PHYSICS

BOOKS - DISHA PUBLICATION PHYSICS (HINGLISH)

MOTION IN A STRAIGHT LINE

Jee Main

1. An automobile travellingat $40 km / h$, can be stopped at distance of 40 m by applying

brakes. If the same autombile is travelling at $80km/h$, the minimum stopping distance, in metres is (assume no skidding) :

A. 75m

B. 160m

C. 100m

D. 150m

Answer: B

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2. All the graphs below are intended to represent the same motion. One of them does it incorrectly. Pick it up.

A. 

B. 

C. 

D. 

Answer: B

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3. A car is standing 200m behind a bus , which is also at rest . The two. Start moving at the same instant but with different forward accelerations. The bus has acceleration $2ms^{-2}$ and The car has acceleration $4ms^{-2}$ The car will catch up will the bus after time :

A. $\sqrt{100}s$

B. $\sqrt{120}s$

C. $10\sqrt{2}s$

D. 15s

Answer: C

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4. A body is thrown vertically upwards. Which one of the following graphs correctly represent the velocity vs time?

A. 

B. 

C. 

D. 

Answer: A

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5. Two stones are through up simultaneously from the edge of a cliff 240 m high with initial speed of 10 m/s and 40 m/s respectively. Which of the following graphs best represents the time variation of relative position of the second stone with respect to the first? Assume stones do not rebound after hitting the ground and neglect air resistance, take .

$g = 10m/s^2$ (The figures are schematic and not drawn to scale)

A. 

B. 

C. 

D. 

Answer: B

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6. A person climbs up a stalled escalator in 60s. If standing on the same but escalator running with constant velocity, he takes 40 s. How much time is taken by the person to walk up the moving escalator?

A. 37s

B. 27s

C. 24s

D. 45s

Answer: C

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7. From a tower of height H, a particle is thrown vertically upwards with a speed u. The time taken by the particle, to hit the ground, is n times that taken by it to reach the highest point of its path. The relation between H, u and n is

A. $2gH = n^2u^2$

B. $gH = (n-2)^2u^2d$

C. $2gH = \nu^2(n-2)$

D. $gH = (n-2)u^2$

Answer: C

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Exercise 1

1. The location of a particle is changed. What can we say about the displacement and distance covered by the particle?

A. Neither can be zero

B. one may be zero

C. Both may be zero

D. One is +ve, other is -ve

Answer: A

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2. The displacement-time graph for two particles A and B are straight lines inclined at

angles of 30° and 60° with the time axis. The ratio of velocities of $V_A : V_B$ is

A. $1/2$

B. $1/\sqrt{3}$

C. $\sqrt{3}$

D. $1/3$

Answer: D

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3. A body moves in a straight line along Y-axis. Its distance y in metre) from the origin is given $y = 8t - 3t^2$. The average speed in the time interval from $t = 0$ second to $t = 1$ second is

A. $-4ms^{-1}$

B. zero

C. $5ms^{-1}$

D. $6ms^{-1}$

Answer: C

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4. For the velocity -time graph shown in the figure below the distance covered by the body in the last two seconds of its motion is what fracting of the total distance travelled by it in all the seven seconds?

A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. $\frac{2}{3}$

D. $\frac{1}{3}$

Answer: B

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5. A car travels from A to B at a speed of $20km/hr$ and returns at a speed of $30km/hr$. The average speed of the car for the whole journey is

A. $5kmh^{-1}$

B. $24kmh^{-1}$

C. $25kmh^{-1}$

D. $50kmh^{-1}$

Answer: B

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6. A man leaves his house for a cycle ride. He comes back to his house after half-an-hour after covering a distance of one km. What is his average velocity for the ride?

A. zero

B. $2kmh^{-1}$

C. $10kms^{-1}$

D. $\frac{1}{2}kmh^{-1}$

Answer: A

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7. The displacement x of a body varies with time t as $x = -\frac{2}{3}t^2 + 16t + 2$. The body will come to rest after :

A. 8s

B. 10s

C. 12s

D. 16s

Answer: C

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8. The coordinates of a moving particle at time t are given by $x = ct^2$ and $y = bt^2$. The speed of the particle is given by :-

A. 2t (c +b)

B. $2t\sqrt{(c^2 - b^2)}$

C. $t\sqrt{(c^2 + b^2)}$

D. $2t\sqrt{(c^2 + b^2)}$

Answer: D

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9. Two particles A and B are connected by a rigid rod AB. The rod slides along perpendicular rails as shown here. The velocity

of A to the left is 10 m/s. What is the velocity of B when angle $\alpha = 60^\circ$?

