KINEMATICS

1. A body moves 6 m north, 8 m east and 10m vertically upwards, what is its resultant displacement from initial position:

(a) $10\sqrt{2}$ m (b) 10m

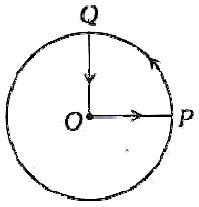
(c) $\frac{10}{\sqrt{2}}$ m (d) 10×2m

2. A man goes 10m towards North, then 20m towards east then displacement is

(a) 22.5 m (b) 25 m

(c) 25.5 m (d) 30m

3. A cyclist starts from the centre O of a circular park of radius one kilometre, reaches the edge P of the park, then cycles along the circumference and returns to the centre along QO as shown in the figure. If the round trip takes ten minutes, the net displacement and average speed of the cyclist (in metre and kilometre per hour) is



(a) 0, 1 (b) $\frac{\pi+4}{2}$, 0

(c) 21.4, $\frac{\pi+4}{2}$ (d) 0, 21.4

4. The displacement-time graph for two particles A and B are straight lines included at angles of 30^o and 60^o with the time axis. The ratio of velocities of $V_A : V_B$ is

(a) 1 : 2

(b) 1 : $\sqrt{3}$

(c) $\sqrt{3}$: 1

(d) 1 : 3

5. A cat moves from X to Y with a uniform speed υ_u and returns to X with a uniform speed υ_d. The average speed for this round trip is

(a) $\frac{2\upsilon_u\upsilon_d}{\upsilon_d+\upsilon_u}$ (b) $\sqrt{\upsilon_u\upsilon_d}$

(c) $\frac{\upsilon_d\upsilon_u}{\upsilon_d+\upsilon_u}$ (d) $\frac{\upsilon_u+\upsilon_d}{2}$

6. A particle is constrained to move on a straight line path. It returns to the starting point after 10 sec. The total distance covered by the particle during this time is 30 m. Which of the following statements about the motion of the particle is false

(a) Displacement of the particle is zero

(b) Average speed of the particle is 3 m/s

(c) Displacement of the particle is 30 m

(d) Both (a) and (b)

7. A particle moves along a semicircle of radius 10m in 5 seconds .The average velocity of the particle is

(a) 2π ms^{-1}

(b) 4π ms^{-1}

(c) 2 ms^{-1}

(d) 4 ms^{-1}

8. A person travels along a straight road for the first half time with a velocity υ_1 and the rest half time with a velocity υ_2. The mean velocity V of the man is

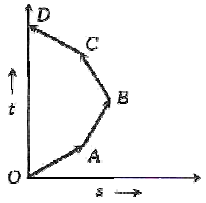
(a) $\frac{2}{V}=\frac{1}{\upsilon_1}+\frac{1}{\upsilon_2}$

(b) $V = \frac{\upsilon_1+\upsilon_2}{2}$

(c) $V = \sqrt{\upsilon_1\upsilon_2}$

(d) $V = \sqrt{\frac{\upsilon_1}{\upsilon_2}}$

9. Which of the following option is correct for the object having a straight line motion represented by the following graph



(a) The object moves with constantly increasing velocity from O to A and then it moves with constant velocity

(b) Velocity of the object increases uniformly

(c) Average velocity is zero

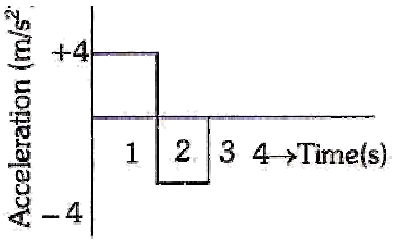
(d) The graph shown in impossible

10. A particle starts its motion from rest under the action of a constant force. If the distance covered in first 10 seconds is S_1 and that covered in the first 20 seconds in S_2, then

(a) $S_2 = 2S_1$ (b) $S_2 = 3S_1$

(c) $S_2 = 4S_1$ (d) $S_2 = S_1$

11. A particle starts from rest at t = 0 and moves in a straight line with an acceleration as shown below. The velocity of the particle at t = 3 s is



(a) 2 ms^{-1} (b) 4 ms^{-1}

(c) 6 ms^{-1} (d) 8 ms^{-1}

12. The acceleration a of a particle starting from rest varies with time according to relation $a = \alpha t + \beta$. The velocity of the particle after a time t will be

