RK VISION ACADEMY

PHYSICS

XI – LAWS OF MOTION

SECTION A

1. Calculate the maximum acceleration of a moving car so that a body lying on the floor of the car remains stationary. The coefficient of static friction between the body and the floor is 0.15 ($g = 10\ m\ s^{-2}$).

(1) 50 m s^{-2}
(2) 1.2 m s^{-2}
(3) 150 m s^{-2}
(4) 1.5 m s^{-2}

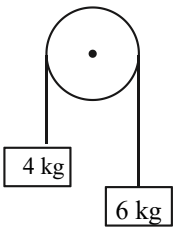
2. A shell of mass m is at rest initially. It explodes into three fragments having mass in the ratio 2 : 2 : 1. If the fragments having equal mass fly off along mutually perpendicular directions with speed v, the speed of the third (lighter) fragment is:

(1) $3\sqrt{2}$ v
(2) v
(3) $\sqrt{2}$ v
(4) $2\sqrt{2}$ v

3. A small block slides down on a smooth inclined plane, starting from rest at time t = 0. Let Sn be the distance travelled by the block in the interval t = n – 1 to t = n. The, the ratio $\frac{S_n}{S_{n+1}}$ is:

(1) $\frac{2n-1}{2n+1}$
(2) $\frac{2n+1}{2n-1}$
(3) $\frac{2n}{2n-1}$
(4) $\frac{2n+1}{2n}$

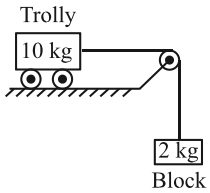
4. Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity is



(1) g/2
(2) g/5
(3) g/10
(4) g

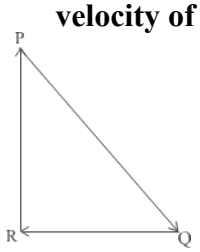
5. Calculate the acceleration of the block and trolly system shown in the figure. The coefficient of kinetic friction between the trolly and the surface is 0.05. ($g = 10\ m/s^2$, mass of the string is negligible and no other friction exists).

(1) 1.50 m/s^2
(2) 1.66 m/s^2
(3) 1.00 m/s^2
(4) 1.25 m/s^2



6. A particle moving with velocity V is acted by three forces shown by the vector triangle PQR. The velocity of the particle will:

(1) Increase
(2) Decrease
(3) Remain constant
(4) Change according to the smallest force



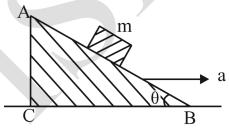
7. A block of mass 10 kg is in contact against the inner wall of a hollow cylindrical drum of radius 1m. The coefficient of friction between the block and the inner wall of the cylinder is 0.1. The minimum angular velocity needed for the cylinder to keep the block stationary when the cylinder is vertical and rotating about its axis, will be:

(1) $\sqrt{10}$ rad/s
(2) $\frac{10}{2\pi}$ rad/s
(3) 10 rad/s
(4) 10π rad/s

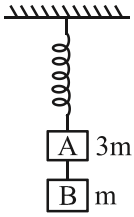
8. **Which one of the following statements is incorrect?**
(1) Frictionless force opposes the relative motion.
(2) Limiting value of static friction is directly proportional normal reaction
(3) Rolling friction is smaller than sliding friction
(4) Coefficient of sliding friction has dimensions of length.

9. **A moving block having mass m, collides with stationary block having mass 4m. The lighter block comes to rest after collision. When the initial velocity of the lighter block is v, then the value of coefficient of restitution(e) will**
(1) 0.8
(2) 0.25
(3) 0.5
(4) 0.4

10. **A block of mass m is placed on a smooth inclined wedge ABC of inclination θ as shown in the figure. The wedge is given an acceleration 'a' towards the right. The relation between a and θ for the block to remain stationary on the wedge is:**
(1) a = g cos θ
(2) a = g/ sin θ
(3) a =g/cosec θ
(4) a = g tan θ



11. **Two blocks A and B of masses 3 m 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:**
(1) g, g/3
(2) g, g
(3) g/3, g/3
(4) g/3, g



12. **One end of string of length l is connected to a particle of mass 'm' and the other end is connected to a small peg on a smooth horizontal table. If the particle moves in circle with speed 'v', the net force on the particle (directed towards center) will be: (T represents the tension in the string)**
(1) $T + mv^2/l$
(2) $T - mv^2/l$
(3) Zero
(4) T

