DPP - Daily Practice Problems

Chapter-wise Sheets

Date : | Start Time : | End Time :

PHYSICS

CP03

SYLLABUS : Motion in a Plane

Max. Marks : 120 **Marking Scheme :** (+4) for correct & (–1) for incorrect answer **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 30 MCQs. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. If $|\vec{A}\times\vec{B}|=\sqrt{3}\vec{A}.\vec{B}$ then the value of $|\vec{A}\times\vec{B}|$ is

(a) $(A^2+B^2+\sqrt{3}AB)^{1/2}$ (b) $(A^2+B^2+AB)^{1/2}$

(c) $\left(A^2+B^2+\frac{AB}{\sqrt{3}}\right)^{1/2}$ (d) $A+B$

2. A projectile is given an initial velocity of $(\hat{i}+2\hat{j})$ m/s, where $\hat{i}$ is along the ground and $\hat{j}$ is along the vertical. If $g=10$ m/s^2, the equation of its trajectory is :

(a) $y=x-5x^2$ (b) $y=2x-5x^2$

(c) $4y=2x-5x^2$ (d) $4y=2x-25x^2$

3. A projectile is thrown in the upward direction making an angle of 60° with the horizontal direction with a velocity of 147 m s^{-1}. Then the time after which its inclination with the horizontal is 45°, is

(a) 15 s (b) 10.98 s

(c) 5.49 s (d) 2.745 s

4. For a particle in uniform circular motion, the acceleration $\vec{a}$ at a point P(R,θ) on the circle of radius R is (Here θ is measured from the x-axis)

(a) $-\frac{v^2}{R}\cos\theta\ \hat{i}+\frac{v^2}{R}\sin\theta\ \hat{j}$

(b) $-\frac{v^2}{R}\sin\theta\ \hat{i}+\frac{v^2}{R}\cos\theta\ \hat{j}$

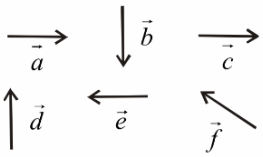
(c) $-\frac{v^2}{R}cos\theta\ \hat{i}-\frac{v^2}{R}\sin\theta\ \hat{j}$

(d) $\frac{v^2}{R}\hat{i}+\frac{v^2}{R}\hat{j}$

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ

Space for Rough Work

5. Six vectors, $\vec{a}, \vec{b}, \vec{c}, \vec{d}, \vec{e}$ and $\vec{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true?



(a) $\vec{b}+\vec{c}=\vec{f}$

(b) $\vec{d}+\vec{c}=\vec{f}$

(c) $\vec{d}+\vec{e}=\vec{f}$

(d) $\vec{b}+\vec{e}=\vec{f}$

6. Two particles start simultaneously from the same point and move along two straight lines, one with uniform velocity v and other with a uniform acceleration a. If α is the angle between the lines of motion of two particles then the least value of relative velocity will be at time given by

(a) $\frac{v}{a}\sin\alpha$ (b) $\frac{v}{a}\cos\alpha$

(c) $\frac{v}{a}\tan\alpha$ (d) $\frac{v}{a}\cot\alpha$

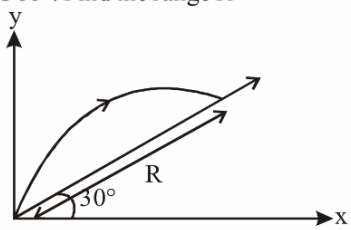
7. Initial velocity with which a body is projected is 10 m/sec and angle of projection is 60°. Find the range R

(a) $\frac{15\sqrt{3}\text{m}}{2}$

(b) $\frac{40}{3}\text{m}$

(c) $5\sqrt{3}\text{m}$

(d) $\frac{20}{3}\text{m}$



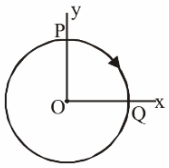
8. A particle moves in a circle of radius 4 cm clockwise at constant speed 2 cm/s. If $\hat{x}$ and $\hat{y}$ are unit acceleration vectors along X and Y-axis respectively (in cm/s^2), the acceleration of the particle at the instant half way between P and Q is given by

(a) $-4(\hat{x}+\hat{y})$

(b) $4(\hat{x}+\hat{y})$

(c) $-(\hat{x}+\hat{y})/\sqrt{2}$

(d) $(\hat{x}-\hat{y})/4$



9. If vectors $\vec{A}=\cos\omega t\hat{i}+\sin\omega t\hat{j}$ and $\vec{B}=\cos\frac{\omega t}{2}\hat{i}+\sin\frac{\omega t}{2}\hat{j}$ are functions of time, then the value of t at which they are orthogonal to each other is :

(a) $t=\frac{\pi}{2\omega}$ (b) $t=\frac{\pi}{\omega}$

(c) $t=0$ (d) $t=\frac{\pi}{4\omega}$

10. A bus is moving on a straight road towards north with a uniform speed of 50 km/hour turns through 90°. If the speed remains unchanged after turning, the increase in the velocity of bus in the turning process is

(a) 70.7 km/hour along south-west direction

(b) 70.7 km/hour along north-west direction.

