

## Kinematics(A-2)

Total No. of Questions: 18

Total Marks: 72

### SECTION 1: MCQ

- Q1 A boat takes two hours to travels  $8\text{ km}$  and back in still water. If the velocity of water is  $4\text{ km/h}$ , the time taken for going upstream  $8\text{ km}$  and coming back is (4 Marks)
- A.  $2\text{ hr}$   
B.  $2\text{ hr } 40\text{ min}$   
C.  $1\text{ hr } 20\text{ min}$   
D.  $2\text{ hr } 30\text{ min}$
- Q2 On a long horizontally moving belt, a child runs to and fro with a speed  $9\text{ km h}^{-1}$  (with respect to the belt) between his father and mother located  $50\text{ m}$  apart on the moving belt. The belt moves with a speed of  $4\text{ km h}^{-1}$ . For an observer on a stationary platform, the speed of the child running in the direction of motion of the belt is (4 Marks)
- A.  $4\text{ km h}^{-1}$   
B.  $5\text{ km h}^{-1}$   
C.  $9\text{ km h}^{-1}$   
D.  $13\text{ km h}^{-1}$
- Q3 A ball is thrown vertically upward. It has a speed of  $10\text{ m/sec}$  when it has reached one half of its maximum height. How high does the ball rise? Take  $g = 10\text{ m s}^{-2}$ . (4 Marks)
- A.  $10\text{ m}$   
B.  $5\text{ m}$   
C.  $6\text{ m}$   
D.  $7\text{ m}$
- Q4 The displacement of a particle moving in a straight line is described by the relation,  $s = 6 + 12t - 2t^2$ . Here ' $s$ ' is in metre and ' $t$ ' is in second. The distance covered by particle in first  $5\text{ sec}$  is: (4 Marks)
- A.  $20\text{ m}$   
B.  $32\text{ m}$   
C.  $24\text{ m}$   
D.  $26\text{ m}$

### SECTION 2: Multiple Select

- Q1 A train covers equal displacements and distance in equal intervals of time then it moves with: (4 Marks)
- A. Uniform acceleration.  
B. Uniform motion.  
C. Uniform speed.  
D. Uniform velocity.
- Q2 Two cars travel along a level straight highway. It is observed that the separation between the cars is increasing. Which one of following statement(s) concerning this situation is necessarily true? (4 Marks)
- A. Velocity of both the cars is increasing.  
B. The front car has greater acceleration.  
C. Both the cars may have same acceleration.  
D. The rear car has smaller acceleration.

- Q3 The ratio of time taken by two cars P, Q starting from rest moving along a straight road with equal accelerations is  $\sqrt{2} : 1$ , then the : (4 Marks)
- Final velocity of car P > final velocity of car Q.
  - Final velocity of car P < final velocity of car Q.
  - Ratio of  $V_P$  to  $V_Q$  is  $2 : \sqrt{2}$ .
  - Ratio of distance travelled by car 'P' to car 'Q' is  $2 : 1$
- Q4 A particle is projected at an angle  $\theta$  from ground with speed  $u (g = 10m/s^2)$ , then which of the following is true? (4 Marks)
- If  $u = 10m/s$  and  $\theta = 30^\circ$ , then time of flight will be 1 sec
  - If  $u = 10\sqrt{3}m/s$  and  $\theta = 60^\circ$ , then time of flight will be 3 sec
  - If  $u = 10\sqrt{3}m/s$  and  $\theta = 60^\circ$ , then after 2 sec velocity becomes perpendicular to initial velocity
  - If  $u = 10m/s$  and  $\theta = 30^\circ$ , then velocity never becomes perpendicular to initial velocity during its flight
- Q5 Mark correct statements . (4 Marks)
- Two particles are thrown with the same speed from the same point at the same instant but at a different angle cannot collide in mid-air
  - A body projected in uniform gravitational field follows a parabolic path
  - In projectile motion velocity is never perpendicular to the acceleration .
  - A particle dropped from rest and blown over by horizontal wind with constant velocity traces a parabolic path
- Q6 The displacement ( $x$ ) of a particle depends on time ( $t$ ) as  $x = \alpha t^2 - 2\beta t^3$ . (4 Marks)
- The particle will return to its starting point after time  $\frac{\alpha}{2\beta}$ .
  - The particle will come to rest after time  $\frac{\alpha}{3\beta}$ .
  - The initial velocity of the particle was zero but its initial acceleration was  $2\alpha$ .
  - No net force will act on the particle at  $t = \frac{\alpha}{6\beta}$ .
- Q7 Which of the following is/are correct regarding uniform and non-uniform motion? (4 Marks)
- If a body travels equal distances in unequal time intervals of time then the body is said to be in a state of non-uniform motion
  - If a body travels unequal distances in equal time intervals of time then the body is said to be in a state of non - uniform motion
  - If a body travels equal distances in equal time intervals of time then the body is said to be in a state of non-uniform motion
  - All of the above
- Q8 A particle initially starts from rest, travels a distance Y in the first two seconds and a distance of X in next two seconds then, (4 Marks)
- $X = 2Y$
  - $X + Y = 4X$
  - $X + Y = 4Y$
  - $X = 3Y$

- Q9 Ship A is located  $4 \text{ km}$  north and  $3 \text{ km}$  east of ship B. Ship A has a velocity of  $20 \text{ kmh}^{-1}$  towards the south and ship B is moving at  $40 \text{ kmh}^{-1}$  in a direction  $37^\circ$  north of east. X and Y axes are along east and north directions, respectively. (4 Marks)
- A. Velocity of A relative to B is  $-32\hat{i} - 44\hat{j}$
- B. Position of A relative to B as a function of time is given by  $\vec{r}_{AB} = (3 - 32t)\hat{i} + (4 - 44t)\hat{j}$
- C. Velocity of A relative to B is  $32\hat{i} - 44\hat{j}$
- D. Position of A relative to B as a function of time is given by  $(32t\hat{i} - 44t\hat{j})$
- Q10 A racing car starts from rest at  $t = 0$  and reaches a final speed  $v$  at time  $t$ . If the acceleration of the car is constant during this time, which of the following statements are true? (4 Marks)
- A. The car travels a distance  $vt$
- B. The average speed of the car is  $v/2$ .
- C. The magnitude of the acceleration of the car is  $v/t$ .
- D. The velocity of the car remains constant
- E. None of statements (a) through (d) is true.

### SECTION 3: Subjective

- Q1 Is it possible that the train in which you are sitting appears to move while it is at rest? (4 Marks)
- Q2 A person walks up a stationary escalator in  $t_1$  second. If he remains stationary on the escalator, then it can take him up in  $t_2$  second. If the length of the escalator is L, then (4 Marks)
- a. Determine the speed of man with respect to the escalator.
- b. Determine the speed of the escalator.
- c. How much time would it take him to walk up the moving escalator?
- Q3 Two trains A and B, 100m and 60m long, are moving in opposite directions on parallel tracks. The velocity of the shorter train is 3 times that of the longer one. If the trains take 4s to cross each other, the velocities of the trains are (4 Marks)
- Q4 Check the correctness of the relation  $S_{nth} = u + \frac{a}{2}(2n - 1)$ , where  $u$  is initial velocity,  $a$  is acceleration and  $S_{nth}$  is the distance travelled by the body in  $n^{th}$  second. (4 Marks)