13. **A girl jumps down from a moving bus, along the direction of motion of the bus, tilting slightly forward. She falls on (A) a sheet of ice (B) a patch of glue.**
(1) In case (A) she falls backward and in case (B) she falls forward
(2) In both cases (A) and (B) she falls forward
(3) In both cases (A) and (B) she falls backward
(4) In case (A) she falls forward and in case (B) she falls backward

14. **A cyclist on a level road takes a sharp circular turn of radius 3 m ($g = 10\ ms^{-2}$). If the coefficient of static friction between the cycle tyres and the road is 0.2, at which of the following speeds will the cyclist not skid while taking the turn?**
(1) 14.4 km h^{-1}
(2) 8.8 km h^{-1}
(3) 9 km h^{-1}
(4) 10.8 km h^{-1}

15. **A car is negotiating a curved road of radius R. The road is banked at an angle θ. The coefficient of friction between the tyres of the car and the road is μ_s. The maximum safe velocity on this road is:**
(1) $\sqrt{gR^2\frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$
(2) $\sqrt{gR^1\frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$

(3) $\sqrt{\frac{g\mu_s + \tan\theta}{R - \mu_s \tan\theta}}$

(4) $\sqrt{\frac{g}{R^2}\frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$

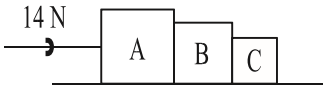
16. Three blocks A, B and C of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a friction less surface, as shown. If a force of 14 N is applied on the 4 kg block, then the contact force between A and B is:

(1) 6 N

(2) 8 N

(3) 18 N

(4) 2 N



17. 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 friction between the block and table is μ_k. When the block A is sliding on the table, the tension in the string is:

(1) $\frac{(m_2 - \mu_k m_1)g}{(m_1 + m_2)}$

(2) $\frac{m_1 m_2 (1 + \mu_k)g}{(m_1 + m_2)}$

(3) $\frac{m_1 m_2 (1 - \mu_k)g}{(m_1 + m_2)}$

(4) $\frac{(m_2 + \mu_k m_1)g}{(m_1 + m_2)}$

18. Two stones of masses m and 2 m are whirled in horizontal circles, the heavier one in a radius r/2 and the lighter one in radius r. The tangential speed of lighter stone is n times that of the value of heavier stone when they experience same of motion of the bus, tilting slightly forward. She falls on centripetal forces. The value of n is:

(1) 1

(2) 2

(3) 3

(4) 4

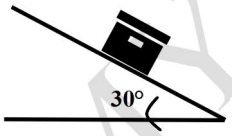
19. A plank with a box on it at one end is gradually raised about the other end. As the angle of inclination with the horizontal reaches 30°, the box starts to slip and slides 4.0 m down the plank in 4.0 s. The coefficients of static and kinetic friction between the box and the plank will be, respectively,

(1) 0.4 and 0.3

(2) 0.6 and 0.6

(3) 0.6 and 0.5

(4) 0.5 and 0.6



20. When a body is stationary :

(1) there is no force acting on it

(2) the forces acting on its are not in contact with it

(3) the combination of forces acting on it balance each other

(4) the body is in vacuum

21. 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) 2ma / g + a

(2) 2ma / g – a

(3) ma / g + a

(4) ma / g – a

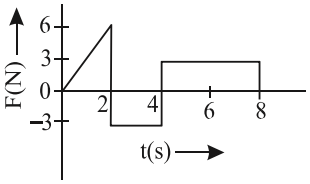
22. The force F acting on a particle of mass m is indicated by the force-time graph shown. The change in momentum of the particle over the time interval from zero to 8 s is:

(1) 24 Ns

(2) 20 Ns

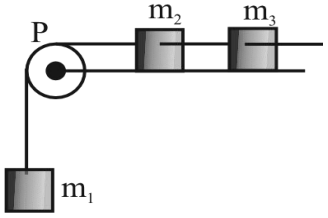
(3) 12 Ns

(4) 6 Ns



23. A system consists of three masses m_1, m_2 and m_3 is connected by a string passing over a pulley P. The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction

= μ). The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is:
(Assume $m_1 = m_2 = m_3 = m$)

