PHYSICS

BOOKS - MARVEL PHYSICS (HINGLISH)

CIRCULAR MOTION

Multiple Choice Questions

1. A particle is moving in a circle with uniform speed v . In moving from a point to another diametrically opposite point

A. momentum changes by mv

B. Kinetic energy changes by $\frac{1}{2}mv^2$

C. momentum changes by 2mv

D. kinetic energy changes by mv^2

Answer: C

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2. In which accelerated motion , the kinetic energy of a particle remain constant ?

A. Rotational motion

B. Rectilinear motion

C. Simple harmonic motion

D. Uniform circular motion

Answer: D

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3. 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

A. Its velocity is constant

B. Its acceleration is constant

C. Its kinetic energy is constant

D. Its linear momentum is constant

Answer: C

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4. The angular speed of the minutes hand of a clock in degree per second is

A. 1

B. 0.1

C. 0.5

D. 1.5

Answer: B

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5. A particle is moving in a circular path with a constant speed. If θ Is the angular displacement, then starting from $\theta = 0$, the maximum and minimum change in the linear momentum will occur when value of θ is respectively

A. 0° and 90°

B. 90° and 180°

C. 180° and 270°

D. 180° and 360°

Answer: D

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6. Two particle move in concentio cireles of radii r_1 and r_2 such that they maintain a straight line through the centre. The ratio of their angular veocities is:

A. $\frac{r_1}{r_2}$

B. $\frac{r_2}{r_1}$

C. one

D. $\frac{1}{2}$

Answer: C

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7. A particle moves in a circle of radius R. In half the period of revolution its displacement is ..... and distance covered is ..... .

A. $R, \pi R$

B. $2R, 2\pi R$

C. $2R, \pi R$

D. $\sqrt{2R}, 2\pi R$

Answer: C

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8. The angular speed of a flywheel rotating at 90 r.p.m . Is

A. π rad/s

B. 2π rad/s

C. 4π rad/s

D. 3π rad/s

Answer: D

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9. A particle starts from rest and moves in a circular motion with constant angular acceleration of $2rads^{-2}$. Find

(a) Angular velocity

(b) Angular displacement of the particle after

$4s$.

(c) The number of revolutions completed by the particle during these $4s$.

(d) If the radius of the circle is $10cm$, find the magnitude and direction of net acceleration of the particle at the end of $4s$.

A. 30 radian

B. 40 radius

C. 50 radium

D. 60radian

Answer: D

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10. The frequency of a particle performing circular motion changes from 60 rpm to 180 rpm in 20 s . Then the angular acceleration is

A. $-2\pi rad/s^2$

B. $-\pi rad/s^2$

C. $-3\pi rad/s^2$

D. $-\frac{\pi}{2} rad/s^2$

Answer: A

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11. If the equation for the displacement of a particle moving in 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 particle after $2s$ from its start is

A. 12 radian /sec

B. 18 radian / sec

C. 24 radian / sec

D. 30 radian / sec

Answer: C

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12. The angular velcity of the earth due to its spain motion is :

A. $\frac{\pi}{3600 \times 12} rad / s$

B. $\frac{2\pi}{3600 \times 6} Rad / s$

C. $\frac{\pi}{1800 \times 6} rad / s$

D. $\frac{3\pi}{3600 \times 12} Rad / s$

Answer: A

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13. The frequency of a particle performing circular motion changes from 60 rpm to 180 rpm in 20 s . Then the angular acceleration is

A. $6.284 rad / s^2$

B. $3.142 ra \frac{d}{s^2}$

C. $0.6284 rad / s^2$

D. $0.142 rad / s^2$

Answer: C

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14. The shaft of a motor car rotates at constant angular frequancy of 3000 revolutions //min .The angle through which it has turned in one second in radians is

A. 2400 π

B. 80π

C. 20π

D. 4800π

Answer: B

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15. The angular displacement of a particle is given by $\theta = t^3 + 2t + 1$, where t is time in seconds. Its angular acceleration at $t = 2s$ is

A. $a + 2b + 3c$

B. $2b + 6ct$

C. $2b - 8ct$

D. $2b + 12ct$

Answer: B

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16. A particle of mass M is revolving along a circule of radius R and another particle of mass m is revolving in a circle of radius r. If

time periods of both particles are same, then the ratio of their angular velocities is

A. $\frac{R}{r}$

B. $\frac{r}{R}$

C. 1

D. $\left(\frac{R}{r}\right)^2$

Answer: C

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17. Two particles of mass M and m are moving in a circle of radii R and r. if their time period are the same, what will be the ratio of their linear velocities?

A. $\frac{r}{R}$

B. $\frac{R}{r}$

C. 1

D. $\sqrt{\frac{r}{R}}$

Answer: B

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18. A small steel shphere tied at the end of a string is whirled in a horizontal circle with uniform angular velocity ω the string is suddently pulled so that the radius of the circle is halved .If ω_2 is the angular velocity then

A. $\omega_1 = \omega_2$

B. $\omega_1 > \omega_2$

C. $\omega_1 < \omega_2$

D. $om \geq a_1 = 2\omega_2$

Answer: C

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19. A clock has its second hand $2.0cm$ long. Find the average speed and modulus of average velocity of the tip of the second hand in $15s$.

A. $\frac{\pi}{10} cm / s$

B. $\frac{\pi}{20} cm / s$

C. $\frac{\pi}{30} cm / s$

D. $\frac{\pi}{5} cm / s$

Answer: C

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20. The angular of the second hand of a watch is 1 cm . What is the velocity of a geostationary satellite is

A. $\frac{\pi}{12} rad / \min$

B. $\frac{\pi}{360} rad / \min$

C. $\frac{\pi}{720} rad / \min$

D. $\frac{\pi}{24} rad / \min$

Answer: C

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21. A particle moves along a circle of radius 10 cm . If its linear speed changes from 4m/s to 5 m/s in 1 s, then its angular acceleration will be

A. 2 rad $/s^2$

B. 5 rad $/s^2$

C. 10 rad $/s^2$

D. 8 rad $/s^2$

Answer: C

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22. A wheel is at rest. Its angular velocity increases uniformly and becomes 80 radian

per second after 5 second. The total angular displacement is :-

A. 80 rad

B. 160 rad

C. 200 rad

D. 120 rad

Answer: B

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23. A wheel rotates with a constant angular velocity of 300 rpm. The angle through which the wheel rotates in 1 s is.

A. 5π radian

B. 20π radian

C. 15π radian

D. 10π radian

Answer: B

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24. What is the angular displacement of the minute hand of a clock in 600 seconds ?

A. π radian

B. $\frac{\pi}{3}$ radian

C. $\frac{\pi}{4}$ radian

D. $\frac{2\pi}{5}$ radian

Answer: B

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25. If a particle is moving in a circular path of radius 'r' with a uniform speed v, then the angle described by it in one second will be

A. $\frac{r}{v}$

B. $\frac{v}{r}$

C. $\frac{v^2}{r}$

D. vr^2

Answer: B

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26. The relative angular speed of the minute hand and second hand of a clock is

A. $\frac{29\pi}{1800} rad/s$

B. $\frac{39\pi}{1800} rad/s$

C. $\frac{49\pi}{1800} rad/s$

D. $\frac{59\pi}{1800} rad/s$

Answer: D

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27. The average acceleration vector for a particle having a uniform circular motion is

A. A constant vector of magnitude $\frac{v^2}{r}$

B. A vector of magnitude $\frac{v^2}{r}$ directed normal to the plane of the given uniform circular motion

C. Equal to the instantaneous acceleration vector at the start of the motion

D. A null vector

Answer: D

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28. An object is moving in a circle of radius 100 m with a constant speed of $31.4m/s$. What is its average speed for one complete revolution

A. Zero

B. $31.4m/s$

C. $3.14m/s$

D. $\sqrt{2} \times 3.14m/s$

Answer: B

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29. A particle moves in a circular path of radius 0.4 m with a constan speed . If it makes 5 revolution in each second of its motion , then the speed of the particle will be

A. $\frac{2\pi^2 p}{t} m/s$

B. $\frac{2\pi^2}{pt} m/s$

C. $\frac{\pi^2 p}{t} m/s$

D. $\frac{2\pi p}{t} m/s$

Answer: A

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30. Ration of angular velocity of hour hand of a clock to self rotation of the earth is

A. $\omega_2 = \frac{\omega_1}{2}$

B. $\omega_1 = \frac{\omega_1}{2}$

C. $\omega_2 = \frac{\omega_1}{16}$

D. $\omega_1 = \frac{\omega_2}{16}$

Answer: B

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31. The relation between tangential or linear acceleration and angular acceleration of a body moving in circle is given by

A. $\alpha = \frac{av}{\omega}$

B. $\alpha = \frac{v\omega}{a}$

C. $\alpha = \frac{\omega}{av}$

D. $\alpha = \frac{a\omega}{v}$

Answer:

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32. A particle moves on circular path of radius 5 m with constant speed 5 m/s. Find the magnitude of its average acceleration when it completes half revolution.

A. $\frac{v^2}{2R}$

B. $\frac{2v^2}{\pi R}$

C. $\frac{v^2}{R}$

D. $\frac{v^2}{\pi R}$

Answer: B

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33. If ω_E is the angular velocity of the earth rotating about its own axis and ω_H is the angular velocity of the hour of a clock , then

A. $\omega_E > \omega_H$

B. $\omega_E = \omega_H$

C. $\omega_E < \omega_H$

D. $\omega_E = 2\omega_H$

Answer: C

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34. If the momentum of a body increases by 0.01%, its kinetic energy will increase by

A. $44\ \%$

B. $55\ \%$

C. $60\ \%$

D. $77\ \%$

Answer: A

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35. A body is whirled in a horizontal circle of radius $20cm$. It has an angular velocity of

$10 rad/s$. What is its linear velocity at any point on the circular path

A. $10 ms^{-1}$

B. $2 ms^{-1}$

C. $20 ms^{-1}$

D. $\sqrt{2} ms^{-1}$

Answer: B

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36. 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. $m_1 r_1 = m_2 r_2$

Answer: C

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37. A 4 kg mass and a 1 kg mass are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is

A. $1:2$

B. $1:1$

C. $2:1$

D. $4:1$

Answer: C

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38. A body is moving in a circular path with a constant speed. It has .

