Ravi Maths Tuition Centre

Time : 1 Mins **LAWS OF MOTION 1 1** **Marks : 1617**

1. (A) Static friction is self adjusting force
   (R) The magnitude of static friction is less than the applied force.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
   e) If assertion is false but reason is true
2. A thin horizontal circular disc is rotating about a vertical axis passing through its centre. An insect is at rest at a point near the rim of the disc. The insect now moves along a diameter of the disc to reach its other end. During the journey of the insect the angular speed of the disc:
   a) remains unchanged b) continuously decreases c) continuously increases
   d) first increases and then decreases
3. A body of mass 1 kg is moving in a vertical circular path of radius 1 m. The difference between the kinetic energies at the highest and lowest position is:
   a) 20 J b) 10 J c) $4\sqrt{5}$ J d) $10(\sqrt{5}-1)$ J
4. (A) A man in a closed cabin falling freely does not experience gravity.
   (R) Inertial and gravitational mass have equivalence.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
   e) If assertion is false but reason is true
5. (A) A bird alights on a stretched wire depressing it slightly. The increase in tension of the wire is more than the weight of the bird.
   (R) The tension must be more than the weight as its component balances the weight.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
   e) If assertion is false but reason is true
6. A child sits stationary at one end of a long trolley moving uniformly with a speed von a smooth horizontal floor. If the child gets up and runs about on the trolley in any manner, what is the speed of the centre of mass of the (trolley + child) system?
   a) Increases b) Remains constant c) Decreases d) None of these

7. A circular disc of moment of inertia 1_t is rotating in a horizontal plane, about its symmetry axis, with a constant angular speed ω_iAnother disc of moment of inertia I_b is dropped coaxially onto the rotating disc. Initially the second disc has zero angular speed. Eventually both the discs rotate with a constant angular speed ω_f. The energy lost by the initially rotating disc to friction is:

a) $\frac{1}{2}\frac{I_b^2}{(I_t+I_b)}\omega_i^2$ b) $\frac{1}{2}\frac{I_t^2}{(I_t+I_b)}\omega_i^2$ c) $\frac{I_b-I_t}{(I_t+I_b)}\omega_i^2$ d) $\frac{1}{2}\frac{I_bI_t}{(I_t+I_b)}\omega_i^2$

8. A cord is bound round the circumference of a wheel of radius R. The axis of the wheel is horizontal and moment of inertia about it is 1. A weight mg is attached to the end of the cord and falls from rest. After falling through distance h, the angular velocity of the wheel will be:

a) $\left[\frac{2gh}{I+mr}\right]^{1/2}$ b) $\left[\frac{2mgh}{I+mr^2}\right]^{1/2}$ c) $\left[\frac{2mgh}{I+2m}\right]^{1/2}$ d) $\sqrt{2gh}$

9. A machine gun fires n bullets per second and the mass of each bullet is m: If v is the speed of each bullet, then the force exerted on the machine gun is:
   a) mng b) mnv c) mnvg d) (mnv) /g
10. The moment of inertia about an axis of a body which is rotating with angular velocity 1 radian per second is numerically equal to:
    a) one-fourth of its rotational kinetic energy b) half of the rotational kinetic energy
    c) rotational kinetic energy d) twice the rotational kinetic energy
11. A particle is moving along a circular path. The angular velocity, linear velocity, angular acceleration and centripetal acceleration of the particle at any instant respectively are $\vec{\omega}, \vec{v}, \vec{\alpha}$ and $\vec{a_c}$ Which of the following relations is not correct?

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

12. (A) The driver in a vehicle moving with a constant speed on a straight road is in a non-inertial frame of reference.
    (R) A reference frame in which Newton's laws of motion are applicable is non-inertial.
    a) If both assertion and reason are true and reason is the correct explanation of assertion.
    b)
    If both assertion and reason are true but reason is not the correct explanation of assertion.
    c) If assertion is true but reason is false. d) If both assertion and reason are false.
    e) If assertion is false but reason is true
13. Tyres are inflated to the required value to save fuel. Because of this:
    a) normal reaction is increased b) normal reaction is decreased
    c) contact area is increased d) contact area is decrease
14. A passenger getting down from a moving bus, falls in the direction of the motion of the bus. This is an example for
    a) second law of motion b) third law of motion c) inertia of rest d) inertia of motion
15. A merry-go-round, made of a ring-like platform of radius R and mass M, is revolving with angular speed ω . A person of mass M is standing on it. At one instant, the person jumps off the round, radially away from the centre of the round. The speed of the round afterwards is

a) 2ω b) ω c) $\frac{\omega}{2}$ d) 0

16. Which one of the following statements is incorrect?
    a) Rolling friction is smaller than sliding friction
    b) Limiting value of static friction is directly proportional to normal reactions
    c) Frictional force opposes the relative motion
    d) Coefficient of sliding friction has dimensions of length
17. If the smoothness of surfaces in contact is increased, the force of friction:
    a) must decrease b) must increase c) may decrease d) none of these
18. (A) In a rigid body the magnitude oflinear velocity of any point is given by the product of angular velocity $\omega$with the distance of that point from the instantaneous axis of rotation.
    (R) Instantaneous axis is an imaginary axis about the motion of a rigid body in combined translation and rotation motion can be taken as pure rotation.
    a) If both assertion and reason are true and reason is the correct explanation of assertion.
    b)
    If both assertion and reason are true but reason is not the correct explanation of assertion.
    c) If assertion is true but reason is false. d) If both assertion and reason are false.
    e) If assertion is false but reason is true.
19. The solid cylinder is rolling without slipping on a plane having inclination θ and the coefficient of static friction μ_s The relation between θ and μ_s is
    a) $\tan\theta > 3\mu_s$ b) $\tan\theta \leq 3\mu_s$ c) $\tan\theta < 3\mu_s^2$ d) none of these
20. (A) A wheel moving down a perfectly frictionless inclined plane will undergo slipping (not rolling motion).
    (R) For perfect rolling motion, work done against friction is zero.
    a) If both assertion and reason are true and reason is the correct explanation of assertion.
    b)
    If both assertion and reason are true but reason is not the correct explanation of assertion.
    c) If assertion is true but reason is false. d) If both assertion and reason are false.
    e) If assertion is false but reason is true.
21. A mass of 1 kg is suspended by means of a thread. The system is (i) lifted up with an acceleration of 4.9 m s^{-2} (ii) lowered with an acceleration of 4.9 m s^{-2}. The ratio of tension in the first and second case is
    a) 3:1 b) 1:2 c) 1:3 d) 2:1.
22. What will be the maximum speed of a caron a road turn of radius 30 m, if the coefficient of friction between the tyres and the road is 0.4?
    a) 10.84m/s b) 9.84m/s c) 8.84m/s d) 6.84m/s
23. A toy-cart is tied to the end of an unstretched string of length a. When revolved, the toy-cart 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 holds, then:
    a) T' = T b) T' = $\frac{3}{2}$T c) T' = $\frac{\sqrt{3}}{2}T$ d) T' = $\sqrt{\frac{3}{2}}T$

24. A force of 2 kg is applied at one end of a spring balance kept horizontally and an equal force of 2 kg is applied at the other end in the opposite direction, simultaneously. Then the reading on the spring balance is:
    a) 2 kgf b) 4 kgf c) 0 kgt d) 1 kgt
25. A block of mass m is placed on a surface with a vertical cross section given by $y = x^3/6$. If the coefficient of friction is 0.5, the maximum height above the ground at which the block can be placed without slipping is
    a) 1/2 m b) 1/6 m c) 2/3 m d) 1/3 m
26. (A) All scalar physical quantities have no direction.
    (R) The magnitude of a vector may be a negative scalar.
    a) If both assertion and reason are true and reason is the correct explanation of assertion.
    b)
    If both assertion and reason are true but reason is not the correct explanation of assertion.
    c) If assertion is true but reason is false. d) If both assertion and reason are false.
    e) If assertion is false but reason is true.
27. A shell of mass 200 g is fired by a gun of mass 100 kg. If the muzzle speed of the shell is 80 m S^{-1}, then the recoil speed of the gun is
    a) 16 cm S^{-1} b) 8 cm S^{-1} c) 8 m S^{-1} d) 16 m S^{-1}
28. (A) A ladder is more likely to slip when a person is near the top when he is near the bottom.
    (R) The friction between the ladder and floor decreases as he climbs up.
    a) If both assertion and reason are true and reason is the correct explanation of assertion.
    b)
    If both assertion and reason are true but reason is not the correct explanation of assertion.
    c) If assertion is true but reason is false. d) If both assertion and reason are false.
    e) If assertion is false but reason is true.
29. Rolling friction:
    a) is independent of velocity b) varies with velocity c) increases with velocity
    d) decreases with velocity
30. A block of mass m is connected to another block of mass M by a spring (massless) of spring constant k. The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the spring is unstretched. Then a constant force F starts acting on the block of mass Mto pull it. Find the force ofthe block of mass m:
    a) $\frac{MF}{(m+M)}$ b) $\frac{mF}{M}$ c) $\frac{(M+m)F}{m}$ d) $\frac{mf}{(m+M)}$
31. An automobile travelling with a speed of 60 kmlh, can brake to stop within a distance of 20 m. If the car is going twice as fast, i. e. , 120 kmlh, the stopping distance will be:
    a) 20 m b) 40 m c) 60 m d) 80 m
32. If an inclined plane is made slowly horizontal by reducing its inclination with horizontal, the component of weight parallel to the plane of block resting on the inclined plane:
    a) remains same b) increases c) decreases d) first increases and then decreases
33. A wheel is rotating at 900 rpm about its axis when the power is cut-off. It comes to rest in one minute. The angular retardation (assuming it to be uniform) (in radian/see^2) is:
    a) $\pi/2$ b) $\pi/4$ c) $\pi/6$ d) $\pi/8$

34. A sphere cannot roll on:
    a) a smooth horizontal surface b) a rough horizontal surface c) a smooth inclined surface
    d) a rough inclined surface

35. Two blocks A and B of masses 10 kg and 15 kg are placed in contact with each other rest on a rough horizontal surface as shown in the figure. The coefficient of friction between the blocks and surface is 0.2. A horizontal force of 200 N is applied to block A. The acceleration of the system is

    a) 4 ms^{-2} b) 6 ms^{-2} c) 8 ms^{-2} d) 10 ms^{-2}

36. A flywheel of mass 50 kg and radius of gyration about its axis of rotation of 0.5 m is acted upon by a constant torque of 12.5 N-m. Its angular velocity at t = 5 see is:
    a) 2.5 rad/sec b) 5 rad/sec c) 7.5 rad/sec d) 10 rad/sec

37. Conservation of momentum in a collision between particles can be understood from
    a) conservation of energy. b) Newton's first law only c) Newton's second law only.
    d) both Newton's second and third law.

38. A motorcycle is travelling on a curved track of radius 500m if the coefficient of friction between road and tyres is 0.5.The speed avoiding skidding will be:
    a) 50 m/s b) 75 m/s c) 25 m/s d) 35 m/s

39. (A) Newton's second law indicates that when a net force acts on an object, it must accelerate.
    (R) When two or more forces are applied to an object, it must accelerate.
    a) If both assertion and reason are true and reason is the correct explanation of assertion.
    b)
    If both assertion and reason are true but reason is not the correct explanation of assertion.
    c) If assertion is true but reason is false. d) If both assertion and reason are false.
    e) If assertion is false but reason is true.

40. Work done in moving a body up an inclined rough plane (μ) of length s will be:
    a) mg (sin θ - μ cos θ)s b) mg (sin θ - μ cos θ)s c) mg (μ sin θ - cos θ)s
    d) mg (sin θ - μ cos θ)s

41. The motion of particle of mass m is given by Y = ut + $\frac{1}{2}$ gt^2. The force acting on the particle is :
    a) mg b) $\frac{mu}{t}$ c) 2mg d) $\frac{2mu}{t}$

42. A rope of negligible mass is wound round a hollow cylinder of mass 3 kg and radius 40 cm. If the rope is pulled 'with a force of 30 N, then the angular acceleration produced in the cylinder is :
    a) 15 rad S^{-2} b) 20 rad S^{-2} c) 25 rad s^{-2} d) 30 rad s^{-2}

43. A rocket of mass 120 kg is fired in the gravity-free space. It ejects gases with velocity 600 m s^{-1} at the rate of 1 kg/so What will be the initial acceleration of the rocket? what is the initial thrust on the rocket?
    a) 60 N b) 120 N c) 600 N d) 1200 N

44. A person of mass M is pulling a box of mass m on a horizontal rough surface. The force applied by him is horizontal. The coefficient of friction between the shoes of the man and the floor is f.land that between the box and the floor is u'. In which of the cases given ahead will he certainly fail to slide the box?
    a) M > m,μ > μ' b) M < m,μ > μ' c) M > m.μ < μ' d) M < m,μ < μ'
45. (A) A particle is moving with constant speed on a straight line in XY plane. Its angular momentum about origin is constant.
    (R) The moment of momentum is zero when particle moves with uniform velocity
    a) If both assertion and reason are true and reason is the correct explanation of assertion.
    b)
    If both assertion and reason are true but reason is not the correct explanation of assertion.
    c) If assertion is true but reason is false. d) If both assertion and reason are false.
    e) If assertion is false but reason is true.
46. Two bodies of masses 2 kg and 4 kg are moving with velocities 2 mls and 10 mls respectively towards each other due to mutual gravitational attraction. What is the velocity of their centre of mass?
    a) 5.3ms^{-1} b) 6.4ms^{-1} c) Zero d) 8.1ms^{-1}
47. Assertion: The moment of inertia of a rigid body reduces to its minimum value, when the axis of rotation passes through its centre of gravity.
    Reason : The weight of a rigid body always acts through its centre of gravity
    a) If both assertion and reason are true and reason is the correct explanation of assertion
    b) If both assertion and reason are true but reason is not the correct explanation of assertion
    c) If assertion is true but reason is false d) If both assertion and reason are false
48. The linear velocity of a particle on the equator is nearly: (radius of the earth is 4000 miles)
    a) zero b) 10 mile/hr c) 100 mile/hr d) 1000 mile/hr
49. (A) In order to stop a car in shortest distance on a horizontal road, one should apply the brakes hard enough to just preventing slipping.
    (R) The coefficient of static friction is larger than the coefficient of kinetic friction.
    a) If both assertion and reason are true and reason is the correct explanation of assertion.
    b)
    If both assertion and reason are true but reason is not the correct explanation of assertion.
    c) If assertion is true but reason is false. d) If both assertion and reason are false.
    e) If assertion is false but reason is true
50. The angular momentum of a moving body remains constant if:
    a) net external force is applied b) net pressure is applied c) net external torque is applied
    d) net external torque is not applied
51. Two identical balls A and B having velocities of 0.5 m/s and - 0.3 m/s respectively collide elastically in one dimension. The velocities of B and A after the collision respectively will be :
    a) -0.3 m/s and 0.5 m/s b) 0.3 m/s and 0.5 m/s c) -0.5 m/s and 0.3 m/s
    d) 0.5 m/s and -0.3 m/s
52. An automobile engine develops 100 kW when rotating at a speed of 1800 rpm. The torque delivered by the engine is :

a) $\frac{10^2}{6\pi}$ N m b) $\frac{10^4}{6\pi}$ N m c) $\frac{10^6}{6\pi}$ N m d) $\frac{10^8}{6\pi}$ N m