A. 9.8m/s

B. 10m/s

C. 5.8m/s

D. 17.3m/s

Answer: D

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10. A bird files with a speed of 10 km/h and a car moves with uniforms speed of 8 km/h .both start from B towrd A (BA=40km) at the same insatnt . The bird having reached A files back immediately to meet the apporaching car. As shown as it reach the car If fiels back to A. The birds repeats this till both the car and the car and the bird reach A simultaneously .The total distancecovered by the bird is 15ψ km. Find the value of ψ

A. 80km

B. 40km

C. 50km

D. 30km

Answer: C

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11. The velocity of a particle is $v = v_0 + gt + ft^2$. If its position is $x = 0$ at $t = 0$, then its displacement after unit time $(t = 1)$ is

A. $v_0 + g/2 + f$

B. $v_0 + 2g + 3f$

C. $v_0 + g/2 + f/3$

D. $v_0 + g + f$

Answer: C

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12. A particle located at $x = 0$ at time $t = 0$, starts moving along with the positive $x - direction$ with a velocity 'v' that varies as

$v = a\sqrt{x}$. The displacement of the particle varies with time as

A. t^2

B. t

C. $t^{1/2}$

D. t^3

Answer: A

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13. The co-ordinates of a moving particle at anytime 't' are given by $x = \alpha t^3$ and $y = \beta t^3$. The speed of the particle at time 't' is given by

A. $3t\sqrt{\alpha^2 + \beta^2}$

B. $3t^2\sqrt{\alpha^2 + \beta^2}$

C. $t^2\sqrt{\alpha^2 + \beta^2}$

D. $\sqrt{\alpha^2 + \beta^2}$

Answer: B

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14. The displacement 'x' (in meter) of a particle of mass 'm' (in kg) moving in one dimension under the action of a force is released to time 't' (in sec) by $t = \sqrt{x} + 3$. The displacement of the particle when its velocity is zero will be.

A. 2m

B. 4m

C. zero

D. 6m

Answer: C

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15. A particle shows distance-time curve as given in this figure. The maximum instantaneous velocity of the particle is around the point

A. B

B. C

C. D

D. A

Answer: B

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16. Which of the following decreases in motion along a straight line with constant retardation while the body is moving away from the origin?

A. Speed

B. Acceleration

C. Displacement

D. None of these

Answer: A

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17. A bullet fired into a wooden block loses half of its velocity after penetrating 60cm. It comes to rest after penetrating a further distance of

A. 22cm

B. 20cm

C. 24cm

D. 26cm

Answer: B

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18. It is given that $t = px^2 + qx$, where x is displacement and t is time. The acceleration of particle at origin is

A. $-\frac{2p}{q^3}$

B. $-\frac{2q}{p^3}$

C. $\frac{2p}{q^3}$

D. $\frac{2q}{p^3}$

Answer: A

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19. A particle is moving with uniform acceleration along a straight line. The average velocity of the particle from P to Q is $8ms^{-1}$

and that Q to S is $12ms^{-1}$. If QS= PQ, then the average velocity from P to S is

A. $9.6ms^{-1}$

B. $12.87ms^{-1}$

C. $64ms^{-1}$

D. $327ms^{-1}$

Answer: A

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20. The velocity of a particle at an instant is 10m/s. After 5sec, the velocity of the particle is 20m/s. Find the velocity at 3 seconds before from the instant when velocity of a particle is 10m/s.

A. 8m/s

B. 4m/s

C. 6m/s

D. 7m/s

Answer: B

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21. A particle experiences a constant acceleration for 20 sec after starting from rest. If it travels distance S_1 in the first 10 sec and a distance S_2 in the next 10 sec, Then

A. $s_2 = s_1$

B. $s_2 = 2s_1$

C. $s_2 = 3s_1$

D. $s_2 = 4s_1$

Answer: C

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22. A body starts from rest from the origin with an acceleration of $6m/s^2$ along x axis and $8m/s^2$ along y axis.The distance from origin after 4 seconds will be

A. 56m

B. 64m

C. 80m

D. 128m

Answer: C

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23. The distance travelled by a particle starting from rest and moving with an acceleration $\frac{4}{3}ms^{-2}$, in the third second is.

