Additional Problems For Self Practice (APSP)

Marked Questions can be used as Revision Questions.

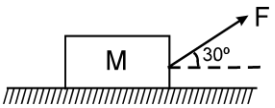
PART-I : PRACTICE TEST PAPER

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions :

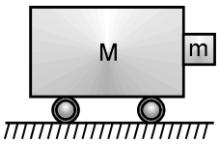
1. The test is of **1 hour** duration and max. marks 120.
2. The test consists **30** questions, **4 marks** each.
3. Only one choice is correct **1 mark** will be deducted for incorrect response. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
4. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 3 above.

1. A block of mass M = 5 kg is resting on a rough horizontal surface for which the coefficient of friction is 0.2. When a force F = 40 N is applied, the acceleration of the block will be (g = 10 m/s^2) :



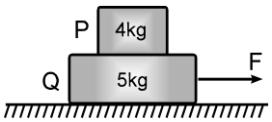
(1) 5.73 m/sec^2 (2) 8.0 m/sec^2
(3) 3.17 m/sec^2 (4) 10.0 m/sec^2

2. A cart of mass M has a block of mass m attached to it as shown in the figure. Co-efficient of friction between the block and cart is μ. What is the minimum acceleration of the cart so that the block m does not fall?



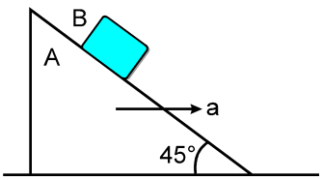
(1) μg (2) μ/g
(3) g/μ (4) none

3. The coefficient of friction between 4kg and 5 kg blocks is 0.2 and between 5 kg block and ground is 0.1 respectively. Choose the correct statements



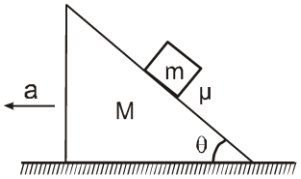
(1) Minimum force needed to cause system to move is 17 N
(2) When force is 4N static friction at all surfaces is 4N to keep system at rest
(3) Maximum acceleration of 4kg block is 2m/s^2
(4) Slipping between 4kg and 5 kg blocks start when F is > 17N

4. If the coefficient of friction between A and B is μ, the maximum horizontal acceleration of the wedge A for which B will remain at rest w.r.t the wedge is



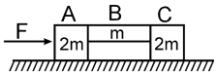
(1) μg (2) $g\left(\frac{1+\mu}{1-\mu}\right)$
(3) $\frac{g}{\mu}$ (4) $g\left(\frac{1-\mu}{1+\mu}\right)$

5. A block of mass m is at rest relative to the stationary wedge of mass M. The coefficient of friction between block and wedge is μ. The wedge is now pulled horizontally with acceleration 'a' as shown in figure. Then the minimum magnitude of 'a' for the friction between block and wedge to be zero is :



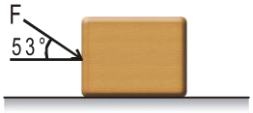
(1) g tan θ (2) μ g tan θ
(3) g cot θ (4) μ g cot θ

6. The system is pushed by a force F as shown in figure. All surfaces are smooth except between B and C. Friction coefficient between B and C is μ. Minimum value of F to prevent block B from downward slipping is



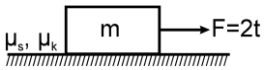
(1) $\left(\frac{3}{2\mu}\right)$ mg (2) $\left(\frac{5}{2\mu}\right)$ mg (3) $\left(\frac{5}{2}\right)$ μmg (4) $\left(\frac{3}{2}\right)$ μmg

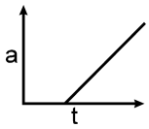
7. A block of mass 20 kg is acted upon by a force F = 30 N at an angle 53° with the horizontal in downward direction as shown. The coefficient of friction between the block and the horizontal surface is 0.2. The friction force acting on the block by the ground is (g = 10 m/s^2)

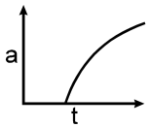


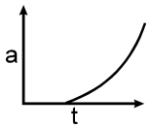
(1) 40.0 N (2) 30.0 N (3) 18.0 N (4) 44.8 N

