



PHYSICS

BOOKS - CHETANA PHYSICS (MARATHI ENGLISH)

MOTION IN A PLANE

Exercise

1. A car travels at a speed of 50 km/hr for 15 minute and then 70 km/hr for next 45

minutes. What is the average speed of the car?



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2. A body travels from place A to place B with uniform velocity of 10 m/s and travels back from place B to place A with uniform velocity of 2 m/s . Calculate the average velocity of the body for the whole journey.



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3. Separate the following in groups of scalars and vectors velocity, speed, displacement, work done, force power, energy acceleration, electric charge, angular velocity.



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4. Define average velocity and instantaneous velocity. When are they same?



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5. Differentiate between

Uniform rectilinear motion and Non-Uniform rectilinear motion



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6. What is position -time graph ? Discuss the position time graph of an object (i) at rest (ii) in uniform motion. (iii) object performing oscillatory motion. (iv) object in non-uniform rectilinear motion.



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7. Explain the terms. (i) Acceleration (ii) average acceleration (iii) instantaneous acceleration



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8. Explain velocity time graph of a particle having Constant velocity (ii) uniform positive acceleration (iii) uniform negative acceleration (iv) non- uniform acceleration.



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9. A metro train runs from station A to B C. It takes 4 minutes in travelling from Station A to Station B. The train halts at station B for 20 s. Then it starts from station B and reaches Station C in next 3 minutes. At the start, the train accelerates for 10 s to reach the constant speed of 72 km/hr . The train moving at the constant speed is brought to rest in 10 sec. At next station. (i) Plot the velocity- time graph for the train travelling from the station A to B

to C. (ii) Calculate the distance between the stations A, B and C.



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10. Which physical quantity can be determined by the area under the velocity time *curves / graphs*?



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11. Using velocity time graph, derive the equations of motion for uniform acceleration moving along a straight line.



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12. An aeroplane has a run of 500 m to take off from runway. It starts from rest and moves with constant acceleration to cover the runway in 30 s. What is the velocity of the aeroplane at the take off?





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13. A car moving along a straight road with a speed of 120 km/hr is brought to rest by applying brakes. The car covers a distance of 100 m before it stops. Calculate (i) average retardation of the car. (ii) time taken by the car to come rest.



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14. A stone is released from the top of a tower 90m high. At the same instant a second stone is projected vertically upwards from the ground with a velocity of 30 m/s . When and where will the two stones meet?



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15. A body released from rest a certain height was observed to cover 78.4 m in the last two seconds before hitting the ground. Find the

height from which it was released.

$$(g = 9.8m / s^2)$$



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16. Define : Free fall



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17. Galileo's law of odd numbers : The distances traversed during equal intervals of time, by a body falling from rest, stand to one

another in the same ratio as the odd numbers beginning with unity namely $1:3:5:7\dots$. Prove it.



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18. Explain 'Relative velocity'.



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19. Two parallel rail tracks run north-south. Train A moves north with a speed of 54 km

hr^{-1} and train B moves south with a speed of $90 \text{ km } hr^{-1}$. What is the (i) velocity of B with respect to A ? (ii) velocity of ground with respect to A? (iii) velocity of a monkey running on the roof of 18 km/hr with respect to train A as observed by a man standing on the ground.



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20. The position vector of a particle moving in XY plane at any instant of time is

$x = 4t^2\hat{i} + 3t^2\hat{j}$. Find the instantaneous speed.



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21. If the motion of an object is described by $x=f(t)$ write formulae for instantaneous velocity and acceleration.



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22. The position of an object moving along the x axis is given by $x = a + bt^2$ where $a = 8.5$

and $b = 2.5 \text{ m s}^2$ and t is measured in second.

What is the velocity at $t = 0 \text{ s}$ and $t = 2 \text{ s}$? What is the average velocity between $t = 2 \text{ s}$ and $t = 4 \text{ s}$?



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23. A train is moving east ward at 10 m s^{-1} . A waiter is walking eastward at 1.2 m s^{-1} and a fly is charging towards the north across the waiter's tray at $2 \text{ m} / \text{s}$. What is the velocity of the fly relative to the earth.



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24. Derive equations of motion for a particle moving in a plane and show that the motion can be resolved in two independent motions in mutually perpendicular directions.



