ETERNAL CAREER CLASSES

Laws of Motion

1. 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

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

3. A body of mass 0.4kg starting at origin at t = 0 with a speed of 10 ms^{-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

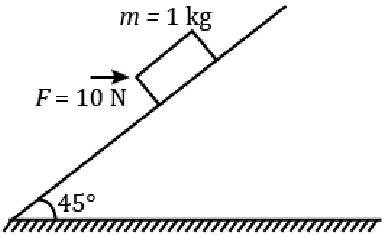
4. A machine gun fires a bullet of mass 40 g with a velocity 1200 ms^{-1}. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can he fire per second at the most ?
(a) one (b) four
(c) two (d) three

5. A gardener waters the plants by a pipe of diameter 1mm. The water comes out at the rate or 10cm^3/sec. The reactionary force exerted on the hand of the gardener is :
(a) Zero (b) 1.27×10^{-2}N
(c) 1.27×10^{-4}N (d) 0.127 N

6. A 100 g iron ball having velocity 10m/s collides with a wall at an angle 30° and rebounds with the same angle. If the period of contact between the ball and wall is 0.1 second, then the force experienced by the wall is :
(a) 10 N (b) 100 N
(c) 1.0 N (d) 0.1 N

7. A constant force starts acting on a body of mass m at rest. The velocity v acquired in traveling a specific distance depends on m as :
(a) $v \propto \frac{1}{m}$ (b) $v \propto \frac{1}{\sqrt{m}}$
(c) $v \propto m$ (d) $v \propto \sqrt{m}$

8. A body of mass 1 kg lies on smooth inclined plane. The block of mass m is given force F = 10 N horizontally as shown. The magnitude of net normal reaction on the blocks is :



(a) $10\sqrt{2}\,N$ (b) $\frac{10}{\sqrt{2}}N$

(c) 10 N (d) none of these

9. Which of the following sets of concurrent forces may be in equilibrium ?

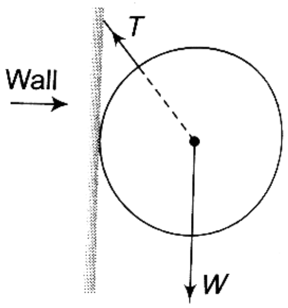
(a) $F_1 = 3$ N, $F_2 = 5$ N, $F_3 = 9$ N

(b) $F_1 = 3$ N, $F_2 = 5$ N, $F_3 = 1$ N

(c) $F_1 = 3$ N, $F_2 = 5$ N, $F_3 = 15$ N

(d) $F_1 = 3$ N, $F_2 = 5$ N, $F_3 = 6$ N

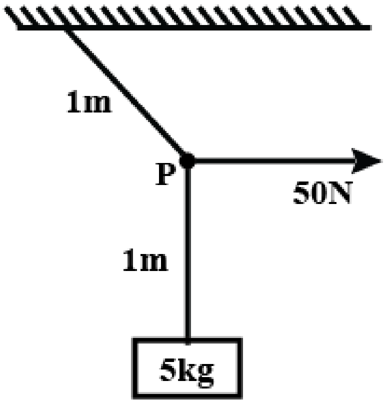
10. A uniform sphere of weight W and radius 3 m is being held by a string of length 2 m. attached to a frictionless wall as shown in the figure. The tension in the string will be :



(a) 5 W/4 (b) 15 W/4

(c) 15 W/16 (d) none of these

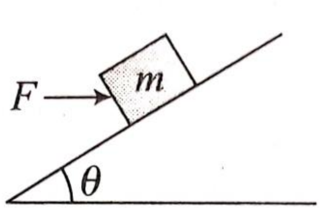
11. A block of mass 5 kg is suspended by a massless rope of length 2 m from the ceiling. A force of 50 N is applied in the horizontal direction at the midpoint P of the rope, as shown in the figure. The angle made by the rope with the vertical in equilibrium is (take g = 10 ms^{-2}) m



(a) 30° (b) 40°

(c) 60° (d) 45°

12. A horizontal force acting on a block of mass m which is placed on an inclined plane (as shown in the figure). What is the normal reaction N on the block ?



