DPP - Daily Practice Problems

Chapter-wise Sheets

Date : Start Time : End Time :

PHYSICS CP03

SYLLABUS : Motion in a Plane

Max. Marks : 180 **Marking Scheme :** (+4) for correct & (–1) for incorrect answer **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQs. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. 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) $4y = 2x - 25x^2$

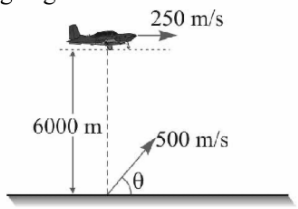
2. An aircraft moving with a speed of 250 m/s is at a height of 6000 m, just overhead of an anti aircraft–gun. If the muzzle velocity is 500 m/s, the firing angle θ should be:

(a) 30°

(b) 45°

(c) 60°

(d) 75°



3. Two racing cars of masses m_1 and m_2 are moving in circles of radii r_1 and r_2 respectively. Their speeds are such that each makes a complete circle in the same duration of time t. The ratio of the angular speed of the first to the second car is

(a) $m_1 : m_2$ (b) $r_1 : r_2$

(c) 1 : 1 (d) $m_1 r_1 : m_2 r_2$

4. A boy playing on the roof of a 10 m high building throws a ball with a speed of 10m/s at an angle of 30° with the horizontal. How far from the throwing point will the ball be at the height of 10 m from the ground ?

[$g = 10 m/s^2$, $\sin 30^o = \frac{1}{2}$, $\cos 30^o = \frac{\sqrt{3}}{2}$]

(a) 5.20m (b) 4.33m (c) 2.60m (d) 8.66m

5. A bomber plane moves horizontally with a speed of 500 m/s and a bomb released from it, strikes the ground in 10 sec. Angle at which it strikes the ground wil be (g = 10 m/s^2)

(a) $\tan^{-1}\left(\frac{1}{5}\right)$ (b) $\tan\left(\frac{1}{5}\right)$

(c) $\tan^{-1}(1)$ (d) $\tan^{-1}(5)$

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) $\frac{v}{a}\cot\alpha$

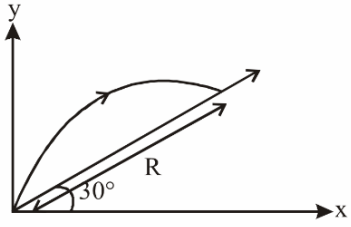
7. Initial velocity with which a body is projected is 10 m/sec and angle of projection is 60°. Find the range R

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

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

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

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



RESPONSE GRID					
1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ
6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ			

Space for Rough Work

8. The position vectors of points A, B, C and D are $A = 3\hat{i}+4\hat{j}+5\hat{k}, B = 4\hat{i}+5\hat{j}+6\hat{k}, C = 7\hat{i}+9\hat{j}+3\hat{k}$ and $D = 4\hat{i}+6\hat{j}$ then the displacement vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are
(a) perpendicular (b) parallel
(c) antiparallel (d) inclined at an angle of 60°

9. A person swims in a river aiming to reach exactly on the opposite point on the bank of a river. His speed of swimming is 0.5 m/s at an angle of 120° with the direction of flow of water. The speed of water is
(a) 1.0 m/s (b) 0.5 m/s (c) 0.25 m/s (d) 0.43 m/s

10. A projectile thrown with velocity v making angle θ with vertical gains maximum height H in the time for which the projectile remains in air, the time period is
(a) $\sqrt{H\cos\theta/g}$ (b) $\sqrt{2H\cos\theta/g}$
(c) $\sqrt{4H/g}$ (d) $\sqrt{8H/g}$

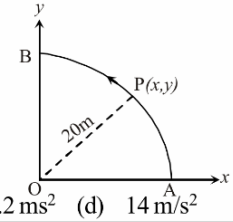
11. A ball is thrown from a point with a speed 'v_0' at an elevation angle of θ. From the same point and at the same instant, a person starts running with a constant speed $\frac{'v_0'}{2}$ to catch the ball. Will the person be able to catch the ball? If yes, what should be the angle of projection θ ?
(a) No, 0° (b) Yes, 30° (c) Yes, 60° (d) Yes, 45°

12. 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) $t = \frac{\pi}{4\omega}$

13. 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

14. The velocity of projection of oblique projectile is $(6\hat{i}+8\hat{j})\,ms^{-1}$. The horizontal range of the projectile is
(a) 4.9m (b) 9.6m (c) 19.6m (d) 14m

15. 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/s² (b) 12 m/s² (c) 7.2 ms² (d) 14 m/s²

16. 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°

17. 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) $ui+u\sin\theta\hat{j}$

18. 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°

19. A projectile can have the same range 'R' for two angles of projection. If 'T_1' and 'T_2' be time of flights in the two cases, then the product of the two time of flights is directly proportional to
(a) R (b) $\frac{1}{R}$ (c) $\frac{1}{R^2}$ (d) R^2

