Worksheet: Kinematic Equations

Q1: A particle is moving in a straight line such that its acceleration $a = -3$ m/s^2 and its initial velocity is 39 m/s. Find its displacement during the time interval from $t = 1$ to $t = 9$ seconds.

Question Video

A 270 m

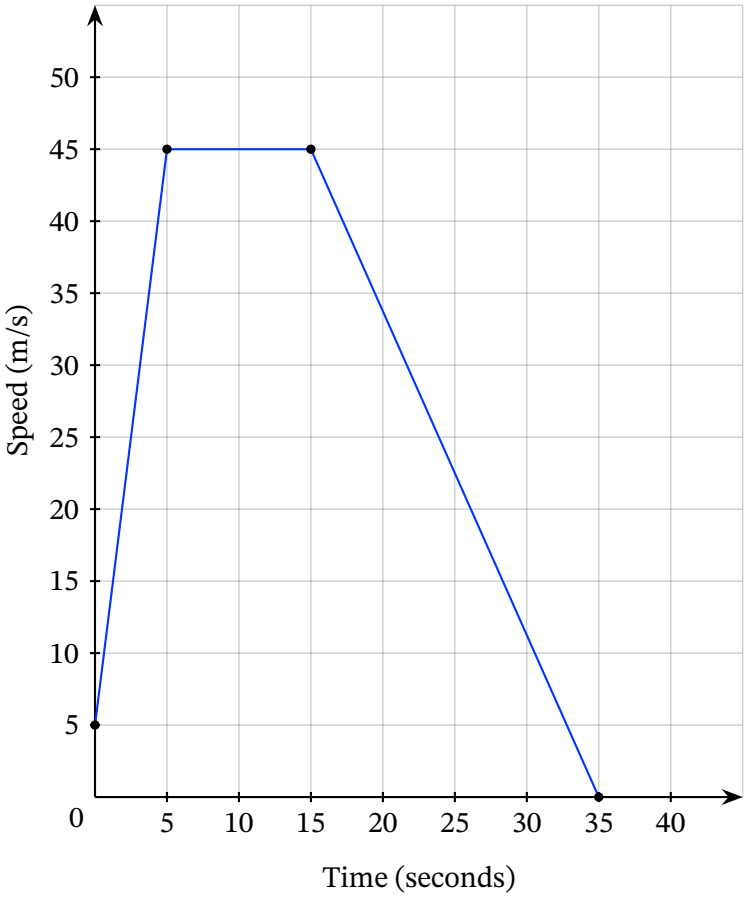
B 192 m

C 72 m

D 67.5 m

Q2: The figure shown is a speed-time graph for a body moving in a straight line. Given that its initial speed was 5 m/s, determine the body's acceleration during the part of the journey where the body was accelerating.

