CBSE

LAWS OF MOTION WS 1

Class 11 - Physics

1. An army vehicle of mass 1000 kg is moving with a velocity of 10 m/s and is acted upon by a forward force of 1000 N due to the engine and a retarding force of 500 N due to friction. What will be its velocity after 10 s? **[1]**

   a) 10 m/s
   b) 15 m/s
   c) 20 m/s
   d) 5 m/s

2. The momentum of a body is: **[1]**

   a) a vector equal in magnitude to the product of mass and instantaneous velocity and direction being that of instantaneous velocity
   b) a scalar equal in magnitude to the product of mass and velocity
   c) a vector equal in magnitude to the product of mass and average speed and direction being that of velocity
   d) a vector equal in magnitude to the product of mass and acceleration and direction being that of velocity

3. The second law of motion is a vector law. It is equivalent to: **[1]**

   a) Two equations, one for each component of the vectors
   b) One equation, one for each component of the vectors
   c) Three equations, one for each component of the vectors
   d) Four equations, one for each component of the vectors and one for time

4. If μ_s is coefficient of static friction and μ_k is coefficient of kinetic friction, then **[1]**

   a) generally, $\mu_s = \mu_k$
   b) there is no relation between μ_s and μ_k
   c) generally $\mu_s < \mu_k$
   d) generally $\mu_s > \mu_k$

5. A body of mass 5 kg starts from the origin with an initial velocity $\vec{u} = (30\hat{i} + 40\hat{j})$ m/s. 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 **[1]**

   a) 20 s
   b) 5 s
   c) 80 s
   d) 40 s

6. Two racing cars of masses m_1 and m_2 are moving in circles of radii r_1 and r_2 respectively. Their speeds are such that each car makes a complete circle in the same time t. The ratio of the angular speed of the first to the second car is **[1]**

   a) $m_1m_2 : r_1r_2$
   b) $m_1 : m_2$
   c) $r_1 : r_2$
   d) 1 : 1

7. A student unable to answer a question on Newton's laws of motion attempts to pull himself up by tugging on his hair. He will not succeed **[1]**

a) as the force applied is internal to the system

b) as the force exerted is small

c) Newton's law of inertia is not applicable to living beings

d) the frictional force while gripping is small

8. A boy of mass m stands on one end of a wooden plank of length L and mass M. The plank is floating on water. If the boy walks from one end of the plank to the other end at a constant speed, the resulting displacement of the plank is given by **[1]**

a) $\frac{mL}{(M+m)}$

b) $\frac{mL}{(M-m)}$

c) $\frac{mL}{M}$

d) $\frac{ML}{m}$

9. A car of mass m starts from rest and acquires a velocity along east $\boldsymbol{v} = v\hat{\mathbf{i}}$ (V > 0) in two seconds. Assuming the car moves with uniform acceleration, the force exerted on the car is **[1]**

a) $\frac{mv}{2}$ exerted by the engine .

b) more than $\frac{mv}{2}$ eastward exerted due to the engine and overcomes the friction of the road

c) $\frac{mv}{2}$ eastward and is due to the friction on the tyres exerted by the road

d) $\frac{mv}{2}$ eastward and is exerted by the car engine

10. A hemispherical bowl of radius r is set rotating about its axis of symmetry in vertical. A small block kept in the bowl rotates with the bowl without slipping on its surface. If the surface of the bowl is smooth and the angle made by the radius through the block with the vertical is θ, then find the angular speed at which the ball is rotating. **[1]**

a) $\omega = \sqrt{rg\sin\theta}$

b) $\omega = \sqrt{\frac{gr}{\tan\theta}}$

c) $\omega = \sqrt{\frac{gr}{\cos\theta}}$

d) $\omega = \sqrt{\frac{g}{r}\cos\theta}$

11. Two bodies A (of mass 1 kg) and B (of mass 3 kg) are dropped from heights of 16 m and 25 m, respectively. The ratio of the times taken by them to reach the ground is: **[1]**

