PHYSICS

BOOKS - BINA LIBRARY PHYSICS (ASSAMESE ENGLISH)

KINEMATICS - 1

Example

1. The position of an object moving along x-axis is given by x = a+bt^2 , where a = 10m, b = 3

ms^{-2}, and 't' is measured in second. What is the average velocity between t = 2s and t = 4s?

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2. The motion of a particle along x-axis is given by equation x = 9+$5t^2$, where x is the distance in cm and t is time in second. Find the displacement after 3 seconds.

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3. The motion of a particle along x-axis is given by equation x = 9+$5t^2$, where x is the distance in cm and t is time in second. Find average velocity during the interval from 3 to 5 seconds

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4. The motion of a particle along x-axis is given by equation x = 9+$5t^2$, where x is the distance

in cm and t is time in second. Find instantaneous velocity after 3 seconds

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5. The distance x of a particle moving in one dimension, under the action of constant force is related to time t by equation. t = $\sqrt{x} + 3$ where x in metre and t in second. Find the displacement of the particle when its velicity is zero.

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6. A car covers first half of the distance between two places at a speed of 40 km/hr and the second half at 60 km/hr. What is the average speed of the car?

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7. The displacement (in meter) of a particle moving along x-axis is given by x = 18t+$5t^2$. Calculate instantaneous velocity at t = 2s

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8. The displacement (in meter) of a particle moving along x-axis is given by x =18t+$5t^2$. Calculate average velocity between t = 2s and t = 3s .

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9. The displacement (in meter) of a particle moving along x-axis is given by x = 18t+$5t^2$. Calculate instantaneous acceleration.

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10. A body starts from rest and has a velocity of 15 ms^{-1} in 6 seconds. If the accelerations is uniform, how far will it move in next 6 seconds ?

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11. A bullet fired into a block of wood loses half of its velocity after penetrating 3 cm. If the

retardation is uniform how much further will it penetrate ?

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12. The driver of a car moving with a velocity 60 km per hours observes ahead a child at a distance of 101m. He immediately applies brake and the car stops just 1m before the child. Find the time required to stop the car.

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13. A body moving with uniform acceleration goes 65 m in 5th second and 105 m in the 9th second. How far will it go in the 20th second?

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14. A mail bag is dropped into a post office, from an areoplane flying horizontally with a velocity 72hm/hr at height of 490m from the ground. How far must the plane be from the post office so that it may directly fall into the post office ?

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15. A stone falls from the top of a building and travels 53.9 m in the last second before it reaches the ground. Find the height of the building.

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16. A ball is dropped from the top of a tower. One second later another ball is thrown

downwards with a velocity of $15ms^{-1}$. When and how far below the top will the second stone overtake the first?

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17. A ball is thrown up with a velocity $4.9ms^{-1}$. Find the maximum height reached by the ball. How long does it spend in air?

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18. A stone is dropped from the top of a tower 100m high. At the same time another stone is thrown vertically upwards from the ground with a velocity of 50 ms^{-1}. Find when and where the stones will meet.

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19. A ball thrown vertically upwards takes 4 seconds to return to the ground. Calculate the maximum height reached.

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20. A ball thrown vertically upwards takes 4 seconds to return to the ground. Calculate the velocity with which it is thrown.

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21. A ball is thrown vertically upwards with a velocity 4.9 m/s from the floor of a bridge over water. The ball strikes water after 2 seconds. Calculate the height of the bridge.

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22. A police van moving on a highway with speed 30 kmh^{-1} fires a bullet at a theif's car speeding away in the same direction with a spped of 190 kmh^{-1} . If the muzzle spped of the bullet is $360kmh^{-1}$, with what speed does the bullet hit the thief's car?

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23. Two cars are moving in the same direction with the same speed (= 30km/hr). They are separated by a distance of 5 km. What is the speed of a car moving in the opposite direction if it met these cars at an interval of 4 minutes?

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24. On a two-lane road, car A travelling with a speed of $15ms^{-1}$ is approached by two cars B

and C moving with speed 20 ms^{-1} each in opposite directions. At an instant when the distance AB is equal to AC , both being 700 m, B decides to overtake A before C does. Find the minimum acceleration required by B to avoid accident.

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Exercise

1. Distinguish between distance and displacement

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2. Distinguish between speed and velocity.

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3. What is meant by the statement 'motion and rest are relative' ?

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4. Define the terms instantaneous velocity and instantaneous acceleration.

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5. Define relative velocity. When is its value zero ?

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6. Can the speed of a body negative ?

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7. Can the velocity of a body negative or zero ?

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8. What does the slope of velocity-time graph indicate ?

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9. What does the area under velocity - time graph indicate?

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10. Can a particle has zero velocity while its acceleration is uniform ?

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11. What does the speedometer of a car indicate?

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12. Distinguish between average velocity and instantaneous velocity.

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13. What is the uniform motion ? How would you represent it graphically?

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14. What does the slope of velocity-time graph indicate ?

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15. Distinguish between average velocity and average speed.