53. A balloon has 8 gram of air. A small hole is pierced into it. The air escapes at a uniform rate of 7 em s^{-1}. If the balloon shrinks in 5.6 seconds then the average force acting on the balloon is:
a) 10^{-4} N b) 10^{-2} dyne c) 56 dyne d) 10^{-6} N

54. velocities of two blocks in the centre of mass frame just after the kick are respectively given by:
a) 4 m/s, 10 m/s b) 10 m/s, 4 m/s c) 4 m/s, -10 m/s d) 10 m/s, -10 m/s

55. (A) The torque ($\tau = I\alpha$) can be applied only about two points:
(i) centre of mass (ii) instantaneous centre of rotation.
(R) The equation $\alpha_{cm} = \alpha R$ can always be applied in case of pure rolling.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

56. Which of the following is a self adjusting force
a) Static friction b) Rolling friction c) Sliding friction d) Dynamic friction

57. (A) In rolling, all points of a rigid body have the same linear speed.
(R) The rotational motion does not effect the linear velocity of rigid body.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

58. A heavy ball is thrown on a rough horizontal surface in such a way that it slides with a speed Vo initially without rolling. It will roll without sliding when its speed falls to:
a) (2/7) Vo b) (3/7) Vo c) (5/7) Vo d) (7/5) Vo

59. (A) When a particle moves in a circle with a uniform speed, its velocity and acceleration both changes.
(R) The centripetal acceleration in circular motion is dependent on angular velocity of the body.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

60. A body is under the action of two equal and oppositely directed forces and the body is rotating with constant acceleration. Which of the following cannot be the separation between the lines of action of the forces?
a) 1 m b) 0.4 m c) 0.25 m d) Zero

61. A ring of radius 0.5 m and mass 10 kg is rotating about its diameter with angular velocity of 20 rad/s. Its KE is:
a) 10 J b) 100 J c) 500 J d) 1000 J

62. A body of mass 5 kg starts from the origin with an initial velocity $\vec{u}$ = (30$\hat{i}$ +40$\hat{j}$) m S^{-1}. If a constant force (-6$\hat{i}$ - 5$\hat{j}$) N acts on the body, the time in which the y-component of the velocity becomes zero is :
a) 5 s b) 20 s c) 40 s d) 80 s

63. If a car is being driven on a circular path, in which of the following circumstances it will not slip:
a) $\frac{mv^2}{r} \geq \mu mg$ b) $\frac{mv^2}{r} = \mu mg$ c) $\frac{mv^2}{r} \leq \mu mg$ d) $\frac{\mu}{r} = \mu g$

64. A particle is projected along the line of greatest slope up a rough plane inclined at an angle of 45° with the horizontal. If the coefficient of friction is $\frac{1}{2}$, their retardation is:
a) $\frac{g}{2\sqrt{2}}$ b) $\frac{g}{\sqrt{2}}$ c) $\frac{g}{\sqrt{2}}\left(1-\frac{1}{2}\right)$ d) $\frac{g}{\sqrt{2}}\left(1+\frac{1}{2}\right)$

65. A truck, weighing 8000 kg, is moving along a track with negligible friction at 1.8 m s^{-1} with the engine turn off when it begins to rain hard. The raindrops fall vertically with respect to the ground. The speed of the truck, when it has collected 1000 kg of rain water, is:
a) 1.6 ms^{-1} b) 10 ms^{-1} c) 3 ms^{-1} d) 9 ms^{-1}

66. (A) The slope of momentum versus time curve gives us the acceleration.
(R) Acceleration is given by the rate of change of momentum.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

67. A pendulum is swinging in an elevator. Its period will be greatest when the elevator is:
a) moving upwards at constant speed b) moving downwards
c) moving downwards at constant speed d) accelerating downwards

68. A particle performs uniform circular motion with an angular momentum L. If the frequency of particle's motion is doubled and its kinetic energy halved, the angular momentum becomes:
a) 2L b) 4L c) L/2 d) L/4

69. (A) A sphere rolling on a rough horizontal surface with constant velocity then it start going up on a smooth inclined plane. Rotational kinetic energy remains constant on inclined surface.
(R) Rotational kinetic energy decreases if torque due to friction opposes angular velocity of the sphere
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

70. A round uniform body of radius R, mass M and moment of inertia I rolls down (without slipping) an inclined plane making an angle θ with the horizontal. Then its acceleration is:
a) $\frac{gsin\theta}{1-MR^2/I}$ b) $\frac{gsin\theta}{1+IIMR^2}$ c) $\frac{gsin\theta}{1+MR^2/I}$ d) $\frac{gsin\theta}{1-IMR^2}$

71. It is found that $|\vec{A}+\vec{B}|=|\vec{A}|$.This necessarily implies:

a) $\vec{B} = 0$ b) $\vec{A}, \vec{B}$ are antiparallel c) $\vec{A}, \vec{B}$ are parallel d) $\vec{A}.\vec{B} = 0$

72. Forces of 1 N and 2 N act along the lines x = 0 and y = O. The equation of the line along which the resultant lies is given by:
a) d - y = 0 b) y - 2x = 0 c) 2y - x = 0 d) y + x = 0

73. A particle tied to a string of negligible weight and length l is swung in a horizontal circular path with constant angular velocity having time period T. If the string length is shortened by 1/2 while the particle is in motion, the time period is:
a) 4T b) 2T c) $\frac{T}{2}$ d) $\frac{T}{4}$

74. Which motion does not require force to maintain it?
a) Uniform circular motion b) Elliptical motion c) Uniform straight line motion
d) Projectile motion

75. A very flexible uniform chain of mass M and length L is suspended vertically so that its lower end just touches the surface of a table. When the upper end of the chain is released, it falls with each link coming to rest the instant it strikes the table. The force exerted by the chain on the table at the moment when ypart of the chain has already rested on the table is:
a) $3\frac{M}{L}$yg b) $\frac{M}{L}$yg c) $2\frac{M}{L}$yg d) None of these

76. If $F_1 + F_2 + F_3 = 0$, then
a) $F_1 > F_2$ b) $F_2 > F_3$ c) $F_3 > F_1$ d) None of these

77. An impulse is supplied to a moving object with the force at an angle of 120° with the velocity vector. What is the angle between the impulse and the change in momentum?
a) 0^0 b) 30^0 c) 60^0 d) 120^0

78. To maintain a rotor at a uniform angular speed of 100 rad s^{-1} an engine needs to transmit torque of 100 N m. The power of the engine is :
a) 10 kW b) 100 kW c) 10 MW d) 100 MW

79. A solid sphere of mass 2 kg rolls up a 30° incline with an initial speed of 10 m/s. The maximum height reached by the sphere is: (Take g = 10 rn/s^2)
a) 3.5 m b) 7.0 m c) 10.5 m d) 14.0 m

80. A coin is of mass 4.8 kg and radius one metre. It is rolling on a horizontal surface without sliding with angular velocity 600 rotations/min. What is the total kinetic energy of the coin?
a) 360 J b) 1440 π^2 J c) 4000 π^2J d) 600 π^2J

81. A steam of water flowing horizontally with a speed of 25 m S^{-1} gushes out of a tube of cross-sectional area 10^{-3} m^2, and hits at a vertical wall nearby. What is the force exerted on the wall by the impact of water?
a) 125 N b) 625 N c) -650 N d) - 1125 N

82. An elevator weighing 6000kg is pulled upward by a cable with an acceleration of 5ms^{-2}.Takingg to be 10ms^{-2},then the tension in the cable is:
a) 6000 N b) 9000 N c) 60000 N d) 90000 N

83. An object placed on a ground is in stable equilibrium. If the object is given a slight push, then initially the position of centre of gravity:
a) moves nearer to ground b) rises higher above the ground c) remains as such
d) may remain at same level

84. A bullet comes out of the barrel of a gun oflength 2 m with a speed of80 m/s. The average acceleration ofthe bullet is
    a) 1.6 m/s^2 b) 160 m/s^2 c) 1600 m/s^2 d) 16 m/s^2
85. A 140 g ball, in horizontal flight with a speed V_1 of 39.0 mis, is struck by a bat. After leaving the bat, the ball travel in the opposite direction with speed V_2 =39.0 m/s. If the impact time $\triangle$t for the ball-bat collision is 1.20 ms, what average net force acts on the ball?
    a) 1308 N b) 1090 N c) 9100 N d) 980 N
86. A 500 kg boat is 9 m long and is floating without motion on still water. A man of mass 100 kg is at one end and ifhe runs to the other end of the boat and stops, the displacement of the boat is:
    a) 1.5 m in the direction of displacement of the man
    b) 0.75 m in the direction of displacement of the man
    c) 1.5 m in the direction opposite to the displacement of the man
    d) 0.75 m in the direction opposite to the displacement of the man
87. If the earth suddenly stops revolving and all its rotational KE is used up in raising its temperature and if s is taken to be the specific heat of the earth's material, the rise of temperature of the earth will be: (R = radius ofthe earth and (ω = its angular velocity)
    a) $\frac{R^2\omega^2}{5Js}$ b) $\frac{R^2\omega^2}{5J}$ c) $\frac{R^2\omega}{5Js}$ d) $\frac{R^2\omega^2}{5s}$
88. A solid sphere of radius R is rolling with velocity u on a smooth plane. The total kinetic energy of the sphere is:
    a) $\frac{7}{10}$mv^2 b) $\frac{3}{4}$mv^2 c) $\frac{1}{2}$mv^2 d) $\frac{1}{4}$mv^2
89. A sphere of diameter 0.2 m and mass 2 kg is rolling on an inclined plane with velocity u = 0.5 rnls . The kinetic energy of the sphere is:
    a) 0.1 J b) 0.3 J c) 0.5 J d) 0.42 J
90. A meter scale is moving with uniform velocity. This implies:
    a)
    the force acting on the scale is zero, but a torque about the centre of mass can act on the scale
    b)
    the force acting on the scale is zero and the torque acting about centre of mass of the scale is also zero
    c) the total force acting on it need not be zero but the torque on it is zero
    d) neither the force nor the torque need to be zero
91. A block released from rest from the top of a smooth inclined plane of inclination 45°, takes time t to reach the bottom. The same block released from rest, from top of a rough inclined plane of same inclination takes time 2t to reach the bottom. The coefficient of friction is:
    a) 0.75 b) 0.5 c) 0.25 d) 0.4
92. A wheel with an initial angular velocity ω_0 reaches an angular velocity of $5\omega_0$ while it turns through an angle of 6 rad. Its uniform angular acceleration α is:
    a) $1/3\omega_0^2 rad/sec^2$ b) $2/3\omega_0^2 rad/sec^2$ c) $2\omega_0^2 rad/sec^2$ d) $4\omega_0^2 rad/sec^2$

93. A car is moving in a circular horizontal track of radius 10m with a constant speed of 10 m/sec. A plumb bob is suspended from the roof of the car by a light rigid rod of length 1.00 m. The angle made by the rod with the track is:
a) zero b) 30^o c) 45^o d) 60^o

94. Assertion: An external force is required to keep a body in motion.
Reason: If the net external force is zero, a body at rest continues to remain at rest and a body in motion continues to move with a uniform velocity.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

95. (A) The dot product of one vector with another vector of different dimensions may be a scalar or a vector.
(R) If the product of two vectors is a scalar, then product is called cross product.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

96. A projectile is thrown in the upward direction making an angle of 60° with the horizontal direction with a velocity of 147 ms^{-1} .Then the time after which its inclination with the horizontal is 45°, is:
a) 15 s b) 10.98 s c) 5.49 s d) 2.745 s

97. A body of mass m slides down an incline and reaches the bottom with a velocity v. If the same mass was in the form of a ring which rolls down this incline, the velocity of the ring at the bottom would have been:
a) v b) $\sqrt{2}v$ c) $v/\sqrt{2}$ d) $\left(\sqrt{2/5}\right)v$

98. 300 J of work is done in sliding a 2 kg blockup an inclined plane of height 10 m. Taking g = 10 m/s^2, work done against friction is _____
a) 100J b) 0 c) 1000J d) 200J

99. A couple produces
a) purely translational motion b) purely rotational motion
c) both translational and rotational motion d) no motion

100. A raindrop of mass 0.2 g is falling with a uniform velocity of 25 ern s^{-1} . Its weight will be: (g = 10m s^{-2})
a) Zero b) 0.02 N c) 0.002 N d) 0.2 N

101. A particle of mass m is moving with a uniform velocity v_1. It is given an impulse such that its velocity becomes v_2. The impulse is equal to _____
a) $m\left[\left|v_2\right| - \left|v_1\right|\right]$ b) $\frac{1}{2}m\left(v_2^2 - v_1^2\right)$ c) $m\left(v_1 + v_2\right)$ d) $m\left(v_2 - v_1\right)$

102. A disc and a hoop (ring) of the same mass and size roll down an inclined plane simultaneously. The object which reaches the bottom of the incline first is:
a) hoop b) disc c) both the hoop and the disc d) none of these

103. Two cars C_1 and C_2 of masses M_1 and M_2 have similar tyres. Given that M1 >M2 and initially both the cars are moving with the same speed. Let the minimum stopping distance for them be x_l and x_2, then:
a) $x_1 = x_2$ b) $x_1 < x_2$ c) $x_1 > x_2$ d) none of these

104. Bullets of 0.03 kg mass each hit a plate at the rate of 200 bullets per second, with a velocity of 50 mlsec and reflect back with a velocity of 30 m s^{-l}. The average force acting on the plate (in Newton) is:
a) 120 b) 180 c) 300 d) 480

105. A ring of radius R is rotating with an angular speed ω_0 about a horizontal axis. It is placed on a rough horizontal table. The coefficient of kinetic friction is μ_kThe time after which it starts rolling is
a) $\frac{\omega_0 \mu_k R}{2g}$ b) $\frac{\omega_0 g}{2\mu_k R}$ c) $\frac{\omega_0 g}{2\mu_k R}$ d) $\frac{\omega_0 R}{2\mu_k g}$

106. The mass of a bicycle rider along with the bicycle is 100 kg. He wants to cross over a circular turn of radius 100 m with a speed of 10 m S^{-1}. If the coefficient of friction between the tyres and the road is 0.6, the frictional force required by the rider to cross the turn, is :
a) 300 N b) 600 N c) 1200 N d) 150 N

107. Physical independence of force is a consequence of _____
a) third law ofmotion b) second law of motion c) first law of motion d) All of these

108. A ball is thrown from a roof top at an angle 45° above the horizontal. It hits the ground a few seconds later. At what point during its motion, does the ball have greatest speed?
a) At the highest point b) At the starting point c) At the point where it touches the ground
d) None of the above

