ONLY ONE OPTION CORRECT TYPE

SECTION (A) : RELATIVE MOTION IN ONE DIMENSION

1.	A motorcycle is moving same direction. What is (1) 15 km/hr towards ca (3) 25 km/hr away from	y with a velocity 80 km/h s the relative velocity of t ar a car	r ahead of a car moving with a velocity of 65 km/hr in the he motorcycle with respect to the car- (2) 15 km/hr away from (4) 145 km/hr towards car					
2.	50 m long trains are 15 m/s. respectively Th	e crossing each other ien time-taken by trains t	in opposite direction with velocity of 10 m/s and to cross each other will be-					
	(1) 2 sec.	(2) 4 sec.	(3) 6 sec.	(4) 8 sec.				
3.	Theif's car is moving with a speed of 10 m/s. A police van chasing this car with a speed of 5 m/s fires a bullet at the theif's car with muzzle velocity 72 km/h. Find the speed with which the bullet will hit the car-							
	(1) 10 m/s	(2) 20 m/s	(3) 15 m/s	(4) 25 m/s				
4.	A person standing on the floor of an elevator drops a coin. The coin reaches the floor of the elevator in a time t_1 if the elevator is stationary and in time t_2 if it is moving with constant velocity. Then-							
	(1) $t_1 = t_2$	(2) $t_1 < t_2$	(3) $t_1 > t_2$	(4) $t_1 < t_2 \text{ or } t_1 > t_2$				
5.	A train in moving in the north at a speed 10 m/sec. Its length is 150 m. A parrot is flying parallel to the train in the south with a speed of 5m/s. The time taken by the parrot to cross the train will be- (4) 12 and (5) 12 and (6) 15 and (7) 12 and (1) 12 and (1							
	(1) 12 300.	(2) 0 300.	(0) 10 300.	(+) 10 300.				
6.	Two cars are moving in the same direction with the same speed 30 km/hr. They are separated by a distance of 5 km, the speed of a car moving in the opposite direction if it meets these two cars at an interval of 4 minutes, will be-							
	(1) 40 km/hr	(2) 45 km/hr	(3) 30 km/hr	(4) 15 km/hr				
7.	A stone is thrown upwards from a tower with a velocity 50 ms ⁻¹ . Another stone is simultaneously thrown downwards from the same location with a velocity 50 ms ⁻¹ . When the first stone is at the highest point the relative velocity of the second stone w.r.t. the first stone is (assume that second stone has not ye reachead the ground) :							
	(1) Zero	(2) 50 ms ⁻¹	(3) 100 ms ⁻¹	(4) 150 ms ⁻¹				
8.	A thief is running away on a straight road in a jeep moving with a speed of 9 m s ⁻¹ . A police man chases him on a motor cycle moving at a speed of 10 m s ⁻¹ . If the instantaneous separation of the jeep from the motorcycle is 100m, how long will it take for the police man to catch the thief?							
	(1) 1s	(2) 19s	(3) 90s	(4) 100s				
9.	A body is thrown up in acceleration with which	a lift with a velocity u rel the lift is moving up will	ative to the lift and the tir be-	me of flight is found to be 't'. The				
	(1) $\frac{u-gt}{t}$	(2) $\frac{u+gt}{t}$	$(3) \ \frac{2u-gt}{t}$	$(4) \ \frac{2u+gt}{t}$				

10. Two trains A & B 100 km apart are travelling towards each other on different tracks with starting speed of 50 km/h for both. The train A accelerates at 20 km/h² and the train B retards at the rate 20 km/h². The distance covered by the train A when they cross each other is :