a) $\frac{5}{4}$

b) $\frac{5}{12}$

c) $\frac{4}{5}$

d) $\frac{12}{5}$

12. A truck and a car are moving with equal velocity. On applying brakes, both will stop after certain distance, then **[1]**

a) truck will cover more distance before stopping

b) both will cover equal distance

c) car will cover less distance before stopping

d) truck will cover less distance before stopping

13. A balloon with mass m 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? **[1]**

a) $\frac{ma}{g+a}$

b) $\frac{ma}{g-a}$

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

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

14. A stone of mass m tied to a string of length l is rotated in a circle with the other end of the string as the centre. The speed of the stone is v. If the string breaks, the stone will **[1]**

a) stop

b) move along tangent

c) move away from the centre

d) move towards the centre

15. A cricket ball of mass 150 g has an initial velocity $\vec{\mathbf{u}} = (3\hat{\mathbf{i}} + 4\hat{\mathbf{j}})\text{ms}^{-1}$ and a final velocity $\vec{\mathbf{v}} = -(3\hat{\mathbf{i}} + 4\hat{\mathbf{j}})\text{ms}^{-1}$ after being hit. The change in momentum (final momentum-initial momentum) is (in kg ms^{-1}). **[1]**

a) $-5(\hat{\mathbf{i}} + \hat{\mathbf{j}})$

b) $-(0.9\hat{\mathbf{i}} + 1.2\hat{\mathbf{j}})$

c) $-(0.45\hat{\mathbf{i}} + 0.6\hat{\mathbf{j}})$

d) zero

16. A man of mass 60 kg records his weight on a weighing machine placed inside a lift. The ratio of the weights of man recorded when lift is ascending up with a uniform speed of 2 m/s to when it is descending down with a uniform speed of 4 m/s will be **[1]**

a) 4

b) 2

c) 1

d) 0.5

17. A 5000 kg rocket is set for vertical firing. The exhaust speed is 800 ms^{-1}. To give an inertial upward acceleration of 20 ms^{-2}, the amount of gas ejected per second to supply the needed thrust will be (g = 10 ms^{-2}) **[1]**

a) 127.5 kgs^{-1}

b) 137.5 kgs^{-1}

c) 185.5 kgs^{-1}

d) 187.5 kgs^{-1}

18. On the centre of a frictionless table, a small hole is made, through which a weightless string of length 2l is inserted. On the two ends of the string, two balls of the same mass m are attached. The arrangement is made in such a way that half of the string is on the table-top and half is hanging below. The ball on the table-top is made to move in a circular path with a constant speed v. What is the centripetal acceleration of the moving ball? **[1]**

a) zero

b) mvl

c) 2 mvl

d) g

19. Force F at a point in space (location of the particle) at a certain instant of time t is: **[1]**

a) related to acceleration **a** at that point at previous instant.

b) related to acceleration **a** at that point at next instant.

c) related to acceleration **a** at previous point at that instant.

d) related to acceleration **a** at that point and the same instant.

20. A particle of mass 10 g moves along a circle of radius of 6.4 cm with a constant tangential acceleration. What is the magnitude of this acceleration if the kinetic energy of the particle becomes equal to 8×10^{-4} J by the end of the second revolution after the beginning of the motion? **[1]**

a) 0.18 m/s^2

b) 0.15 m/s^2

c) 0.2 m/s^2

d) 0.1 m/s^2

21. Suppose the earth suddenly stops attracting objects placed near surface. A person standing on the surface of the earth will **[1]**

a) Either fly up or sink into earth

b) fly up

c) sink into earth

d) remain standing

22. If a ladder weighing 250 N is placed against a smooth vertical wall having a coefficient of friction between it **[1]**

and floor 0.3, then what is the maximum force of friction available at the point of contact between the ladder and the floor?