109. Two blocks of masses 10 kg and 20 kg are connected by a massless string and are placed on a smooth horizontal surface as shown in the figure. If a force F = 600 N is applied to 10 kg block, then the tension in the string is

a) 100 N b) 200 N c) 300 N d) 400 N

110. (A) The spin angular velocity of a star is greatly enhanced when it collapses under gravitational pull and become a neutron star.
(R) According to law of conservation of angular momentum there is increase in angular velocity of collapsing star.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

111. (A) Two vectors are equal when their magnitude and direction both are equal.
(R) For any two vectors $\vec{A}$ and $\vec{B}$, if angle between them is $\frac{\pi}{4}$rad, then $\vec{A} \times \vec{B} = \vec{A}.\vec{B}$.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

112. The instantaneous angular position of a point on a rotating wheel is given by the equation θ(t) = $2t2^3$ - $6t^2$. The torque on the wheel becomes zero at
a) t = 1 s b) t = 0.5 s c) t= 0.25 s d) t = 2 s

113. A body under the action ofa force $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$, acquires an acceleration of 1 m/s^2. The mass of this body must be _____
a) 10kg b) 20kg c) $10\sqrt{2}$kg d) $2\sqrt{10}$ kg

114. The angular velocity of the body changes from ω_1 to ω_2 without applying torque but by changing moment of inertia. The initial radius of gyration to the final radius of gyration is:
a) $\omega_2 : \omega_1$ b) $\omega_2^2 : \omega_1^2$ c) $\sqrt{\omega_2} : \sqrt{\omega_1}$ d) $\frac{1}{\omega_2} : \frac{1}{\omega_1}$

115. The ratio of the radii of gyration of a circular disc about a tangential axis in the plane of the disc and of a circular ring of the same radius about a tangential axis in the plan of the ring is:
a) $\sqrt{3} : \sqrt{5}$ b) $\sqrt{12} : \sqrt{3}$ c) $1 : \sqrt{3}$ d) $\sqrt{5} : \sqrt{5}$

116. (A) A projectile is thrown with an initial velocity of $\vec{u} = u_x\hat{i} + u_y\hat{j}$ If horizontal (X-direction) range is maximum then $u_x = u_y$.
(R) For maximum horizontal range angle of projection must be 45°.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

117. The centre of mass of a body
a) lies always at the geometrical centre b) lies always inside the body
c) lies always outside the body d) may lie within or outside the body

118. (A) In rotation motion all points of a rigid body have the same linear speed.
(R) Rotational motion does not affect the linear velocity of particles of the rigid body
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

119. Assertion: Static friction is a self-adjusting force upto its limit μ_s N where μ_s is the coefficient of static friction.
Reason: One can use the equation is $f_s = \mu_s$ N only when the maximum value of static friction comes into play.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

120. A shell is fired from a cannon, it explodes in mid air, its total _____
a) momentum increases b) momentum decreases c) KE increases d) KE decreases

121. A cyclist bends while taking turn to:
a) reduce friction b) generate required centripetal force c) reduce apparent weight
d) reduce speed

122. what is the state of motion when the man stops climbing?
a) $\vec{u}rel. > 0$ b) $\vec{u}rel. < 0$ c) $\vec{u}rel. or \vec{V} = 0$ d) None of these

123. A block of mass m is placed on a smooth wedge of inclination q. The whole system is accelerated horizontally so that the block does not slip on the wedge. The force exerted by the wedge on the block (g is acceleration due to gravity) will be _____
a) mg/cos θ b) mg cos θ c) mg/sin θ d) mg

124. tension in the string is if both the masses are equal, then the mass on the plane, i. e. , mass m_1 :
a) moves upwards b) moves downwards c) remains stationary d) nothing can be said

125. (A) Force of friction increases when surfaces in contact are highly smooth.
(R) When surfaces are highly polished, intermolecular forces come into play and friction force increases.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

126. A particle performs uniform circular motion with an angular momentum L If the angular frequency of the particle is doubled and kinetic energy is halved, its angular momentum becomes:
a) 4L b) 2L c) L/2 d) L/4

127. A second's pendulum is mounted in a rocket. Its period of oscillation decreases when the rocket
a) Comes down with uniform acceleration b) Moves up with a uniform velocity
c) Moves round the earth in a geostationary orbit d) Moves up with uniform acceleration

128. (A) A disc is rolling ona rough horizontal surface without slipping. The velocity of centre of mass is v. The other points on the disc lie on a circular arc having same speed v.
(R) When a disc is rotating without sliding on a rough horizontal surface the magnitude of velocities of all the points at a distance r from point of contact is same.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If assertion is true but reason is false.
e) If assertion isfalse but reason is true.

129. The moments of inertia of two rotating bodies A and B are I_A and I_B (IA > I_B). If their angular momenta are equal, then
a) Kinetic energy of A = Kinetic energy of B b) Kinetic energy of A > Kinetic energy of B
c) Kinetic energy of A < Kinetic energy of B
d) Kinetic energy of the two bodies cannot be compared with the given data

130. The rate of mass of the gas emitted from rear of a rocket is initially 0.1 kg/sec. If the speed of the gas relative to the rocket is 50 mlsec and mass of the rocket is 2 kg, then the acceleration of the rocket (in m/sec ^{2}) is:
a) 5 b) 5.2 c) 2.5 d) 25

131. (A) If $\vec{P}.\vec{Q} = |\vec{P} \times \vec{Q}|$ then angle between $\vec{P}$ and $\vec{Q}$ is π/2.

(R) If angle between $\vec{P}$ and $\vec{Q}$is π/2, then dot product is zero.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

132. A block of mass m rests on a rough inclined plane. The coefficient of friction between the surface and the block is μ. At what angle of inclination θ of the plane to the horizontal will the block just start to slide down the plane?
a) $\theta=\tan^{-1}\mu$ b) $\theta=\cos^{-1}\mu$ c) $\theta=\sin^{-1}\mu$ d) $\theta=\sec^{-1}\mu$

133. A body with mass 5 kg is acted upon by a force $\vec{F} = (-3\hat{i} + 4\hat{j})$ N. If its initial velocity at t = 0 is $\vec{u} = (6\hat{i} - 12\hat{j})$ m s^{-1}, the time at which it will just have a velocity along the y-axis is
a) 0 b) 10 s c) 2 s d) 15 s

134. A ball is travelling with uniform translatory motion. This means that
a) it is at rest
b) the path can be a straight line or circular and the ball travels with uniform speed
c)
all parts of the ball have the same velocity (magnitude and direction) and the velocity is constant
d)
the centre of the ball moves with constant velocity and the ball spins about its centre uniformly

135. A 7 kg object is subjected to two forces (N) $\vec{F_1} = 20\hat{i} + 30\hat{j}$ and $\vec{F_2} = 8\hat{i} - 5\hat{j}$. The magnitude of resulting acceleration in m/s^2 will be :
a) 5 b) 4 c) 3 d) 2

136. A uniform metre stick of mass M is hinged at one end and supported in a horizontal direction by a string attached to the other end. What should be the initial acceleration (in rad/sec^2) of the stick if the string is cut?

a) $\frac{3}{2}g$ b) g c) 3g d) 4g

137. A spherical ball of mass 20 kg is stationary at the top of a hill of height 100 m. It rolls down a smooth surface to the ground, then climbs up another hill of height 30 m and finally rolls down to a horizontal base at a height of 20 m above the ground. The velocity attained by the ball is:
a) 40 m/s b) 20 m/s c) 10 m/s d) 10 $\sqrt{3}$m/s

138. For the same total mass which of the following will have the largest moment of inertia about an axis passing through the centre of gravity and perpendicular to the plane of the body?
a) A disc of radius a b) A ring of radius a c) A square lamina of side 2a
d) Four rods forming square of side 2a

139. A bucket tied at the end of a 1.6 m long string is whirled in a vertical 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?
(Takeg = 10 m s^{-2})
a) 4 ms^{-1} b) 6.25 ms^{-1} c) 16 ms^{-1} d) None of these

140. A sphere of mass M rolls without slipping on an inclined plane of inclination θ. What should be the minimum coefficient of friction, so that the sphere rolls down without slipping?
a) $\frac{2}{5}tan\theta$ b) $\frac{2}{7}tan\theta$ c) $\frac{5}{7}tan\theta$ d) $tan\theta$

141. A 6000 kg rocket is set for a vertical firing. If the exhaust speed is 1000 m s^{-1}, the gas ejected per second to supply thrust needed to overcome the weight of the rocket is:
a) 117.6 kg/s b) 58.8 kg/s c) 6 kg/s d) 178.4 kg/s

142. A block of mass m is placed on a smooth inclined plane of inclination e with the horizontal. The inclined plane is accelerated horizontally so that the block does not slide down. what should be acceleration of the inclined Plane?
a) g sin θ b) g cos θ c) g tan θ d) None of these

143. Pick out the wrong statement:
a) Newton's laws of motion hold good for both inertial and non-inertial frames
b) During explosion, linear momentum is conserved
c) Area under force-time graph gives the magnitude of impulse
d) Force of friction is zero when no driving force is applied
e) The apparent weight of a lift moving upwards with uniform velocity, equals its true weight

144. Two rings of the same radius and mass are placed such that their centres are at a common point and their planes are perpendicular to each other. The moment of inertia of the system about an axis passing through the centre and perpendicular to the plane of one of the rings is:
(mass of the ring = m, radius = r)
a) (1/2) mr^2 b) mr^2 c) (3/2) mr^2 d) $2mr^2$

145. An annular ring with inner and outer radii R_1 and R_2 is rolling without slipping with a uniform angular speed. The ratio of the forces experienced by the two particles situated on the inner and outer parts of the ring, i. e., F_1/F_2, is:
a) 1 b) R_1/R_2 c) R_2/R_1 d) $(R_1/R_2)^2$

146. A square plate of side I has mass per unit area μ Its moment of inertia about an axis passing through the centre and perpendicular to its plane is:

a) $\frac{\mu l^2}{12}$ b) $\frac{\mu l^2}{6}$ c) $\frac{\mu l^4}{12}$ d) $\frac{\mu l^2}{6}$

147. If momenta of two particles of a system are given by: $\vec{P_1} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{P_2} = -\hat{i} + 2\hat{j} + 3\hat{k}$, then the angle made by the direction of motion of the system with x-axis is:
a) $\cos^{-1}(1)$ b) $cos^{-1}(1)\sqrt{36/38}$ c) 45° d) $cos^{-1}(1)\sqrt{1/38}$

148. Figure shows a man of mass 55 kg standing stationary with respect to a horizontal conveyor belt that is accelerating with 1 m s^{-2}. The net force acting on the man is

a) 35 N b) 45 N c) 55 N d) 65 N

149. For which of the following does the centre of mass lie outside the body?
a) A pencil b) A shotput c) A dice d) A bangle

150. (A) If rod is thrown upward with initial angular velocity and velocity of centre of mass then its linear momentum change but angular velocity remains same.
(R) Torque on rod about centre of mass due to gravitational force is zero.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If assertion is true but reason is false.
e) If assertion is false but reason is true.

151. The length of an elastic string is xwhen the tension is 5 N. Its length is ywhen the tension is 7 N. What will be its length, when the tension is 9 N?
a) 2x + y b) 2y - x c) 7y - 5x d) 7y + 5x

152. Two circular discs A and B are of equal masses and thicknesses but made of metal with densities d_A and d_B ($d_A > d_B$) If their moments of inertia about an axis passing through their centres and perpendicular to circular faces be 1_A and I_B , then:
a) $I_A = I_B$ b) $I_A > I_B$ c) $I_A < I_B$ d) $I_A \geq I_B$

153. A ring of mass 0.8 kg and radius 0.1 m makes $\frac{5}{\pi}$ rotations per second about axis perpendicular to its plane through centre. Calculate angular momentum and kinetic energy of ring:
a) 0.08 kg-m^2 /s, 0.2 J b) 0.85 kg-m^2 /s, 0.2 J c) 0.85 kg-m^2 /s, 0.4 J
d) 0.08 kg-m^2/s, 0.4 J

154. A weightless ladder, 20 ft long rests against a frictionless wall at an angle of 60° with the horizontal. A 150 pound man is 4 ft from the top of the ladder. A horizontal force is needed to prevent it from slipping. Choose the correct magnitude from the following:
a) 19.5 pounds b) 10.0 pounds c) 17.3 pounds d) 15.5 pounds

155. (A) The centre of mass of an electron and proton, when released moves faster towards proton.
(R) Electron is heavier than proton.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

156. (A) If $|\vec{P}+\vec{Q}| = |\vec{P}-\vec{Q}|$,then $\vec{P}$ must be perpendicular to $\vec{Q}$.

(R) The above relation will hold even when $\vec{Q}$ is a null vector.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

157. Which of the following statements is true?
a) More force is required to start a motion than to maintain it against friction.
b) Less force is required to start a motion than to maintain it against friction.
c) Equal force is required to start a motion and to maintain it against friction.
d) None of the above

158. A monkey of mass 30 kg climbs a rope which can withstand a maximum tension of 360 N. The maximum acceleration which this rope can tolerate for the climbing of monkey is: (g = 10 ms^{-2})
a) 2 ms^{-2} b) 3 ms^{-2} c) 4 ms^{-2} d) 5 ms^{-2}

159. (A) For a body in uniform circular motion. the centripetal force is required.
(R) The body in circular motion changes its direction everywhere.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

160. A ring of mass 0.3 kg and radius 0.1 m and a solid cylinder of mass 0.4 kg and of the same radius are given the same KE and released simultaneously on a flat horizontal surface such that they begin to roll as soon as released towards a wall which is at the same distance from the ring and cylinder. Which will reach the wall first?
a) Ring b) Cylinder c) Both ring and cylinder d) None of these

161. A body moves along a circular path of radius 10m and the coefficient of friction is 0.5. What should be its angular velocity (in rad/sec) if it is not to slip from the surface? (Take g = 9.8m s^{-2})
a) 10 b) 5 c) 0.1 d) 0.7

162. A person slides freely down a frictionless inclined plane while his bag falls down vertically from the same height. The final speeds of the man (v_M) and the bag (v_B) should be such that:
a) $u_M < u_B$ b) $u_M = u_B$ c) they depend on the masses d) $u_M > u_B$

163. Which one of the following is not a conservative force?
a) Gravitational force b) Electrostatic force between two charges
c) Magnetic force between two magnetic dipoles d) Frictional force
e) Force between nucleons

164. Vehicles are streamlined to reduce

a) static friction b) kinetic friction c) fluid friction d) sliding friction

165. The moment of inertia of a body depends upon
a) mass of the body b) axis of rotation of the body c) shape and size of the body
d) all of these

166. The particles attract each other and are permitted to move towards each other along the line joining their centres of mass. At a particular moment of time their speeds arev and 2v. What is the speed, if their common centre of mass at this instant?
a) Zero b) 1.5v c) v d) 3v

167. Certain neutron stars (extremely dense stars) are believed to be rotating at about 1 rev/so 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 x 10^3m/s^2 b) 120 x 10^3m/s^2 c) 8 x 10^5m/s^2 d) 4 x 10^8m/s^2

