Brain International School

Vikas Puri, New Delhi

ASSIGNMENT NO. 3

SUBJECT: PHYSICS **CLASS-XI** **JULY,2025**

CH: 3 MOTION IN A PLANE

1. Two vectors, both equal in magnitude, have their resultant equal in magnitude of the either. Find the angle between the two vectors.

   OR

   Two equal forces have their resultant equal to either. What is the inclination between them?

   Ans: 120°

2. Two forces whose magnitudes are in the ratio of 3:5 give a resultant of 35 N. If the angle of inclination be 60°, calculate the magnitude of each force.

   Ans: 15 N, 25 N.

3. Two forces equal to P and 2 P newton act on a particle. If the first be doubled and the second be increased by 20 N, the direction of the resultant is unaltered. Find the value of P.

   Ans: 10 N.

4. The sum of the magnitudes of two forces acting at a point is 18 N and the magnitude of their resultant is 12 N. If the resultant makes an angle of 90° with the force of smaller magnitude, what are the magnitudes of the two forces?

   Ans: 5N, 13 N.

5. Two equal forces have the square of their resultant equal to three times their product. Find the angle between them.

   Ans: 60°

6. At what angle do the two forces (P + Q) and (P−Q) act so that the resultant is $\sqrt{3P^2 + Q^2}$.

   Ans: 60°

7. The resultant of two equal forces acting at right angles to each other is 1414 dyne. Find the magnitude of either force.

   Ans: 1000 dyne.

8. Find the angle between two vectors $\vec{P}$ *and* $\vec{Q}$ if resultant of vectors is given by $R^2 = P^2 + Q^2$.

   Ans: 90°

9. Two vectors of 10 units & 5 units make an angle of 120° with each other. Find the magnitude & angle of resultant with vector of 10-unit magnitude.

   Ans: $5\sqrt{3}$, 30^0

10. If $|\vec{A} + \vec{B}| = |\vec{A}| + |\vec{B}|$,then find the angle between A and B.

    Ans: *zero*

11. If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vectors. Find the angle between these vectors.

$Ans: 90^0$

12. Find unit vector parallel to the resultant of the vector $\vec{A} = \hat{\imath} + 4\hat{\jmath} - 2\hat{k}$ and $\vec{B} = 3\hat{\imath} - 5\hat{\jmath} + \hat{k}$.

Ans: $\frac{1}{3\sqrt{2}}(4\hat{\imath} - \hat{\jmath} - \hat{k})$

13. A Vector$\vec{X}$, when added to the resultant of the vectors $\vec{A} = 3\hat{\imath} - 5\hat{\jmath} + 7\hat{k}$ and $\vec{B} = 2\hat{\imath} + 4\hat{\jmath} - 3\hat{k}$ gives a unit vector along Y-axis. Find the vector $\vec{X}$.

Ans: $-5\hat{\imath} + 2\hat{\jmath} - 4\hat{k}$

14. If $\vec{A} = 3\hat{\imath} + 4\,\hat{\jmath}$ and $\vec{B} = 7\hat{\imath} + 24\hat{\jmath}$, find a vector having the same magnitude as $\vec{B}$ and parallel to $\vec{A}$.

Ans: $15\,\hat{\imath} + 20\,\hat{\jmath}$

15. Find the angle between the vectors
$\vec{A} = \hat{\imath} + 2\,\hat{\jmath} - \hat{k}$ and $\vec{B} = -\hat{\imath} + \hat{\jmath} - 2\,\hat{k}$.

Ans: 60°.

16. Prove that the vectors $\vec{A} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ and $\vec{B} = 2\hat{\imath} - \hat{\jmath}$ are perpendicular to each other.

Ans: $\vec{A} \perp \vec{B}$.

17. Find the value of λ so that the vectors $\vec{A} = 2\hat{\imath} + \lambda\hat{\jmath} + \hat{k}$ and $\vec{B} = 4\hat{\imath} - 2\hat{\jmath} - 2\hat{k}$ are perpendicular to each other.

Ans: 3

18. Find the angle between the vector $\vec{A} = \hat{\imath} + \hat{\jmath} + \hat{k}$ and $\vec{B} = -\hat{\imath} - \hat{\jmath} + 2\hat{k}$.

