CBSE

MOTION IN A PLANE WS 10

Class 11 - Physics

Section A

1. The magnitude of displacement of a particle is **[1]**

   a) is equal to the path length of the particle between two points.

   b) is less than the path length of the particle between two points.

   c) is more than the path length of the particle between two points.

   d) is either less or equal to the path length of the particle between two points.

2. The position of a particle is given by $\vec{r} = 3.0t\hat{i} + 2.0t^2\hat{j} + 4.0\hat{k}$. Find the magnitude and direction of the velocity of the particle at t = 2.0 s. **[1]**

   a) 8.84 m s^{-1}, 75° with x-axis

   b) 6.54 m s^{-1}, 74° with x-axis

   c) 7.54 m s^{-1}, 72° with x-axis

   d) 8.54 m s^{-1}, 70° with x-axis

3. The three initial and final positions of a man on the x-axis are given as **[1]**

   i. (-8m, 7m)

   ii. (7m, -3m)

   iii. (-7m, 3m)

   Which pair gives the negative displacement?

   a) (iii)

   b) (i) and (iii)

   c) (ii)

   d) (i)

4. A particle starting from the origin (0, 0) moves in a straight line in the (x, y) plane. Its coordinates at a later time are $(\sqrt{3}, 3)$. The path of the particle makes with the x-axis an angle of **[1]**

   a) 30°

   b) 45°

   c) 60°

   d) 0°

5. A body moves 6 m north, 8 m east and 10 m vertically upwards, the resultant displacement from its initial position is **[1]**

   a) $\frac{10}{\sqrt{2}}$ m

   b) 20 m

   c) 10 m

   d) $10\sqrt{2}$ m

6. A cyclist moves in such a way that he takes 60° turn after every 100 metres. What is the displacement when he takes seventh turn? **[1]**

   a) 200 m

   b) 100 m

   c) $\frac{100}{\sqrt{3}}m$

   d) $100\sqrt{3}$ m

7. **Assertion (A):** If the position vector of a particle moving in space is given by $\overrightarrow{\mathbf{r}} = 2t\hat{\mathbf{i}} + 4t^2\hat{\mathbf{j}}$, then the particle moves along a parabolic trajectory. **[1]**

Reason (R): Because $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k} = 2\hat{i} + 4t^2\hat{j} \Rightarrow y = x^2$.

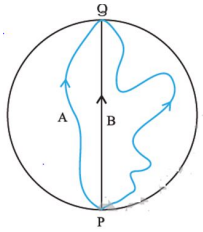
a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

8. Three girls skating on a circular ice ground of radius 200 m start from a point P on the edge of the ground and reach a point Q diametrically opposite to P following different paths as shown in figure. What is the magnitude of the displacement vector for each? For which girl is this equal to the actual length of path skate? **[1]**



a) 200 m for each; A

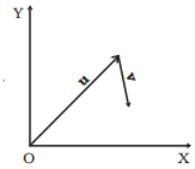
b) 300 m for each; C

c) 400 m for each; B

d) 200 m for each; B

9. Figure shows the orientation of two vectors u and v in the XY plane. **[1]**

If u = a$\hat{i}$ + b$\hat{j}$ and v = p$\hat{i}$ + q$\hat{j}$



Which of the following is correct?

a) a, b, p and q are all positive.

b) s and p are positive while b and q are negative.

c) a, q and b are positive while p is negative.

d) a, p and b are positive while q is negative.

10. Can we add a velocity vector to a displacement vector? **[1]**

Section B

11. **State True or False:** **[2]**

(a) For square whose side is a, then length of diagonal is $\sqrt{3}$a. **[1]**

(b) The total path length is always equal to the magnitude of the displacement vector of a particle. **[1]**

12. A car travels 20 km due north and then 35 km in a direction 60^o west of north. Find the magnitude and direction of resultant displacement of car. **[2]**

13. The position of a particle is given by r = $3.0t\hat{i} + 2.0t^2\hat{j} + 5.0\hat{k}$ where t is in seconds and the coefficients have the proper units for r to be in metres. **[2]**

i. Find v(t) and a(t) of the particles.

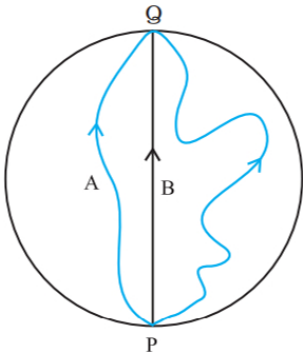
ii. Find the magnitude and the direction of v(t) at t = 1.0 s.

14. A body is moving with a uniform velocity of 10 m s^{-1} on a circular path of diameter 2.0 m. Calculate (i) the difference between the magnitude of the displacement of the body and the distance covered in half a round and (ii) the magnitude of the change in velocity of the body in half a round. **[2]**

15. A boy travels 10 m due to North and then 7 m due to East. Find the displacement and direction of the body. **[2]**

16. Distinguish between position and displacement vectors. **[2]**

17. Three girls skating on a circular ice ground of radius 200 m start from a point P on the edge of the ground and reach a point Q diametrically opposite to P following different paths as shown in figure. What is the magnitude of the displacement vector for each? For which girl is this equal to the actual length of the path skated? **[2]**



18. The position of a particle is given by **[2]**

$\vec{r} = 3.0t\hat{i} + 2.0t^2\hat{j} + 5.0\hat{k}$

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 = 3.0 s

Section C

19. **Fill in the blanks:** **[3]**

(a) The position vector of a particle lying at the origin is a _____ vector. **[1]**

(b) A vector that extends from a reference point to the point at which particle is located is called _____. **[1]**

(c) The vector which tells how much and in which direction an object has changed its position in a given interval of time is called _____. **[1]**

20. The position of a particle is given by r = $3.0t\hat{\mathrm{i}} + 2.0t^2\hat{\mathrm{j}} + 5.0\hat{\mathrm{k}}$ where t is in seconds and the coefficients have the proper units for r to be in metres. **[3]**

i. Find v(t) and a(t) of the particles.

ii. Find the magnitude and the direction of v(t) at t = 2.0 s.

21. Show that for a particle moving in two dimensions **[3]**

$\overrightarrow{r'} = \vec{r} + \vec{v}(t' - t) + \frac{1}{2}\vec{a}(t' - t)^2$

where $\vec{r}$ and $\overrightarrow{r'}$ are the position vectors of the particle at time t and t' respectively.

22. A particle has a displacement of 12 m towards east and 5 m towards the north and then 6 m vertically upward. Find the magnitude of the sum of these displacements. **[3]**

Section D

23. A bird is at a point P whose coordinates are (4m ,-1m, 5m). The bird observes two points P_1 and P_2 having coordinates (-1 m, 2 m, 0 m) and (1 m, 1 m, 4 m) respectively. At time t = 0, it starts flying in a plane of three positions, with a constant speed of $5ms^{-1}$ in a direction perpendicular to the straight line P_1P_2 till it sees P_1 and P_2 collinear at time t. Calculate t. **[5]**