant speed.

(iv) Draw an accurate speed-time graph of the motion of the train from P to Q.

2001

1. Two points, p and q, lie on a straight stretch of level road.
Car A passes the point p with a speed of 2 m/s travelling towards q and accelerating uniformly at 2 m/s^2.
As car A passes p, car B passes the point q with a speed of 1 m/s travelling towards p and accelerating uniformly at 3 m/s^2 .
The two cars meet after 10 seconds.

(i) Find the speed of each car when they meet.

(ii) Find the distance each car has travelled during this 10 seconds.

Suppose now that the speed of car A when passing point p is u m/s instead of 2 m/s, while the speed of car B passing point q and the acceleration of each car remain unchanged.
If the time taken for the two cars to meet in this case is 8 seconds, find the value of u.

1. A car is travelling on a straight stretch of level road [*pq*]. The car passes the point *p* with a speed of 5 m/s and accelerates uniformly to its maximum speed of 20 m/s in a time of 6 seconds. The car continues with this maximum speed for 30 seconds before decelerating uniformly to rest at *q* in a further 4 seconds.

Draw a speed-time graph of the motion of the car from *p* to *q*.

Hence, or otherwise, find

(i) the uniform acceleration of the car

(ii) the uniform deceleration of the car

(iii) | *pq* | , the distance from *p* to *q* .

Another car, with acceleration and deceleration the same as in **(i)** and **(ii)** above, starts from rest at *p* and accelerates uniformly to its maximum speed of 25 m/s. It continues with this maximum speed for a certain time and then decelerates uniformly to rest at *q* .
How long does it take this car to go from *p* to *q* ?

Answers

2011
(i) $a = 2$ m s^{-2}
(ii) $a = -4/3$ m s^{-2}
(iii) $|PQ| = 210$ m
(iv) Average speed = 17.5 m s^{-1}

2010
(v) $a = 3$ m s^{-2}
(vi) $a = -10$ m s^{-2}
(vii) $|PQ| = 621$ m
(viii) Average speed = 25.875 m s^{-1}

2009
(i) $V_A = 17$ m s^{-1}, $V_B = 33$ m s^{-1}
(ii) $S_A = 70$ m, $S_B = 133$ m
(iii) $t = 14.8$ s

2008
(i) Retardation = 2.5 m s^{-2}
(ii) $t = 4$ s
(iii) $s = 80$ m
(iv) $v = 14.1$ m s^{-1}

2007
(i)
(ii) $a = 3$ m s^{-2}
(iii) $a = -5$ m s^{-2}
(iv) $s = 360$ m
(v) $v = 9$ m s^{-1}

2006
(i) Acceleration = 4 m s^{-2}
(ii) Deceleration = 5 m s^{-2}
(iii) Distance = 460 m
(iv) Average speed = 23 m s^{-1}

2005

(i)

(ii) $a = 2\ m\ s^{-2}$

(iii) Deceleration = $1\ m\ s^{-2}$

(iv) $s = 600\ m$

(v) average speed = $40/3\ m\ s^{-1}$

2004

(i) Retardation = $- 0.875\ m\ s^{-2}$

(ii) $t = 40/7\ s$

(iii) $v = 5\sqrt{2}\ m\ s^{-1}$

(iv) $s = 29\ m$

2003

(i)

(ii) $a = 1\ m\ s^{-2}$

(iii) $a = -4\ m\ s^{-2}$

(iv) $s = 80\ m$

(v) $v = 40/3\ m\ s^{-1}$

2002

(i) $a = 2\ m\ s^{-2}$

(ii) $t = 40\ s$

(iii) $t = 75s$

2001

(i) $V_A = 22\ m\ s^{-1}$

$V_B = 31\ m\ s^{-1}$

(ii) $S_A = 120\ m$

$S_B = 160\ m$

(iii) $u = 14\ m\ s^{-1}$

2000

(i)

(ii) Acceleration = $2.5\ m\ s^{-2}$

(iii) Deceleration = $5\ m\ s^{-2}$

(iv) Distance = 715 m

(v) time = 36.1 s