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25. A train is moving east ward at 10 m s^{-1} . A waiter is walking eastward at 1.2 m s^{-1} and a fly is charging towards the north across the

waiter's tray at 2 m/s . What is the velocity of the fly relative to the earth.



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26. Derive equations of motion for a particle moving in a plane and show that the motion can be resolved in two independent motions in mutually perpendicular directions.



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27. Define the terms : (i) projectile (ii) Velocity of projection (iii) Angle of projection (iv) Trajectory of projectile.



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28. Show that the path of a projectile is a parabola.



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29. Define (i) Times of ascent (II) Time of descent (iii) Time of flight. Derive necessary expressions.



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30. Define horizontal range. Derive the necessary expression for it.



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31. A projectile is thrown at an angle of 30° to the horizontal. What should be the range of initial velocity (u) so that its range will be between 40m and 50m? Assume $g = 10 \text{ m s}^{-2}$.



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32. A man throws a ball to maximum horizontal distance of 80 m. Calculate the maximum height reached.



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33. A particle is projected with speed of u at an angle θ to the horizontal on an inclined surface making an angle ϕ ($\phi < \theta$) to the horizontal. Find an expression for its range along the inclined surface.



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34. Find a formula for maximum height attained by object



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35. A stone is thrown vertically upward with a velocity of 30 m/s . How high will it rise? After how much time will it return to ground ? [Take $g = 10 \text{ m/s}^2$]



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36. At which point of its trajectory does the projectile have minimum speed?



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37. Show that for a given velocity of projection, there are two angles of projection which give the same range of projectile.



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38. Derive the expression for trajectory of a particle projected horizontally with velocity u from height H .



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39. Define the terms : (i) Uniform circular motion (ii) Radius vector (iii) period (iv) Angular speed (v) Centripetal acceleration (vi) Centripetal force.



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40. State the requirements for an object to perform uniform circular motion.



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41. Find the expression for the speed and angular speed of a particle performing uniform circular motion. State SI unit of angular speed.



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42. Show that the centripetal force on a particle undergoing uniform circular motion

$$-m\omega^2 \vec{r}$$



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43. A particle moves in a circle with constant speed of 15 m/s . The radius of the circle is 2 m . Determine the centripetal acceleration of the particle.



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44. What is conical pendulum? Show that its time period is given by $2\pi\sqrt{\frac{l \cos \theta}{g}}$, where l is the length of the string, θ is the angle that the

string makes with the vertical and g is the acceleration due to gravity.



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45. A car moves in a circle at the constant speed of $50\text{m} / \text{s}$ and completes 1 revolution in 40s. Determine the magnitude of acceleration of the car.



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46. A string of length 0.5 m carries a bob at its end. If this is to be used as a conical pendulum of period $0.4\pi s$. Calculate the angle of inclination of the string with the vertical.



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47. An object thrown from a moving bus is an example of:

A. Uniform circular motion

B. Rectilinear motion

C. Projectile motion

D. Motion in one dimension

Answer:



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48. For a particle having uniform circular motion, which of the following is constant?

A. Speed

B. Acceleration

C. Velocity

D. Displacement

Answer:



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49. The bob of a conical pendulum undergoes

A. Rectilinear motion in horizontal plane

B. Uniform motion in horizontal circle

C. Uniform motion in a verticle circle

D. Restilinear motion in verticle circle

Answer:



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50. For uniform acceleration in rectilinear motion which of the following is not correct?

A. Velocity- time graph is linear

B. Acceleration is the slope of velocity time graph

C. The area under the velocity-time graph equals displacement

D. Velocity-time graphs is non linear.

Answer:



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51. If three particles A, B and C are having velocities \vec{V}_A , \vec{V}_B and \vec{V}_C which of the following formula gives the relative velocity of A with respect to B.

A. $\vec{V}_A + \vec{V}_B$

B. $\vec{V}_A - \vec{V}_C + \vec{V}_B$

C. $\vec{V}_A - \vec{V}_B$

D. $\vec{V}_C - \vec{V}_A$

Answer:



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52. The actual distance travelled by the particle during its motion is called

A. Speed

B. displacement

C. path length

D. position

Answer:



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53. When a car moves towards east 50 m then towards south 50 m later on towards west

50m, finally towards north 50, the displacement of the car in magnitude is

A. 200 m

B. 100 m

C. 50m

D. zero

Answer:



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54. A body covers one-half of its journey at 40 m s^{-1} and the next half at 50 m s^{-1} . Its average velocity is.