168. The normal component of acceleration of a particle in circular motion is due to:
a) speed of the particle b) change in direction of velocity
c) change in the magnitude of velocity d) rate of change of acceleration

169. A solid sphere rolls down an inclined plane and its velocity at the bottom is V_1. The same sphere slides down the plane (without friction) and its velocity at the bottom is V_2. Which of the relations given below is correct?
a) $v_1 = v_2$ b) $v_1 = \sqrt{\frac{5}{7}}v_2$ c) $v_1 = \sqrt{\frac{7}{5}}v_2$ d) None of these

170. It is easier to roll a barrel than pull it along the road. This statement is:
a) false b) true c) uncertain d) not possible

171. A Diwali rocket is ejecting 0.05 kg of gases per second at a velocity of 400 m/sec. The accelerating force on the rocket is :
a) 20 dynes b) 22 dynes c) 20 N d) 1000 N

172. A body of mass 0.4 kg starting at origin at t = 0 with a speed of 10 m S^{-1} in the positive x-axis direction is subjected to a constant F = 8 N towards negative x-axis. The position of the body after 25 s is :
a) -6000 m b) -8000 m c) +4000 m d) +7000 m

173. Generally the mass of a fly wheel is concentrated in its rim Why?
a) To decrease the moment of inertia b) To increase the moment of inertia
c) To obtain stable equilibrium d) To obtain a strong wheel

174. A horizontal force, just sufficient to move a body of mass 4 kg lying on a rough horizontal surface, is applied on it. The coefficients of static and kinetic friction between the body and the surface are 0.8 and 0.6 respectively. If the force continues to act even after the block has started moving, the acceleration of the block (in metre per sec^2) is: (g = 10 m/s^2)
a) 1/4 b) 1/2 c) 2 d) 4

175. Two carts of masses 200 kg and 300 kg on horizontal rails are pushed apart. Suppose the coefficient of friction between the carts and the rails are same. If the 200 kg cart travels a distance of 36m and stops, then the distance traveled by the cart weighing 300 kg is :
a) 32 m b) 16 m c) 24 m d) 12 m

176. A bullet is fired from a gun. The force on the bullet is given by: $F = 600^{-2} \times 10^5 t$. Where F is in newton and 1 in second. The force on the bullet becomes zero as soon as it leaves the barrel. What is the average impulse imparted to the bullet?
a) 9 N^{-s} b) Zero c) 0.9 N^{-s} d) 1.8 N^{-s}

177. A lift weighing 1000 kg is moving upwards with an acceleration of 1 m/s2. The tension in the supporting cable is _____
a) 980N b) 10800N c) 9800N d) 8800N

178. The coefficient of friction between the tyres and the road is 0.1. The maximum speed with which a cyclist can take a circular turn of radius 3 m without skidding is
(Take g = 10 m S^{-2})
a) $\sqrt{15}$m s^{-1} b) $\sqrt{3}$ m s^{-1} c) $\sqrt{30}$ m s^{-1} d) $\sqrt{10}$ m s^{-1}

179. A sphere of mass m is tied to the end of a string of length l and rotated through the other along a horizontal circular path with speed v. The work done in full horizontal circle is:
a) zero b) $\frac{Mv^2}{l} \times 2\pi l$ c) mg· 2πl d) $\frac{Mv^2}{l} \times l$

180. A particle with position vector $\vec{r}$ has a linear momentum p. Which of the following statements is true in respect of its angular momentum Labout the origin?
a) L acts along p b) L acts along r c) L is maximum when p and r are parallel
d) L is maximum when p is perpendicular to r e) L is minimum when p is perpendicular to r

181. A body rolls down an inclined plane. If its kinetic energy of rotation is 40% of its kinetic energy of translation, then the body is:
a) solid cylinder b) solid sphere c) disc d) ring

182. A closed tube partly filled with water lies in a horizontal plane. lfthe tube is rotated about perpendicular bisector, the moment of inertia of the system:
a) increases b) decreases c) remains constant d) depends on sense of rotation

183. A particle has initial velocity $(2\hat{i} + 3\hat{j})$ and acceleration $(2\hat{i} + 3\hat{j})$ The magnitude of velocity after 10 seconds will be :
a) 5 units b) 9 units c) 9√2 units d) 5√2 units

184. A cricket player catches a ball of mass 10^{-1} kg, moving with a velocity of 25 m s^{-1}. Ifthe ball is caught in 0.1 s, the force of the blow exerted on the hand of the player is:
a) 4 N b) 25 N c) 40 N d) 250 N

185. Which of the following statements is not true regarding the Newton's third law of motion?
a) To every action there is always an equal and opposite reaction
b) Action and reaction act on the same body.
c) There is no cause-effect relation between action and reaction.
d) Action and reaction forces are simultaneous forces

186. (A) A ladder is more apt to slip, when you are high up on it than when you just begin to climb.
(R) At the high up on a ladder the torque is large and on climbing up the torque is small.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

187. Which of the following statements is correct?

a) For a general translation motion, momentum $\vec{p}$ and velocity $\vec{v}$ need not parallel.
b)

For a general rotational motion, angular momentum $\vec{L}$i and angular velocity $\vec{w}$ always be parallel.

c) For a general translation motion, acceleration $\vec{a}$ and velocity $\vec{v}$ are always parallel.
d)

For a general rotational motion, angular momentum $\vec{L}$ and angular velocity $\vec{w}$ need not be parallel.

188. A disc and a sphere of same radius but different masses roll off on two inclined planes of the same altitude and length. Which one of the two objects gets to the bottom of the plane first?
a) Disc b) Sphere c) Both reach at the same time d) Depends on their masses

189. Three blocks with masses m, 2m and 3m are connected by strings as shown in the figure. After an upward force F is applied on block m, the masses move upward at constant speed v. What is the net force on the block of mass 2m? (g is the acceleration due to gravity)

a) 2m b) 3m c) 6m d) zero

190. (A) To unscrew a rusted nut we need a wrench with longer arm.
(R) Wrench with longer arm reduces the torque of the arm.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

191. Assertion: The terms action and reaction in the third law of motion stand for simultaneous mutual forces between a pair of bodies.
Reason: In this context action always precede or cause reaction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

192. A monkey of mass 40 kg climbs an massless rope which can stand a maximum tension of 500 N. In which of the following cases will the rope break? (Take g = 10 m s^{-2})

a) The monkey climbs up with an acceleration of 5 m s^{-2}.
b) The monkey climbs down with an acceleration 5 m s^{-2}.
c) The monkey climbs up with a uniform speed of 5 ms^{-1}
d) The monkey falls down the rope freely under gravity.

193. 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 = 10 ms^{-2} then, the maximum angular velocity of the stone will be:
a) 2 rad s^{-1} b) 4 rad s^{-1} c) 8 rad s^{-1} d) 16 rad s^{-1}

194. (A) A cyclist always bends inwards while negotiating a curve.
(R) y bending he lowers his centre of gravity
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

195. Moment of inertia of a uniform horizontal cylinder of mass M about an axis passing through its edge and perpendicular to the axis of the cylinder when its length is 6 times its radius R is:
a) $\frac{39MR^2}{4}$ b) $\frac{39MR}{4}$ c) $\frac{49MR}{4}$ d) $\frac{49MR^2}{4}$

196. Two bodies of mass 10 kg and 2 kg are moving with velocities $2\hat{i} - 7\hat{j} + 3\hat{k}$ and $-10\hat{i} + 35\hat{j} - 3\hat{k}$ m/s respectively. The velocity of their centre of mass is:
a) $2\hat{i}$ m/s b) $2\hat{k}$ m/s c) $(2\hat{j} + 2k)$ m/s d) $(2\hat{i} + 2\hat{j} + 2\hat{k})$ m/s

197. A thin rod of mass m and length 2/ is made to rotate about an axis passing through its centre and perpendicular to it. Ifits angular velocity changes from 0 to coin time t, the torque acting on it is:
a) $\frac{ml^2\omega}{12t}$ b) $\frac{ml^2\omega}{3t}$ c) $\frac{ml^2\omega}{t}$ d) $\frac{4ml^2\omega}{3t}$

198. In a bicycle the radius of rear wheel is twice the radius of front wheel. If l_F and r_r are the radius, V_F and v_r are the speeds of top most points of wheel, then:
a) $v_r = 2u_F$ b) $u_F = 2u_r$ c) $u_F = u_r$ d) $u_F > u_r$

199. Which of the following statements is true for the planets orbiting around the sun?
a)
Their velocity increases when 'they are nearest to the sun in accordance with the conservation of angular momentum.
b)
Their velocity decreases when they are nearest to the sun in accordance with the conservation of angular momentum.

c) Areal velocity of the planet varies with time to conserve the energy.

d)

Areal velocity of the planet is directly proportional to the distance of the planet from the sun.

200. (A) If the sum of the two unit vectors is also a unit vector, then magnitude of their difference is root of three.

(R) To find resultant of two vectors, we use square law.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

201. A bucket full of water is revolved in vertical circle of 2 m. What should be the maximum time-period of revolution so that water does not fall of f the bucket?

a) 1 sec b) 2 sec c) 3 sec d) 4 sec

202. (A) A horse has to apply more force to start a cart than to keep it moving.

(R) The coefficient of static friction is greater than the coefficient of kinetic friction.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true

203. (A) For projection angle $\tan^{-1}(4)$, the horizontal range and the maximum height of a projectile are equal.

(R) The maximum range of projectile is directly proportional to square of velocity and inversely proportional to acceleration due to gravity.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

204. Starting fiom rest, a body slides dovm a 45^{o} inclined plane in twice the time it takes to slide down the same distance in the absence of friction. The coefficient of friction between the body and the inclined piane is _____

a) 0.80 b) 0.75 c) 0.25 d) 0.33

205. A disc revolves with a speed $33\frac{1}{3}$ rev/min, and has a radius of 15 cm. Two coins A 3 and B are placed at 4 cm and 14 cm away from the centre of the disc. If the coefficient of friction between the coins and the disc is 0.15, which of the coins will revolve with the record?

a) A b) B c) Both A and B d) Neither A nor B

206. Which of the following is NOT an illustration of Newton's third law?

a) Flight of a jet plane b) A cricket player lowering his hands while catching a cricket ball

c) Walking on floor d) Rebounding of a rubber ball

207. A lift with its load has a mass of 2000 kg. It is supported by a steel cable. Find the tension in the cable when it accelerates downwards with uniform acceleration of 1 m/s^2.

a) 19600 N b) 17600 N c) 18500 N d) 19100 N

208. A wheel, initially at rest, is rotated with a uniform angular acceleration. The wheel rotates through an angle θ_1 in the first one second and through an additional angle θ_2 in the next one second. The ratio θ_2/θ_1 is:

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

209. A block of mass m is placed on a smooth inclined plane of inclination e with the horizontal. The inclined plane is accelerated horizontally so that the block does not slide down. What is the vertical force exerted by the inclined plane on the block?

a) mg sin θ b) mg cos θ c) mg d) None of these

210. A car is moving on a circular level road of curvature 300 metres. If the coefficient of friction is 0.3 and acceleration due to gravity is 10m/s^2, the maximum speed the car can have is:

a) 30 km/hr b) 81 km/hr c) 108 km/hr d) 162 km/hr

211. if μ_k is the coefficient of kinetic friction, μ_r the coefficient of rolling friction and μ_s the coefficient of static friction then generally:

a) $\mu_s > \mu_r > \mu_k$ b) $\mu_s > \mu_k > \mu_r$ c) $\mu_s < \mu_k < \mu_r$ d) $\mu_s < \mu_k > \mu_r$

212. From a given sample of a uniform wire, two circular loops P and Qare made, P of radius randQofradius nr.Ifthe M.I. of Q about its axis is 4 times that of P about its axis (assuming wire diameter much smaller, than either radius), the value of n is:

a) $(4)^{2/3}$ b) $(4)^{1/3}$ c) $(4)^{1/2}$ d) $(4)^{1/4}$

213. (A) In uniform circular motion of a body. its linear speed remains constant.
(R) Total acceleration of the body has no radial component.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

214. Suppose a rocket with an initial mass M_0 expels a mass $\triangle$m in the form of gases in time $\triangle$ t, then the mass of the rocket after time tis:

a) M_0 b) $M_0 + \frac{\triangle m}{\triangle t}$ c) $M_0 - \frac{\triangle m}{\triangle t}$ d) $M_0 - \frac{\triangle m}{\triangle t} t$

215. A solid cylinder of mass M and radius R rotates about its axis with angular speed ω. Its rotational kinetic energy is

a) $\frac{1}{2}MR^2\omega^2$ b) $MR^2\omega^2$ c) $\frac{1}{4}MR^2\omega^2$ d) $\frac{1}{8}MR^2\omega^2$

216. A car is negotiating a curve of radius 150 m with a speed of 15 ms^{-1} . The angle through which the pendulum suspended from the top of the ceiling would deviate is: ($g=10\ ms^{-2}$)
a) $\tan^{-1}(3/20)$ b) $\tan^{-1}(5/16)$ c) $\tan^{-1}(4/15)$ d) $\tan^{-1}(3/16)$

217. A 100 N force acts horizontally on a block of 10 kg placed on a horizontal rough surface of coefficient of friction p = 0.5. If the acceleration due to gravity (g) is taken as 10 ms^{-2}, the acceleration of the block (in ms^{-2})is _____
a) $2.5ms^2$ b) $10ms^2$ c) $5ms^2$ d) $7.5ms^2$

218. (1) Centre of gravity of a body is the point at which the weight of the body acts.
(2) Centre of mass coincides with the centre of gravity if the earth is assumed to have infinitely large radius.
(3) To evaluate the gravitational field intensity due to any body at an external point, the entire mass of the body can be considered to be concentrated at its centre of gravity
(4) The radius of gyration of any body rotating about an axis is the length of the perpendicular dropped from the centre of gravity of the body to the axis
Which one of the following pairs of statements is correct?
a) (1) and (4) b) (1) and (2) c) (2) and (3) d) (3) and (4)

219. A ball is dropped from a spacecraft revolving around the earth at a height of 120 km. What will happen to the ball?
a) It will continue to move with velocity u along the original orbit of spacecraft.
b) It will move with the same speed tangentially to the spacecraft.
c) It will fall down to the earth gradually. d) It will go very far in space.