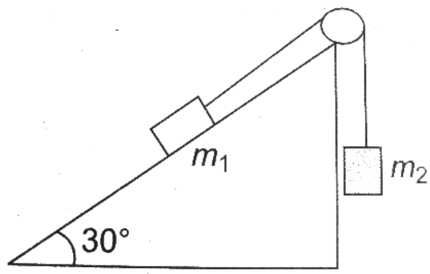
(a) mg sinθ + F cosθ

(b) mg cosθ – F sinθ

(c) mg cosθ + F sinθ

(d) mg sinθ – F cosθ

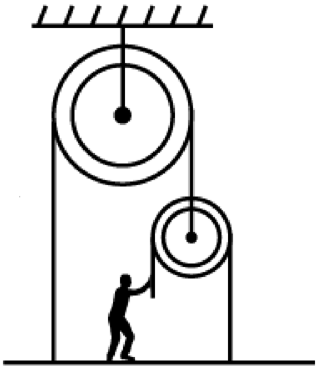
13. M is a fixed wedge. Masses m_1 and m_2 are connected by a light string. The wedge is smooth and the pulley is smooth and fixed. m_1 = 10 kg and m_2 = 7.5 kg. When m_2 is just released, the distance it will travel in 2 seconds is



(a) 2.8 m (b) 7.5 m

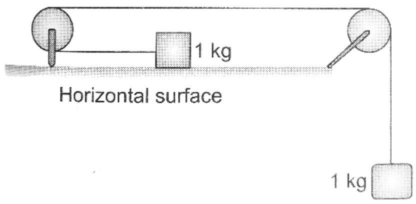
(c) 4.0 m (d) 6.0 m

14. In the given diagram, with what force must the man pull the rope to hold the plank in position ? Mass of the man is 80 kg. Neglect the weights of plank, rope and pulley. Take g = 10 ms^{-2}



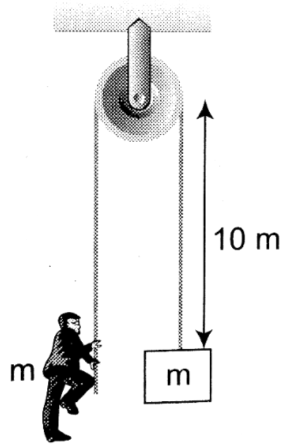
(a) 200 N (b) 300 N
(c) 600 N (d) 150 N

15. Consider the system as shown in the figure. The pulley and the string are light and all the surfaces are frictionless. The tension in the string is (g = 10m/s^2)



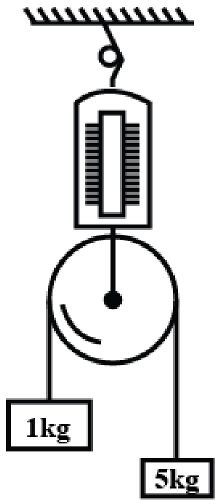
(a) 0 N (b) 1 N
(c) 2 N (d) 5 N

16. A body and a block, both of same mass, are suspended at the same horizontal level, from each end of a light string that moves over a frictionless pulley as shown. The body starts moving upwards with an acceleration 2.5 m/s^2 relative to the rope. If the block is to travel a total distance 10 m before reaching at the pulley, the time taken by the block in doing so is equal to :



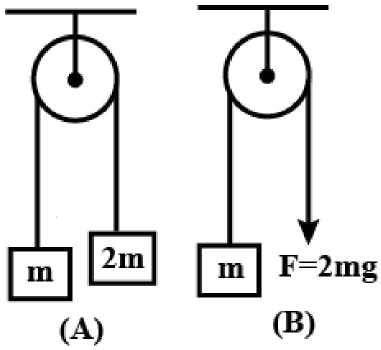
(a) $\sqrt{8}$ s (b) 4 s
(c) $10/\sqrt{2}$ s (d) 8 s

17. Two masses of 1 kg and 5 kg are attached to the ends of a massless string passing over a pulley of negligible weight. The pulley itself is attached to a light spring balance as shown in figure. The masses start moving during this interval; the reading of spring balance will be :