a) 35 N
b) 75 N
c) 50 N
d) 25 N

23. A spring balance and a physical balance are kept in a lift. In these balances, equal masses are placed. If now the lift starts moving upwards with constant acceleration, then **[1]**

a) the reading of spring balance will decrease and physical balance will remain in equilibrium
b) the reading of spring balance will increase
c) the reading of spring balance will remain unchanged and physical balance will remain in equilibrium
d) the reading of spring balance will increase and the equilibrium position of the physical balance will disturb

24. A lift accelerates upward, then decelerates and stops at higher floor. The apparent weight of the body in the later parts of its motion is **[1]**

a) no change
b) more than actual weight
c) less than actual weight
d) equal to actual weight

25. A bob of mass 0.1 kg hung from the ceiling of a room by a string 2 m long is set into oscillation. The speed of the bob at its mean position is 1 m s^{-1}. What is the trajectory of the bob if the string is cut when the bob is at its mean position? **[1]**

a) bob will fall vertically downwards
b) bob will fall vertically upwards
c) bob will go down in a parabolic path
d) bob will go upwards

26. An ice cube is kept on an inclined plane of angle 30°. Coefficient of kinetic friction between block and inclined plane is $\frac{1}{\sqrt{3}}$. What is acceleration of block? **[1]**

a) 1.5 m/s^2
b) 5 m/s^2
c) 2 m/s^2
d) zero

27. A bullet of mass 10 g is fired from a gun of mass 1 kg. If the recoil velocity is 5 m/s, the velocity of the muzzle is **[1]**

a) 5 m/s
b) 500 m/s
c) 50 m/s
d) 0.05 m/s

28. The maximum speed with which a car can be driven round a curve of radius 18 m without skidding (when g = 10m/s^2 and the coefficient of friction between rubber tyres and the roadway is 0.2) is **[1]**

a) 14.4 km/h
b) 18.0 km/h
c) 21.6 km/h
d) 36.0 km/h

29. In a rocket, fuel burns at the rate of 1 kg/s. This fuel is ejected from the rocket with a velocity of 60 km/s. This exerts a force on the rocket equal to **[1]**

a) 600 N
b) 60000 N

c) 60 N

d) 6000 N

30. A gun fires a bullet of mass 50 g with a velocity of 30 ms^{-1}. Because of this, the gun is pushed back with a velocity of 1 ms^{-1}. The mass of the gun is **[1]**

a) 5.5 kg

b) 1.5 kg

c) 3.5 kg

d) 0.5 kg

31. If the radii of circular paths of two particles of same masses are in the ratio of 6 : 8, then to have a constant centripetal force, their velocities should be in a ratio of **[1]**

a) $\sqrt{3} : 2$

b) $2 : \sqrt{3}$

c) $\sqrt{3} : 4$

d) $4 : \sqrt{3}$

32. A body of mass m is placed on a rough surface with coefficient of friction μ inclined at an angle θ. If the mass is in equilibrium, then **[1]**

a) $\theta = \tan^{-1} \frac{\mu}{m}$

b) $\theta = \tan^{-1} \frac{m}{\mu}$

c) $\theta = \tan^{-1} \frac{1}{\mu}$

d) $\theta = \tan^{-1} \mu$

33. A motor cycle racer takes a round with speed 20 ms^{-1} in a curvature of radius of R = 40m, then the leaning angle of motor cycle for safe turn is (g = 10 ms^{-2}) **[1]**

a) 20°

b) 45°

c) 30°

d) 60°

34. A batsman deflects a ball by an angle of 45^o without changing its initial speed which is equal to 54 km/h. What is the impulse imparted to the ball? (Mass of the ball is 0.15 kg.) **[1]**

a) 4.4 kg ms^{-1}

b) 4.8 kg ms^{-1}

c) 4.6 kg ms^{-1}

d) 4.2 kg ms^{-1}

35. An object of mass 3 kg is at rest. Now a force of $\vec{F} = 6t^2\hat{i} + 4t\hat{j}$ is applied on the object. Then velocity of object at t = 3 is **[1]**