(1) 45 km
(2) 55 km
(3) 65 km
(4) 60 km

- A bus is moving with a velocity 10 ms⁻¹ on a straight road. A scooterist wishes to overtake the bus in 100s. If, the bus is at a distance of 1 km from the scooterist, with what velocity should the scooterist chase the bus?
 (1) 50 ms⁻¹
 (2) 40 ms⁻¹
 (3) 30 ms⁻¹
 (4) 20 ms⁻¹
- A 120 m long train is moving towards west with a speed of 10 m/s. A bird flying towards east with a speed of 5 m/s crosses the train. The time taken by the bird to cross the train will be
 (1) 16 sec
 (2) 12 sec
 (3) 10 sec
 (4) 8 sec
- **13.** A particle is thrown up inside a stationary lift of sufficient height. The time of flight is T. Now it is thrown again with same initial speed v_0 with respect to lift. At the time of second throw, lift is moving up with speed v_0 and uniform acceleration g upward (the acceleration due to gravity). The new time of flight is-

(1)
$$\frac{T}{4}$$
 (2) $\frac{T}{2}$ (3) T (4) 27

14. Two men P & Q are standing at corners A & B of square ABCD of side 8 m. They start moving along the track with constant speed 2 m/s and 10 m/s respectively. Find the time when they will meet for the first time.



15. A coin is released inside a lift at a height of 2 m from the floor of the lift. The height of the lift is 10 m. The lift is moving with an acceleration of 9 m/s² downwards. The time after which the coin will strike with the lift is : $(g = 10 \text{ m/s}^2)$

(1) 4 s (2) 2 s (3)
$$\frac{4}{\sqrt{21}}$$
 s (4) $\frac{2}{\sqrt{11}}$ s

16. A man in a balloon, throws a stone downwards with a speed of 5 m/s with respect to balloon. The balloon is moving upwards with a constant acceleration of 5 m/s². Then velocity of the stone relative to the man after 2 second is :



- Two norticles a
- 17. Two particles are moving along a straight line as shown. The velocity of approach between A and B is $V_A \longrightarrow V_B \longrightarrow V_B$

$$(1) V_{A} + V_{B}$$

$$(2) |V_{A} - V_{B}|$$

$$(3) V_{A} - V_{B}$$

$$(4) V_{B} - V_{A}$$

18. A jet airplane travelling from east to west at a speed of 500 km h⁻¹ ejected out gases of combustion at a speed of 1500 km h⁻¹ with respect to the jet plane. What is the velocity of the gases with respect to an observer on the ground ?

(1) 1000 km h^{-1} in the direction west to east (3) 2000 km h^{-1} in the direction west to east

- (2) 1000 km h⁻¹ in the direction east to west
- (4) 2000 km h^{-1} in the direction east to west

19. Car A and car B move on a straight road and their velocity versus time graphs are as shown in figure. Comparing the motion of car A in between t = 0 to t = 8 sec. and motion of car B in between t = 0 to t = 7 sec., pick up the correct statement.



(1) Distance travelled by car A is less than distance travelled by car B.

(2) Distance travelled by car A is greater than distance travelled by car B.

(3) Average speed of both cars are equal.

. . . .

(4) Average speed of car A is less than average speed of car B.

SECTION : (B) RELATIVE MOTION IN TWO DIMENSIONS

. .

1.	A stone is just release will hit the ground in-	leased from the window of a train moving along a horizontal straight track. The stone							
	(1) Straight line path	(2) Circular path	(3) Parabolic path	(4) Hyperbolic path					
2.	The motion of one projectile as seen from another will always								
	(1) Straight line	(2) Parabolic	(3) Circular	(4) Hyperbolic					
3.	A traveller while in a ur	niformly moving train thre	ows a ball up in the air. T	he ball will return-					

A traveller while in a uniformly moving train throws a ball up in the air. The ball will return (1) In his hand
 (2) Ahead in the direction of motion of the train
 (3) Trail behind
 (4) Deflected sideways

4. A boat is moving with a velocity 3i + 4j with respect to ground. The water in the river is moving with a velocity -3i - 4j with respect to ground. The relative velocity of the boat with respect to water is -