(c) 50 km/hour along west

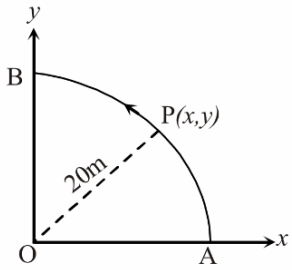
(d) zero

11. The velocity of projection of oblique projectile is $(6\hat{i}+8\hat{j})\,\text{m s}^{-1}$. The horizontal range of the projectile is

(a) 4.9m (b) 9.6m

(c) 19.6m (d) 14m

12. A point P moves in counter-clockwise direction on a circular path as shown in the figure. The movement of 'P' is such that it sweeps out a length $s=t^3+5$, where s is in metres and t is in seconds. The radius of the path is 20 m. The acceleration of 'P' when $t=2$ s is nearly



(a) 13 m/s^2 (b) 12 m/s^2

(c) 7.2 ms^2 (d) 14 m/s^2

RESPONSE GRID					
	5. ⓐⓑⓒⓓ	**6.** ⓐⓑⓒⓓ	**7.** ⓐⓑⓒⓓ	**8.** ⓐⓑⓒⓓ	**9.** ⓐⓑⓒⓓ
	10. ⓐⓑⓒⓓ	**11.** ⓐⓑⓒⓓ	**12.** ⓐⓑⓒⓓ		

Space for Rough Work

13. The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to the vector $\vec{A}$ and its magnitude is equal to half the magnitude of vector $\vec{B}$. The angle between $\vec{A}$ and $\vec{B}$ is
(a) 120° (b) 150°
(c) 135° (d) 180°

14. A man running along a straight road with uniform velocity $\vec{u} = u\hat{i}$ feels that the rain is falling vertically down along $-\hat{j}$. If he doubles his speed, he finds that the rain is coming at an angle θ with the vertical. The velocity of the rain with respect to the ground is

(a) $ui - uj$ (b) $ui - \frac{u}{\tan\theta}\hat{j}$

(c) $2u\hat{i} + u\cot\theta\hat{j}$ (d) $ui + u\sin\theta\hat{j}$

15. Two projectiles A and B thrown with speeds in the ratio $1 : \sqrt{2}$ acquired the same heights. If A is thrown at an angle of 45° with the horizontal, the angle of projection of B will be
(a) 0° (b) 60°
(c) 30° (d) 45°

16. A stone tied to the end of a string of 1 m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolutions in 44 seconds, what is the magnitude and direction of acceleration of the stone?
(a) π^2 m s^{-2} and direction along the radius towards the centre
(b) π^2 m s^{-2} and direction along the radius away from the centre
(c) π^2 m s^{-2} and direction along the tangent to the circle
(d) $\pi^2/4$ m s^{-2} and direction along the radius towards the centre

17. A particle moves so that its position vector is given by $\vec{r} = \cos\omega t\hat{x} + \sin\omega t\hat{y}$. Where ω is a constant. Which of the following is true ?
(a) Velocity and acceleration both are perpendicular to $\vec{r}$
(b) Velocity and acceleration both are parallel to $\vec{r}$
(c) Velocity is perpendicular to $\vec{r}$ and acceleration is directed towards the origin
(d) Velocity is perpendicular to $\vec{r}$ and acceleration is directed away from the origin

18. A ship A is moving Westwards with a speed of 10 km h^{-1} and a ship B 100 km South of A, is moving Northwards with a speed of 10 km h^{-1}. The time after which the distance between them becomes shortest, is :

(a) 5 h (b) $5\sqrt{2}$ h

(c) $10\sqrt{2}$ h (d) 0 h

19. A projectile is fired at an angle of 45° with the horizontal. Elevation angle of the projectile at its highest point as seen from the point of projection is

(a) 60° (b) $\tan^{-1}\left(\frac{1}{2}\right)$

(c) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (d) 45°

20. The position vector of a particle $\vec{R}$ as a function of time is given by $\vec{R} = 4\sin(2\pi t)\hat{i} + 4\cos(2\pi t)\hat{j}$

where R is in meter, t in seconds and $\hat{i}$ and $\hat{j}$ denote unit vectors along x-and y-directions, respectively.
Which one of the following statements is wrong for the motion of particle?

