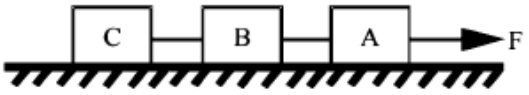
Total Time: 1hour Total Marks: 120

- Each Questions carry 4 mark
- There is a negative marking of – 1 for each wrong answer

Section - A (Only One Correct Option)

1. If a body looses half of its velocity on penetrating 3 cm in a wooden block, then how much will it penetrate more before coming to rest?
   (a) 1 cm (b) 2 cm
   (c) 3 cm (d) 4 cm.
2. A lift is moving down with acceleration a. A man in the lift drops a ball inside the lift. The acceleration of the ball as observed by the man in the lift and a man standing stationary on the ground are respectively
   (a) g, g (b) $g-a, g-a$
   (c) $g-a, g$ (d) a, g
3. When forces F_1, F_2, F_3 are acting on a particle of mass m such that F_2 and F_3 are mutually perpendicular, then the particle remains stationary. If the force F_1 is now removed then the acceleration of the particle is
   (a) F_1/m (b) F_2F_3/mF_1
   (c) $(F_2-F_3)/m$ (d) F_2/m.
4. Two forces are such that the sum of their magnitudes is 18 N and their resultant is 12 N which is perpendicular to the smaller force. Then the magnitudes of the forces are
   (a) 12 N, 6 N (b) 13 N, 5 N
   (c) 10 N, 8 N (d) 16N, 2N.
5. Speeds of two identical cars are u and $4u$ at the specific instant. The ratio of the respective distances in which the two cars are stopped from that instant is
   (a) 1 : 1 (b) 1 : 4
   (c) 1 : 8 (d) 1 : 16.
6. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (vertically). If the acceleration of the system is $g/8$, then the ratio of the masses is
   (a) 8 : 1 (b) 9 : 7
   (c) 4 : 3 (d) 5 : 3.

7. Three identical blocks of masses $m = 2$ kg are drawn by a force $F = 10.2$ N with an acceleration of 0.6 ms^{-2} on a frictionless surface, then what is the tension (in N) in the string between the blocks B and C?



(a) 9.2 (b) 3.4
(c) 4 (d) 9.8

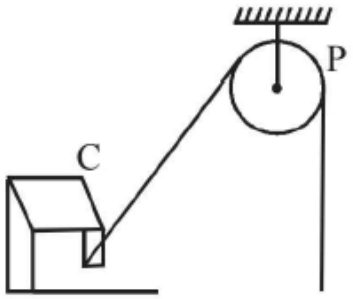
8. One end of a massless rope, which passes over a massless and frictionless pulley P is tied to a hook C while the other end is free. Maximum tension that the rope can bear is 360 N. With what value of maximum safe acceleration (in ms^{-2}) can a man of 60 kg climb on the rope?

(a) 16

(b) 6

(c) 4

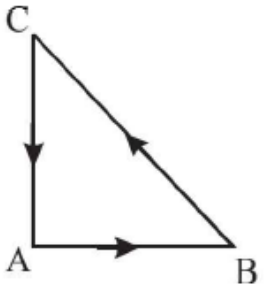
(d) 8.



9. A spring balance is attached to the ceiling of a lift. A man hangs his bag on the spring and the spring reads 49 N, when the lift is stationary. If the lift moves downward with an acceleration of 5 m/s^2, the reading of the spring balance will be

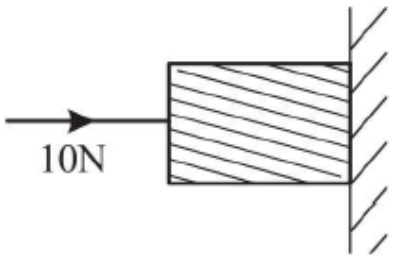
(a) 24 N (b) 74 N
(c) 15 N (d) 49 N

10. Three forces start acting simultaneously on a particle moving with velocity, $\vec{v}$. These forces are represented in magnitude and direction by the three sides of a triangle ABC. The particle will now move with velocity



(a) less than $\vec{v}$
(b) greater than $\vec{v}$
(c) $|v|$ in the direction of the largest force BC
(d) $\vec{v}$, remaining unchanged

11. A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2. The weight of the block is



(a) 20 N (b) 50 N
(c) 100 N (d) 2 N

12. 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

(a) 0.02 (b) 0.03
(c) 0.04 (d) 0.06

13. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m. If a force P is applied at the free end of the rope, the force exerted by the rope on the block is

