Uniform Circular Motion

41. A particle of mass m is executing uniform circular motion on a path of radius r. If p is the magnitude of its linear momentum. The radial force acting on the particle is

(a) pmr (b) $\frac{rm}{p}$

(c) $\frac{mp^2}{r}$ (d) $\frac{p^2}{rm}$

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

(a) Proportional to r^2

(b) Independent of r

(c) Proportional to r

(d) Proportional to $1/r$

43. Two masses M and m are attached to a vertical axis by weightless threads of combined length l. They are set in rotational motion in a horizontal plane about this axis with constant angular velocity ω. If the tensions in the threads are the same during motion, the distance of M from the axis is

(a) $\frac{Ml}{M+m}$ (b) $\frac{ml}{M+m}$

(c) $\frac{M+m}{M}l$ (d) $\frac{M+m}{m}l$

44. A boy on a cycle pedals around a circle of 20 *metres* radius at a speed of $20 metres/sec$. 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^o (b) 63.90^o

(c) 26.12^o (d) 30.00^o

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

(a) A constant vector of magnitude $\frac{v^2}{r}$

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

(c) Equal to the instantaneous acceleration vector at the start of the motion

(d) A null vector

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

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

(c) $\frac{v^2 R}{g}$ (d) $\frac{v^2 b}{R}$

47. When a particle moves in a uniform circular motion. It has

(a) Radial velocity and radial acceleration

(b) Tangential velocity and radial acceleration

(c) Tangential velocity and tangential acceleration

(d) Radial velocity and tangential acceleration

48. A motorcycle is going on an overbridge of radius R. The driver maintains a constant speed. As the motorcycle is ascending on the overbridge, the normal force on it

(a) Increases

(b) Decreases

(c) Remains the same

(d) Fluctuates

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

(a) 14 *rpm* (b) 10 *rpm*

(c) 2.25 *rpm* (d) 7 *rpm*

50. 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) $v = \sqrt{\frac{rg(\tan\theta+\mu)}{1-\mu\tan\theta}}$

(c) v/r^2m

(d) v/rm

51. 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*

52. 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*

53. 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) 14 *m/s* (b) 3 *m/s*

(c) 3.92 *m/s* (d) 5 *m/s*

54. A body of mass 5 *kg* is moving in a circle of radius $1m$ with an angular velocity of 2 *radian/sec*. The centripetal force is

(a) 10 *N* (b) 20 *N*

(c) 30 *N* (d) 40 *N*

55. If a particle of mass m is moving in a horizontal circle of radius r with a centripetal force $(-k/r^2)$, the total energy is

(a) $-\frac{k}{2r}$ (b) $-\frac{k}{r}$

(c) $-\frac{2k}{r}$ (d) $-\frac{4k}{r}$

56. A stone of mass of 16 *kg* is attached to a string 144 *m* long and is whirled in a horizontal circle. The maximum tension the string can withstand is 16 *Newton*. The maximum velocity of revolution that can be given to the stone without breaking it, will be

(a) 20 ms^{-1} (b) 16 ms^{-1}

(c) 14 ms^{-1} (d) 12 ms^{-1}

57. A circular road of radius 1000 *m* has banking angle 45^o. The maximum safe speed of a car having mass 2000 *kg* will be, if the coefficient of friction between tyre and road is 0.5

(a) 172 *m/s* (b) 124 *m/s*

(c) 99 *m/s* (d) 86 *m/s*

58. 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 4.44 *mm/s*

(c) 8.88 and 6.28 *mm/s*

(d) 6.28 and 8.88 *mm/s*

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

(c) $mg.2\pi l$ (d) $\left(\frac{mv^2}{l}\right).(l)$

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

(a) 10 *m/s* (b) 2 *m/s*

(c) 20 *m/s* (d) $\sqrt{2}$ *m/s*