THE GURUKUL INSTITUTE

PLOT 5C, 2ND FLOOR, COMPLEX, SEC-13, OPP. JAIPURIA SCHOOL,
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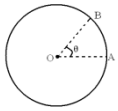
PHYSICS – KINEMATICS

REST AND MOTION; REFRENCE FRAME

1. A body moves 6m north, 8m east and 10m vertically upwards what is the magnitude of the resultant displacement from initial position.
2. A person moves from A to B along the semicircular path. Compare the distance moved by him and the magnitude of displacement.
3. (i) Can a body moving with uniform speed have variable vecity?
(ii) Can a body moving with uniform velocity have veriable speed?
(iii) Can average velocity ever becomes equal to instantaneous velocity/
4. A particle moves along a circle of radius R. Find the path length and magnitude of displacement from initial position A to final position B.



5.A cyclist moves 12km due north and then 5km due east in 3 hr. Find (a) his average speed, (b) average velocity, in m/s.
6.A train is moving with a constant speed of 5 m/s and there are two persons A and B standing at a separation of 10 m inside the train. Another person C is standing on the ground. Then, find
(a) displacement by A, if he moves towards B and back to its position in 10 seconds in frame of reference of train and in frame of reference of C.
(b) distance covered by A in frame of reference of train and in frame of reference of C.
7.(i) Can body have an acceleration with zero velocity?
(ii) Can the direction of the velocity of a body change when its acceleration is constant?
8. A body moving in a curved path possesses a velocity of 3 m/s towards north at any instant of its motion. After 10 s, the velocity of the body was found to be 4 m/s towards west. Calculate the average acceleration during this interval.

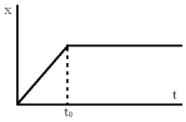
Kinematical Equations of a Particle Moving With Constant Acceleration
And Motion Under Gravity (Free Fall)

9.(i) A stone is thrown upwards with a speed v from the top of a tower. It reaches the ground with a velocity 3v. What is the height of the tower?
(ii) A stone is thrown vertically upwards with a velocity of 19.6 m/s. After 2 seconds, another stone is thrown upwards with a velocity of 9.8 m/s. When and where will these stones collide? (take g= 9.8 m/s^2)
10.The motion of a particle is described by the equation u=at. Where a is constant The distance traveled by the particle in the first 4 second.
11. A body moving with a constant retardation in straight line travels 5.7 m and 3.9 m in the 6^{th} and 9^{th} second, respectively. When will the body come momentarily to rest?
12. A car moving in a straight line at 30 m/s slows uniformly to a speed of 10m/s in 5 sec. Determine:
(a) the acceleration of the car
(b) displacement in the third second.
13. A bullet fired into a fixed target loses half of its velocity after penetrating 3 cm. How much further it will penetrate before coming to rest assuming that it faces constant resistance to motion.
14. An anti- aircraft shell is fired vertically upwards with a muzzle velocity of 294 m/s. Calculate (a) the maximum height reached by it, (b) time taken to rech this height, (c) the velocities at the ends of 20^{th} and 40^{th} second. (d) when will its height be 2450 m?
Given g= 9.8 m/s^2.
15. A boy sitting on a rail road car moving with a constant velocity tosses a coin up. Describe the path of the coin as seen by
(a) the man on the train.
(b) the man standing on the ground near the rail.
16.A particle moves with a velocity $v(t)= (1/2)\ kt^2$ along a straight line, where k is a+ve constant. Find the average speed of the particle in time T.
17. Position of a particle moving along x- axis is given by $x= 3t- 4t^2+t^3$, where x is in meters and t in seconds.

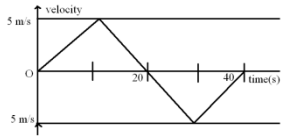
(a) Find the position of the particle in the time interval from t=0 to t=4 s.
(b) Find the displacement of the particle in the time interval from t= 0 to t=4s.
(c)Find the average velocity of the particle in the time interval from t=2 to t=4s.
(d)Find the velocity of the particle at t=2s.

Graphical Representation And Equation Of Motion

18. The adjacent figure shows the displacement- time graph of a particle moving on the x- axis. Choose the correct option given below.
(a) The particle is continuously going in positive x –direction.
(b) The particle is at rest
(c) The particle moves at a constant velocity upto a time t_0, and then stops.
(d) The particle moves at a constant acceleration upto a time t_0 and then stops.