(a) $\frac{\alpha t^2}{2} + \beta$ (b) $\frac{\alpha t^2}{2} + \beta t$

(c) $\alpha t^2 + \frac{1}{2}\beta t$ (d) $\frac{(\alpha t^2 + \beta)}{2}$

13. The relation between time and distance is $t = \alpha x^2 + \beta x$, where α and β are constants. The retardation is

(a) $2\alpha\upsilon^3$ (b) $2\beta\upsilon^3$

(c) $2\alpha/\upsilon^3$ (d) $2\beta^2\upsilon^3$

14. The initial velocity of a particle is u (at t = 0) and the acceleration f is given by αt. Which of the following relation is valid

(a) $\upsilon = u + \alpha t^2$ (b) $\upsilon = u + \alpha\frac{t^2}{2}$

(c) $\upsilon = u + \alpha t$ (d) $\upsilon = u$

15. What determine the nature of the path followed by the particle

(a) Speed (b) Velocity

(c) Acceleration (d) Both (b) and (c)

16. A particle moves along x-axis as

$x = 4t - 2) + a\,(t - 2)^2$

Which of the following is true

(a) The initial velocity of particle is 4

(b) The acceleration of particle is 2a

(c) The particle is a origin at t = 0

(d) None of these

17. A body starting from rest moves with uniform acceleration. The distance covered by the body in time t is proportional to

(a) $\sqrt{t}$ (b) $t^{3/2}$

(c) t^2 (d) t^3

18. A car, starting from rest, accelerate at the rate f through a distance S. then continues at constant speed for time t and then decelerated at the rate $\frac{f}{2}$ to come to rest. If the total distance traversed in 15 S, then

(a) $S = \frac{1}{2}ft^2$ (b) $S = \frac{1}{4}ft^2$

(c) $s = \frac{1}{72}ft^2$ (d) $s = \frac{1}{6}ft^2$

19. The displacement x of a particle varies with time t, $x = ae^{-\alpha t} + be^{\beta t}$, where a, b, α and β are positive constants. The velocity of the particle will

(a) Go on decreasing with time

(b) Be independent of α and β

(c) Drop of zero when $\alpha = \beta$

(d) Go no increasing with time

20. Two cars A and B are traveling in the same direction with velocity υ_1 and υ_2 ($\upsilon_1 > \upsilon_2$). 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 will be zero collision when

(a) $d < \frac{(\upsilon_1 - \upsilon_2)^2}{2a}$ (b) $d < \frac{\upsilon_1^2 - \upsilon_2^2}{2a}$

(c) $d > \frac{(\upsilon_1 - \upsilon_2)^2}{2a}$ (d) $d > \frac{\upsilon_1^2 - \upsilon_2^2}{2a}$

21. A car moving with a speed of 40 km/h can be stopped by applying brakes after atleast 2m. If the same car is moving with a speed of 80 km/h, what is the minimum stopping distance

(a) 8 m (b) 2 m

(c) 4 m (d) 6 m

22. The acceleration 'a' in m/s^2 of a particle is given by $\alpha = 3t^2 + 2t + 2$ where t is the time. If the particle starts out with a velocity u = 2m/s at t = 0, then the velocity at the end of 2 second is

(a) 12 m/s (b) 18 m/s

(c) 27 m/s (d) 36 m/s

23. A particle moves along a straight line such that its displacement at any time t is given by $S = t^3 - 6t^2 + 3t + 4$ metres

The velocity when the acceleration is zero is

(a) $3ms^{-1}$ (b) $-12ms^{-1}$

(c) $42\ ms^{-1}$ (d) $-9ms^{-1}$

24. The position x of a particle varies with time t as $x = at^2 - bt^3$. The acceleration of the particle will be zero at time t equal to