Question Video



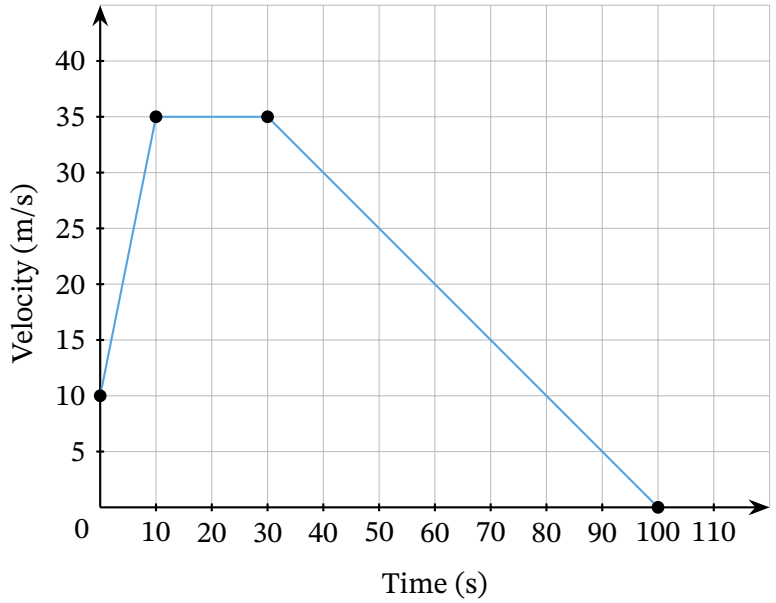
A $8\ \text{m/s}^2$

B $4.5\ \text{m/s}^2$

C $3\ \text{m/s}^2$

D $2.25\ \text{m/s}^2$

Q3: The figure shown is a velocity-time graph for a body moving in a straight line with an initial velocity of 10 m/s. Determine the total distance covered by the body, given that it came to rest 100 seconds after it started moving.



A 1,450 m

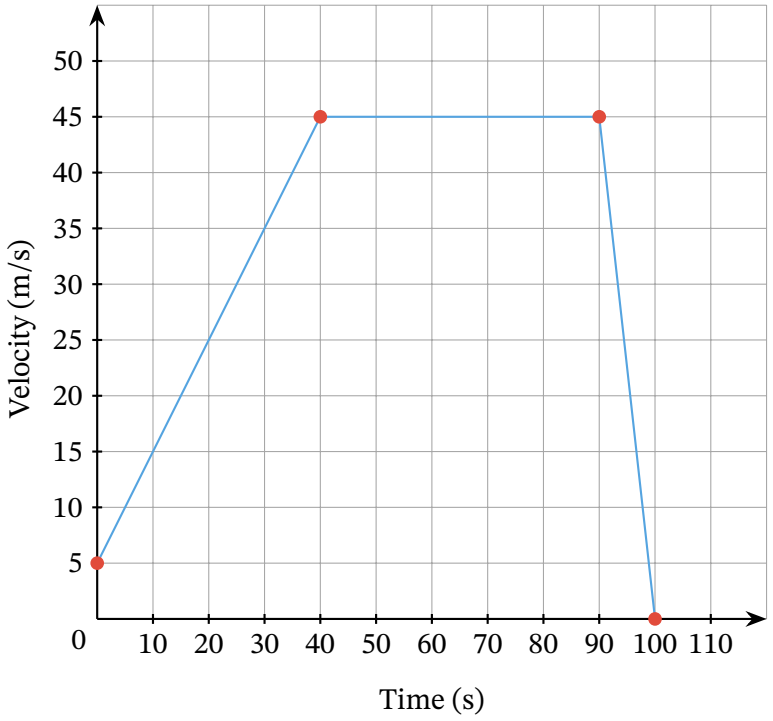
B 2,150 m

C 4,600 m

D 300 m

E 1,050 m

Q4: The figure shown is a velocity-time graph for a body moving in a straight line. Determine the deceleration of the body during the final section of its movement, given that it came to rest 100 seconds after it started moving.



A $0.9\ m/s^2$

B $1\ m/s^2$

C $0.5\ m/s^2$

D $4.5\ m/s^2$

E $0.45\ m/s^2$

Q5: A particle moves along the x-axis in the direction of x increasing. It starts at $x = 37$ cm with an initial velocity of 47 cm/s and moves with uniform acceleration of 51 cm/s^2 in the same direction as its motion. Determine its velocity and its displacement from the origin after 6 seconds.

A $\mathbf{v} = 200$ cm/s, $\mathbf{s} = 965$ cm

B $\mathbf{v} = 353$ cm/s, $\mathbf{s} = 1{,}200$ cm

C $\mathbf{v} = 200$ cm/s, $\mathbf{s} = 778$ cm

D $\mathbf{v} = 353$ cm/s, $\mathbf{s} = 1{,}237$ cm

E $\mathbf{v} = 200$ cm/s, $\mathbf{s} = 1{,}163$ cm

Q6: A particle was observed moving in a straight line. Its velocity was measured 7 seconds after it was first observed and was found to be 188 cm/s. It was measured again 22 seconds after the initial observation and was found to be 86 cm/s. Assuming that its acceleration was constant, find its initial velocity.