Is it possible that the average velocity of a body is zero, but its average speed is non-zero?

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16. A particle moves along a straight line according to x = `Pt^2 + 2qt + r where x is the distance travelled in time t and p, q and r are

constants. Find an expression for the acceleration of the particle.

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17. The displacement equation of a particle moving along a straight line with uniform acceleration is

$x = v_0 t + \frac{1}{2} a t^2$.

Find the distance covered by the particle in the last second of its motion.

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18. Derive -

v = $v_0 + at$

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19. Derive -

x = $v_0 t + \frac{1}{2} a t^2$

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20. Derive -

$v^2 = v_0^2 + 2ax$

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21. Obtain velocity - time relation and velocity - position relation for a uniformly accelerated motion.

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22. Draw the velocity - time graph of a body having initial velocity, when the velocity is uniform.

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23. Draw the velocity - time graph of a body having initial velocity, when the velocity is non - uniform.

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24. Show that the average velocity of a particle in uniform motion is equal to the slope of the corresponding time - displacement curve .

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25. An athlete completes one round of a circular track of radius R in 30 seconds. What will be the displacement at the end of 2 min 15 second ?

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26. Can a body have a constant velocity and still have a varying speed ?

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27. Is it possible that the velocity of a particle is zero though it has still an acceleration ?

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28. A body slides down a smooth inclined plane when released from the top , while another body falls freely from the same point. Which one will strike the ground earlier?

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29. The displacement of particle along a straight line at time t is given by x = $2\alpha + \beta t + \gamma t^2$.

Find its acceleration.

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30. A particle located at x = 0 at time t = 0 starts moving along positive x-direction with velocity v that varies as $v = a\sqrt{x}$. Show that $x \propto t^2$.

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31. A body moving with a uniform acceleration describes 12 m in third second of its motion

and 20 m in the fifth second. Find the velocity after 10 seconds.

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32. A bullet fired into a fixed target losses half of its velocity after penetrating 5cm. How much further will it penetrate before coming to rest assuming that it faces constant resistance ?

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33. A body moving with uniform acceleration attains velocity 25m/s after 5 seconds and 34 m/s after 8 second. Calculate the distance it covers in the 10th second.

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34. A car moving with a speed of 126kmh^{-1} is brought to stop within a distance of 200 m. What is its retardation and how long it takes for the car to stop ?

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35. A body covers 4 m in 3rd second and 12 m in 5th second. How far will it travel in the next three seconds (assume uniform acceleration) ?

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36. A stone is dropped from a rising balloon at a height of 75 m above the ground. It reaches the ground in 6 seconds. Calculate the velocity

of the balloon just at the moment when the stone is dropped.

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37. A balloon is rising with a speed of $5ms^{-1}$. When it is at a height of 98m a packet is dropped from it. What is the velocity of the packet when it strikes the ground?

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38. From the top of a tower 100m in height, a ball is dropped and at the same time another ball is projected vertically upwards from the ground with a velocity of $25ms^{-1}$. Find when and where two balls will meet.

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39. The displacement of a particle (in meter) moving along x axis is given by x = 18 + $5t^2$.

Calculate the instantaneous velocity at t = 2S and instantaneous acceleration.

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40. A jet aeroplane travelling at the speed of 500 km/h ejects the burnt gases at the speed of 1200 km/h relative to the jet aeroplane. Find the speed of the burnt gases w.r.t. a stationary observer on earth.

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41. A police van moving on a highway with speed 30 kmh^{-1} fires a bullet at a theif's car speeding away in the same direction with a spped of 192 kmh^{-1} . If the muzzle spped of the bullet is $150ms^{-1}$, at what speed does the bullet hit the thief's car?

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42. A man throws balls with the same speed vertically upwards one after another at an interval of 2 seconds. What should be the

speed so that more than two balls are in the sky at any time? (g = $9.8ms^{-2}$)

A. more than 19.6 ms^{-1}

B. at least 9.8 ms^{-1}

C. any speed less than 19.6 ms^{-1}

D. only speed 19.6 ms^{-1}

Answer: B

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43. Speeds of two identical cars are v and 4v at a specific instant. The ratio of respective distances in which the two cars are stopped from that instant is

A. 1:1

B. 1:4

C. 1:8

D. 1:16

Answer: D

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44. The speed of a boat is 5 km/h in still-water. It crosses a river of width 1 km along the shortest path in 20 min. The velocity of river water in km/h is

A. 5

B. 1

C. 3

D. 4

Answer: D

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45. Thief's car is moving with a speed of $10\frac{m}{s}$. A police van chasing the car with a speed of 5 ms^{-1} fires a bullet at the thief's car with muzzle velocity 72km/h. The speed with which the bullet hits the car is

A. 10 ms^{-1}

B. 20 ms^{-1}

C. 15 ms^{-1}

D. 25 ms^{-1}

Answer: C

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46. A particle is moving with a velocity 5m/s towards east and its velocity changes to 5m/s north in 10 second. Its acceleration is