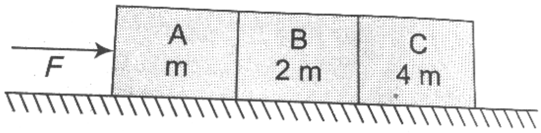
(a) more than 6 kg
(b) less than 6 kg
(c) equal to 6 kg
(d) none of the above

18. Figure shows two pulley arrangements for lifting a mass m. In case-A, the mass is lifted by attaching a mass 2m while in case-2 the mass is lifted by pulling the other end with a downward force F =2mg, If a_a and a_b are the accelerations of the two masses then (Assume string is massless and pulley is ideal)



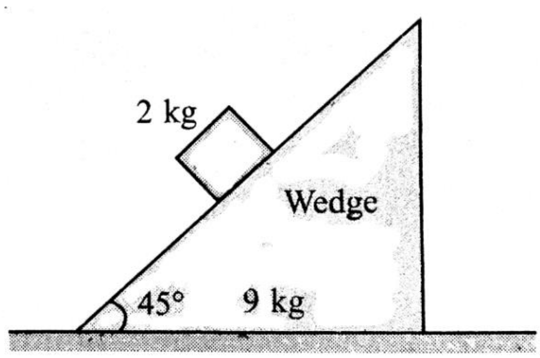
(a) $a_a = a_b$ (b) $a_a = a_b/2$
(c) $a_a = a_b/3$ (d) $a_a = 2a_b$

19. A force F is applied on block A as shown in figure. The contact force between the blocks A and B and between the blocks B and C respectively are (Assume frictionless surface)



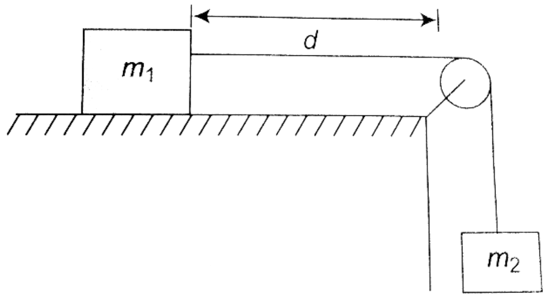
(a) $\frac{F}{7}, \frac{2F}{7}$ (b) $\frac{6F}{7}, \frac{4F}{7}$
(c) $F, \frac{F}{2}$ (d) $\frac{4F}{7}, \frac{6F}{7}$

20. A block of mass 2 kg slides down the face of a smooth 45° wedge of mass 9kg as shown in figure. The wedge is placed on a frictionless horizontal surface. Determine the acceleration of the wedge.



(a) 2 m/s^2 (b) $\frac{11}{\sqrt{2}}$ m/s^2
(c) 1 m/s^2 (d) none of these

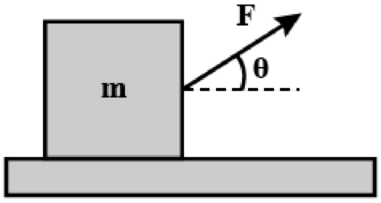
21. A block of mass m_1 lies on a smooth horizontal table and is connected to another freely hanging block of mass m_2 by a light inextensible string passing over a smooth fixed pulley situated at the edge of the table. Initially the system is at rest with m_1 a distance d from the pulley. Then the time taken for m_1 to reach the pulley is :



(a) $\frac{m_2 g}{m_1+m_2}$ (b) $\sqrt{\frac{2d(m_1+m_2)}{m_2 g}}$
(c) $\sqrt{\frac{2m_2 d}{(m_1+m_2)g}}$ (d) None of these

22. A body of mass 2kg is at rest on a horizontal table. The coefficient of friction between the body and the table is 0.3. A force of 5N is applied on the body. The acceleration of the body is
(a) 0 ms^{-2} (b) 2.5 ms^{-2}
(c) 5 ms^{-2} (d) 7.5 ms^{-2}

23. In previous questions, if we pull the block by the force F making an angle θ and the block remains stationary, the value of friction force is :



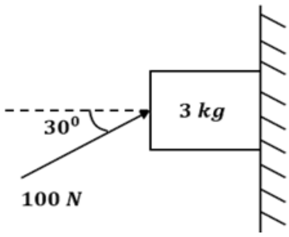
(a) μmg (b) F cos θ
(c) $\frac{\mu mg}{\sin\theta + \mu\cos\theta}$ (d) $\frac{\mu mg}{\sqrt{1+\mu^2}}$