19.From the velocity –time plot shown in figure, find
(a) distance travelled by the particle during the first 40 seconds.
(b) displacement travelled by the particle during the first 40 seconds.
(c) Also find the average velocity during this period.



20.(i) A ball is thrown vertically upwards with a speed of 20 m/s from a hard floor. Draw a graph showing the velocity of the ball as a function of time if the ball suffers elastic collisions continuously.
(ii) Figure shows the x- coordinate of a particle as a function of time. Find the signs of v_X and a_x at t= t_1, t= t_2 and t= t_3.
21.A particle is moving rectilinearly with a time varying acceleration a= 4-2t, where a is in m/s^2 and t is in sec. If the particle is starting its motion with a velocity of -3 m/s from x= 0. Draw a-t, v-t and x-t curve for the particle.

TWO DIMENSIONAL MOTION

22. The co-ordinates of a moving particle at any time t are given by $x= \alpha t^3$ any $y= \beta t^3$. The speed of the particle at 't' is given by
23.(i) A projectile is thrown horizontally from the top of a tower and strikes the ground after 3 second at an angle of 45^0 with the horizontal. Find the height of the tower and speed with which the body was projected. Given g=9.8 m/s^2
(ii)A bullet P is fired from a gun when the angle of elevation of the gun is 30^0. Another bullet Q is fired from the gun with same initial speed when the angle of elevation is 60^0. Which of the two bullets would have a greater horizontal range and why?
24. A ball is thrown at a speed of 50 m/s at an angle of 60^0 with the horizontal. Find: (a) the maximum height reached, and (b) the range of the ball. (take g= 10 m/s^2)
25. A particle is projected with velocity V_0= 100 m/s at an angle $\theta = 30^0$ with the horizontal. Find
(a) velocity of the particle after 2 s
(b) angle between initial velocity and the velocity after 2s,
(c) the maximum height reached by the projectile,
(d) horizontal range of the projectile, and
(e) the total time of flight
26.A football is kicked off with an initial speed of 20 m/s at an angle of projection of 45^0. A receiver on the goal line at a distance of 60 m away in the direction of the kick starts running to meet the ball at that instant. What must be his speed if he is to catch the ball before it hits the ground? [Take g= 10 m/s^2]

The Projectile On an Inclined Plane

27.A particle is thrown at time t=0, with a velocity y of 10 m/s at an angle of 60^0 with the horizontal, from a point on an incline plane, making an angle of 30^0 with the horizontal. The time when the velocity of the projectile becomes parallel to the incline is
(a) $2/\sqrt{3}$ sec b) $1/\sqrt{3}$ sec c) $1/2\ \sqrt{3}$ sec d) 3 sec
28. The surface of a hill is inclined at an angle α to the horizontal. A stone is thrown from the top of the hill at an angle β with the vertical with a velocity v_0. How far from the top will the stone strike the surface of the hill ?
29. A batsman hits a ball at a height of 1.22 m above the ground so that the ball leaves the bat at an angle of 45^0 with the horizontal. A 7.31 m high wall is situated at a distance of 97.53 m from the position of the batsman. Will the ball clear the wall if its range at the same level of 1.22 m is 106.68 m? Take g= 10 m/s^2.

30. (i) Is the height you take for jumping important in the long jump?
(ii) Name the three quantities which would be reduced if air resistance is taken into account in the study of motion of oblique projectile.

UNIFORM / NON UNIFORM CIRCULAR MOTION

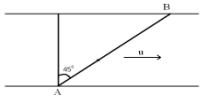
31.Find the magnitude of average acceleration of the tip of the second hand of length 10 cm during 10 sec.
32. A point moves along a circle with velocity v= at, where a =0.5 m/s^2. Fnd the total acceleration of the point at the moment when it covered $(1/10)^{th}$ of the circle after beginning of motion.
33.(i) The tangential acceleration changes the speed of a particle whereas the normal acceleration changes its direction. State whether the statements are true or false?
(ii) At a certain moment, the angle between velocity vector 'v' and the acceleration vector 'a' of the particle is θ. What will be the motion of the particle at this moment for different θ's: rectilinear of curvilinear, accelerated or decelerated?
34. Find the ratio of radius of curvature at the highest point of projectile to that just after its projection if the angle of projection is 30^0.