A. constant velocity

B. constant momentum

C. constant kinetic enegy

D. constant acceleration

Answer: C

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39. Ration of angular velocity of hour hand of a clock to self rotation of the earth is

A. $\alpha = \frac{\omega_1}{2}$

B. $\omega_1 = \frac{\omega_2}{2}$

C. $\omega_2 = \frac{\omega_1}{16}$

D. $\omega_1 = \frac{\omega_2}{16}$

Answer: B

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40. In a non - uniform circular motaion the ratio of tangential to radial acceleration is (where, r= radius of circle, v= speed of the particle, $\alpha =$ angular acceleration)

A. $\alpha = \frac{av}{\omega}$

B. $\alpha = \frac{v\omega}{a}$

C. $\alpha = \frac{\omega}{av}$

D. $\alpha = \frac{a\omega}{v}$

Answer: D

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41. A car runs at a constant speed on a circulat track of radius $100m$. Taking $62.8s$ for every circular lap. The average velocity and average speed for each circular lap respectively are :

A. $5m/s, 10m/s$

B. $0m/s, 10m/s$

C. $0m/s, 5m/s$

D. $10m/s, 5m/s$

Answer: B

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42. What is the angular velocity in rad s^{-1} of the hour minute and second hand of a clock ?

A. $\frac{\pi}{21600} rads^{-1}$

B. $\frac{\pi}{1800} rads^{-1}$

C. $\frac{\pi}{43200} rads^{-1}$

D. $\frac{\pi}{30} radS^{-1}$

Answer: A

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43. Which one of the following has the maximum angular velocity

A. hour hand of a clock

B. minute hand of a clock

C. Second hand of a clock

D. A geostationary satellite

Answer: C

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44. A cyclist is moving on a circular path with constant speed V . What is the change in its velocity after it has desscribed an angle of 60°

A. Zero

B. $2v \sin \theta$

C. $2V \sin 2\theta$

D. $2V \sin \frac{\theta}{2}$

Answer: D

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45. The angular velocity of a wheel increases from 120 to 480 rpm in 10 s .The number of revolutions made during this time is

A. 100 rev

B. 150 rev

C. 200 rev

D. 250rev

Answer: D

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46. The linear velocity of a body , moving on the circumference of a circle of radius r, equal to the velocity acquired by a freely falling body

in covering a distance to half the radius of the

. Then the centripetal acceleration of the body

is

A. $\frac{g}{4}$

B. $\frac{g}{2}$

C. $\frac{g}{3}$

D. g

Answer: D

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47. A particle P is moving in a circle of radius r with a uniform speed u. C is the centre of the circle and AB is diameter. The angular velocity of P about A and V are in the ratio :

A. $4:1$

B. $2:1$

C. $1:2$

D. $1:1$

Answer: C

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48. A particle is moving in a circle of radius 1.5 m. Its speed is increasing by 180 rev/ minute in one mintue , what is its linear acceleration ?

A. $0.25m/s^2$

B. $0.30m/s^2$

C. $0.39m/s^2$

D. $0.47m/s^2$

Answer: D

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49. A particle is moving along a circular path. The angular velocity, linear velocity, angular acceleration and centripetal acceleration of the particle at any instant are $\vec{\omega}$, $\vec{v}$, $\vec{a}$, $\vec{a}_c$ respectively. Which of the following relations are correct ?

A. $\vec{\omega} \perp \vec{v}$

B. $\vec{\omega} \perp \vec{a}_c$

C. $\vec{\omega} \perp \vec{\alpha}$

D. $\vec{v} \perp \vec{a}_c$

Answer: C

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50. If a particle rotates along a circle of radius 3 m with an angular acceleration of $\frac{\pi}{2}\text{rad}/s^2$ starting from rest, then its average velocity over the time it covers quarter circle is :

A. $\frac{\pi}{\sqrt{2}}m/s$

B. $\frac{\pi}{2\sqrt{2}} m/s$

C. $\frac{2\sqrt{2}}{\pi} m/s$

D. $\frac{\pi}{2} m/s$

Answer: B

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51. A wheel starting from rest is rotating with a constant angular acceleration of 2 rad / $\sec^2$ Interval .A student notes that it traces an angle of 80^ radian in 4 sec.interval. What was

the angular velocity of the wheel , when the student started his observations ?

A. $\omega_0 = 8rad/s$

B. $\omega_0 = 16rad/s$

C. $\omega_0 = 24rad/s$

D. $\omega_0 = 48rad/s$

Answer: B

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52. Identifly the wrong statement from the following :

A. A body can have energy without momentum

B. Kinetic energy is not conserved in an inelastic collision

C. A body can have momentum without energy

D. The momentum is conserved in an elastic collision

Answer: C

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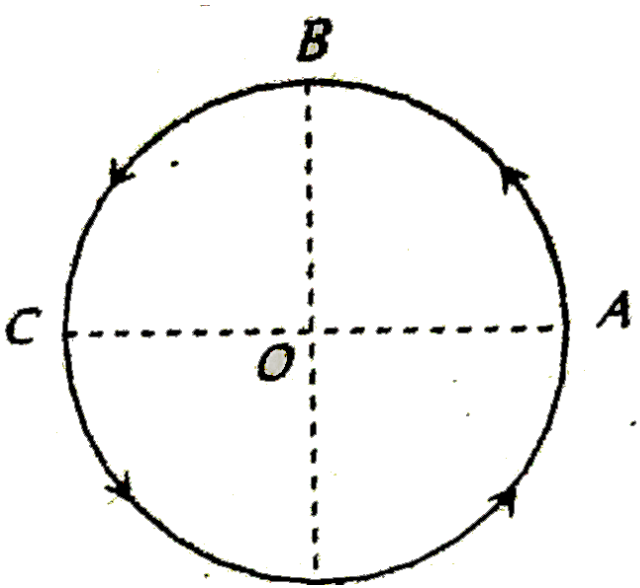
53. Figure shows a body of mass m moving with a uniform speed v along a circle of radius r . The change in velocity in going from A to B

is



A. $\frac{v}{\sqrt{2}}$

B. v

C. zero

D. $v\sqrt{2}$

Answer: D

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54. The length of second's hand in watch is $1cm$. The change in Velocity of its tip in 15 seconds is

A. Zero

B. $\frac{\pi}{30\sqrt{2}} cm/\sec$

C. $\frac{\pi}{30} cm/\sec$

D. $\frac{\pi\sqrt{2}}{30} cm/\sec$

Answer: D

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55. A particle of mass m is moving in a plane along a circular path of radius r. Its angular momentum about the axis of rotation is L. The centripetal force acting on the particle is.

A. L^2 / mr^2

B. l^2 / mr^3

C. L^2 / mr

D. L^2 / r^3

Answer: B

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56. The motor of an engine is rotating about its axis with angular velocity of $120\mathrm{rpm}$. It comes to rest in $10s$, after being switched off. Assuming constant deceleration, calculate the number of revolutions made by it before coming to rest.

A. 12

B. 10

C. 16

D. 20

Answer: C

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57. What is work done by centripetal force in moving on body half-cycle on a circular path of radius 30m?

A. $\frac{mv^2}{r} \times \frac{2\pi r}{3}$

B. $\frac{mv^2}{r} \times \frac{\pi r^2}{3}$

C. Zero

D. $\frac{mv^2}{r} \times \pi r$

Answer: C

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58. A body is moving in a circular path with acceleration a. If its speed gets doubled, find

the ratio of centripetal acceleration after and before the speed is changed

A. $1:4$

B. $2:1$

C. $4:1$

D. $3:1$

Answer: C

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59. 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 which of the following statement is true

A. the centripetal force will be doubled

B. the direction of the centripetal force will be reversed

C. There will be no change in the magnitude and direction of the centripetal force

D. the centrifugal force will act towards the centre

Answer: C

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60. The angle between the radius vector and the centripetal force is

A. zero

B. $\frac{\pi}{2}$

C. $\frac{3\pi}{4}$

D. π

Answer: D

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61. A particle moving along a circular path of radius 'r' with uniform angular velocity ω. Its angular acceleration is

A. $\frac{\omega}{r}$

B. $r\omega$

C. $r\omega^2$

D. $r^2\omega$

Answer: C

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62. $Erg - m^{-1}$ can be the unit of measure for

A. acceleration

B. force

C. momentum

D. Power

Answer: B

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63. If the overbridge is concave instead of being convex, the thrust on the road at the lowest position will be

A. $mg - \frac{mv^2}{r}$

B. $mg \times \frac{mv^2}{r}$

C. $g + \frac{mv^2}{r}$

D. $mg \div \frac{mv^2}{r}$

Answer: C

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64. A car of mass m moving over a convex bridge of radius r .Find the normal reaction acting on car when it is at bighest point the bridge.