a) $18\hat{i} + 6\hat{j}$

b) $18\hat{i} + 4\hat{j}$

c) $18\hat{i} + 3\hat{j}$

d) $3\hat{i} + 18\hat{j}$

36. A particle of mass m is projected with velocity v making an angle of 45° with the horizontal. When the particle lands on the level ground, the magnitude of the change in its momentum will be **[1]**

a) $\sqrt{2}mv$

b) zero

c) $\frac{mv}{\sqrt{2}}$

d) 2 mv

37. A ball of mass 25 g, moving with a velocity of 2 ms^{-1} is stopped within 5 cm. The average resistance offered to the ball is **[1]**

a) 10 N

b) 2 N

c) 1 N

d) 5 N

38. No force is required for **[1]**

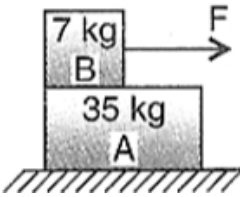
a) an object moving in circular motion

b) an object moving with constant acceleration

c) an object moving in straight line with constant velocity

d) an object moving in elliptical path

39. Block A of mass 35 kg is resting on a frictionless floor. Another block B of mass 7 kg is resting on it as shown in the figure. The coefficient of friction between the blocks is 0.5 while kinetic friction is 0.4. If m_A = 10 kg, m_B = 40 kg and the applied force are 40 N, the acceleration of the block B with respect to block A will be: (g = 10 ms^{-2}) **[1]**



a) 0.5 ms^{-2}

b) zero

c) 2.5 ms^{-2}

d) 0.8 ms^{-2}

40. The coefficient of friction between tyres and the road is 0.1. Find the maximum speed allowed by traffic police for cars to cross a circular turn of radius 10 m to prevent accident. **[1]**

a) 5 ms^{-1}

b) $\sqrt{20}\ ms^{-1}$

c) $\sqrt{10}\ ms^{-1}$

d) 9 ms^{-1}

41. The velocity of a body of rest mass m_0 is $\frac{\sqrt{3}}{2}c$ (where c is the velocity of light in vacuum). Then mass of this body is **[1]**

a) $(\frac{1}{2})m_0$

b) $(\frac{2}{\sqrt{3}})m_0$

c) $(\frac{\sqrt{3}}{2})m_0$

d) $2m_0$

42. A monkey of mass 40 kg climbs on a rope which can stand a maximum tension of 600 N. What is the tension in the rope if the monkey climbs up with a uniform speed of 5 ms^{-1}? **[1]**

a) 400 N

b) 275 N

c) 315 N

d) 206 N

43. The motion of a rocket is based on the principle of conservation of **[1]**

a) linear momentum

b) angular momentum

c) kinetic energy

d) mass

44. A body takes time t to reach the bottom of an inclined plane of angle θ with the horizontal. If the plane is made rough, time taken now is 2t. The coefficient of friction of the rough surface is **[1]**

a) $\frac{2}{3}\tan\theta$

b) $\frac{1}{2}\tan\theta$

c) $\frac{3}{4}\tan\theta$

d) $\frac{1}{4}\tan\theta$

45. Force is required: **[1]**

a) only to keep an object moving

b) only to stop a moving object

c) to start a stationary object and to stop a moving object

d) only to start a stationary object moving

46. A person of mass 60 kg is inside a lift of mass 940 kg and presses the button on control panel. The lift starts **[1]**

moving upwards with an acceleration 1.0 m/s^2. If g = 10 ms^2, the tension in the supporting cable is

a) 8600 N
b) 9680 N
c) 11000 N
d) 1200 N

47. Impulse is: **[1]**

a) the derivative of force over a short period
b) the integral of force over a short period
c) the difference of force over a short period
d) the average of force over a short period

