MOTION IN A PLANE LEVEL 2
SET 2

Single Correct Answer Type

1. There are two forces each of magnitude 10 units. One inclined at an angle of 30° and the other at an angle of 135° to the positive direction of x −axis. The x and y components of the resultant are respectively.
   a) $1.59\hat{i}$ and $12.07\hat{j}$ b) $10\hat{i}$ and $10\hat{j}$ c) $1.59\hat{i}$ d) $15.9\hat{i}$ and $12.07\hat{j}$
2. If $\vec{A}+\vec{B}=\vec{C}$ and $A=\sqrt{3}, B=\sqrt{3}$ and $C=3$, then the angle between $\vec{A}$ *and* $\vec{B}$ is
   a) 0° b) 30° c) 60° d) 90°
3. If $\vec{A}\cdot\vec{B}=0$ and $\vec{A}\times\vec{B}=1$, then $\vec{A}$ and $\vec{B}$ are
   a) Perpendicular unit vectors b) Parallel unit vectors
   c) Parallel d) Perpendicular.
4. The maximum speed with which a car is driven round a curve of radius 18 m without skidding (where, g $=10\text{ms}^{-2}$ and the coefficient of friction between rubber tyres and the roadway is 0.2) is
   a) 36.0 km h^{-1} b) 18.0 km h^{-1} c) 21.6 km h^{-1} d) 14.4 km h^{-1}
5. The minimum speed for a particle at the lowest point of a vertical circle of radius r, to describe the circle is v. If the radius of the circle is reduced to one-fourth its value, the corresponding minimum speed will be
   a) $v/4$ b) $v/2$ c) $2v$ d) $4v$
6. A string of length l is fixed at one end and caries a mass m at the other end. The string makes $2/\pi$ rps around a vertical axis through the fixed end. What is the tension in string?
   a) $m\,l$ b) 16 $m\,l$ c) 4 $m\,l$ d) 2 $m\,l$
7. A motorcycle is going on an overbridge of radius R. The driver maintains a constant speed. As the motorcycle is ascending on the overbridge, the normal force on it
   a) Increases b) Decreases c) Remains the same d) Fluctuates
8. If $\vec{A}$ and $\vec{B}$ denote the sides of a parallelogram and its area is $\frac{1}{2}AB$(A and B are the magnitude of $\vec{A}$ and $\vec{B}$ respectively), the angle between $\vec{A}$ and $\vec{B}$ is
   a) 30° b) 60° c) 45° d) 120°
9. The maximum and minimum tension in the string whirling in a circle of radius 2.5 m with constant velocity are in the ratio 5: 3 the the velocity is
   a) $\sqrt{98}\,m/s$ b) $7\,m/s$ c) $\sqrt{490}\,m/s$ d) $\sqrt{4.9}$
10. In the above question, if the angular velocity is kept same but the radius of the path is halved, the new force will be
    a) $2F$ b) F^2 c) $F/2$ d) $F/4$
11. If $\vec{A},\vec{B}$ and $\vec{C}$ are the unit vectors along the incident ray, reflected ray and outward normal to the reflecting surface, then
    a) $\vec{B}=\vec{A}-\vec{C}$ b) $\vec{B}=\vec{A}+(\vec{A}\cdot\vec{C})\vec{C}$ c) $\vec{B}=2\vec{A}-\vec{C}$ d) $\vec{B}=\vec{A}-2(\vec{A}\cdot\vec{C})\vec{C}$
12. A particle is thrown with a speed u at an angle θ with the horizontal. When the particle makes an angle α with the horizontal, its speed becomes v, whose values is
    a) u cos θ b) u cos θ cos α c) u cos θ sec α d) u sec θ cos α
13. A bullet is fired horizontally with a velocity of 80 ms^{-1}. During the first second,
    a) It falls 9.8 m b) It falls $\frac{80}{9.8}$ m c) It does not fall at all d) It falls 4.9 m
14. In a circus stuntman rides a motorbike in a circular track of radius R in the vertical plane. The minimum speed at highest point of track will be
    a) $\sqrt{2gR}$ b) $2gR$ c) $\sqrt{3gR}$ d) $\sqrt{gR}$
15. A particle is moving in a circular path with a constant speed v. If θ is the angular displacement, then starting from θ = 0°, the maximum and maximum changes in the momentum will occur, when value of θ is respectively
    a) 45° and 90° b) 90° and 180° c) 180° and 360° d) 90° and 270°