A. 44.4 m s^{-1}

B. 50 m s^{-1}

C. 45 m s^{-1}

D. 40 m s^{-1}

Answer:



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55. A bus travel its onward journey with a constant speed of 30km/hr and its return journey with a constant speed of 60km/hr . the average speed for its entire journey is

A. 90 km/hr

B. 45 km/hr

C. 40 km/hr

D. 15 km/hr

A. A. 90 km/hr

B. B. 45 km/hr

C. C. 40 km/hr

D. D. 15 km / hr

Answer:



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56. A particle oscillates along a straight line 1m long, if it completes one oscillation in 0.1s, then the distance covered by it and its average speed in one oscillation is,

A. 1m, 20 m / s

B. 2m, 20 m / s

C. 2m, 15 m / s

D. 1m, 15 m / s

A. A. 1m, 20 m / s

B. B. 2m, 20 m / s

C. C. 2m, 15 m / s

D. D. 1m, 15 m / s

Answer:



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57. The position of an object moving along X-axis is given by $x = a + bt^2$ where $a = 8.5$ m and $b = 2.5$ m and t is measured in second. If the object starts from $t = 0$, the velocity at $t = 2$ s is

A. 18.5 m / s

B. 10 m / s

C. 9.25 m / s

D. 1.5 m / s

Answer:



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58. A car accelerates on a straight road from rest to a speed of 180 km/hr in 25 second. Assuming Uniform acceleration of the car out, the distance covered in this is

A. 625 m

B. 600 m

C. 144 m

D. 72 m

Answer:



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59. A body has initial velocity of 3 m/s and has an acceleration of 2 m/s^2 . The distance travelled by it in 5 s and its velocity is

A. 40 m, 13 m/s

B. 10 m, m/s

C. 40 m, 10 m/s

D. 10 m, 10 m/s

Answer:



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60. An electron travelling with a speed of $5 \times 10^3 \text{ m/s}$ passes through an electric field with an acceleration of 10^{12} ms^{-2} . How long will it take for electron to double its speed?

A. $0.5 \times 10^{-9} \text{ s}$

B. $0.5 \times 10^1 - 10 \text{ s}$

C. $5 \times 10^{-9} \text{ s}$

$$D. 5 \times 10^{-12} \text{ s}$$

Answer:



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61. A stone is thrown vertically upwards with initial velocity of 14 m s^{-1} . The maximum height it will reach is $[g = 9.8 \text{ m s}^{-2}]$

A. 60 m

B. 30.4 m

C. 29.4 m

D. 10 m

Answer:



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62. A swimmer's speed in the direction of flow of rivers is 16 km h^{-1} . The swimmer's speed in still water and the velocity of flow of the river respectively are.

A. 4 km h^{-1} , 12 km h^{-1}

B. 12 km^{-1}

C. 12 km h^{-1} , 12 km h^{-1}

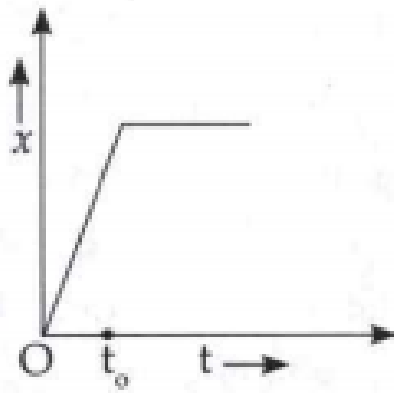
D. 4 km h^{-1} , 4 km h^{-1}

Answer: 12 km h^{-1} , 4 km h^{-1}



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63. Figure shows the displacement-time graph of a particle moving along x-axis.



- A. The particle is continuously going in positive x-direction
- B. The particle is at rest
- C. The velocity increases upto time t_0 and then becomes constant.