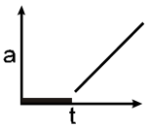
8. A force F = 2t (where t is time in seconds) is applied at t = 0 sec. to the block of mass m placed on a rough horizontal surface. The coefficient of static and kinetic friction between the block and surface are μ_s and μ_k respectively. Which of the following graphs best represents the acceleration vs time of the block. ($\mu_s > \mu_K$)



(1) 

(2) 

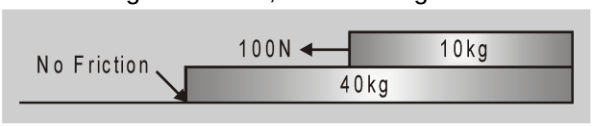
(3) 

(4) 

9. A block lying on a long horizontal conveyor belt moving at a constant velocity receives a velocity v_0 = 5 m/s relative to the ground in the direction opposite to the direction of motion of the conveyor. After t = 4 s, the velocity of the block becomes equal to the velocity of the belt. The coefficient of friction between the block and the belt is μ = 0.2. The magnitude of velocity of the conveyor belt is (Use g = 10 m/s^2) :

(1) 3 m/s (2) 5 m/s (3) 4 m/s (4) 7 m/s

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



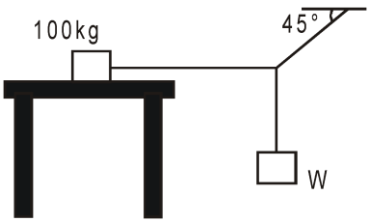
(1) 0.98 m/s^2 (2) 1.47 m/s^2 (3) 1.52 m/s^2 (4) 6.1 m/s^2

11. A block W is held against a vertical wall by applying a horizontal force F. The minimum value of F needed to hold the block is if μ < 1

(1) Less than W (2) Equal to W (3) Greater than W (4) Data is in sufficient

12. The system shown in the figure is in equilibrium. The maximum value of W, so that the maximum value of static frictional force on 100 kg body is 450 N, will be :-

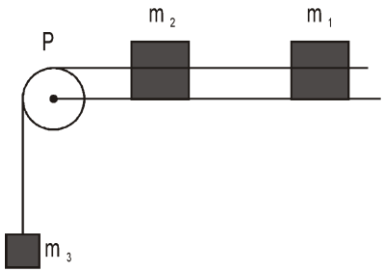
(1) 100 N (2) 250 N
(3) 450 N (4) 1000 N



13. The upper half of an inclined plane of inclination θ is perfectly smooth while lower half is rough. A block starting from rest at the top of the plane will again come to rest at the top of the plane will again come to rest at the bottom, if the coefficient of friction between the block and lower half of the plane is given by :

(1) $\mu = \frac{2}{\tan\theta}$ (2) $\mu = 2\tan\theta$ (3) $\mu = \tan\theta$ (4) $\mu = \frac{1}{\tan\theta}$

14. A system consists of three masses m_1, m_2 and m_3 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 $m_1 = m_2 = m_3 = m$)



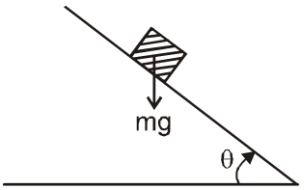
(1) $\frac{g(1-g\mu)}{9}$ (2) $\frac{2g\mu}{3}$

(3) $\frac{g(1-2\mu)}{3}$ (4) $\frac{g(1-2\mu)}{2}$

15. A block A of mass m_1 rests on a horizotal 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 the table is m_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) $\frac{m_1m_2(1+\mu_k)g}{(m_1+m_2)}$ (3) $\frac{m_1m_2(1-\mu_k)g}{(m_1+m_2)}$ (4) $\frac{(m_2+\mu_k m_1)g}{(m_1+m_2)}$

16. 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 30º the box starts to slip and slides 4.0 m down the plank in 4.0s. The coefficients of static and kinetic friction between the box and the plank will be, respectively :