A. $mg - \frac{mv^2}{r}$

B. $mg + \frac{mv^2}{r}$

C. $mg \times \frac{mv^2}{r}$

D. $\frac{v^2 g}{r}$

Answer: A

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65. Two particles of equal masses are revolving in circular paths of radii r_1 and r_2 respectively

with the same speed. The ratio of their centripetal force is

A. $\frac{R_2}{R_1}$

B. $\left(\frac{R_1}{R_2}\right)^2$

C. $\sqrt{\frac{R_1}{R_2}}$

D. $\frac{R_1}{R_2}$

Answer: A

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66. Two satellites A and B are revolving around the earth with the same angular speed .If they are at heights of 300 km and 500 km respectively . Then the cenctripetal acceleration will be

A. More for A

B. More forB

C. the same for both

D. decided by their masses

Answer: B

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67. A body of mass 2 kg is tied to the end od a string 2 m long and revolved in horizontal circle .If the breaking tension of the string is 400 N, then the maximum velocity of the body will be

A. 20

B. 30

C. 40

D. 60

Answer: B

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68. A proton of mass $1.6 \times 10^{-27} kg$ goes round in a circular orbit of radius 0.10 m under a centripetal force of $4 \times 10^{-13} N$. then the frequency of revolution of the proton is about

A. $3 \times 10^{7} rad/s$

B. $4 \times 10^7 rad/s$

C. $5 \times 10 rad/s$

D. $8 \times 10^7 rad/s$

Answer: C

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69. A small coin is kept at the rim of a horizontal circular disc which is set into rotation about verticle axis passing through its centre. If radius of the disc is

$5cm$ and $\mu_s = 0.25$, then the angular speed at which the coin will just slip off at

A. 2rad /s

B. 3 rad/s

C. 5 rad/s

D. 4 rad/s

Answer: D

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70. A car is moving with speed $30m/\sec$ on a circular path of radius 500 m . Its speed is increasing at the rate of , $2m/\sec^2$, What is the acceleration of the car

A. $2m/s^2$

B. $9.8m/s^2$

C. $2.7m/s^2$

D. $1.8m/s^2$

Answer: C

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71. A body of mass 10 kg is moving in a circle of radian 1 m with an angular velocity of $2rad/s$ the centripetal force is

A. $0.032N$

B. $0.048N$

C. $0.16N$

D. $0.064N$

Answer: D

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72. From the ceiling of a train, a pendulum of length 'l' is suspended. The train is moving with an acceleration a_0 on horizontal surface. What must be the period of oscillation of pendulum?

A. $T = 2\pi\sqrt{\frac{l}{g}}$

B. $T = 2\pi\sqrt{\frac{l}{g+a}}$

C. $T = 2\pi\sqrt{\frac{l}{(g^2+a^2)^{1/2}}}$

D. $T = 2\pi\sqrt{\frac{l}{(g^2 - a^2)^{1/2}}}$

Answer: C

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73. A car is moving on a circular road of radius $100m$. At some instant its speed is $20m/s$ and is increasing at the rate of $3m/s^2$. The magnitude of its acceleration is

A. $3m/s^2$

B. $2m / s^2$

C. $4m / s^2$

D. $5m / s^2$

Answer: D

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74. A particle moves in a circle of radius 25 cm at two revolutions per sec. The acceleration of the particle in m / s^2 is:

A. π^2

B. $4\pi^2$

C. $8\pi^2$

D. $2\pi^2$

Answer: B

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75. A paticle of mass m is executing uniform circular motion on a path of radius r. If p is the

magnitude of its linear momentum, then the radial force acting on the particle is

A. $\frac{P}{mr^2}$

B. $\frac{p^2}{mr}$

C. $\frac{\pm}{r}$

D. $\frac{p^2 r}{m}$

Answer: B

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76. Certain neutron stars are believed to be rotating at about $1rev/\sec$. If such a star has a radius of 20 km , the acceleration of an object on the equator of the star will be

A. $4 \times 10^8 m/s$

B. $8 \times 10^5 m/s$

C. $16 \times 10^6 m/s$

D. $20 \times 10^8 m/s$

Answer: B

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77. A mass 2 kg is whirled in a horizontal circle by means of a string at an initial speed of 5 revolutions per minute . Keeping the radius constant the tension in the string is doubled. The new speed is nearly

A. 10 rpm

B. 7 rpm

C. 14 rpm

D. 2.5rpm

Answer: B

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78. Which one of the following forces is a pseudo force ?

A. Force acting on a falling body

B. Force acting on a charged particle placed in an electric field

C. Force experienced by a person standing on a merry- go- round

D. Force which keeps the electrons moving in circular orbits

Answer: C

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79. A car of mass M is travelling with a uniform speed on a road as shown in the figure

the force exerted by the road on the car is maximum at

A. P

B. Q

C. R

D. S

Answer: C

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80. A mass attached to a string rotates about a fixed centre with an angular velocity ω in a horizontal plane ,The length of the string and the angular velocity are now doubled .IF T_0 is the initial tension in the string , then the new tension will be

A. $2T_0$

B. $4T_0$

C. $8T_0$

D. $6T_0$

Answer: C

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81. A coin placed on a rotating gramophone disc, remains at rest when it is at a distance of 9 cm from its centre ,the angular velocity of the disc is then tripled .At what distance from the centre ,the coin should be placed , so that it will remain at rest ?

A. 2cm

B. 1 cm

C. 3 cm

D. 6 cm

Answer: B

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82. A bottle of soda water is grasped by the neck and swung briskly in a circle .Near which portion of the bottle do the bubbles collect ?

A. Near the neck

B. near the bottom

C. near the centre of the bottle

D. bubbles remain distributed uniformly throughout the volume of the bottle

Answer: A

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83. A particle performs a uniform circular motion in a circle of radius 10 cm . What is its centripetal acceleration if it takes 10 seconds to complete 5 revolutions ?

A. $2.5\pi^2 c\frac{m}{s^2}$

B. $5\pi^2 cm/s^2$

C. $10\pi^2 cm/s^2$

D. $20\pi^2 cm/s^2$

Answer: C

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84. If acycle wheel of radius 0.4 m completes one revolution in one second , then the acceleration of a point on the rim is in one second , then the acceleration of a point on the rim is

A. $0.8\pi^2 m/s^2$

B. $1.2\pi^2 m/s^2$

C. $1.6\pi^2 m/s^2$

D. $0.4\pi m/s^2$

Answer: C

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85. A stone of mass 250 gram , attached at the end of a string of length 1.25 m is whirled in a horizontal circle at a speed of 5 m/s . What is the tension in the string ?

A. $2.5N$

B. 5N

C. 6N

D. 8N

Answer: B

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86. A particle is moving along a circle of radius 1 m at a speed of 2 m/s .If the speed is incresed at the rate of 3 m/s^2 then the resultant acceleration is

A. $2m/s^2$

B. $3m/s^2$

C. $5m/s^2$

D. $10m/s^2$

Answer: C

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87. A electron of mass 9×10^{-31} kg is revolving in a stable circular orbit or radius 1.8×10^{-12} m in a hydrogen atom.

If the electrostatic froce of attraction between

the proton and electron is 8xx10^(-8)` N, the velosity of the electron is

A. $4 \times 10^5 m/s$

B. $5 \times 10^5 m/s$

C. $3 \times 10^6 m/s$

D. $4 \times 10^6 m/s$

Answer: A

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88. The earth $(mass = 10^{24}kg)$ revolves round the Sun with an angular velocity $2 \times 10^{-7}rads^{-1}$ in a circular orbit of radius $1.5 \times 10^{8}km$. Find the force exerted by the Sun on the earth (in $\times 10^{21}N$).

A. Zero

B. $18 \times 10^{20}N$

C. $27 \times 10^{30}N$

D. $3.6 \times 10^{22}N$

Answer: D

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89. A car has a linear velocity v on a circular track of radius r. IF its speed is increasing at a rate of am/s^2, , then its resultant acceleration will be

A. $\sqrt{\left(\frac{v^2}{r}\right)^2 + a^2}$

B. $\sqrt{\left(\frac{v^2}{r}\right)^2 - a^2}$

C. $\left(\frac{v^2}{r}\right)^2 + a$

D. $\left(\frac{v^2}{r}\right)^2 . - a$

Answer: A

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90. A particle is performing a U.C .M along a circular path of radius r, with a uniform speed v. Its tangential and radial acceleration are

A. zero and infinite

B. $\frac{v^2}{r}$ and zero

C. zero and $\frac{v^2}{r}$

D. $r\omega^2$ and infinite

Answer: C

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91. A particle of mass 'm' moves with a constant speed along a circular path of radius r under the action of a force F .Its speed is given by

A. $\sqrt{\frac{Fr}{m}}$

B. $\sqrt{\frac{F}{mr}}$

C. $\sqrt{\frac{F}{r}}$

D. $\sqrt{Fmr}$

Answer: A

Watch Video Solution

92. A particle of performaing a U.C.M along a circle if radius r. The relation between its centripetal acceleration (a) and kinetic energy (E) is given by

A. $a = 2Em$

B. $a = \frac{E}{mr}$

C. $a = \frac{2E}{mr}$

D. $a = \left(\frac{2E}{mr}\right)^2$

Answer: C

Watch Video Solution

93. An electric fan has blades of length 30 cm as measured from the axis of rotation .If the fan is rotating at 1200 r.p.m., then the

acceleration of a point on the tip of the blade is $\left(\text{take}\pi^2 = 10\right)$

A. $1600m / s^2$

B. $3200m / s^2$

C. $4800m / s^2$

D. $600m / s^2$

Answer: C

Watch Video Solution

94. A cosmonaut is orbiting the earth in a spaceraft at an altitude h= 630 km with a speed of 8 km /s .The radius of the earth is 6400 km. What is the approximate value of the acceleration of the cosmonaut ?

A. $10m/s^2$

B. $9m/s^2$

C. $8m/s^2$

D. $11m/s^2$

Answer: B

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95. Which driving a car around a curve of 200 m radius ,the driver notices that a simple rendulum hung to the roof of the car is marking an angle of 15° to the horizontal ,what is the speed of the car km /h ?

