PHYSICS

BOOKS - TARGET PHYSICS (HINGLISH)

CIRCULAR MOTION

Classical Thinking

1. The angular displacement in circular motion is

A. dimensional quantity

B. dimensionless quantity

C. unitless and dimensionless quantity

D. unitless quantity

Answer: B

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2. Angular displacement is measured in

A. metre

B. time

C. radian

D. steradian

Answer: C

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3. A flywheel rotates at a constant speed of 3000 r.p.m. The angle described by the shaft in one second is

A. 3π rad

B. 30πrad

C. 100πrad

D. 3000π rad

Answer: C

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4. Direction is $\vec{a} \times \vec{r}$ is

A. tangent to path

B. perpendicular to path

C. parallel to the path

D. along the path

Answer: A

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5. The angular speed of second hand in a watch is

A. 60 rad/s

B. $\pi rad / s$

C. $\pi / 30 rad / s$

D. $2 rad / s$

Answer: C

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6. The angular velocity of a particle rotating in a circular orbit 100 times per minute is

A. $1.66 rad / s$

B. $10.47 rad / s$

C. $10.47 deg / s$

D. $60 deg / s$

Answer: B

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7. A body mass 100 g is revolving in a horizontal circle. If its frequency of rotation is 3.5 r.p.s. and radius of circular path is 0.5 m, the angular speed of the body is

A. $18\,rad/s$

B. $20 rad/s$

C. $22 rad/s$

D. $24 rad/s$

Answer: C

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8. What is the angular velocity of the earth?

A. $\frac{2\pi}{86400} rad/s$

B. $\frac{2\pi}{3600} rad / s$

C. $\frac{2\pi}{24} rad / s$

D. $\frac{2\pi}{6400} rad / s$

Answer: A

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9. An electric motor of 12 horse-power generates an angular velocity of $125 rad / s$. What will be the frequency of rotation?

A. 20Hz

B. $20/\pi Hz$

C. $20/2\pi Hz$

D. 40 Hz

Answer: A

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10. The ratio of angular speeds of minute hand and hour hand of a watch is

A. $1:12$

B. $60:1$

C. $1:60$

D. $12:1$

Answer: D

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11. A body moves with constant angular velocity on a circle. Magnitude of angular acceleration

A. $r\omega^2$

B. constant

C. zero

D. $r\omega$

Answer: C

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12. A wheel having a diameter of 3 m starts from rest and accelerates uniformly to an angular velocity of 210 r.p.m. in 5 seconds.

Angular acceleration of the wheel is

A. $4.4 rads^{-2}$

B. $3.3 rads^{-2}$

C. $2.2 rads^{-2}$

D. $1.1 rads^{-2}$

Answer: A

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13. The correct relation between linear velocity $\overrightarrow{v}$ and angular velocity $\overrightarrow{\omega}$ of a particle is

A. $\overrightarrow{v} = \overrightarrow{\omega} \times \overrightarrow{r}$

B. $\overrightarrow{v} = \overrightarrow{r} + \overrightarrow{\omega}$

C. $\overrightarrow{v} = \overrightarrow{\omega} . \overrightarrow{r}$

D. $\overrightarrow{v} = \overrightarrow{r} - \overrightarrow{\omega}$

Answer: A

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14. A Wheel has circumference C. IF it makes f r.p.s, the linear speed of a point on the circumference is

A. $2\pi fC$

B. fC

C. $fC/2\pi$

D. $fC/60$

Answer: B

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15. A body is whirled in a horizontal circle of radius $20cm$. It has an angular velocity of $10rad/s$. What is its linear velocity at any point on the circular path

A. $10m/s$

B. $2m/s$

C. $20m/s$

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

Answer: B

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16. 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. $10.6 m / s$

B. $11.2 m / s$

C. $12.6\ m / s$

D. $13.6 m / s$

Answer: C

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17. In uniform circular motion,

A. both velocity and acceleration are constant

B. velocity changes and acceleration is constant.

C. velocity is constant and acceleration

D. both velocity and acceleration change.

Answer: D

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18. A particle moves along a circule path with a constant angular velocity. This necessarily means that the motion

A. its motion is confined to a single plane

B. its motion is not confined to a single plane

C. nothing can be said regarding the plane of motion

D. its motion is one- dimensional

Answer: A

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19. Select the WRONG statement

A. In U.C.M. linear speed is constant

B. In U.C.M. linear velocity is constant

C. In U.C.M magnitude of angular momentum is constant

D. In U.C.M. angular velocity is constant

Answer: B

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20. If a particle moves in a circle describing equal angles in equal intervals of time, then the velocity vector.

A. remains constant

B. changes in magnitude only

C. changes in direction only

D. changes both in magnitude and direction

Answer: C

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21. A particle moves along a circle with a uniform speed v. After the position vector has made an angle of 30° with the reference position, its speed will be

A. $v\sqrt{2}$

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

C. $\frac{v}{\sqrt{3}}$

D. v

Answer: D

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22. A car travels north with a uniform velocity. It goes over a piece of mud which sticks to the tyre. The particles of the mud, as it leaves the ground are thrown

A. vertically upwards

B. vertically inwards

C. towards north

D. towards south

Answer: D

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23. A particle in U.C.M possesses linear accleration since

A. its linear speed changes continously

B. both magnitude and direction of linear velocity change continuosly.

C. direction of linear velocity changes continuosly

D. its linear speed does not change continuously

Answer: C

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24. The accelaration of a particle in U.C.M. directed towards centre and along the radius is called

A. centripetal accleration

B. centrifugal acceleration

C. gravitational acceleration

D. tangential acceleration

Answer: A

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25. In an inertial frame of reference, a body performing uniform circular motion in clockwise direction has

A. constant velocity

B. zero angular acceleration

C. centripetal acceleration

D. tangential acceleration

Answer: C

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26. An electric fan has blades of length $30cm$ as measured from the axis of rotation. If the fan is rotating at $1200r \pm$, find the acceleration of a point on the tip of a blade.

A. $1600cm/s^2$

B. $4740cm/s^2$

C. $2370cm/s^2$

D. $5055cm/s^2$

Answer: B

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27. The diameter of a flywheel is 1.2 m and it makes 900 revolutions per minute. Calculate the acceleration at a point on its rim

A. $540\pi^2 m / s^2$

B. $270 m / s^2$

C. $360\pi^2 m / s^2$

D. $540 m / s^2$

Answer: A

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28. The angular frecuancy needed for a centrifugal to produce an acceleration of 1000 g rad/s^(2) at a radius arm of 10 cm ,is

A. $1500 rev / \min$

B. $4000 rev / \min$

C. $2000 rev / \min$

D. $3000 rev / \min$

Answer: D

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29. If the angle between tangential acceleration and resultant acceleration in non ucm is a, then direction of the resultant acceleration will be

A. $\tan^{-1}\left(\frac{a_t}{a_r}\right)$

B. $\tan^{-1}\left(\frac{a_r}{a_t}\right)$

C. $\tan^{-1}\left(\frac{a_r}{a_\alpha}\right)$

D. $\tan^{-1}\left(\frac{a_t}{a_\alpha}\right)$

Answer: B

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30. A car is moving along a circular road at a speed of 20 m/s. The radius of circular road is 10 m. IF the speed is increased at the rate of 30m/s^2, what is the resultant acceleration at that moment?

A. 10m/s

B. 50m/s^2

C. 250m/s^2

D. 80m/s^2

Answer: B

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31. The force required to keep a body in uniform circular motion is

A. centripetal force

B. centrifugal force

C. frictional force

D. breaking force

Answer: A

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32. A vehicle moving on a horizontal road may be thrown outward due to

A. gravitational force

B. normal reaction

C. frictional force between tyres and road

D. lack of proper centripetal force

Answer: D

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33. Select the WRONG statement

A. Centrifugal force has same magnitude as that of centripetal force

B. Centrifugal force is along the radius , away from the centre

C. Centrifugal force exists in inertial frame of reference

D. Centrifugal force is called pseudo force, as its origin cannot be explained

Answer: C

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34. An important consequence of centrifugal force is that the earth is

A. bulged at poles and flat at the equator

B. flat at poles and bulged at the equator

C. high tides and low rides

D. rising and setting of sun

Answer: B

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35. Fats can be separated from milk in a cream separator because of

A. cohesive force

B. gravitational force

C. Centrifugal force

D. viscous force

Answer: C

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36. When a car is going round a circular track, the resultant of all the forces on the car in an inertial frame is

A. acting away from the centre

B. acting towards the centre

C. zero

D. acting tangential to the track

Answer: B

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37. Place a coin on gramophone disc near its centre and set the disc into the rotation. As the speed of rotation increases, the coin will slide away from the centre of the disc. The motion of coin is due to

A. radial force towards centre

B. non-conservative force

C. centrifugal force

D. centripetal force

Answer: C

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38. IF p is the magnitude of linear momentum of a particle executing a uniform circular motion, then the ratio of centripetal force acting on the particle to its linear momentum is given by

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

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

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

D. v.r

Answer: C

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39. A racing car of mass 10^2 kg goes around a circular track (horizontal) of radius 10cm. The maximum thrust that track can withstand is 10^5N. The maximum speed with which car can go around is

A. 10m/s

B. 100m/s

C. 50m/s

D. $20m/s$

Answer: B

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40. Two particles of equal masses are revvolving in circular paths of radii r_1 and r_2 respectively with the same speed . The ratio of their centripetal forces is

