Module-Test-7
(Physics-JEE)

December 24, 2022

Section-A
(One Options Correct Type)

This section contains 20 multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which ONLY ONE option is correct.

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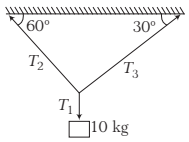
1. Four forces act on a point object. The object will be in equilibrium, if
(a) they are opposite to each other in pairs
(b) sum of x, y and z-components of forces is zero separately
(c) they can be represented by a closed figure of 4 sides by direction and magnitude.
(d) All of the above

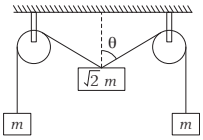
2. A block of mass 10 kg is suspended by three strings as shown in the figure. The tension T_2 is



(a) 100 N (b) $\frac{100}{\sqrt{3}}$ N (c) $\sqrt{3} \times 100$ N (d) $50\sqrt{3}$ N

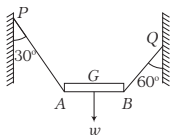
3. An object is resting at the bottom of two strings which are inclined at an angle of 120° with each other. Each string can withstand a tension of 20 N. The maximum weight of the object that can be sustained without breaking the strings is
(a) 10 N (b) 20 N (c) $20\sqrt{2}$ N (d) 40 N

4. The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle θ should be



(a) 0° (b) 30° (c) 45° (d) 60°

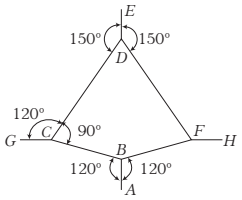
5. A non-uniform rod AB of weight w is supported horizontally in a vertical plane by two light strings PA and QB as shown in the figure. G is the centre of gravity of the rod. If PA and QB make angles 30° and 60° respectively with the vertical, the ratio $\frac{AG}{BG}$ is



(a) $\frac{1}{2}$ (b) $\sqrt{3}$ (c) $\frac{1}{3}$ (d) $\frac{1}{\sqrt{3}}$

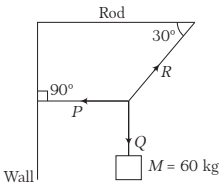
6. A weight w is suspended from the mid-point of a rope, whose ends are at the same level. In order to make the rope perfectly horizontal, the force applied to each of its ends must be
(a) less than w (b) equal to w
(c) equal to $2w$ (d) infinitely large

7. The below figure is the part of a horizontally stretched net. Section AB is stretched with a force of 10 N. The tensions in the sections BC and BF are



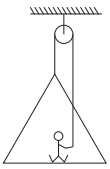
(a) 10 N, 11 N (b) 10 N, 6 N
(c) 10 N, 10 N
(d) Cannot be calculated due to insufficient data

8. A body of mass 60 kg suspended by means of three strings, P, Q and R as shown in the figure is in equilibrium. The tension in the string P is



(a) 130.9 kgf (b) 60 kgf
(c) 50 kgf (d) 103.9 kgf

9. A man of mass 50 g stands on a frame of mass 30 g. He pulls on a light rope which passes over a pulley. The other end of the rope is attached to the frame. For the system to be in equilibrium, what force man must exert on the rope?



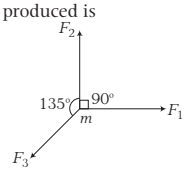
(a) 40 g (b) 80 g
(c) 30 g (d) 50 g

10. Two particles of equal mass are connected to a rope AB of negligible mass, such that one is at end A and the other dividing the length of the rope in the ratio 1 : 2 from A. The rope is rotated about end B in a horizontal plane. Ratio of the tensions in the smaller part to the other is (ignore effect of gravity)
(a) 4 : 3 (b) 1 : 4 (c) 1 : 2 (d) 1 : 3

11. A body is under the action of two mutually perpendicular forces of 3 N and 4 N. The resultant force acting on the body is
(a) 7 N (b) 1 N
(c) 5 N (d) zero

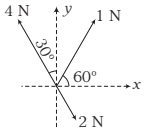
12. Two equals forces are acting at a point with an angle of 60° between them. If the resultant force is equal to $40\sqrt{3}$ N, the magnitude of each force is
(a) 40 N (b) 20 N
(c) 80 N (d) 30 N

13. When a force F acts on a body of mass m, the acceleration produced in the body is a. If three equal forces $F_1 = F_2 = F_3 = F$ act on the same body as shown in figure. The acceleration produced is



(a) $(\sqrt{2}-1)\,a$ (b) $(\sqrt{2}+1)\,a$ (c) $\sqrt{2}\,a$ (d) a

14. Three forces acting on a body are shown in the figure. To have the resultant force only along the y-direction, the magnitude of the minimum additional force needed is



16. Two bodies of masses m_1 and m_2 are connected by a light string which passes over a frictionless massless pulley. If the pulley is moving upward with uniform acceleration $\frac{g}{2}$, then tension in the string will be