16. An object is projected at an angle of $45°$ with the horizontal. The horizontal range and the maximum height reached will be in the ratio
a) $1:2$ b) $2:1$ c) $1:4$ d) $4:1$

17. A weightless thread can bear tension upto 37 N. A. stone of mass 500 g is tied to it and revolved in a circular path of radius 4 m in a vertical plane. If $g = 10\ ms^{-2}$, then the maximum angular velocity of the stone will be
a) $2\ rad\ s^{-1}$ b) $4\ rad\ s^{-1}$ c) $8\ rad\ s^{-1}$ d) $16\ rad\ s^{-1}$

18. A1 kg stone at the end of 1 m long string is whirled in a vertical circle at constant speed of 4 m/sec. The tension in the string is 6 N, when the stone is at $(g = 10\ m/\sec^2\ )$
a) Top of the circle b) Bottom of the circle c) Half way down d) None of the above

19. A body moving along a circular path of radius R with velocity v, has centripetal acceleration$a$. If its velocity is made equal to $2v$, then its centripetal acceleration is
a) $4a$ b) $2a$ c) $\frac{a}{4}$ d) $\frac{a}{2}$

20. A toy cyclist completes one round of a square track of side 2 m in 40 s. What will be the displacement at the end of 3 min?
a) 52 m b) Zero c) 16 m d) $2\sqrt{2}$ m

21. The X and Y components of vector $\vec{A}$ have numerical values 6 and 6 respectively and that of $(\vec{A} + \vec{B})$ have numerical values 10 and 9. What is the numerical value of $\vec{B}$?
a) 2 b) 3 c) 4 d) 5

22. If the equation for the displacement of a particle moving on a circular path is given by $(\theta) = 2t^3 + 0.5$, where θ is in radians and t in seconds, then the angular velocity of the particle after 2 sec from its start is
a) $8\ rad/sec$ b) $12\ rad/sec$ c) $24\ rad/sec$ d) $36\ rad/sec$

23. A car round an unbanked curve of radius 92 m without skidding at a speed of $26\ ms^{-1}$. The smallest possible coefficient of static friction between the tyres and the road is
a) 0.75 b) 0.60 c) 0.45 d) 0.30

24. A bend in a level road has a radius of 80 m. Find the maximum speed which a car turning the bend may have without skidding, if $\mu = 0.25$
a) $24\ ms^{-1}$ b) $4\ ms^{-1}$ c) $14\ ms^{-1}$ d) $9.8\ ms^{-1}$

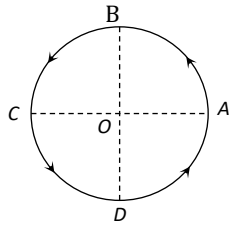
25. 

Figure shows a body of mass m moving with a uniform speed v along a circle of radius r. The change in velocity in going from A to B is
a) $v\sqrt{2}$ b) $v/\sqrt{2}$ c) v d) zero

26. If the sum of the two unit vectors is also a unit vector, then magnitude of their difference is
a) $\sqrt{2}$ b) $\sqrt{3}$ c) $\sqrt{4}$ d) $\sqrt{7}$

27. Two stones are projected from the same speed but making different angels with the horizontal. Their horizontal ranges are equal. The angle of projection of one is $\pi/3$ and the maximum height reached by it is 102 m. Then maximum height reached by the other in metre is
a) 336 b) 224 c) 56 d) 34

28. A particle of a mass m is projected with velocity v making an angle of $45°$ with the horizontal. The magnitude of the angular momentum of the particle about the point of projection when the particle is at its maximum height is (where $g =$ acceleration due to gravity)
a) Zero b) $mv^3/(4\sqrt{2}g)$ c) $mv^3/(\sqrt{2}g)$ d) $mv^2/2g$

29. A man can thrown a stone 100 m away. The maximum height to which he can throw vertically is
a) 200 m b) 100 m c) 50 m d) 25 m

30. A wheel making 20 revolution per second is in a horizontal circle with a uniform angular velocity. Let T be the tension in the string. If the length of the string is halved and its angular velocity is doubled, tension in the string will be
a) π rad s^{-2} b) 2π rad s^{-2} c) 4π rad s^{-2} d) 8π rad s^{-2}

31. A cricketer can throw a ball to a maximum horizontal distance of 100 m. With the same effort, he throws the ball vertically upwards. The maximum height attained by the ball is
a) 100 m b) 80 m c) 60 m d) 50 m

32. A can filled with water is revolved in a vertical of radius 4 m and the water does not fall down. The time period for a revaluation is about
a) 2 s b) 4 s c) 8 s d) 10 s