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

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

C. $\left(\frac{r_1}{r_2}\right)^2$

D. $\left(\frac{r_2}{r_1}\right)^2$

Answer: A

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41. A 10 kfg object attached to a nylon cord outside a space vehicle is rotating at a speed of $5m/s$. If the force acting on the cord is 125 N, its radius of path is

A. 2m

B. 4m

C. 6m

D. 1m

Answer: A

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42. The breaking tension of a string if 50 N. A body of mass 1 kg is tied to one end of a 1m long string and whirled in a horizontal circle,

The maximum speed of the body should be

A. $5\sqrt{2}m/s$

B. $10m/s$

C. $7.5m/s$

D. $5m/s$

Answer: A

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43. A proton of mass 1.6×10^{-27}kg goes round in a circular orbit of radius 0.12 m under a certripetal force of 6×10^{-14} N. then the frequency of revolution of the proton is about

A. 1.25×10^{6} cycles per second

B. 2.50×10^{6} cycles per second

C. 3.75×10^{6} cycles per second

D. 5.00×10^{6} cycles per second

Answer: D

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44. The safety speed of a vehicle on a curve horizontal road is

A. $\mu r g$

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

C. $\mu r^2 g$

D. $\mu / (rg)^2$

Answer: B

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45. The safe speed of a vehicle on a horizontal curve road is independent is

A. mass of vehicle

B. coefficient of friction between road surface and tyre of vehicle

C. radius of curve

D. acceleration due to gravity

Answer: A

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46. Railway tracks are banked at the curves so that :

A. resultant force will be decreased

B. weight of train may be reduced

C. centrifugal force may be balanced by the horizontal component of the normal reaction of the rail.

D. frictional force may be produced between the wheels and tracks

Answer: C

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47. The angle of banking of the road does not depend upon

A. acceleration due to gravity

B. radius of curvature of the road

C. mass of the vehicle

D. speed of the vehicle

Answer: C

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48. For a banked curved road. The necessary centripetal force or any vehicle is provided by

A. vertical component of normal reaction of the vehicle

B. horizontal component of the normal reaction of the vehicle

C. both vertical and horizontal components of the normal reaction of the vehicle

D. weight of the vehicle

Answer: B

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49. IF the radius of the circular track decreases, then the angle of banking

A. increases

B. decreases

C. first increase then decrease

D. does not change

Answer: A

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50. When the bob of a conical pendulam is moving in a horizontal circle at constant speed, which quantity is fixed?

A. velocity

B. Acceleration

C. Centripetal force

D. Kinetic energy

Answer: D

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51. The period of a conical pendulam is

A. equal to that of a simple pendulam of same length l

B. more than that of a simple pendulam of same length l.

C. less than that of a simple pendulam of same length l.

D. independent of length of pendulam.

Answer: C

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52. Consider a simple pendulam of length 1 m. Its bob performs a circular motion is horizontal plane with its string making an angle 60° with the vertical. The centripetal accleration experienced by the bob is

A. $17.3m/s^2$

B. $5.8m/s^2$

C. $10m/s^2$

D. $5m/s^2$

Answer: A

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53. A particle of mass 1 kg is revolved in a horizontal circle of radius 1 m with the help of a string. IF the maximum tension the string can with stand is $16\pi^2$ N, then the maximum frequency with which the particle can revolve is

A. 3 Hz

B. 2 Hz

C. 4 Hz

D. 5 Hz

Answer: B

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54. When a particle is moved , in a verticle it has

A. it has constant radial and tangential acceleration

B. its has variable tangential and radial acceleration

C. it has only constant radial acceleration

D. it has only constant tangential acceleration

Answer: B

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55. A particle moving in a verticle circle its

A. kinetic energy is constant

B. potential energy is constant

C. neither K.E.nor P.E. is constant

D. both kinectic energy and potential energy

Answer: C

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56. IF a stone is tied to one end of the string and whirled in verticle circle, then the tension in the string at the lowest point is equal to

A. centripetal force

B. the difference between centripetal force and weight of the stone

C. the addition of the centripetal force and weight of the stone

D. weight of the stone

Answer: C

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57. If a bodyy is tied to a string and whirled in vertical circle, then the tension in the string at the highest position is

A. maximum

B. minimum

C. between maximum and minimum values

D. zero

Answer: C

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58. A body of mass m is suspended from a string of length l. What is minimum horizontal velocity that should be given to the body in its highest position so that it may complete one full revolution in the vertical plane with the point of suspension as the centre of the circle.

A. $v = \sqrt{lg}$

B. $v = \sqrt{2lg}$

C. $v = \sqrt{4lg}$

D. $v = \sqrt{5lg}$

Answer: A

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

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

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

Answer: A

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60. A motor cycle is going on an over bridge of radius R. the driver maintains a constant speed. As motor cycle is descending, normal force on it

A. increases

B. decreases

C. remain the same

D. fluctuates

Answer: B

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61. A body of mass m is tied to a string of length l and whirled in a verticle cirlce. The velocity of the body at the lowest position is u.

Then the tension in the string at a position when the string makes an angle θ with the vertical is

A. $\dfrac{mu^2}{l}$

B. $\dfrac{mu^2}{l} + mg\cos\theta$

C. $\dfrac{mu^2}{l} + mg(2\cos\theta - 3)$

D. $\dfrac{mu^2}{l} + mg(3\cos\theta - 2)$

Answer: D

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62. A motorcyclist rides in a horizontal circle along the inner wall of cylindrical chamber of radius r. If the coefficient of friction between the tyres and the wall of is μ, the minimum angular speed to prevent him from sidding down is

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

B. $\frac{1}{r}\sqrt{\mu g}$

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

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

Answer: C

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63. A particle is moving in a verticle circle. If v_1 is the velocity of particle at highest point and $v_2$is the velocity of particle at lowest point , then the relation between v_1 and v_2 is

A. $v_1 = v_2$

B. $v_1 < v_2$

C. $v_2 = \sqrt{5}v_1$

D. $v_1 = \sqrt{5} v_2$

Answer: C

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64. Calculate the angular acceleration of a centrifuge which is accelerated from rest to 350 r.p.s. in 220 s.

A. 10 rad s^{-2}

B. 20 rad s^{-2}

C. 25 rad s^{-2}

D. 30 rad s^{-2}

Answer: A

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65. A wheel rotates with a constasnt acceleration of $2.0ra\frac{d}{s^2}$. If the wheel starts from rest, how many evolutions wil it make in the first 10 senconds?

A. 16

B. 22

C. 24

D. 20

Answer: B

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66. A car is moving at a speed of $72km/h$. The diameter of its wheels is $0.5m$. If the wheels are stopped in 20 rotations by applying brakes, calcualte the angular retardation produced by the brakes.

A. $-45.5 rad / s^2$

B. $-33.5 rad / s^2$

C. $-25.48 rad / s^2$

D. $50.9 rad / s^2$

Answer: C

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67. A paricle of mass 2 kg is rotating by means of a string in a verticle circle. The difference in the tensions at the bottom and the top would be

A. 12 kg wt

B. 2 kg wt

C. $>$ 12 kg wt

D. $<$ 12 kg wt

Answer: A

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68. A particle does uniform circular motion in a horizontal plane. The radius of the circle is 20 cm. If the centripetal force F is kept constant but the angular velocity is doubled , the new radius of the path (original radius R) will be

A. $R/4$

B. $R/2$

C. 2R

D. 4R

Answer: A

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Critical Thinking

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

A. πrad

B. 5πrad

C. 10πrad

D. 20πrad

Answer: C

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2. For a particle in a non-uniform accelerated circular motion:

(i) Velocity is radial and acceleration is transverse only

(ii) Velocity is transverse and acceleration is radial only

(iii) Velocity is radial and acceleration has both radial and transverse components

(iv) Velocity is transverse and acceleration has both radial and transverse components

A. velocity is radial and acceleration is transverse only

B. velocity is transverse and acceleration is radial only

C. velocity is radial and acceleration has both radial and transverse components

D. velocity is transverse and acceleration has both radial and tranverse components

Answer: D

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3. A wheel completes 2000 revolutions to cover the 9.5 km. distance. then the diameter of the wheel is

A. 1.5 m

B. 1.5cm

C. 7.5cm

D. 7.5m

Answer: A

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4. The ratio of angular speed of second hand to that of the minute hand of a clock is

A. $60:1$

B. $1:60$

C. $1:1$

D. $1:6$

Answer: A

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

A. 0.01

B. 0.1

C. 1.0

D. 0.001

Answer: B

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6. A paricle is describing the circular path of radius 20 m in every 2 s. The average angular speed of the particle during 4 s is

A. $20\ \pi \text{rad} s^{-1}$

B. $4\ \pi \text{rad} s^{-1}$

C. $\pi \text{rad} s^{-1}$

D. $2\pi \text{rad} s^{-1}$

Answer: C

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7. Calculate the angular acceleration if a flywheel gains a speed of 540 r.p.m. in 6 seconds.