A 60.13 cm/s

B 121.86 cm/s

C 235.6 cm/s

D 337.6 cm/s

Q7: A particle, accelerating uniformly at 50 cm/s^2, was moving in a straight line. If its initial velocity was 45 km/h in the same direction as the acceleration, find the time required for it to cover 54 m.

A 9 s

B 2 s

C 8 s

D 4 s

Q8: A particle started moving in a straight line at 7 m/s. Given that its acceleration was of magnitude 2 cm/s^2 in the opposite direction to its movement, find the time taken for the particle to come to rest.

A 700 s

B 1,050 s

C 350 s

D 175 s

Q9: A particle was moving in a straight line at 172.8 km/h. If it decelerated over 120 m to come to rest, find the deceleration a of the particle and the time t taken to cover this distance.

A $a = 19.2\ \text{m/s}^2, t = 1.25\ \text{s}$

B $a = 9.6\ \text{m/s}^2, t = 5\ \text{s}$

C $a = 9.6\ \text{m/s}^2, t = 2.5\ \text{s}$

D $a = 19.2\ \text{m/s}^2, t = 2.5\ \text{s}$

Q10: Determine the time required for a particle to increase its velocity from 7 m/s to 18 m/s over a distance of 269 m, given that it is moving in a straight line with a uniform acceleration.

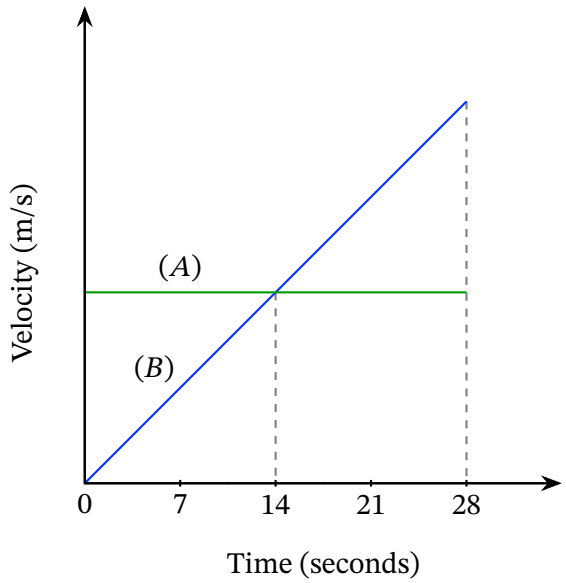
A 21.52 s

B 12.67 s

C 17.09 s

D 19.53 s

Q11: The figure shown is a velocity-time graph for two cars moving in a straight line. The movement of car A is represented by the green line, and the movement of car B by the blue line. Determine how long it took for the two cars to meet again, given that they started from the same point.



A 14 s

B 7 s

C 21 s

D 28 s

Q12: A particle, moving in a straight line, was accelerating at a rate of 22 cm/s^2 in the same direction as its initial velocity. If the magnitude of its displacement 10 seconds after it started moving was 29 m, calculate the magnitude of its initial velocity v_0 and its velocity v at the end of this period.

A $v_0 = 1.8$ m/s, $v = 4$ m/s

B $v_0 = 7.3$ m/s, $v = 9.5$ m/s

C $v_0 = 2.35$ m/s, $v = 4.55$ m/s

D $v_0 = 4$ m/s, $v = 6.2$ m/s

Q13: A particle started accelerating from rest at 40 cm/s^2. When its velocity reached 11 m/s, it started decelerating at a rate of 40 cm/s^2 until it came to rest. Find the total time t during which the particle was moving and the distance d it covered.

A $t = 55$ s, $d = 302.5$ m

B $t = 55$ s, $d = 605$ m

C $t = 27.5$ s, $d = 1{,}210$ m

D $t = 110$ s, $d = 605$ m

Q14: A body, moving in a straight line with a uniform acceleration of 2 m/s^2, covered 136 m before it stopped accelerating. It continued to move at the velocity it had acquired for a further 27 seconds. Given that the total distance covered by the body was 1,162 m, find its initial velocity.

