EXERCISE - 1

(Single option Correct)

1. A lift ascends with a constant acceleration of $4\,m/s^2$, then with a constant velocity v and then moves with a constant retardation of $4m/s^2$ to finally come to rest If the total height ascended be 20 m and the total time taken be 6 s, then the time during which the lift was moving with constant velocity v is
(a) 2 s (b) 3 s (c) 4 s (d) 5 s

2. A particle moves along a straight line such that its displacement x changes with time t as $x = \sqrt{at^2 + 2bt + c}$ where a, b and c are constants, then the acceleration varies as
(a) $\frac{1}{x}$ (b) $\frac{1}{x^2}$ (c) $\frac{1}{x^3}$ (d) $\frac{1}{x^4}$

3. A particle moves along a straight line such that the relation between time t and displacement s is $s^2 = t$, then
(a) acceleration is positive and directly proportional to v^2
(b) acceleration is positive and directly proportional to v^3
(c) acceleration is negative and directly proportional to v^2
(d) acceleration is negative and directly proportional to v^3

4. A particle starts from rest, with an acceleration $a = \frac{\lambda}{x^2}$, where $\lambda > 0$ and x is the distance of the particle from a fixed point O. The particle is at a distance μ from O, when it is at rest. Its velocity when at a distance 2μ from O is
(a) $\sqrt{\frac{\lambda}{\mu}}$ (b) $\sqrt{\frac{\lambda}{2\mu}}$ (c) $\sqrt{\frac{2\lambda}{\mu}}$ (d) none of these

5. A particle starts from a point x = 0 along the positive X – axis with a velocity v varying with x as $v = \mu\sqrt{x}$, the average velocity of the particle over the first s meters of its path is
(a) $\mu\sqrt{s}$ (b) $\mu\sqrt{\frac{s}{2}}$ (c) $2\mu\sqrt{s}$ (d) $\frac{\mu}{2}\sqrt{s}$

6. The displacement x and time t for a particle moving in one dimension is given by $t = ax^2 + bx$, where a and b are constants. The deceleration of the particle is
(a) bv^2 (b) $2av^3$ (c) $2b^2v^2$ (d) $2abv^3$

7. The acceleration 'a' for a particle depends on displacement s as a = 5 + s. At t = 0, s = 0 and velocity v = 5. Then the velocity v, corresponding to displacement s is given by
(a) v = 5 + s (b) $v = \sqrt{5+s}$ (c) $v = \sqrt{s^2 + 10s}$ (d) v = s - 5

8. Position of a particle moving along x – axis is given by $x = 2 + 8t - 4t^2$, where t is time in sec. The distance traveled by the particle in the first two seconds is:
(a) 2 units (b) 8 units (c) 10 units (d) 16 units

9. For a velocity versus time graph, which of the following statement is true
(a) The curve can be a circle
(b) The area under the curve and above the x- axis, between any two instants gives the average acceleration.
(c) The slope at any instant yields the rate of change of acceleration at the instant
(d) None of these

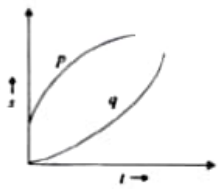
10. The displacement time graph for a particle is a straight line parallel to time axis. It necessarily implies that:
(a) The object is stationary with velocity zero
(b) the acceleration of the object is zero
(c) Both (a) and (b)
(d) none of the above

11. For motion with uniform velocity :
(a) The velocity time graph is a straight line parallel to the time axis.
(b) The position time graph is a parabola with its axis as the time axis
(c) The acceleration time graph is a straight line inclined with the time axis
(d) None of the above

