Shiksha Classes, Bhandara

Physics

Subject : Physics **Topic : Circular Motion** **M.M. : 180**

Marking Scheme:
(i) Each question is allotted 4 (four) marks for each correct response.
(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 A particle of mass 'm' describes a circle of radius (r). The centripetal acceleration of the particle is $\frac{4}{r^2}$. The momentum of the particle :–

(1) $\frac{2m}{r}$ (2) $\frac{2m}{\sqrt{r}}$

(3) $\frac{4m}{r}$ (4) $\frac{4m}{\sqrt{r}}$

Q.2 A particle is moving around a circular path with uniform angular speed (ω). The radius of the circular path is (r). The acceleration of the particle is :–

(1) $\frac{\omega^2}{r}$ (2) $\frac{\omega}{r}$

(3) vω (4) vr

Q.3 Let 'θ' denote the angular displacement of a simple pendulum oscillating in a vertical plane. If the mass of the bob is (m), then the tension in string is
mg cos θ :
(1) always
(2) never
(3) at the extreme positions
(4) at the mean position

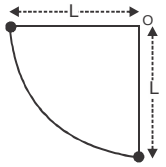
Q.4 The angular acceleration of particle moving along a circular path with uniform speed :
(1) uniform but non zero
(2) zero
(3) variable
(4) such as can not be predicted from given information

Q.5 A car moves on a circular road, describing equal angles about the centre in equal intervals of times which of the statements about the velocity of car are true :
(1) velocity is constant.
(2) magnitude of velocity is constant but the direction of velocity change.
(3) both magnitude and direction of velocity change.
(4) velocity is directed towards the centre of circle.

Q.6 A pendulum bob has a speed 3 m/s while passing through its lowest position, length of the pendulum is 0.5 m then its speed when it makes an angle of 60^o with the vertical is :–
(1) 2 m/s (2) 1 m/s
(3) 4 m/s (4) 3 m/s

Q.7 An insect trapped in a circular groove of radius 12 cm moves along the groove steadily and completes 7 revolutions in 100 s. What is the linear speed of the motion :
(1) 2.3 cm/s (2) 5.3 cm/s
(3) 0.44 cm/s (4) none of these

Q.8 The mass of the bob of a simple pendulum of length L is m. If the bob is left from its horizontal position then the speed of the bob and the tension in the thread in the lowest position of the bob will be respectively :



(1) $\sqrt{2gL}$ and 3 mg
(2) 3 mg and
(3) 2 mg and $\sqrt{2gL}$
(4) 2 gL and 3 mg

Q.9 A stone of mass 1 kg is tied to the end of a string of 1 m length. It is whirled in a vertical circle. If the velocity of the stone at the top be 4 m/s. What is the tension in the string ?
(1) 6 N (2) 16 N
(3) 5N (4) 10 N

Q.10 If the speed and radius both are trippled for a body moving on a circular path, then the new centripetal force will be :–
(1) $F_2 = 2F_1$ (2) $F_2 = F_1$
(3) $F_2 = 3F_1$ (4) $F_2 = F/3$

Q.11 The blades of an aeroplane propeller are rotating at the rate of 600 revolutions per minute. Its angular velocity is :
(1) 10 π rad/s (2) 20 π rad/s
(3) 2π rad/s (4) None of them

Q.12 A particle moves in a circle of the radius 25 cm at two revolutions per second. The acceleration of the particle in m/sec^2 is :
(1) π^2 (2) $8\pi^2$
(3) $4\pi^2$ (4) $2\pi^2$

Q.13 When a body moves with a constant speed along a circle :
(1) no acceleration is produced in the body
(2) no force acts on the body
(3) its velocity remains constant
(4) no work gets done on it

Q.14 A particle moves in a circle describing equal angle in equal times, its velocity vector :
(1) remains constant
(2) changes in magnitude
(3) change in direction
(4) changes in magnitude and direction

Q.15 A mass of 2 kg is whirled in a horizontal circle by means of a string at an initial speed of 5 r.p.m. Keeping the radius constant the tension in the string is doubled. The new speed is nearly :
(1) 7 r.p.m. (2) 14 r.p.m.
(3) 10 r.p.m. (4) 20 r.p.m.

