PHYSICS

BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

CIRCULAR MOTION

Example

1. The angular velocity of the earth will be

A. $\frac{2\pi}{86400} radS^{-1}$

B. $\frac{\pi}{86400} radS^{-1}$

C. $\frac{2\pi}{43200} radS^{-1}$

D. $\frac{\pi}{43200} \text{rad} s^{-1}$

Answer: A

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2. A particle moves in a circular path of radius 0.5 m with a linear speed of 2 ms^{-1} ,its angular speed is

A. $2rads^{-1}$

B. $3rads^{-1}$

C. $4rads^{-1}$

D. None of these

Answer: C

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3. The minute hand of a clock Is 10 cm long.

The linear speed of its tip Is

A. $1.643 \times 10^{-4} ms^{-1}$

B. $1.876 \times 10^{-4} ms^{-1}$

C. $1.744 \times 10^{-4} ms^{-1}$

D. $1.502 \times 10^{-4} ms^{-1}$

Answer: C

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4. A grindstone Is found to have a angular speed of 150 rpm, 10s after starting from rest. The angular acceleration of the grindstone is

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

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

C. $\frac{\pi}{6}$

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

Answer: B

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5. The angular velocity of a particle is given by the equation $\omega = 2t^2 + 5rads^{-1}$. The instantaneous angular acceleration at t=4 s is

A. $16rads^{-2}$

B. $19rads^{-2}$

C. $10rads^{-2}$

D. $12rads^{-2}$

Answer: A

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6. A particle moves in a circle of radius 2 cm at a speed given by v =4t, where v is in cms ^-1 and t in seconds. The tangential acceleration

at t =1s and total acceleration at t =1s are respiccitively .

A. $6cms^{-2}$ and $5cms^{-2}$

B. $4cms^{-2}$ and $4\sqrt{5}\quad cms^{-2}$

C. $5cms^{-2}$ and $5\sqrt{5}\quad cms^{-2}$

D. None of these

Answer: B

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7. A particle is moving on a circular path of radius 0.3 m and rotaing at 1200 rpm. The centripetal acceleration of the particle

A. $4732.60ms^{-2}$

B. $47.3260ms^{-2}$

C. $4.73260ms^{-2}$

D. $473.260ms^{-2}$

Answer: A

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8. An artificial satelite of mass 2500 kg is orbiting around the earth with a speed of $4kms^{-1}$ at a distance of 10^4 km form the earth . The centripetal force acting on it is .

A. 4 KN

B. 6 kN

C. 8 kN

D. 2 kN

Answer: A

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9. A car is moving in a circular horizontal track of radius 10 m with a constant speed of 10 m/s. A plumb bob is suspended from the roof of the car by a light rigid rod. The angle made by the rod with the vertical is $\left(g = 10m/s^2\right)$

A. 60°

B. 30°

C. 45°

D. zero

Answer: C

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10. What is the maximum speed at which a car can turn round a curve of 30 m radius on a level road if the coefficient of friction between the types and the road is 0.4 .(Given, acceleration due to gravity =$10ms^{-2}$

A. $12ms^{-1}$

B. $10ms^{-1}$

C. $11ms^{-1}$

D. $15ms^{-1}$

Answer: C

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11. A circular racetrack of radius 300 m is banked at an angle of 15° If the coefficient of friction between the wheels of a race car and the road is 0.2 what is the (a) optimum speed of the race car to avoid wear and tear on its

tyres , and (b) maximum permissible speed to aviod slipping ?

A. $49.2ms^{-1}$

B. $38.1ms^{-1}$

C. $36.3ms^{-1}$

D. $48.3ms^{-1}$

Answer: B

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12. Consider a bob whose upper and is fixed with length of 2 m is given with a horizontal push through angular displacement of 60° . What is the angular velocity of the bob ? If it is of 2kg . [Take ,g $= 10ms^{-2}$]

A. $\sqrt{10}rads^{-1}$

B. $\sqrt{20}rads^{-1}$

C. $\sqrt{8}rads^{-1}$

D. None of these

Answer: A

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13. Length of a simple pendulum Is 2 m and mass of its bob is 0.2 kg. If the tension in the string exceeds 4 N, it will break. If g= $10ms-^{-2}$ and the bob is through which the sting can make with vertical during rotation is .