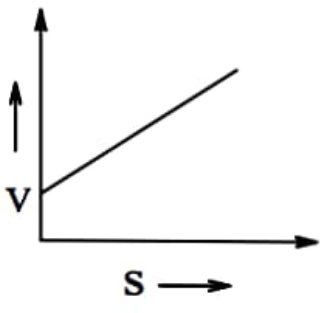
12. A train takes t sec to perform a journey. It travels for $\left(\frac{t}{n}\right)$ sec with uniform acceleration, then for $(n-3)\frac{t}{n}$ sec with uniform speed v and finally it comes to rest with uniform retardation. The average speed of the train is

(a) $(3n-2)\frac{v}{2n}$
(b) $(2n-3)\frac{v}{2n}$
(c) $(3n-2)\frac{v}{3n}$
(d) $(2n-3)\frac{v}{3n}$

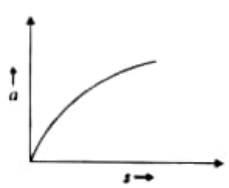
13. The time dependence of the position of two bodies moving along a straight line is given by curves p and q respectively. Then
(a) curve q corresponds to decelerated motion
(b) curve p corresponds to accelerated motion
(c) velocity at the end of the motion is more for the body corresponding to curve q
(d) none of these



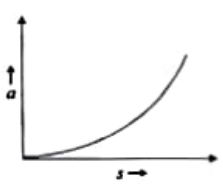
14. The graph given to the right is the velocity (v) versus displacement (s) graph of a particle moving in straight line. Which of the following graphs best represents the acceleration versus displacement graph?

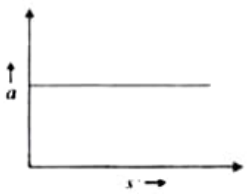


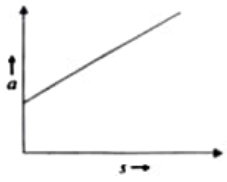
(a)



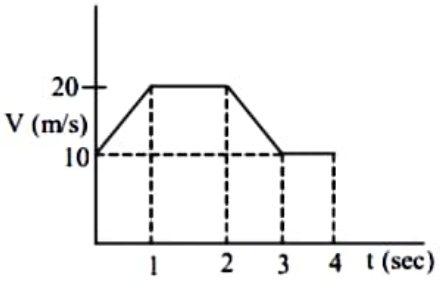
(b)



(c) 

(d) 

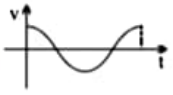
15. Figure given below shows the variation of velocity with time for a particle moving along a straight line, the average velocity, during the entire motion is



(a) 15 m/s (b) 7.5 m/s
(c) 6.25 m/s (d) 13.75 m/s

16. A train moving with a velocity of 30km/hr had to slow down to15 km/hr due to repairs along the way and then after some time regains its original speed. If the distance covered during retardation be one km and that during acceleration be half km, the time lost in the journey is
(A) 3 min. (B) 4 min. (C) 2 min. (D) 1 min.

17. If position time graph of a particle is sine curve as shown, what will be its velocity-time graph?

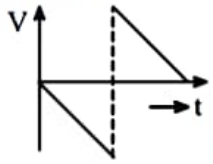
(A) 

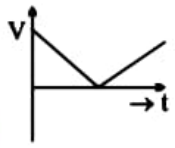
(B) 

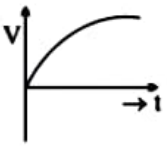
(C) 

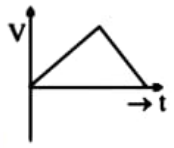
(D) 

18. The velocity- time graph of a body falling from rest under gravity and rebounding the same height from a solid surface is represented by which of the following graphs?