24. In previous question, if a horizontal force F = μ mg/2 acts on the block and the block remains stationary, then tension in string is :

(a) zero (b) $\frac{3\mu mg}{2}$

(c) $\frac{\mu mg}{2}$ (d) None of these

25. A force of 100N is applied on a block of mass 3kg as shown in the figure. The coefficient of friction between the surface and the block is $\mu = \frac{1}{\sqrt{3}}$. The frictional force acting on the block is :



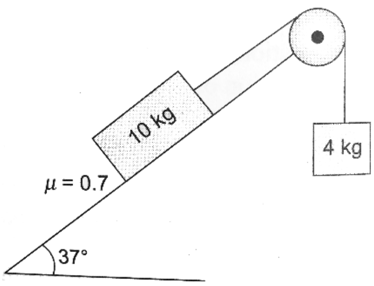
(a) 15 N downwards
(b) 25 N upwards
(c) 20 N downwards
(d) 30 N upwards

26. A block of mass 1 kg is at rest on a horizontal table. The coefficient of static friction between the block and the table is 0.5. The magnitude of the force acting upwards at an angle of 60° from the horizontal that will just start the block moving is :

(a) 5 N (b) $\frac{20}{2+\sqrt{3}}N$

(c) $\frac{20}{2-\sqrt{3}}N$ (d) 10 N

27. In the arrangement shown in the figure [sin 37° = 3/5]



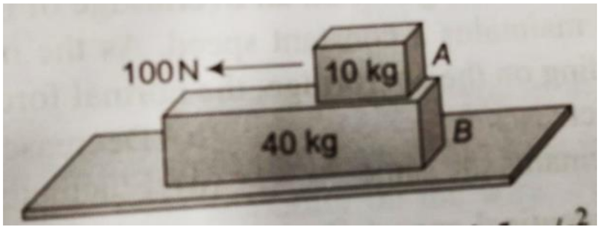
(a) direction of force of friction is up the plane
(b) the magnitude of force of friction is zero
(c) the tension in the string is 20 N
(d) magnitude of force of friction is 56 N

28. A small mass slides down an inclined plane of inclination θ with the horizontal. The coefficient of friction is $\mu = \mu_0 x$ where x is the distance through which the mass slides down and μ_0, a constant. Then the speed is maximum after the mass covers a distance of :

(a) $\frac{\cos\theta}{\mu_0}$ (b) $\frac{\sin\theta}{\mu_0}$

(c) $\frac{\tan\theta}{\mu_0}$ (d) $\frac{2\tan\theta}{\mu_0}$

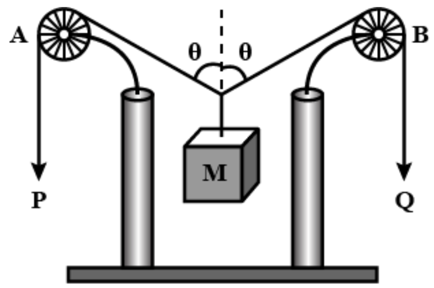
29. A 40 kg slab rests on a frictionless floor as shown in the figure. A 10 kg block rests on the top of the slab. The static coefficient of friction between the block and slab is 0.60 while the kinetic friction is 0.40. The 10 kg block is acted upon by a horizontal force 100 N. If g = 9.8 m/s^2, the resulting acceleration of the slab will be :



(a) 1 m/s^2 (b) 1.5 m/s^2

(c) 2 m/s^2 (d) 6 m/s^2

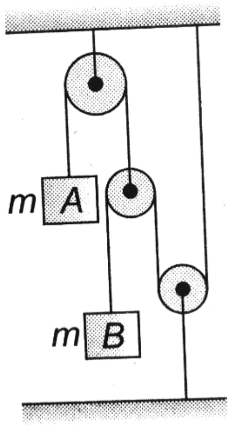
30. In the arrangement shown in figure the ends P and Q of an non-stretchable string move downwards with uniform speed U. Pulleys A and B are fixed. Mass M moves upwards with a speed