A. 40°

B. 60°

C. 50°

D. 180°

Answer: B

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14. A weightless thread can with stand tension upto 30N.A stone of mass 0.5 kg is tied to it and is revolved in a circular path of radius 2 m in a vertical plane. If g=10 ms^{-2}, then maximum angular velocity of stone is

A. $4rads^{-1}$

B. $5rads^{-1}$

C. $6rads^{-1}$

D. $7rads^{-1}$

Answer: B

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15. A stone is whirled in a vertical circle at the end of a rope of length 0.5m . The velocities of the stone at lowest and highest points to just complete the circle are $[Take, g = 9.8ms^{-2}]$

A. $4.949 \text{ and } 2.213ms^{-1}$

B. $5.921 \text{ and } 3.312ms^{-1}$

C. $1.235 \text{ and } 2.312ms^{-1}$

D. None of these

Answer: A

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16. A wheel is rotating at 900rpm about its axis . When the power is cut off ,it comes to rest In 1 min. The angular retardation in red s^{-2}

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

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

C. $\frac{\pi}{6}$

D. $\frac{\pi}{8}$

Answer: A

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Exercise 1

1. 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. $25ms^{-2}$

B. $36ms^{-2}$

C. $5ms^{-2}$

D. $15ms^{-2}$

Answer: C

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2. Angular velcoity is a

A. scalar quantity

B. radial vector quantity

C. axial vector quantilty

D. tangential vector quantity

Answer: B

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3. A particluar moves along a circle of radius P with constant tangential accelertion . It the velocity of the particles is V at the end of third revolution , after the revolution has started then the tangenital accleration is

A. $\frac{v^2}{12\pi r}$

B. $\frac{v^2}{10\pi r}$

C. $\frac{v^2}{14\pi r}$

D. $\frac{v^2}{9\pi r}$

Answer: A

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4. The motor of an engine is rotating about its axis with an angular velcoity of $100 rev me^{-1}$. It comes to rest is 15 s, after being switched off. Assuming constant angualar decelearation . What are the numbers of revolutions made by it befor coming to rest ?

A. 12.5

B. 40

C. 32.6

D. 15.6

Answer: A

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5. The angualr speed of a flywheel making 360 rpm is

A. 12π

B. 6π

C. 3π

D. 2π

Answer: A

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6. A ball is moving in a circular path of radius 5m . If tangential acceleration at any instant is $10ms^{-1}$ and the net acceleration , then the instantaneous speed is

A. $50\sqrt{3}ms^{-1}$

B. $9.3ms^{-1}$

C. $6.6ms^{-1}$

D. $5.4ms^{-1}$

Answer: B

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7. A particle moves throught angular displacement θ on a circlur path of radius r. The liner displacement wil be

A. $2r\sin(\theta/2)$

B. $2r\cos(\theta/2)$

C. $2r\tan(\theta/2)$

D. $2r\cot(\theta/2)$

Answer: A

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8. 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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9. A car is travelling with liner velcoity v on a circular road of radius R. If its speed is

increasing at the rate of a ms^{-1}, then the net acceleration will be.

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

B. $\frac{v^2}{R} - a$

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

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

Answer: D

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10. A rotating wheel changes angular speed form 1800 rpm to 3000 rmp to 20 s . What is the angular acceleration assuming to be uniform?

A. $60\pi rads^{-2}$

B. $90\pi rads^{-2}$

C. $2\pi rads^{-2}$

D. $40\pi rads^{-2}$

Answer: C

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11. A motor cycle is going on an overbridge of radius R. The driver maintains a constant motion . It the stone travles.

A. increase

B. decreases

C. remains the same

D. flutuates erratically

Answer: A

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12. A stone tied to one end of rope and rotated in a circular motion . If the string suddenly breaks then the stone travels.