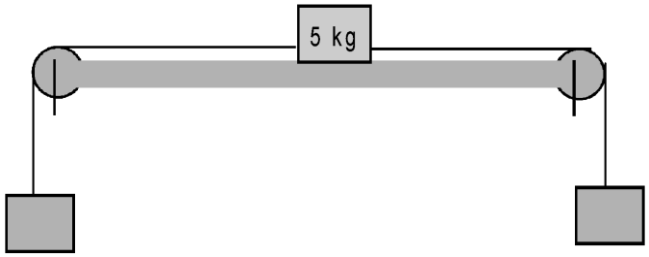


(1) 0.6 and 0.5 (2) 0.5 and 0.6
(3) 0.4 and 0.3 (4) 0.6 and 0.6

17. A conveyor belt is moving at a constant speed of 2m/s. A box is gently dropped on it. The coefficient of friction between them is μ= 0.5. The distance that the box will move relative to belt before coming to rest on it taking g = 10 ms^{-2}, is :

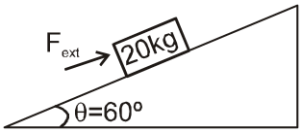
(1) 1.2 m (2) 0.6 m (3) zero (4) 0.4 m

18. In the arrangement shown in figure, 5 kg block is placed on a rough table (μ =0.4) and a 3kg mass is connected at one end. then the range of mass m, for which the systme will remain in equilibrium is



(1) 1 kg to 3 kg (2) 1 kg to 5 kg
(3) Any value greater than 8 kg (4) 3 kg to 5 kg

19. A block of mass 20 kg is kept on rough incline plane. If angle of repose is 30° ,then what should be value of F_{ext} so that the block does not move over inlcine plane ?

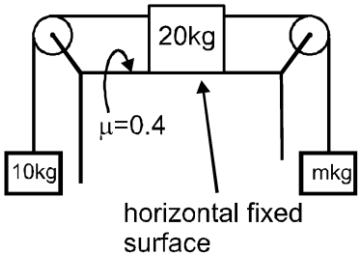


(1) 120 N (2) 200 N

(3) 110 N (4) Both (1) & (2)

20. Value(s) of m for which system remains at rest (pulleys and strings are ideal) [g = 10 m/s^2] :

(1) 1 kg
(2) 2 kg
(3) 18 kg
(4) 20 kg

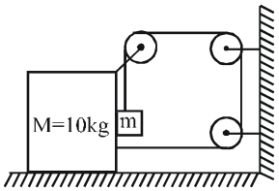


21. A hockey player is moving northward and suddenly turns westward with same speed to avoid an opponent. The friction force that acts on the player due to ground is :

(1) north-west (2) along west (3) south-west (4) along south

22. The maximum value of m(in kg) so that the arrangement shown in the figure is in equilibrium is (friction coefficient between block and wedge is 0.1 and between wedge and ground is 0.4)

(1) 2 (2) 2.5
(3) 3 (4) 3.5



23. A block of mass 5 kg slides down an inclined plane which makes an angle $\theta=60^0$ with the horizontal. The co-efficient of friction between the block and the plane is $\mu = 3/4$. The force exerted by the block on the plane is(g = 10 m/s^2):

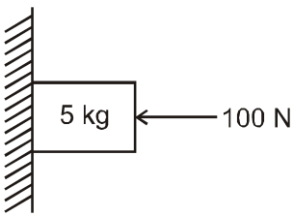
(1) 25 N (2) 125/4 N (3) 15 N (4) 75/4 N

24. An insect is moving on an incline plane of inclination θ. Between the incline and the insect, coefficient of static and kinetic friction are μ_s and μ_k respectively ($\mu_s > \mu_k$). With what maximum acceleration, can the insect move ?