Relative Motion Between Rain and Man

35. A stationary person observes that rain is falling vertically down at 30km/hr. A cyclist is moving on the level road, at 10 km/hr. In which direction should the cyclist hold his umbrella to protect himself from rain?
36.A man walking eastward at 5 m/s observes that wind is blowing from the north. On doubling his speed eastward, he observes that wind is blowing from north east. Find the velocity of the wind.
37. From a lift moving upward with a uniform acceleration 'a', a man after a time t. Show that a+ g= 2v/t

PROBLEMS

1. A car covers the first half of the distance between two places at a speed of 40 km/hr and the second half at 60 km/hr. What is the average speed of the car?
2. A car starts from rest and moves with a constant acceleration of 2.0 m/s^2 for 30 seconds. The brakes are then applied and the car comes to rest in another 60 seconds with constant retardation. Find
(a) total distance covered by the car, and
(b) maximum speed attained by the car.
(c) Find the shortest distance from initial point to the point when its speed is half of the maximum speed.
3. A rocket is fired vertically and ascends with constant vertical acceleration of 20 m/s^2 for 1 minute. Its fuel is then all used an it continues as a free particle. Find the
(a) maximum height reached by the rocket.
(b) total time eslaped from the take off till the rocket strikes the earth. ($g= 10m/s^2$)
4.An elevator car whose floor to ceiling distance is equal to 2.7m starts ascending with respect to ground. [Use g= 9.8 m/s^2].
5. A body falling freely from a given height 'H' hits an inclined plane in its path at a height 'h'. As a result of this impact, the velocity of the body becomes horizontal. For what value of (h/H) will the body take maximum time to reach the ground?
6. A particle projected with velocity v_0 strikes at right angles a plane passing through the point of projection and having inclination β with the horizontal. Find the height (from horizontal plane) of the point where the particle strikes the plane.
7.A man can row a boat 4 km/hr in still water.If he is crossing a river where the current is 2 km/hr,
(a) In what direction will his boat be headed if he wants to reach a point on the other bank, directly opposite to the starting point?
(b) If width of the river is 4 km, how long will it take him to cross the river, with the condition in part 'a'.
(c) In what direction should he hea the boat if he wants to cross the river in shortest time/
(d) How long will it take him to row 2 km up the stream and then back to his starting point?
8. A man wants to reach point B on the opposite bank of a river flowing at a speed u as shown in the figure. What minimum speed relative to water should the man have so that he can reach point B? In which direction should he swims?



9.A man wants to cross a river 500 m wide. The rowing speed of the man relative to water is 3 km/hr and the river flows at the speed of 2 km/hr. If the man's walking speed on the shore is 5 km/ hr, then in which direction should he starts rowing in order to reach the directly opposite point on the other bank in the shortest time?
10.Two particle A and B move with constant velocities v_1 and v_2 along two mutually perpendicular straight lines towards the intersection point O. At moment t= 0, the particles were located at distance L_1 and L_2 from O, respectively. Find the time when they are nearest and also this shortest distance.
11. A wheel rotates around a stationary axis so that rotation angle θ varies as $\theta= Pt^2$, where P= 0.20 rad/s^2. Find the total acceleration 'a' of the point A at the rim at the moment t= 2.55 sec, if the linear velocity of the point A at this moment is v= 0.65 m/s.