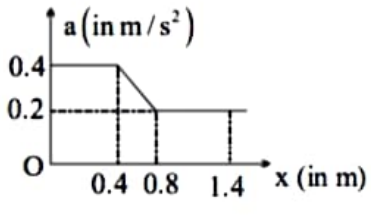
(A) 

(B) 

(C) 

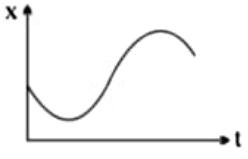
(D) 

19. The acceleration of a particle which moves along the positive x-axis varies with its position as shown. If the velocity of the particle is 0.8 m/s at x = 0, the velocity of the particle at x = 1.4 is(in m/s)



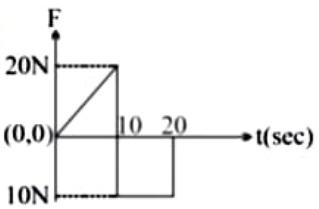
(A) 1.6 (B) 1.2
(C) 1.4 (D) none of these

20. The graph of position *x* versus time *t* represents the motion of a particle. If *b* and *c* are both positive constants and b > c, which of the following expressions best describes the acceleration a of the particle?



(A) a = b – ct (B) a = + b (C) a = – c (D) a = b + ct

21. A particle of mass 1 kg is acted upon by a force 'F' which varies with time as shown in the figure. If initial velocity of the particle is $10ms^{-1}$, the maximum velocity attained by the particle during the period is



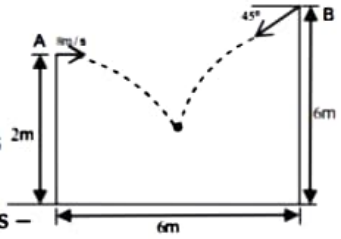
(A) 210 ms^{-1} (B) 110 ms^{-1}

(C) 100 ms^{-1} (D) 90 ms^{-1}

22. A particle moves in the xy plane with velocity $V = k_1\hat{i} + k_2x\hat{j}$, where $\hat{i}$ and $\hat{j}$ are the unit vectors along the x and y axes, and k_1 and k_2 are constants. At the initial moment of time the particle was located at the point x = y = 0, then the equation of the particle's trajectory y (x) is -

(A) $y = \frac{k_1}{2k_2}x^2$ (B) $y = \frac{k_2}{2k_1}x^2$ (C) $y = \frac{2k_1}{k_2}x^2$ (D) $y = \frac{2k_2}{k_1}x^2$

23. From points A and B at the respective heights of 2m and 6m, two bodies are thrown simultaneously towards each other; one is thrown horizontally with a velocity of 8m/s and the other, downward at an angle of 45° to the horizontal at an initial velocity such that the bodies collide in flight. The horizontal distance between points A and B equals 6m. The initial velocity v_0 of the body thrown at an angle 45° is –



(A) $4\sqrt{2}\,m/s$ (B) $8\sqrt{2}\,m/s$ (C) $16\sqrt{2}\,m/s$ (D) $32\sqrt{2}\,m/s$

24. The trajectory of a projectile in a vertical plane is $y = ax - bx^2$, where a, b are constants, and x and y are respectively the horizontal and vertical distances of the projectile form the point of projection. The maximum height attained is ..... and the angle of projection with the horizontal is .....

(A) $\frac{a^2}{2b}, \tan^{-1}(a)$ (B) $\frac{a^2}{2b}, \tan^{-1}(b)$ (C) $\frac{a^2}{4b}, \tan^{-1}(a)$ (D) $\frac{a^2}{4b}, \tan^{-1}(b)$

EXERCISE - 2

(More than one option is Correct)

1. The displacement x of a particle varies with time t as $x = \alpha t^2 - \beta t^3$

(A) particle will return to its starting point after time $\frac{\alpha}{\beta}$.

(B) the particle will come to rest after time $\frac{2\alpha}{3\beta}$

(C) the initial velocity of the particle was zero but its initial acceleration was not zero.

(D) no net force act on the particle at time $\frac{\alpha}{3\beta}$

2. A particle moves along x-axis and displacement varies with time t as $x = \left(t^3 - 3t^2 - 9t + 5\right)$. Then

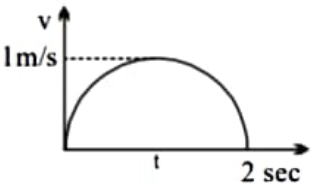
(A) in the interval 3< t< 5, the particle is moving in +x direction

(B) the particle reverses its direction of motion twice in entire motion if it starts at t = 0

(C) the average acceleration from $1 \le t \le 2$ seconds is $6\,m/s^2$.