A. $3\pi \text{rad} s^{-2}$

B. $6\pi \text{rad} s^{-2}$

C. $9\pi \text{rad} s^{-2}$

D. $12\pi \text{rad} s^{-2}$

Answer: A

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8. A particle is in circular motion in a horizotantal plane. It has angular velocity of 10 $\pi rad/s$ at the end of 2 s and angular velocity

15 $\pi rad/s$ at the end of 4s. The angular acceleration of particle is

A. $5\pi rad/s^2$

B. $2.5\pi rad/s^2$

C. $6\pi rad/s^2$

D. $16\pi rad/s^2$

Answer: B

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9. Angular displacement (θ) of a flywheel varies with time as $\theta = 2t + 3t^2$ radian. The angular acceleration at t=2s is given by

A. $14 rad / s^2$

B. $18 rad / s^2$

C. $6 rad / s^2$

D. $16 rad / s^2$

Answer: C

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10. The linear velocity of a particle on the N-pole of the earth is

A. zero

B. $486km/hr$

C. infinite

D. $125m/s$

Answer: A

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11. To enable a particle to describe a circular path, what should be the angle between its velocity and acceleration?

A. 0°

B. 45°

C. 90°

D. 180°

Answer: C

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12. If a body revolves n times in a circle of radius π cm in one minute, then its linear celocity will be

A. $\frac{60}{2n} cm / s$

B. $\frac{2n}{60} cm / s$

C. $\frac{2\pi^2 n}{60} cm / s$

D. $\frac{2\pi^2 n^2}{60} cm / s$

Answer: C

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13. The second's hand of a watch has length 6 cm. Speed of end point and magnitude of difference of velocities at two perpendicular positions will be

A. 6.28 and 0 mm/s

B. 8.88 and 4.44mm/s

C. 8.88 and 6.28$m\frac{m}{s}$

D. 6.28 and 8.88 mm/s

Answer: D

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14. Two Cars C_1 and C_2 are going round in concentric circles of radii R_1 and R_2. They complete the circular paths in the same time

Then $\frac{Speed of C_1}{Speed of C_2}$ =

A. 1

B. R_1 / R_2

C. R_2 / R_1

D. can not be determined as data is insufficient

Answer: B

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15. A wheel is 0.25m in radius . When it makes 15 revolutions per minute, its linear speed at a point on circumference is

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

B. $\frac{\pi}{8}m/s$

C. $\frac{\pi}{4}m/s$

D. $\pi m/s$

Answer: B

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16. A stone tied to the end of a string of length 50 cm is whirled in a horizontal circle with a constant speed . IF the stone makes 40 revolutions in 20 s, then the speed of the stone along the circle is

A. $\pi / 2ms^{-1}$

B. πms^{-1}

C. $2\pi ms^{-1}$

D. $4\pi ms^{-1}$

Answer: C

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17. If the radius of the rarth is 6400 km, then the linear velocity of a point on the equator will be nearly

A. $1600 km/hr$

B. $1675 km / hr$

C. $1500 km / hr$

D. $1800 km / hr$

Answer: B

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18. What is the value of linear velocity, if $\overrightarrow{\omega} = 3\hat{i} - 4\hat{j} + \hat{k}$ and $\overrightarrow{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$?

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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19. IF the equation for the displancement of a particle moving on a circular path is given by $\theta = 2t^3 + 0.5$, where θ is in radius and t is in seconds, then the angular velocity of the particle at t=2 s is

A. 8 rad/s

B. 12rad/s

C. 24rad/s

D. 36rad/s

Answer: C

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20. A particle covers equal distance aroung a circular path, in equal intervals of time. Which of the following quntities connected with the motion of the particle remains constant with time?

A. Displacement

B. Velocity

C. Speed

D. Acceleration

Answer: C

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21. A particle performing uniform circular motion has

A. radial velocity and radial acceleration

B. radial velocity and transverse acceleration

C. transverse velocity and radial acceleration

D. transverse velocity and transverse acceleration

Answer: C

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22. Assertion : In circular motion, the centripetal and centrifugal force acting in opposite direction balance each other.

Reason : Centripetal and centrifugal forces don't act at the same time.

A. Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. Assertion is true, Reason is true, Reason is not a correct explanation for Assertion

C. Assertion is true, Reason is false

D. Assertion is false, but Reason is true

Answer: D

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23. A car is travelling at a given instant $40m/s$ on a circular road of radius 400m. Its speed is increasing at the rate of $3m/s$. Its tangential acceleration is

A. $4m/s^2$

B. $3m/s^2$

C. $5m/s^2$

D. $2m/s^2$

Answer: B

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24. For a particle in circular motion the centripetal acceleration is

A. is less than its tangential acceleration

B. is equal to its tangential acceleration

C. is more than its tangential acceleration

D. may be more or less than its tangential acceleration

Answer: D

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25. IF a body moves with constant speed along a curved path,its tangential acceleration is

A. zero

B. is parallel to its velocity

C. perpendicular to its velocity

D. can make any arbitrary angle with its velocity

Answer: A

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26. An aircraft executes a horizontal loop of radius 1 km with a steady speed of $900 km h^{-1}$. Compare its centripetal acceleration with the acceleration due to gravity.

A. 9.2

B. 6.25

C. 5.0

D. 8.25

Answer: B

Watch Video Solution

27. A turn table which is rotating uniformly has a particle placed on it. As seen from the ground, the particle goes in a circle with speed 20 cm/s and acceleration 20 cm/s^2. The particle is now shifted to a new position where radius is half of the original value . the new values of speed and acceleration will be

A. $10cm / s, 10cm / s^2$

B. $10cm / s, 80cm / s^2$

C. $40cm / s, 10cm / s^2$

D. $40cm / s, 40cm / s^2$

Answer: A

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28. A particle is moving on a circular path with constant speed, then its acceleration will be

A. zero

B. external radial acceleration

C. internal radial acceleration

D. constant acceleration

Answer: C

Watch Video Solution

29. Two particles A and B are located at distances r_A and r_B from the centre of a rotating disc such that $r_A > r_B$. In this case

(Angular velocity (ω) of rotation is constant)

A. both A and B do not have any acceleration

B. both A and B have same acceleration.

C. A has greater than B

D. B has greater than A

Answer: C

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30. A particle goes round a circular path with uniform speed v.After describing half the circle, what is the change in its centripetal acceleration?

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

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

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

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

Answer: B

Watch Video Solution

31. 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. $a_r = 0$and $a_t \neq 0$

C. $a_r \neq 0$and $a_t = 0$

D. $a_r \neq 0$and $a_t \neq 0$

Answer: C

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32. 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 not suffer any change in magnitude

B. The centripetal force will have its direction reversed

C. The centripetal force will suffer change in direction

D. The centripetal force would be doubled

Answer: A

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33. A cylindrical vessel partially filled with water is rotated about its vertical central axis. It's surface will

A. rise equality

B. rise from the sides

C. rise from the middle

D. lowered equally

Answer: B

Watch Video Solution

34. A car of mass 840 kg moves on a circular path with constant speed of 10m/s. It is turned through 90° after travelling 660 m on the road. The centripetal force acting on the car is

A. 324 N

B. 2640 N

C. 284 N

D. 200 N

Answer: D

Watch Video Solution

35. If a body of mass 500 gm is revolving in a horizontal circle od radius 0.49 m , then the centripetal force acting on it (if its period is 11 s), will be

A. 0.008 N

B. 8.0N

C. 0.8N

D. 0.08

Answer: D

Watch Video Solution

36. The ratio of centripetal forces on two electrons which are revolving around nucleus of hydrogent atom in 2^{nd} and 3^{rd} orbits respectively is

A. $27:8$

B. $81:16$

C. $8:27$

D. $16:81$

Answer: B

Watch Video Solution

37. A mass 2 kg describes a circle of radius 1 m on a smooth horizontal table at a uniform speed .If is joined to the centre of the circle by a string, which can just withstand 32 N, then the greatest number of revolution per minute , perfomed by the mass would be

A. 38

B. 4

C. 76

D. 16

Answer: A

Watch Video Solution

38. A particle does uniform circular motion in a horizontal plane. The radius of the circle is 20 cm . The centripetal force acting on the particle is 10 N . It's kinetic energy is

A. 0.1 J

B. 0.2 J

C. 2.0 J

D. 1.0 J

Answer: D

Watch Video Solution

39. A coin, placed on a rotating turntable slips, when it is placed at a distance of $9cm$ from the center. If the angular velocity of the turnable is tripled, it will just slip, If its distance from the center is

A. 27 cm

B. 9 cm

C. 3 cm

D. 1 cm

Answer: D

Watch Video Solution

40. 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. 5 rad / s

B. 7 rad / s

C. 10rad / s

D. 4.9rad / s

Answer: B

Watch Video Solution

41. A string breaks under a load of 4 kg. A mass weighing 200 g is attached to the end of this string which is one metre long and rotation when the string breaks, Is nearly(g=10m/s^2)

A. 16rad/s

B. 14rad/s

C. 12rad/s

D. $20 rad / s$

Answer: B

Watch Video Solution

42. A body moves along circular path of radius 50 m and the coefficient of friction is 0.4. What should be its angular velocity is rad / s if it is not to slip from the surface? (g=9.8m / s^2)

A. 2.8

B. 0.28

C. 0.27

D. 2.7

Answer: B

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43. A car of mass 1000kg moves on a circular path with constant speed of 12m/s. It turned through90° after travelling 471 m on the road . The centripetal force acting on the car is

A. 320N

B. 480N

C. 640N

D. 1280N

Answer: B

Watch Video Solution

44. On a railway curve, the outside rail is laid higher than the inside one so that resultant force exerted on the wheels of the rail car by the tops of the rails will