Q.16 In a vertical circle of radius (r), at what point in its path a particle may have tension equal to zero :
(1) highest point
(2) lowest point
(3) at any point
(4) at a point horizontal from the centre of radius

Q.17 If the radius of circular path of two particles of same masses are in the ratio of 1 : 2 and they have equal centripetal forces, then their velocities should be in the ratio of :
(1) 1 : $\sqrt{2}$ (2) $\sqrt{2}$: 1
(3) 4 : 1 (4) 1 : 4

Q.18 A string of length 0.1 m cannot bear a tension more than 100N. It is tied to a body of mass 100g and rotated in a horizontal circle. The maximum angular velocity can be -
(1) 100 rad/s (2) 1000 rad/s
(3) 10000/s (4) 0.1 rad/s

Q.19 The radius of the circular path of a particle is doubled but its frequency of rotation is kept constant. If the initial centripetal force be F, then the final value of centripetal force will be :
(1) F (2) F/2
(3) 4F (4) 2F

Q.20 A 0.5 kg ball moves in a circle of radius 0.4m at a speed of 4 ms^{-1}. The centripetal force on the ball is –
(1) 10N (2) 20N
(3) 40N (4) 80N

Q.21 A car is travelling at 20 m/s on a circular road of radius 100 m. It is increasing its speed at the rate of 3 m/s^2. Its acceleration is :–
(1) 3 m/s^2 (2) 4 m/s^2
(3) 5 m/s^2 (4) 7 ms^{-1}

Q.22 A weightless thread can bear tension upto 3.7 kg wt. A stone of mass 500 gm is tied to it and revolved in a circular path of radius 4m in a vertical plane. If g = 10 ms^{-2}, then the maximum angular velocity of the stone can be
(1) 16 rad/s (2) $\sqrt{21}$ rad/s
(3) 2 rad/s (4) 4 rad/s

Q.23 A stone attached to one end of a string is whirled in a vertical circle. The tension in the string is maximum when :
(1) the string is horizontal.
(2) the string is vertical with the stone at highest position.
(3) the string is vertical with the stone at the lowest position.
(4) the string makes an angle of 45° with the vertical

Q.24 A cyclist goes round a circular path of circumference 34.3 m in $\sqrt{22}$ sec. the angle made by him, with the vertical, will be
(1) 45^o (2) 40^o
(3) 42^o (4) 48^o

Q.25 A particle moving along a circular path. The angular velocity, linear velocity, angular acceleration and centripetal acceleration of the particle at any instant respectively are $\vec{\omega}, \vec{v}, \vec{\alpha}$ are $\vec{a}_c$. Which of the following relation is/are correct :–

(a) $\vec{\omega} \perp \vec{v}$ (b) $\vec{\omega} \perp \vec{\alpha}$ (c) $\vec{v} \perp a_c$ (d) $\vec{\omega} \perp a_c$

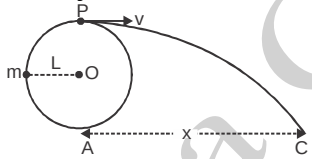
(1) a, b, d (2) b, c, d
(3) a, b, c (4) a, c, d

Q.26 A body is revolving with a constant speed along a circle. If its direction of motion is reversed but the speed remains the same then :–

(a) the centripetal force will not suffer any change in magnitude.
(b) the centripetal force will have its direction reversed.
(c) the centripetal force will not suffer any change in direction.
(d) the centripetal force is doubled.

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

Q.27 A body tied to a string of length L is revolved in a vertical circle with minimum velocity, when the body reaches the upper most point the string breaks and the body moves under the influence of the gravitational field of earth along a parabolic path. The horizontal range AC of the body will be :



(1) x = L (2) x = 2L
(3) x = $2\sqrt{2}$L (4) x = $\sqrt{2}$L

Q.28 A particle is moving in a vertical circle the tension in the string when passing through two position at angle 30° and 60° from vertical from lowest position are T_1 and T_2 respectively then

(1) $T_1 = T_2$ (2) $T_1 > T_2$
(3) $T_1 < T_2$ (4) T_1 T_2

Q.29 A body crosses the topmost point of a vertical circle with critical speed. What will be its centripetal acceleration when the string is horizontal :

(1) g (2) 2g
(3) 3g (4) 6g

Q.30 a_r and a_t represent radial and tangential acceleration. The motion of a particle will be uniform circular motion, if :

(1) $a_r = 0$ and $a_t = 0$ (2) $a_r = 0$ but $a_t \neq 0$
(3) $a_r \neq 0$ but $a_t = 0$ (4) $a_r \neq 0$ and $a_t \neq 0$

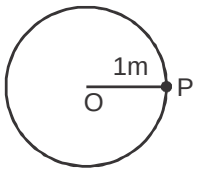
Q.31 Stone tied at one end of light string is whirled round a vertical circle. If the difference between the maximum and minimum tension experienced by the string wire is 2 kg wt, then the mass of the stone must be :–