(a) $\frac{a}{b}$ (b) $\frac{2a}{3b}$

(c) $\frac{a}{3b}$ (d) zero

25. If a train traveling at 72 kmph is to be brought to rest in a distance of 200 metres, then its retardation should be

(a) $20\ ms^{-2}$ (b) $10\ ms^{-2}$

(c) $2\ ms^{-2}$ (d) $1\ ms^{-2}$

26. If the body is moving in a circle of radius r with a constant speed v, its angular velocity is

(a) v^2/r (b) vr

(c) v/r (d) r/v

27. A cyclist turns around a curve at 15 miles/hour. If he turns at double the speed, the tendency to overturn is

(a) Doubled (b) Quadrupled

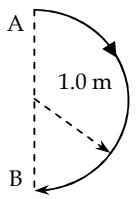
(c) Halved (d) Unchanged

28. Two particles of equal masses are revolving in circular paths of radii r_1 and r_2 respectively with the same speed. The ratio of their centripetal forces is:

(a) $\frac{r_2}{r_1}$ (b) $\sqrt{\frac{r_2}{r_1}}$

(c) $\left(\frac{r_1}{r_2}\right)^2$ (d) $\left(\frac{r_2}{r_1}\right)^2$

29. In 1.0 s, a particle goes from point A to point B, moving in a semicircle of radius 1.0 m(see figure). The magnitude of the average velocity is:



(a) 3.14 m/s (b) 2.0 m/s

(c) 1.0 m/s (d) zero

30. An aeroplane is flying with a uniform speed of 100 m/s along a circular path of radius 100 m, the angular speed of the aeroplane will be

(a) 1 rad/sec (b) 2 rad/sec

(c) 3 rad/sec (d) 4 rad/sec

31. What it the value of linear velocity, if $\vec{\omega} = 3\hat{i} - 4\hat{j} + \hat{k}$ and $\vec{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$

(a) $6\hat{i} + 2\hat{j} - 3\hat{k}$ (b) $-18\hat{i} - 13\hat{j} + 2\hat{k}$

(c) $4\hat{i} - 13\hat{j} + 6\hat{k}$ (d) $6\hat{i} - 2\hat{j} + 8\hat{k}$

32. If a_r and a_t represent radial and tangential accelerations the motion of a particle will be uniformly circular if

(a) $a_r = 0$ and $a_t = 0$ (b) $a_r = 0$ but $a_t \neq 0$

(c) $a_r \neq 0$ but $a_t = 0$ (d) $a_r \neq 0$ and $a_t \neq 0$

33. The maximum range of a gun on horizontal terrain is 16 km. If $g = 10 m/s^2$. What must be the muzzle velocity of the shell

(a) 200 m/s (b) 400 m/s

(c) 100 m/s (d) 50 m/s

34. Ratio between maximum range and square of time of flight in projectile motion is

(a) 10 : 49 (b) 49 : 10

(c) 98 : 10 (d) 10 : 98

35. An aeroplane is flying horizontally with a velocity of 600 km/h at a height of 1960 m. When it is vertically at a point A on the ground, a bomb is released from it. The bomb strikes the ground at point B. The distance AB is

(a) 1200 m (b) 0.33 km

(c) 3.33 km (d) 33 km

36. A particle moves in a plane with constant acceleration in a direction different from the initial velocity. The path of the particle will be

(a) A straight line (b) An arc of a circle

(c) A parabola (d) An ellipse

37. A bomber plane moves horizontally with a speed of 500 m/s and a bomb released form it, strikes the ground in 10 sec. Angle at which it strikes the ground will be ($g = 10 m/s^2$)

(a) $\tan^{-1}\left(\frac{1}{5}\right)$ (b) $\tan^{1}\left(\frac{1}{2}\right)$

(c) $\tan^{-1}(1)$ (d) $\tan^{-1}(5)$

38. A large number of bullets are fired in all directions with same ν. What is the maximum area on the ground on which these bullets will speed

(a) $\pi \frac{\nu^2}{g}$

(b) $\pi \frac{\nu^4}{g^2}$

(c) $\pi^2 \frac{\nu^4}{g^2}$

(d) $\pi^2 \frac{\nu^2}{g^2}$

39. A projectile fired with initial velocity u at some angle θ has a range R. If the initial velocity be doubled at the same angle of projection, then the range will be

(a) 2R (b) R/2

(c) R (d) 4R

40. A projectile moves from the ground such that its horizontal displacement is x = Kt and vertical displacement is y = Kt(1 - αt), where K and α are constants and t is time. Find out total time of flight (T) and maximum height attained (Y_{mass}) its