A. have a horizontal inward component

B. be vertical

C. equilibrate the centripetal force

D. be decreased

Answer: A

Watch Video Solution

45. A motor cyclist moves round a circular track with a certain speed and leans at an angle θ_1. IF he doubles the speed , then he has to lean inward at an angleθ_2. Then

A. $\theta_2 = 4\theta_1$

B. $\theta_2 = 2\theta_1$

C. $\tan\theta_1 = 4\tan\theta_2$

D. $\tan\theta_2 = 4\tan\theta_1$

Answer: D

Watch Video Solution

Watch Video Solution

46. A railway track is banked for a speed v, by making the height of the outer rail h higher than that of the inner rail. If the distance between the rails is l and the radius of the curvature of the track is r, then

A. $\frac{h}{l}=\frac{v^2}{rg}$

B. $\tan\left\{\sin^{-1}\left(\frac{h}{l}\right)\right\}=\frac{v^2}{rg}$

C. $\tan^{-1}\left(\frac{h}{l}\right)=\frac{v^2}{rg}$

D. $\frac{h}{r}=\frac{v^2}{lg}$

Answer: B

Watch Video Solution

47. 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

Watch Video Solution

48. A body is kept on a horizontal disc of radius 2 m at a distance of 1 m from the centre . The coefficient of friction between the body and the surface of disc is 0.4. The speed of rotation of the disc at which the body starts slipping is (g=10m/s^2)

A. 2rad/s

B. $4 rad / s$

C. $0.2 rad / s$

D. $0.4 rad / s$

Answer: A

Watch Video Solution

49. A bend in a level road has a radius of 100 m Find the maximum speed which a car turning this bend may have without skidding if coefficient of friction between the tyres and the road is 0 .8 S .

A. $20m/s$

B. $24m/s$

C. $28m/s$

D. $32m/s$

Answer: C

Watch Video Solution

50. When the road is dry and the coefficient of friction is μ, the maximum speed of a car in a circular path is 10 m/s. if the road becomes wet and $\mu' = \frac{\mu}{2}$, what is the maximum speed permitted?

A. $5ms^{-1}$

B. $10ms^{-1}$

C. $10\sqrt{2}ms^{-1}$

D. $5\sqrt{2}ms^{-1}$

Answer: D

Watch Video Solution

51. A car moves at speed of 36 km hr^{-1}on a level road. The coefficient of friction between the tyres and the road is 0.8 . The car negotiates a curve of radius R. IF g=10 ms^{-2}, then the car will skid (or slip) while negotiating the curve if the value R is

A. 20 m

B. 12 m

C. 14 m

D. 16 m

Answer: B

Watch Video Solution

52. On a dry road , the maximum permissible speed of car in a circular path is 12ms^{-1}. IF the road becomes wet, then the maximum speed is $4\sqrt{2}ms^{-1}$. IF the coefficient of friction for dry road is μ, then that for the wet road is

A. $\frac{2}{9}\mu$

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

C. $\frac{2\mu}{3}$

D. $\frac{3}{4}\mu$

Answer: A

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53. A crate of egg is located in the middle of the flat bed of a pick up truck as the truck negotiates an unbanked curve in the road. The curve may be regarded as an arc of circle of radius 35m. IF the coefficient of friction between the crate and the flat bed of the truck is 0.6, the speed with which the truck should turn so that the crate does not slide over the bed is

A. $14.3m/s$

B. $10.3m/s$

C. $12.3m/s$

D. $15.3m/s$

Answer: A

Watch Video Solution

54. The maximum frictional force between the tyres of a car and the road is 0.5 mg. the car negotiates a curve of radius 10 metre. The velocity is

A. $10m\frac{/}{s}$

B. $7m/s$

C. $4.9m/s$

D. $14.2m/s$

Answer: B

Watch Video Solution

55. A railway line is banked with an angle of 0.01 radians. The height of the outer rail over inner rail, if the distance between the two rails of 1.5m, will be

A. 0.025 m

B. 0.035 m

C. 0.015 m

D. 0.045 m

Answer: C

Watch Video Solution

56. A train has to negotiate a curve of radius 400m. The speed of the train is $72 km / hour$. The horizontal distance is to be raised with respect to the inner radius by h. IF distances between rail is l=1 m, the value of h will be (g=10m / s^2)

A. 15 cm

B. 10cm

C. 5 cm

D. 2.5 cm

Answer: B

Watch Video Solution

57. If angle of banking is $\sin^{-1}$ (0.2) and normal reaction is 2000 N then the weight of the car is

A. 1959.6 N

B. 2000.8N

C. 21000 N

D. 22000 N

Answer: A

Watch Video Solution

58. A bus is moving in a circular horizontal track of radius 10 m with a constant speed 10 m/s. A plumb bob is suspended from the roof of length 1.0m. The angle made by the rod with the track is (take g=10m/s^2)

A. zero

B. 30°

C. 45°

D. 60°

Answer: C

Watch Video Solution

59. A road is 8 m wide. Its radius of curvature is 40 m. The outer edge is above the lower edge by a distance of 1.2 m. This road is most suited for a velocity of

A. $5.7ms^{-1}$

B. $8ms^{-1}$

C. $36.1ms^{-1}$

D. $9.7ms^{-1}$

Answer: B

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60. A road is 10 m wide. Its radius of curvature is 50 m . The outer edge is above the lower edge by a distance of 1.5 m . This road is most suited for the velocity

A. $2.6m/s$

B. $4.6m/s$

C. $6.6m/s$

D. $8.6m/s$

Answer: D

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61. A circular road of radius 1000 m has banking angle 45°. IF the coefficient of friction is between tyre and road is 0.5, then the maximum safe speed of a car having mass 2000 kg will be

A. 172m/s

B. 124m/s

C. $99m/s$

D. $86m/s$

Answer: A

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62. While driving around curve of radius 17.32m, an engineer notes that a pendulam in his car hangs at an angle of 30° to the vertical. The speed of the car is (approxiamately)

A. $10m/s$

B. $15m/s$

C. $5m/s$

D. $6.7m/s$

Answer: A

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63. A boy on a cycle pedals around a circle of 20 metres radius at a speed of $20\text{metres}/\text{sec}$. The combined mass of the boy and the cycle is

90 kg . The angle that the cycle makes with the vertical so that it may not fall is $(g = 9.8m / \sec^2)$

A. 60.25°

B. 63.90°

C. 26.12°

D. 30.00°

Answer: B

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64. For traffic moving at 60 $km/hour$ along a circular track of radius 0.1 km, the correct angle of banking is

A. $\tan^{-1}\left(\frac{60^2}{0.1}\right)$

B. $\tan^{-1}\left[\frac{(50/3)^2}{100 \times 9.8}\right]$

C. $\tan^{-1}\left[\frac{100 \times 9.8}{(50/3)^2}\right]$

D. $\tan^{-1}\sqrt{(60 \times 0.1 \times 9.8)}$

Answer: B

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65. A circular racing car track has a radius of curvature of 500 m. The maximum speed of the car is 180km/hr. The angle of banking θ is (g=10m/s^2)

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

B. $\theta = \tan^{-1}(0.5)$

C. $\theta = \tan^{-1}(0.3)$

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

Answer: B

Watch Video Solution

66. A cyclist with combined mass 80 kg going around a curved road with a uniform speed $20m/s$. He has to bend inward by an angle $\theta = \tan^{-1}(0.50)$ with the verticle , then the force of friction between road surface and tyres will be

$(g = 10m/s^2$

A. 300 N

B. 400 N

C. 800 N

D. 250 N

Answer: B

Watch Video Solution

67. The maximum safe speed for which a banked road is intended , is to be increased by 20%. IF the angle of banking is not changed , then the radius of curvature of the road should be changed from the 30 m to

A. 36.3m

B. 21.1m

C. 43.2m

D. 63.2m

Answer: C

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68. A cyclist going around a circular road of radius 10 m is observed to be bending inward 30° with vertical. Frictional force acting on the cyclist is (Given:g=10m/s^2, mass of the cyclist is 90 kg)

A. 532 N

B. 800N

C. 1559 N

D. 520 N

Answer: D

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69. The maximum speed with which a vehicle can negotiate a cuved road, which is banked at the angle $\theta = \tan^{-1}(0.24)$ is $54 km / hr$. IF the same road is flat and vehicle has to negotiate the curve with same maximum speed, the coefficient of friction between the road and tyres of the vehicle should be

A. 0.35

B. 0.24

C. 0.8

D. 0.5

Answer: B

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70. A mass of 10kg 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 quadrupled. The new speed is nearly

A. 14 r.p.m

B. 10 r.p.m

C. 2.25 r.p.m

D. 7 r.p.m

Answer: B

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71. A simple pendulum of length 1 m the bob performs circular motion in horizontal plane if its string making an angle 60° with the verticle , then the period of rotation of the bob will be $\left(g = 10m / s^2\right.$

A. 2s

B. 1.4s

C. 1.98s

D. 2.4s

Answer: B

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72. The length of the string of a conical pendulam is 10 m and it has a bob of mass 50 g. The angle that the string makes with the vertical is 30°. If the bob covers one revolution is 3 s, then the corresponding centripetal force acting on the bob will be

A. 10 N

B. 1 N

C. 100 N

D. 5 N

Answer: B

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73. In a conical pendulam, 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. $T = \frac{mgL}{\sqrt{L^2 - r^2}}$

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

C. $T = \dfrac{mgL}{(L^2 - r^2)}$

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

Answer: A

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74. An, aeroplane , flying in the sky, suddenly starts revolving in a vertical circle of radius 4 km. At the highest point of the circle , the pilot experiences weightlessness. Its velocity at the highest point will be

A. $100m/s$

B. $200m/s$

C. $300m/s$

D. $400m/s$

Answer: B

Watch Video Solution

75. A hollow sphere has radius 6.4 m. Minimum velocity required by a motor cyclist at bottom to complete the circle will be.

