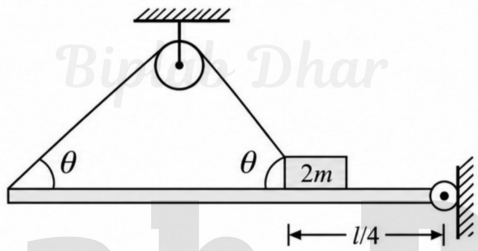
Advanced Test on: **Rotational Motion (Torque)** Duration: **40 min.**

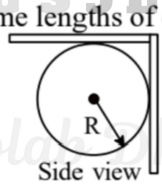
Single option correct type

1) A uniform horizontal rod of mass m and length l is hinged at one end and with its other end a block of mass $2m$ is attached with a string pulley system as shown in figure. If the system is in equilibrium at $\theta = 53°$, find the minimum value of co-efficient of friction, between the block and the rod.



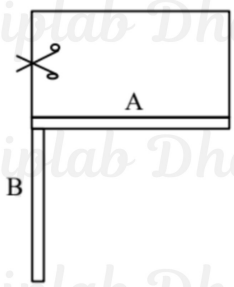
A) 0.4 (B) 0.5 (C) 1 (D) 2

2) A plate bent at right angles along its centre line, is placed onto a horizontal fixed cylinder of radius R as shown. The minimum co-efficient of friction between the cylinder and the plate so that plate does not slip off the cylinder will be (Assume lengths of each part of the plate is 2R).



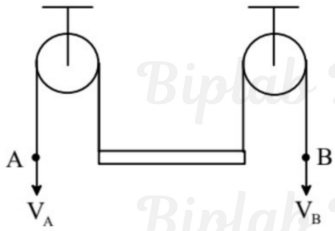
(A) $\frac{1}{\sqrt{2}}$ (B) $\sqrt{2}$ (C) $\sqrt{2}-1$ (D) $1-\frac{1}{\sqrt{2}}$

3) A 'L' shaped object, made of two equal rods A and B each of mass m, length 2L are hanging from ceilling with two threads as shown in figure. Find the vertical force on rod B, by rod A, just after the left string is cut



(A) $\frac{7mg}{65}$ (B) $\frac{mg}{8}$ (C) $\frac{mg}{37}$ (D) None of these

4) A thin uniform rod of mass 5 kg and length 1 m is held in horizontal position with the help of strings attached to ends of rod, other ends of strings are held by some external agent. Now end A is pulled down with speed $V_A = 3t$ and end B is pulled down with speed $V_B = t$. Where 't' is time in sec. Choose the correct choice(s) at time t = 0 [Take $g = 10\ m/s^2$]



(A) Angular acceleration of rod is 1 rad/s^2

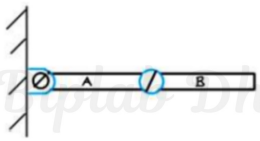
(B) Tension in left string is $\frac{185}{6}$ N

(C) Acceleration of rod is 1 m/s^2

(D) Tension in right string is $\frac{170}{3}$ N

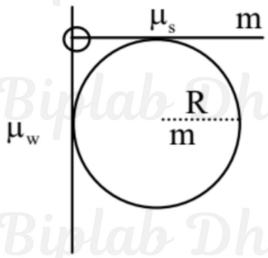
Matrix match type:

5) In the figure shown, two identical rod A and B each of mass m and length l are connected by a frictionless hinge. Rod A is also connected with a vertical wall by another hinge. The system can rotate in a vertical plane. When the rods are horizontal, system is released. Just after this, match the following quantities



Column – I		Column – II	
(A)	Acceleration of centre of rod B is $3k \times \frac{g}{7}$	(P)	k = 9
(B)	Angular acceleration of rod A is $3k \times \frac{g}{7L}$	(Q)	k = 2.5
(C)	Angular acceleration of rod B is $3k \times \frac{g}{7L}$	(R)	k = 3
(D)	Hinge force on rod B is $2k \times \frac{mg}{7}$	(S)	k = 13
		(T)	k = 1
		(U)	None of these

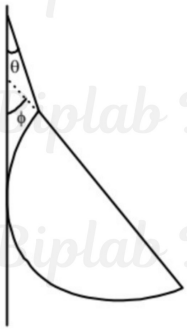
6) A stick with mass m and length 2R is pivoted at one end on a vertical wall. It is held horizontal, and a disc with mass m and radius R is placed beneath it, in contact with both it and wall as shown in figure. The coefficient of friction between disc and wall is μ_w, between disc and stick is μ_s. System is released and it does not fall. Now match column I and II



Column – I		Column – II	
(A)	μ_s min	(P)	1
(B)	μ_w min	(Q)	2
(C)	Vertical component of contact force between stick and disc	(R)	2mg
(D)	Vertical component of contact force between wall and disc	(S)	Mg
		(T)	$\sqrt{5}$ mg

Integer Type:

7) A solid hemisphere is supported by a string fixed to a point on rim and to a point on a smooth vertical wall with which the curved surface of the sphere is in contact. If θ and ϕ are the inclinations of the string and the plane base of the hemisphere to the vertical, then the value of $(\tan\phi - \tan\theta)$ is $\frac{x-1}{2x}$, Find x



8) A uniform rod of mass m and length $2l$ lies on smooth horizontal surface. A particle of same mass m is connected to string of length l, whose other end is connected to rod. Initially string is taut and both rod and string lies in same horizontal plane with 90° angle between them. If particle is given initially velocity v_0 perpendicular to string, then just after giving velocity v_0 to particle its radius of curvature is nL. Find n.