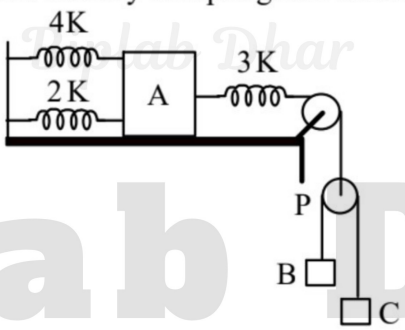
Advanced Test on: **NLM (Spring, Circular Motion)** Duration: **40 min.**

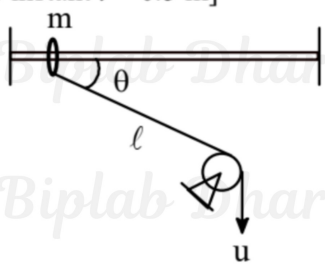
Single option correct type

1) In this diagram block B and C have masses 2 kg and 6 kg respectively. In equilibrium of block A, find the displacement of the block A. Initially the springs are in natural length and K = 100 N/m



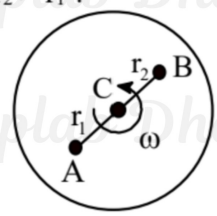
(A) 0.1 m (B) 0.2 m (C) 0.3 m (D) 0.4 m

2) A ring of mass m = 1 kg can freely slide on a horizontal rod. It is being pulled by a thread, passing over a pulley, with a constant velocity u = 3 m/s, as shown in figure. At this situation, when $\theta = 30^\circ$, find the tension in the string. [At this instant $l = 0.5$ m]



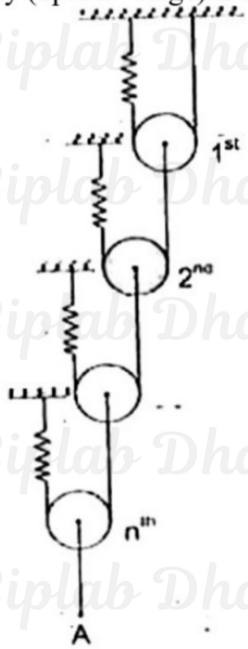
(A) 1 N (B) 2 N (C) 4 N (D) 8 N

3) Two identical coins connected by a massless string kept on the rough horizontal disc rotating with constant angular velocity $\omega(>0)$ about the vertical axis passing through the centre 'C_1' do not slip on disc. If f_1 and f_2 represent the friction on coin 'A' and friction on coin B respectively. Which of the following possibility is ruled out for $r_2 > r_1$?



(A) $f_1 \neq 0, f_2 = 0$ (B) $f_1 \neq 0, f_2 \neq 0$ (C) $f_1 = 0, f_2 \neq 0$ (D) $f_1 = f_2 = 0$

4) There is an arrangement of an pulleys as shown in figure. All the pulleys are massless and frictionless, and the strings used are inextensible. Each of these springs have a spring constant k. We define the stiffness of the assembly k_f, as the force required to be applied at point A for its unit displacement. Each stage of the assembly (upto n^{th} stage) is labeled as shown

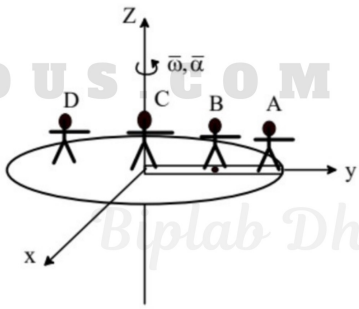


Find k_f for $n = \infty$

(A) 2k (B) 3k (C) 4k (D) 3.3k

Multi Options correct type:

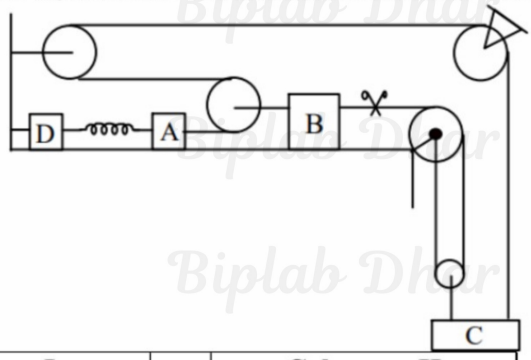
5) A particle of mass 'm' is placed inside a smooth groove made on a disc of radius 2 R, rotating with angular velocity 'ω' and angular acceleration 'α'. The particle can move inside the groove.



There are four imaginary observer's watching the motion of the particle. Observer A is standing at the edge of the disc, B is standing on the object, C is standing at center of the disc and D is at a distance R/2 from the center, on the opposite side of the particle. All the observers along with the particle lie on same diameter. At this instant, when particle is at 'R' distance from center, match the following

	Column I		Column II
(A)	w.r.t observer A	(P)	Centrifugal force = $m\omega^2 R\,\hat{j}$
(B)	w.r.t observer B	(Q)	Centrifugal force = $-m\omega^2 R\hat{j}$
(C)	w.r.t observer C	(R)	Centrifugal force = $2m\omega^2 R\hat{j}$
(D)	w.r.t observer D	(S)	Centrifugal force = 0
		(T)	Pseudo force along x – axis = $mR\alpha\hat{i}$
		(U)	Pseudo force along x–axis = $2mR\alpha\,\hat{i}$
		(V)	Pseudo force along x–axis = 0

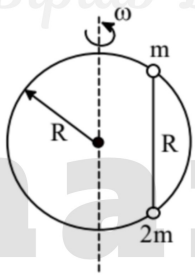
6) Initially the system is in equilibrium. Find the acceleration of the blocks. Each block has mass m



	Column – I		Column – II
A	Acceleration of A	P	g/15
B	Acceleration of B	Q	7g/15
C	Acceleration of C	R	23g/30
D	Acceleration of D	S	g/6
		T	0

Integer Type:

7) Two beads of mass m and 2m are connected by a massless rod of length R and threaded onto a smooth circular wire of radius R. When the wire rotates uniformly about a vertical diameter, the beads do not slide on it and rod remains vertical as shown. What must be the angular velocity (in rad/s) of the wire? ($g = 10\ m/s^2$) Radius R = 5/3 m.



8) An old record player of 10 cm radius turns at 10 rad/s while mounted on a 30° incline as shown in the figure. A particle of mass m can be placed anywhere on the rotating record. If the least possible coefficient of friction μ that must exist for no slipping to occur is μ, find $2\sqrt{3}\,\mu$