CLASS XI PHYSICS
Chapter–4: Motion in a Plane
Work Sheet-2   Module -2 / 2

1.The position of a particle is given by **r** = 3.0t **i** + 2.0 t^2 **j** + 5.0**k** t where t is in seconds and the coefficients have the proper units for r to be in metres. (a) Find v(t) and a(t) of the particle. (b) Find the magnitude and direction of v(t) at t = 1.0 s. [3 mks]

2. A particle starts from origin at t = 0 with a velocity 5.0 î m/s and moves in x-y plane under action of a force which produces a constant acceleration of (3.0 i+2.0 j) m/s^2.
(a) What is the y-coordinate of the particle at the instant its x-coordinate is 84 m ?
(b) What is the speed of the particle at this time ? [3 mks]

3. A hiker stands on the edge of a cliff 490 m above the ground and throws a stone horizontally with an initial speed of 15 m s-1. Neglecting air resistance, find the time taken by the stone to reach the ground, and the speed with which it hits the ground. (Take g = 9.8 m s-2). [3 mks]

4. A cricket ball is thrown at a speed of 28 m s–1 in a direction 30° above the horizontal. Calculate (a) the maximum height, (b) the time taken by the ball to return to the same level, and (c) the distance from the thrower to the point where the ball returns to the same level [3 mks]

5. An insect trapped in a circular groove of radius 12 cm moves along the groove steadily and completes 7 revolutions in 100 s. (a) What is the angular speed, and the linear speed of the motion? (b) Is the acceleration vector a constant vector ? What is its magnitude ?   [3 mks]

6. The ceiling of a long hall is 25 m high. What is the maximum horizontal distance that a ball thrown with a speed of 40 m s-1 can go without hitting the ceiling of the hall ? [3 mks]

7. A cricketer can throw a ball to a maximum horizontal distance of 100 m. How much high above the ground can the cricketer throw the same ball ? [2 mks]

8. A stone tied to the end of a string 80 cm long is whirled in a horizontal circle with a constant speed. If the stone makes 14 revolutions in 25 s, what is the magnitude and direction of acceleration of the stone ? [3 mks]

9. An aircraft executes a horizontal loop of radius 1.00 km with a steady speed of 900 km/h. Compare its centripetal acceleration with the acceleration due to gravity.   [2 mks]

10. Read each statement below carefully and state, with reasons, if it is true or false :
(a) The net acceleration of a particle in circular motion is *always* along the radius of the circle towards the centre
(b) The velocity vector of a particle at a point is *always* along the tangent to the path of the particle at that point
(c) The acceleration vector of a particle in *uniform* circular motion averaged over one cycle is a null vector [3 mks]

11. The position of a particle is given by r = 3.0t î − 2.0t^2 ĵ + 4.0 k̂ m where t is in seconds and the coefficients have the proper units for r to be in metres. (a) Find the v and a of the particle? (b) What is the magnitude and direction of velocity of the particle at t = 2.0 s ?   [3 mks]

12. A particle starts from the origin at t = 0 s with a velocity of 10.0 j m/s and moves in the *x-y* plane with a constant acceleration of (8.0 i+ 2.j)m. s-2. (a) At what time is the *x-* coordinate of the particle 16 m? What is the *y*-coordinate of the particle at that time? (b) What is the speed of the particle at the time ? [3 mks]

13. An aircraft is flying at a height of 3400 m above the ground. If the angle subtended at a ground observation point by the aircraft positions 10.0 s apart is 30°, what is the speed of the aircraft ? [2 mks]

14.A fighter plane flying horizontally at an altitude of 1.5 km with speed 720 km/h passes directly overhead an anti-aircraft gun. At what angle from the vertical should the gun be fired for the shell with muzzle speed 600 m s-1 to hit the plane ? At what minimum altitude should the pilot fly the plane to avoid being hit ? (Take *g* = 10 m s-2). [3 mks]

15 A cyclist is riding with a speed of 27 km/h. As he approaches a circular turn on the road of radius 80 m, he applies brakes and reduces his speed at the constant rate of 0.50 m/s every second. What is the magnitude and direction of the net acceleration of the cyclist on the circular turn ? [3 mks]