D. The particle moves at a constant velocity
upto a time t_0 and then stops

Answer:



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64. Area under the curved of velocity-time
graph of a particle moving with constant
velocity is

A. acceleration of the particle

B. distance travelled by the particle

C. constant speed of the particle

D. variable speed of the particle

Answer:

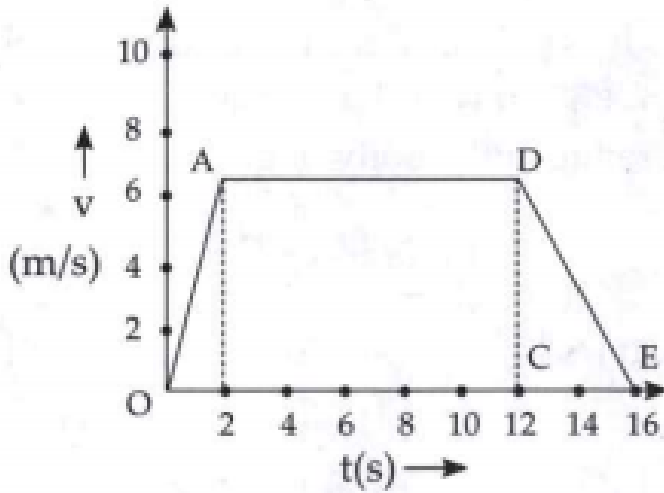


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65. The v - t graph of an athlete is shown

below. The distance travelled by him between

$t=0$ and $t=12$ s is



A. 36 m

B. 46 m

C. 66 m

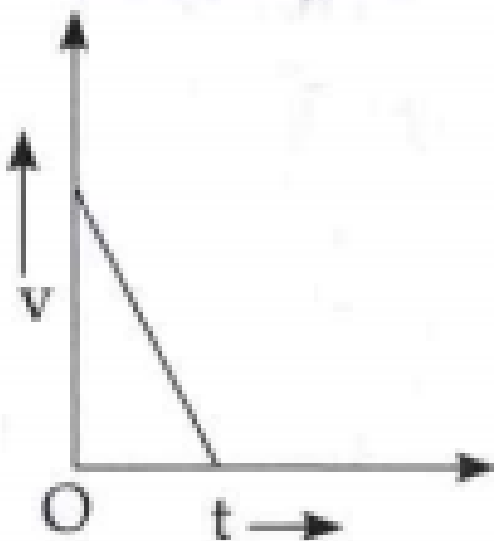
D. 78 m

Answer:



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66. The v-t graph below represents



A. Constant positive acceleration

B. zero acceleration

C. constant positive acceleration with non-zero initial velocity

D. constant negative acceleration

Answer:



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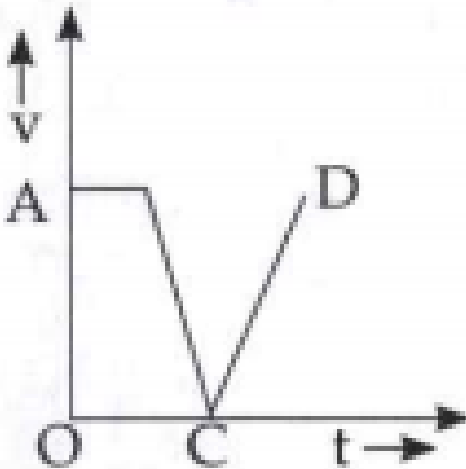
67. The velocity-time graph of a body is shown in the following graph. At point C

A. the force acting on the body is zero

B. only gravitational force is present

C. the force opposes the motion of the body

D. the force is maximum



A. A. the force acting on the body is zero

B. B. only gravitational force is present

C. C. the force opposes the motion of the
body

D. D. the force is maximum

Answer:



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68. The two dimensional motion of a body in which a vertical motion with constant acceleration (g) and a horizontal motion with constant velocity acts, such a motion is

A. Curved motion

B. circular motion

C. sinusoidal motion

D. projectile motion

Answer:



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69. Whic of the following is NOT an example of a projectile?