$\left(g = 10m/s^2\right)(\text{use } \tan 15^\circ = 0.2645)$

A. 75

B. 83

C. 91

D. 98

Answer: B

 Watch Video Solution

96. A particle moves with constant speed v along a circular path of radius r and completes the circle in time T. The acceleration of the particle is

A. $\frac{2\pi v}{T}$

B. $\frac{2\pi r}{T}$

C. $\frac{2\pi r^2}{T}$

D. $\frac{2\pi v^2}{T}$

Answer: A

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97. The ratio of the kinetic energies of two particles in UCM is 4:1 If their momenta are kept constant then the ratio of their masses $m_1 : m_2$ will be

A. $4/3$

B. $1:4$

C. $1/2$

D. $1/3$

Answer: B

Watch Video Solution

98. A stone of mass 16 kg is attached to a string 144 m long and is whirled in a horizontal circle .The maximum tension the

string can stand is 16 newton .The maximum velocity of revolution that can be given to the stone without breaking it will be

A. $2ms^{-1}$

B. $16ms^{-1}$

C. $14ms^{-1}$

D. $12ms^{-1}$

Answer: D

Watch Video Solution

99. A sphere of mass m is tied to end of a string of length l and rotated through the other end along a horizontal circular path with speed v . The work done in full horizontal circle is

A. zero

B. $\left(\frac{mv^2}{l}\right)2\pi l$

C. $mg2\pi l$

D. $\left(\frac{mv^2}{l}\right)(l)$

Answer: A

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100. A body describes a circular path of radius 10 m, , with a uniform speed .IF it is acted upon by a centripetal force of 0.4 newton ,then the kinetic energy of the body will be

A. 1 joule

B. 1.5 joule

C. 2 joule

D. 3 joule

Answer: C

Watch Video Solution

101. An annular ring with inner and outer radii R_1 and R_2 is rolling wihtout slipping with a uniform angular speed. The ratio of the forces experienced by the two particles situated on the inner and outer parts of the ring, $\frac{F_1}{F_2}$ is

A. 1

B. $\frac{R_1}{R_2}$

C. $\frac{R_2}{R_1}$

D. $\left(\frac{R_1}{R_2}\right)^2$

Answer: B

Watch Video Solution

102. A flywheel of diameter 1 m is rotating at 600 r.p.m., the acceleration of a point on the rim of the fly wheel is

A. $100\pi^2 m/s^2$

B. $150\pi^2 m/s^2$

C. $200\pi^2 m/s^2$

D. $300\pi^2 m/s^2$

Answer: C

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103. when a body performs a U.C .M Its tangential acceleration is

A. $\frac{v^2}{r}$

B. $\frac{v}{r^2}$

C. $\frac{v}{r}$

D. zero

Answer: D

Watch Video Solution

104. A flyover bridge is in the form of a circular are of radius 39.5 m . What is the limiting speed at which a car can cross the bridge without losing constact with the road , at the

highest point ? [Assume that the centre of gravity of the car is 0.5 m above the road and $g = 10m/s^2$]

A. 10m/s

B. 12m/s

C. 15m/s

D. 20m/s

Answer: D

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105. A particle moves along a circle of radius $\left(\frac{20}{\pi}\right)$ metre with constant tangential acceleration .If the velocity of the particle is 40 m/s at the end of second revolution , after the revolution has began , then the tangential acceleration .If the velocity of the particle is 40 m/s at the end of second revolution , after the revolution has began , then the tangential acceleration is

A. $5m/s^2$

B. $10m/s^2$

C. $15m/s^2$

D. $20m/s^2$

Answer: B

Watch Video Solution

106. A particle of mass m is moving along a circular path of radius r, with uniform speed v . The relation between its kinetic energy (E) and momentum (P) is given by

A. $E = \frac{P}{2m}$

B. $E = \frac{P^2}{2mr^2}$

C. $E = \frac{P^2}{m}$

D. $E = \frac{2m}{P^2}$

Answer: B

Watch Video Solution

107. A wheel rotates about an axis passing through the center and perpendicular to the

plane with slowly increasing angular speed. Then it has

A. tangential velocity and radial acceleration

B. radial velocity and radial acceleration

C. tangential velocity and tangential and radial accelerations

D. Tangential velocity and tangential acceleration

Answer: C

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108. A particle moves in a circular orbit under the action of a central attractive force which is inversely proportional to the distance 'r' . The speed of the particle is

A. proportional to r^2

B. Independent of r

C. proportional to r

D. proportional to 1/r

Answer: B

Watch Video Solution

109. A hemispherical bowl of radius R si set rotating abouv its axis of symmetry whichis kept vertical. A small blcok kept in the bowl rotates with the bowl without slippingn on its surface. If the surfaces of the bowl is mooth, and the abgel made by the radius through the block with the vertical is θ, find the angular speed at which the bowl is rotating.

A. $\sqrt{\frac{g}{R.\cos\theta}}$

B. $\sqrt{\frac{R\cos\theta}{g}}$

C. $\sqrt{\frac{g\sin\theta}{R}}$

D. $\sqrt{\frac{R\sin\theta}{g}}$

Answer: A

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110. A person stands in contact against the inner surface of a cylindrical drum of radius (R

) rotating with angular velocity ω . The coefficient of friction between the inner surface of the minumum rotational speed of the cylinder , which enables the person to ramain stuck to the wall , when the platform on which the person was standing is suddenly removed ?

A. $\sqrt{\frac{\mu R}{g}}$

B. $\sqrt{\frac{g}{\mu R}}$

C. $\sqrt{\frac{2g}{\mu R}}$

D. $\sqrt{\frac{rg}{\mu}}$

Answer: B

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111. A particle describes a horizontal circle on the smooth surface of an inverted cone. The height of the plane of the circle aove the vertex is 9.8 cm. Find the speed of the particle. Take $g = 9.8ms^{-2}$.

A. $5m/s$

B. $7m/s$

C. $10m/s$

D. $12m/s$

Answer: C

Watch Video Solution

112. the electron in the first orbit of hydrogen atom revolves round the nucleus in a circular orbit of radius 0.5 Å . It takes 1.5×10^{-4} Ps to complete one revolution . What is the centripetal force acting on the electron ?

A. $5 \times 10^{-5} N$

B. $6 \times 10^{-6} N$

C. $7 \times 10^{-7} N$

D. $8 \times 10^{-8} N$

Answer: D

Watch Video Solution

113. A particle of mass m describes a circle of radius r . The centripetal acceleration of the

particle is $\frac{4}{r^2}$. What will be the momentum of the particle ?

A. $\frac{2m}{r}$

B. $\frac{r}{\sqrt{2m}}$

C. $\frac{2m}{\sqrt{r}}$

D. $\frac{R}{2m}$

Answer: C

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114. A coin kept on a rotating gramophone disc just beging to slip if its centre is at a distance of 8 cm from the centre of the disc .The angular velocity of the gramophone disc is then doubled , Through what distance , the coin should be shifted towards the centre , so that the coin will just slip ?

A. 2 cm

B. 4 cm

C. 6 cm

D. 16 cm

Answer: C

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115. A long beam is spun at a costant speed of 1.75 rad /s During the period of training an astronaut is made to walk slowly along this beam , away from the axis of rotation At what distance , from the axis of rotation , he will

experience a centrifugal acceleration equal to the acceleration due gravity ?

A. $3.2m$

B. $1.6m$

C. $0.8m$

D. $6.4m$

Answer: A

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116. 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. remains the same

B. fluctuates erratically

C. Increase

D. Decreses

Answer: C

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Watch video solution

117. A particle describes a horizontal circle in a conical funnal whose inner surface is smooth with speed of 0.5 m/s. What is the height of the plane of circle from vertex of the funnel ?

A. 2 cm

B. 4 cm

C. 2.5cm

D. 0.25 cm

Answer: C

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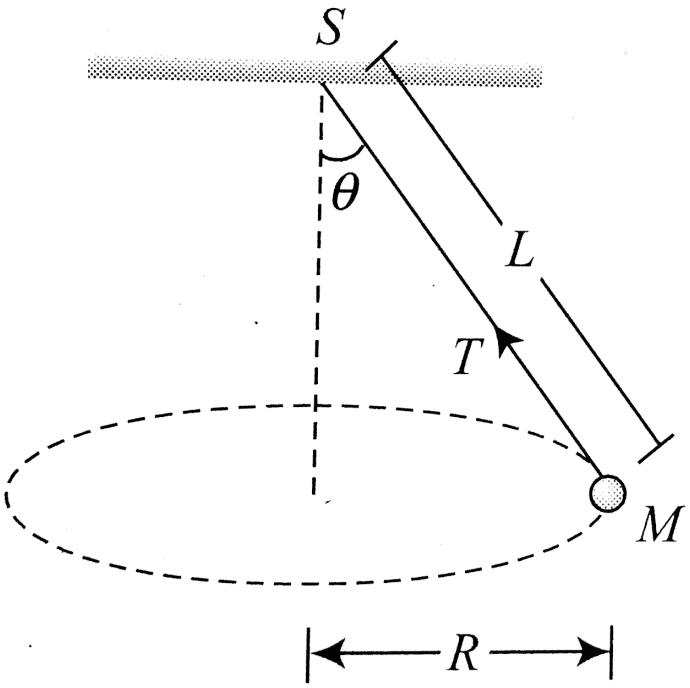
118. A string of length L is fixed at one end and carries a mass M at the other end. The string makes $2/\pi$ revolution per second around the vertical axis through the fixed end as shown in

the figure, then tension in the string is.



A. 2 ml

B. 4 ml

C. 8 ml

D. 16 ml

Answer: D

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119. A body of mass m is tied to one end of a spring and whirled round in a horizontal circle with a constant angular velocity .The elongation is 1 cm . If the angular velocity is

doubled , the elongation in the spring is 5 cm.

what is the original length of the spring ?