(D) in the interval $5 \le t \le 6$ seconds, the distance travelled is equal to the displacement.

3. Velocity-time graph for a car is semicircle as shown here. Which of the following is correct ?



(A) Car must move in circular path.
(B) Acceleration of car is never zero.
(C) Mean speed of the particle is $\pi/4$ m/s.
(D) The car makes a turn once during its motion.

4. 2 bodies start moving in straight line simultaneously from point O. The first body moves with constant velocity of $40\,m/s$ & and the second body starts from rest with a constant acceleration of $4\,m/s^2$

(a) Time that elapses before the second body catches up with the first body is $20s$.

(b) Greatest distance between the two bodies prior to their meeting is $200m$

(c) Time elapsed when the distance between them is maximum is $10s$

(d) All above statements are false.

5. Velocity V of a moving point, on x – axis varies with its x – coordinate as $V=\beta x^{\frac{1}{3}}$ when β is a positive constant. Assuming the particle to start from origin.

(a) Acceleration of particle is variable.

(b) Mean velocity of point averaged over time T from starting is $\left(\frac{2\beta}{3}\right)^{\frac{3}{2}}\sqrt{T}$

(c) Mean velocity of point averaged over the time taken by the point to move from the origin to the point where its x – coordinate becomes x_0 is $\frac{2\beta x_0^{\frac{1}{3}}}{3}$

(d) All above statements are false.

6. A particle starts rectilinearly from station A with acceleration varying according to $a=\alpha-\beta s$ & comes to halt at station B, α & β are positive constants & s is its distance from station A,

(a) Distance between A & B is $\frac{2\alpha}{\beta}$

(b) Maximum velocity of particle is $\frac{\alpha}{\sqrt{\beta}}$

(c) Distance yet to be covered, when particle attains its maximum velocity is $\frac{\alpha}{\beta}$

(d) Maximum velocity is 2α

7. A platform is moving upwards with constant acceleration of $2\,m/s^2$. At time $t=0$, a boy standing on platform throws a ball upwards with speed of $8\,m/s$ (with respect to himself). At this instant, platform was at a height of $4\,m$ from ground & was moving with $2\,m/s$ speed. Take $g=10\,m/s^2$

(a) Ball strikes platform at height of $\frac{76}{9}$ m

(b) Ball strikes platform in time $\frac{4}{3}$ s

(c) Maximum height attained by ball from ground is $9\,m$.

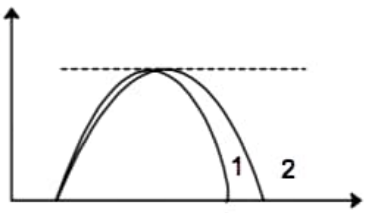
(d) Maximum distance of ball from platform is $\frac{8}{3}$ m

8. A man is standing on a truck moving with a constant velocity of 15 m/s on a horizontal road. The man throws a ball in such a way that it returns to the truck after the truck has moved 60 m
(Take $g = 10\,m/s^2$)
(a) Speed of the ball as seen from the truck is 20 m/s
(b) Angle of projection as seen from the truck is 90^o with horizontal.
(c) Speed of ball as seen from the ground is 25 m/s
(d) Angle of projection as seen from the ground is 53^0

9. A car is moving rectilinearly on a horizontal path with acceleration a_0. A person sitting inside the car observes that an insect S is crawling up the screen with an acceleration a. If θ is the inclination of the screen with the horizontal, the acceleration of the insect;
(a) parallel to screen is $(a + a_0 \cos\theta)$ (b) along the horizontal is $(a_0 - a\cos\theta)$
(c) perpendicular to screen is $a_0 \sin\theta$ (d) perpendicular to screen is $a_0 \tan\theta$

