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"If there is no struggle, there is no progress."— Frederick Douglass

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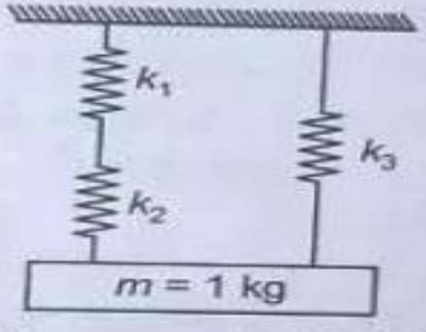
A mass of 1 kg is suspended by means of 3 springs as shown in the figure. The spring constant k_1, k_2 and k_3 are respectively 1 kN/m, 3 kN/m and 2 kN/m. The natural frequency of the system is approximately



(a) 46.90 rad/s (b) 52.44 rad/s
(c) 60.55 rad/s (d) 77.46 rad/s

[1996 : 2 Marks]

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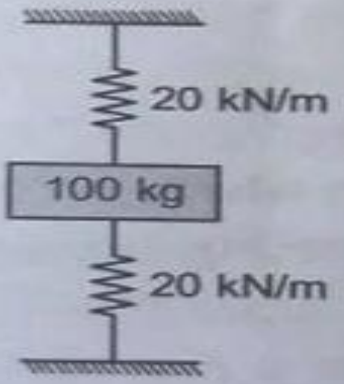
As shown in the figure, a mass of 100 kg is held between two springs. The natural frequency of vibration of the system in cycle/s, is



(a) $\frac{1}{2\pi}$

(b) $\frac{5}{\pi}$

(c) $\frac{10}{\pi}$

(d) $\frac{20}{\pi}$

[2000 : 2 Marks]

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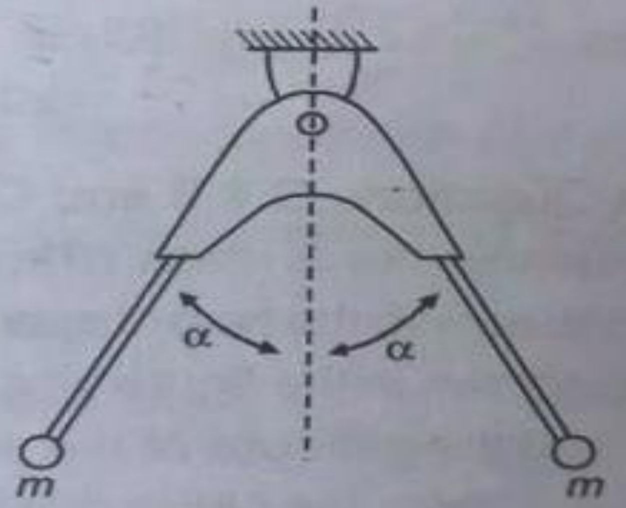
The assembly shown in the figure is composed of two massless rods of length l with two particles, each of mass m. The natural frequency of this assembly for small oscillations is



(a) $\sqrt{g/l}$

(b) $\sqrt{2g/l(\cos\alpha)}$

(c) $\sqrt{g/l(\cos\alpha)}$

(d) $\sqrt{(g\cos\alpha)/l}$

[2001 : 2 Marks]

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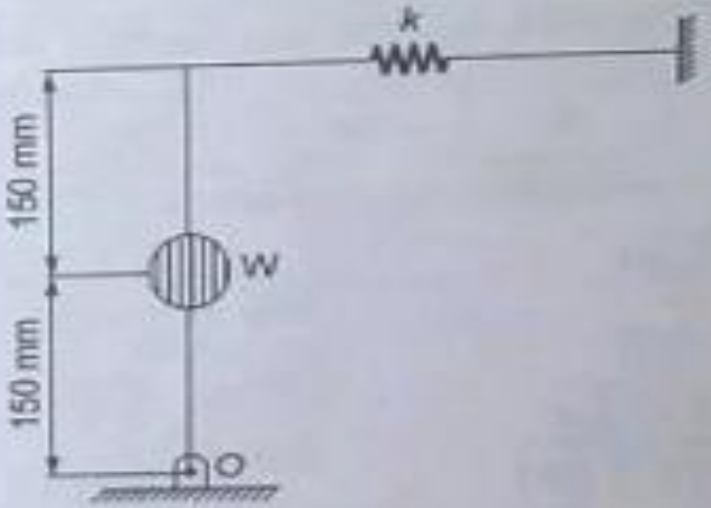
A uniform stiff rod of length 300 mm and having a weight of 300 N is pivoted at one end and connected to a spring at the other end. For keeping the rod vertical in a stable position the minimum value of spring constant *k* needed is



(a) 300 N/m
(b) 400 N/m
(c) 500 N/m
(d) 1000 N/m

[2004 : 2 Marks]

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A mass m, of 20 kg is attached to the free end of a steel cantilever beam of length 1000 mm having a cross-section of 25× 25 mm. Assume the mass of the cantilever to be negligible and E_{steel} = 200 GPa. If the lateral vibration of this system is critically damped using a viscous damper, the damping constant of the damper is