(1) 1 kg (2) 6 kg
(3) 1/3 kg (4) 2 kg

Q.32 In uniform circular motion, the velocity vector and acceleration vector are

(1) Perpendicular to each other
(2) Same direction
(3) Opposite direction
(4) Not related to each other

Q.33 A mass tied to a string moves in a vertical circle with a uniform speed of 5 m/s as shown. At the point P the string breaks. The mass will reach a height above P of nearly :



(1) 1 m (2) 0.5 m
(3) 1.27 m (4) 1.25 m

Q.34 A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle. The motion of the particle takes place in a plane. It follows, that :

(1) its velocity is constant.
(2) its K.E. is constant.
(3) its acceleration is constant.
(4) it moves in a straight line.

Q.35 If the overbridge is concave instead of being convex, then the thrust on the road at the lowest position will be :-

(1) $mg + \frac{mv^2}{r}$ (2) $mg - \frac{mv^2}{r}$

(3) $\frac{m^2v^2g}{r}$ (4) $\frac{v^2g}{r}$

Q.36 A car moving with speed 30 m/s on a circular path of radius 500 m. Its speed is increasing at the rate of $2m/s^2$. The acceleration of the car is

(1) $9.8\ m/s^2$ (2) $1.8\ m/s^2$

(3) $2\ m/s^2$ (4) $2.4\ m/s^2$

Q.37 A mass m is attached to the end of a rod of length ℓ. The mass goes around a verticle circular path with the other end hinged at the centre. What should be the minimum velocity of mass at the bottom of the circle so that the mass completes the circle ?

(1) $\sqrt{4g\ell}$ (2) $\sqrt{3g\ell}$

(3) $\sqrt{5g\ell}$ (4) $\sqrt{g\ell}$

Q.38 A fighter plane is moving in a vertical circle of radius 'r'. Its minimum velocity at the highest point of the circle will be :–

(1) $\sqrt{3gr}$ (2) $\sqrt{2gr}$ (3) $\sqrt{gr}$ (4) $\sqrt{\frac{gr}{2}}$

Q.39 A stone is tied to a string of length 'ℓ' and is whirled in a vertical circle with the other end of the string as the centre. At a certain instant of time, the stone is at its lowest position and has a speed 'u'. The magnitude of the change in velocity as it reaches a position where the string is horizontal (g being acceleration due to gravity) is :

(1) $\sqrt{u^2 - g\ell}$ (2) $u - \sqrt{u^2 - 2g\ell}$

(3) $\sqrt{2g\ell}$ (4)

Q.40 A particle is kept at rest at the top of a sphere of diameter 42 m. When disturbed slightly, it slides down. At what height 'h' from the bottom, the particle will leave the sphere :–

(1) 14 m (2) 28 m

(3) 35 m (4) 7 m

Q.41 A stone tied to the end of a string of 1m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolution in 44 seconds, what is the magnitude and direction of acceleration of the stone

(1) $\pi^2 ms^{-2}$ and direction along the tangent to the circle.

(2) $\pi^2 ms^{-2}$ and direction along the radius towards the centre.

(3) $\frac{\pi^2}{4}\ ms^{-2}$ and direction along the radius towards the centre.

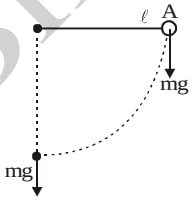
(4) $\pi^2 ms^{-2}$ and direction along the radius away from the centre.

Q.42 A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 seconds for every circular lap. The average velocity and average speed for each circular lap respectively is :-

(1) 0,0 (2) 0, 10 m/s

(3) 10 m/s, 10 m/s (4) 10 m/s, 0

Q.43 Mass m is released from point A as shown in figure then tension in the string at the point B will be-



(1) mg (2) 2mg

(3) 3mg (4) 4mg

Q.44 A roller coaster is designed such that riders experience "weightlessness" as they go round the top of a hill whose radius of curvature is 20m. The speed of the car at the top of the hill is between:-

(1) 16m/s and 17m/s (2) 13m/s and 14 m/s

(3) 14m/s and 15m/s (4) 15m/s and 16 m/s

Q.45 Radius of the curved road on national highway is R. Width of the road is b. The outer edge of the road is raised by h with respect to inner edge so that a car with velocity v can pass safe over it. The value of h is

(1) $\frac{v^2 b}{Rg}$ (2) $\frac{v}{Rgb}$

(3) $\frac{v^2 R}{g}$ (4) $\frac{v^2 b}{R}$