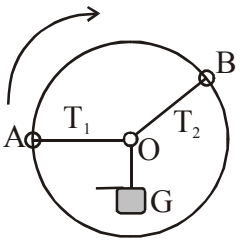
CLASS TEST

SECTION-I

Single Correct Answer Type **5 Q. [Marks 3 (–1)]**

1. A rigid hoop can rotate in a vertical plane about the center. Two massless strings are attached to the hoop, one at A, the other at B. These strings are tied together at the center of the hoop at O, and a weight G is suspended from that point. The strings have a fixed length, regardless of the tension, and the weight G is only supported by the strings. Originally OA is horizontal.

Now, the outer hoop will start to slowly rotate 90° clockwise until OA will become vertical, while keeping the angle between the strings constant and keeping the object static. Which of the following statements about the tensions. T_1 and T_2 in the two strings is correct?



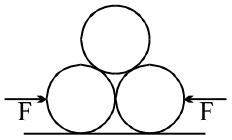
(A) T_1 always decreases.

(B) T_1 always increases.

(C) T_2 always increases.

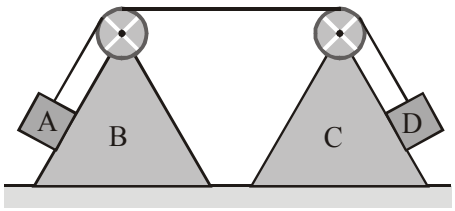
(D) T_2 will become zero at the end of the rotation.

2. Two smooth cylindrical bars weighing W each lie next to each other in contact. A similar third bar is placed over the two bars as shown in figure. Neglecting friction, the minimum horizontal force on each lower bar necessary to keep them together is :-



(A) W/2 (B) W (C) $W/\sqrt{3}$ (D) $W/(2\sqrt{3})$

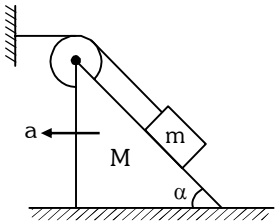
3. The figure shows two wedges and two blocks. Let acceleration of A and D are $\vec{a}_1$ and $\vec{a}_4$ wrt B and C respectively, and acceleration of B and C are $\vec{a}_2$ and $\vec{a}_3$ wrt ground respectively. The correct relation between these four vectors is :-



(A) $\vec{a}_1 + \vec{a}_4 = \vec{a}_2 + \vec{a}_3$ (B) $\vec{a}_1 + \vec{a}_4 = -(\vec{a}_2 + \vec{a}_3)$

(C) $\vec{a}_1 = \vec{a}_4$ (D) None of the above

4. In the adjoining figure if acceleration of M with respect to ground is a, then:



(A) acceleration of m with respect to M is 2a

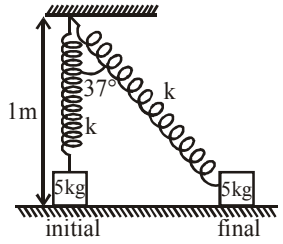
(B) acceleration of m with respect to ground is 2a sin (α/2)

(C) acceleration of m with respect to ground is a

(D) acceleration of m with respect to ground is a tanα

5. In the figure shown, initially spring is relaxed. Spring constant of spring is k = 100 N/m. Find minimum

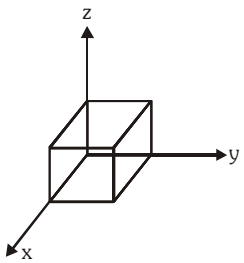
value of μ (coefficient of friction) between surface & block so that block remains in equilibrium in final stage :-



(A) $\mu = 0.1$ (B) $\mu = 0.2$ (C) $\mu = 0.4$ (D) $\mu = 0.5$

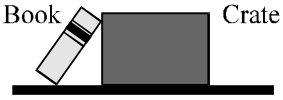
Multiple Correct Answer Type 6 Q. [4 M (–2)]

6. A solid cube of mass 5kg is placed on a rough horizontal surface, in xy–plane as shown. The friction coefficient between the surface and the cube is 0.4. An external force $\vec{F} = 6\hat{i} + 8\hat{j} + 20\hat{k}$ N is applied on the cube. (use g=10m/s^2)



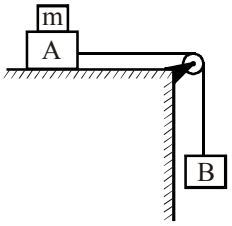
(A) The block starts slipping over the surface
(B) The friction force on the cube by the surface is 10N.
(C) The friction force acts in xy–plane at angle 127° with the positive x–axis in anticlockwise direction.
(D) The contact force exerted by the surface on the cube is $10\sqrt{10}$N.