(a) 1250 Ns/m (b) 625 Ns/m
(c) 312.50 Ns/m (d) 156.25 Ns/m

[2004 : 2 Marks]

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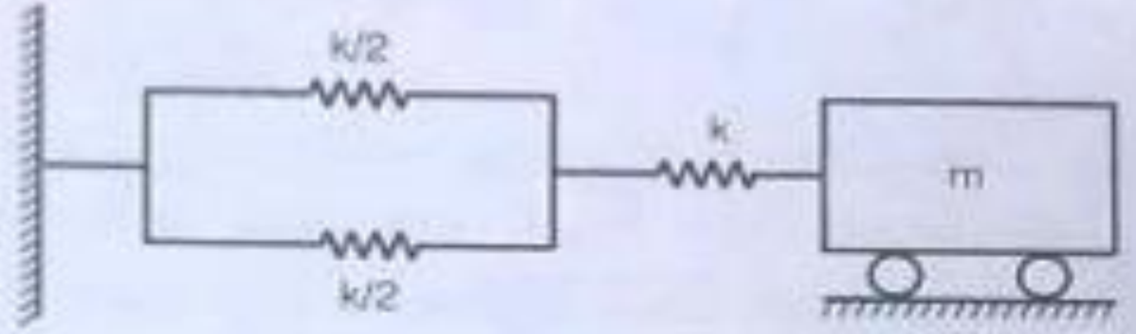
The natural frequency of the system shown below is



(a) $\sqrt{\frac{k}{2m}}$ (b) $\sqrt{\frac{k}{m}}$

(c) $\sqrt{\frac{2k}{m}}$ (d) $\sqrt{\frac{3k}{m}}$

[2007 : 2 Marks]

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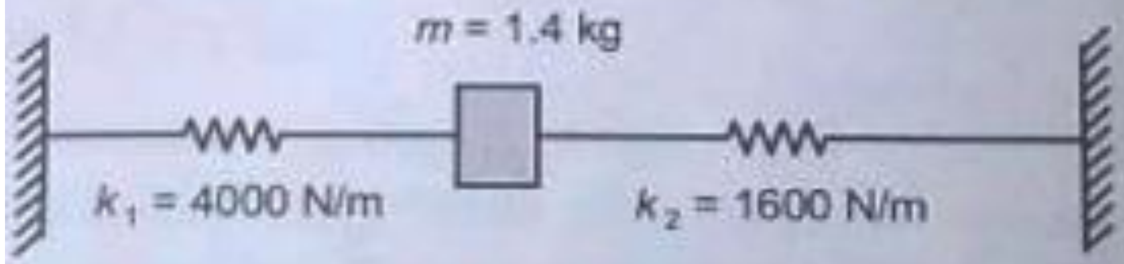
2 The natural frequency of the spring mass system shown in the figure is closest to



(a) 8 Hz
(b) 10 Hz
(c) 12 Hz
(d) 14 Hz

[2008 : 2 Marks]

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A uniform rigid rod of mass $m = 1$ kg and length $L = 1$ m is hinged at its centre & laterally supported at one end by a spring of spring constant $k = 300$ N/m. The natural frequency ω_n in rad/s is

(a) 10 (b) 20

(c) 30 (d) 40

[2008 : 2 Marks]

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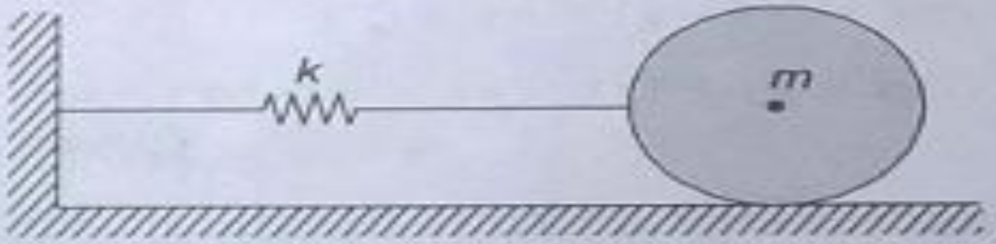
A disc of mass m is attached to a spring of stiffness k as shown in the fig. The disc rolls without slipping on a horizontal surface. The natural frequency of vibration of the system is



(a) $\frac{1}{2\pi}\sqrt{\frac{k}{m}}$

(b) $\frac{1}{2\pi}\sqrt{\frac{2k}{m}}$

(c) $\frac{1}{2\pi}\sqrt{\frac{2k}{3m}}$

(d) $\frac{1}{2\pi}\sqrt{\frac{3k}{2m}}$

[2011 : 2 Marks]

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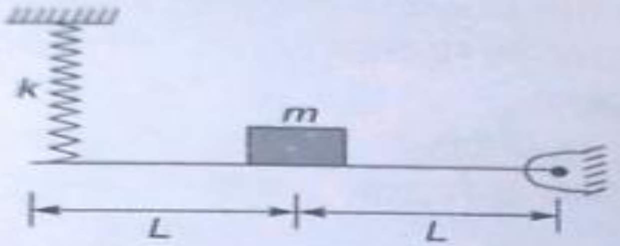
A concentrated mass m is attached at the centre of a rod of length 2L as shown in the figure. The rod is kept in a horizontal equilibrium position by a spring of stiffness k. For very small amplitude of vibration, neglecting the weights of the rod and spring, the undamped natural frequency of the system is



