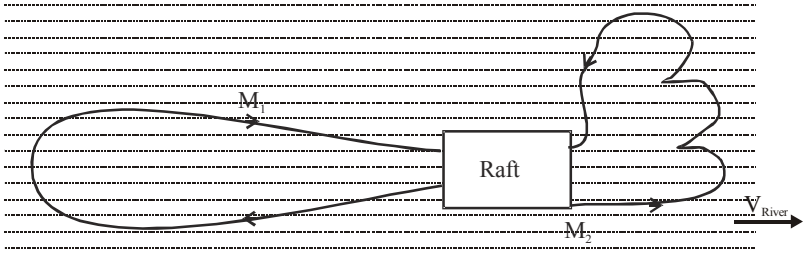
CLASS TEST

SECTION-I

Single Correct Answer Type **13 Q. [Marks 3 (–1)]**

1. Two motorboats M_1 & M_2 start at time t = 0 from raft in river and after time t_0 they come back to the raft. Speed of motorboats in still water is equal. Paths of M_1 and M_2 as seen by observer on raft are shown in figure then (River is flowing uniformly with non-zero velocity) :-



(A) w.r.t. Raft during the time intervel t = 0 to t = $\frac{t_0}{2}$ both travel same distance.

(B) w.r.t. ground during the time intervel t = 0 to t = $\frac{t_0}{2}$ both travel same distance.

(C) w.r.t. Raft during the time intervel t = 0 to t = $\frac{t_0}{2}$ magnitude of displacement is same for both.

(D) w.r.t. ground during the time intervel t = 0 to t = $\frac{t_0}{2}$ magnitude of displacement is same for both.

2. A particle is released from rest from top of a fixed wedge of inclination angle α with horizontal. An another particle is projected at an angle θ with horizontal such that its horizontal range is equal to the base length of the wedge. Also time taken by first particle to reach bottom of wedge & time of flight of second particle is same then angle θ is

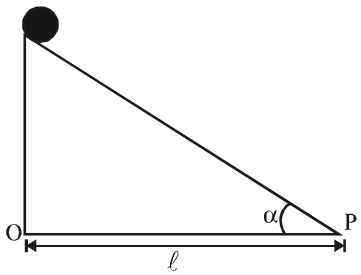


Fig. (i)

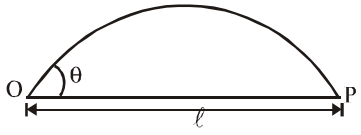
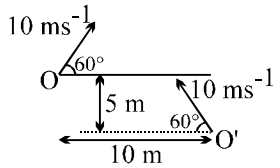


Fig. (ii)

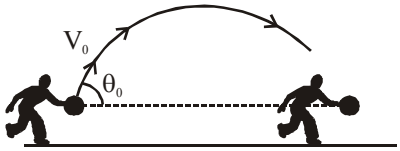
(A) $\tan^{-1}$ (2 cosecα) (B) $\tan^{-1}$ [2 sin2α] (C) $\tan^{-1}$ [2 cosec 2α] (D) $\tan^{-1}$ [3 cosec 2α]

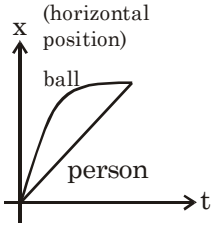
3. Two particles are projected simultaneously from two points O and O' such that 10 m is the horizontal and 5 m is the vertical distance between them as shown in the figure. They are projected at the same inclination 60° to the horizontal with the same velocity 10 ms^{-1}. The time after which their separation becomes minimum is

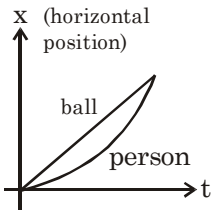


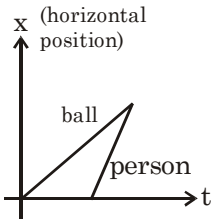
(A) 2.5 sec (B) 1 sec (C) 5 sec (D) 10 sec

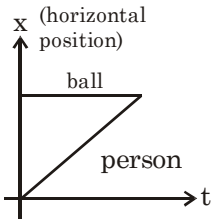
4. A person initially at rest throws a ball upward at an angle θ_0 with horizontal with an initial speed v_0. He tries to catch the ball by accelerating with a constant acceleration. He catches the ball at exactly the same height he threw the ball. Let g be the gravitational acceleration. Which of the following graphs represents the above situation?



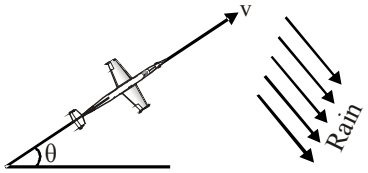
(A) 

(B) 

(C) 

(D) 

5. Rain is falling with speed $12\sqrt{2}$ m/s at an angle of 45° with vertical line. A man in a glider going at a speed of *v* at angle of 37° with horizontal with respect to ground. Find the speed (in m/s) of glider so that rain appears to him falling vertically. Consider motion of glider and rain drops in same vertical plane.