A. 6m

B. 4m

C. $\frac{10}{3}m$

D. $\frac{19}{3}m$

Answer: C

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24. The displacement x of a particle along a straight line at time t is given by : $x = a_0 + \frac{a_1 t}{2} + \frac{a_2}{3}t^2$. The acceleration of the particle is

A. $\frac{a_2}{3}$

B. $\frac{2a_2}{3}$

C. $\frac{a_1}{2}$

D. $a_0 + \frac{a_2}{3}$

Answer: B

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25. An automobile travelling with a speed $60km/h$, can brake to stop within a distance

of $20m$. If the car is going twice as fast i. e. , $120km/h$, the stopping distance will be

A. 60m

B. 40m

C. 20m

D. 80m

Answer: D

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26. A body travels 2m in the first two second and 2.20m in the next 4 second with uniform deceleration. The velocity of the body at the end of 9 second is

A. $-10ms^{-1}$

B. $-0.20ms^{-1}$

C. $-0.40ms^{-1}$

D. $-0.80ms^{-1}$

Answer: B

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27. A particle accelerates from rest at a constant rate for some time and attains a velocity of 8 m/sec. Afterwards it decelerates with the constant rate and comes to rest. If the total time taken is 4 sec, the distance travelled is

A. 32m

B. 16m

C. 4m

D. 14m

Answer: B

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28. A bus starts moving with acceleration $2ms^{-2}$. A cyclist $96m$ behind the bus starts simultaneously towards the bus at a constant speed of $20m/s$. After what time will he be able to overtake the bus ?

A. 4sec

B. 8sec

C. 18sec

D. 16sec

Answer: B

29. metro train starts from rest and in five seconds achieves a speed 108 km/h. After that it moves with constant velocity and comes to rest after travelling 45m with uniform

retardation. If total distance travelled is 395 m, find total time of travelling.

A. 12.2s

B. 15.3s

C. 9s

D. 17.2s

Answer: D

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30. A particle starting with certain initial velocity and uniform acceleration covers a distance of 12m in first 3 seconds and a distance of 30m in next 3 seconds. The initital velocity of the particle is

A. $3ms^{-1}$

B. $2.5ms^{-1}$

C. $2ms^{-1}$

D. $1ms^{-1}$

Answer: D

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31. A particle travels 10m in first 5 sec and 10 m in next 3 sec. Assuming constant acceleration what is the distance travelled in next 2 sec.

A. 8.3 m

B. 9.3m

C. 10.3m

D. 5.6m

Answer: A

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32. An NCC parade is going at a uniform speed of 6 km/h thorugh a place under a berry tree on which a bird is sitting at a height of 12.1 m. At a particular instant the bird drops a berry. Which cadet (gie the distance from the tree at tehinstant) will receive the berry on his uniform?

A. 3.62m

B. 4.12m

C. 2.62m

D. 5.32m

Answer: C

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33. A particle starts from rest and travel a distance x with uniform acceleration, then moves uniformly a distance 2x and finally comes to rest after moving further 5x with

uniform retardation. The ratio of maximum speed to average speed is

A. $\frac{5}{2}$

B. $\frac{5}{3}$

C. $\frac{7}{4}$

D. $\frac{7}{5}$

Answer: C

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34. A particle is moving in a straight line with initial velocity u and uniform acceleration f. If the sum of the distances travelled in t^{th} and $(t+1)^{th}$ seconds is $100cm$, then its velocity after t seconds, in cm/s, is.

A. 80

B. 50

C. 20

D. 30

Answer: B

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35. A car is moving along a straight road with a uniform acceleration. It passes through two points P and Q separated by a distance with velocity $30km/h$ and $40km/h$ respectively. The velocity of the car midway between P and Q is

A. 33.3km /h

B. $20\sqrt{2}km/h$

C. $25\sqrt{2}km/h$

D. 35km/h

Answer: C

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36. A particle starts moving rectilinearly at time $t = 0$ such that its velocity v changes with time t according to the equation $v = t^2 - t$, where t is in seconds and v in ms^{-1}. Find the time interval for which the particle retards.

A. $\frac{1}{2} < t < 1$

B. $\frac{1}{2} > t > 1$

C. $\frac{1}{4} < t < 1$

D. $\frac{1}{2} < t < \frac{3}{4}$

Answer: A

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37. A car , moving with a speed of $50km/hr$, can be stopped by brakes after at least $6m$. If

the same car is moving at a speed of $100km/hr$, the minimum stopping distance is

A. 12m

B. 18m

C. 24m

D. 6m

Answer: C

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38. A particle moves along a staight line such that its displacement at any time t is given by $s = t^3 - 6t^2 + 3t + 4m$. Find the velocity when the acceleration is 0.

A. $3ms^{-1}$

B. $-12ms^{-1}$

C. $42ms^{-1}$

D. $-9ms^{-1}$

Answer: D

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39. A particle moves along a straight line OX. At a time t (in seconds) the distance x (in metre) of the particle is given by $x = 40 + 12t - t^3$. How long would the particle travel before coming to rest ?