A. in perpedicular direction

B. in direction of centrfugal force

C. towards centripetal force

D. in tangential direction

Answer: D

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13. A ball of mass 0.25kg attached to the ends of a string of length 1.96m is rotating in a horizonal circle. The string will break, If tension is more than 25N. What is the maximum velocity with which the ball can be rotated ?

A. $3ms^{-1}$

B. $5ms^{-10}$

C. $9ms^{-1}$

D. $14ms^{-1}$

Answer: C

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14. If the length of second's hand of a clock is 10cm , the speed of its dip $\left(\text{in}cm^{-1}\right)$ is nearly .

A. 2

B. 0.5

C. 1

D. 3

Answer: C

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15. A particle moves with uniform speed in a circular path the angle between instantaneous velocity and acceleration is

A. 0°

B. 180°

C. 90°

D. 45°

Answer: c

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16. A particles is moving along a circular path of radius 5 m , moving with a uniform speed of $5ms^{-1}$. What will be the avetage acceleration, Whan the particle completes half revolution?

A. zero

B. $10\pi ms^{-2}$

C. π / ms^{-2}

D. None of these

Answer: d

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17. Match the following columns and choose the correct option from the codes gives below

. For uniform circular motion.

A.
A	B	C	D
1	2	2	1

B.
A	B	C	D
1	2	1	2

C.
A	B	C	D
1	1	1	2

D.
A	B	C	D
2	1	1	2

Answer: B

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18. Two racing cars having masses m_1 and _ (2) move in concentric circles of radir_1 and r_2 respectively . If their angular speeds are same , then the ration of their linear speeds is

A. $m_1 : m_2$

B. $r_1 : r_2$

C. $1 : 1$

D. $m_1 r_1 : m_2 r_2$

Answer: b

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

A. 1.5m

B. 1.5cm

C. 7.5cm

D. 7.5m

Answer: B

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20. The change in the centripetal force of a body moving in a circular path , if speed is made half and radius is made 5 times original value , will

A. increase by $\frac{18}{20}$

B. decreases by $\frac{19}{20}$

C. decreaseby $\frac{9}{20}$

D. increase by $\frac{17}{20}$

Answer: B

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21. 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 palace in a plane , it follow that

A. its velocity is constant

B. its acceleration is constant

C. its kinetic energy is constant

D. itmoves in a straight line

Answer: C

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22. In uniform circular motion of a particle

A. velocity is constant but acceleration is variable

B. velocity is variable but acceleration is constant

C. both velocity and acceleration is variable

D. speed is constant but acceleration is variable

Answer: C

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23. The angular velocity of the seconds hand in a watch is

A. $\left(\frac{\pi}{6}\right) rads^{-1}$

B. $\left(\frac{\pi}{60}\right) rads^{-1}$

C. $\left(\frac{\pi}{30}\right) rads^{-1}$

D. $\left(\frac{\pi}{15}\right) rads^{-1}$

Answer: C

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24. A car wheel is rotated to uniform angular acceleration about its axis, intially its angular velocity is zero .It rotates through an angle θ_1 in the first 2 s , in the next 2 s, it rotates through an additional angle θ_2,the ratio of $\frac{\theta_2}{\theta_1}$ is

A. 1

B. 2

C. 3

D. 5

Answer: C

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25. Theangular speed of a car increases from 600 rpm to 1200 rpm in 10 s .What is the angular acceleration of the car ?

A. $600 rads^{-2}$

B. 60 rads^(-2)

C. $60\pi rads^{-2}$

D. $2\pi rads^{-2}$

Answer: D

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26. Velocity vector and acceleration vector in a uniform circular motion are related as

A. both in the same direction

B. perpendicular to each other

C. both in oppsite direction

D. not related to each other

Answer: B

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27. One end of a string of length 1.0 m is tied to a body of mass 0.5 kg . It is whirled in a vertical circle with angular frequency $4rads^{-1}$ .The tension in the string when the body is at the lower most points of its motion will be equal to $(Take, g = 10ms^{-2})$

A. 3N

B. 5N

C. 8N

D. 13N

Answer: D

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28. In hydrogen atom, the electron is moving round the nucleus with velocity $2.18 \times 10^6 ms^{-1}$ in an orbit of radius 0.528 A. The acceleration of the electron is .