33. A bob of mass 10 kg is attached to wire 0.3 m long. Its breaking stress is $4.8 \times 10^7 N/m^2$. The area of cross section of the wire is $10^{-6} m^2$. The maximum angular velocity with which it can be rotated in a horizontal circle
a) 8 rad/sec b) 4 rad/sec c) 2 rad/sec d) 1 rad/sec

34. When a ceiling fan is switched on, it makes 10 rotations in the first 4 s. How many rotations will it make in the next 4 s? (Assuming uniform angular acceleration)
a) 10 b) 20 c) 40 d) 30

35. A stone tied to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time, the stone is at its lowest position and has speed u. The magnitude of the change in its velocity as it reaches a position where the string is horizontal is
a) $\sqrt{u^2 - 2gL}$ b) $\sqrt{2gL}$ c) $\sqrt{u^2 - gl}$ d) $\sqrt{2(u^2 - gL)}$

36. The wheel of toy car rotates about axis. It slows down from 400 rps to 200 rps in 2s. Then its angular retardation in $rads^{-2}$ is
a) 200 π b) 100 c) 400 π d) None of these

37. If a_r and a_t represent radial and tangential accelerations, the motion of a particle will be uniformly circular if
a) $a_r = 0$ and $a_t = 0$ b) $a_r = 0$ but $a_t \neq 0$ c) $a_r \neq 0$ but $a_t = 0$ d) $a_r \neq 0$ and $a_t \neq 0$

38. The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is
a) $\theta = \tan^{-1}\left(\frac{1}{4}\right)$ b) $\theta = \tan^{-1}(4)$ c) $\theta = \tan^{-1}(2)$ d) $\theta = 45°$

39. A cane filled with water is revolved in a vertical circle of radius 4 m and the water just does not fall down. The time period of revolution will be
a) 1 sec b) 10 sec c) 8 sec d) 4 sec

40 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 position 10 s apart is 30°, then the speed of the aircraft is
a) 19.63 ms^{-1} b) 1963 ms^{-1} c) 108 ms^{-1} d) 196.3 ms^{-1}

41. Find the maximum velocity for skidding for a car moved on a circular track of radius 100 m. The coefficient of friction between the road and tyre is 0.2
a) 0.14 m/s b) 140 m/s c) 1.4 km/s d) 14 m/s

42. A particle is moving in a circle of radius R with constant speed v, if radius is double then its centripetal force to keep the same speed should be
a) Doubled b) Halved c) Quadrupled d) Unchanged

43. A projectile shot into air at some angle with the horizontal has a range of 200 m. If the time of flight is 5 s, then the horizontal component of the velocity of the projectile at the highest point of trajectory is
a) 40 ms^{-1} b) 0 ms^{-1}
c) 9.8 ms^{-1} d) Equal to the velocity of projection of the projectile

44. An artillery piece which consistently shoots its shells with the same muzzle speed has a maximum range R. To hit a target which is $\frac{R}{2}$ from the gun and on the same level, the elevation angle of the gun should be
a) 15° b) 45° c) 30° d) 60°

45. The string of a pendulum of length l is displaced through 90° from the vertical and released. Then the minimum strength of the string in order to withstand the tension as the pendulum passes through the mean position is

a) mg b) 6 mg c) 3 mg d) 5 mg

46. A man is supported on a frictionless horizontal surface. It is attached to a string and rotates about a fixed centre at an angular velocity ω. The tension in the string if F. If the length of string and angular velocity are doubled, the tension is string is now

a) F b) $F/2$ c) 4 F d) 8 F

47. A particle is projected from horizontal making an angle 60° with initial velocity 40ms^{-1}. The time taken by the particle to make angel 45° from horizontal, is

a) 15 s b) 2.0 s c) 20 s d) 1.5 s

48. A 500 kg car takes a round turn of radius 50 m with a velocity of 36 km h^{-1}. The centripetal force, is

a) 250 N b) 750 N c) 1000 N d) 1200 N

49. In the case of an oblique projectile, the velocity is perpendicular to acceleration

a) Once only b) Twice c) Thrice d) Four times

50. A large number of bullets are fired in all directions with same speed v. What is the maximum area on the ground on which these bullets will spread

a) $\pi\frac{v^2}{g}$ b) $\pi\frac{v^4}{g^2}$ c) $\pi^2\frac{v^4}{g^2}$ d) $\pi^2\frac{v^2}{g^2}$

a) $2mg$ b) mg c) $3mg$ d) $\sqrt{3}mg$