A. 40m

B. 56m

C. 16m

D. 24m

Answer: B

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40. A body is thrown upward and reaches its maximum height. At that position-

A. its acceleration is minimum

B. its velocity is zero and its acceleration is also zero

C. its velocity is zero but its acceleration is maximum

D. its velocity is zero and its acceleration is the acceleration due to gravity.

Answer: D

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41. A man throws balls with the same speed vertically upwards one after the other at an interval of 2s. What should be the speed of the

throw so that more than two balls are in the sky at any time ? (Given $g = 9.8m / s^2$)

A. only with speed 19.6m/s

B. more than 19.6m/s

C. at least 9.8m/s

D. any speed less than 19.6m/s

Answer: B

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42. Two bodies of different masses m_a and m_b are dropped from two different heights a and b. The ratio of the time taken by the two to cover these distances are

A. $a : b$

B. $b : a$

C. $\sqrt{a} : \sqrt{b}$

D. $a^2 : b^2$

Answer: C

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43. A ball is dropped it on a floor and bounces back to a height somewhat less then the original height. The curve which its motion correctly about y and t is

A. 

B. 

C. 

D. 

Answer: B

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44. A stone is dropped from a rising balloon at a height of 76 m above the ground and reaches the ground in 6s. What was the velocity of the balloon when the stone was dropped?

A. $\left(\frac{52}{3}\right)$ m/s upward

B. $\left(\frac{52}{3}\right)$ m/s downward

C. 3m/s

D. 9.8m/s

Answer: A

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45. A boy standing at the top of a tower of 20m of height drops a stone. Assuming $g = 10ms^{-2}$, the velocity with which it hits the ground is :-

A. 10.0m/s

B. 20.0m/s

C. 40.0m/s

D. 5.0m/s

Answer: B

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46. Find the ratio of the distance moved by a free-falling body from rest in fourth and fifth seconds of its journey.

A. $4:5$

B. $7:9$

C. $16:25$

D. $1:1$

Answer: B

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47. A ball dropped from a point A falls down vertically to C, through the midpoint B. The

descending time from A to B and that from A to C are in the ratio

A. $1:1$

B. $1:2$

C. $1:3$

D. $1:\sqrt{2}$

Answer: D

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48. A body dropped from top of a tower falls through $40m$ during the last two seconds of its fall. The height of tower in m is (g= 10 m//s^@)`

A. 60m

B. 45m

C. 80m

D. 50m

Answer: B

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49. A ball is dropped downwards. After 1 second another ball is dropped downwards from the same point. What is the distance between them after 3 seconds

A. 25m

B. 20m

C. 50m

D. 9.8m

Answer: A

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50. A stone thrown vertically upwards with a speed of 5 m/sec attains a height H_1. Another stone thrown upwards from the same point with a speed of 10m/sec attains a height H_2. The correct relation between H_1 and H_2 is

A. $H_2 = 4H_1$

B. $H_2 = 3H_1$

C. $H_1 = 2H_2$

D. $H_1 = H_2$

Answer: A

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51. A ball is thrown vertically upwards with a speed of $10m/s$ from the top of a tower 200 m height and another is thrown vertically downwards with the same speed simultaneously. The time difference between

them on reaching the ground is $(g = 10m/s^2)$

A. 12s

B. 6s

C. 2s

D. 1s

Answer: C

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52. Two stones are thrown from the top of a tower, one straight down with an initial speed u and the second straight up with the same speed u. When the two stones hit the ground they will have speeds in the ratio.

A. $2:3$

B. $2:1$

C. $1:2$

D. $1:1$

Answer: D

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53. Water drops fall at regular intervals from a tap 5 m above the ground. The third drop is leaving the tap, the instant the first drop touches the ground. How far above the ground is the second drop at that instant. $(g = 10ms^{-2})$

A. 1.25m

B. 2.50m

C. 3.75m

D. 5.00m

Answer: C

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54. A stone is dropped from the top of a tower 200 m high. At the same time, another stone is projected vertically upwards from the ground with a velocity of $40m/s$. Calcuate when and where the two stones will mest.

A. 68.4m

B. 48.4m

C. 18.4m

D. 78.4m

Answer: D

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55. A stone falls freely from rest from aheight h and it travels a distance $9h/25$ in the last second. The value of h is

A. 145m

B. 100m

C. 122.5m

D. 200m

Answer: C

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56. A body A is thrown vertically upwards with initial velocity v_1. Another body B is dropped from a height h. Find how the distance x

between the bodies depends on the time t if the bodies begin to move simultaneously.

A. $x = h - v_1 t$

B. $x = (h - v_1)t$

C. $x = h - \frac{v_1}{t}$

D. $x = \frac{h}{t} - v_1$

Answer: A

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57. A juggler keeps on moving four balls in the air throwing the balls after regular intervals. When one ball leaves his hand $\left(\text{speed} = 20ms^{-1}\right)$ the positions of other balls (height in m) $\left(\text{Take} g = 10ms^{-2}\right)$.