(a) $T = \alpha$, $Y_{mass} = \frac{K}{2\alpha}$

(b) $T = \frac{1}{\alpha}$, $Y_{mass} = \frac{2K}{\alpha}$

(c) $T = \frac{1}{\alpha}$, $Y_{mass} = \frac{K}{6a}$

(d) $T = \frac{1}{\alpha} = Y_{mass} = \frac{K}{4\alpha}$

41. A particle is projected with velocity V_0 along x-axis. The deceleration on the particle is proportion to the square of the distance from the origin i.e. $a = \alpha x^2$, the distance at which the particle stops is

(a) $\sqrt{\frac{3V_0}{2\alpha}}$ (b) $\left(\frac{3V_0}{2\alpha}\right)^{\frac{1}{3}}$

(c) $\sqrt{\frac{2V_0^2}{3\alpha}}$ (d) $\left(\frac{3V_0^2}{2\alpha}\right)^{\frac{1}{3}}$

42. Two particles A and B are projected with same speed so that the ratio of their maximum heights reached is 3 : 1. If the speed of A is doubled without altering other parameters, the ratio of the horizontal ranges attained by A and B is

(a) 1 : 1 (b) 2 : 1

(c) 4 : 1 (d) 3 : 2

43. A cricketer hits a ball with a velocity 25 m/s at 60^o above the horizontal. How far above the ground it passes over a fielder 50 m from the best (assume the ball is struck very close to the ground)

(a) 8.2 m (b) 9.0 m

(c) 11.6 m (d) 12.7 m

44. The horizontal range is four times the maximum height obtained by a projectile. The angle of projection is

(a) 90^o (b) 60^o

(c) 45^o (d) 30^o

45. A ball is thrown upwards at an angle of 60^o to the horizontal. It falls on the ground at a distance of 90 m. If the ball is thrown with the same initial velocity at an angle 30^o, it will fall on the ground at a distance of

(a) 30 m (b) 60 m

(c) 90 m (d) 120 m

46. A stone projected with a velocity u at an angle θ with the horizontal reaches maximum height H_1. When its is projected with velocity u at an angle $\left(\frac{\pi}{2}-\theta\right)$ with the horizontal, it reaches maximum height H_2. The relation between the horizontal range R of the projectile, H_1 and H_2 is

(a) $R = 4\sqrt{H_1H_2}$ (b) $R = 4(H_1 - H_2)$

(c) $R = 4(H_1 + H_2)$ (d) $R = \frac{H_1^2}{H_2^2}$

47. The horizontal range of projectile is $4\sqrt{3}$ times its maximum height, its angle of projection will be

(a) 45^o (b) 60^o

(c) 90^o (d) 30^o

48. An object is projected at an angle of 45^o with the horizontal. The horizontal range and the maximum height reaches will be in the ratio.

(a) 1 : 2 (b) 2 : 1

(c) 1 : 4 (d) 4 : 1

49. The coordination of a moving particle at any time '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) $\sqrt{\alpha^2+\beta^2}$ (b) $3t\sqrt{\alpha^2+\beta^2}$

(c) $3t^2\sqrt{\alpha^2+\beta^2}$ (d) $t^2\sqrt{\alpha^2+\beta^2}$

50. A stone tied to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. The magnitude of the change in its velocity as it reaches a position where the string is horizontal is

(a) $\sqrt{u^2-2gL}$ (b) $\sqrt{2gL}$

(c) $\sqrt{u^2+gl}$ (d) $\sqrt{2(u^2-gL)}$

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ANSWERS KEY

1	A	**11**	B	**21**	A	**31**	B	**41**	D
2	A	**12**	B	**22**	B	**32**	C	**42**	C
3	D	**13**	A	**23**	D	**33**	B	**43**	A
4	D	**14**	B	**24**	C	**34**	B	**44**	C
5	A	**15**	D	**25**	D	**35**	C	**45**	C
6	C	**16**	B	**26**	C	**36**	C	**46**	A
7	D	**17**	C	**27**	B	**37**	A	**47**	D
8	B	**18**	C	**28**	A	**38**	B	**48**	D
9	C	**19**	D	**29**	B	**39**	D	**49**	C
10	C	**20**	C	**30**	A	**40**	D	**50**	D