A. $17.7 m / s$

B. $10.2 m / s$

C. $12.4 m / s$

D. $16.0 m / s$

Answer: A

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76. A bucket full of water is revolved in a vertical circle of radius 4 m such that water does not fall down. The time of one revolution is

A. 10 second

B. 8 second

C. 4 second

D. 6 second

Answer: C

Watch Video Solution

77. A particle of mass m is rotating by means of a string in a vertical circle . The difference in tension at the top and the bottom revolution is

A. 6 mg

B. 4 mg

C. 2 mg

D. 3 mg

Answer: A

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78. A 2 kg stone at the end of a string 1 m long is whirled in a vertical circle at a constant speed. The speed of the stone is $4m/\sec$. The tension in the string will be 52 N , when the stone is

A. at the top of the circle

B. at the bottom of the circle

C. halfway down

D. at any position other than that in (A),(B) and ©

Answer: B

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79. A 40kg child sits on a swing supported by two chains,each 3 m long. If the tension in each chain at lowest point in 350 N, then the child's speed at the lowest point is [Take g=10 m/s^2]

A. $4.7m/s$

B. $3m/s$

C. $7.2m/s$

D. $9.1m/s$

Answer: A

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80. An aeroplane flying in the sky with a uniform speed of $200m/s$ moves in a vertical circle of radius 400 m. The mass of the pilot is

70 kg. The force exerted by the pilot on the seat at the highest point of the circle will be [Take g=10m/s^2]

A. 3000 N

B. 6300 N

C. 7700 N

D. 630 N

Answer: B

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81. In the above problem, the force exerted by the pilot on the seat at the lowest point of the circle will be [Take g=10m/s^2]

A. 4500 N

B. 6300 N

C. 7700 N

D. 770 N

Answer: C

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82. A women weighing 600 N is sitting in a car which is travelling at a constant speed on a straight road. The car suddenly goes over a humb in the road (humb may be regarded as an arc of a circle of radius 12.1m) . If the women experiences weightlessness, calculate the speed of the car. [Take g=10m / s^2]

A. 11m / s

B. 8m / s

C. 15m / s

D. 5m / s

Answer: A

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83. A body of mass 1 kg is moving in a vertical circular path of radius 1 m. The difference between the kinetic energies at its highest and lowest positions is [take g=10m/s^2]

A. 20 J

B. 10J

C. $4\sqrt{5}J$

D. $10\left(\sqrt{5}-1\right)J$

Answer: A

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84. The maximum and minimum tension in the string whirling in a circle of radius 2.5 m with constant velocity are in the ratio $5:3$ then its velocity is

A. $\sqrt{98}m/s$

B. $7m / s$

C. $\sqrt{490}m / s$

D. $\sqrt{4.9}m / s$

Answer: A

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85. A student weighing 667N rides a steadily rotating Ferris wheel (student sits upright). At the highest point , the magnitude of the normal force $\overrightarrow{N}$ on the student from the seat is 556 N. The magnitude of $\vec{N}$, if the wheel's speed is doubled is

A. 223 N

B. 111 N

C. 444 N

D. 332 N

Answer: A

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86. A body is allowed to slide down a frictionless track from rest position at its top under gravity. The track ends in a circular loop of diameter D. Then, the minimum height of the inclined track (in terms of D) so that it may complete successfully the loop is

A. $h = \frac{5}{2}D$

B. $h = \frac{3}{2}D$

C. $h = \frac{5}{4}D$

D. $h = 2D$

Answer: C

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87. Assertion For looping a verticla loop of radius, r the minimum velocity at lowest point should be $\sqrt{5gr}$. Reason In this event the velocityh at the highest point will be zero.

A. Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. Assertion is true, Reason is true, Reason is not a correct explanation for Assertion

C. Assertion is true, Reason is false

D. Assertion is false, but Reason is true

Answer: C

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88. A flywheel at rest is reached to an angular velocity of 36 rad/s in 6 s with a constant angular accleration. The total angle turned during this interval is

A. 216 rad

B. 144 rad

C. 108 rad

D. 72 rad

Answer: C

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89. An engine requires 5 s to go from a speed of 600 r.p.m to 1200 r.p.m. with constant acceleration. How many revolutions does it make in this period?

A. 7.50

B. 750

C. 75

D. 7500

Answer: C

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90. A wheel of a vehicle is rotated to a uniform angular acceleration about its axis. Initially its angular velocity is zero. It rotates through an angle θ_1 in the first 2 s and in the next 3 s, it rotates through an additional angle θ_2. The ratio of $\frac{\theta_2}{\theta_1}$ is

A. $\frac{4}{21}$

B. $\frac{21}{4}$

C. $\frac{4}{25}$

D. $\frac{25}{4}$

Answer: B

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91. When a ceiling fan is switched off, its angular velocity reduces to 50% while it makes 36 rotations. How many more rotations will it make before coming to rest?(Assume uniform angular retardation)

A. 18

B. 12

C. 36

D. 48

Answer: B

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92. A particle moves along a circle if radius (20 //pi) m with constant tangential acceleration. If the velocity of the particle is $80m/s$ at the end of the second revolution after motion has begun the tangential acceleration is .

A. $40\pi m / s^2$

B. $40 m / s^2$

C. $640\pi m / s^2$

D. $160\pi m / s^2$

Answer: B

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93. A stone of mass 1kg tied to a light inextensible sstring of length $L = 10m$ is whirling in a circular path of radius L in vertical plane. If the ratio of the maximum tension in the string to the minimmum tension in the string is 4 and if g is taken to be $10ms^{-2}$, the speed of the stone at the highest point of the circle is.

A. $5\sqrt{2}m / s$

B. $20m / s$

C. $10m / s$

D. $10\sqrt{3}m/s$

Answer: C

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Competitive Thinking

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

A. The velocity vector is tangent to the circle.

B. The acceleration vector is tangent to the circle

C. The acceleration vector points to the centre of the circle

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

Answer: B

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2. If ω_E and ω_H are the angular velocities of the earth rotating about its own axis and the hour hand of the clock respectively, then

A. $\omega_E = \frac{1}{5}\omega_H$

B. $\omega_E = 2\omega_H$

C. $\omega_E = \omega_H$

D. $\omega_E = \frac{1}{2}\omega_H$

Answer: D

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3. A fan is making 600 revolutions per minute. If after some time it makes 1200 revolutions per minute, then the increase in its angular velocity is

A. $10\pi rad / s$

B. $20\pi rad / s$

C. $40\pi rad / s$

D. $60\pi rad / s$

Answer: B

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4. Angular velocity of hour arm of a clock, in rad/s, is

A. $\frac{\pi}{43200}$

B. $\frac{\pi}{21600}$

C. $\frac{\pi}{30}$

D. $\frac{\pi}{1800}$

Answer: B

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5. Angular speed of hour hand 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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6. The ratio of angular speed of a second-had to the hour-hand of a watch is

A. $3600:1$

B. $720:1$

C. $72:1$

D. $60:1$

Answer: B

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7. The difference between angular speed of minute hand and second hand of a clock is

A. $\frac{59\pi}{900} rad / s$

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

C. $\frac{59\pi}{2400} rad / s$

D. $\frac{59\pi}{3600} rad / s$

Answer: B

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8. The relation between linear speed v, angular speed ω and angular acceleration α in circular motion is

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

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

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

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

Answer: A

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9. The angle turned by a body undergoing circular motion depends on time as $\theta = \theta_0 + \theta_1 t + \theta_2 t^2$. Then the angular acceleration of the body is

A. θ_1

B. θ_2

C. $2\theta_1$

D. $2\theta_2$

Answer: D

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10. If the body is moving in a circle of radius r with a constant speed v , its angular velocity is

A. v^2 / r

B. vr

C. v / r

D. r/v

Answer: C

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11. 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. MR:mr

B. M:m

C. R:r

D. 0.0423611111111

Answer: C

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12. If the length of the second's hand in a stop clock is 3 cm the angular velocity and linear velocity of the tip is

A. $0.2047rad / s, 0.0314m / s$

B. $0.2547rad / s, 0.314m / s$

C. $0.1472rad / s, 0.06314m / s$

D. $0.1047rad / s, 0.00314m / s$

Answer: D

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13. A wheel of diameter 20 cm is rotating 600 rpm. The linear velocity of particle at its rim is

A. $6.28cm / s$

B. $62.8cm / s$

C. $0.628cm / s$

D. $628.4cm / s$

Answer: D

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14. The angular velocity of a wheel is $70rad / \sec$. If the radius of the wheel is 0.5 m , then linear velocity of the wheel is

A. $10m/s$

B. $20m/s$

C. $35m/s$

D. $70m/s$

Answer: C

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15. An athlete completes one round of a circular track of radius 10 m in 40 s . The distance covered by him in 2 min 20 s is

A. 70 m

B. 140 m

C. 110 m

D. 220 m

Answer: D

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

A. zero

B. $\dfrac{\pi}{30\sqrt{2}} cm / s$

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

D. $\dfrac{\pi\sqrt{2}}{30} cm / s$

Answer: D

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17. When a body moves with a constant speed along a circle

A. its linear velocity remains constant

B. no force acts on it

C. no work is done on it

D. no acceleration is produced in it

Answer: C

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18. What is the angle between velocity vector and acceleration vector in unitorm circular motion ?