220. (A) When a stone attached to the string just rotates in a vertical circle, its apparent weight is zero at the highest point.
(R) At the highest point, the apparent weight is equal to mg minus tension in string.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

221. If the earth were to suddenly contract to IIn th of its present radius without any change in its mass, the duration (in hrs.) of the new day will be nearly:
a) 24/n b) 24n c) $24/n^2$ d) $24n^2$

222. When a horse pulls a wagon, the force that causes the horse to move forward is the force:
a) the ground exerts on it b) it exerts on the ground c) the wagon exerts on it
d) it exerts on the wagon

223. A body is projected upwards with a kinetic energy of 100 J. Taking the friction of air into account, when it returns to the earth, its kinetic energy will be:
a) 100 J b) < 100 J c) > 100 J d) none of these

224. The moment of inertia of a thin circular disc about an axis passing through its centre and perpendicular to its plane is I. Then, the moment of inertia of the disc about an axis parallel to its diameter and touching the edge of the rim is:
a) I b) 2I c) $\frac{3}{2}I$ d) $\frac{5}{2}I$

225. (A) The shafts of motors are provided with ball bearings.
(R) The rolling friction is less than sliding friction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

226. (A) Two similar trains are moving along the equatorial line with the same speed but in opposite direction. They will exert equal pressure on the rails.
(R) In uniform circular motion, the magnitude of acceleration remains constant but the direction continuously changes.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

227. A weightless thread can support tension upto 30 N. A stone of mass 0.5 kg is tied to it and is revolved in a circular path of radius 2m in a vertical plane. If g =10ms^{-2}, then the maximum angular velocity of the stone will be:
a) 5 rad/s b) $\sqrt{30}$ rad/s c) $\sqrt{60}$ rad/s d) 10 rad/s

228. If a cicketer catches a ball of mass 150 gm moving with a veiocity of 20 m/s, then he experiences a force of _____ (Time taken to complete the catch is 0.1 sec)
a) 300N b) 30N c) 3N d) 0.3N

229. (A) The passengers sitting in a bus fall backward, whenthe bus suddenly starts moving.
(R) Every body has the inability to change by itself, its state of rest.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

230. The moment of inertia of a uniform semicircular disc of mass M and radius rabout a line perpendicular to the plane of disc through the centre is:
a) Mr^2 b) $\frac{1}{2}$Mr^2 c) $\frac{1}{4}$Mr^2 d) $\frac{2}{5}$Mr^2

231. A block of mass 10 kg is in contact against the inner wall of a hollow cylindrical drum of radius 1m. The coefficient of fuction between the block and the inner wall of the cylinder is 0.1. The minimum angular velocity needed for the cylinder to keep the block stationary when the cylinder is vertical and rotating about its axis, will be_____ (g = 10 m/s^2)
a) 10 rad/s b) 10 rad/s c) 10p rad/s d) $\sqrt{10}$ rad/s

232. Two particles of mass 1 kg and 3 kg have position vector $2\hat{i} + 3\hat{j} + 4\hat{k}$ and $-2\hat{i} + 3\hat{j} - 4\hat{k}$ respectively. The centre of mass has a position vector
a) $2\hat{i} + 3\hat{j} - 2\hat{k}$ b) $\hat{i} + 3\hat{j} - 2\hat{k}$ c) $-\hat{i} + 3\hat{j} + 2\hat{k}$ d) $-\hat{i} + 3\hat{j} - 2\hat{k}$

233. A meter stick of mass 400 gm is pivoted at one end and displaced through an angle of 60°. The increase in its potential energy is:
a) 2 J b) 3 J c) 0 J d) 1 J

234. Two discs one of density 7.2 g/cm^3 and the other of density 8.9 gm/cm^3 , are of same mass and thickness. Their moments of inertia are in the ratio:
a) $\frac{8.9}{7.2}$ b) $\frac{7.2}{8.9}$ c) (8.9 x 7.2) :1 d) 1: (8.9 x 7.2)

235. When two surfaces are coated with a lubricant, then they:
a) stick to each other b) slide upon each other c) roll upon each other d) none of these

236. A cyclist is riding with a speed of 27 km h $^{-1}$. As he approaches a circular turn on the road of radius 80 m, he applies brakes and reduces his speed at a constant rate of 0.5 ms $^{-1}$. The magnitude of the net acceleration of the cyclist is:
a) 0.86 ms^{-2} b) 0.43 ms^{-2} c) 1.24 ms^{-2} d) 1.76 ms^{-2}

237. (A) In uniform circular motion, acceleration is time-dependent.
(R) In uniform circular motion, tangential force acting on the body is time-dependent.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

238. A rocket has a mass of 100 kg. 90% of this is fuel. It ejects fuel vapours at the rate of 1 kg/see with a velocity of 500 m/sec relative to the rocket. It is supposed that the rocket is outside the gravitational field. The initial upthrust on the rocket when it just starts moving upwards is:
a) Zero b) 500 N c) 1000 N d) 2000 N

239. The driver of a car suddenly sees a broad wall in front of him. He should
a) break sharply b) turn sharply c) both (a) and (b) d) none of these

240. Assertion: The centre of mass of a body may lie where there is no mass.
Reason: The centre of mass has nothing to do with the mass
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

241. The z component of the angular momentum of a particle whose position vector is $\vec{r}$ with components x, y and z and linear momentum is $\vec{P}$ with components P_x ,P_y and p_z is :
a) $xp_y - yp_z$ b) $yp_z - zp_y$ c) $zp_x - xp_z$ d) $xp_y + yp_x$

242. If the tension in the cable of 1000 kg elevator is 1000 kg weight, the elevator:
a) is accelerating upwards b) is accelerating downwards c) may be at rest or accelerating
d) may be at rest or in uniform motion

243. (A) Two projectiles of masses m and 4m when projected with same initial velocity vector have different ranges.
(R) The horizontal range of a projectile depends on mass of the body.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

244. (A) The centre of mass of a proton-proton system when released from their respective positions, remains at rest.
(R) The centre of mass of a system move only when external force (s) is (are) applied on the system.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

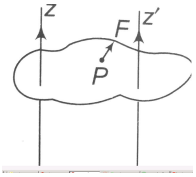
245. 4000 kg rocket is set for firing. If the exhaust speed is 1000 m s^{-1}, the mass to be ejected per second to just overcome gravitational pull (g = 10 m s^{-2}) is:
a) 20 kg b) 10 kg c) 5 kg d) 40 kg

246. The motion of the centre of mass of system of two particles is not affected by the internal forces:
a) irrespective of their directions b) only when they act along the line joining the particles
c) only when the forces are perpendicular to each other
d) when the angle between the lines of action of the forces lies between 0° and 90°

247. A wheel having a rotational inertia of 0.20 kg-m^2 rotates at 360 rpm about a vertical axis. What is the angular speed of the wheel when a torque of -1 N-m is applied about the same axis for 3.0 sec?
a) 12.68 rad/sec b) 22.68 rad/sec c) 32.68 rad/sec d) 42.68 rad/sec

248. Assertion: If there are no external forces, the centre of mass of a double star moves like a free particle.
Reason: If we go to the centre of mass frame, then we find that the two stars are moving in a circle about the centre of mass, which is at rest
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

249. Figure shows a lamina in x, y plane. Two axes z and z' pass perpendicular to its plane. A force F acts in the plane of lamina at point P as shown. Which of the following statements is correct? (The point P is closer to z' axis than the z- axis)



a) Torque τ caused by F about z axis is along $\hat{k}$.
b) Torque τ caused by F about z' axis is along $-\hat{k}$.

c) Torque caused by F about z axis is greater in magnitude than that about z' axis.
d) Total torque is given by $\tau = \tau + \tau'$

250. The breaking force of a string is 16 kgf. The maximum frequency at which a body of mass $\frac{1}{2}$ Kg can be whirled in a horizontal smooth plane (g = π2ms^{-2}) with $\frac{1}{2}$ m of that string is:
a) 10 b) 5 c) 4 d) 8

251. A ring of mass m and radius r is melted and then moulded into a sphere. The moment of inertia of the sphere will be:
a) more than that of the ring b) less than that of the ring c) equal to that of the ring
d) none of the above

252. In uniform circular motion:
a) both velocity and acceleration are constant
b) acceleration and speed are constant but velocity changes
c) both acceleration and velocity change d) both acceleration and speed are constant

253. The value of T_1 is:
a) 1 N b) 5 N c) 8 N d) 10 N

254. A particle of mass M is moving in a horizontal circle of radius R with uniform speed V. When it moves from one point to a diametrically opposite point, its:
a) kinetic energy changes by $\frac{MV^2}{4}$ b) momentum does not change
c) momentum changes by 2MV d) kinetic energy changes by MV^2

255. (A) Moment of inertia of a rigid body is not unique.
(R) Moment of inertia of a rigid body depends on the distribution of mass about the axis of rotation.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

256. (A) Action and reaction in Newton's third law cannot cancel each other.
(R) Action and reaction act on different bodies.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

257. A water fountain on the ground sprinkles water all around it. If the speed of water coming out of the fountain is v, the total area around the fountain that gets wet is :
a) $\pi\frac{v^2}{g}$ b) $\pi\frac{v^4}{g^2}$ c) $\frac{\pi v^4}{2g^2}$ d) $\pi\frac{v^2}{g^2}$

258. If a spherical ball rolls on a table without slipping. The fraction of its total energy associated with rotational energy is:
a) 3/5 b) 2/7 c) 2/5 d) 3/7

259. When a mass is rotating in a plane about a fixed point its angular momentum is directed along
a) the radius b) the tangent the orbit c) the line at angle of 45° to the plane of rotation
d) the axis of rotation

260. When the axle rotates in a sleeve, the friction involved in the process is:
a) sliding b) rolling c) limiting d) none of these

261. A door 1.6 m wide requires a force of 1 N to be applied at the free end to open or close it. The force that is required at a point 0.4 m distant from the hinges for opening or closing the door is:
a) 1.2 N b) 3.6 N c) 2.4 N d) 4 N

262. The position of the centre of mass of a cube of uniform density will be at:
a) edge of a cube b) the centre of one face
c) the centre of the intersection of diagonals of one face
d) the geometric centre of the cube

263. A cylinder is rolling over a surface. Which points on it move rectilinearly?
a) All points on the curved surface of the cylinder
b) All points on the flat surfaces of the cylinder c) All points on the axis of the cylinder
d) None of the above

264. A dog weighing 5 kg is standing on a flat boat so that it is 10m from the shore. The dog walks 4 m on the boat towards the shore and then halts. The boat weighs 20 kg and one can assume that there is no friction between it and the water. How far is the dog from the shore at the end of this time ?
a) 3.2m b) 0.8m c) 10m d) 6.8m

265. A bicycle is travelling northwards and so its angular momentum points towards west. In what direction should the cyclist apply a torque to turn left?
a) West b) South c) East d) North

266. (A) The apparent weight of a body in an elevator moving with some downward acceleration is less than the actual weight of body.
(R) Some part of the weight is spent in producing downward acceleration, when body is in elevator.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

267. A body is sliding down a rough inclined plane. The coefficient offriction between the body and the plane is 0.5. The ratio of the net force required for the body to slide down and the normal reaction on the body is 1 : 2. Then the angle of the inclined plane is:
a) 15^0 b) 30^0 c) 45^0 d) 60^0

268. A 100 kg gun fires a ball of 1 kg horizontally from a cliff of height 500 m. It falls on the ground at a distance of 400 m from the bottom of the cliff. The recoil velocity of the gun is (Take g = 10 m S^{-2})
a) $0.2ms^{-1}$ b) $0.4ms^{-1}$ c) 0.6 m S^{-1} d) 0.8 m S^{-1}

269. A force produces an acceleration of 4 m s^{-2} in a body of mass ml kg and the same force produces an acceleration of 6 m s^{-2} in another body of mass m2. If the same force is applied to (m_1 + m_2), then the acceleration will be:
a) 10 m s^{-2} b) 2 m s^{-2} c) 2.4 m s^{-2} d) 5.4 m s^{-2}

270. In the question number 66, if wheel starts from rest, what is the kinetic energy of the wheel when 2 m of the cord is unwound?
a) 20 J b) 25 J c) 45 J d) 50 J

271. A body is moving with uniform velocity of 2 m s^{-1} on a rough level surface. The frictional force on it is 10 N. If the body moves with velocity 4 m s^{-1}, the force of friction will be:
a) 2.5 N b) 5 N c) 10 N d) 20 N

272. A parachutist of weight W strikes the ground with his legs fixed and comes to rest with an upward acceleration of magnitude 3 g. Force exerted on him by the ground during landing is:
a) 2 W b) 3 W c) 4 W d) Zero

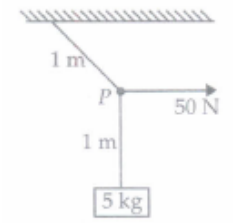
273. (A) Whenever a particle moves in a circular path with uniform speed, an acceleration exists which is directed towards the centre.
(R) The net acceleration of a particle in circular motion is always radially inward.
a) If assertion is false but reason is true.
b) If both assertion and reason are true and reason is the correct explanation of assertion.
c) If both assertion and reason are true but reason is not the correct explanation of assertion.
d) If assertion is true but reason is false. e) If both assertion and reason are false.

274. If a gymnast, sitting on a rotating stool with his arms outstretched, suddenly lowers his arms:
a) the angular velocity increases b) his moment of inertia increases
c) the angular velocity remains same d) the angular momentum increases

275. If a cyclist moving with a speed of 4.9 m/s on a level road can take a sharp circular turn of radius 4 m, then coefficient of friction between the cycle tyres and road is:
a) 0.41 b) 0.51 c) 0.61 d) 0.71

276. A block slides with a velocity of 10 mls on a rough horizontal surface. It comes to rest after covering a distance of 50 metres. If g is 10 m/sec^2, then the coefficient of dynamic friction between the block and the surface is:
a) 0.1 b) 1 c) 10 d) 5

277. A block of mass 5 kg is suspended by a massless rope of length 2 m from the ceiling. A force of 50 N is applied in the horizontal direction at the midpoint P of the rope, as shown in the figure.
The angle made by the rope with the vertical in equilibrium is (Take g = 10 m s^{-2})



a) 30° b) 40° c) 60° d) 45°

278. A rigid spherical body is spinning around an axis without any external torque. Due to change in temperature, the volume increases by 1%. Its angular speed:

a) will increase approximately by 1% b) will decrease approximately by 1%
c) will decrease approximately by 0.67% d) will decrease approximately by 0.33%

279. The friction may be classified as:
a) gravitational interaction b) electrical interaction c) magnetic interaction
d) nuclear interaction

280. A uniform force of $3\hat{i} + \hat{j}$ newton acts on a particle of mass 2 kg. Hence the particle is displaced from position $2\hat{i} + \hat{k}$ metre to position $4\hat{i} + 3\hat{j} - \hat{k}$ metre. The work done by the force on the particle is:
a) 9 J b) 6 J c) 13 J d) 15 J

281. (A) Angle of repose is equal to the angle of limiting friction.
(R) When the body is just at the point of motion, the force of friction in this stage is called limiting friction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

282. If a cyclist doubles his speed while negotiating a curve, how does the tendency to overturn vary?
a) Remains unchanged b) Doubled c) Halved d) Quadrupled

283. (A) The path of one projectile as seen from another projectile is a striaght line.
(B) Relative acceleration of one projectile W.r.t. another projectile is zero.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

284. A constant force acting on a body of mass of 5 kg change its speed from 5 m S^{-1} to 10 m S^{-1} in 10 s without changing the direction of motion. The force acting on the body is
a) 1.5 N b) 2 N c) 2.5 N d) 5 N

285. A sphere of mass m and radius r rolls on a horizontal plane without slipping with the speed u. Now, if it rolls up vertically, the maximum height it would attain will be:
a) $3u^2/4g$ b) $5u^2/2g$ c) $7u^2/10g$ d) $u^2/2g$

286. A projectile is moving at 60 m/sec at its highest point where it breaks into two equal parts due to an internal explosion. One part moves up vertically at 50 m/sec with respect to the ground. The other part will move at:
a) 110 m/sec b) 120 m/sec c) 130 m/sec d) $10\sqrt{61}$ m/sec

287. A satellite in force-free space sweeps stationary interplanetary dust at a rate (dMldt) = au. The acceleration of satellite is:
a) $-2av^2/M$ b) $-av^2/M$ c) $-2av^2/2M$ d) $-av^2$

288. Two particles of masses m_1 and m_2 are connected by a rigid massless rod of length r to constitute a dumb-bell which is free to move in the plane. The moment of inertia of the dumb-bell about an axis perpendicular to the plane passing through the centre of mass is:

a) $\frac{m_1 m_2 r^2}{(m_1+m_2)}$ b) $(m_1 + m_2) r^2$ c) $\frac{m_1 m_2 r^2}{(m_1-m_2)}$ d) $(m_1 - m_2) r^2$

289. (A) Many great rivers flow toward the equator. The sediments that they carry increases the time of rotation of the earth about its own axis.