Ans: 90°

19. For what value of m, is the vector $\vec{A} = 2\hat{\imath} + 3\hat{\jmath} - 6\hat{k}$ perpendicular to the vector $\vec{B} = 3\hat{\imath} - m\hat{\jmath} + 6\hat{k}$?

Ans: -10

20. Calculate the area of the triangle determine by the two vectors: $\vec{A} = 3\hat{\imath} + 4\hat{\jmath}$ and $\vec{B} = -3\hat{\imath} + 7\hat{\jmath}$.

Ans: 16.5 square units

21. Find the area of a parallelogram formed by vectors $\vec{A} = 3\hat{\imath} + 2\hat{\jmath}$ and $\vec{B} = -3\hat{\imath} + 7\hat{\jmath}$.

Ans: $3\sqrt{3}$ square units

22. Find the components of $\vec{a} = 2\hat{\imath} + 3\hat{\jmath}$ along the directions of vectors $\hat{\imath} + \hat{\jmath}$ and $\hat{\imath} - \hat{\jmath}$.

23. Rain is falling vertically with a speed of 35 m/s. Winds starts blowing after sometime with a speed of 12 m/s in east to west direction. In which direction should a boy waiting at a bus stop hold his umbrella?

Ans: $\theta = \tan^{-1}\frac{12}{35}$

24. A motorboat is racing towards north at 25 km/h and the water current in that region is 10 km/h in the direction of 60° east of south. Find the resultant velocity of the boat.

Ans: $22m/s$

25. The position of a particle is given by

$$\vec{r} = 3.0\,t\,\hat{\imath} - 2.0\,t^2\hat{\jmath} + 4.0\,\hat{k}\ \text{m}$$

Where t is in seconds and the coefficients have the proper units for $\vec{r}$ to be in meters.

(i) Find the $\vec{v}$ and $\vec{a}$ of the particle. (ii) What is the magnitude and direction of velocity of the particle at t = 2 s?

26. The position of a particle is given by

$$\vec{r} = 3.0\,t\,\hat{\imath} - 2.0\,t^2\hat{\jmath} + 5.0\,\hat{k}\ \text{m}$$

Where t is in seconds and the coefficients have the proper units for $\vec{r}$ to be in meters.

(i) Find the $\vec{v}$ and $\vec{a}$ of the particle. (ii) What is the magnitude and direction of velocity of the particle at t = 1 s?

27. A particle starts from origin at t = 0 with a velocity 10.0 j m/s and moves in x-y plane under action of a force which produces a constant acceleration of $(8\hat{\imath} + 2\hat{\jmath})$ m/s^2(a) (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?

28. A particle starts from origin at t = 0 with a velocity 5.0 i m/s and moves in x-y plane under action of a force which produces a constant acceleration of $(3\hat{\imath} + 2\hat{\jmath})$ 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?

Ans:(a) $36\ m$ (b) $26\ m/s$

29. An aeroplane is flying at a height of 1960 m in horizontal direction with a velocity of 360 km/hr. When it is vertically above the point. A on the ground, it drops a bomb. The bomb strikes a point B on the ground, then the time taken by the bomb to reach the ground is-

(a) $20\sqrt{2}$ sec (b) 20 sec (c) $10\sqrt{2}$ sec (d) 10 sec

30. A body is projected with a velocity of 30 ms^{-1} at an angle of 30° with the vertical. Find the maximum height, time of flight and the horizontal range.

31. From the top of a tower 156.8 m high a projectile is projected with a velocity of 39.2 ms^{-1} in a direction making an angle 30° with horizontal. Find the distance from the foot of tower where it strikes the ground and time taken to do so.

ANS: t = 8 sec, R = 271.57 m

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32. A cricket ball is thrown at a speed of 28 m/s 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.

Ans:(a) $10\ m$ (b) $2.9\ s$ (c) 69 m

CIRCULAR MOTION

33. 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?

Ans:$10\ m/s2$

34. 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?

Ans:(a) $0.44\frac{rad}{s}, 5.3\frac{cm}{s}$ (b) $2.3cm/s2$