A. 180°

B. 90°

C. 45°

D. 60°

Answer: B

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19. In uniform circular motion,

A. both the angular velocity and the angular momentum vary

B. the angular velocity varies but the angular momentum remains constant

C. both the angular velocity and the angular momentum remains constant

D. the angular momentum varies but the angular velocity remains constant

Answer: C

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20. 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. 0

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

C. $mg(2\pi r)$

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

Answer: A

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21. If a particle moves with uniform speed its tangntial acceleration will be

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

B. zero

C. $r\omega^2$

D. infinte

Answer: B

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22. A particle moves in a circular path with decreasing speed . Choose the correct statement.

A. Angular mometum remains constant

B. Acceleration $\left(\vec{a}\right)$ is towards the centre

C. Particle moves in a spiral path with decreasing radius.

D. The direction of angular momentum remains constant.

Answer: D

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23. A particel comes round a circle of radius 1 m once. The time taken by it its 10s. The average velocity of motion is

A. $0.2\pi m / s$

B. $2\pi m / s$

C. $2m / s$

D. zero

Answer: D

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24. The tangential velocity of a particle making p rotations along a circle of radius π in t seconds is

A. $\dfrac{2\pi p}{t^2}$

B. $\dfrac{2\pi p^2}{t}$

C. $\dfrac{\pi^2 p}{2t}$

D. $\dfrac{2\pi^2 p}{t}$

Answer: D

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25. If KE of the particle of mass m performing UCM in a circle of radius r is E. Find the acceleration of the particle

A. $\frac{2E}{mr}$

B. $\left(\frac{2E}{mr}\right)^2$

C. 2Emr

D. $\frac{4E}{mr}$

Answer: A

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26. Assertion: IF a body moving in a circular path has constant speed, then there is nor foce acting on it.

Reason: The direction of the velocity vector of a body moving in a circular path is changing

A. Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. Assertion is true, Reason is true, Reason is not a correct explanation for Assertion

C. Assertion is true, Reason is false

D. Assertion is false, but Reason is true

Answer: D

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27. The centripetal acceleration is given by

A. v^2 / r

B. vr

C. vr^2

D. v / r

Answer: A

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28. Angle between radius vector and centripetal acceleration is

A. 0^c

B. π^c

C. $2\pi^c$

D. None of these

Answer: B

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29. For a particle in uniform circular motion, the acceleration $\vec{a}$ at a point $p(R, \theta)$ on the circle of radiu R is (Here θ is measured from the $x - a\xi s$)

A. $\frac{v^2}{R}\hat{i} + \frac{v^2}{R}\hat{j}$

B. $-\frac{v^2}{R}\cos\theta\hat{i} + \frac{v^2}{R}\sin\theta\hat{i}$

C. $-\frac{v^2}{R}\sin\theta\hat{i} + \frac{v^2}{R}\cos\theta\hat{j}$

D. $-\frac{v^2}{R}\cos\theta\hat{i} - \frac{v^2}{R}\sin\theta\hat{j}$

Answer: D

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30. Two cars of masses m_1 and m_2 are moving in circles of raddii r_1 and r_2 respectively. Their speeds are such that they make complete circle in the same time t The ratio of their centripetal acceleration is .

A. $m_1 r_1 : m_2 r_2$

B. $m_1 : m_2$

C. $r_1 : r_2$

D. $1 : 1$

Answer: C

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31. A particle moves in a circle of radius 5 cm with constant speed and time period $0.2\pi s$. The acceleration of the particle is

A. $5m/s^2$

B. $15m/s^2$

C. $25m/s^2$

D. $36m/s^2$

Answer: A

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32. If a cycle wheel of raduius 0.4m completes one revolution in one second, then acceleration of the cycle is

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

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

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

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

Answer: D

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33. 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. $8\pi^2$

C. $4\pi^2$

D. $2\pi^2$

Answer: C

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

A. $20 \times 10^8 m / s^2$

B. $8 \times 10^5 m / s^2$

C. $120 \times 10^5 m / s^2$

D. $4 \times 10^{8} m / s^{2}$

Answer: B

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35. 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. $\dfrac{\alpha^{2} r^{2}}{v}$

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

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

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

Answer: C

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36. 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. $2.7m/s^2$

C. $1.8m/s^2$

D. $9.8m/s^2$

Answer: B

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37. Centripetal force in velocity from can be expressed as

A. $\overrightarrow{F} = -\dfrac{mv^2}{r}$

B. $\overrightarrow{F} = -\dfrac{mv^2}{r^3}\overrightarrow{F}$

C. $\overrightarrow{F} = -m\omega^2\overrightarrow{r}$

D. $\overrightarrow{F} = -\dfrac{mv^2\overrightarrow{r}}{\overrightarrow{r}}$

Answer: B

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38. One end of string of length l is connected to a particle on mass m and the other end is connected to a small peg on a smooth horizontal table. If the particle moves in circle with speed v the net force on the particle (directed toward centre) will be (T reprents the tension in the string):

A. T

B. $T+\frac{mv^2}{l}$

C. $T-\frac{mv^2}{l}$

D. Zero

Answer: A

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39. 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. pmr

B. $\frac{rm}{p}$

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

D. $\frac{p^2}{rm}$

Answer: D

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40. The magnitude of the centripetal force acting on a body of mass m executing uniform motion in a circle of radius r with speed v is

A. mvr

B. mv^2 / r

C. $v / r^2 m$

D. v / rm

Answer: B

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41. Tension of a string is 6.4 N and load is applied to it at its lower end of a string is 0.1 kg .If the length of string is 6 m , then its angular velocity will be `

A. $3 rad / s$

B. $4 rad / s$

C. $2 rad / s$

D. $1 rad / s$

Answer: A

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42. A cyclist turns around a curve at 15 miles/hour. If he turns at double the speed, the tendency to overturn is

A. doubled

B. quadrupled

C. halved

D. unchanged

Answer: B

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43. 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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44. A string breaks if its tension exceeds 10 newtons . A stone of mass 250 gm tied to this string of length 10 cm is rotated in a horizontal circle. The maximum angular velocity of rotation can be

A. $20 rad / s$

B. $40 rad / s$

C. $100 rad / s$

D. $200 rad / s$

Answer: A

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45. Toy cart tied to the end of an unstretched string of length a, when revolved moves in a horizontal circle of radius 2a with a time period T. Now the toy cart is speeded up until it moves in a horizontal circle of radius 3a with a period T. If Hooke's law (F=kx) holds, then

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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46. A 500 kg car takes a round turn of radius 50 m with a velocity of 36 km/hr . The centripetal force is

A. 250 N

B. 750 N

C. 1000 N

D. 1200 N

Answer: C

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47. A $100kg$ car is moving with a maximum velocity of $9m/s$ across a circular track of radius 30 m . The maximum force of friction between the road and the car is

A. 1000 N

B. 706 N

C. 270 N

D. 200 N

Answer: C

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48. 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. 0.08×10^{8} cycles per s

B. 4×10^{8} cycles per s

C. 8×10^{8} cycles per s

D. 12×10^{8} cycles per s

Answer: A

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49. If the radius of curvature of the path of two particles of same masses are in the ratio $1:2$, then in order to have same centripetal force, their velocity, should be in the ratio of

A. $1:4$

B. $4:1$

C. $\sqrt{2}:1$

D. $1 : \sqrt{2}$

Answer: D

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50. 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. 1cm

B. 4cm

C. 9cm

D. 16 cm

Answer: A

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51. A motor cycle driver doubles its velocity when he is having a turn. The force exerted outwardly will be

A. double

B. half

C. 4 times

D. $\frac{1}{4}$times

Answer: C

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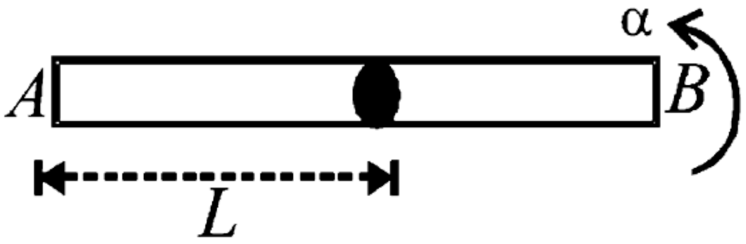
52. A long horizontal rod has a bead which can slide along its length and initially placed at a



distance L from one end A of the rod. The rod is set in angular motion about A with constant angular acceleration α. if the coefficient of friction between the rod and the bead is μ, and gravity is neglected, then the time after which the bead starts slipping is

A. $\sqrt{\frac{\mu}{\alpha}}$

B. $\dfrac{\mu}{\sqrt{\alpha}}$

C. $\dfrac{1}{\sqrt{\mu\alpha}}$

D. infinitesimal

Answer: A

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53. On the centre of a frictionless table, a small hole is made, through which a weightless string of lenth 2l is inserted. On the two ends of the strings, two balls of the same mass m are attached, Arrangement is made in such a way that half of the string is on the table top and half is hanging below. The ball on the table top is made to move in a circular path with a constant speed v, What is the centripetal acceleration of the moving ball?