A. $9 \times 10^{18} ms^{-2}$

B. $9 \times 10^{22} ms^{-2}$

C. $9 \times 10^{-22} ms^{-2}$

D. $9 \times 10^{12} ms^{-2}$

Answer: B

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29. 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. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: B

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30. 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. $5\pi rad$

C. $10\pi rad$

D. $20\pi rad$

Answer: C

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

A. $1.66 rads^{-1}$

B. $10.47 rads^{-1}$

C. $10.57 rads^{-1}$

D. $60 rads^{-1}$

Answer: B

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32. The value of centripetal acceleration in terms of frequency of revolution is A ...Here refer to

A. $4\pi^2 v^2 R$

B. $8\pi^2 v^2 R$

C. $4\pi^2 v^2 R$

D. $8\pi^2 v^2 R^2$

Answer: A

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33. A ball of mass 0.12 kg is being whirled in a horizontal circle at the end of a string 0.5 m long. It is capable of making 231 revolutions in one minute. Find the breaking tension of the string

A. 5.8 N

B. 15.1 N

C. 31.5 N

D. 35.1 N

Answer: D

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34. 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. $m\left(g+\pi nr^2\right)$

C. $m(g+nr)$

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

Answer: D

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

A. A

B. B

C. C

D. D

Answer: B

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36. 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. 8 s

D. 10 s

Answer: B

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37. A small coin is kept at the rim of a horizontal circular disc which is set into rotation about vertical axis passing through

its centre . If radius of the disc is 10 cm and $\mu_s = \frac{3}{7}$, then the angular speed at which the coin will just slip off at

A. $5 rads^{-1}$

B. $6.54 rads^{-1}$

C. $10 rads^{-1}$

D. $4.9 rads^{-1}$

Answer: B

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38. A partical is moving along a circular path of radius $5m$ and with uniform speed $5m/s$. What will be the avarage acceleration when the partical completes half revoluation?

A. Zero

B. $10ms^{-2}$

C. $10\pi ms^{-2}$

D. $\frac{10}{\pi}\text{ms}^{-2}$

Answer: D

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39. Two particles of masses in the ratio 3:5 are moving in circular paths of radii in the ratio 4:7 with time periods in the ratio 4:5 . The ratio of their centripetal forces is

A. $\frac{16}{28}$

B. $\frac{15}{28}$

C. $\frac{192}{875}$

D. 23/28`

Answer: B

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40. A cosmonaut is orbiting the earth in a spacecraft at an altitude h =630km with a speed of $8kms^{-2}$. If the radius of the earth is 6400km, the acceleration of the cosmonaut is

A. $9.10ms^{-2}$

B. $9.80ms^{-2}$

C. $10.0ms^{-2}$

D. $9.88ms^{-2}$

Answer: A

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41. A coin placed on a rotating turn table just slips if it is placed at a distance of 8 cm from the centre. If angular velocity of the turn table is doubled . It will just slip at a distance of

A. 1 cm

B. 2 cm

C. 4 cm

D. 8 cm

Answer: B

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42. A car of mass 1000 kg moves on a circular track of radius 20 . If the coefficient of friction is 0.64, then the maximum velocity with which the car can move is

A. $22.4ms^{-1}$

B. $5.6ms^{-1}$

C. $11.2ms^{-1}$

D. None of these

Answer: C

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43. The coefficient of friction between the tyres and the road is 0.25. The maximum speed with which a car can be driven round a curve

of radius 40 m without skidding is (assume $g = 10ms^{-2}$)