A. 10,20,10

B. 15,20,15

C. 5,15,20

D. 5,10,20

Answer: B

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58. Similar balls are thrown vertically each with a velocity $20ms^{-1}$, one on the surface of earth and the other on the surface of moon. What will be ratio of the maximum heights attained by them? (Acceleration on moon $= 1.7ms^{-2}$ approx)

A. 6

B. $\frac{1}{6}$

C. $\frac{1}{5}$

D. 4

Answer: B

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59. Two trains are each 50 m long moving parallel towards each other at speeds $10ms^{-1}$ and $15ms^{-1}$ respectively, at what time will they pass each other ?

A. $5\sqrt{\frac{2}{3}}$sec

B. 4 sec

C. 2 sec

D. 6sec

Answer: B

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60. A train of $150m$ length is going toward north direction at a speed of $10ms^{-1}$. A parrot flies at a speed of $5ms^{-1}$ toward south direction parallel to the railway track. The time

taken by the parrot to cross the train is equal to.

A. 12s

B. 8 s

C. 15s

D. 10s

Answer: D

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61. An object has velocity $\overrightarrow{v}_1$ w.r.t. ground. An observer moving with constant velocity $\overrightarrow{v}_0$ w.r.t. ground measures the velocity of the object as $\overrightarrow{v}_2$. The magnitudes of three velocities are related by

A. $v_0 \leq v_1 + v_2$

B. $v_1 \leq v_2 + v_0$

C. $v_2 \leq v_0 + v_1$

D. All of the above

Answer: D

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62. A boat takes two hours to travel 8 km and back in still water. If the velocity of water is 4 km/h, the time taken for going upstream 8 km and coming back is

A. 160 minutes

B. 80 minutes

C. 100 minutes

D. 120 minutes

Answer: A

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63. Which one of the following represents displacement-time graph of two objects A and B moving with zero relative velocity?

A. 

B. 

C. 

D. 

Answer: B

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64. A car is standing 800 m behind a bus, which is also at rest. The two start moving at the same instant but the different forward accelerations. The bus has acceleration $4m/s^2$ and the car has acceleration $8m/s^2$. The car will catch up with the bus after a time of:

A. 20s

B. 10s

C. 5s

D. 15s

Answer: A

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65. A thief running away on a straight road on a jeep moving with a speed of 9m/s. A police man chases him on a motor cycle moving at a speed of 10m/s. If the instantaneous

separation of jeep from the motor cycle is 100m, how long will it take for the policemen to catch the thief?

A. 1 second

B. 19 second

C. 90 second

D. 100 second

Answer: D

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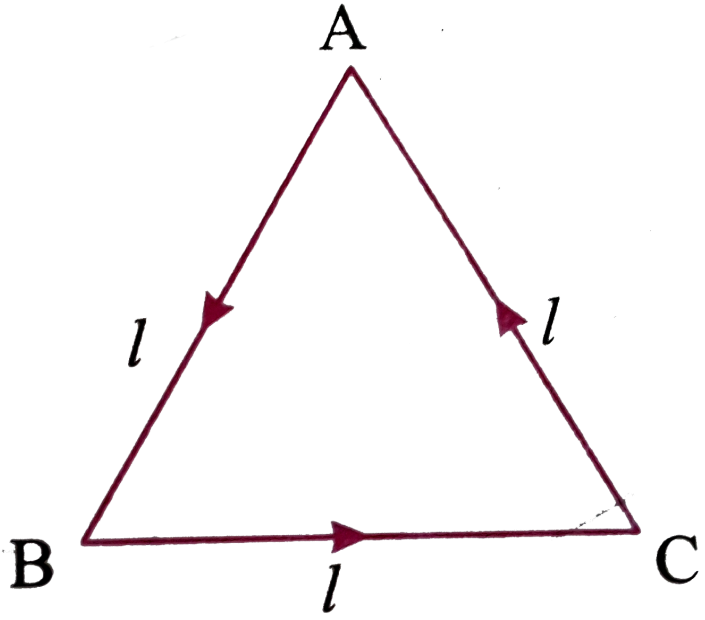
66. Three particles A, B and C and situated at the vertices of an equilateral triangle ABC of side of length l at time $t = 0$,Each of the particles move with constant speed u. A always has its velocity along AB, B along BC and C along CA.