A. 13 cm

B. 14 cm

C. 15 cm

D. 16 cm

Answer: C

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120. A car is moving on a circular path and takes a turn. If R_1 and R_2 be the reactions on the inner and outer wheels, respectively, then

A. $R_1 = R_2$

B. $R_1 < R_2$

C. $R_1 > R_2$

D. $R_1 \geq R_2$

Answer: B

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121. IF a particle of mass m is moving in a horizontal circle of radius r with a centripetal force $\left(-\frac{K}{r^2}\right)$, then its total energy is

A. $\frac{K}{2r}$

B. $-\frac{K}{r}$

C. $-\frac{2k}{r}$

D. $-\frac{4K}{r}$

Answer: A

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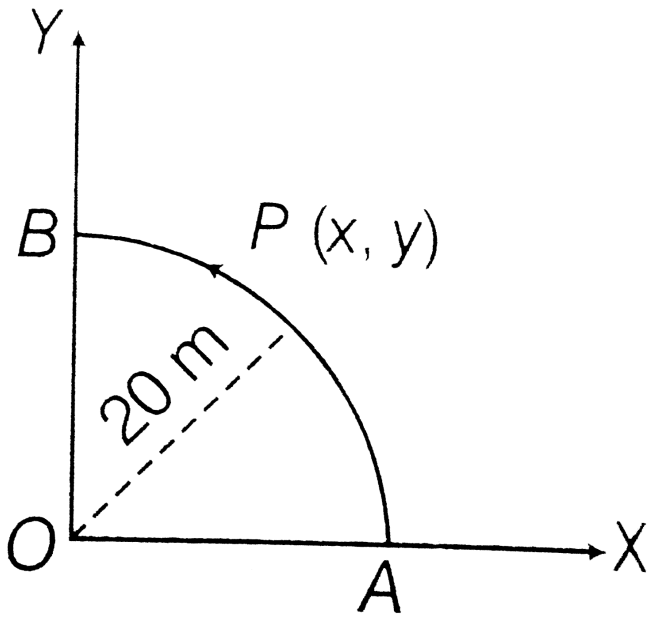
122. A point P moves in counter-clockwise direction on figure. The movement of P is such that it sweeps out a length $s = t^3 + 5$, where s is in metre and t is in second. The radius of the pathh is 20 m. the acceleration of P when t=2s is nearly



A. $14m/s^2$

B. $113m/s^2$

C. $12m/s^2$

D. $7.2m/s^2$

Answer: A

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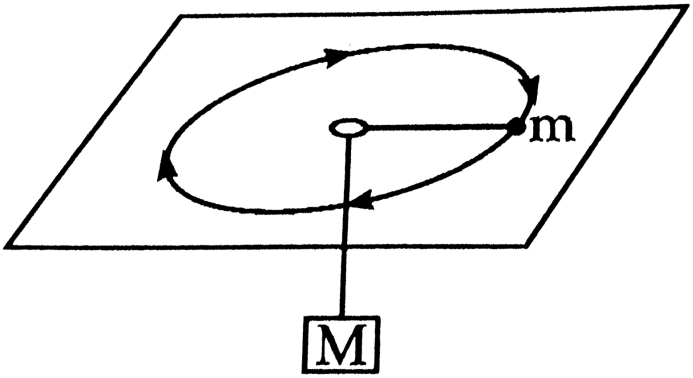
123. A mass m on a friction less table is attached to a hanging mass M by a cord through a hole in the table . Then the angular

speed with which m must spin for M stay at rest will be



A. $\frac{1}{2\pi}\sqrt{\frac{ML}{mg}}$

B. $\frac{1}{\pi}\sqrt{\frac{Mg}{mL}}$

C. $\frac{1}{\pi}\sqrt{\frac{ML}{Mg}}$

D. $\frac{1}{2\pi}\sqrt{\frac{Mg}{mL}}$

Answer: D

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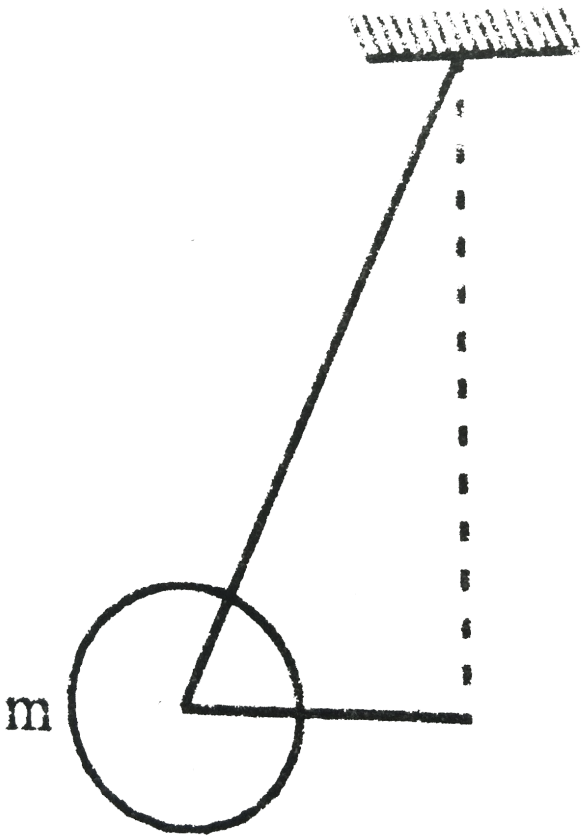
124. A ball of mass $(m)0.5kg$ is attached to the end of a string having length $(L)0.5m$. The ball is rotated on a horizontal circular path about vertical axis. The maximum tension that the string can bear is $324N$. The maximum possible value of angular velocity of ball (in

radian//s) is -



A. 9

B. 18

C. 27

D. 36

Answer: D

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125. A particle of mass m is moving in a circular path of constant radius r such that its centripetal acceleration a_c is varying with time t as $a_c = k^2rt^2$, where k is a constant. The power delivered to the particle by the forces acting on it is :

A. $2\pi mK^2r^2t$

B. mK^2r^2t

C. $\frac{mK^4r^2t^5}{3}$

D. zero

Answer: B

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126. Which of the following statements is FALSE for a paricle moving in a circle with a constant angular sppeed?

A. The velocity vector is tangential to the circle

B. The acceleration vector is tangential to the circle

C. the acceleration vector points towards the centre of the circle

D. the velocity and acceleration vectors are perpendicular to each other

Answer: B

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127. A toy cart is tied to the end of an unstrectched string of length 'l' when revolved , the toy cart moves in horizontal circle with radius '2l' and time period T. IF it is speeded until it moves in horizontal circle of radius '3l' with period $T_1,$ relation between $T \text{ and } T_1$ is (Hooke 's law is obeyed)

A. $T_1 = \frac{2}{\sqrt{3}}T$

B. $T_1 = \sqrt{\frac{3}{2}}T$

C. $T_1 = \sqrt{\frac{2}{3}}T$

D. $T_1 = \frac{\sqrt{3}}{2}T$

Answer: D

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128. A particle of mass m describes a circle of radius r with a uniform speed v. The centripetal acceleration of the pariticle is $\frac{4}{r^2}$ .What is the magnitude of the linear momentum of the particle ?

A. $\frac{2m}{\sqrt{r}}$

B. $\frac{2m}{r}$

C. $\frac{4m}{\sqrt{r}}$

D. $\frac{4m}{r}$

Answer: A

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129. A particle moves in a circle of radius 2 m at a second

what is its resultant (total) acceleration at time $t = 1$ s ?

A. $8m / s^2$

B. $2\sqrt{2}m / s^2$

C. $5\sqrt{5}m / s^2$

D. $4\sqrt{5}m / s^2$

Answer: D

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130. A pariticle of mass m is performing a U.C .M along a circular path of radius r. Its angular momentum abount the axis of rotation (axis

of the circle (is L. What is the kinetic energy of the pariticle ?

A. $\frac{1}{2}\frac{L^2}{mr^2}$

B. $\frac{2L^2}{mr^2}$

C. $\frac{L^2}{mr^2}$

D. $\frac{2L^2}{3mr^2}$

Answer: A

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131. A cyclist bends while taking turn to

A. the car is heaver then the cycle

B. car has four wheels and the cycle has only two wheels

C. the cyclist has to balance the centrifugal force but the passebger cannot balance the centrifugal force hence he is puched outwards

D. the speed of the car is more than the speed of the cycle

Answer: C

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132. A car takes a turn on a slippery road at a safe speed of 9.8 m/s .If the coefficient of friction is 0.2 the manimum radius of the are in which the car takes a trun is

A. 20 m

B. 49 m

C. 24.5 m

D. 80 m

Answer: B

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133. A train of mass 10^5 kg rounds a curve of radius 100m at a speed of 20 m/s . If the track

is not , then the thrust on the outer rail of the track is

A. $2 \times 10^5 N$

B. $3 \times 10^5 N$

C. $4 \times 10^5 N$

D. $5 \times 10^5 N$

Answer: C

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134. A car is travelling along a curved road of radius r. If the coefficient of friction between the tyres and the road is μ the car will skid if its speed exceeds .

A. $\sqrt{\frac{\mu g}{r}}$

B. $\sqrt{\mu g r}$

C. $\mu r g$

D. $\frac{\mu g}{r}$

Answer: B

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135. What is the angle of banking of a railway track of radius of curvature 250m, if the maximum velocity of the train is 90 km / hr .? (use $g = 10\frac{m}{s^2}$)

A. $\theta = \tan^{-1}\left(\frac{1}{2}\right)$

B. $\theta = \tan^{-1}\left(\frac{1}{3}\right)$

C. $\theta = \tan^{-1}\left(\frac{1}{4}\right)$

D. $\theta = \tan^{-1}\left(\frac{1}{5}\right)$

Answer: C

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136. The angle of banking for a railway track is given by $\theta = \sin^{-1}\left(\frac{1}{16}\right)$. If it is a metre gauge railway line , then the elevation of the outer rail above the inner rail is

A. $5cm$

B. $625cm$

C. $10cm$

D. $12.5cm$

Answer: B

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137. A man with his hands in his pocket is standing in a bus , which is taking a turn in a horizontal curve of radius 50 m , with a speed of 7 m/s far from the vertical must he lean to keep his balance ?