(1) 8j (2) -6i - 8j (3) 6i + 8j (4) $5\sqrt{2}$

- 5. A ball is thrown from rear end of the compartment to the front end which is moving at constant horizontal velocity. An observer A sitting in the compartment and another observer B standing on the ground draw the trajectory. They will have-
 - (1) Equal horizontal and equal vertical ranges.
 - (2) Equal vertical ranges but different horizontal ranges.
 - (3) Different vertical ranges but equal horizontal ranges.
 - (4) Different vertical and different horizontal ranges.
- 6. An aeroplane is flying in a horizontal direction at 600 km/hr at a height of 6 km. and is advancing towards a point which is exactly over a target. At that instant the pilot releases a ball which on descending the earth strikes the target, the falling ball appears-
 - (1) To the pilot in the aeroplane, as falling along a parabolic path.
 - (2) To a person standing near the target, as falling exactly vertical.
 - (3) To a person standing near the target as describing a parabolic path.
 - (4) To the pilot siting in the aeroplane as falling in a zigzag path.
- 7. A train is standing on a platform, a man inside a compartment of a train drops a stone. At the same instant train starts to move with constant acceleration. The path of the particle as seen by the person who drops the stone is :
 - (1) parabola
 - (2) straight line for sometime & parabola for the remaining time
 - (3) straight line
 - (4) variable path that cannot be defined

8.	 Consider two cases: (i) A cart moves horizontally with constant velocity and a stone is projected vertically upwards. (ii) A cart slides down a smooth incline plane and a stone is projected in direction perpendicular to incline. Stone will fall in the cart : (1) in both the cases (2) only in case (i) (3) only in case (ii) (4) as cart is moving in both cases, stone will fall behind the cart in both cases. 								
9.	A bird is flying towards east with a velocity 40 km/hr and a train is moving with a velocity 40 km/hr towards east. A man in train drops a food packet. The path of food packet as seen by bird till it falls on ground is (ignore air resistance)								
	(1) parabola	(2) circle	(3) hyperbola	(4) straight line					
10.	A body A is going from South to North and body B is going from West to East with identical velocity. Then direction of relative velocity of A with respect to B is- (1) North-West (2) South-West (3) North-East (4) South-East								
11.	A car A is going North-East at 80 km/hr. and another car B is going South-East at 60 km./hr. Then the direction of the velocity of A relative to B makes with the North and angle α such that tan α is-								
	(1) $\frac{1}{7}$	(2) $\frac{3}{4}$	(3) $\frac{4}{3}$	(4) $\frac{3}{5}$					
12.	A ship is travelling due east at 10 km/h. A ship heading 30° east of north is always due north from the first ship. The speed of the second ship in km/h is -								
	(1) 20 $\sqrt{2}$	(2) 20 \sqrt{3/2}	(3) 20	(4) 20/ $\sqrt{2}$					
13.	Two billiard balls are rolling on a flat table. One has velocity components $v_x = 1$ m/s, $v_y = \sqrt{3}$ m/s and the other has components $v_x = 2$ m/s and $v_y = 2$ m/s. If both the balls start moving from the same point, the angle between their path is								
	(1) 60°	(2) 45°	(3) 22.5°	(4) 15°					

SECTION : (C) RELATIVE MOTION IN RIVER FLOW & AIR FLOW

1. The speed of a boat is 5 km/hr in still water. If it crosses a river of width 1 km along the shortest possible path in 15 min., then velocity of the river is-(1) 4 km/hr (3) 2 km/hr (4) 1 km/hr (2) 3 km/hr

2. A boat P is moving at 40 km/hr and another boat Q is moving at 20 km/hr. Which one of the following is not a possible value for their relative velocity-(1) 10 km/hr (2) 20 km/hr (4) 40 km/hr (3) 30 km/hr

3. A boat man could row his boat with a speed 10 m/sec. He wants to take his boat from P to a point Q just opposite on the other bank of the river flowing at a speed 4 m/sec. He should row his boat-



(3) To the given moving observer boat B moves faster than A

4.

5.

6.

7.

8.