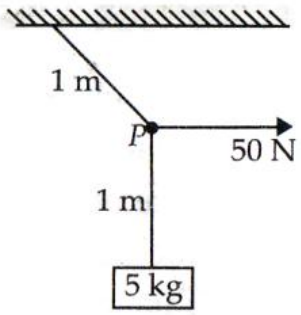


(1) g (1 - μ g) / 9
(2) 2g μ / g
(3) g (1 - 2μ) / 3
(4) g (1 - 2μ) / 2

24. 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
(1) 180 N
(2) 220 N
(3) 270 N
(4) 320 N

25. A body of mass 3 kg hits a wall at an angle of 60° and returns at the same angle. The impact time was 0.2 sec. The force exerted on the wall
(1) 150 3 N
(2) 50 3 N
(3) 100 N
(4) 75 3 N

26. 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})



(1) 30°
(2) 40°
(3) 60°
(4) 45°

27. A body subjected to three concurrent forces is found to be in equilibrium. The resultant of any two forces
(1) is equal to third force.
(2) is opposite to third force
(3) is collinear with the third force
(4) all of these

28. Which of the following sets of concurrent forces may be in equilibrium?
(1) $F_1 = 3N, F_2 = 5N, F_3 = 9N$
(2) $F_1 = 3N, F_2 = 5N, F_3 = 1N$
(3) $F_1 = 3N, F_2 = 5N, F_3 = 15N$
(4) $F_1 = 3N, F_2 = 5N, F_3 = 6N$

29. 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
(1) 16 cm s^{-1}
(2) 8 cm s^{-1}
(3) 8 m s^{-1}
(4) 16 m s^{-1}

30. 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 newtons and t in seconds. The force on the bullet becomes zero as soon as it leaves the barrel. What is the average impulse imparted to the bullet?
(1) 9 Ns
(2) Zero
(3) 0.9 Ns

(4) 1.8 Ns

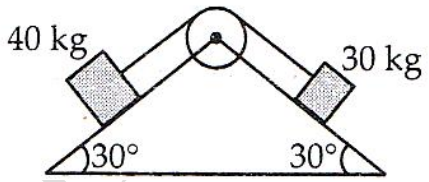
31. A shell of mass m moving with velocity v suddenly breaks into 2 pieces. The part having mass m/4 remains stationary. The velocity of the other shell will be

(1) v
(2) 2 v
(3) 3/4 v
(4) 4/3 v

32. The rate of mass of the gas emitted from the rear of a rocket is initially 0.1 kg/s. If the speed of the gas relative to the rocket is 50 m/s and the mass of the rocket is 2 kg, then the acceleration of the rocket in m/s^2 is

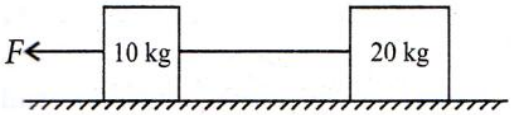
(1) 5
(2) 5.2
(3) 2.5
(4) 25

33. (a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.
(b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion
(c) Assertion is correct, reason is incorrect
(d) Assertion is incorrect, reason is correct



(1) 0.7 m s^{-2}
(2) 0.8 m s^{-2}
(3) 0.6 m s^{-2}
(4) 0.5 m s^{-2}

34. 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



(1) 100 N
(2) 200 N
(3) 300 N
(4) 400 N

35. A lift is moving up with an acceleration of 4 m/s^2. If g = 10 m/s^2. The weight of the man is

(1) increased by 25%
(2) increased by 40%
(3) decreased by 20%
(4) decreased by 40%

SECTION B

36. A uniform metal chain is placed on a rough table such that one end of it hangs down over the edge of the table. When one-third of its length hangs over the edge, the chain starts sliding. Then, the coefficient of static friction is:

(1) 3/4
(2) 1/4
(3) 2/3
(4) 1/2

37. Which of the following statements are incorrect?

i) If there were no friction, work need to be done to move a body up an inclined plane is zero.
ii) If there were no friction, moving vehicles could not be stopped even by locking the brakes.
iii)As the angle of inclination is increased, the normal reaction on the body placed on it increases.
iv)A duster weighing 0.5 kg is pressed against a vertical board with a force of 11 N. If the coefficient of friction is 0.5, the work done in rubbing it upward through a distance of 10 cm is 0.55 J.