7. A book leans against a crate on a table. Neither is moving. Which of the following statements concerning this situation is/are **INCORRECT**?



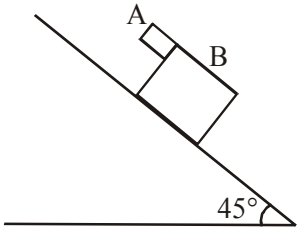
(A) The force of the book on the crate is less than that of crate on the book.
(B) Although there is no friction acting on the crate, there must be friction acting on the book or else it will fall.
(C) The net force acting on the book is zero.
(D) The direction of the frictional force acting on the book is in the same direction as the frictional force acting on the crate.

8. Two blocks of mass 6kg (A) and 3kg (B) are connected with a string passing over a pulley as shown. The block 6kg lies on a horizontal rough surface. What can be the values of additional mass m placed on the block A so that the system does not accelerate ? (The coefficient of friction between all surface is 0.3)



(A) 3 kg (B) 6 kg (C) 9 kg (D) 12 kg

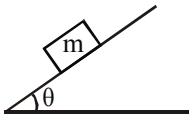
9. Two cubical blocks A & B of mass 1kg and 5kg are released from the given position as shown in figure. All the surfaces are smooth :-

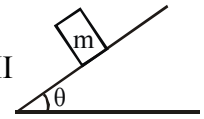


(A) Acceleration of A relative to B is $5\sqrt{2}$ m/s^2 (B) Acceleration of A relative to ground 10 m/s^2

(C) Force on B by A is $5\sqrt{2}$ N (D) Net force on A is 10N

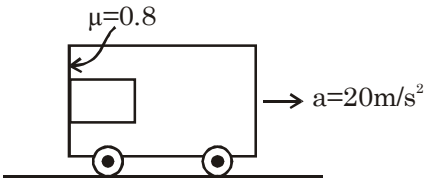
10. A block is first placed on its long side and then on its short side on the same inclined plane (see figure). The block slides down in situation II but remains at rest in situation I. A possible explanation is

Situation–I 

Situation–II 

(A) The normal contact force is less in situation-II.
(B) The frictional force is less in situation-II because the contact area is less.
(C) The shorter side is smoother.
(D) In situation-I, frictional force is more.

11. A truck is accelerating on horizontal road with an acceleration 20 m/s^2. A block placed against the rear wall of the truck as shown has a mass of 100 kg and coefficient of friction between it and the wall is 0.8.



(A) Acceleration of the box is 20 m/s^2
(B) The friction acting on the block is 1600 N
(C) The friction acting on the block is 1000 N
(D) The contact force between the wall and block is 1000 N.

Linked Comprehension Type (1 Para × 3Q.) [Marks 3 (0)]
(Single Correct Answer Type)

Paragraph for Question no. 12 to 14

A shot putter with a mass of 80 kg pushes the iron ball of mass of 6 kg from a standing position, accelerating it uniformly from rest at an angle of 45° with the horizontal during a time interval of 0.1 seconds. The ball leaves his hand when it is 2 m high above the level ground and hits the ground 2 seconds later.

12. The acceleration of the ball in shot putter's hand

(A) $11\sqrt{2}$ m/s^2 (B) $100\sqrt{2}$ m/s^2 (C) $90\sqrt{2}$ m/s^2 (D) $9\sqrt{2}$ m/s^2

13. The horizontal distance between the point of release and the point where the ball hits the ground

(A) 16 m (B) 18 m (C) 20 m (D) 22 m

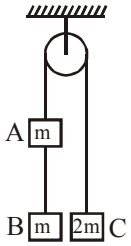
14. The minimum value of the static coefficient of friction if the shot putter does not slip during the shot is closest to