10. A particle is projected from a point P with a velocity v at an angle θ with horizontal. At a certain point Q it moves at right angle to its initial direction. Then:
(a) velocity of particle at Q is v sin θ
(b) velocity of particle at Q is v cot θ
(c) time of flight from P to Q is (v/g) cosec θ
(d) time of flight from P to Q is (v/g) sec θ

11. Trajectories of two projectiles are shown in figure. Let T_1 and T_2 be the time periods and u_1 and u_2 be the speeds of projection of the two projectiles respectively.
Then :
(a) $T_2 > T_1$ (b) $T_2 = T_1$
(c) $u_1 > u_2$ (d) $u_1 < u_2$

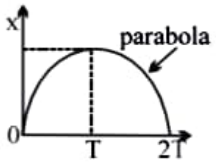


12. Choose the correct alternative(s).
(a) If the greatest height to which a man can throw a stone is h, then the greatest horizontal distance upto which he can throw the stone is 2*h*
(b) The angle of projection with the horizontal for a projectile whose range R is n times the maximum height H is $\tan^{-1}(4/n)$
(c) The time of flight T and the horizontal range R of a projectile are connected by the equation $gT^2 = 2R\tan\theta$, where θ is the angle of projection
(d) A ball is thrown vertically up. Another ball is thrown at an angle θ with the vertical. Both of them are thrown from horizontal ground and both remain in air for the same period of time. Then the ratio of maximum heights attained by the two balls is 1:1

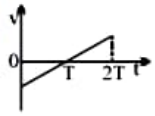
EXERCISE - 3

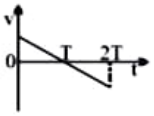
COMPREHENSION – 1

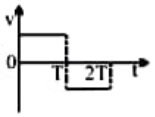
The x-t graph of a particle moving along a straight line is shown in figure

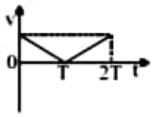


1. The v-t graph of the particle is correctly shown by

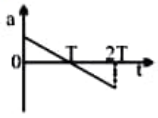
(A) 

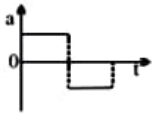
(B) 

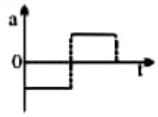
(C) 

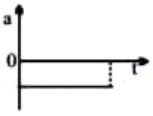
(D) 

2. The a-t graph of the particle is correctly shown by

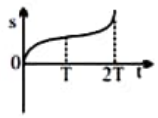
(A) 

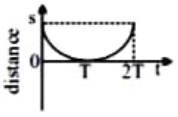
(B) 

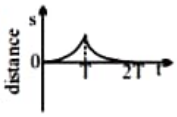
(C) 

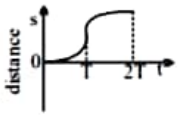
(D) 

3. The distance-time graph of the particle is correctly shown by

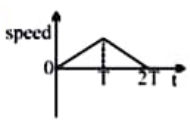
(A) 

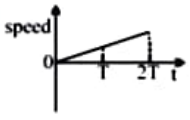
(B) 

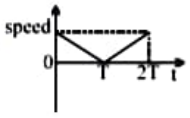
(C) 

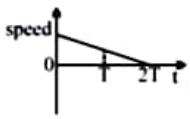
(D) 

4. The speed-time graph of the particle is correctly shown by

(A) 

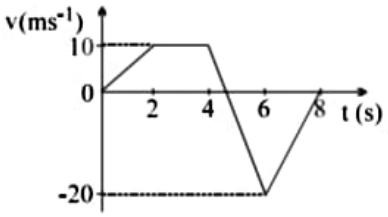
(B) 

(C) 

(D) 

COMPREHENSION – 2

The figure shows a velocity-time graph of a particle moving along a straight line