(1) $g \sin\theta + \mu_s g \cos\theta$ (2) $g \sin\theta + \mu_k g \cos\theta$
(3) $g \sin\theta - \mu_k g \cos\theta$ (4) $\mu_s g \cos\theta + g \sin\theta$

25. A block of mass 5 kg is held against a wall with a force of 100 N. as shown in figure. It is moved horizontally slowly by applying a force parallel to the wall. Then the frictional force on the block due to wall is (Given $\mu = 0.5$ and g = 10 m/sec2)

(1) 50 N (2) 100 N
(3) $50\sqrt{2}$ N (4) $100\sqrt{2}$ N



26. A block of mass 2 kg moves on a horizontal surface of friction coefficient $\mu = \frac{x}{40}$, where x is distance of block from the origin. If at x = 0 block was given speed of 2 m/sec in positive x direction. Then distance which the block covers before it stops is

(1) 2m (2) 4 m (3) 8 m (4) 1 m

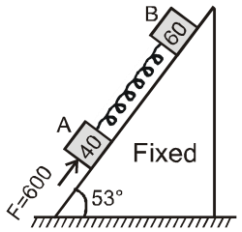
27. In pushing a box across the floor, you have to apply a horizontal force just sufficient to get the box moving. As the box moves, you continue to apply the same force. The acceleration of the box, is :

(1) $a = \mu_k g$ (2) $a = \mu_s g$ (3) $a = (\mu_s - \mu_k)g$ (4) $a = -\mu_k g$

28. A block of mass 10kg is placed on rough inclined plane of variable angle θ and friction coefficient $\mu_S = \mu_k = 3/4$. When θ is 37º net reaction force applied by inclined is $\vec{N_1}$ and when θ = 53º net reaction force applied by inclined is $\vec{N_2}$, then $|\vec{N_1}| - |\vec{N_2}|$ is :

(1) 0 (2) 25 N (3) –25 N (4) –37 N

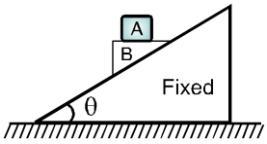
29. Two bodies placed on a wedge kept fixed on a horizontal surface as shown in figure are separated by a spring. They are in equilibrium by a force of 600 N applied on A. There is no friction between B and inclined plane and μ is coefficient of friction between A and inclined plane then ($g = 10\ m/s^2$)



(1) $\mu = \frac{3}{4}$ (2) $\mu \geq \frac{3}{4}$

(3) $\mu = \frac{5}{6}$ (4) $\mu \geq \frac{5}{6}$

30. Block 'A' is placed over the block 'B' as shown in the figure. Wedge is fixed and there is no friction. Between block 'B' and fixed inclined. Force of friction on the block 'A' is :



(1) towards right (2) towards left

(3) zero (4) always kinetic

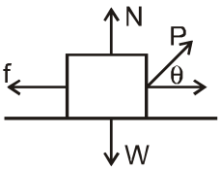
Practice Test (JEE-Main Pattern)

OBJECTIVE RESPONSE SHEET (ORS)

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

PART - II : PRACTICE QUESTIONS

1. A student pulls a wooden box along a rough horizontal floor (without the block loosing contact with the floor) at constant speed by means of a force *P* as shown to the right. (W is weight of block, N is normal reaction on the block, f is force of friction on the block). Which of the following must be true ?



(1) P > f and N < W. (2) P > f and N = W.

(3) P = f and N > W. (4) P < f and N = W.

2. The coefficient of friction between a body and ground is $\frac{1}{\sqrt{3}}$ then:

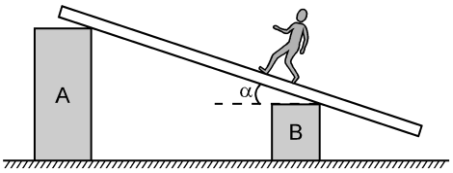
(1) The angle of friction can vary from 0^0 to 30^0

(2) The angle of friction can vary from 60^0 to 90^0

(3) The angle of friction can vary from 0^0 to 60^0

(4) The angle of friction can be vary from 30^0 to 90^0

3. A plank is held at an angle α to the horizontal (Fig.) on two fixed supports A and B. The plank can slide against the supports (without friction) because of its weight Mg. With what acceleration and in what direction, a man of mass m should move so that the plank does not move.