A. mvl

B. g

C. zero

D. 2mvl

Answer: B

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54. The banking angle is independednt of

A. radius of the path

B. mass of the vehicle

C. acceleration due to gravity

D. maximum velocity of the vehicle around the curved path

Answer: B

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55. A car sometimes overturns while taking a turn. When it overturns, it is

A. the inner wheel which leaves the ground first

B. the outer wheel which leaves the ground first

C. both the wheels whicl leave the ground simultaneously

D. either wheel leaves the ground first

Answer: A

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56. A cyclist taking turn bends inwards while a car passenger taking same turn is thrown outwards. The reason is

A. Car is heavier than cycle

B. Car has four wheels while cycle has only two

C. Difference in the speeds of the two

D. Cyclist has to counteract the centrifugal force while in the case of car, only the passenger is thrown by this force.

Answer: D

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57. A train is moving towards north. At one place it turn towards north -east. Here, we observe that:

A. the radius of curvature of outer rail will be greater than that of the inner rail

B. the radius of the inner rail will be greater than that of the outer rail

C. the radius of curvature of one of the rails will be greater

D. the radius of curvature of the outer and inner rails will be the same.

Answer: A

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58. A car is travelling on a circular banked road. The centripetal accelerations of a car is provided by

A. normal reaction

B. weight of a car

C. horizontal component of normal reaction

D. vertical component of normal reaction

Answer: C

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59. A car is negotiating a curved road of radius R. The road is banked at angle θ. The coefficeint of friction between the tyres of the car and the road is μ_s. The maximum safe velocity on this road is

A. $\sqrt{\frac{g\mu_s + \tan\theta}{R1 - \mu_s \tan\theta}}$

B. $\sqrt{\frac{g\mu_s + \tan\theta}{R^2 1 - \mu_s \tan\theta}}$

C. $\sqrt{gR^2 \frac{u_s + \tan\theta}{1 - \mu_s \tan\theta}}$

D. $\sqrt{gR \frac{u_s + \tan\theta}{1 - \mu_s \tan\theta}}$

Answer: D

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60. A body is moving in a circular orbit with static friction 0.2. If radius through which the body revolves is 100 m and g=9.8 m/s^2, then maximum speed with which body revolved in

A. $14 m/s$

B. $19 m/s$

C. $11 m/s$

D. $13 m/s$

Answer: A

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61. 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. $10.84 m / s^2$

B. $9.84 m / s$

C. $8.84 m / s$

D. $6.84 m / s$

Answer: A

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62. A car is moving at a speed of 60km/h traversing a circular road track of radius 60,m. The minumum coefficient of friction to prevent the skidding of the car is (g=10m/s^2)

A. $25/54$

B. $21/54$

C. $15/44$

D. $21/44$

Answer: A

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63. A cyclist on the ground goes round a ciruclar path of circumference 34.3 m in $\sqrt{22}$ second. The angle made by him, with the vertical, will be:-

A. 42°

B. 43°

C. 44°

D. 45°

Answer: D

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64. An aircraft executes a horizontal loop with a speed of 150 m/s with its, wings banked at an angle of 12°. The radius of the loop is $(g = 10m/s^2)$

A. 10.6 km

B. 9.6 km

C. 7.4 km

D. 5.8 km

Answer: A

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65. A car of mass $1000 kg$ negotiates a banked curve of radius $90 m$ on a fictionless road. If the banking angle is 45° the speed of the car is:

A. $20ms^{-1}$

B. $30ms^{-1}$

C. $5ms^{-1}$

D. $10ms^{-1}$

Answer: B

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66. Radius of the curved road on national highway is r. Width of the road is l. 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 safely over it. The value of h is

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

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

C. $\frac{v^2 l}{rg}$

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

Answer: C

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67. A person with his hands in his pockets is skating on ice at the velocity of $10m/s$ and describes a circle of radius 50 m . What is his inclination with vertical

A. $\tan^{-1}\left(\frac{1}{10}\right)$

B. $\tan^{-1}\left(\frac{3}{5}\right)$

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

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

Answer: D

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

A. 0.25 cm

B. 2cm

C. 4 cm

D. 2.5 cm

Answer: D

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

A. is conserved

B. increases

C. decreases

D. may increase or decrease

Answer: A

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70. A heavy mass is attached to a thin wire and is whirled in a vertical circle. The wire is most likely to break

A. when the mass is at the highest point of the circle

B. when the mass is at the lowest point of the circle

C. when the wire is horizontal

D. at an angle of $\cos^{-1}(1/3)$ from the upward vertical.

Answer: B

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71. A body of mass m hangs at one end of a string of length l , the other end of which is fixed. It is given a horizontal velocity so that the string would just reach where it makes an angle of 60° with the vertical. The tension in the string at mean position is

A. 2mg

B. mg

C. 3mg

D. $\sqrt{3}mg$

Answer: A

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72. A simple pendulum of length l and mass (bob) m is suspended vertically. The string makes an angle θ with the vertical. The restoring force acting on the pendulum is

A. mv^2 / L

B. $mg\cos\theta + mv^2 / L$

C. $mg\cos\theta - mv^2 / L$

D. $mg\cos\theta$

Answer: B

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73. A simple pendulum oscillates in a verticle plane. When it passes through the bottommost point, the tension in the string is 3 times the weight of the pendulum bob. What is the maximum displacement of the pendulum of the string with respect to the vertical

A. 30°

B. 45°

C. 60°

D. 90°

Answer: D

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74. A simple pendulum of mass m and length l stands in equilibrium in vertical position .The maximum horizontal velocity that should be given to the bob at the bottom so that it completes on revolution is

A. $\sqrt{lg}$

B. $\sqrt{2lg}$

C. $\sqrt{3lg}$

D. $\sqrt{5lg}$

Answer: D

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75. What is the minimum velocity with which a body of mass m must enter a vertical loop of radius R so that it can complete the loop?

A. $\sqrt{3gR}$

B. $\sqrt{5gR}$

C. $\sqrt{gR}$

D. $\sqrt{2gR}$

Answer: B

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76. The force acting on the electron in a hydrogen atom depends on the principal quantum number as

A. $F \propto n^4$

B. $F \propto n^2$

C. $F \propto \frac{1}{n^2}$

D. $F \propto \frac{1}{n^4}$

Answer: D

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77. A particle is moving in a vertical circle with constant speed. The tansions in the string when passing through two positions at angles 30° and 60° from vertical (lowest position) are T_1 and T_2 respectively. Then

A. $T_1 = T_2$

B. $T_2 > T_1$

C. $T_1 > T_2$

D. tension in the string always remains the same

Answer: C

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78. 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. mg

B. $m\left(g+\pi n r^{2}\right)$

C. $m(g+\pi n r)$

D. $m\left(g+\frac{\pi^{2} n^{2} r}{900}\right)$

Answer: D

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79. A bucket full of water is revolved in vertical circle of radius 2 m . What should be the maximum time-period of revolution so that the water doesn't fall off the bucket

A. 1 s

B. 2 s

C. 3 s

D. 4 s

Answer: C

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80. 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. 2 s

B. 4 s

C. 6 s

D. 8 s

Answer: B

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81. A bucket tied at the end of a $1.6m$ long string is whirled in a verticle circle with constant speed. What should be the minimum speed so that the water from the bucket does not spill, when the bucket is at the highest position $(Take g = 10m/s^2)$

A. $4m/s$

B. $6.25m/s$

C. $16m/s$

D. None of the above

Answer: A

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

A. 6 g

B. 3 g

C. 2 g

D. g

Answer: B

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83. A mass attached to one end of a string crosses top - most point on a vertical circle with critical speed. Its centripetal acceleration when string becomes horizontal will be

(where, g=gravitational acceleration)

A. g

B. 3g

C. 4 g

D. 6 g

Answer: B

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84. 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. $5rad/s$

B. $\sqrt{30}rad/s$

C. $\sqrt{60}rad/s$

D. $10rad/s$

Answer: A

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85. A weightless thread can bear tension upto $3.7kg$ wt A stone of mass $500g$ is tied to it and revolves in a verticle circle of radius $4m$ What will be the maximum angular velocity of the stone if $g = 10m/s^2$.