5. The particle is not at rest at
(A) t = 0 s (B) t = 5 s (C) t = 8 s (D) all of the above

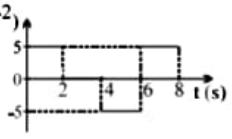
6. Identify the region in which the rate of change of velocity $\left|\frac{\Delta \vec{v}}{\Delta t}\right|$ of the particle is maximum
(A) 0 to 2s (B) 2 to 4s (C) 4 to 6 s (D) 6 to 8 s

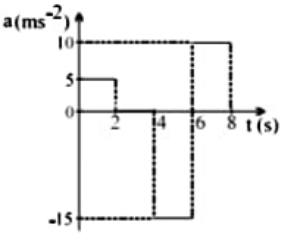
7. If the particle starts from the position $x_0 = -15$ m, then its position at t = 2s will be x=
(A) –5 m (B) 5 m (C) 10 m (D) 15 m

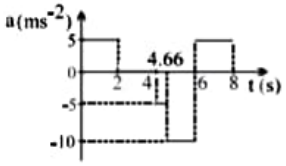
8. The maximum displacement of the particle is
(A) 33.3 m (B) 23.3 m (C) 18.3 m (D) zero

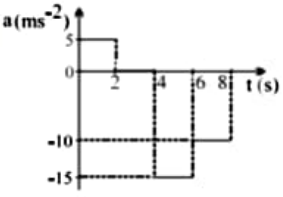
9. The total distance travelled by the particle is
(A) 66.6 m (B) 51.6 m (C) zero (D) 36.6 m

10. The correct acceleration-time graph of the particle is shown as

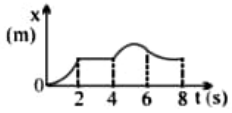
(A) 

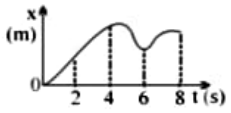
(B) 

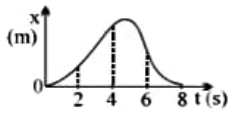
(C) 

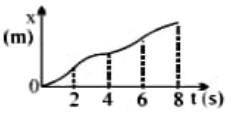
(D) 

11. The correct displacement-time graph of the particle is shown as

(A) 

(B) 

(C) 

(D) 

COMPREHENSION – 3

The distance from A to B is *l*. A plane files at constant speed v relative to air along straight line from A to B and then back from B to A. Calculate the total time taken for this round trip, if a wind is blowing in three directions with velocity u. The direction of wind for the three cases is given below.

12. Along the line from A to B

(A) $\frac{2l}{v\left(1+\frac{2u^2}{v^2}\right)}$ (B) $\frac{2l}{v\left(1-\frac{u^2}{v^2}\right)}$ (C) $\frac{2l}{v\sqrt{1-\frac{u^2}{v^2}}}$ (D) $\frac{2l}{v\sqrt{1+\frac{u^2}{v^2}}}$

13. Perpendicular to line AB,

(A) $\frac{2l}{v\left(1+\frac{u^2}{v^2}\right)}$ (B) $\frac{2l}{v\left(1-\frac{u^2}{v^2}\right)}$ (C) $\frac{2l}{v\sqrt{1-\frac{u^2}{v^2}}}$ (D) $\frac{2l}{v\sqrt{1+\frac{u^2}{v^2}}}$

14. At an angle θ to line AB

(A) $\frac{2l\sqrt{1-\left(\frac{u^2}{v^2}\right)\sin^2\theta}}{v\times\left(1-\frac{u^2}{v^2}\right)}$

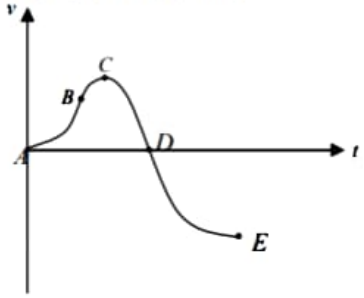
(B) $\frac{2l}{v}\times\frac{\sqrt{1-\frac{u^2}{v^2}\cos^2\theta}}{1-\frac{u^2}{v^2}}$