48. For ordinary terrestrial experiments, the observer in an inertial frame in the following cases is **[1]**

a) a child revolving in a giant wheel
b) a cyclist negotiating a sharp curve
c) a driver in a sports car moving with a constant high speed of 200 kmh^{-1} on a straight rod
d) the pilot of an aeroplane which is taking off

49. A 500 kg car takes a round turn of radius 50 m with a velocity of 36 km/h. The centripetal force is **[1]**

a) 1000 N
b) 750 N
c) 1200 N
d) 250 N

50. A marble block of mass 2 kg lying on ice when given a velocity of 6 m/s is stopped by friction in 10 s. Then the coefficient of friction is **[1]**

a) 0.03
b) 0.06
c) 0.02
d) 0.01

51. According to the special theory of relativity, which of the following has same value in all inertial frames? **[1]**

a) Velocity of light
b) Mass of an object
c) Length of an object
d) Velocity of sound

52. If two forces of 5 N each are acting along X- and Y-axes, then the magnitude and direction of the resultant is **[1]**

a) $5\sqrt{2}, \frac{\pi}{4}$
b) $-5\sqrt{2}, \frac{\pi}{3}$
c) $-5\sqrt{2}, \frac{\pi}{4}$
d) $5\sqrt{2}, \frac{\pi}{3}$

53. A body of mass 2kg travels according to the law x(t) = pt + qt^2 + rt^3 where p = 3ms^{-1}, q = 4ms^{-2} and r = 5ms^{-3}. The force acting on the body at t = 2 seconds is **[1]**

a) 68 N
b) 134 N
c) 136 N
d) 158 N

54. If the coefficient of static friction between the tyres and road is 0.5, what is the shortest distance in which an automobile can be stopped when travelling at 72 km/h? **[1]**

a) 40.8
b) 50 m
c) 80.16 m
d) 60 m

55. A 1 kg stationary bomb is exploded in three parts having mass 1 : 1 : 3 respectively. Parts having same mass move in perpendicular direction with velocity 30 m/s, then the velocity of bigger part will be **[1]**

a) $15\sqrt{2}$ m/sec
b) $\frac{10}{\sqrt{2}}$ m/sec

c) $10\sqrt{2}$ m/sec

d) $\frac{15}{\sqrt{2}}$ m/sec

56. A ball strikes a bat with velocity v. The ball has mass m and after striking it retraces its path. What is the impulse imparted by the bat? **[1]**

a) 3 mv

b) zero

c) mv

d) 2 mv

57. A satellite in a force-free space sweeps stationary interplanetary dust at the rate $\frac{dM}{dt} = \beta v$. The acceleration of the satellite is **[1]**

a) $\frac{-\beta v^2}{2M}$

b) $\frac{-M\beta}{v^2}$

c) $-\beta v^2$

d) $\frac{-\beta v^2}{M}$

58. A body of mass 0.40 kg moving initially with a constant speed of 10 ms^{-1} to the north is subject to a constant force of 8.0 N directed towards the south for 30 s. Take the instant the force is applied to be t = 0, the position of the body at that time to be x = 0, and predict its position at t = -100 s **[1]**

a) -67 km

b) -60 km

c) -50 km

d) -55 km

59. In equilibrium of particle when net external force of the particle is zero. Then, the particle is **[1]**

a) moving with uniform velocity

b) at rest

c) Both at rest and moving with uniform velocity

d) moving with uniform acceleration

60. A stream of water flowing horizontally with a speed of 15 ms^{-1} gushes out of a tube of cross-sectional area 10^{-2} m^2 and hits a vertical wall nearby. What is the force exerted on the wall by the impact of water, assuming it does not rebound? **[1]**

a) 2.55×10^3 N

b) 2.75×10^3 N

c) 2.45×10^3 N

d) 2.25×10^3 N

61. A lift is moving downwards with an acceleration equal to the acceleration due to gravity. A body of mass m kept on the floor of the lift is pulled horizontally. If the coefficient of friction is μ, then the frictional resistance offered by the body is **[1]**