A. $4rad/s$

B. $16rad/s$

C. $\sqrt{21}rad/s$

D. $2rad/s$

Answer: A

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86. A mass of 5 kg is tied to a string of length 1.0 m and is rotated in vertical circle with a uniform speed of $4m/s$. The tension in the string will be 130 N when the mass is at (g= 10 m/s^2)

A. highest point

B. mid way

C. bottom

D. cannot be justified

Answer: C

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87. 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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88. A particle of mass M is moving in a horizontal circle of radius R with uniform speed v. When the particle moves from one point to a diametrically opposite point , its

A. momentum does not change

B. momentum changes by 2 Mv

C. Kinectic energy changes by $\frac{Mv^2}{4}$

D. Kinectic energy changes by Mv^2

Answer: B

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89. 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. $m^2K^2r^2t^2$

B. mK^2r^2t

C. mK^2rt^2

D. mKr^2t

Answer: B

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90. A particle with charge Q coulomb, tied at the end of an inextensible string of length R metre, revolves in a vertical plane. At the centre of the circular trajectory, there is a fixed charge of magnitude Q coulomb . The mass of the moving charge M is such that $Mg = \frac{Q^2}{4\pi\varepsilon_0 R^2}$. If at the highest position of the particle, the tension of the string just vanishes, the horizontal velocity at the lowest point has to be

A. 0

B. $2\sqrt{gR}$

C. $\sqrt{2gR}$

D. $\sqrt{5gR}$

Answer: B

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91. A simple pendulam of length L carriers a bob of mass m. When the bob is at its lowest position, it is given the minimum horizontal speed necessary for it to move in a vertical circle about the point of suspension. When the string is horizontal the net force on the bob is

A. $\sqrt{10}mg$

B. $\sqrt{5}mg$

C. 4 mg

D. 1 mg

Answer: A

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92. If a particle of mass m is moving in a horizontal circle of radius r with a centripetal force $\left(-1/r^2\right)$, the 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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93. 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 accleration 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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94. A particle of mass 10 g moves along a circle of radius 6.4 cm with a constant tangential acceleration. What is the magnitude of this acceleration. What is the magnitude of this acceleration, if the kinetic energy of the particle becomes equal to 8×10^{-4}J by the end of the second revolution after the beginning of the motion?

A. $0.18 m / s^2$

B. $0.2 m / s^2$

C. $0.1 m / s^2$

D. $0.15 m / s^2$

Answer: C

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95. Two stone of masses m and $2m$ are whirled in horizontal circles, the heavier one in a radius $r/2$ and the lighter one in radius r. The tangential speed of lighter stone is n times that of the value of heavier stone when the experience same centripetal forces. the value of n is

A. 1

B. 2

C. 3

D. 4

Answer: B

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96. A body of mass 1 kg tied to one end of string is revolved in a horizontal circle of radius 0.1 m with a speed of $3 \text{revolution}/\sec$, assuming the effect of gravity is negligible, then linear velocity, acceleration and tension in the string will be

A. $1.88m/s, 35.5m/s^2, 35.5N$

B. $2.88m/s, 45.5m/s^2, 45.5N$

C. $3.88m/s, 55.5m/s^2, 4 = 55.5N$

D. None of these

Answer: A

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97. A particle moves in a circle of radius 5 cm with constant speed and time period $0.2\pi s$. The acceleration of the particle is

A. $15m/s^2$

B. $25m/s^2$

C. $36m/s^2$

D. $5m/s^2$

Answer: D

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98. A uniform circular disc of radius 50 cm at rest is free to turn about an axis which is perpendicular to its plane and passes through its centre. It is subjected to a torque which produces a constant angular acceleration of 2 rad s^{-1}. Its net acceleration in ms^{-2} at the end of 2 s is approximately

A. 6.0

B. 3.0

C. 8.0

D. 7.0

Answer: C

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99. A particle is moving with a uniform speed in a circular orbit of radius R in a central force inversely proportional to the n^{th} power of R. If the period of rotation of the particle is T, then :

A. $T \propto R^{(n+1)/2}$

B. $T \propto R^{n/2}$

C. $T \propto R^{3/2}$ for any n (D)

D. $T \propto R^{\frac{n}{2}+1}$

Answer: A

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100. A particle is moving in a circular path of radius a under the action of an attractive potential $U = -\frac{k}{2r^2}$. Its total energy is :

A. zero

B. $-\frac{3}{2}\frac{k}{a^2}$

C. $-\frac{k}{4a^2}$

D. $\frac{k}{2a^2}$

Answer: A

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101. A point object moves along an arc of a circle or radius'R' . Its velocity depends upon the distance covered 'S' as $V = K\sqrt{S}$

Where'K' is a constant. IF θ is the angle between the total acceleration and tangential accleration , then

A. $\tan\theta = \sqrt{\frac{S}{R}}$

B. $\tan\theta = \sqrt{\frac{S}{2R}}$

C. $\tan\theta = \frac{S}{2R}$

D. $\tan\theta = \frac{2S}{R}$

Answer: D

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102. A wheel of circumference C is at rest on the ground. When the wheel rolls forward through half a revolution, then the displacement of initial point of contact will be

A. $C\sqrt{\frac{1}{\pi^2}+\frac{1}{4}}$

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

C. $\pi\sqrt{C^2+4}$

D. $C\sqrt{\frac{1}{\pi}+\frac{1}{2}}$

Answer: A

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Evaluation Test

1. In children's park there was a slide to be made by contract. By mistake, the person who had taken the contract made the coefficient of friction of the slide as high as $1/3$. Now, the fun is that the child expecting to slide down the incline will stop somewhere in between. Find the angle θ with the horizontal at which he will stop on the incline.(Assume negligible frictional losses)

A. 45°

B. 37°

C. 53°

D. 60°

Answer: A

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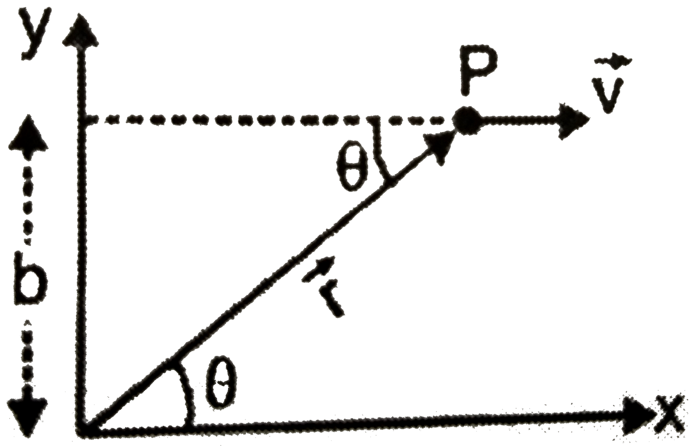
2. A particle moving parallel to x-axis as shown in fig. such that at all instant the y-axis component of its position vector is constant and is equal to 'b'. Find the angular velocity of the particle about the origin when its radius vector makes angle θ from the axis.



A. $\frac{v}{b}\sin^2\theta$

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

C. $\frac{v}{b}\sin\theta$

D. vb

Answer: A

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3. A wire which is bent in the shape of a curve given by, $y = a^3 x^4$. A bead of mass m is located at point P(x,y). If the wire is smooth, find ω with which wire needs to be rotated for bead to be static.

A. $a\sqrt{x^3 g}$

B. $2a\sqrt{x^3 g}$

C. $2x\sqrt{a^3g}$

D. $x\sqrt{a^3g}$

Answer: C

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4. A bullet is moving horizontally with certain velocity. It pierces two paper discs rotating coaxially with angular speed ω separated by a distance l. IF the hole made by bullet on second disc is shifted by an angle θ with respect to the first, find velocity of bullet.

A. ωl

B. $\frac{l\theta}{\omega}$

C. $\omega\frac{l}{\theta}$

D. $\omega l(\theta)^2$

Answer: C

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5. The metro which has been recently inroduced in Mumbai, encounters a sharp turn between Andheri and Chakala. To avoid any derailing issues, the authorities thought of banking the rails.The turn is of a radius of 400 m and the maximum speed attained by Mumbai Metro is 72 km/hr. IF the distance between the rails is 1 m then through what height should the outer rail be raised?

A. 2.5 cm

B. 0.5 cm

C. 10 cm

D. 15 cm

Answer: C

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6. A clown is exhibiting a magic trick on the streets wherein he rotates a bucket in a vertical plane without allowing the water in it to spill out. Here, clearly the clown uses centrifugal force to balance the weight of water . This will be possible, when

A. the bucket has r.p.m. $= \sqrt{\frac{400}{\pi^2 R}}$

B. the bucket has maximum speed= $\sqrt{2gR}$

C. the bucket has r.p.m. $= \sqrt{\frac{900g}{\pi^2 R}}$

D. the bucket has r.p.m $= \sqrt{\frac{3600g}{\pi^2 R}}$

Answer: C

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7. The graphs below show angular velocity as a function of θ. In which one of these is the magnitude of angular velocity constantly decreasing with time?

A.

B.

C.

D.

Answer: A

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8. For a particle moving in a circle,

A. the resultant force on the particle must be towards the centre

B. the cross product of tangential acceleration and angular velocity will be zero

C. direction of angular acceleration and angular velocity must be same

D. the resultant force must be away from the centre

Answer: A

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9. A chain of mass m and radius R placed on a smooth table is revolving with a speed v about a vertical axis coinciding with the symmetry axis of the chain. Find the tension in the chain.

A. $\dfrac{Mv^2}{2R}$

B. $\dfrac{Mv^2}{R}$

C. $\dfrac{Mv^2}{2\pi R}$

D. $\dfrac{3Mv^2}{2R}$

Answer: C

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10. A ball suspended by a thread swing in a vertical plane that its acceleration values in the lowest possition and the extreme postition are equal . Find the thread deffection angle in the extreme possition.

A. 53°

B. 37°

C. 45°

D. 47°

Answer: A

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11. A swing moving in a children's garden is observed to move with an angular velocity given by, $\omega - a\left(t^2\right)\hat{i} + b\left(e^{-1}\right)\hat{j}$. What will be the angle between angular acceleration and angular velocity at t=1 s given that a=b=1 unit?

A. 20°

B. 36°

C. 15°

D. 9°

Answer: A

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