20. A man standing on the roof of a house of height h throws one particle vertically downwards and another particle horizontally with the same velocity u. The ratio of their velocities when they reach the earth's surface will be

(a) $\sqrt{2gh+u^2}:u$ (b) 1 : 2
(c) 1 : 1 (d) $\sqrt{2gh+u^2}:\sqrt{2gh}$

21. If a unit vector is represented by $0.5\hat{i}+0.8\hat{j}+c\hat{k}$, the value of c is
(a) 1 (b) $\sqrt{0.11}$ (c) $\sqrt{0.01}$ (d) 0.39

22. An aeroplane is flying at a constant horizontal velocity of 600 km/hr at an elevation of 6 km towards a point directly above the target on the earth's surface. At an appropriate time, the pilot releases a ball so that it strikes the target at the earth. The ball will appear to be falling
(a) on a parabolic path as seen by pilot in the plane
(b) vertically along a straight path as seen by an observer on the ground near the target
(c) on a parabolic path as seen by an observer on the ground near the target
(d) on a zig-zag path as seen by pilot in the plane

RESPONSE GRID				
8. (a)(b)(c)(d)	9. (a)(b)(c)(d)	10. (a)(b)(c)(d)	11. (a)(b)(c)(d)	12. (a)(b)(c)(d)
13. (a)(b)(c)(d)	14. (a)(b)(c)(d)	15. (a)(b)(c)(d)	16. (a)(b)(c)(d)	17. (a)(b)(c)(d)
18. (a)(b)(c)(d)	19. (a)(b)(c)(d)	20. (a)(b)(c)(d)	21. (a)(b)(c)(d)	22. (a)(b)(c)(d)

Space for Rough Work

23. A particle is projected with a velocity v such that its range on the horizontal plane is twice the greatest height attained by it. The range of the projectile is (where g is acceleration due to gravity)

(a) $\frac{4v^2}{5g}$ (b) $\frac{4g}{5v^2}$ (c) $\frac{v^2}{g}$ (d) $\frac{4v^2}{\sqrt{5}g}$

24. Two stones are projected from the same point with same speed making angles $(45° + \theta)$ and $(45° - \theta)$ with the horizontal respectively. If $\theta \le 45°$, then the horizontal ranges of the two stones are in the ratio of

(a) 1 : 1 (b) 1 : 2 (c) 1 : 3 (d) 1 : 4

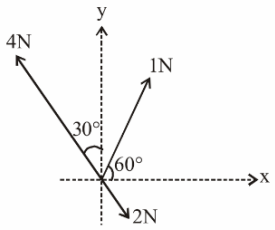
25. Three forces acting on a body are shown in the figure. To have the resultant force only along the y-direction, the magnitude of the minimum additional force needed is:

(a) 0.5 N

(b) 1.5 N

(c) $\frac{\sqrt{3}}{4}$ N

(d) $\sqrt{3}$N



26. A particle moves in x-y plane under the action of force $\vec{F}$ and $\vec{p}$ at a given time t $p_x = 2\cos\theta, p_y = 2\sin\theta$. Then the angle θ between $\vec{F}$ and $\vec{p}$ at a given time t is :

(a) $\theta = 30°$ (b) $\theta = 180°$ (c) $\theta = 0°$ (d) $\theta = 90°$

27. A person sitting in the rear end of the compartment throws a ball towards the front end. The ball follows a parabolic path. The train is moving with velocity of 20 m/s. A person standing outside on the ground also observes the ball. How will the maximum heights (y_m) attained and the ranges (R) seen by the thrower and the outside observer compare with each other?

(a) Same y_m different R (b) Same y_m and R

(c) Different y_m same R (d) Different y_m and R

28. A car moves on a circular road. It describes equal angles about the centre in equal intervals of time. Which of the following statement about the velocity of the car is true ?

(a) Magnitude of velocity is not constant

(b) Both magnitude and direction of velocity change

(c) Velocity is directed towards the centre of the circle

(d) Magnitude of velocity is constant but direction changes

29. Three particles A, B and C are thrown from the top of a tower with the same speed. A is thrown up, B is thrown down and C is horizontally. They hit the ground with speeds v_A, v_B and v_C respectively then,

(a) $v_A = v_B = v_C$ (b) $v_A = v_B > v_C$

(c) $v_B > v_C > v_A$ (d) $v_A > v_B = v_C$

30. A particle is moving such that its position coordinate (x, y) are

(2m, 3m) at time t = 0

(6m, 7m) at time t = 2 s and

(13m, 14m) at time t = 5s.