(A) 0.28 (B) 0.38 (C) 0.48 (D) 0.58

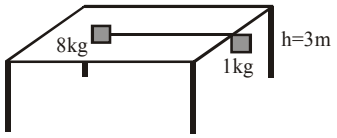
SECTION-III

Numerical Grid Type (Ranging from 0 to 9) 2 Q. [4 M (0)]

1. Two objects A & B are connected by a light string and these blocks are further connected to block C by thread that passes over a light frictionless pulley as shown. The objects are at rest. At t = 0, block B is given a velocity 40 m/s in vertical upward direction. Find the time (in sec) after which string between A & B again becomes tight (string is large, blocks do not collide with each other or with pulley)



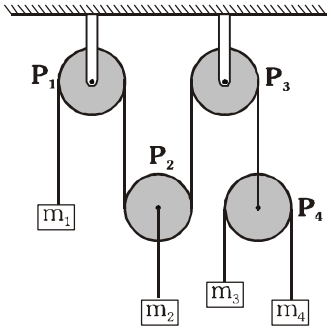
2. On a horizontal table with a height 3m, there is a block of mass 8 kg at rest. The block is connected by a long (length >> height of table = 3m) massless string to a second block of mass 1 kg which hangs from the edge of table as shown in the figure. The blocks are then released. Find distance (in meter) between the points where the two blocks hit ground. Neglect friction every where, and assume the blocks do not bounce back after collision with ground. ($g = 10\ m/s^2$).



SECTION-IV

Matrix Match Type (4 × 5) 2 Q. [8 M (for each entry +2(0)]

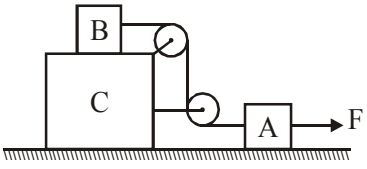
1. Match the entries of column I with column II. Given that the pulleys are massless and frictionless and four masses are of $m_1 = 2kg$, $m_2 = 3$ kg and $m_3 = m_4 = 1$ kg connected with ideal strings as shown in figure.



	Column I		Column II
(A)	Acceleration of pulley P_4	(P)	$\frac{2g}{7}$ vertical up
(B)	Acceleration of mass m_3	(Q)	$\frac{12g}{7}$ newton
(C)	Tension in string attached to block of mass m_2	(R)	$\frac{g}{7}$ vertical downward
(D)	Acceleration of mass m_2	(S)	$\frac{g}{7}$ vertical upward
		(T)	$\frac{24}{7}$ g newton

2. In figure, A, B and C have masses 2 kg, 5 kg and 10 kg respectively. A horizontal force F is applied to A. Strings are either horizontal or vertical. In column I is given information reading F and in column II information about accelerations of A, B and C and tension in the string T. [No friction anywhere]

	Column I		Column II
(A)	F = 35 N	(P)	$a_A = 5\ m/s^2$
(B)	F = 21 N	(Q)	$a_C = 0\ m/s^2$
(C)	F = 49 N	(R)	$a_B = 3\ m/s^2$
(D)	F = 20 N	(S)	T = 5 N
		(T)	T = 35 N



CLASS TEST # 21 **ANSWER KEY**

SECTION-I

Single Correct Answer Type **5 Q. [Marks 3 (–1)]**

1. Ans. (D) **2. Ans. (D)** **3. Ans. (D)** **4. Ans. (B)**
5. Ans. (D)

Multiple Correct Answer Type **6 Q. [4 M (–2)]**

6. Ans. (B,D) **7. Ans. (A,B,D)** **8. Ans. (B,C,D)** **9. Ans. (A,B,D)**
10. Ans. (C, D) **11. Ans. (A,C)**

Linked Comprehension Type **(1 Para × 3Q.) [Marks 3 (0)]**
(Single Correct Answer Type)

12. Ans. (C) **13. Ans. (B)** **14. Ans. (B)**

SECTION-III

Numerical Grid Type (Ranging from 0 to 9) **2 Q. [4 M (0)]**

1. Ans. 6 **2. Ans. 2**

SECTION-IV

Matrix Match Type (4 × 5) **2 Q. [8 M (for each entry +2(0)]**

1. Ans. (A) R; (B) R; (C) T; (D) S **2. Ans. (A) P,Q (B) Q,R (C) Q,T (D) Q**