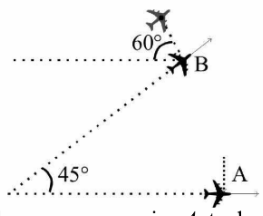
(a) Magnitude of acceleration vector is $\frac{v^2}{R}$, where v is the velocity of particle
(b) Magnitude of the velocity of particle is 8 meter/second
(c) Path of the particle is a circle of radius 4 meter.
(d) Acceleration vector is along - $\vec{R}$

21. The vectors $\overrightarrow{A}$ and $\overrightarrow{B}$ are such that $|\overrightarrow{A} + \overrightarrow{B}| = |\overrightarrow{A} - \overrightarrow{B}|$
The angle between the two vectors is
(a) 60° (b) 75°
(c) 45° (d) 90°

RESPONSE GRID					
	13. ⓐⓑⓒⓓ	**14.** ⓐⓑⓒⓓ	**15.** ⓐⓑⓒⓓ	**16.** ⓐⓑⓒⓓ	**17.** ⓐⓑⓒⓓ
	18. ⓐⓑⓒⓓ	**19.** ⓐⓑⓒⓓ	**20.** ⓐⓑⓒⓓ	**21.** ⓐⓑⓒⓓ	

Space for Rough Work

22. Passengers in the jet transport *A* flying east at a speed of 800 kmh^{-1} observe a second jet plane *B* that passes under the transport in horizontal flight. Although the nose of *B* is pointed in the 45° north east direction, plane *B* appears to the passengers in *A* to be moving away from the transport at the 60° angle as shown. The true velocity of *B* is



(a) 586 kmh^{-1} (b) 600 kmh^{-1}
(c) 717 kmh^{-1} (d) 400 kmh^{-1}

23. An artillary piece which consistently shoots its shells with the same muzzle speed has a maximum range R. To hit a target which is R/2 from the gun and on the same level, the elevation angle of the gun should be
(a) 15° (b) 45°
(c) 30° (d) 60°

24. A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 seconds in every circular loop. The average velocity and average speed for each circular loop respectively, is
(a) 0, 10 m/s (b) 10 m/s, 10 m/s
(c) 10 m/s, 0 (d) 0, 0

25. A vector of magnitude b is rotated through angle θ. What is the change in magnitude of the vector?
(a) $2b\sin\frac{\theta}{2}$ (b) $2b\cos\frac{\theta}{2}$
(c) $2b\sin\theta$ (d) $2b\cos\theta$

26. A boat which has a speed of 5 km/hr in still water crosses a river of width 1 km along the shortest possible path in 15 minutes. The velocity of the river water in km/hr is
(a) 3 (b) 4
(c) $\sqrt{21}$ (d) 1

27. A stone projected with a velocity u at an angle θ with the horizontal reaches maximum height H_1. When it is projected with velocity u at an angle $\left(\frac{\pi}{2}-\theta\right)$ with the horizontal, it reaches maximum height H_2. The relation between the horizontal range R of the projectile, heights H_1 and H_2 is
(a) $R = 4\sqrt{H_1H_2}$ (b) $R = 4(H_1 - H_2)$
(c) $R = 4(H_1 + H_2)$ (d) $R = \frac{H_1^2}{H_2^2}$

28. A water fountain on the ground sprinkles water all around it. If the speed of water coming out of the fountain is *v*, the total area around the fountain that gets wet is :
(a) $\pi\frac{v^4}{g^2}$ (b) $\frac{\pi}{2}\frac{v^4}{g^2}$ (c) $\pi\frac{v^2}{g^2}$ (d) $\pi\frac{v^2}{g}$

29. The vector sum of two forces is perpendicular to their vector differences. In that case, the forces
(a) cannot be predicted
(b) are equal to each other
(c) are equal to each other in magnitude
(d) are not equal to each other in magnitude

30. A particle crossing the origin of co-ordinates at time t = 0, moves in the xy-plane with a constant acceleration a in the y-direction. If its equation of motion is $y = bx^2$ (b is a constant), its velocity component in the x-direction is
(a) $\sqrt{\frac{2b}{a}}$ (b) $\sqrt{\frac{a}{2b}}$ (c) $\sqrt{\frac{a}{b}}$ (d) $\sqrt{\frac{b}{a}}$

RESPONSE GRID				
22. ⓐⓑⓒⓓ	23. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ	25. ⓐⓑⓒⓓ	26. ⓐⓑⓒⓓ
27. ⓐⓑⓒⓓ	28. ⓐⓑⓒⓓ	29. ⓐⓑⓒⓓ	30. ⓐⓑⓒⓓ	

DAILY PRACTICE PROBLEM DPP CHAPTERWISE CP03 - PHYSICS			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	45	Qualifying Score	60
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work