A. 2D/3V

B. 5D/7V

C. 6D/10V

D. 7D/9V

Answer: A

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67. A ball is thrown vertically upward with a velocity u from balloon descending with a

constant velocity v. The vall will pass by the balloon after time

A. $\frac{u-v}{2g}$

B. $\frac{u+v}{2g}$

C. $\frac{2(u-v)}{g}$

D. $\frac{2(u+v)}{g}$

Answer: D

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68. A bus is moving with a speed of $10ms^{-1}$ on a straight road. A scooterist wishes to overtake the bus in 100 s. If the bus is at a distance of 1 km from the scooteritst with what speed should the scooterist chase the bus?

A. $40ms^{-1}$

B. $25ms^{-1}$

C. $10ms^{-1}$

D. $20ms^{-1}$

Answer: D

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69. A man running on the horizontal road at $8kmh^{-1}$ find the rain appears to be falling vertically. He incresases his speed to $12kmh^{-1}$ and find that the drops make angle 30^2 with the vertical. Fin dthe speed and direction of the rain with respedt to the road.

A. $4\sqrt{7}km/h$

B. $9\sqrt{7}km/h$

C. $12\sqrt{7}km/h$

D. $15\sqrt{7}km/h$

Answer: A

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70. An airplane flies from a town A to a town B when there is no wind and takes a total time T_0 for a return trip. When there is a wind blowing in a direction from town A to town B,

the plane's time for a similar return trip, T_w, would satisfy

A. $T_0 < T_w$

B. $T_0 > T_w$

C. $T_0 = T_w$

D. the result depends on the wind velocity between the towns

Answer: A

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Exercise 2

1. A particle travels half the distance with a velocity of $6ms^{-1}$. The remaining half distance is covered with a velocity of $4ms^{-1}$ for half the time and with a velocity of $8ms^{-1}$ for the rest of the half time. What is the velocity of the particle averaged over the whole time of motion ?

A. $9ms^{-1}$

B. $6ms^{-1}$

C. $5.35ms^{-1}$

D. $5ms^{-1}$

Answer: B

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2. Let A, B, C, D be points on a vertical line such that AB = BC = CD. If a body is released from position A, the times of descent through AB, BC and CD are in the ratio.

A. $1:\sqrt{3}-\sqrt{2}:\sqrt{3}+\sqrt{2}$

B. $1:\sqrt{2}-1:\sqrt{3}-\sqrt{2}$

C. $1:\sqrt{2}-1:\sqrt{3}$

D. $1:\sqrt{2}:\sqrt{3}-1$

Answer: B

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3. When two bodies movie uniformly towards each other, the distance between then decreases by $6m/s$. If both the bodies move

in the same direction with their same speed, the distance between them increases by $4m/s$. What are the speeds of the two bodies.

A. $3ms^{-1}$ and $3ms^{-1}$

B. $4ms^{-1}$ and $2ms^{-1}$

C. $5ms^{-1}$ and $1ms^{-1}$

D. $7ms^{-1}$ and $3ms^{-1}$

Answer: C

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4. The deceleration exerienced by a moving motor blat, after its engine is cut-off is given by $dv/dt = -kv^3$, where k is constant. If v_0 is the magnitude of the velocity at cut-off, the magnitude of the velocity at a time t after the cut-off is.

A. $\dfrac{v_0}{\sqrt{(2v_0^2kt+1)}}$

B. v_0e^{-kt}

C. $v_0/2$

D. v_0

Answer: A

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5. An object is vertically thrown upwards. The the displacement-time graph for the motion is as shown in .

A. 

B. 

C. 

D. 

Answer: B

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6. A packet is dropped from a flight ascending with a velocity at height of 10km. If the packet takes 100s to reach the ground, then the velocity of the flight is (take $g = 10ms^{-2}$)

A. $100ms^{-1}$

B. $300ms^{-1}$

C. $200ms^{-1}$

D. $400ms^{-1}$

Answer: D

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7. The velocity-time graph for the vertical component of the velocity of a body thrown upwards from the ground and landing on the roof of a building is given in the figure. The height of the building is

A. 50m

B. 40m

C. 20m

D. 30m

Answer: B

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8. The acceleration of a particle is increasing linearly with time t as bt. The particle starts from the origin with an initial velocity v_0. The

distance travelled by the particle in time t will be

A. $v_0 t + \frac{1}{3} b t^2$

B. $v_0 t + \frac{1}{3} b t^3$

C. $v_0 t + \frac{1}{6} b t^3$

D. $v_0 t + \frac{1}{2} b t^2$

Answer: C

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9. A point traversed half the distance with a velocity v_0. The remaining part of the distance was covered with velocity v_1 for half the time, and with velocity v_2 for the other half of the time. Find the mean velocity of the point averaged over the whole time of motion.