A. $40ms^{-1}$

B. $20ms^{-1}$

C. $15ms^{-1}$

D. $10ms^{-1}$

Answer: D

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44. A body moves along a circular path of radius 10m and the coefficient of friction is 0.5.What should be its angular speed $\left(\in rads^{-1} \right)$, if is not to slip from the surface ? $\left(Given, g = 9.8ms^{-2} \right)$

A. 5

B. 10

C. 0.1

D. 0.7

Answer: D

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45. body is just being revolved in a vertical circle of radius R with a uniform speed. The string breaks when the body is at the highest point. The horizontal distance covred by the body after the string breaks is

A. 2R

B. R

C. $R\sqrt{2}$

D. 4R

Answer: A

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46. A railway carriager has its centre pf gravity at a height of 0.75m above the rails, which are 1m apart. The maximum safe speed at which it could travel round on unbanked curve of radius 100 m is

A. $12ms^{-1}$

B. $18ms^{-1}$

C. $22ms^{-1}$

D. $27ms^{-1}$

Answer: C

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47. A cyclist is moving in a circular track of radius 80 m with a velocity v =36kmh^{-1} . He has to lean from the vertical approximately through an angle

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

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

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

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

Answer: B

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48. A body of mass 1 kg is rotating in a verticle circle of radius 1 m .What will be the difference in its kinetic energy at the top and bottom of

the circle ?

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

A. 50J

B. 30 J

C. 20 J

D. 10 J

Answer: C

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49. A stone of mass 1 kg is tied to a string 2m long and it's rotated at constant speed of 40 ms^{-1} in a vertical circle. The ratio of the tension at the top and the bottom is

[Take g=10ms^2]

A. $11:12$

B. $39:41$

C. $41:39$

D. 12:11`

Answer: B

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50. In a loop ,a body starts at a height h =2R. The minimum speed with which the body must be pushed down initially in order that it may be able to complete the vertical circle is

A. $\sqrt{2gR}$

B. $\sqrt{gR}$

C. $\sqrt{3gR}$

D. $\sqrt{5gR}$

Answer: D

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51. 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 $\left(Takeg = 10m / s^2\right)$

A. $4ms^{-1}$

B. $6.25ms^{-1}$

C. $2ms^{-1}$

D. $16ms^{-1}$

Answer: A

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52. A mass m is attached to the end of a rod of length l. The mass goes along a vertical circular path with the other end, hinged at its

centre . What should be the minimum speed of mass at the bottom of this circular path

A. $\sqrt{4gl}$

B. $\sqrt{2gl}$

C. $\sqrt{3gl}$

D. None of these

Answer: A

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53. What should be the coefficient of friction between the tyres and the road, when a car travelling at $60kmh^{-1}$ makes a level turn of radius $40m$?

A. 0.5

B. 0.66

C. 0.71

D. 0.8

Answer: C

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54. The maximum speed with which a car driven round a curve of radius 18 m without skidding (where ,$g = 10ms^{-2}$ and the coefficient of friction between rubber tyres and the roadway is 0.2)is

A. $36.0kmh^{-1}$

B. $18.0kmh^{-1}$

C. $21.6kmh^{-1}$

D. $14.4kmh^{-1}$

Answer: C

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Exercise 2 Miscellaneous Problems

1. A particle is moving on a circular path of 10 m radius. At any instant of time, its speed is $5ms^{-1}$ and the speed is increasing at a rate of $2ms^{-2}$. At this instant, the magnitude of the net acceleration will be

A. $3.2ms^{-2}$

B. $2ms^{-2}$

C. $2.5ms^{-2}$

D. $4.3ms^{-2}$

Answer: A

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2. A vehicle is moving with uniform speed along horizontal, concave and convex surface

roads. The surface on which, the normal reaction on the vehicle is maximum is

A. horizontal

B. concave

C. convex

D. same on all surfaces

Answer: B

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3. A circular curve of a highway is designed for traffic moving at 72 km/h. if the radius of the curved path is 100 m, the correct angle of banking of the road should be given by:

A. $\tan^{-1}\left(\frac{2}{5}\right)$

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

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

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

Answer: A

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

A. $\sqrt{2(u^2 - gl)}$

B. $\sqrt{u^2 - gl}$

C. $u - \sqrt{u^2 - 2gl}$

D. $\sqrt{2gl}$

Answer: A

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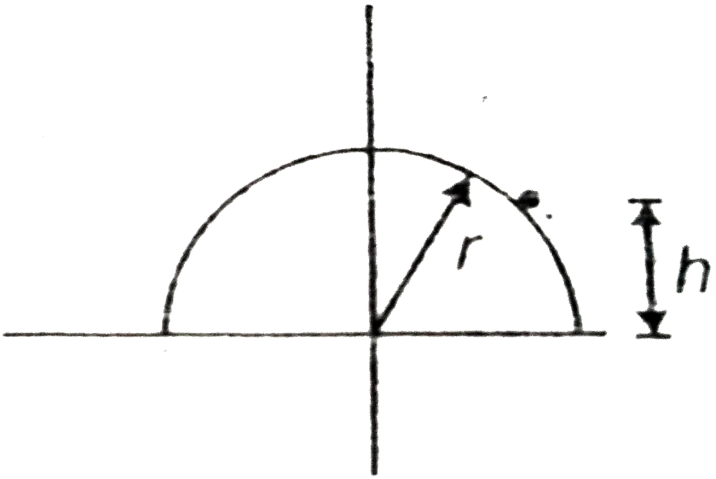
5. A small body of mass m slides without friction from the top of a hemisphere of radius r. At what height will the body be detached

from the surface of hemisphere?



A. h=r

B. $h = r/2$

C. $h = r/3$

D. $2r/3$

Answer: C

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6. A body of mass m hangs at one end of a string of length l, the other and of which is fixed . It is given a horizontal velocity so that the string would just reach where it makes an angle of 30° with the vertical . The tension in the string at mean position is

A. $mg\left(5-2\sqrt{3}\right)$

B. $mg\left(3-3\sqrt{3}\right)$

C. $mg\left(3-\sqrt{3}\right)$

D. $mg(4-\sqrt{3})$

Answer: C

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7. A particle is kept at rest at the top of a sphere of diameter 84m. When disturbed slightly ,it slides down .At what height h from the botton , the particle will leaves the sphere

A. 75m

B. 65m

C. 70m

D. 80m

Answer: C

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8. A particle suspended by a light inextensible thread of length l is projected horizontally from its lowest position with velocity $\sqrt{7gl/2}$.

The string will slack after swinging through an angle equal to

A. 30°

B. 90°

C. 120°

D. 150°

Answer: C

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9. A particle moves from rest at a on the surface of a smooth circular cylinder. The equation relating α and $\beta$is 

A. $3\sin\alpha = 2\cos\beta$

B. $3\sin\alpha = 3\cos\beta$

C. $3\sin\beta = 2\cos\alpha$

D. $2\sin\beta = 3\cos\alpha$

Answer: C

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10. A ball suspended by a thread swings ia a vertical plane so that its acceleration in the extreme position and lowest position are equal. The angle θ of thread deflection in the extreme position will be

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

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

C. $\tan^{-1}\left(\frac{1}{2}\right)$

D. $2\tan^{-1}\left(\frac{1}{2}\right)$

Answer: D

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11. A ball of mass (m) 0.5 kg is attached to the end of a string having length (L) 0.5 m. The ball is rotated on a horizontal circular path about vertical axis . The maximum tension that the string can bear is 324 N . The maximum possible value of angular velocity of ball (in $rads^{-1}$)is

A. 9

B. 18

C. 27

D. 36

Answer: D

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12. A points P moves in counter- clockwise direction on a circular path as shown in the figure . The momement of P is such that it sweeps out a length $s = t^3 + 5$, where s is in metre and t is in seconds . The radius of the

path is 20 m. The acceleration of P when t =2s is nearly 

A. $13ms^{-2}$

B. $12ms^{-2}$

C. $7.2ms^{-2}$

D. $14ms^{-2}$

Answer: D

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13. A bob of mass M is suspended by a massless string of length L . The horizontal velocity v at position A is just sufficient to make it reach the points B. The angle θat which the speed of the bob os half of that at A , satisfies 