A. $\sqrt{2}NW$

B. $\frac{1}{\sqrt{2}}NW$

C. $\frac{1}{\sqrt{2}}NE$

D. $\sqrt{2}NE$

Answer: B

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47. A body falling from a height travels 40 m in the last 2s of its fall to ground. The height in meter is

A. 60

B. 45

C. 80

D. 50

Answer: B

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48. A stone dropped into a lake form a tower 500 m high. The sound of splash is heard after

A. 10s

B. 11.5s

C. 14s

D. 21s

Answer: B

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49. The velocity of a body depends on time according to $v = 20 + 0.1t^2$. The body undergoes

A. uniform acceleration

B. uniform retardation

C. non-uniform acceleration

D. zero acceleration

Answer: C

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50. If X = at + bt^2 , where X is distance travelled by a body in km while t is time in second. The unit of b is

A. kms^{-1}

B. kms

C. kms^{-2}

D. kms^2

Answer: C

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51. The equation $\sqrt{x}$ = t+9 gives the variation of displacement with time. Which of the following is correct?

A. velocity is proportional to time

B. velocity is inversely proportional to time

C. acceleration depends on time

D. acceleration is constant

Answer: D

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52. A body starts from rest. The ratio of the distances travelled by it during the 4th and 3rd second is

A. 7/5

B. 5/7

C. 3/4

D. 4/5

Answer: A

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53. A body is released from a height and falls freely. Another body is released exactly 1 sec later from the same height. The seperation

between the two bodies, 2sec after the release of the second body is

A. 4.9 m

B. 9.8 m

C. 19.6 m

D. 24.5 m

Answer: D

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54. A body dropped from a height h with an initial speed zero reaches the ground with a velocity 3km/h . Another identical body was dropped from the same height with an initial speed of 4 km/h. It will reach the ground with a velocity`

A. 3 km/h

B. 4 km/h

C. 5 km/h

D. 12 km/h

Answer: C

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55. Water drops fall at regular intervals from a tap, which is 5 m above the ground. The third drop is leaving the tap at the instant the first drop touches the ground. How far above the ground is the second drop at that instant?

A. 2.5 m

B. 3.75 m

C. 4 m

D. 1.25 m

Answer: B

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56. A train 150 m in length is moving north at a speed of 10m/s. A parrot flies at a speed of 5m/s towards south parallel to the railway track. The time taken by the parrot to cross the train is

A. 12s

B. 8s

C. 10s

D. 15s

Answer: C

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57. For a body moving along a straight line, the average velocity is equal to its

instantaneous velocity. The motion of the body is

A. uniform

B. may be uniform or non-uniform

C. uniformly accelerated

D. non-uniformly accelerated

Answer: A

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58. If the time-displacement graph of a particle is parallel to time-axis, the velocity of the particle is

A. variable

B. infinity

C. zero

D. numerically equal to its acceleration

Answer: C

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59. When a particle is moving with uniform velocity which of the following changes

A. speed

B. velocity

C. position vector

D. acceleration

Answer: C

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60. The distance covered by a body moving along a straight line is proportional to the square of time. The acceleration of the body is

A. increasing

B. decreasing

C. constant

D. zero

Answer: C

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61. If a body starts from rest and travels 1.2 m in 8th second , then acceleration is

A. $0.08ms^{-2}$

B. $0.16ms^{-2}$

C. $0.20\ ms^{-2}$

D. $0.225\ ms^{-2}$

Answer: C

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62. The equation $\sqrt{x}$ = t+9 gives the variation of displacement with time. Which of the following is correct?

A. velocity is proportional to time

B. velocity is inversely proportional to time

C. acceleration depends on time

D. acceleration is constant

Answer: D

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63. If X = at + bt^2 , where X is distance travelled by a body in km while t is time in second. The unit of b is

A. kms^{-1}

B. kms^{-2}

C. kms

D. kms^2

Answer: B

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64. A body is released from the top of a tower of height h meters. It takes t seconds to reach the ground. Where is the body at time t/2 seconds?

A. at h/2 meters from the ground

B. at h/4 meters from the ground

C. at 3h/4 meters from the ground

D. depends upon its mass and volume

Answer: C

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65. The distances travelled by a body falling freely from rest in the 1st, 2nd and 3rd seconds are in the ratio.

A. 1:2:3

B. 1:3:5

C. 1:5:9

D. none of the above

Answer: C

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66. An object is projected upward with a velocity of $100ms^{-1}$. It will strike the ground in approximately

A. 10s

B. 20s

C. 15s

D. 5s

Answer: B

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67. A particle is moving eastward with a velocity of $5ms^{-1}$ in 10s, the velocity of the particle changes $5ms^{-1}$ northward. The average acceleration is

A. $\frac{1}{\sqrt{2}}ms^{-2}$ towards north-west

B. $\frac{1}{\sqrt{2}}ms^{-2}$ towards north-east

C. $\frac{1}{2}ms^{-2}$ towards north-west

D. $2ms^{-2}$ towards north-east

Answer: A

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