OBJECTIVE

1. In the given v-t graph, the distance travelled by the body in 5 sec will be
(a) 100 m b) 80 m c) 40 m d) 20 m
2. In Question 1, the displacement of the body in 5 sec will be
a) 100 m b) 80 m c) 40m d) 20 m
3. In Question 1, the average velocity of the body in 5 second is
a) 20m/s b) 16 m/s c) 8m/s d) 4m/s
4.In the above question, the average speed of the body during 5 sec is
a) 20 m/s b)16m/s c) 8 m/s d) 4 m/s
5.A body when projected vertically up, covers a total distance D during its time of flight. If there were no gravity, the distance covered by it during the same time would be
a) 0 b) D c) 2D d) 4D
6.A particle is projected vertically upward with initial velocity 25 ms^{-1}. During third seconds of its motion, which of the following statement is correct?
(a) displacement of the particle is 30 m.
b) Distance covered by the particle is 30 m.
c)Distance covered by the particle is 2.5 m
d) None of these.
7. A swimmer crosses a river of width d flowing at velocity v. While swimming, he keeps himself always at an angle of 120^0 with the river flow and on reaching the other end he finds a drift of d/2 in the direction of flow of river. The speed of the swimmer with respect to the river is
a) $(2-\sqrt{3})$ v b)$2(2-\sqrt{3})$ v c) $4(2-\sqrt{3})$ v d) $(2+\sqrt{3})$v
8.A person walks up a stationary escalator in 90 sec. If the escalator moves with the person , first standing on it, it will take 1 minute to reach the top from ground. How much time it would take him to walk up the moving escalator?
a) 24 sec b) 48 sec c) 36 sec d) 40 sec
9.A driver applies brakes on seeing a traffic signal 400 m ahead. At the time of applying the brakes, the vehicle was moving with 15 m/s and retarding with 0.3 m/s^2. The distance of vehicle after 1 minute from the traffic light is
a) 25 m b) 375m c) 360 m d) 40 m
10.A particle is projected from a point A with a velocity v at an angle θ (upward) to the horizontal. At a certain point B, it moves at right angle to its initial direction . It follows that
(a) velocity of the particle at B is v.
b) velocity of the particle at B is v cosθ.
c) velocity of the particle at B is v tanθ.
d) the time of flight from A to B is v/ g sin θ
11.The relative velocity of a car 'A' with respect to car B is $30\sqrt{2}$ m/s due North- East. The velocity of car 'B' is 20 m/s due south. The relative velocity of car 'C' with respect to car 'A' is $10\sqrt{2}$ m/s due North- West. The speed of car C and the direction (in terms of angle it makes with the east) are
a) $20\sqrt{2}$ m/s, 45^0 b) $20\sqrt{2}$ m/s, 135^0
c) $10\sqrt{2}$ m/s, 45^0 d) $10\sqrt{2}$ m/s, 135^0
12. If a boat can have a speed of 4 km/hr in still water, for what values of speed of river flow, it can be managed to row the boat right across the river, without any drift?
a) ≥ 4 km/ hr b) greater than zero but less than 4 km/hr
c) only 4 km/ hr d) none of these
13. Which of the following parameterers of a particle executing uniform circular motion remains constant?
a) velocity b) Radial acceleration c) Angular velocity
d) All of these
14.A bullet makes n turns inside the barrel of length 'L' of a rifle and emerges from it with a speed v. Assuming that the bullet moves inside the barrel with a uniform acceleration, the angular velocity of the bullet about its longitudinal axis as it emerges from the barrel is
a) v/L b) 2πnv/Lc) (πn/2v) d) none of these
15. A particle is projected horizontally from the top of a cliff of height H with a speed $\sqrt{2gH}$. The radius of curvature of the trajectory at the instant of projection will be
a) H/2 b) H c) 2H d) ∞

ASSIGNMENT

SECTION- I
PART- A
LEVEL- I

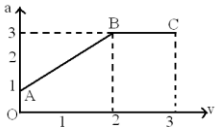
1. What is the significance of the slope of x- t graph?

2. A car starts accelerating uniformly from rest for sometime, maintain the velocity for sometime and then comes to rest with uniform decleration . Draw the v-t curve for the motion.
3. Derive three equations of motion by calculus method. Express conditions under which they can be used.
4. The angular displacement of a body is given by $\theta = 2t^2+5t-3$. Find the value of the angular velocity and angular acceleration when t= 2s.
5. A bulb is accidentally dropped from the ceiling of a train moving with constant velocity. What shape of the path will be seen from an observer on the ground?
6. A projectile is thrown with a velocity $v_0 = 3\hat{i} + 4\hat{j}$ in m/s where $\hat{i}$ and $\hat{j}$ are the unit vector along the horizontal and vertical direction respectively. What is the speed of the projectile at the highest point of its motion?
7. The time of flight of a projectile is 10 s. Its range on a horizontal plane is 100 m. Calculate the angle of projection and the velocity of projection.
8. Is uniform circular motion, an example of constant acceleration? Why?
9. The blades of an aeroplane propeller are 2m long and rotate at 300 rpm. Calculate: (i) frequency, (ii) period of rotation, (iii) angular velocity, and (iv) linear velocity of a point 0.5 m from the top of the blades.
10. A man can swim with a speed of 4 km/h in still water. How long does he take to cross a river 1 km wide if the river flows steadily at 3 km/h and he makes his stokes normal to the river current? How far down the river does he go when he reaches the other bank?