a) mg

b) 2μmg

c) zero

d) μmg

62. The S.I unit of force is **[1]**

a) Joule

b) dyne

c) Newton

d) erg

63. A car of mass 1000 kg negotiates a banked curve of radius 90 m on a frictionless road. If the banking angle is 45°, the speed of the car is **[1]**

a) 5 ms^{-1}

b) 30 ms^{-1}

c) 20 ms^{-1}

d) 10 ms^{-1}

64. The rear side of a truck is open and a box of mass 20 kg is placed on the truck 4 m away from the open end. If μ is 0.15 and g is 10 ms^{-2} and the truck starts from rest with an acceleration of 2 ms^{-2} on a straight road, then the box will fall off the truck when it is at a distance of x metre from the starting point. The value of x is **[1]**

a) 8 m
b) 32 m
c) 16 m
d) 4 m

65. A particle revolves round a circular path. The acceleration of the particle is inversely proportional to **[1]**

a) velocity
b) radius
c) mass of particle
d) both velocity and mass of particle

66. A car when passes through a bridge exerts a force on it which is equal to **[1]**

a) $\frac{Mv^2}{r}$
b) $Mg + \frac{Mv^2}{r}$
c) $Mg - \frac{Mv^2}{r}$
d) $Mg.\frac{Mv^2}{r}$

67. An aircraft executes a horizontal loop at a speed of 720 km/h with its wings banked at 15^o. What is the radius of the loop? **[1]**

a) 11 km
b) 17.24 km
c) 14 km
d) 15.24 km

68. Dimensions of impulse are same as that of **[1]**

a) force
b) energy
c) momentum
d) acceleration

69. A 0.5 kg ball moving with a speed of 12 m/s strikes a hard wall at an angle of 30° with the wall. It is reflected with the same speed at the same angle. If the ball is in contact with the wall for 0.25 second, the average force acting on the wall is **[1]**

a) 12 N
b) 96 N
c) 24 N
d) 48 N

70. A car of mass 400 kg is pulling a coach of mass 300 kg with a force of 4500 N. If the coefficient of friction is 0.001, what is tension? **[1]**

a) 1929 N
b) 2100 N
c) 2750 N
d) 2126 N

71. If maximum and minimum values of the resultant of two forces acting at a point are 7 N and 3 N respectively, the smaller force is equal to **[1]**

a) 4 N
b) 2 N
c) 3 N
d) 5 N

72. A man of mass 60 kg and a boy of mass 30 kg are standing together on frictionless ice surface. If they push each other apart, the man moves away with a speed of 0.4 m/s relative to ice. After 5 s they will be away from each other at a distance of **[1]**

a) 9.0 m
b) 6.0 m
c) 30 m
d) 3.0 m

73. A block of mass m slides down with uniform speed on an inclined plane having inclination θ. If the coefficient of friction between the inclined plane and the block is μ, then the contact force between them is **[1]**

a) mg sin θ

b) mg

c) $\sqrt{(mg\sin\theta)^2 + (\mu mg\cos\theta)^2}$

d) mg $\cos\theta\sqrt{1+\mu^2}$

74. A stone of mass 0.25 kg tied to the end of a string is whirled round in a circle of radius 1.5 m with a speed of 40 rev./min in a horizontal plane. What is the tension in the string? **[1]**

a) 6.9 N

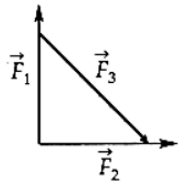
b) 6.3 N

c) 6.6 N

d) 6.1 N

75. Which of the four arrangements in the figure correctly shows the vector addition of two forces F_1 and F_2 to yield the third force F_3? **[1]**

a)



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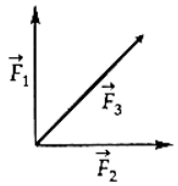

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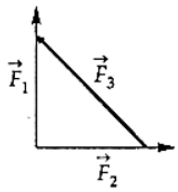

d)