A. $\theta = \tan^{-1}(0, 2)$

B. $\theta = \tan^{-1}(0.15)$

C. $\theta = \tan^{-1}(0.1)$

D. $\theta = \tan^{-1}(0.50)$

Answer: C

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138. A van is moving with a speed of 108 km / hr on level road where the coefficient of fraction between the tyres and the road is 0.5 for the safe driving of the van , the minimum

radius of curvature of the road will be ($g = 10m/s^2$)

A. 80m

B. 180m

C. 40 m

D. 20 m

Answer: B

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139. A cyclist goes round a circular path of circumference $34.3 \min \sqrt{22} s$.The angle made by him , with vertical , is

A. 45°

B. 44°

C. 43°

D. 41°

Answer: A

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140. A coin just remains on a disc rotating at a steady rate of 180r.p.m .A coin is kept at a distance of 2 cm from the axis of rotationn . The coefficient of fricition between the coin and the disc is ____ $\left[gg = 9.8m/s^2\right]$

A. 0.524

B. 0.624

C. 0.724

D. 0.824

Answer: C

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141. What would be the maximum speed of a car on a road turn of radius 30 m, if the coefficient of fraction between the types and the road is 0.4 ?

A. $6.84m/s$

B. $8.84m/s$

C. $10.84m/s$

D. $4.84m/s$

Answer: C

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142. The radius of curvature of a metre gauge railway line at a place where the train is moving at $36km/h$ is 50 m .If there is no side thrust on the rails , then the elevation of the outer rail above the inner rail will be $(g = 10m/s^2)$

A. $0.1m$

B. $0.2m$

C. $0.3m$

D. $0.4m$

Answer: B

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143. A cyclist moves in a circular track of radius 100 m. If the coefficient of friction is 0.2 , then the maximum velocity with which the cyclist can take the turn with leaning inward is

A. $140m/s$

B. $14m/s$

C. $1.4m/s$

D. $4.9m/s$

Answer: B

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144. A cyclist is moving in a circular track of radius 80 m,, with a velocity of 36 km/ hour . In order to keep his balance , he has to lean

inwards from the velocity through an angle θ if $g = 10m/s^2$, then θ is given by

A. $\tan^{-1}(2)$

B. $\tan^{-1}(4)$

C. $\tan^{-1}\left(\frac{1}{4}\right)$

D. $\tan^{-1}\left(\frac{1}{8}\right)$

Answer: D

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

A. $\frac{Rg}{bv^2}$

B. $\frac{v^2b}{R}$

C. $\frac{v}{bgR}$

D. $\frac{v^2b}{Rg}$

Answer: D

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146. What is the smallest radius of a curve on a horizontal road , at which a cyslist can travel if his speed is 36 km / hour and the angle of inclination is 45° ?(g =$10m/s^2$)

A. $25m$

B. $20m$

C. $15m$

D. $10m$

Answer: D

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147. A cystlist riding a bicycle a bicycle at a speed of $14\sqrt{3}$ m/s takes a turn around a circular a circular road of radius $20\sqrt{3}$ m without skidding . What is his inclination to the vertical ?

A. 30°

B. 45°

C. 60°

D. 80°

Answer: C

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148. The angle of banking (θ) for a metre gauge railway line is given by $\theta = \sin^{-1}\left(\frac{1}{20}\right)$. What is the elevation of the outer rail above the inner rail ?

A. 4 cm

B. 5 cm

C. 8 cm

D. 12 cm

Answer: B

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149. A motor cylist moving with a velocity of 72 km / hour on a flat road takes a turn on the road at a point where the radius of curvature

of the road is 20 m . The acceleration due to gravity is 10 $m/\sec^2$. In order to avoid skidding , he must not bend with respect to the vertical plane by an angle greater than

A. $\theta = \tan^{-1} 6$

B. $\theta = \tan^{-1} 2$

C. $\theta = \tan^{-1} 25.92$

D. $\theta = \tan^{-1} 4$

Answer: B

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150. The minimum velocity (in ms^(-1))` with which a car driver must traverse a flat curve of radius 150m and coefficient of friction 0.6 to avoid skidding is

A. 30

B. 25

C. 60

D. 15

Answer: A

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151. the angle of banking is independent of

A. radius of the path

B. mass of the vehicle

C. acceleration due to gravity

D. maximum velocity of the vehicle along the curved path

Answer: B

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152. the angle of banking is independent of

A. acceleration due to gravity

B. radius of curvature of the road

C. speed of the vehicle

D. none of the above

Answer: D

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153. Keeping the banking angle same , to increase the maximum speed with which a vehicle can traveln on the curve road by $10\,\%$, the radius of curvature of the road has to be changed from 20 m to

A. $12.1m$

B. 24.2m

C. 6m

D. 48 m

Answer: B

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154. the maximum velocity with which a driver a must drive his car on a flat curved road of radius of curvature 150 m and coefficient of friction 0.6 to avoid the skidding of his car is (take $g = 10m/s^2$)

A. 60m/s

B. 50 m/s

C. 40 m/s

D. 30 m/s

Answer: D

Watch Video Solution

155. On a dry road the maximum safe speed for a vehicle moving on a curved raod is 30 km/ hour , After heavy showers , the maximum safe speed for the same raod was 18 km/ hour . The ratio of the coefficient of friction for the dry road to that of wett road is

A. $\frac{5}{3}$

B. $\frac{25}{9}$

C. $\frac{3}{5}$

D. $\frac{5}{2}$

Answer: B

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156. A weightless thread can support tension up to $30N$. A particle of mass $0.5kg$ is tied to it and is revolved in a circle of radius $2m$ in a

verticle plane. If $g = 10m/s^2$, then the maximum angular velocity of the stone will be

A. $3rad/s$

B. $4rad/s$

C. $5rad/s$

D. $6rad/s$

Answer: C

Watch Video Solution

157. A body of mass 1 kg is suspended from a string 1 m long it is rotated in a vertical circle , what is the tension in the string when it is horizontal and the speed of the body is 2m/s ?

A. 4 N

B. 3N

C. 2 N

D. 1N

Answer: A

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158. A body attached at one end of a string crosses the topmost point of a vertical circle with the critical speed Its centripetal acceleration , when the string is horizontal will be

A. g

B. 3g

C. 5g

D. 6g

Answer: B

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159. A mass m is kept hanging by a rad of length L. What tangential velocity must be given to it so that it can just reach the top of the vertical circle ?

A. $5\sqrt{gL}$

B. $4\sqrt{gL}$

C. $3\sqrt{gL}$

D. $2\sqrt{gL}$

Answer: D

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160. A body of mass 100 gram is tied at the end of a string of length 1m. It is rotated in a vertical circle at a critical speed of 4 m/s at the highest point . The tension in the string at the huighest point in its path is [take $g = 10m/s^2$]

A. $0.3N$

B. $0.6N$

C. $0.9N$

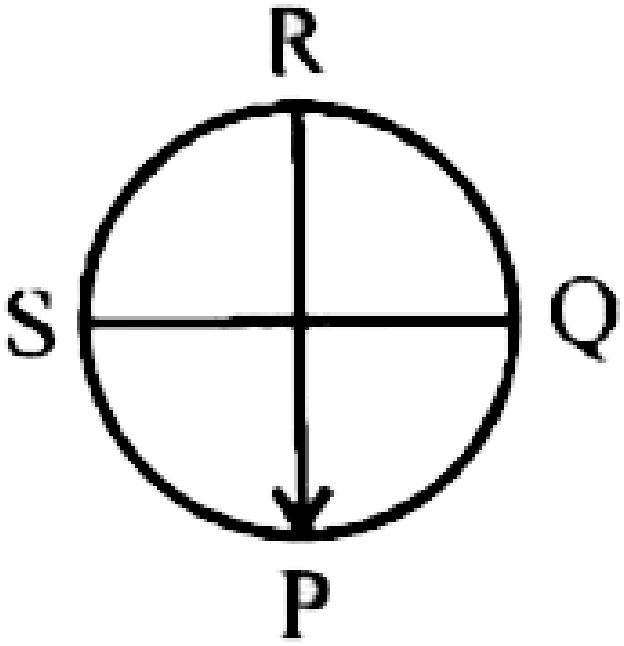
D. $1.2N$

Answer: B

Watch Video Solution

161. A stone is attached to one end of a string and rotated in a vertical circle . If the string breaks at the position of maximum tension ,

then it will break at



A. Q

B. P

C. S

D. R

Answer: B

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162. To describe a verctical of radius 20 cm , the minimum speed of a paruticle at the lowest point of the circle is 10 cm/s . If the radius of the circle is redduced to 1/4 of its original value „ Then the corresponding minimum speed will be

A. 2.5 cm/s

B. 5 cm/s

C. 7.5 cm/s

D. 10 cm/s

Answer: B

 Watch Video Solution

163. One end of string of length 2 m , is tied to a body of mass 0.5 kg , the other end is tied to a small nail on a smooth vertical board , what minimum speed should be given to the body

at its lowermost point , so that the string does not become slack at any point in its motion along a vertical circular path ? $\left(g = 10m/s^2\right)$

A. 6m/s

B. 10 m/s

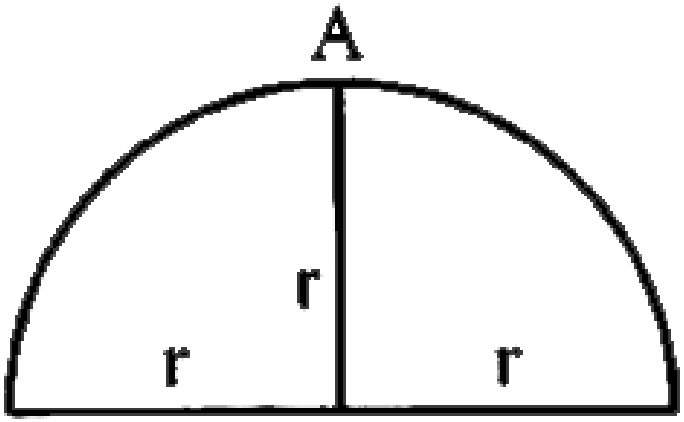
C. 8 m/s

D. 12 m/s

Answer: B

Watch Video Solution

164. A body of mass m slides from rest , down the surface of a smooth hemisperical bowl of radius r from the highest point A . What is the velocity of the body when if reaches the bottom ?