LEVEL- II

1.The position of a particle along the x- axis is given in centimeters by $x = 9.75 + 1.50\,t^3$, where t is in seconds and x in cm. Consider the time interval t= 2 s to t=3 s and calculate
(a) the average velocity,
(b) the instantaneous velocity at t= 2s,
(c) the instantaneous velocity when t= 2.5 s,
2. A motorcyclist moving uniform retardation takes 10 s and 20 s to travel successive quarter kilometer. How much further he will travel before coming to rest?
3. A point moving in a straight line traversed half the distance with a velocity v_0. The remaining part of the distance was covered with velocity v_1 for half the time , and with velocity v_2 for the other half of the time. Find the mean velocity of the point averaged over the whole time of motion.
4.At the instant the traffic light turns green, a car starts with a constant acceleration of 2.2 m/s^2.At the same instant a truck, travelling with a constant speed of 9.5 m/s, overtakes and passes the car.
(a) How far beyond the starting point will the car overtake the truck?
(b) How fast will the car be travelling at the instant?
5.A train is crossing an observer standing on a platform. The first compartment of the train takes 2 seconds to cross the observer while the second compartment takes 2.5 seconds to cross him. The train is moving with uniform acceleration. Find (a) the velocity of the train when the front of the first compartment crosses the observer, and (b) the acceleration of the train. Given, the length of each compartment is 15 metres.
6.A ball is thrown with a velocity of 100 ms^{-1} at an angle of 30^0 to the horizontal and meets the same horizontal plane later. Find
(a) its time of flight, (b) the horizontal distance it travels,
(c) the velocity with which it strikes the ground at the end of its flight. [$g=9.8ms^{-2}$]
7.A projectile shot at an angle of 60^0 above the horizontal strikes a wall 30 m away at a point 15 m above the point of projection. (a) Find the speed of projection. (b)Find the magnitude of velocity of the projectile when it strikes the wall.
8. Two particles move in a uniform gravitational field with an acceleration g. At the initial moment , the particles were located at one point in space and moved with velocities v_1=3.0 m/s and v_2= 4.0 m/s horizontally in opposite directions. Find the distance between the particles and the moment when their velocity vectors become mutually perpendicular.
9.A particle is projected with a velocity u at an angle θ with the horizontal. Find the radius of curvature of a parabola traced out by the particle at the point where velocity makes an angle (θ/2) with the horizontal.
10. From the foot of an inclined plane, whose angle is $\tan^{-1}(7/25)$, a shot is projected with a velocity of 196 m/s at an angle of 30^0 with the horizontal up the plane. Find the range.
11. The acceleration experienced by a moving boat after its engine is cut off, is given by $d\omega/dt = -kv^3$, where k is a constant if v_0 is the magnitude of the velocity at cutoff find the magnitude of the velocity at time t after the cut off.
12. A particle is thrown over a triangle from one end of a horizontal bases and grazing the vertex, it falls on other end of base. If α and β are base angles and θ the angle of projection , prove $\tan\theta = \tan\alpha + \tan\beta$.
13.A particle is moving with a constant angular acceleration of 4 rad/s^2 in a circular path. At times t=0, the particle was at rest. Find the time at which the magnitude of centripetal acceleration and tangential acceleration are equal.
14.Two boats A and B move away from buoy anchored at the middle of a river along mutually perpendicular straight lines, the boat A moves along the river and the boat B across the river. Having moved off an equal distance from the buoy the boat returned. Find the times of motion of boats t_A/ t_B if the velocity of each boat with respect to water is n times greater than the stream velocity.

15.A particle starts its motion from the origin in positive x-direction. The given graph shows the variation of acceleration (a) with velocity (v). Plot the corresponding graph between velocity and time.