A. Aeroplane in flight

B. A bullet fired from the gun

C. A hammer thrown by an athlete

D. A stone thrown from, the top of the
building

Answer:



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70. In a projectile motion, the velocity vector of the projectile is

A. always perpendicular to the acceleration

B. never perpendicular to acceleration

C. perpendicular to acceleration two times

during its flight

D. perpendicular to acceleration only once

during its flight

Answer:



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71. The trajectory of particle is symmetrical about the perpendicular drawn from the highest point on x-axis, if the particle performs projectile motion in xy plane. This is due to

A. velocity of projection of projectile

B. air resistance while performing projectile motion

C. gravitational acceleration which is same for upward and downward motion

D. angle of projection of projectile

Answer:



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72. A shell is fired at an angle of 30° to the horizontal with velocity 196 m/s . The time of flight is

A. 6.5 s

B. 10 s

C. 16.5 s

D. 20 s

Answer:



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73. A projectile can have the same range R for two angles of projection. If t_1 and t_2 are the times of flight in the two cases, then the product of the two time of flight is proportional to

A. R^2

B. $\frac{1}{R^2}$

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

D. R

A. A. R^2

B. B. $\frac{1}{R^2}$

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

D. D. R

Answer:



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74. When a body is projected vertically up from the ground, its velocity is reduced to $\left(\frac{1}{3}\right)^{rd}$ of its initial value at height y above the ground . The maximum height reached by the body is

A. $\frac{3}{4y}$

B. $\frac{8y}{9}$

C. $\frac{9}{8}y$

D. $9y$

Answer:



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75. A body is projected with a vertical velocity of 30 m/s at an angle of 30° with the horizontal, the maximum height and horizontal range are respectively

- A. 79.53 m, 1148 m
- B. 11.48 m, 79.53 m
- C. 159.06 m, 11.48 m
- D. 22.96 m, 79.53 m

Answer:



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76. The angle between velocity and acceleration of a particles describing uniform circular motion is.

A. 180°

B. 45°

C. 90°

D. 60°

Answer:



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77. A particles moves with a uniform speed v and time period T in a circular path of radius r .
If the speed of the particle is doubled, its new time periods is

A. T

B. $T / 2$

C. $2T$

D. $T/4$

Answer:



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78. In uniform circular motion, the centripetal acceleration is

A. towards the centre of the circular path
and perpendicular to the instantaneous
velocity

B. A constant acceleration

C. away from the centre of the circular path

and perpendicular to the instantaneous

velocity

D. a variable acceleration, parallel to the

instantaneous velocity

Answer:



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79. An aeroplane is flying with a uniform speed of 150 km / h along the circumference of a circle. The change in its velocity in half the revolution (in km / h) is:

A. 150

B. 100

C. 200

D. 300

A. A. 150

B. B. 100

C. C. 200

D. D. 300

Answer:



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80. The ratio of angular speed of a second hand to the hour of a watch is

A. 60 : 1

B. 72 : 1

C. 720 : 1

D. 3600 : 1

Answer:



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81. What is approximately the centripetal acceleration (in units of acceleration due to gravity on earth $g = 10ms^{-2}$) of an aircraft flying at a speed of $400 ms^{-1}$ through a circular arc of radius 0.6 km.

A. 26.7

B. 16.9

C. 13.5

D. 30.2

Answer:



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82. Two cars of masses m_1 and m_2 are moving in circles of radii r_1 and r_2 respectively. Their speeds are such that they make complete

circles in the same time t . The ratio of their centripetal acceleration

A. $m_1 : m_2$

B. $r_1 : r_2$

C. $1 : 1$

D. $m_1 r_1 : m_2 r_2$

Answer:



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83. A body moves in a circle covers equal distance in equal intervals to time. Which of the following remains constant?

A. Velocity

B. Acceleration

C. Speed

D. Displacement

Answer:



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84. The acceleration of an object moving in a circle of radius R with uniform speed v is

A. $\frac{v^2}{R}$

B. $\frac{v^2}{2R}$

C. $\frac{2v^2}{R}$

D. $\frac{3v^2}{2R}$

Answer:



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85. A particle is moving with a constant speed 'v' in a circle what is the magnitude of average velocity after half rotation ?

A. $2v$

B. $\frac{2v}{\pi}$

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

D. $\frac{v}{2\pi}$

Answer:



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86. The earth moves round the sun in a near circular orbit of radius 1.5×10^{11} m. Its centripetal acceleration is

A. $1.5 \times 10^{-3} \text{ m s}^{-2}$

B. $6 \times 10^{-3} \text{ m s}^{-2}$

C. $3 \times 10^{-3} \text{ m s}^{-2}$

D. $12 \times 10^{-3} \text{ m s}^{-2}$

Answer:



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87. Which one of the following statements is not correct in uniform circular motion?