A. $\sqrt{gr}$

B. $\sqrt{2gr}$

C. $\sqrt{3gr}$

D. $2mgr$

Answer: B

View Text Solution

165. In a constant , when the bob moves in a horizontal circle of radius r, with uniform speed v, the string of length L describes a cone of semivertical angle θ . The tension in the string is given by

A. $T = \frac{mgL}{(L^2 - r^2)}$

B. $\frac{(L^2 - r^2)^{1/2}}{mgL}$

C. $T = \frac{mgL}{\sqrt{L^2 - r^2}}$

D. $T = \frac{mgL}{(L^2 - r^2)^2}$

Answer: C

Watch Video Solution

166. In a conical pendulum , the centripetal force $\left(\frac{mv}{r}\right)^2$ acting on the bob is given by

A. $\frac{mgr}{\sqrt{L^2 - r^2}}$

B. $\frac{mgr}{L^2 - r^2}$

C. $\frac{\left(L^2 - r^2\right)^{1/2}}{mgL}$

D. $\frac{mgL}{\left(L^2 - r^2\right)^{1/2}}$

Answer: A

Watch Video Solution

167. If T and T' are the periods of a simple pendulum and a conical pendulum of the

sample length then .

A. $T = T'$

B. $T < T'$

C. $T > T'$

D. $T = \frac{1}{2}T'$

Answer: C

Watch Video Solution

168. A simple pendulum of effective length 'l' is kept in equilibrium in vertical position . What horizontal velocity should be given to its bob , so that it just completes a vertical circular motion ?

A. $\sqrt{5gl}$

B. $\sqrt{3gl}$

C. $\sqrt{gl}$

D. $\sqrt{7gl}$

Answer: A

Watch Video Solution

169. A bucket containing water is tied to one end of a rope of length 2.5 m and rotated about the other end in a vertical circle so that water does not spill even when bucet is upside down . What is the maximum velocity of the bucket at which this happens ? How many rotations per minute is it making $g = 10m/s^2$.

A. $2.5m/s$

B. $4m/s$

C. $5m/s$

D. $7m/s$

Answer: C

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170. A moter cyclist loops a vertical circular loop of diameter 18 m, without droping down , even at the highest point of the loop . What

should be his minimum speed at the lowest point of the loop ?

A. $10m/s$

B. $16m/s$

C. $21m/s$

D. $30m/s$

Answer: C

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171. A small body attached at the end of an inextensible string completes a vertical circle , then its

A. angular velocity remains constant

B. angular momentum reamains constant

C. total mechanical energy remains constant

D. linear momentum reamains constant

Answer: C

Watch Video Solution

172. A body of mass 100 gram , tied at the end of a string of length 3m rotes in a vertical circle and is just able to complete the circle . If the tension in the string at its lowest point is 3.7 N, then its angular velocity will be _____

$[g = 10m/s^2]$

A. $4rad/s$

B. $3rad/s$

C. $2rad/s$

D. $1 rad / s$

Answer: B

Watch Video Solution

173. A body of mass 500 gram is rotating in a vertical of radius 1 m . What is the difference in its kinetic energies at the top and the bottom of the circle ?

A. $4.9 J$

B. $19.8J$

C. $2.8J$

D. $-9.8J$

Answer: B

 Watch Video Solution

174. A weightless thread can bear tension upto 3.7 kg wt .A stone of mass 500 gm is tied to it and rotated in a circular path of radius 4 m, in

a vertical circle If $g = 10m/s^2$ then the maximum angular velocity of the stone will be

A. 3

B. 4

C. 5

D. 6

Answer: B

Watch Video Solution

175. A cane filled with water is revolved in a vertical circle of radius 4 m and water just does not fall down. The time period of revolution will be –

A. 10 s

B. 1s

C. 4s

D. 20s

Answer: D

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176. A motor cyclist in a circus , drives in a vertical loop inside a death well . What is the minimum speed required to complete the vertical circle , without falling down to complete the vertical circle , without falling down at the highest point , if the radius of the death well is 5 m?

A. 7m/s

B. 5 m/s

C. 10.5m/s

D. 15 m/s

Answer: A

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177. A body is allowed to slide down a frictionless inclined track under gravity from a height of 10 cm . The track ends in a circular loop of diameter D. The body is just able to

complete the circular track , then the diameter of the track will be

A. $4cm$

B. $8cm$

C. $6cm$

D. $2cm$

Answer: B

Watch Video Solution

178. A body of mass Mkg is on the top point of a smooth hemisphere of radius 5m . It is released to slide down the surface of hemisphere it leaves the surface when its velocity is $5ms^{-1}$ At this instant the angle made by the radius vector of the body with the vertical is (Take $g = 10m/s^2$)

A. 30°

B. 60°

C. 45°

D. 20°

Answer: B

Watch Video Solution

179. The bob of a simple prendulum is suspended by a strinng of length 80 cm . What minimum horizontal velocity should be imparted to the bob so that it reaches it reaches the height of suspension point ? $\left(g = 10m/s^2\right)$

A. $3m/s$

B. $4m/s$

C. $2m/s$

D. $5m/s$

Answer: B

 Watch Video Solution

180. A body of mass 0.1 Kg attached at the end of a string 6m long , is whirled in a vertical circle . The tension in the string is 6.4 N at the

lowest point . What is the maximum angular velocity the body ?

$(g = 10m / s^2)$

A. 12 rad /s

B. 9 rad/s

C. 6 rad /s

D. 3 rad /s

Answer: D

Watch Video Solution

181. A bucket full of water is rapidly rotated in a vertical circle of radius r . It of is found that the water does not fall down from the bucket , even when the bucket is inverted at the highest point . If it continues with this speed , then the normal contact force exerted by the bucket on the water at the lowest point in its path is

A. mg

B. 2mg

C. $3mg$

D. $\frac{mg}{2}$

Answer: B

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182. A store of mass 1 kg , attached at the end of a 1 m long string is whirled in a horizontal circle . IF the string makes an angle of 30° with the vertical , then the approximate value of the centripetal force acting on the stone is $\left(g = 10m/s^2\right)$

A. 4N

B. 5N

C. 6N

D. 7N

Answer: C

Watch Video Solution

183. A buket full of water is revolved in a vertical circle of radius 1m . What is the minimum frequency of revolution , required to

prevent the water from failing down ?

$[g = 10m/s^2]$

Watch Video Solution

184. A Roller coaster is desigend such that riders experience "Weightlessness " as they go round the top of a hill whose radius of curvature is 20 m. The speed of the car at the top of the hill is between

A. $15m/s$ and $16m/s$

B. $16m/s$ and $17m/s$

C. $13m/s$ and $14m/s$

D. $14m/s$ and $15m/s$

Answer: D

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185. A particle is moving in a vertical in a vertical circle . The tensions in the string when passing through two positions at angles

30° and 60° from the lowest positon are T_1 and T_2 respectively , then

A. $T_1 > T_2$

B. $T_1 < T_2$

C. $T_1 = T_2$

D. Tension in the string always remain the same

Answer: A

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186. A particle of mass m is rotated in a vertical circle by means of a string . The differnce in the tensions in the string at the bottom and the top of the circle would be

A. 2 mg

B. 3 mg

C. 4mg

D. 6 mg

Answer: D

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187. A 2kg stone at the end of a string 1 m long is whirled in a vertical circle . At a certain positon , the speed of the stone is 4m /s . The tension in the string will be 52 N, when the stone is $\left[g = 10m / s^2\right]$

A. at the bottom of the circle

B. at the top of the circle

C. at a height of half the radius from the bottom

D. at the ends of the horizontal diameter

Answer: A

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188. A stone of mass m is tied to a string and is moved in a vertical circle of radius r making n revolution per minute. The total tension in the string when the stone is its lowest point is.

A. $m\left[g + 4\pi^2 r\right]$

B. $m\left[g+\frac{\pi^2 n^2 r^2}{60}\right]$

C. $m\left[g+\frac{\pi^2 n^2 r}{900}\right]$

D. $m\left[g+n^2 r^2\right]$

Answer: C

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189. A fighter plane moves in a vertical circle of radius 2500 m . The mass of the plane is 15000 kg and its speed at the olowest point of its motion is 900 km/ hour . What is the force

exerted by air on the plane at the lowest point $(g = 10m/s^2)$

A. $3 \times 10^5 N$

B. $4.1 \times 10^5 N$

C. $5.25 \times 10^5 N$

D. $6.5 \times 10^5 N$

Answer: C

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190. What is the apparent of a body of mass m attached at the end of a string and which is just completing the loop in a vertical circle , at the lowest point in its path ?

A. 0

B. mg

C. $3mg$

D. $6mg$

Answer: D

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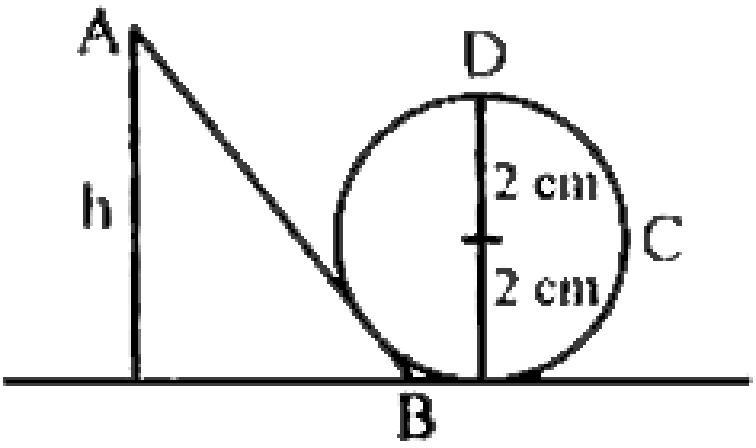
191. A frictionless track ABCD ends in a circular loop of radius 2cm. A body slides down the track from a point A which is at a height h . The minimum value of h for a body to complete the loop is



A. $3cm$

B. $5cm$

C. $\frac{10}{3}cm$

D. $4cm$

Answer: B

View Text Solution

192. A body is just being revolved in a vertical circle of radius R. The string breaks when the body is at the highest point . What is the

horizontal distance covered by the body after the string breaks ?