A. $\theta = \frac{\pi}{4}$

B. $\frac{\pi}{4} < \theta < \frac{\pi}{2}$

C. $\frac{\pi}{2} < \theta < \frac{3\pi}{4}$

D. $\frac{3\pi}{4} < \theta < \pi$

Answer: C

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14. The car of a wheel rotating with centain angular velocity is topped in 5 s and before it stops, it makes 20 revolutions . Then initially it was rotating with the frequency.

A. 8Hz

B. 11Hz

C. 12Hz

D. 15Hz

Answer: A

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15. Length of a simple pendulum is 2m and mass of its bob is 2 kg if the tension in the string exceeds 100 N , it will break . If g =ms^{-2} and the bob is whirled in a horizontal plane , the maximum angle through which the sting can make vertical during ratating is

A. $\cos^{-1}(2/5)$

B. $\cos^{-1}(5/2)$

C. $\cos^{-1}(2/10)$

D. $\cos^{-1}(1/10)$

Answer: C

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16. A body moving along a circular path of radius R with velocity V , has centripetal

acceleration a If its velocity is made equal to 2v , then its centripetal acceleration is

A. 4a

B. 2a

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

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

Answer: A

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17. A body starts ratating from rest and completes 100 revolutions in 20 s. Find its angular acceleration

A. $\pi rads^{-2}$

B. $5\pi rads^{-2}$

C. $4.5\pi rads^{-2}$

D. $3.5\pi rads^{-2}$

Answer: A

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18. A weightless thread can bear tension upto 37 N . A stone of mass 500 g is tied to it and revolved in a circular path of radius 4 m in a vertical plane . If g =10ms^{-2}, then the maximum angular velocity of the stone will be

A. $2rads^{-1}$

B. $4rads^{-1}$

C. $8rads^{-1}$

D. $16rads^{-1}$

Answer: B

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19. A small block is shot into each of the four tracks as shown below. Each of the tracks rises to the same height. The speed with which the block enters the track is the same in all cases. At the highest point of the track, the normal reaction is maximum in

A. 

B. 

C. 

D. 

Answer: A

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20. The figure shows a circular path of a moving particle . If the velocity of the particle at some instant is V =-$3\hat{i} - 4\hat{j}$, through which quadrant is the particle moving when clockwise and anti-clockwise respectively

A. 1st and 4th

B. 2nd and 4th

C. 2nd and 3rd

D. 3rd and 4th

Answer: B

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21. Two particles A and B start at the origin O and travel in oppsite directions along the circular path at constant speeds v_A =0.7 ms

and $v_B = 1.5ms^{-1}$, respectively . Determine the time when they collide and the magnitude of the acceleration of B just before this happens .

A. $0.45ms^{-2}$

B. $0.25ms^{-2}$

C. $1ms^{-2}$

D. $2ms^{-2}$

Answer: A

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22. A cyclist is riding with a speed of $27kmh^{-1}$. As he approaches a circular turn on the road of radius 80 m, he applies brakes and reduces his speed at the constant rate $0.5ms^{-2}$. What is the magnitude and direction of the net acceleration of the cyclist on the circular turn ?

A. 54.44°

B. 64.44°

C. 74.44°

D. None of these

Answer: A

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23. You may have seen in a circus a motorcyclist driving in vertical loops inside a death well (a hollow spherical chamber with holes so the spectators can watch from outside) Explain clearly why the motorcyclist

does not drop down when he is at the uppermost point of death well with no support from below What is the minimum speed required at the uppermost position to perfrom a vertical loop if the radius of the chamber is 25 m ?