A. The speed of the particle remains constant

B. The acceleration always points towards the centre

C. The angular speed remains constant

D. The velocity remains constant.

Answer:





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88. A body moving along a circular path of radius r with velocity V , has centripetal acceleration ' a '. If its velocity is made equal to $2V$, then its centripetal acceleration is.

A. $4a$

B. $2a$

C. $a/4$

D. $a/2$

Answer:



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89. A body of mass 2 kg is rotating with angular speed $2\pi \text{ rad s}^{-1}$ in a circular path of radius 1m. The centripetal force acting on the body is.

A. $2\pi^2$

B. $4\pi^2$

C. $6\pi^2$

D. $8\pi^2$

Answer:



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90. Parabola is the locus of the points which are equidistance from

A. focus

B. directrix

C. latus rectum

D. focus as well as directrix

Answer:



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91. What does the slope of X-t graph at any point give ?



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92. What does the slope of X-t graph at any point give ?



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93. What does the slope of X-t graph at any point give ?



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94. What does the slope of X-t graph at any point give ?



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95. When a body moves along a straight line, it is called

- A. Rectilinear motion
- B. Circular motion
- C. Projectile motion
- D. Oscillatory motion

A. A. Rectilinear motion

B. B. Circular motion

C. C. Projectile motion

D. D. Oscillatory motion

Answer:



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96. When a body moves along a straight line, it is called

A. Rectilinear motion

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97. When a body moves along a straight line, it is called

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98. When a body moves along a straight line, it is called

- A. Rectilinear motion
- B. Circular motion
- C. Projectile motion
- D. Oscillatory motion



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99. A body is thrown with velocity of 49 m s^{-1} at an angle of 30° with the horizontal, the time required to attained maximum height is ,

A. 5 s

B. 4 s

C. 3 s

D. 2 s

A. A. 5 s

B. B. 4 s

C. C. 3 s

D. D. 2 s

Answer:



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100. A body is thrown with velocity of 49 m s^{-1} at an angle of 45° with the horizontal, the time required to attained maximum height is ,

A. 5.05 s

B. 6.06 s

C. 7.07 s

D. 8.08 s



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101. A body is thrown with velocity of 49 m s^{-1} at an angle of 90° with the horizontal, the time required to attained maximum height is ,

A. 5 s

B. 10 s

C. 15 s

D. 20 s



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102. A body is thrown with velocity of 49 m s^{-1} at an angle of 30° with the horizontal, what is maximum height attained by body? ,

A. 20.625

B. 61.25

C. 30.625

D. 41.25

A. A. 20.625

B. B. 61.25

C. C. 30.625

D. D. 41.25

Answer:



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103. At which point of the trajectory does projectile have minimum velocity?



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104. State the SI unit of angular speed.



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105. State the factors on which time period of a conical pendulum depend



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106. Discuss the velocity time graph for an object with constant negative acceleration.



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107. Explain the term :

Relative velocity.



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108. If the position vector of a body performing rectilinear motion is given by $\vec{r} = 3t^2\hat{i} + 4t^2\hat{j}$ m. Find the velocity and acceleration of the particle at $t=1$ sec.



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109. Define: Horizontal Range and Time of flight.



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110. A car moves at a constant speed of 60 km hr^{-1} for half of the journey and 80 km hr^{-1} for remaining half of the journey. Find the average speed of the car in one hour.



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111. State the requirements for a particle to perform uniform circular motion.



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112. Derive the equation of the trajectory of a projectile.



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113. Derive the equation of motion from the velocity-time graph.



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114. Starting from rest, a car moves with uniform acceleration and attains a velocity of 72 km hr^{-1} in 20 s. It then moves with uniform speed for 25 s and is brought to rest in 10 s under uniform retardation. Find the total distance travelled using velocity-time graph.



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115. A particle of mass 200 g completes one rotation of a circular track of radius 2 m in 20 second. Calculate angular speed.



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116. A particle of mass 200 g completes one rotation of a circular track of radius 2 m in 21 second. Calculate centripetal acceleration .



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117. Define angular velocity. Show that the centripetal force on a particle performing uniform circular motion is $\frac{-mv^2 \vec{r}}{r^2}$



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118. A man throws a ball to a maximum horizontal distance of 120m. Find the maximum height reached by the ball.



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