(a) $\frac{Pm}{M+m}$ (b) $\frac{Pm}{M-m}$

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

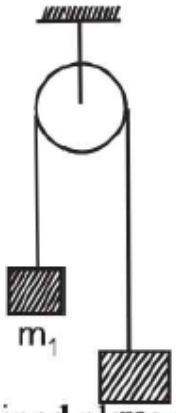
14. A light spring balance hangs from the hook of the other light spring balance and a block of mass M kg hangs from the former one. Then the true statement about the scale reading is

(a) Both the scales read M kg each
(b) The scale of the lower one reads M kg and of the upper one zero
(c) The reading of the two scales can be anything but the sum of the reading will be M kg
(d) Both the scales read $M/2$ kg each

15. A rocket with a lift-off mass 3.5×10^4 kg is blasted upwards with an initial acceleration of $10 m/s^2$. Then the initial thrust of the blast is

(a) 3.5×10^5 N (b) 7.0×10^5 N
(c) 14.0×10^5 N (d) 1.75×10^5 N

16. Two masses $m_1 = 5\,\text{kg}$ and $m_2 = 4.8\,\text{kg}$ tied to a string are hanging over a light frictionless pulley. What is the acceleration of the masses when left free to move ? $(g = 9.8\text{m/s}^2)$



(a) $5\ \text{m/s}^2$

(b) $9.8\ \text{m/s}^2$

(c) $0.2\ \text{m/s}^2$

(d) $4.8\ \text{m/s}^2$

17. A block rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.8. If the frictional force on the block is 10 N, the mass of the block (in kg) is

(take $g = 10\ \text{m/s}^2$)

(a) 1.6 (b) 4.0

(c) 2.0 (d) 2.5

18. A smooth block is released at rest on a 45° incline and then slides a distance 'd'. The time taken to slide is 'n' times as much to slide on rough incline than on a smooth incline. The coefficient of friction is

(a) $\mu_k = \sqrt{1-\frac{1}{n^2}}$ (b) $\mu_k = 1-\frac{1}{n^2}$

(c) $\mu_s = \sqrt{1-\frac{1}{n^2}}$ (d) $\mu_s = 1-\frac{1}{n^2}$

19. A parachutist after bailing out falls 50 m without friction. When parachute opens, it decelerates at $2\ \text{m/s}^2$. He reaches the ground with a speed of 3 m/s. At what height, did he bail out ?

(a) 182 m (b) 91 m

(c) 111 m (d) 293 m

20. A bullet fired into a fixed target loses half of its velocity after penetrating 3 cm. How much further it will penetrate before coming to rest assuming that it faces constant resistance to motion ?

(a) 2.0 cm (b) 3.0 cm
(c) 1.0 cm (d) 1.5 cm

Section - B (One or More than One Correct Option)

21. The blocks B and C in the Fig. 3.90 have mass m each. The strings AB and BC are light, having tensions T_1 and T_2, respectively. The system is in equilibrium with a constant force mg acting on C.

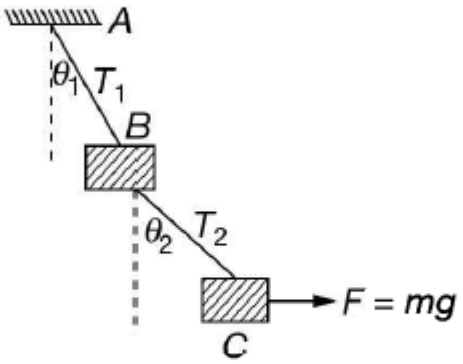


Fig. 3.90

(A) $\tan\theta_1 = 1/2$ (B) $\tan\theta_2 = 1/2$

(C) $T_1 = \sqrt{5}mg$ (D) $T_2 = \sqrt{2}mg$

22. Four forces act on a point object. The object will be in equilibrium if

(A) all of them are in the same plane
(B) they are opposite to each other in pair
(C) the sum of x, y and z components of all the force is zero separately
(D) they are from a closed figure of four sides

23. In the given Fig. 3.91, pulleys are massless and frictionless, and strings are light and inextensible. A force is applied on pulley A vertically upward. At any time, acceleration of 5 kg is a_1 (upward) and 10 kg is a_2 (upward) then ($g = 10\ \text{m/s}^2$)