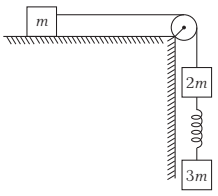
(a) $\frac{3m_1m_2}{m_1+m_2}\,g$

(b) $\frac{m_1+m_2}{4m_1m_2}\,g$

(c) $\frac{2m_1m_2}{m_1+m_2}\,g$

(d) $\frac{m_1m_2}{m_1+m_2}\,g$

17. In the system shown in figure, assume that all the surfaces are smooth, string and spring are massless. When masses connected are released, the acceleration of the system is



(a) $\frac{17}{5}\,\text{ms}^{-2}$ (b) $\frac{50}{6}\,\text{ms}^{-2}$

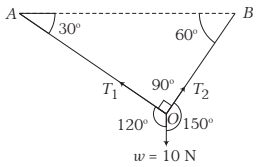
(c) $\frac{60}{5}\,\text{ms}^{-2}$ (d) $\frac{60}{7}\,\text{ms}^{-2}$

18. A block of mass 200 kg is set into motion on a frictionless horizontal surface with the help of frictionless pulley and a rope system as shown in figure. What horizontal force F should be applied to produce in the block an acceleration of 1 ms^{-2}?

(a) 0.5 N (b) 1.5 N

(c) $\frac{\sqrt{3}}{4}$ N (d) $\sqrt{3}$ N

15. A ball of mass 1 kg hangs in equilibrium from two strings OA and OB as shown in figure. What are the tensions in strings OA and OB ? (Take, $g = 10\ \text{ms}^{-2}$)

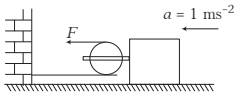


(a) 5 N, 5 N

(b) $5\sqrt{3}$ N, $5\sqrt{3}$ N

(c) 5 N, $5\sqrt{3}$ N

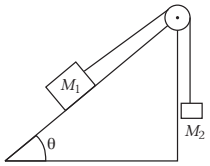
(d) $5\sqrt{3}$ N, 5N



(a) 50 N (b) 100 N

(c) 200 N (d) 10 N

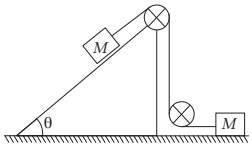
19. Two masses M_1 and M_2 are attached to the ends of a string which passes over a pulley attached to the top of an inclined plane. The angle of inclination of the plane is 30° and M_1 = 10 kg, M_2 = 5 kg. What is the acceleration of mass M_2?



(a) 10 ms^{-2} (b) 5 ms^{-2}

(c) Zero (d) None of these

20. Two blocks, each having a mass M, rest on frictionless surfaces as shown in the figure. If the pulleys are light and frictionless and M on the incline is allowed to move down, then the tension in the string will be



(a) $\frac{2}{3}\,Mg\sin\theta$ (b) $\frac{3}{2}\,Mg\sin\theta$

(c) $\frac{Mg\sin\theta}{2}$ (d) $2Mg\sin\theta$

Section-B
(Numerical Answer Type)

This section contains 10 questions. The answer to each question is a NUMERICAL VALUE. For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place).

Do any 5 questions out of 10 Questions.

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1. A mass of 10 kg is suspended vertically by a rope from the roof. When a horizontal force is applied on the mass, the rope deviated at an angle of 45° at the roof point. If the suspended mass is at equilibrium, the magnitude of the force applied in newton is ($g = 10\,\text{m s}^{-2}$)

2. A body of mass $m = 10^{-2}$ kg is moving in a medium and experiences a frictional force $F = -k v^2$. Its initial speed is $v_0 = 10\,\text{m s}^{-1}$. If, after 10 s, its energy is $\frac{1}{8} m v_0^2$, the value of $1000k$ will be

3. A ball of mass 0.2 kg is thrown vertically upwards by applying a force by hand. If the hand moves 0.2 m while applying the force and the ball goes upto 2 m height further, find the magnitude of the force in newton.

4. A player caught a cricket ball of mass 150 g moving at a rate of $20\,\text{m s}^{-1}$. If the catching process is completed in 0.1 s, the force of the blow exerted by the ball on the hand of the player is equal to

5. 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 ($g = 10\,\mathrm{m\,s^{-2}}$)

6. 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 $5\,\mathrm{m\,s^{-2}}$, the reading of the spring balance will be

7. A block is placed on a rough horizontal surface then the frictional force on the block is

8. A marble block of mass 2 kg lying on ice when given a velocity of $6\,\mathrm{m\,s^{-1}}$ is stopped by friction in 10 s. Then, the coefficient of friction multiplied by 100 is

9. 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

10. Two blocks of equal mass are slacked on top of each other on a horizontal plane, then the frictional force between them is

A.N.S.W.E.R.

Section-A

1. (d)
2. (d)
3. (b)
4. (c)
5. (c)
6. (d)
7. (c)
8. (d)
9. (a)
10. (d)
11. (c)
12. (a)
13. (a)
14. (a)
15. (c)
16. (a)
17. (b)
18. (b)
19. (c)
20. (c)

Section-B

1. 100
2. 1
3. 22
4. 30
5. 2
6. 24
7. 0
8. 6
9. 2
10. 0