PART – B

OBJECTIVE

(MULTI CHOICE SINGLE CORRECT)

1. The displacement time graph for two particles A and B are straight lines inclined at angles of 30^0 and 60^0 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

2.A car travels the first half of a distance between two places at a speed of 30 km/hr and the second half of the distance at 50 km/hr. The average speed of the car for the whole journey is

a) 42.5 km/hr b) 40.0 km/hr c) 37.5 km/hr

d) 35.0 km/hr

5.A motor car moving with a uniform speed of 20 m/sec comes to stop on the application of brakes after travelling a distance of 10 m. Its acceleration is

a) 20 m/sec^2 b) -20m/sec^2 c) -40 m/sec^2

d) +2m/ sec^2

6.The velocity of body depends on time according to the equation v= 20+ 0.1 t^2. The body is undergoing

a) Uniform acceleration b) Uniform retardation

c) Non- uniform acceleration d) zero acceleration

7.A body travels for 15 sec starting from rest with constant acceleration. If it travels distances S_1, S_2 and S_3 in the first five seconds, second five seconds and next five seconds respectively the relation between S_1,S_2 and S_3 is

a) $S_1=S_2=S_3$ b) $5S_1= 3S_2=S_3$ c) $S_1=1/3\ S_2 = 1/5\ S_3$

d)$S_1=1/5\ S_2 =1/3\ S_3$

8. The relation 3t= $\sqrt{3x+6}$ describes the displacement of a particle in one direction where x is in meters and t in sec. The displacement, when the velocity is zero, is

a) 24 m b) 12m c) 5m d) zero

9.A body freely falling from the rest has a velocity 'v' after it falls through a height 'h'. The distance it has to fall down for its velocity to becomes double, is

a) 2h b) 4h c) 6h d) 8h

10. A particle is thrown vertically upwards. If its velocity at half of the maximum height is 10 m/s, then maximum height attained by it is (take g= 10 m/s^2)

a) 8m b) 10m c)12m d) 16m

11. Three different objects of masses m_1, m_2 and m_3 are allowed to fall from rest and from the same point 'O' along three different frictionless paths. The speed of the three objects, on reaching the ground , will be in the ratio of

a) m_1:m_2:m_3` b) m_1:$2m_2$:$3m_3$ c)1:1:1 d)1/m_1: 1/m_2: 1/m_3

12.A ball is released from the top of a tower of heights h meters.It takes T seconds to reach the ground. What is the position of the ball in T/3 seconds

a) h/9 meters from the ground

b) 8h/9 meters from the ground

c) 7h/9 meters from the ground

d) 17 h/18 meters from the ground

13. A parachutist after bailing out falls 50m without friction. When parachute opens, it decelerates at 2m/s^2. He reaches the ground with a speed of 30 m/s. At what height, did he bail out?

a) 75m b) 111m c) 91m d) 182m

14.If the equation for the displacement of a particle moving on a circular path is given by (θ) =2t^3 + 0.5, where θ is in radians and t in seconds, then the average angular velocity of the particle after 2 sec from its starts is

a) 8 rad/sec b) 12 rad/sec c) 24 rad/sec d)36 rad/sec

15.A body is thrown horizontally from the top of a tower of height 5 m. It touches the ground at a distance of 10 m from the foot of the tower. The initial velocity of the body is (g=10 m/s^2)

a) 2.5 m/s b) 5 m/s c)10m/s d) 20m/s

16.A particle is moving eastwards with velocity of 5m/s. In 10 sec the velocity changes to 5m/s northwards. The average acceleration in this time is

a) zero b)1/$\sqrt{2}$ m/s^2 toward north- west

c) 1/$\sqrt{2}$ m/s^2 toward north-east d) 1/2 m/s^2 toward north-west

17.Galileo writes that for angles of projection of a projectile at angles (45+θ) and (45-θ) the horizontal ranges described by the projectile are in the ratio of (if $\theta \leq 45$)

a) 2:1 b) 1:2 c) 1:1 d) 2:3

18. A ball is thrown from a point with a speed v_0, at an of projection θ. From the same point and at the same instance a person starts running with a constant speed $v_0/2$ to catch the ball. Will the person be able to catch the ball? If yes what should be the angle of projection.