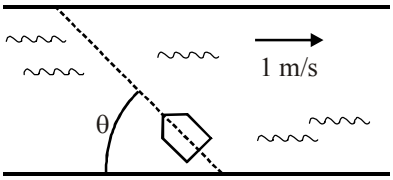


(A) 15 (B) 60 (C) 25 (D) none of these

6. A boat moves with full power downstream in a river. At t = 0 it was right infront of a point A on the shore. At t = 1 hr it was right infront of a point B where it turns back and starts moving upstream with full power. A plank that is floating in river was met at t = 0 by the boat and was again met at C while going upstream. If AB = 6 km and AC = 4 km, the value of t when boat returns back infront of A is :-
(A) 2 hr (B) 3 hr (C) 4 hr (D) 5 hr

7. A boat is traveling upstream at 14km/h with respect to a river that is flowing at 6km/h (with respect to the ground. A man runs directly across the boat, from one side to the other, at 6km/h (with respect to the boat). The speed of the man with respect to the ground is
(A) 10 km/h (B) 14 km/h (C) 18.5 km/h (D) 21 km/h

8. A boy wishes to row across a river in the shortest possible time. He can row at 2 m/s in still water and the river is flowing at 1 m/s. At what angle θ should he point the bow (front) of his boat ?



(A) 30° (B) 45° (C) 60° (D) 90°

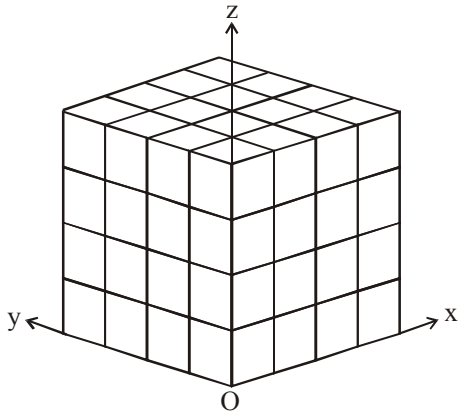
9. A projectile of mass 1.50 kg leaves the ground with a kinetic energy of 200 J. Only gravity acts on the projectile after it leaves the ground. At the highest point in its trajectory, its kinetic energy is 100 J. To what vertical height, relative to its launch point, did it rise?
(A) 12.2 m (B) 5.10 m (C) 9.14 m (D) 6.67 m

10. A particle moves in XY plane such that its position, velocity and acceleration are given by

$$\vec{r} = x\hat{i} + y\hat{j}\ ;\ \vec{v} = v_x\hat{i} + v_y\hat{j}\ ;\ \vec{a} = a_x\hat{i} + a_y\hat{j}$$

Which of the following condition is correct if the particle is speeding down?
(A) $xv_x + yv_y < 0$ (B) $xv_x + yv_y > 0$ (C) $a_xv_x + a_yv_y < 0$ (D) $a_xv_x + a_yv_y > 0$

11. A child starts at one corner of a cubical jungle gym in a playground and climbs up to the diagonally opposite corner. The original corner (O) is the coordinate origin, and the x-, y- and z-axes are oriented along the jungle gym edges. The length of each side is 2 m. The child's displacement is:



(A) $2\hat{\mathbf{i}}+2\hat{\mathbf{j}}+2\hat{\mathbf{k}}$ (B) $2.8\hat{\mathbf{i}}+2.8\hat{\mathbf{j}}+2\hat{\mathbf{k}}$ (C) $2\hat{\mathbf{i}}+2\hat{\mathbf{j}}+2.8\hat{\mathbf{k}}$ (D) $2\hat{\mathbf{i}}+2\hat{\mathbf{j}}+3.5\hat{\mathbf{k}}$

12. The time of flight of a bullet over a horizontal range R is T second. The angle of projection will be equal to :-

(A) $\tan^{-1}\left(\frac{gT^2}{2R}\right)$ (B) $\tan^{-1}\left(\frac{2R}{gT^2}\right)$ (C) $\tan^{-1}\left(\frac{T}{Rg}\right)$ (D) $\tan^{-1}\left(\frac{Rg}{T}\right)$

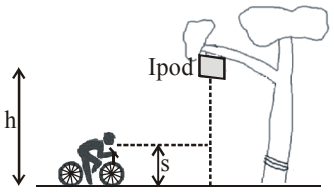
13. A projectile is projected with speed u at an angle of 60^o with horizontal from the foot of an inclined plane. If the projectile hits the inclined plane horizontally, the range on inclined plane will be :-