A. R

B. $R\sqrt{2}$

C. $4R$

D. $2R$

Answer: D

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193. The bulging of the earth at the equator and flattening at the poles is due to

A. Centripetal force

B. Centrifugai force

C. Gravitional force

D. Electrotrostatic force

Answer: B

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194. The period of a conical pendulum in terms of its length (l) , semivertical angle (θ) and acceleration due to gravity (g) is

A. $\frac{1}{2\pi}\sqrt{\frac{l\cos\theta}{g}}$

B. $\frac{1}{2\pi}\sqrt{\frac{l\sin\theta}{g}}$

C. $2\pi\sqrt{\frac{l\cos\theta}{g}}$

D. $4\pi\sqrt{\frac{l\tan\theta}{g}}$

Answer: C

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195. A car of mass 1500 kg rounds a curve of radius 250 m , at 90 km / hour . What is the centripetal force acting on it ?

A. $2550N$

B. $3100N$

C. $3750N$

D. $4200N$

Answer: C

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196. A racing car competes 5 rounds of a circular track in 2 minute . What is the radius of the track if the car has uniform centripetal acceleration of $\pi^2 m / s^2$?

A. 120m

B. 144m

C. 160m

D. 80m

Answer: B

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197. A particle rotates in U.C.M with tengential velocity 'v' along a ghorizontal circle of diameter 'D' . Total angular displacement of the particle in time 't' is

A. vt

B. $\left(\frac{v}{D}\right) - t$

C. $\frac{vt}{2D}$

D. $\frac{2vt}{D}$

Answer: D

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198. In vertical circular motion, the ratio of kinetic energy of a particle at highest point to that at lowest point is

A. 5

B. 2

C. 0.5

D. 0.2

Answer: D

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199. A particle moves along a circle of radius r with constant tangential acceleration. If the velocity of the particle is v at the end of second revolution, after the revolution has started, then the tangential acceleration is

A. $\frac{v^2}{8\pi r}$

B. $\frac{v^2}{6\pi r}$

C. $\frac{v^2}{4\pi r}$

D. $\frac{v^2}{2\pi r}$

Answer: A

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200. Angular speed of the hour of a clock in degree per second is

A. $\frac{1}{30}$

B. $\frac{1}{60}$

C. $\frac{1}{120}$

D. $\frac{1}{720}$

Answer: C

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201. For a particle moving in vertical circle, the total energy at different positions along the path

A. Is conserved

B. increases

C. decreases

D. may increase or decrease

Answer: A

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Test Your Grasp 1

1. The ratio of the angular speed of the hour and the minute hand of a clock is

A. $1:12$

B. $1:6$

C. $1:8$

D. $12:1$

Answer: A

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Test Your Grasp 2

1. A particle starts from rest and moves with an angular acceleration of 3 rad/s^2 in circle of radius 3 m . Its linear speed after 5 seconds will be

A. 15 m/s

B. 30m/s

C. 45m/s

D. 7.5m/s

Answer: C

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Test Your Grasp 3

1. The displacement of a particle moving in a circular path is given by $\theta = 3t^2 + 0.8,$ where θ is in radian and t is in seconds . The angular velocity of the particle at t=3 sec . Is

A. 18 rad/s

B. 15 rad/s

C. 12 rad /s

D. 8 rad /s

Answer: A

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Test Your Grasp 4

1. What is the value of linear velocity ,

If $\vec{\omega} = 3\hat{i} - 4\hat{j} + \hat{k}$ and $\vec{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$?

A. $6\hat{i} + 2\hat{j} - 3\hat{k}$

B. $-18\hat{i}-13\hat{j}+2\hat{k}$

C. $4\hat{i}-13\hat{j}+6\hat{k}$

D. $6\hat{i}-2\hat{j}+8\hat{k}$

Answer: B

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Test Your Grasp 5

1. Two particles P and Q start from a point on a circle at time t=0 . They travel in opposite

directions along a circular path of radius 10 m at constant speeds of $V_p = 2.14m/s$ and $V_Q = 1m/s$. After what -time they will collide ?

A. 5s

B. 10s

C. 15s

D. 20s

Answer: D

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Test Your Grasp 6

1. In a circular motion of radius 3 cm the distance (s) travelled by a body along the circumference bears the relationship $s = ct^3$ with time (t) where c= 0.1 m/s^3 . What are the tangential and centripetal acceleration when its linear speed is 0.3 m/s?

A. $0.2m/s^2, 3m/s^2$

B. $2m/s^2, 0.6m/s^2$

C. $0.6m/s^2, 3m/s^2$

D. $2m/s^2, 4m/s^2$

Answer: C

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Test Your Grasp 7

1. A car when passes through a convex bridge exerts a force on it which is equal to

A. $F = mg + \frac{mv^2}{r}$

B. $F = \frac{MV^2}{R}$

C. $f = mg - \frac{mv^2}{r}$

D. $F = mg + \left(\frac{mv^2}{r}\right)^2$

Answer: C

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Test Your Grasp 8

1. An electron moves along a circular path of radius 10 cm. If the centripetal acceleration is $4 \times 10^{11} m/s^2$, then its linear speed is

A. $0.5 \times 10^5 m/s$

B. $10^5 m/s$

C. $2 \times 10^5 m/s$

D. $3 \times 10^5 m/s$

Answer: C

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Test Your Grasp 9

1. A car is moving on a circular track of diameter 72 m with a speed of 6 m/s . It is acclereration at the rate of $\sqrt{3}m/s^2$ If the mass of the car is 1000 kg , the net force acting on the car is :

A. 1000 N

B. 2000 N

C. $1000\sqrt{3}N$

D. $\frac{1000}{\sqrt{3}}N$

Answer: B

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Test Your Grasp 10

1. When a disc is rotating with angular velocity ω , a particle situated at a distance of 4 cm just begins to slip . If the angular velocity is doubled , at what distance will the particle start to slip ?

A. 4 cm

B. 9 cm

C. 16 cm

D. 1 cm

Answer: D

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Test Your Grasp 11

1. A particle is moving along a circular path of radius 5 m with a uniform speed 5 m/s. What will be the average acceleration when the particle completes half revolution ?

A. $10m/s^2$

B. zero

C. $\frac{10}{\pi}m/s^2$

D. $10\pi m/s^2$

Answer: C

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Test Your Grasp 12

1. The K.E (K) of a particle moving along a circle r depends upon the distance covered (s) as $K = as^2$ The centripetal force acting on the particle is given by

A. $2as$

B. $2as^2$

C. $\frac{2as^2}{r}$

D. $\frac{2ar}{s^2}$

Answer: C

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Test Your Grasp 13

1. A particle is moving with a constant angular acceleration of $4rad/s^2$ in a circular path. At time $t = 0$, particle was at rest. Find the time at which the magnitudes of centripetal

acceleration and tangential acceleration are equal.

A. $\frac{2}{3}s$

B. $\frac{1}{3}s$

C. $\frac{1}{4}s$

D. $\frac{1}{2}s$

Answer: D

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Test Your Grasp 14

1. The circumference of a circular track is 1.256 km . What is the tangent of the angle of banking of the track if the maximum speed at which a car can be safely driven along it is 20 m/s and $g = 10m/s^2$?

A. $\frac{1}{2}$

B. $\frac{1}{3}$

C. $\frac{1}{4}$

D. $\frac{1}{5}$

Answer: D

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Test Your Grasp 15

1. What is the maximum speed with which a car safely turn a around a curved horizontal road of radius 50 m ? [The coefficient of friction between the tyres and the surface of the road is 0.4]

A. $7m/s$

B. $14m/s$

C. $21m/s$

D. $28m/s$

Answer: B

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Test Your Grasp 16

1. A curved road having a radius of curvature of 30 m is banked at the correct angle . If the speed of the car is to be doubled , then the radius of curvature of the road should be

A. 62 m

B. 120 m

C. 90 m

D. 15 m

Answer: B

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Test Your Grasp 17

1. A small pot completely filled with water is tied at the end of a 1.6 m long string . It is whirled in a vertical circle what minimum speed should be given to the pot , so that the water from the pot does not spill when the pot is at the highest postion ? (use $g = 10m/s^2$)

A. $2m/s$

B. $4m / s$

C. $8m / s$

D. $16m / s$

Answer: B

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Test Your Grasp 18

1. A weightless thread can bear tension upto 3.7 kg wt .A stone of mass 500 gm is tied to it

and rotated in a circular path of radius 4 m, in a vertical circle If $g = 10m/s^2$ then the maximum angular velocity of the stone will be

A. 2 rad /s

B. 5 rad /s

C. 4rad /s

D. 3 rad /s

Answer: C

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Test Your Grasp 19

1. If T and T' are the periods of a simple pendulum and a conical pendulum of the sample length then .

A. $T_1 = T_2$

B. $T_1 >_2$

C. $T_1 < T_2$

D. $T_1 = \frac{T_2}{2}$

Answer: B

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Test Your Grasp 20

1. A sphere is suspended by a thread of length l. What minimum horizontal velocity has to be imparted the ball for it to reach the height of the suspension?

A. $\sqrt{gl}$

B. gl

C. $2gl$

D. $\sqrt{2gl}$

Answer: D

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