(C) $\frac{2l}{v}\times\frac{\sqrt{\frac{u}{v}\cos^2\theta}}{1-\frac{u^2}{v^2}}$

(D) $\frac{2l}{v}\times\frac{\sqrt{1-\frac{u^2}{v^2}}}{1-\left(\frac{u^2}{v^2}\right)\sin^2\theta}$

MATCH LIST – 1

The velocity – time graph of a particle moving along X – axis is shown in the figure. Match the entries of Column I with entries of Column – II .

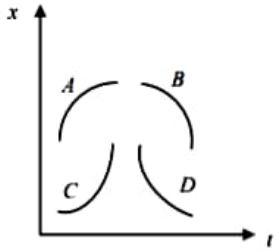


Column – I	**Column – II**
(A) For AB , particle is	(P) moving in +ve x – direction with an increasing speed
(B) For BC , particle is	(Q) moving in +ve x – direction with a decreasing speed
(C) For CD, particle is	(R) moving in –ve x – direction with an increasing speed
(D) For DE, particle is	(S) moving in – ve x – direction ith a decreasing speed

MATCH LIST – 2

Column (I) shows the position - time graph of the particle moving along x- axis .

Column – I



Column – II

(P) Accelerating

(Q) Decelerating

(R) Speeding up

(S) Slowing down

Exercise – 1

1. (C)	2. (C)	3. (D)	4. (A)	5. (D)	6. (B)	7. (A)
8. (B)	9. (D)	10. (C)	11. (A)	12. (B)	13. (C)	14. (D)
15. (A)	16. (D)	17. (C)	18. (A)	19. (B)	20. (A)	21. (B)
22. (B)	23. (C)	24. (C)				

Exercise – 2

1. (A, B, C, D)	2. (A, D)	3. (C)	4. (A, B, C)	5. (A, B, C)
6. (A, B, C)	7. (A, B, C, D)		8. (A, B, C, D)	9. (B, C)
10. (B, C)	11. (B, D)		12. (A, B, C, D)	

Exercise – 3

Comprehension Type

1. (B)	2. (D)	3. (A)	4. (C)	5. (B)	6. (C)	7. (A)
8. (A)	9. (A)	10. (B)	11. (C)	12. (B)	13. (C)	14. (A)

Match List – 1

A – p: B – p: C – q: D – R

Match List – 2

A – q, s: B – p, r: C – p, r: D – q, s

Exercise – 4

1. (15 m/s, 133.33 s, 200 s, 266.67 s)
2. (45 km / hr,)
3. (122.7 km/hr)
4. (300 m)
5. (0.793 m)
6. (61 cm/s)
7. (3 km/hr)
8. (50 m/s)
9. (13 m/ s)
10. (58.8 m)
11. $\left(\sqrt{\frac{2gh}{2+\cot^2\theta}}\right)$
14. $\frac{7\sqrt{3}}{5}$m
15. $\left(\frac{1}{2}\right)$
16. 12.0s
17. 46.47 ms^{-1}

Previous IIT – JEE Questions

1. (a) $\left(\frac{\alpha\beta t}{\alpha+\beta}\right)$ (b) $\left(\frac{\alpha\beta t^2}{2(\alpha+\beta)}\right)$
2. displacement = 0
3. 1:1
4. B
5. T
6. (a) $\theta = 45^0$ (b) 2 m/s
7. B
8. A
9. (i) 1 s . ; (ii) $\left(5\sqrt{3}, 5\right)$
10. (a) $\frac{u^2\sin 2\alpha}{g\cos\theta}$, (b) $\frac{u\cos(\alpha+\theta)}{\cos\theta}$
11. u = 7.29 m/s, t = 1 s.
12. (2 OR 8)
13. (5)