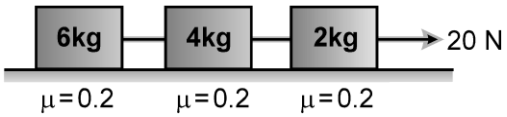


(1) g sin α $\left(1+\frac{m}{M}\right)$ down the incline
(2) g sin α $\left(1+\frac{M}{m}\right)$ down the incline
(3) g sin α $\left(1+\frac{m}{M}\right)$ up the incline
(4) g sin α $\left(1+\frac{M}{m}\right)$ up the incline

4. A block of mass 4 kg is kept on ground. The co-efficient of friction between the block and the ground is 0.80. An external force of magnitude 30 N is applied parallel to the ground. The resultant force exerted by the ground on the block is:
(1) 40 N (2) 30 N (3) 0 N (4) 50 N

5. A block is placed gently on a rough incline plane of angle of inclination 37º with horizontal. Now the block is pressed against the incline horizontally with a force P. If coefficient of friction between the block & the incline is 0.75 & mass of the block 2 kg. Choose the correct option.
(Take sin 37º = $\frac{3}{5}$ & g = 10 m/s^2)
(1) Minimum value of P for which block starts sliding is 15 N
(2) Minimum value of P for which block starts sliding is zero
(3) Minimum value of P for which block starts sliding is 30 N
(4) Block will not slide for any value of P.

Comprehension # 1



According to given arrangement find out the answers of the following questions :

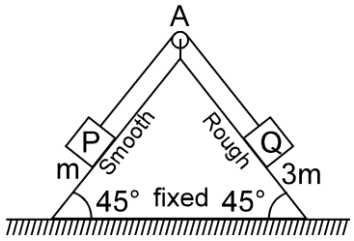
6. Tension in the string connecting 4kg and 6kg masses is
(1) 8N (2) 12N (3) 6N (4) 4N

7. Friction force on 4 kg block is
(1) 4N (2) 6 N (3) 12 N (4) 8 N

8. Friction force on 6 kg block is
(1) 12 N (2) 8 N (3) 6 N (4) 4 N

Comprehension # 2

A fixed wedge with both surface inclined at 45^0 to the horizontal as shown in the figure. A particle P of mass m is held on the smooth plane by a light string which passes over a smooth pulley A and attached to a particle Q of mass 3m which rests on the rough plane. The system is released from rest. Given that the acceleration of each particle is of magnitude $\frac{g}{5\sqrt{2}}$ then



9. The tension in the string is :

(1) mg (2) $\frac{6mg}{5\sqrt{2}}$ (3) $\frac{mg}{2}$ (4) $\frac{mg}{4}$

10. In the above question the coefficient of friction between Q and the rough plane is :

(1) $\frac{4}{5}$ (2) $\frac{1}{5}$ (3) $\frac{3}{5}$ (4) $\frac{2}{5}$

11. In the above question the magnitude and direction of the force exerted by the string on the pulley is :

(1) $\frac{6mg}{5}$ downward (2) $\frac{6mg}{5}$ upward (3) $\frac{mg}{5}$ downward (4) $\frac{mg}{4}$ downward

APSP Answers

PART - I

1.	(1)	**2.**	(3)	**3.**	(3)	**4.**	(2)	**5.**	(3)	**6.**	(2)	**7.**	(3)
8.	(4)	**9.**	(1)	**10.**	(1)	**11.**	(3)	**12.**	(3)	**13.**	(2)	**14.**	(3)
15.	(2)	**16.**	(1)	**17.**	(4)	**18.**	(2)	**19.**	(4)	**20.**	(2, 3)	**21.**	(3)
22.	(2)	**23.**	(2)	**24.**	(4)	**25.**	(1)	**26.**	(2)	**27.**	(3)	**28.**	(2)
29.	(4)	**30.**	(2)										

PART – II

1.	(1)	**2.**	(1)	**3.**	(2)	**4.**	(4)	**5.**	(4)	**6.**	(1)	**7.**	(4)
8.	(2)	**9.**	(2)	**10.**	(4)	**11.**	(1)						