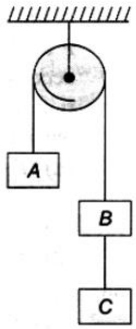
(1) (i) and (ii)
(2) (i), (ii) and (iv)
(3) (ii) and (iii)
(4) None of these

38. 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. The force of friction on the block if the acceleration of the truck is 5 ms^{-2} is:
1) 5.88 N
2) 5 N
3) 0.88 N
4) 10.88 N

39. A block of wood resting on an inclined plane of angle 30^o, just starts moving down. If the coefficient of friction is 0.2, its velocity (in ms-1) after 5 seconds is: ($g = 10\ ms^{-2}$)
1) 12.75
2) 16.34
3) 18.25
4) 20

40. A person of mass 60 kg is inside a lift of mass 940 kg and presses the button on control panel. The lift starts moving upwards with an acceleration 1.0 m/s2. If $g = 10\ m\ s^{-2}$, the tension in the supporting cable is
(1) 8600 N
(2) 9680 N
(3) 11000 N
(4) 1200 N

41. Three equal weights A, B, C of mass 2 kg each are hanging on a string passing over a fixed frictionless pulley as shown in the figure. The tension in the string connecting weights B and C is :



(1) zero
(2) 13 N
(3) 3.3 N
(4) 19.6 N

42. A block of mass M is pulled along horizontal frictionless surface by a rope of mass 'm'. Force P is applied at one end of the rope. The force exerted by the rope on the block is
(1) $F = \frac{PM}{M+m}$
(2) $F = \frac{Pm}{M+m}$
(3) $F = \frac{P}{M+m}$
(4) None

43. A painter is raising himself and the crate on which he stands with an acceleration of 5 m/s^2 by a massless rope and pulley arrangement. Mass of the painter is 100 kg and that of the crate is 50 kg. If g = 10 m/s^2, then the
(i) tension in the rope is 2250 N
(ii) tension in the rope is 1125 N
(iii) force of contact between the painter and the floor is 750 N
(iv) force of contact between the painter and the floor is 375 N
(1) (i), (iii)
(2) (ii), (iv)
(3) (i), (iv)
(4) (ii), (iii)

44. If a body is in equilibrium under a set of noncollinear forces, then the minimum number of forces has to be

(1) Four
(2) Three
(3) Two
(4) Five

45. The relation F = ma, cannot be deduced from Newton's second law, if
(1) force depends on time
(2) momentum depends on time
(3) acceleration depends on time
(4) mass depends on time

46. We can derive Newton's
(1) second and third laws from the first law.
(2) first and second laws from the third law.
(3) third and first laws from the second law.
(4) all the three laws are independent of each other.

47. A constant force acting on a body of mass of 5 kg change its speed from 5 m s^{-1} in 10 s without changing the direction of motion. The force acting on the body is
(1) 1.5 N
(2) 2 N
(3) 2.5 N
(4) 5 N

48. A particle at rest suddenly disintegrates into two particles of equal masses which start moving. The two fragments will :
(1) move in same direction with equal speeds
(2) move in any direction with any speed
(3) move in opposite directions with equal speeds
(4) move in opposite directions with unequal speeds

49. Two bodies of mass 4 kg and 6 kg are attached to the ends of a string passing over a pulley. the 4 kg mass is attached to the table top by another string. The tension in this string T_1 is equal to : Take g = 10 m/s^2
(1) 20 N
(2) 25 N
(3) 10.6 N
(4) 10 N

50. When a horse pulls a wagon, the force that causes the horse to move forward is the force:
1) the ground exerts on it
2) it exerts on the ground
3) the wagon exerts on it
4) it exerts on the wagon

RK VISION ACADEMY

PHYSICS

XI – LAWS OF MOTION

SECTION A

1.	4
2.	4
3.	1
4.	2
5.	4
6.	3
7.	3
8.	4
9.	2
10.	4
11.	4
12.	4
13.	2
14.	2
15.	2
16.	1
17.	2
18.	2
19.	3
20.	3
21.	1
22.	3
23.	3
24.	3
25.	3
26.	4
27.	4
28.	4
29.	1
30.	3
31.	4
32.	3
33.	1
34.	4
35.	2

SECTION B

36.	4
37.	4
38.	2
39.	2
40.	3
41.	2
42.	1
43.	2
44.	2
45.	4
46.	3
47.	1
48.	3
49.	1
50.	1