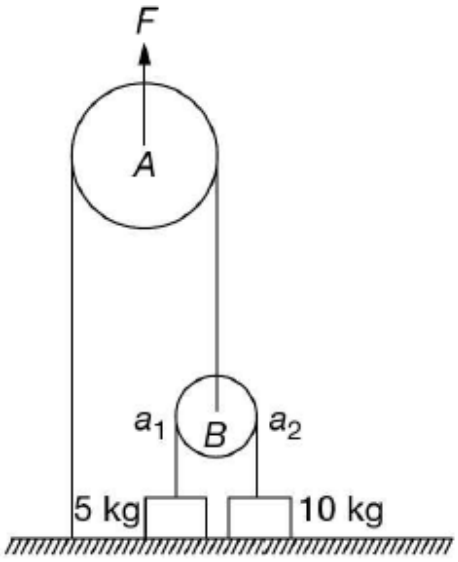


Fig. 3.91

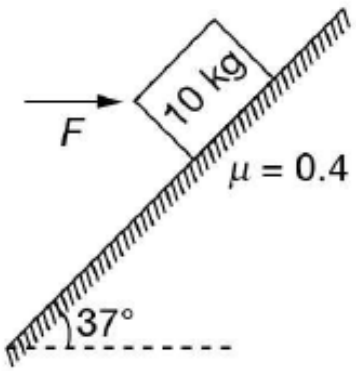
(A) $a_1 = 0, a_2 = 0$ if $F = 100$ N

(B) $a_1 = 5\ \text{m/s}^2$ and $a_2 = 0$ if $F = 300$ N

(C) $a_1 = 15\ \text{m/s}^2$ and $a_2 = 2.5\ \text{m/s}^2$ if $F = 500$ N

(D) acceleration of the masses is independent of F

24. A block of mass 10 kg is placed on a rough inclined plane of inclination 37° ($\tan 37° = 3/4$). The co-efficient of friction between block and surface is 0.4. A horizontal force $F = 50$ N is applied on the block, then ($g = 10\ \text{m/s}^2$)



(A) Acceleration of block is zero.
(B) Acceleration of block is 2.4 m/s^2 along the inclined plane.
(C) Frictional force between block and surface is 44 N.
(D) Frictional force between block and surface is 20 N.

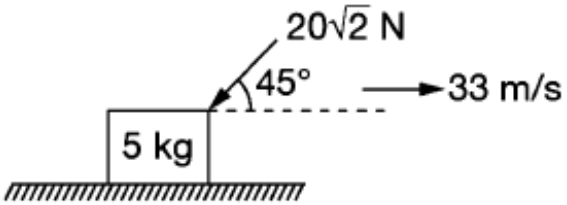
25. Four identical blocks each of mass m are kept on a horizontal frictionless plane in contact with adjacent blocks as shown in Fig. 3.92. A force F is applied on the system

Fig. 3.92

(A) Acceleration of each block is $\frac{F}{4m}$
(B) Net force on the block C is $\frac{F}{4}$
(C) Net force on the block A is $\frac{3F}{4}$
(D) Force by the block C on block D is $\frac{F}{8}$

Section - C (Integer Type Answer)

26. A block of mass 5 kg is kept on a rough horizontal floor. It's given velocity is 33 m/s towards right. A force of $20\sqrt{2}$ N continuously acts on the block as shown. If the co-efficient of friction between block and floor is 0.5, find the velocity of the block after 5 seconds ($g = 10$ m/s^2).



27. In the given Fig. 3.98, strings are massless and pulley is frictionless. Find ratio of tension in the strings BC and AB ($g = 10\ m/s^2$).

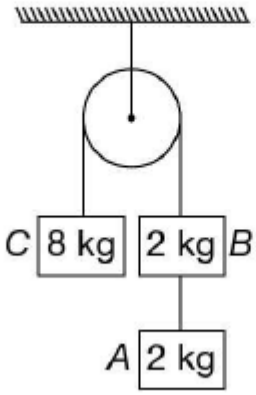


Fig. 3.98

28. In Fig. 3.99 shown, find the acceleration of block

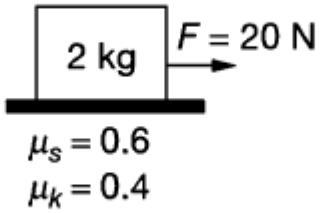


Fig. 3.99

29. Two blocks of masses 5 kg and 3 kg are placed on a smooth horizontal surface. A horizontal force $F = 16$ N is applied on 5 kg as shown. Find normal force between the blocks.

30. For the given Fig. 3.100. Find the tension in the string.

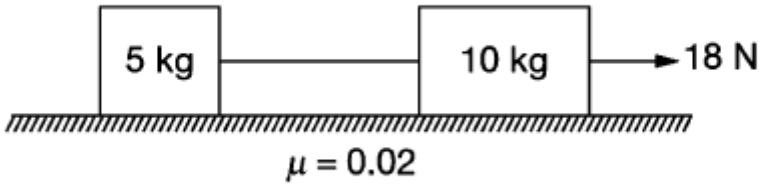


Fig. 3.100