(A) $\frac{u^2\sqrt{21}}{2g}$ (B) $\frac{3u^2}{4g}$ (C) $\frac{u^2}{8g}$ (D) $\frac{\sqrt{21}}{8}\frac{u^2}{g}$

Linked Comprehension Type (1 Para × 2 Q.) [Marks 4 (–1)]
(Multiple Correct Answer Type)

Paragraph for Question no. 14 and 15

A bicycle rider is traveling at a constant speed along a straight road and then gradually applies the brakes during a time interval $0 < t < t_f$ until the bicycle comes to a stop. The combined mass of the cyclist and bicycle is m. Assume that the magnitude of the braking acceleration increases linearly in time according to $|\vec{a}| = bt/m, \quad 0 < t < t_f$, where $b > 0$ is a constant.



At the instant the person applies the brakes, a horizontal distance from the rider, the wind blows and snaps an iPod off the branch of the tree with a zero initial speed . The ipod was initially a height h above the ground. The cyclist catches the iPod at the instant the cyclist has come to a stop. You may assume that the cyclist catches it at a height 's' above the ground.

14. Which of the following is/are **CORRECT** ?

(A) The time at which the cyclist catches the iPod is $\sqrt{\frac{2(h-s)}{g}}$

(B) The time at which the cyclist catches the iPod is $\sqrt{\frac{(h-s)}{g}}$

(C) The initial speed of the cyclist is $\frac{b(h-s)}{mg}$

(D) The initial speed of the cyclist is $\frac{2b(h-s)}{mg}$

15. Which of the following is/are **CORRECT** ?

(A) The retardation of cyclist at the moment he catches the iPod is $\frac{b}{m}\sqrt{\frac{2(h-s)}{g}}$

(B) The retardation of cyclist at the moment he catches the iPod is $\frac{b}{m}\sqrt{\frac{(h-s)}{g}}$

(C) The distance travelled by cyclist till the instant he catches the iPod is $\frac{b}{3m}\left[\frac{2(h-s)}{g}\right]^{3/2}$

(D) The distance travelled by cyclist till the instant he catches the iPod is $\frac{b}{3m}\left[\frac{2h-s}{g}\right]^{3/2}$

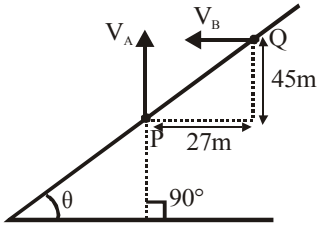
SECTION-IV

Numerical Grid Type (Single digit Ranging from 0 to 9) 3 Q. [Marks 4(–2)]

1. On a day rain is falling vertically. A boy cycling on the road finds rain falling at an angle 30° with vertical relative to him when moves with speed v_1. On increasing speed to v_2 rain falls at an angle 60° with vertical relative to him. Find $\frac{v_2}{v_1}$.

2. A particle is moving in a plane with velocity given by $\vec{v} = v_0\hat{i} + a\omega\cos\omega t\hat{j}$. If particle is at origin at t=0 then its trajectory is given by equation $y = a^m \sin\left(\frac{\omega x^n}{v_0}\right)$. Find the value of $(m+2n)^2$.

3. Two particles A and B are projected simultaneously from points P and Q respectively as shown in figure. Particle A was projected vertically while particle B was projected horizontally. If horizontal and vertical component of PQ are 27 m and 45 m respectively then find the minimum value of V_B in m/s for which a collision is possible between A and B.



Matrix Match Type (4 × 5) 1 Q. [8 M (for each entry +2(0)]

1. Match the following question.

Column-I	Column-II
(A) Positive acceleration	(P) Speed may increase uniformly
(B) Constant negative acceleration	(Q) Speed may decrease uniformly
(C) Distance does not change with time	(R) Speed is zero
(D) Acceleration is perpendicular to velocity	(S) Speed is constant
	(T) Speed may increase non uniformly

CLASS TEST # 15 (TNPS) **ANSWER KEY**

SECTION-I

Single Correct Answer Type **13 Q. [Marks 3 (–1)]**

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

Linked Comprehension Type **(1 Para × 2 Q.) [Marks 4 (–1)]**

(Multiple Correct Answer Type)

14. Ans. (A,C) **15. Ans. (A,C)**

SECTION-IV

Numerical Grid Type (Single digit Ranging from 0 to 9) **3 Q. [Marks 4(–2)]**

1. Ans. 3 **2. Ans. 9** **3. Ans. 9**

Matrix Match Type (4 × 5) **1 Q. [8 M (for each entry +2(0)]**

1. Ans. (A)→P,Q,T ; (B)→P,Q ; (C)→R ; (D)→S