A. $\dfrac{v_0 + v_1 + v_2}{3}$

B. $\dfrac{2v_0 + v_1 + v_2}{3}$

C. $\dfrac{v_0 + 2v_1 + 2v_2}{3}$

D. $\dfrac{2v_0(v_1 + v_2)}{(2v_0 + v_1 + v_2)}$

Answer: D

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10. Engine of a train that is moving with unifrom acceleration passes a pole with speed u while the last compartment passes the pole with speed 'v'. The middle point of the train passes the given pole with speed:

A. $\frac{u+v}{2}$

B. $\frac{1}{2}\sqrt{u^2+v^2}$

C. $\sqrt{uv}$

D. $\sqrt{\left(\frac{u^2+v^2}{2}\right)}$

Answer: D

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11. From the top of a multi-storeyed building 40m tall, a boy projects a stone vertically upwards with an initial velocity of$10ms^{-1}$such that it eventually falls to the ground.

A. 1s

B. 2s

C. 3s

D. 4s

Answer: D

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12. A car, starting from rest, accelerates at the rate f through a distance s, then continues at constant speed for time t and then

decelerates at the rate f/ 2 to come to rest. If the total distance travelled is 15 s, then

A. $S = \frac{1}{2} ft^2$

B. $S = ft$

C. $S = \frac{1}{4} ft^2$

D. $S = \frac{1}{72} ft^2$

Answer: D

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13. A ball is dropped from the top of a building. The ball takes $0.5s$ to fall the $3m$ length of a window some distance from the to of the building. If the speed of the ball at the top and at the bottom of the window are v_T and v_T respectively, then $\left(g = 9.8m/s^2\right)$

A. $v_T + v_B = 12ms^{-1}$

B. $v_T - v_B = 4.9ms^{-1}$

C. $v_B v_T = 1ms^{-1}$

D. $v_B/v_T = 1ms^{-1}$

Answer: A

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14. A truck has to carry a load in the shortest time from one point to another at a distance L from the first.It can only start up or slow down at the same acceleration a. What maximum velocity must the truck attain to satisfy this condition ?

A. $\sqrt{La}$

B. $\sqrt{2La}$

C. $\sqrt{3La}$

D. $\sqrt{5La}$

Answer: A

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15. A body begins to move with an initial velocity of $2ms^{-1}$ and continues to move at a constant acceleration a.Ten seconds later a second body begins to move from the same

point with an initial velocity of $12ms^{-1}$ in the same direction with the same acceleration.What is the maximum acceleration at which it would be possible for the second body to overtake the first ?

A. $1m/s^2$

B. $2m/s^2$

C. $1/2m/s^2$

D. $3m/s^2$

Answer: A

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16. A car accelerates from rest at a constant rate for some time after which it decelerates at a constant rate β to come to rest. If the total time elapsed is t, the maximum velocity acquired by the car is given by :

A. $\left(\frac{\alpha^2+\beta^2}{\alpha\beta}\right)t$

B. $\left(\frac{\alpha^2-\beta^2}{\alpha\beta}\right)$

C. $\frac{(\alpha+\beta)t}{\alpha\beta}$

D. $\frac{\alpha\beta t}{\alpha+\beta}$

Answer: D

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17. Starting from rest a particle moves in a straight line with acceleration

$a = \left(25 - t^2\right)^{1/2} m/s^2 \quad \text{for} \quad 0 \leq t \leq 5s$

$a = \frac{3\pi}{8} m/s^2 \quad \text{for} \quad t > 5s$

The velocity of particle at $t = 7s$ is:

A. 11m/s

B. 22m/s

C. 33m/s

D. 44m/s

Answer: B

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18. The balls are released from the top of a tower of height H at regular interval of time. When first ball reaches at the ground, the n^{th} ball is to be just released and $\left(\frac{n+1}{2}\right)^{th}$ ball

is at same distance 'h' from top of the tower.

The value of h is

A. $\frac{2}{3}H$

B. $\frac{1}{4}H$

C. $\frac{4}{5}H$

D. $\frac{5H}{6}$

Answer: B

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19. A particle starting from rest falls from a certain height. Assuming that the acceleration due to gravity remain the same throughout the motion, its displacements in three successive half second intervals are S_1, S_2 and S_3 then

A. $S_1 : S_2 : S_3 = 1 : 5 : 9$

B. $S_1 : S_2 : S_3 = 1 : 3 : 5$

C. $S_1 : S_2 : S_3 = 9 : 2 : 3$

D. $S_1 : S_2 : S_3 = 1 : 1 : 1$

Answer: B

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20. Two car A and B travelling in the same direction with velocities v_1 and $v_2(v_1 > v_2)$. When the car A is at a distance d ahead of the car B, the driver of the car A applied the brake producing a uniform retardation a. There wil be no collision when.