A 34.23 m/s

B 41.42 m/s

C 30 m/s

D 44.59 m/s

Q15: A particle was decelerating in a straight line at a rate of 4 cm/s^2. If it momentarily came to rest 10 seconds after it started moving, find the distance it covered in 18 seconds.

A 72 cm

B 200 cm

C 328 cm

D 648 cm

Q16: A small ball was projected horizontally in the opposite direction of the wind at 42.9 cm/s to move in a straight line with a retardation of 7.5 cm/s^2. Find the time taken for the ball to return back to the point of projection.

A 5.72 s

B 11.44 s

C 2.86 s

D 17.16 s

Q17: A particle was moving with a constant acceleration a such that it covered 750 cm in 12 seconds. When its acceleration was increased to $2a$, it covered a further 500 cm in 4 seconds. After that, it started decelerating at a rate of $3a$ until it came to rest. Find the value of a and the total distance covered by the particle x.

A $a = 7.81\ \text{cm/s}^2$, $x = 1{,}100$ cm

B $a = 15.62\ \text{cm/s}^2$, $x = 1{,}850$ cm

C $a = 15.62\ \text{cm/s}^2$, $x = 1{,}100$ cm

D $a = 6.25\ \text{cm/s}^2$, $x = 1{,}850$ cm

Q18: A particle, starting from rest, began moving in a straight line. It covered a distance of 125 m while accelerating uniformly at a rate of 10 $\mathrm{m/s^2}$. Then, maintaining the velocity that it had gained, it covered a distance of 479 m. Finally, it decelerated uniformly at a rate of 5 $\mathrm{m/s^2}$ until it came to rest. How long was the particle moving for?

A 24.58 s

B 10.61 s

C 37.7 s

D 29.79 s

Q19: A body started moving in a straight line from rest. Accelerating uniformly, it covered 450 m until its speed became 50 m/s. Continuing at this velocity, it covered a further 500 m. Finally, it decelerated uniformly over 200 m until it came to rest. Find the acceleration a of the body over its final 200 m and the time t taken to cover the whole distance.

A $a = -12.5\ \mathrm{m/s^2}$, $t = 26.1$ s

B $a = -6.25\ \mathrm{m/s^2}$, $t = 36$ s

C $a = -0.25\ \mathrm{m/s^2}$, $t = 32$ s

D $a = -25\ \mathrm{m/s^2}$, $t = 27$ s

Q20: If a particle which was moving in a straight line with an initial velocity v_0 started decelerating at a rate of 10 m/s^2 such that it came to rest 5 seconds later, what would the body's velocity be 6 seconds after it started decelerating? Let the direction of the initial velocity be the positive direction.

A -60 m/s

B -10 m/s

C 10 m/s

D 50 m/s

Q21: Given that a particle started moving from rest with a constant acceleration of 3.5 m/s^2 until its velocity became 378 km/h, find the distance it covered.

A 1,050 m

B 6,300 m

C 3,150 m

D 1,575 m

Q22: A particle started moving in a straight line from rest with a uniform acceleration of 5.4 m/s^2. Determine its velocity after 2 seconds from when it started moving.

A 2.7 m/s

B 10.8 m/s

C 0.37 m/s

Q23: A car was moving in a straight line at 45 km/h. Given that the velocity decreased at a constant rate until the car came to rest 10 seconds after the driver hit the brakes, calculate the deceleration of the car.

A $1.25\ m/s^2$

B $0.62\ m/s^2$

C $4\ m/s^2$

D $2.25\ m/s^2$

Q24: A particle started moving from rest in a straight line with a uniform acceleration of $15.3\ cm/s^2$. If, whilst accelerating, it covered a distance of 7 cm, determine its velocity after it travelled this distance.

A 15 cm/s

B 214 cm/s

C 7 cm/s

D 10 cm/s

Q25: A car that was moving in a straight line started slowing down. Its velocity decreased uniformly from 92 km/h to 52 km/h over 20 seconds. Given that it maintained a constant rate of deceleration, how much farther would the car travel before it came to rest?

A 3.72 s

B 46 s

C 26 s

D 20 s