(R) The angular momentum of the earth about its rotation axis is conserved.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

290. A particle of mass 0.2 kg is moving in a circle of radius 1m with f = (2/ π)see -I, then its angular momentum is:

a) 0.8 kg - m^2/s b) 2 kg - m^2/sec c) 8 kg - m^2/s d) 16 kg - m^2/sec

291. If the angles of projection of a projectile with same initial velocity exceed or fall short of 45° by equal amounts a, then the ratio of horizontal ranges is:

a) 1 : 2 b) 1 : 3 c) 1 : 4 d) 1 : 1 e) 1 : $\sqrt{2}$

292. When a body slides down from rest along a smooth inclined plane making an angle of 30° with the horizontal, it takes time 20 s. When the same body slides down from rest along a rough inclined plane making the same angle and through the same distance, it takes time 20p s, where p is some number greater than 1. The coefficient of friction between the body and the rough plane is

a) $\mu = \left(1 - \frac{1}{p^2}\right)\frac{1}{\sqrt{3}}$ b) $\mu = \sqrt{1 - \frac{1}{9p^2}}$ c) $\mu = (1 - p^2)\frac{1}{\sqrt{3}}$ d) $\mu = \sqrt{1 - 9p^2}$

293. A block of mass 50 kg slides over a horizontal distance of 1m. If the coefficient of friction between their surfaces is 0.2, then work done against friction is:

a) 98 J b) 72 J c) 56 J d) 34 J

294. Assertion: The position of centre of mass does not depend upon the reference frame.

Reason: Centre of mass depends only upon the rest mass of the body.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

295. A balloon with mass 'z' is descending down with an acceleration 'a' (where a < g). How much mass should be removed from it so that it starts moving up with an acceleration 'a'?

a) $\frac{2ma}{g+a}$ b) $\frac{2ma}{g-a}$ c) $\frac{ma}{g+a}$ d) $\frac{ma}{g-a}$

296. Two identical solid cylinders run a race starting from rest at the top of an inclined plane. If one cylinder slides and the other rolls:

a) the sliding cylinder will reach the bottom first with greater speed

b) the rolling cylinder will reach the bottom first with greater speed

c) both will reach the bottom simultaneously with the same speed
d) both will reach the bottom simultaneously but with different speeds

297. A phonograph turn-table rotating at 78 rev/min slows down and stops in 30 see after the motor is turned off. Then the revolutions made by it in this time are:
a) 19.5 b) 39 c) 78 d) 156

298. A balloon of mass M is descending at a constant acceleration a. When a mass m is released from the balloon it starts rising with the same acceleration a. Assuming that its volume does not change, what is the value of m?
a) $\left[\frac{a}{a+g}\right]M$ b) $\left[\frac{2a}{a+g}\right]M$ c) $\left[\frac{a+g}{a}\right]M$ d) $\left[\frac{a+g}{2a}\right]M$

299. A cord is tied to a pail of water and the pail is swung in a vertical circle of radius 4 m and g = 9 ms^{-2} . The minimum velocity of the pail at the highest point of the circle, if no water is to spill from the pail, is:
a) 7 ms^{-1} b) 6 ms^{-1} c) 10 ms^{-1} d) 3 ms^{-1}

300. (A) If the effect of air resistance is neglected, all objects fall with the same acceleration.
(R) The gravitational force is same on each object.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

301. A body of mass M hits normally a rigid wall with velocity v and bounces back with the same velocity. The impulse experienced by the body is _____
a) MV b) 1.5MV c) 2MV d) zero

302. A monkey of mass 20 kg is holding a vertical rope. The rope will not break when a mass of 25 kg is suspended from it but will break if the mass exceeds 25 kg. What is the maximum acceleration with which the monkey can climb up along the rope?
a) 2.5m/s^2 b) 5m/s^2 c) 10m/s^2 d) 25m/s^2

303. Assertion: There is no appreciable change in the position of the body during the action of the impulsive force.
Reason: In case of impulsive force the time of action of the force is very short.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

304. A flywheel rotating at 420 rpm slows down at a constant rate of 2 rad s^{-2}. The time required to stop the flywheel is :
a) 22 s b) 11 s c) 44 s d) 12 s

305. A disc is rotating with angular velocity $\vec{\omega}$ about its axis. A force acts at a point whose position vector with respect to the axis of rotation is The power associated with the torque due to the force is given by
a) $(\vec{r}\text{x}\vec{F}).\vec{\omega}$ b) $(\vec{r}\text{x}\vec{F})\text{x}\vec{\omega}$ c) $\vec{r}\text{x}(\vec{F}\text{x}\vec{\omega})$ d) $\vec{r}\text{x}(\vec{F}.\vec{\omega})$

306. A rupee coin, starting from rest rolls down a distance of Im on a plane inclined at an angle of 30° with the horizontal. Assuming that g = 9.81 m s^{-2}, time taken is:
a) 0.32 s b) 0.48 s c) 0.78 s d) 1.0 s

307. (A) Comets move around the sun in eJliptical orbits. The gravitational force on the comet due to the sun is not normal to the comet's velocity but the work done by the gravitational force over every complete orbit of the comet is zero.
(R) Gravitational force is a non-conservative force.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

308. A raw egg and a hard boiled egg are made to spin on a table with the same angular speed about the same axis. The ratio of the time taken by the two to stop is:
a) = 1 b) < 1 c) < 1 d) none of these

309. A monkey is descending from the branch of a tree with constant acceleration. If the breaking strength is 75% of theweight of the monkey, the minimum acceleration with which monkey can slide down without breaking the branch is _____
a) g b) $\frac{3g}{4}$ c) $\frac{g}{4}$ d) $\frac{g}{2}$

310. The moment of inertia of a disc of mass M and radius R about an axis, which is tangential to the circumference of the disc and parallel to the diameter is:
a) $\frac{3}{2}MR^2$ b) $\frac{2}{3}MR^2$ c) $\frac{5}{2}MR^2$ d) $\frac{4}{5}MR^2$

311. A solid cylinder of mass 20 kg and radius 20 cm rotates about its axis with a angular speed 100 rad s^{-1}. The angular momentum of the cylinder about its axis is :
a) 40 J s b) 400 J s c) 20 J s d) 200 J s

312. A cyclist moves on a circular track of radius 100 metre. If the coefficient of friction is 0.2, then the maximum speed with which the cyclist can take a turn without leaning inwards is:
a) 9.8 ms^{-1} b) 1.4 ms^{-1} c) 140 ms^{-1} d) 14.0 ms^{-1}

313. Mass is distributed uniformly over a thin triangular plate and positions of two vertices are given by (1,3) and (2, - 4). What is the position of 3rd vertex if centre of mass o the plate lies at the origin?
a) (1,-2) b) (-2,4) c) (-3,1) d) (1,2)

314. Two equal and opposite forces act on a rigid body at a certain distance. Then:
a) the body is in equilibrium b) the body will rotate about its centre of mass
c) the body may rotate about any point other than its centre of mass
d) the body cannot rotate about its centre of mass

315. The coefficient of static friction, m_3, between block A of mass 2 kg and the table as shown in the figure is 0.2. What would be the maximum mass value of block B so that the two blocks do not move? The string and the pulley are assumed to be smooth and massless.
a) 0.4kg b) 2.0kg c) 4.0kg d) 0.2kg

316. A person is standing on a rotating table with metal spheres in his hands. Ifhe withdraws his hands to his chest, then the effect on his angular velocity will be

a) increase b) decrease c) remain same d) can't say

317. A police jeep is chasing with velocity of 45 km/h, a thief in another jeep moving with velocity of 153 km/h. Police fires a bullet with muzzle velocity of 180 m/s. The velocity with which it will strike the jeep of the thief, is:
a) 150 m/s b) 27 m/s c) 450 m/s d) 250 m/s

318. A rod of mass M and length L is suspended freely from its end and it can oscillate in the vertical plane about the point of suspension. It is pulled to one side and then released. It passes through the equilibrium position with angular speed ω. What is its kinetic energy while passing through the mean position?
a) $ML^2\omega^2$ b) $ML^2\omega^2/4$ c) $ML^2\omega^2/6$ d) $ML^2\omega^2/12$

319. A body is acted on by a force toward a point. The magnitude of the force is inversely proportional to the square of the distance. The path of body wil Ibe:
a) ellipse b) hyperbola c) circle d) parabola

320. what is the time taken by the eM to hit the ground?
a) 2s b) $\sqrt{2}$ s c) 1 s d) $\frac{1}{2}s$

321. A block A of mass m_1 rests on a horizontal table. A light string connected to it passes over a frictionless pulley at the edge of table and from its other end another block B of mass m_2 is suspended. The coefficient of kinetic fliction between the block and the table is m_k. When the block A is sliding on the table, the tension in the string is _____
a) $\frac{\left(m_2-\mu km_1\right)g}{\left(m_1+m_2\right)}$ b) $\frac{m_1m_2\left(1+\mu_k\right)g}{\left(m_1+m_2\right)}$ c) $\frac{m_1m_2\left(1-\mu_k\right)g}{\left(m_1+m_2\right)}$ d) $\frac{\left(m_2+\mu_km_1\right)g}{\left(m_1+m_2\right)}$

322. A heavy uniform chain lies on a horizontal table top. If the coefficient of friction between the chain and the table surface is 0.25, then the maximum fraction of the length of the chain, that can hang over one edge of the table is:
a) 20% b) 25% c) 35% d) 15%

323. A solid sphere rolls down without slipping on a 30° inclined plane. If g = 10m/s^2 , the acceleration of the rolling sphere is:
a) 5 ms^{-2} b) $\frac{7}{25}ms^{-2}$ c) $\frac{25}{7}ms^{-2}$ d) $\frac{15}{7}ms^{-2}$

324. (A) Newton's first law is not merely a special case (a = 0) of the second law (F = ma) .

(R) Newton's first law defines the frame from where Newton's second law $\vec{F}=m\vec{a}$ is applicable.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

325. A box is placed on an inclined plane and has to be pushed down. The angle of inclination is:
a) equal to angle of friction b) more than angle of friction c) equal to angle of repose
d) less than angle of repose

326. A loop rolls down on an inclined plane. The fraction of its total kinetic energy that is associated with the rotational motion is:

a) 1 : 2 b) 1 : 3 c) 1 : 4 d) 2 : 3

327. what is the minimum velocity of the centre of mass in its path?
a) 10 ms^{-1} b) 5 ms^{-1} c) $5\sqrt{2}ms^{-1}$ d) $10\sqrt{2}ms^{-1}$

328. A disc revolves in a horizontal plane at a steady rate of 3 rad/s. A coin will remain on the disc if kept at a distance of 20 cm from the axis of rotation. The coefficient of friction is: ($g = n^2ms^{-2}$)
a) 0.5 b) 0.3 c) 0.20 d) 0.72

329. When a bus suddenly takes a turn, the passengers are thrown outwards because of :
a) Inertia of motion b) Acceleration of motion c) Speed of motion d) Both (b) and (c)

330. A body subjected to three concurrent forces is found to be in equilibrium. The resultant of any two forces
a) is equal to third force b) is opposite to third force c) is collinear with the third force
d) all of these

331. A solid sphere rolls down two different inclined planes of same height, but of different inclinations. In both cases:
a) speed and time of descent will be same
b) speed will be same, but time of descent will be different
c) speed will be different, but time of descent will be same
d) speed and time of descent both are different

332. If a person with a spring balance and a body hanging from it goes up and up in an aeroplane, then the reading of the weight of the body as indicated by the spring balance will:
a) go on increasing b) go on decreasing c) first increases and then decreases
d) remain the same

333. (A) A body X is dropped from the top of a tower. At the same time, another body Y is thrown horizontally from the same position with a velocity u. Both bodies will reach the ground at the same time.
(R) Horizontal velocity has no effect motion in the vertical direction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

334. A horse pulls the cart. Which of the following forces makes the cart move?
a) Force exerted by the horse on the cart b) Force exerted by the ground on the cart
c) Force exerted by the ground on the horse d) Force exerted by the horse on the ground

335. (A) An athlete runs some distance, before taking a long Jump.
(R) It is due to inertia of motion.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

336. A stone of mass m is tied to a string of length l and rotated in a circle with a constant speed v, if the string is released, the stone flies:

a) radially outward b) radially inward c) tangentially outward d) with an acceleration $\frac{mv^2}{l}$

337. The height y and the distance x along the horizontal plane of a projectile on a certain planet (with no surrounding atmosphere) are given by: y = (8t - $5t^2$) metre and x = 6t metre, where t is in seconds. The velocity of projection is:
a) 8 m/s b) 6 m/s c) 10 m/s d) not obtained from the data

338. Two blocks A and B of masses 3m and m respectively are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in figure. The magnitudes of acceleration of A and B immediately after the string is cut, are respectively:

a) g,$\frac{g}{3}$ b) $\frac{g}{3}$,g c) g,g d) $\frac{g}{3}$,$\frac{g}{3}$

339. (A) If there is no external torque on a body about its centre of mass, then the velocity of the centre of mass remains constant.
(R) The linear momentum of an isolated system remains constant.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

340. Of the two eggs which have identical sizes, shapes and weights, one is raw and other is half boiled. The ratio between the moment of inertia of the raw to the half boiled egg about central axis is:
a) = 1 b) > 1 c) < 1 d) not comparable

341. A body of mass 100 g is sliding from an inclined plane of inclination e = 30°. What is the frictional force experienced if μ=1.7?
a) $1.7 \times \sqrt{2} \times \frac{1}{\sqrt{3}} N$ b) $1.7 \times \sqrt{3} \times \frac{1}{2} N$ c) $1.7 \times \sqrt{3} N$ d) $1.7 \times \sqrt{3} \times \frac{1}{\sqrt{2}} N$

342. A body of mass M and radius R is rolling horizontally without slipping with speed u. It then rolls up a hill to a maximum height h. If = $h = 5v^2/6g,$ what is the M.I. of the body?
a) $\frac{1}{2}MR^2$ b) $\frac{2}{3}MR^2$ c) $\frac{3}{4}MR^2$ d) $\frac{2}{5}MR^2$

343. Four bodies of masses 2,3,5 and 8 kg are placed at the four corners of a square of side 2 m. The position of eM will be:
a) $\left(\frac{8}{9}, \frac{13}{9}\right)$ b) $\left(\frac{7}{9}, \frac{11}{9}\right)$ c) $\left(\frac{11}{9}, \frac{13}{9}\right)$ d) $\left(\frac{11}{9}, \frac{8}{9}\right)$

344. Three blocks of masses m_1, m_2 and m_3 kg are placed in contact with each other on a frictionless table. A force F is. the force experienced by mass m_2 is:
a) F b) $\frac{Fm_1}{m_1+m_2}$ c) $\frac{F\left(m_2+m_1\right)}{m_2+m_2+m_3}$ d) $\frac{F\left(m_2+m_3\right)}{m_1+m_2+m_3}$

345. A reference frame attached to the earth:
a) is an inertial frame by definition
b) cannot be an inertial frame because the earth is revolving round the sun
c) is an inertial frame because Newton's laws are applicable
d) is an inertial frame because the earth is rotating about its own axis.