(a) 2U cos θ (b) U cos θ

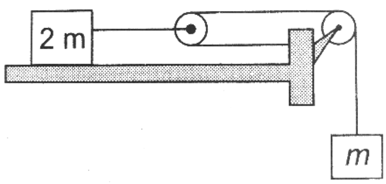
(c) $\frac{2U}{\cos\theta}$ (d) $\frac{U}{\cos\theta}$

31. In the arrangement shown, the pulleys and the strings are ideal. The acceleration of block B is :



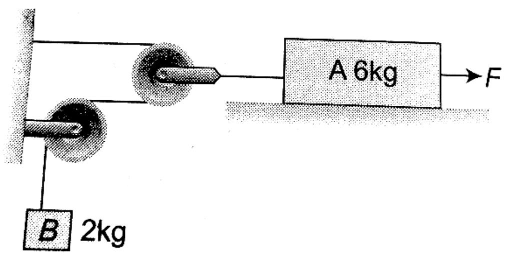
(a) g/5 (b) g/2
(c) 2g/5 (d) 2g/3

32. Consider the situation shown in figure. All the surface are smooth. The tension in the string connected to 2m is :



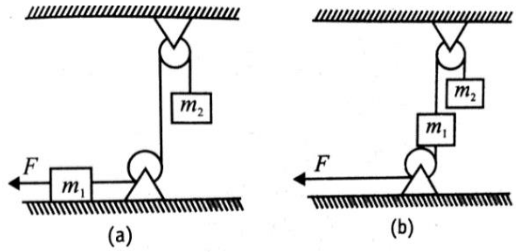
(a) $\frac{mg}{3}$ (b) $\frac{4mg}{3}$
(c) $\frac{2mg}{3}$ (d) mg

33. The system starts from rest and A attains a velocity of 5m/s after it has moved 5m towards right. Assuming the arrangement to be frictionless everywhere and pulley and strings to be light, the value of the constant force F applied on A is :



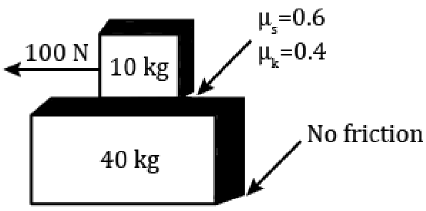
(a) 50 N (b) 75 N
(c) 100 N (d) 96 N

34. The ratio of tensions in the string connected to the block of mass m_2 in figure-(i) and figure-(ii) respectively is (friction is absent everywhere): [m_1 = 50 kg, m_2 = 80 kg and F = 1000 N]



(a) 7 : 2 (b) 2 : 7
(c) 3 : 4 (d) 4 : 3

35. A 40 kg slab rests on a frictionless floor. A 10kg block rests on top of the slab. The static coefficient of friction between the block and the slab is 0.60 while the kinetic coefficient of friction is 0.40. The 10 kg block is acted upon by a horizontal force of 100 N. The resulting acceleration of the slab will be :



(a) 1.5 ms^{-2} (b) 2.0 ms^{-2}
(c) 10 ms^{-2} (d) 1.0 ms^{-2}

36. A 30 gm bullet initially travelling at 120 m/s penetrates 12 cm into a wooden block. The average resistance exerted by the wooden block is :

(a) 2850 N (b) 2200 N
(c) 2000 N (d) 1800 N

37. A player caught a cricket ball of mass 150 gm moving at a rate of 20 m/s. IF the catching process be completed in 0.1 s, then the force of the blow exerted by the ball on the hands of the player is :

(a) 0.3 N (b) 30 N
(c) 300 N (d) 3000N

38. Two bodies of mass 3kg and 4 kg are suspended at the ends of massless string passing over a frictionless pulley. The acceleration of the system is (g = 9.8 m/s^2)

(a) 4.9 m/s^2 (b) 2.45 m/s^2
(c) 1.4 m/s^2 (d) 9.5 m/s^2

39. A man weighing 80 kg is standing in a trolley weighting 320 kg. The trolley is resting on frictionless horizontal rails. If the man starts walking on the trolley with a speed of 1 m/s, then after 4sec his displacement relative to the ground will be :