a) yes, 60^0 b) yes, 30^0 c) NO d) Yes, 45^0

19. A boat is moving with velocity of $3\hat{i} + 4\hat{j}$ in river and water is moving with a velocity of $-3\hat{i} - 4\hat{j}$ with respect to ground. Relative velocity of boat with respect to water is

a) $-6\hat{i} - 8\hat{j}$ b) $6\hat{i} + 8\hat{j}$ c) $8\hat{i}$ d) $6\hat{i}$

MULTI CHOICE MULTI CORRECT

1. Two particles projected from the same point with same speed u at angles of projection α and β strike the horizontal ground at the same point. If h_1 and h_2 are the maximum heights attained by the projectiles, R is the range for both and t_1 and t_2 are their time of flights, respectively, then:

a) $\alpha + \beta = \pi/2$ b) $R = 4\sqrt{h_1 h_2}$ c) $t_1/t_2 = \tan\alpha$

d) $\tan\alpha = \sqrt{4h_1}/h_2$

2.Let a_r and a_t represent radial and tangential accelerations. The motion of a particle may be circular if:

a) $a_r = a_t = 0$ b) $a_r = 0$and $a_t = 0$ c) $a_r \neq 0$ and $a_t = 0$

d) $a_r = 0$ and $a_t = 0$

3. A particle is projected from ground with speed u at an angle θ with the horizontal. Radius of curvature:

a) is minimum at the highest point

b) is minimum at the point of projection

c) is same at all the points

d) varies $\frac{\text{from } u^2\cos^2\theta}{g}$ $\frac{\text{to } u^2}{g\cos\theta}$

4.A body is projected with velocity u at an angle of projection θ with the horizontal. The body makes 30^0 with the horizontal at t=2 second and then after 1 seconds it reaches the maximum height. Then:

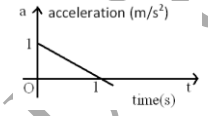
a) $u = 20\sqrt{3}$ m/s b) $\theta = 60^0$ c) $\theta = 45^0$

d) $u = 20/\sqrt{3}$ m/s

NUMERICAL BASED TYPE

1. A train of length 200m switches on its headlight when it starts moving with acceleration 0.5 m/s^2. Some time later, its tail light is switched on. An observer on the ground notices that the two events occur at the same place. The time interval between the two events is $K\times 10\sqrt{2}$. Then find the value of K.

2. A particle starting from rest moves in a straight line with acceleration as shown in the a-t graph. Find the distance (in m) travelled by the particle in the first four seconds from starts of its motion.



SECTION - II

1.Two particles starts moving along the same straight line starting at the same moment from the same point. The first moves with constant velocity u and the second with constant acceleration f. During the time that elapses before seconds catches the first, the greatest distance between the particles is

a) u/f b) $u^2/2f$ c) $f/2u^2$ d) u^2/f

2. The height y and distance x along the horizontal for a body projected in the vertical plane are given by $y = 8t - 5t^2$ and $x = 6t$. The initial speed of projection is

a) 8 m/s b) 9m/s c) 10m/s d)(10/3) m/s

3.A particle is projected horizontally in air at a height of 25 m from the ground with a speed of 10 m/s.The speed of the particle after 2 seconds will be

a) 10 m/s b)22.4 m/s c)25m/s d)28.4m/s

4.A stone falls freely from rest and the total distancecovered by it in the last second of its motion equal the distance covered by it in the first three seconds of its motion . The stone remains in the air for

a) 3 sec b) 5 sec c) 7 sec d) 4 sec

5.Speed of two identical cars are u and 4u at a specific instant. The ratio of the respective distance in which the two cars are stopped from that instant is

a) 1:1 b)1:4 c)1:8 d)1:16

6. A body is thrown horizontally from a tower, 100 m high with a velocity 10 ms^{-1}.It is moving at an angle of 45^0 with horizontal after.

a) 2 sec b) 4 sec c) 1 sec d) 3 sec

7. A ball is projected from ground with a speed of 20m/s at an angle of 45^0 with horizontal. There is a wall of 25 m height at a distance of 10 m from the projection point. The ball will hit the wall at a height of

a) 5m b) 7.5m c) 10m d) 12.5m

8. A motor boat is to reach a point 30^0 upstream on the other side of a river flowing with velocity 5m/s. Velocity of motor boat with respect to water is $5\sqrt{3}$ m/sec. The driver should steer the boat an angle of

a) 60^0 w.r.t. the line of destination from starting point

b) 60^0 w.r.t. normal to the bank

c) 120^0 w.r.t. stream direction

d) None of these