346. A body of mass m is tied to one citd. of a spring and whirled round in a horizontal plane with a constant angular velocity. The elongation in the spring is 5 cm. The original length of spring is:
a) 16 cm b) 15 cm c) 14 cm d) 13 cm

347. The moment of inertia of a circular disc of radius 2 m and mass 1 kg about an axis passing through its centre of mass is 2 kg-m^2. Its moment of inertia about an axis parallel to this axis and passing through its edge (in kg-m^2) is:
a) 10 b) 8 c) 6 d) 4

348. A small block slides down from the top of a hemisphere of radius r. It is assumed that there is no friction between the block and the hemisphere. At what height, h will the block lose contact with the surface of sphere?
a) $\frac{r}{3}$ b) $\frac{2r}{3}$ c) $\frac{r}{2}$ d) $\frac{r}{4}$

349. A particle is moving along a circular path of radius 2 m with uniform speed of 5 m s^{-1}. What will be the change in velocity when the particle completes half of the revolution?
a) Zero b) 10 ms^{-1} c) $10\sqrt{2}ms^{-1}$ d) $\frac{10}{\sqrt{2}} ms^{-}1$

350. Two bodies A and B have masses M and m respectively, where M >m and they are at a distance d apart. Equal force is applied to them so that they approach each other. The position where they hit each other is:
a) nearer to B b) nearer to A c) at equal distance from A and B d) cannot be decided

351. A block of mass 1 kg lies on a horizontal surface in a truck. The coefficient of static friction between the block and the surface is 0.6. If the acceleration of the truck is 5 m S^{-2}. The frictional force acting on the block is
a) 10 N b) 5 N c) 2.5 N d) 20 N

352. A thin uniform circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing through its centre and perpendicular to the plane with angular velocity ω. Another disc of same mass but half the radius is gently placed over it coaxially. The angular speed of the composite disc will be:
a) $\frac{5}{4}\omega$ b) $\frac{4}{5}\omega$ c) $\frac{2}{5}\omega$ d) $\frac{5}{2}\omega$

353. A disc of moment of inertia I_1 is rotating freely with angular velocity ω_1 when a second, non-rotating disc with moment of inertia I_2 is dropped on it gently the two then rotate as a unit. Then the total angular speed is:
a) $\frac{I_1\omega_1}{I_2}$ b) $\frac{I_2\omega_1}{I_1}$ c) $\frac{I_1\omega_1}{I_2+I_1}$ d) $\frac{(I_1+I_2)\omega_1}{I_2}$

354. It is easier for a swimmer jumping into water from a height to describe a loop in the air by:
a) pulling the arms and legs closer b) spreading the arms and legs
c) keeping the arms and legs straight d) none of the given methods

355. A bullet of mass 40 g moving with a speed of 90 m S^{-1} enters a heavy wooden block and is stopped after a distance of 60 cm. The average resistive force exerted by the block on the bullet is
a) 180 N b) 220 N c) 270 N d) 320 N

356. A motor car is moving with speed 30 ms^{-1} on a circular path of radius 500 m. Its speed is increasing at the rate of 2 ms^{-2}; what will be its resultant acceleration?
a) 2.5 ms^{-2} b) 2.7 ms^{-2} c) 2 ms^{-2} d) 4.5 ms^{-2}

357. A lift is moving upwards with a uniform velocity u in which a block of mass m is lying. The frictional force offered by the block, when coefficient of friction is μ, will be:
a) zero b) mg c) μmg d) 2 μmg

358. A thin hollow cylinder is free to rotate about its geometrical axis. It has a mass of 8 kg and a radius of 20 cm. A rope is wrapped around the cylinder. What force must be exerted along the rope to produce an angular acceleration of 3 rad/sec^2?
a) 8.4 N b) 5.8 N c) 4.8 N d) None of these

359. A projectile of mass 30 kg is shot vertically upwards with an initial velocity of 10 m/s. After 5 s, it explodes into two fragments, one of which having a mass of 20 kg is travelling vertically with a velocity of 150 m/s. What is the velocity of the other fragment at that instant?
a) -15 m/s b) 15 m/s c) Zero d) None of these

360. A bullet is fired from a gun. The force on the bullet is given by F = 600-2 $\times$ 10^5 t where, F is newton and / in second. The force on the bullet becomes zero as soon as it leaves the barrel. What is the average impulse imparted to the bullet?
a) 8N-s b) 0 c) 0.9N-s d) 1.8N-s

361. A uniform disc of mass m and radius R is rolling down a rough inclined plane which makes an angle 30° with the horizontal. If the coefficients of static and kinetic friction are each equal to μ and the only forces, acting are gravitational and frictional, then the magnitude of the frictional force acting on the disc is:
a) (mg/3) upwards b) (mg/3) downwards c) (mg/6) upwards d) (mg/6) downwards

362. A solid cylinder of mass M and radius R rolls down an inclined plane without slipping. The speed of its centre of mass when it reaches the bottom is: (h is the height of inclined plane)
a) $\sqrt{2gh}$ b) $\sqrt{\frac{4}{3}gh}$ c) $\sqrt{\frac{4}{3}gh}$ d) $\sqrt{4g/h}$

363. (A) A cyclist always bends inwards while negotiating a curve.
(R) By bending, cyclist lowers his centre of gravity.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

364. A stone of mass m tied to a string of length l is rotating along a circuiar path with constant speed v. The torque on the stone is:
a) mlv b) mv/l c) mv^2/l d) mv^2l e) zero

365. Moment of inertia of ring about its diameter is I. Then, moment of inertia about an axis passing through centre perpendicular to its plane is:
a) 2I b) $\frac{I}{2}$ c) $\frac{3}{2}I$ d) I

366. A thick walled hollow sphere has outer radius R. It rolls down an inclined plane without slipping and its speed at the bottom is v. If the inclined plane is frictionless and the sphere slides down without rolling, its speed at the bottom will be 5 v /4. What is the radius of gyration of the sphere?
a) $\frac{R}{\sqrt{2}}$ b) $\frac{R}{2}$ c) $\frac{3R}{4}$ d) $\frac{\sqrt{3R}}{4}$

367. A uniform sphere of mass 200 gm rolls without slipping on a plane surface so that its centre moves at a speed of 2.00 cm/see, Its KE is:
a) 5.6×10^{-5} J b) 5.6×10^{-4} J c) 5.6×10^{-3} J d) 5.6×10^{-2} J

368. Centre of mass of 3 particles 10 kg, 20 kg and 30 kg is at (0,0,0). Where should a particle of mass 40 kg be placed so that the combined centre of mass will be at(3, 3, 3)?
a) (0,0,0) b) (7.5,7.5,7.5) c) (1,2,3) d) (4,4,4)

369. A circular racetrack of radius 300 m is banked at an angle of 15°. The coefficient of friction between the wheels of a race car and the road is 0.2. The optimum speed of the race car to avoid wear and tear on its tyres is
(Take tan 15° = 0.27, g = 10 m S^{-2})
a) $10\sqrt{3}ms^{-1}$ b) $9\sqrt{10}ms^{-1}$ c) $\sqrt{10}ms^{-1}$ d) $2\sqrt{10}ms^{-1}$

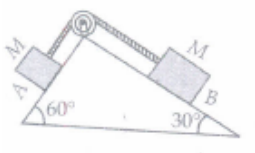
370. A girl press her physics text book against a rough vertical wall with her hand. The direction of the frictional force on the book exerted by the wall is
a) downwards b) upwards c) out from the wall d) into the wall

371. A ring is rolling on a surface without slipping. What is the ratio of its translational to rotational kinetic energies?
a) 5 : 7 b) 2 : 5 c) 2 : 7 d) 1:1

372. An inclined plane makes an angle of 30^o with the horizontal. A ring rolling down this inclined plane from rest without slipping has a linear acceleration equal to:
a) 2g/3 b) g/2 c) g/3 d) g/4

373. The maximum safe speed of a vehicle over a curved road of radius 150 m is 10 ms^{-1}. If the width of road is 7.5 m, the height of the outer edge is:
a) 0.25 m b) 0.50 m c) 0.35 m d) 0.60 m

374. Two blocks each of mass M are resting on a frictionless inclined plane as shown in figure. Then



a) The block A moves down the plane b) The block B moves down the plane.
c) Both the blocks remain at rest d) Both the blocks move down the plane

375. A flywheel rolls down on an inclined plane. At any instant of time, the ratio of rotational kinetic energy to total kinetic energy is:
a) 1 : 2 b) 3 : 1 c) 4 : 3 d) 1 : 3

376. Two particles of equal mass have velocities $\vec{v}_1 = 2\hat{i} ms^{-1}$ and $\vec{v}_2 = 2\hat{j} ms^{-1}$ first particle has an acceleration $\vec{a}_1 = (3\hat{i} + 3\hat{j}) ms^{-2}$ while the acceleration of the two particle is zero. The center of mass of the two particles moves in a path of :
a) straight line b) parabola c) circle d) ellipse

377. All the magnitudes of which of the following can be treated as vectors?
a) Angular displacement b) Average angular velocity c) Instantaneous angular velocity
d) None of the above

378. An elevator and its load weigh a total of 1600 lb. If the elevator, originally moving downwards at 20 ftlsec is brought to rest with constant acceleration in a distance of 50 ft , then tension T in the supporting cable is given by:
a) 1800 poundal b) 1800 pound force c) 57600 pound force d) none of these

379. A rocket of initial mass 1500 kg ejects gas at a constant rate of 10 kg/s with a relative speed of 5 km/s. What is the acceleration of the rocket 50 seconds after the blast, neglecting gravity?
a) 10 ms^{-2} b) 25 ms^{-2} c) 50 ms^{-2} d) 100 ms^{-2}

380. An aircraft executes a horizontal loop at a speed of 720 km h^{-i} with its wings banked at 15°. What is the radius of the loop?
(Take g = 10 m S^{-2}, tan 15° = 0.27)
a) 14.8 km b) 14.8 m c) 29.6 km d) 29.6 m

381. A book of mass 0.5 kg has its length 75 ern and breadth 25 cm. Then the moment of inertia about an axis perpendicular to the book and passing through the centre of gravity ofthc book is:
a) $\frac{10}{289} kg - m^2$ b) $\frac{282}{10} kg - m^2$ c) $\frac{10}{384} kg - m^2$ d) $\frac{10}{483} kg - m^2$

382. (A) A sphere is placed such that is its centre is at origin of coordinate system. If I_x and I_y be the moment of inertia about x-axis and y-axis respectively then moment of inertia about z-axis is $I_x + I_y$.
(R) For any body according to perpendicular axis theorem $i_z = I_x + I_y$.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

383. A child is standing at one end of a long trolley moving with a speed v on a smooth horizontal floor. If the child starts running towards the other end of the trolley with a speed u, the centre of mass of the system (trolley + child) will move with a speed
a) zero b) (v + u) c) (v-u) d) v

384. The earth (mass = 6 x 10^{24}kg) revolves around the sun with an angular velocity of 2 x 10^{-7} radian/see in a circular orbit of radius 1.5 x 10^8 km. The force exerted by the sun, on the earth is:
a) 6 x 10^{19} N b) 18 x 10^{25} N c) 36 x 10^{21} N d) 27 x 10^{39} N

385. A block of mass I kg is placed on a truck which accelerates with an acceleration 5 m/s^2. The coefficient of static friction between the block and the truck is 0.6. The frictional force acting on the block is:
a) 5 N b) 6 N c) 5.88 N d) 4.6 N

386. A body of mass 10 kg is moving with a constant velocity of 10 m/s. When a constant force acts for 4 s on it, it moves with a velocity 2 m/s in the opposite direction. The acceleration produced in it is:
a) 3 m/s^2 b) -3 m/s^2 c) 0.3 m/s^2 d) -0.3 m/s^2

387. Assertion: The moment after a stone is released out of an accelerated train, there is no horizontal force or acceleration on the stone.
Reason: Force on a body at a given time is determined by the situation at the location of the body at that time.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

388. A batsman hits back a ball straight in the direction of the bowler without changing its initial speed of 12 m/s If the mass of the ball is 0.15 kg, find the impulse imparted to the ball (assume linear motion of the ball) :
a) 1.8 Ns b) 3.6 Ns c) 3.6 Nm d) 1.8 Nm

389. When sand is poured on a rotating disc, its angular velocity will:
a) decrease b) increase c) remain constant d) none of these

390. A horizontal platform is rotating with a uniform angular velocity around a vertical axis passing through the centre. At a certain instant of time, a viscous fluid of mass m is dropped at the centre and is allowed to spread out and finally fall. The angular velocity during this period:
a) decreases continuously b) decreases initially and increases again
c) remains unaltered d) increases continuously

391. A body of mass 10 kg is acted upon by two perpendicular forces, 6 N and 8 N. The resultant acceleration of the body is :

a) 1 m s^{-2} at an angle of $\tan^{-1}\left(\frac{3}{4}\right)$ w.r.t. 8 N force.

b) 0.2 m s^{-2} at an angle of $\tan^{-1}\left(\frac{3}{4}\right)$ w.r.t. 8 N force.

c) 1 m s^{-2} at an angle of $\tan^{-1}\left(\frac{4}{3}\right)$ w.r.t. 8 N force.

d) 0.2 m s^{-2} at an angle of $\tan^{-1}\left(\frac{4}{3}\right)$ w.r.t. 8 N force.