A. $16ms^{-1}$

B. $20ms^{-1}$

C. $25ms^{-1}$

D. None of these

Answer: A

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24. A particle is moving in a circle of radius R in such a way that at any instant the normal and tangential components of the acceleration are equal. If its speed at $t = 0$ is u_0 the time taken to complete the first revolution is :

A. $\frac{R}{v_0}\left(1 - e^{-2\pi}\right)$

B. $\frac{2R}{v_0}\left(1 - e^{-2\pi}\right)$

C. $\frac{3R}{v_0}\left(1 - e^{-2\pi}\right)$

D. None of these

Answer: A

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25. 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. $\sqrt{98}ms^{-1}$

B. $7ms^{-1}$

C. $\sqrt{490}ms^{-1}$

D. $\sqrt{4.9}ms^{-1}$

Answer: A

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Mht Cet Corner

1. 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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2. 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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3. The difference between angular speed of minute hand and second hand of a clock is

A. $\frac{59\pi}{900} rads^{-1}$

B. $\frac{59\pi}{1800} rads^{-1}$

C. $\frac{59\pi}{2400} rads^{-1}$

D. $\frac{59\pi}{3600} rads^{-1}$

Answer: B

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4. 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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5. A car of mass $1500kg$ is moving with a speed of $12.5ms^{-1}$ on a circular path of radius $20m$ on a level road What should be the frictional force to avoid slipping of car Calculate the cofficient of friction .

A. 0.2

B. 0.4

C. 0.6

D. 0.8

Answer: D

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6. 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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7. A ball of mass 0.25 kg attached to the end of a string of length 1.96 m is moving in a horizontal circle. The string will break if the tension is more than 25 N . What is the maximum speed with which the ball can be moved

A. $14ms^{-1}$

B. $2ms^{-1}$

C. $3.92ms^{-1}$

D. $5ms^{-1}$

Answer: A

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8. 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. gl

B. 2gl

C. $\sqrt{gl}$

D. $\sqrt{2gl}$

Answer: D

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9. A wheel has a speed of 1200 revolution per minute and is made to slow down at a rate of $4rad/s^2$. The number of revolutions it makes before coming to rest is

A. 143

B. 272

C. 314

D. 722

Answer: C

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10. 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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11. If α is angular acceleration , ω is angular velocity and a is the centripetal acceleration then ,which of the following is true ?

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

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

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

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

Answer: A

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12. 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. $2ms^{-2}$

B. $2.7ms^{-2}$

C. $1.82ms^{-2}$

D. $9.82ms^{-2}$

Answer: B

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13. A particle of mass m is rotating in a plane in circular path of radius r. Its angular momentum is L. The centripetal force acting on the particle is

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

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

C. $\frac{L^2}{m^2 r^2}$

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

Answer: D

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14. When a celling fan is switched off, its angular velocity falls to half while it makes 36 rotations. How many more rotations will it make before coming to rest ?

A. 24

B. 36

C. 18

D. 12

Answer: D

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15. 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. $1600ms^{-2}$

B. $4737ms^{-2}$

C. $2370ms^{-2}$

D. $5055ms^{-2}$

Answer: B

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16. body is just being revolved in a vertical circle of radius R with a uniform speed. The string breaks when the body is at the highest

point. The horizontal distance covred by the body after the string breaks is

A. 2R

B. R

C. $R\sqrt{2}$

D. 4R

Answer: A

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17. The angle of banking is independent of

A. speed of vehicle

B. radius of cuvature of road

C. height of inclination

D. None of these

Answer: C

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18. Angular velocity of hour hand of a watch is

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

B. $\frac{\pi}{30} rads^{-1}$

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

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

Answer: C

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

A. $6:1$

B. $1:6$

C. $1:12$

D. $12:1$

Answer: D

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20. 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. 4 s

B. 10 s

C. 1 s

D. 11 s

Answer: A

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21. What will be maximum speed of a car on a curved road of radius 30 m , If the coefficient of friction between the tyres and the road is 0.4?

$(g = 9.8m/s^2)$

A. $9.84ms^{-1}$

B. $10.84ms^{-1}$

C. $7.84ms^{-1}$

D. $5.84ms^{-1}$

Answer: B

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