- (4) To the given moving observer boat A moves faster than B
- **9.** A man who can swim at the rate of 2 km/hr (in still river) crosses a river to a point exactly opposite on the other bank by swimming in a direction of 120° to the flow of the water in the river. The velocity of the water current in km/hr is
 - (1) 1 (2) 2 (3) 1/2. (4) 3/2

SECTION : (D) RELATIVE MOTION IN RAIN AND WIND

1. During a rainstorm, raindrops are observed to be striking the ground at an angle θ with the vertical. A wind is blowing horizontally at the speed of 5.0 m/s. The speed of raindrops is

(1) $5 \sin \theta$ (2) $\frac{5}{\sin \theta}$ (3) $5 \cos \theta$ (4) $\frac{5}{\cos \theta}$

2. A car with a vertical wind shield moves along in a rain storm at speed of 40 km/hr. The rain drops fall vertically with a terminal speed of 20 m/sec. The angle at which the rain drops strike the wind shield is-

(1) $\tan^{-1}\left(\frac{5}{9}\right)$ (2) $\tan^{-1}\left(\frac{9}{5}\right)$ (3) $\tan^{-1}\left(\frac{3}{2}\right)$ (4) $\tan^{-1}\left(\frac{2}{3}\right)$

- A man standing on a road hold his umbrella at 30° with the vertical to keep the rain away. He throws the umbrella and starts running at 10 km/hr. He finds that raindrops are hitting his head vertically, the speed of raindrops with respect to the road will be
 (1) 10 km/hr
 (2) 20 km/hr
 (3) 30 km/hr
 (4) 40 km/hr
- It is raining vertically downwards with a velocity of 3 km h⁻¹. A man walks in the rain with a velocity of 4 kmh⁻¹. The rain drops will fall on the man with a relative velocity of ;
 (1) 1 kmh⁻¹
 (2) 3 kmh⁻¹
 (3) 4 kmh⁻¹
 (4) 5 kmh⁻¹
- **5.** A flag on a bus is fluttering in north direction & wind is blowing in east direction. Then which of the following will be true -
 - (1) bus is moving in south direction.
 - (2) bus is moving in north east direction.
 - (3) bus may be moving in any direction between south & east.
 - (4) bus may be moving in any direction between south & west.
- 6. Rain seems to be falling to a person sitting in a bus moving uniformly eastwards with 10 m/s. It appears to come from vertical and hit the bus windows at a velocity 20 m/s. Find the velocity of rain drops w.r.t. ground.
 - (1) $5\sqrt{5}$ m/s (2) $\sqrt{5}$ m/s (3) $10\sqrt{5}$ m/s (4) $10\sqrt{10}$ m/s
- Rain is falling vertically with a velocity of 3 kmh⁻¹. A man walks in the rain with a velocity of 4 kmh⁻¹. The rain drops will fall on the man with a velocity of
 (1) 5 kmh⁻¹
 (2) 4 kmh⁻¹
 (3) 3 kmh⁻¹
 (4) 1 kmh⁻¹
- **8.** To a stationary man, rain appears to be falling at an angle 30° with the vertical. As he starts moving with a speed of 0.5 m/s he finds that the rain is falling vertically. Then the speed of rain w.r.t. the moving man is :

(1) 0.5 m/s (2) 1 m/s (3) $0.5\sqrt{3}$ m/s (4) $\sqrt{3}$ m/s

ANSWER KEY

32011	UN (A) .		(0)	•	(0)			-		•	(0)	_	(0)
1.	(1)	2.	(2)	3.	(3)	4.	(1)	5.	(4)	6.	(2)	7.	(3)
8.	(4)	9.	(3)	10.	(4)	11.	(4)	12.	(4)	13.	(2)	14.	(2)
15.	(2)	16.	(4)	17.	(4)	18.	(1)	19.	(4)				
SECTION : (B)													
1.	(3)	2.	(1)	3.	(1)	4.	(3)	5.	(2)	6.	(3)	7.	(3)
8.	(1)	9.	(4)	10.	(1)	11.	(1)	12.	(3)	13.	(4)		
4	(2)	2	(4)	2	(0)		(0)	-	(0)	c	(1)	7	$\langle 0 \rangle$
1.	(2)	Ζ.	(1)	3.	(2)	4.	(2)	э.	(2)	0.	(1)	7.	(2)
8.	(2)	9.	(1)										
SECTION : (D)													
1.	(2)	2.	(1)	3.	(2)	4.	(4)	5.	(3)	6.	(3)	7.	(1)
8.	(3)												