392. A cricket mat of mass 50 kg is rolled loosely in the form ofa cylinder of radius 2 m. Now again it is rolled tightly so that the radius becomes $\frac{3}{4}$th of original value; then the ratio of moment of inertia of mat in the two cases is:
a) 1 : 3 b) 4 : 3 c) 16 : 9 d) 3 : 5

393. When a sphere rolls without slipping, the ratio of its kinetic energy of translation to its total kinetic energy is:
a) 1:7 b) 1:2 c) 1:1 d) 5:7

394. (A) Average angular velocity is a scalar quantity.
(R) Large angular displacement ($\triangle\theta$) is a scalar.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

395. A body, possessing kinetic energy T, moving on a rough horizontal surface, is stopped in a distance y. The frictional force exerted on the body is:
a) Ty b) $\frac{\sqrt{T}}{y}$ c) $\frac{T}{y}$ d) $\frac{T}{\sqrt{y}}$

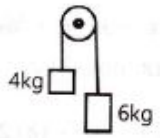
396. A crate with mass 50kg will just slide with uniform speed down a rough ramp at 30° to the horizontal. What is the coefficient of (static) friction?
a) 0.576 b) 0.987 c) 1.157 d) 2.245

397. In conservative force fields, at equilibrium, potential energy:
a) must be maximum b) must be minimum c) must be constant
d) may be maximum or minimum or constant

398. A body of mass m is moving in a circle of radius r with a constant speed u. The work done by the centripetal force in moving the body over half the circumference of the circle is:
a) mu^2r b) zero c) mu^2/r d) r^2/mu^2

399. A system consists of two identical particles. One particle is at rest and the other particle has an acceleration a. The centre of mass of the system has an acceleration of:
a) 2a b) a c) $\frac{a}{2}$ d) $\frac{a}{4}$

400. Two bodies of mass 4kg and 6kg are tied to the ends of a massless string. The string passes over a puliey which is frictionless (see figure). The acceleration of the system in terms of acceleration due to graviry (g) is _____

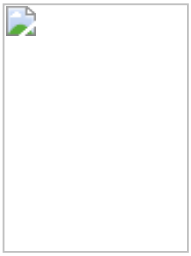


a) g/10 b) g c) g/2 d) g/5

401. A rocket of mass 100 kg bums 0.1 kg of fuel per sec. If velocity of exhaust gas is 1 kmlsec, then it lifts with an acceleration of:
a) 1000 ms^{-2} b) 100 ms^{-2} c) 10 ms^{-2} d) 1 ms^{-2}

402. The force on a rocket moving with a velocity 300 m/s is 210 N. The rate of consumption of fuel of rocket is _____
a) 0.7 kg/s b) 1.4 kg/s c) 0.007 kg/s d) 10.7 kg/s

403. Two masses of 5 kg and 3 kg are suspended with the help of massless inextensible strings as shown in figure. The whole system is going upwards with an acceleration of 2 m s^{-2}. The tensions T_1 and T_2 are respectively (Take g = 10 m s^{-2})



a) 96 N, 36 N b) 36 N, 96 N c) 96 N, 96 N d) 36 N, 36 N

404. A car is going at a speed of 6 m/s when it encounters a 15m slope of angle 30°. The friction coefficient between the road and tyre is 0.5. The driver applies the brakes. The minimum speed of the car with which it can reach the bottom is: (g = 10 m/s ^{2})
a) 4 m/s b) 3 m/s c) 7.49 m/s d) 8.45 m/s

405. A player takes 0.1 see in catching a ball of mass 150 g moving with a velocity of 20 m/s. The force imparted by the ball on the hands of the player is:
a) 0.3 N b) 3 N c) 30 N d) 300 N

406. A stone of mass 1 kg tied to a light inextensible string of length L=$\frac{10}{3}m$ is whirling in a circular path of radius L in a vertical plane. If the ratio of the maximum to the minimum tension in the string is 4 and g = 10 m/s^2, the speed of the stone at the highest point of the circle is:
a) 20 m/s b) 10√3 m/s c) 5√2 m/s d) 10 m/s

407. where do the fragments P and Q hit the ground from the point of projection?
a) R,R b) $\frac{R}{2}, \frac{3R}{2}$ c) $R, \frac{R}{2}$ d) $\frac{R}{2}R$

408. A disc revolves in horizontal plane at a steady rate of 3 rev/so A coinjust remains on the disc ifkept at a distance of 2 cm from the axis of rotation. What is the coefficient of friction between the coin and the disc?
a) 0.5 b) 0.65 c) 0.7 d) 0.75

409. (A) In the case of free fall of the lift, the man will feel weightlessness.
(R) In free fall, acceleration of the lift is equal to acceleration due to gravity.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

410. (A) In javelin throw, the athlete throws the projectile at an angle slightly more than 45°.
(R) The maximum range does not depend upon angle of projection.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

411. A stone of mass 1 kg, tied to the end of a string of length 1m, is whirled in a horizontal circle with a uniform angular velocity of 2 radls. The tension in the string is (in N):
a) 2 b) 1/2 c) 4 d) 1/4

412. Consider the quantities; pressure, power, energy, impulse, gravitational potential, electrical charge, temperature, area. Out of these, the only vector quantities are:
a) impulse, pressure and area b) impulse and area c) area and gravitational potential
d) impulse and pressure

413. A particle of mass 0.3 kg is subjected to a force F = - kx with k =15 N/m. What will be its initial acceleration if it is released from a point 20 em away from the origin?
a) 5 m/s^2 b) 10 m/s^2 c) 3 m/s^2 d) 15 m/s^2

414. A child is standing with his two arms outstretched at the centre of a turntable that is rotating about its central axis with an angular speed ω_0 Now, the child folds his hands back so that moment of inertia becomes 3 times the initial value. The new angular speed is
a) $3\omega_0$ b) $\frac{\omega_0}{3}$ c) $6\omega_0$ d) $\frac{\omega_0}{6}$

415. A solid sphere is rotating in free space. If the radius of the sphere is increased keeping mass same which one -of the following will not be affected?
a) Moment of inertia b) Angular momentum c) Angular velocity
d) Rotational kinetic energy

416. A solid cylinder of mass 3 kg is rolling on a horizontal surface with velocity 4 ms^{-1}. It collides with horizontal spring of force constant 200 Nm^{-1}. The maximum compression produced in the spring will be :
a) 0.7 m b) 0.2 m c) 0.5 m d) 0.6 m

417. (A) In projectile motion, the angle between the instantaneous velocity and acceleration at the highest point is 180°.
(R) At the highest point, velocity of projectile will be in horizontal direction only.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

418. (A) Mass is a property of one object alone, whereas weight results from the interaction of two objects. .
(R) If the weight is measured from a non-inertial frame, the measurement gives an apparent weight instead of the actual weight.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

419. A body of mass 2 kg is projected from the ground with a velocity of 20 m s^{-1} at an angle of 30° with the vertical. If t_1 is the time in seconds at which the body is projected and t_2 is the time in seconds at which it reaches the ground, the change in momentum (in kg ms^{-1}) during the time (t_2 - t_1) is:
a) 40 b) $40\sqrt{3}$ c) $50\sqrt{3}$ d) 60

420. A woman throws an object of mass 500 g with a speed of 25 ms^{-1}. If the object hits a wall and rebounds with half the original speed, what is the change in momentum (in $kg\text{-}ms^{-1}$) of the object?
a) -12.60 b) -18.75 c) -14.28 d) -16.48

421. A particle of mass m is executing oscillations about the origin on the x-axis. Its potential energy is $U(x) = K|x|^3$, where K is a positive constant. If the amplitude of oscillation is a, then its time period T is:
a) proportional to $1/\sqrt{a}$ b) independent of a c) proportional to $\sqrt{a}$ d) proportional to $a^{3/2}$

422. The relation between the time of flight of a projectile T_f and the time to reach the maximum height t_m is :
a) $T_f = 2t_m$ b) $T_f = t_m$ c) $T_f = \frac{t_m}{2}$ d) $T_f = \sqrt{2}\,(t_m)$ e) $T_f = \frac{t_m}{\sqrt{2}}$

423. The coefficient of friction between the tyres and the road is 0.25. The maximum speed with which car can be driven round a curve of radius 40 m without skidding is: (assume g = 10 ms^{-2})
a) 40 ms^{-1} b) 20 ms^{-1} c) 15 ms^{-1} d) 10 ms^{-1}

424. (A) Cream gets separated out of milk when it is churned. It is due to gravitational force.
(R) In all circular motions. centripetal force is provided by gravitational force.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

425. A solid cylinder of mass 20 kg has length 1 m and radius 0.2 m. Then its moment of inertia (in $kg\text{-}m^2$) about its geometrical axis is:
a) 0.8 b) 0.4 c) 0.2 d) 20.2 e) 20.4

426. The angle of projection for which the horizontal range and the maximum height of the projectile are equal is:
a) 45° b) $\theta = \tan^{-1}(4)$ c) $\theta = \tan^{-1}(0.25)$ d) none of these

427. A body of mass m and radius r is released from rest along a smooth inclined plane of angle of inclination θ. The angular momentum of the body about the instantaneous point of contact after a time t from the instant of release is equal to:
a) mgrt $\cos\theta$ b) mgrt $\sin\theta$ c) (3/2) mrgt $\sin\theta$ d) none of these

428. The maximum force of static friction upto which body does not move is called:
a) normal reaction b) coefficient of friction c) limiting friction d) rolling friction

429. A small sphere of radius R rolls without slipping inside a large hemispherical bowl of radius R. The sphere starts from rest at the top point of the hemisphere. What fraction of the total energy is translational when the small sphere is at the bottom of the hemisphere?
a) $\frac{7}{5}$ b) $\frac{2}{7}$ c) $\frac{5}{7}$ d) $\frac{7}{10}$

430. Two blocks of masses 8 kg and 12 kg are connected at the two ends of a light inextensible string. The string passes over a frictionless pulley. The acceleration of the system is
a) $\frac{g}{4}$ b) $\frac{g}{5}$ c) $\frac{g}{8}$ d) $\frac{g}{6}$

431. With what minimum acceleration can a fireman slide down a rope whose breaking strength is $\frac{2}{5}$ of his weight?
a) 1 g b) 0.4 g c) 0.6 g d) 0.8 g

432. A ring starts to roll down the inclined plane of height h without slipping. The velocity with which it reaches the ground is:
a) $\sqrt{\frac{10gh}{7}}$ b) $\sqrt{\frac{4gh}{7}}$ c) $\sqrt{\frac{4gh}{3}}$ d) $\sqrt{2gh}$ e) $\sqrt{gh}$

433. (A) The hard boiled egg and raw egg can be distinguished on the basis of spinning of both.
(R) The moment of inertia of hard boiled egg is more as compared to raw egg.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

434. The driving side belt has a tension of 1600 N and the slack side has 500 N tension. The belt turns a pulley 40 cm in radius at a rate of 300 rpm. This pulley drives a dynamo having 90% efficiency. How many kilowatts are being delivered by the dynamo?
a) 12.4 b) 6.2 c) 24.8 d) 13.77

435. When a body is stationary:
a) there is no force acting on it b) the forces acting on it are not in contact with it
c) the combination of forces acting on it balances each other d) the body is in vacuum

436. A body of mass 20 kg is moving with a velocity of 2u and another body of mass 10 kg is moving with velocity u. The velocity of their centre of mass is:
a) 5v /3 b) 2v /3 c) v d) zero

437. A lift of mass 1000kg is moving with an acceleration of 1 m/s^2 in upward direction. Tension developed in the string, which is connected to the lift, is :
a) 9,800 N b) 10,800 N c) 10,000 N d) 11,000 N

438. A box of mass 50 kg is pulled up on an inclined plane of 12 m long and 2 m high by a constant force of 100 N from rest. It acquires a velocity of2 mls when it reaches the top of the plane. The work done against friction (in joule) is: ($g = 10 m/s^2$)
a) 50 b) 100 c) 150 d) 200

439. A wire of mass m and length I is bent in the form of a circular ring, the moment of inertia of the ring about its axis is:
a) $(\frac{1}{8\pi^2})ml^2$ b) $(\frac{1}{2\pi^2})ml^2$ c) $(\frac{1}{4\pi^2})ml^2$ d) ml^2

440. (A) The direction of the friction force on an object is opposite to the actual motion (kinetic friction) or the impending motion (static friction) of the object relative to the surface with which it is in contact.
(R) Friction force always opposes the motion.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

441. The centre of mass of a body:
a) depends on the choice of co-ordinate system
b) is independent of the choice of co-ordinate system
c) mayor may not depend on the choice of co-ordinate system d) none of the above

442. A block of mass M is placed on a smooth inclined plane of inclination θ. The inclined plane itself is placed in a cabin, which is accelerating upwards at the rate a in a direction making angle θ with the horizontal. What will be the acceleration of the block down the inclined plane?
a) g sin θ - a b) g sin θ + a c) (g -a)sinθ d) (g + a) sin θ

443. A force of 50 dyne is acted on a body of mass 5g which is at rest for an interval of 3 sec; then impulse is:
a) 0.16×10^{-3} N-s b) 0.98×10^{-3} N-s c) 1.5×10^{-3} N-s d) 2.5×10^{-3} N-s

444. (A) During a turn, the value of centripetal force should be less than the limiting frictional force.
(R) The centripetal force is provided by the frictional force between the tyres and the road
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

445. The moment of inertia of a uniform rod about a perpendicular axis passing through one end is I_1. The same rod is bent into a ring and its moment of inertia about a diameter is I_2. Then, $\frac{I_1}{I_2}$ is
a) $\frac{\pi^2}{3}$ b) $\frac{2\pi^2}{3}$ c) $\frac{4\pi^2}{3}$ d) $\frac{8\pi^2}{3}$

446. A metre scale is moving with uniform velocity. This implies
a)
the force acting on the scale is zero and the torque acting about centre of mass of the scale is also zero.
b) the total force acting on it need not be zero but the torque on it is zero.
c) neither the force nor the torque need to be zero.
d)
the force acting on the scale is zero, but a torque about the centre of mass can act on the scale.

447. A machine gun fires a bullet of mass 40 g with a velocity 1200 m s^{-1}. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can he fire per second at the most?
a) One b) Four c) two d) Three

448. (A) In circular motion, work done by centripetal force is zero.
(R) In circular motion, centripetal force is perpendicular to the displacement.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

449. A block is placed on a rough inclined plane of inclination θ = 30^0 If the force to drag it along the plane is to be smaller than to lift it, the coefficient of friction μ should be less than
a) 1/2 b) $\sqrt{3}/2$ c) 2/3 d) $1/\sqrt{3}$

450. A cricket ball of mass 150 g has an initial velocity $\vec{u} = (3\hat{i} + 4\hat{j})$ ms^{-1} and a final velocity $\vec{v} = -(3\hat{i} + 4\hat{j})$ ms^{-1} after being hit. The change in momentum (final momentum - initial momentum) is (in kg ms^{-1})
a) zero b) $-(0.45\hat{i} + 0.6\hat{j})$ c) $-(0.9\hat{i} + 1.2\hat{j})$ d) $-5(\hat{i} + \hat{j})$