A. $d < \frac{(v_A - v_B)^2}{2a}$

B. $d < \frac{v_A^2 - v_B^2}{2a}$

C. $d > \frac{(v_A - v_B)^2}{2a}$

D. $d > \frac{v_A^2 - v_B^2}{2a}$

Answer: C

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21. A ball is dropped into a well in which the water level is at a depth h below the top. If the speed of sound is C, then the time after which the splash is heard will be give by.

A. $T = 2h/v$

B. $T = \sqrt{\left(\frac{2h}{g}\right)} + \frac{h}{v}$

C. $T = \sqrt{\left(\frac{2h}{v}\right)} + \frac{h}{g}$

D. $T = \sqrt{\left(\frac{h}{2g}\right)} + \frac{2h}{v}$

Answer: B

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22. A body dropped from a height h with an initial speed zero, strikes the ground with a

velocity $3k\frac{m}{h}$. Another body of same mass is dropped from the same height h with an initial speed $-u' = 4km/h$. Find the final velocity of second body with which it strikes the ground

A. 3km/hr

B. 4km/hr

C. 5km/hr

D. 6 km/hr

Answer: C

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23. A body is thrown vertically up to reach its maximum height in t seconds. The total time from the time of projection to reach a point at half of its maximum height while returning (in seconds) is

A. $\sqrt{2}t$

B. $\left(1+\frac{1}{\sqrt{2}}\right)t$

C. $\frac{3t}{2}$

D. $\frac{t}{\sqrt{2}}$

Answer: B

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24. A particle of unit mass undergoes one-dimensional motion such that its velocity varies according to

$v(x) = \beta x^{-2n}$

where β and n are constant and x is the position of the particle. The acceleration of the particle as a function of x is given by.

A. $-2nb^2x^{-4n-1}$

B. $-2b^2x^{-2n+1}$

C. $-2nb^2e^{-4n+1}$

D. $-2nb^2x^{-2n-1}$

Answer: A

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25. On a two lane road, car A is travelling with a speed of $36kmh^{-1}$, Two cars B and C approach car A in opposite directions with a

speed of $54kmh^{-1}$. At a certain instant, when the distance AB is equal to AC, both 1 km B decided to overtake A before Cdoes. What minimum acceleration of car B is required to avoid and accident?

A. 8

B. 6

C. 3

D. 1

Answer: D

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26. A hunter tries to hunt a monkey with a small very poisonous arrow, blow form a pipe with initial speed v_0. The monkey is hanging on a branch of a tree at height H above the ground. The hunter is at a distance L form the the bottom of the tree. The monkey sees the arrow leaving the blow pipe and immediately loses the grip on the tree, falling freely down with zero initial velocity. The minimum initial

speed v_0 of the arrow for hunter to success while monkey is in air-

A. $\sqrt{\frac{g(H^2+L^2)}{2H}}$

B. $\sqrt{\frac{gH^2}{\sqrt{H^2+L^2}}}$

C. $\sqrt{\frac{g\sqrt{H^2+L^2}}{H}}$

D. $\sqrt{\frac{2gH^2}{\sqrt{H^2+L^2}}}$

Answer: A

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27. A ball is droped from a high rise platform $t = 0$ starting from rest. After $6s$ another ball is thrown downwards from the same platform with a speed v. The two balls meet at $t = 18s$. What is the value of v ?

A. 75m/s

B. 55m/s

C. 40m/s

D. 60m/s

Answer: A

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28. A body starts from rest and travels a distance x with uniform acceleration, then it travels a distance 2x with uniform speed, finally it travels a distance 3x with uniform retardation and comes to rest. If the complete motion of the particle is along a straight line, then the ratio of its average velocity to maximum velocity is

A. $2/5$

B. $3/5$

C. $4/5$

D. $6/7$

Answer: B

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29. A rubber ball is dropped from a height of $5m$ on a plane, where the acceleration due to gravity is not shown. On bouncing it rises to

$1.8m$. The ball loses its velocity on bouncing by a factor of

A. $\frac{3}{5}$

B. $\frac{9}{25}$

C. $\frac{2}{5}$

D. $\frac{16}{25}$

Answer: C

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30. A particle moving along x-axis has acceleration f, at time t, given by $f = f_0\left(1 - \frac{t}{T}\right)$, where f_0 and T are constants. The particle at t= 0 has zero velocity. In the time interval between t= 0 and the instant when f= 0, the particle's velocity (v_x) is

A. $\frac{1}{2}f_0T^2$

B. f_0T^2

C. $\frac{1}{2}f_0T$

D. $f_0 T$

Answer: C

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