(a) 5 m (b) 4.8 m
(c) 3.2 m (d) 3.0 m

40. A lift of mass 1000 kg 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) 9800 N (b) 10000 N
(c) 10800 N (d) 11000 N

41. 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 ? (g = 10 m/s^2)

(a) 10 m/s^2 (b) 25 m/s^2
(c) 2.5 m/s^2 (d) 5 m/s^2

42. Sand is being dropped on a conveyor belt at the rate of M kg/s. The force necessary to keep the belt moving with a constant velocity of *v* m/s will be

(a) Mv newton (b) 2 Mv newton
(c) $\frac{Mv}{2}$ newton (d) zero

43. A body, under the action of a force $\vec{F} = 6\hat{\imath} - 8\hat{\jmath} + 10\hat{k}$, acquires an acceleration of 1 ms^{-2}. The mass of this body must be

(a) $2\sqrt{10}$ kg (b) 10 kg
(c) 20 kg (d) $10\sqrt{2}$ kg

44. The mass of a lift is 2000 kg. When the tension in the supporting cable is 28000 N, then its acceleration is

(a) 30 ms^{-2} downwards
(b) 4 ms^{-2} upwards
(c) 4 ms^{-2} downwards
(d) 14 ms^{-2} upwards

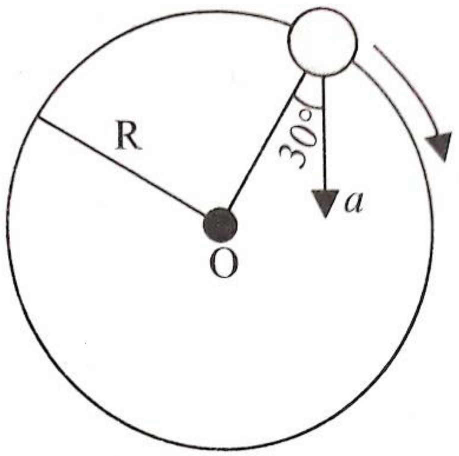
45. A person of mass 60kg is inside a lift of mass 940 kg and presses the button on control panel. The lift starts moving upwards with an acceleration 1.0 m/s^2. If g = 10 m/s^2, the tension in the supporting cable is

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

46. A stone is dropped from a height h. It hits the ground with a certain momentum P. If the same stone is dropped from a height 100% more than the previous height the momentum when it hits the ground will change by

(a) 68% (b) 41%
(c) 200% (d) 100%

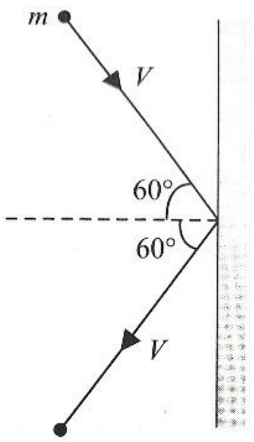
47. In the given figure, a = 15 m/s^2 represents the total acceleration of a particle moving in the clockwise direction in a circle of radius R = 2.5 m at a given instant of time. The speed of the particle is



(a) 5.7 m/s (b) 6.2 m/s

(c) 4.5 m/s (d) 50 m/s

48. A rigid ball of mass *m* strikes a rigid wall at 60° and gets reflected without loss of speed as shown in the figure below. The value of impulse imparted by the wall on the ball will be



(a) $\frac{mV}{2}$ (b) $\frac{mV}{3}$

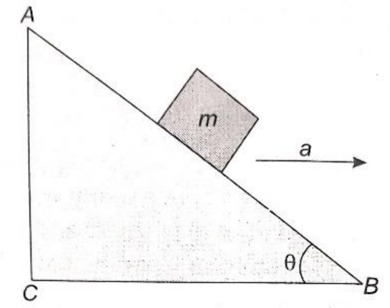
(c) mV (d) 2mV

49. A spring of force constant k is cut into lengths of ratio 1 : 2 : 3. They are connected in series and the new force constant is k'. Then they are connected in parallel and force constant is k. Then k' : k" is :

(a) 1 : 9 (b) 1 : 11

(c) 1 : 14 (d) 1 : 16

50. 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



(a) a = g tan θ (b) a = $\frac{g}{cosec\theta}$

(c) a = cos θ (d) a = $\frac{g}{sin\theta}$