Average velocity vector $(\vec{V}_{av})$ from t = 0 to t = 5s is :

(a) $\frac{1}{5}(13\hat{i} + 14\hat{j})$ (b) $\frac{7}{3}(\hat{i} + \hat{j})$

(c) $2(\hat{i} + \hat{j})$ (d) $\frac{11}{5}(\hat{i} + \hat{j})$

31. 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

32. Two boys are standing at the ends A and B of a ground where $AB = a$. The boy at B starts running in a direction perpendicular to AB with velocity v_1. The boy at A starts running simultaneously with velocity v and catches the other boy in a time t, where t is

(a) $a/\sqrt{v^2 + v_1^2}$ (b) $a/(v + v_1)$

(c) $a/(v - v_1)$ (d) $\sqrt{a^2/(v^2 - v_1^2)}$

33. 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°

34. 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 - $\vec{R}$

35. The vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$ The angle between the two vectors is

(a) 60° (b) 75° (c) 45° (d) 90°

RESPONSE GRID					
	23. (a)(b)(c)(d)	**24.** (a)(b)(c)(d)	**25.** (a)(b)(c)(d)	**26.** (a)(b)(c)(d)	**27.** (a)(b)(c)(d)
	28. (a)(b)(c)(d)	**29.** (a)(b)(c)(d)	**30.** (a)(b)(c)(d)	**31.** (a)(b)(c)(d)	**32.** (a)(b)(c)(d)
	33. (a)(b)(c)(d)	**34.** (a)(b)(c)(d)	**35.** (a)(b)(c)(d)		

Space for Rough Work

36. The velocity of projection of oblique projectile is $(6\hat{i}+8\hat{j})\,m\,s^{-1}$. The horizontal range of the projectile is
(a) 4.9m (b) 9.6m (c) 19.6m (d) 14m

37. 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°

38. 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

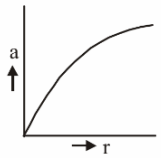
39. A vector of magnitude b is rotated through angle θ. What is the change in magnitude of the vector?
(a) $2b\sin\frac{\theta}{2}$ (b) $2b\cos\frac{\theta}{2}$ (c) $2b\sin\theta$ (d) $2b\cos\theta$

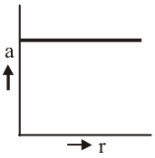
40. A stone projected with a velocity u at an angle θ with the horizontal reaches maximum height H_1. When it is projected with velocity u at an angle $\left(\frac{\pi}{2}-\theta\right)$ with the horizontal, it reaches maximum height H_2. The relation between the horizontal range R of the projectile,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

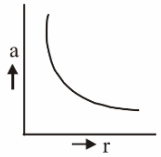
41. The vector sum of two forces is perpendicular to their vector differences. In that case, the forces
(a) cannot be predicted
(b) are equal to each other
(c) are equal to each other in magnitude
(d) are not equal to each other in magnitude

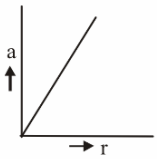
42. A particle crossing the origin of co-ordinates at time t = 0, moves in the xy-plane with a constant acceleration a in the y-direction. If its equation of motion is $y = bx^2$ (b is a constant), its velocity component in the x-direction is
(a) $\sqrt{\frac{2b}{a}}$ (b) $\sqrt{\frac{a}{2b}}$ (c) $\sqrt{\frac{a}{b}}$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

43. A vector $\vec{A}$ is rotated by a small angle Δθ radian ($\Delta\theta \ll 1$) to get a new vector $\vec{B}$ In that case $|\vec{B}-\vec{A}|$ is :
(a) $|\vec{A}|\Delta\theta$ (b) $|\vec{B}|\Delta\theta-|\vec{A}|$
(c) $|\vec{A}|\left(1-\frac{\Delta\theta^2}{2}\right)$ (d) 0

44. If a body moving in circular path maintains constant speed of 10 ms^{-1}, then which of the following correctly describes relation between acceleration and radius ?
(a) 

(b) 

(c) 

(d) 

45. The position of a projectile launched from the origin at $t = 0$ is given by $\vec{r}=\left(40\hat{i}+50\hat{j}\right)m$ at $t = 2s$. If the projectile was launched at an angle θ from the horizontal, then θ is (take $g = 10\ ms^{-2}$)
(a) $\tan^{-1}\frac{2}{3}$ (b) $\tan^{-1}\frac{3}{2}$ (c) $\tan^{-1}\frac{7}{4}$ (d) $\tan^{-1}\frac{4}{5}$

RESPONSE GRID					
	36. ⓐⓑⓒⓓ	37. ⓐⓑⓒⓓ	38. ⓐⓑⓒⓓ	39. ⓐⓑⓒⓓ	40. ⓐⓑⓒⓓ
	41. ⓐⓑⓒⓓ	42. ⓐⓑⓒⓓ	43. ⓐⓑⓒⓓ	44. ⓐⓑⓒⓓ	45. ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM DPP CHAPTERWISE CP03 - PHYSICS			
Total Questions	45	Total Marks	180
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	50	Qualifying Score	70
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work