(a) $\sqrt{\frac{k}{m}}$ (b) $\sqrt{\frac{2k}{m}}$

(c) $\sqrt{\frac{k}{2m}}$ (d) $\sqrt{\frac{4k}{m}}$

[2012 : 2 Marks]

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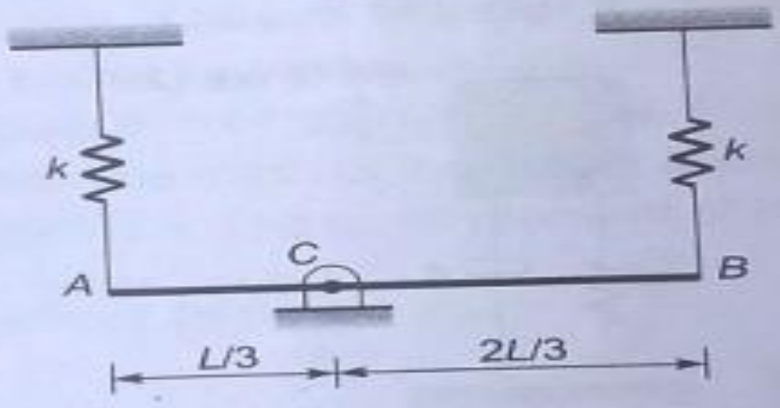
A rigid uniform rod *AB* of length L and mass m is hinged at *C* such that $AC = L/3$, $CB = 2L/3$. Ends *A* and *B* are supported by springs of spring constant *k*. The natural frequency of the system is given by



(a) $\sqrt{\frac{k}{2m}}$ (b) $\sqrt{\frac{k}{m}}$

(c) $\sqrt{\frac{2k}{m}}$ (d) $\sqrt{\frac{5k}{m}}$

[2014 : 2 Marks, Set-1]

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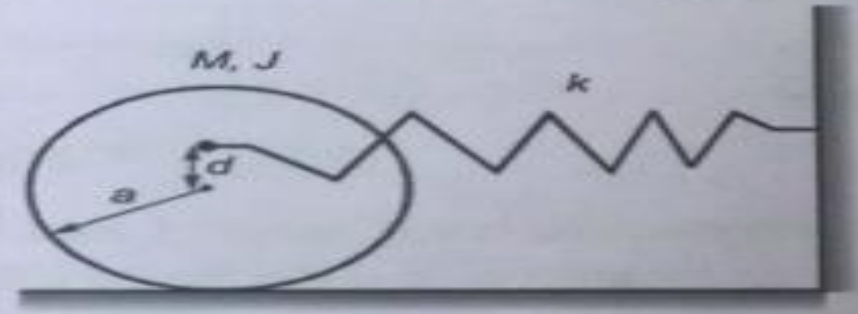
A solid disc with radius a is connected to a spring at a point d above the center of the disc. The other end of the spring is fixed to the vertical wall. The disc is free to roll without slipping on the ground. The mass of the disc is M and the spring constant is k. The polar moment of inertia for the disc about its centre is $J = \frac{Ma^2}{2}$



The natural frequency of this system in rad/s is given by

(a) $\sqrt{\frac{2k(a+d)^2}{3Ma^2}}$ (b) $\sqrt{\frac{2k}{3M}}$

(c) $\sqrt{\frac{2k(a+d)^2}{Ma^2}}$ (d) $\sqrt{\frac{k(a+d)^2}{Ma^2}}$

[2016 : 2 Marks, Set-1]

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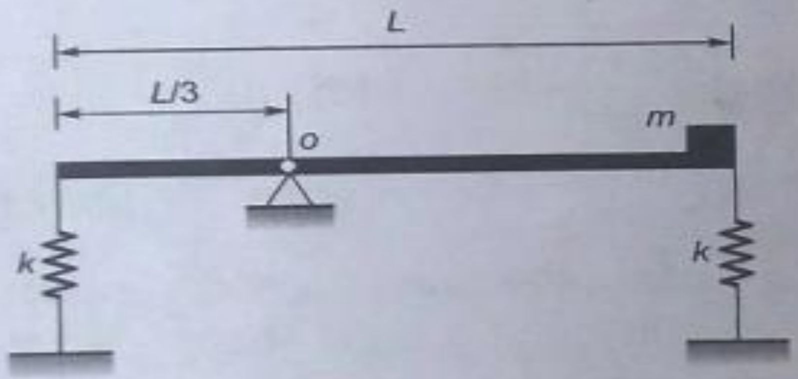
6 A thin uniform rigid bar of length L and M is hinged at point O, located at a distance of $L/3$ from one of its ends. The bar is further supported using springs, each of stiffness k, located at the two ends. A particle of mass $m = M/4$ is fixed at one end of the bar, as shown in the figure. For small rotations of the bar about O, the natural frequency of the system is



(a) $\sqrt{\frac{5k}{M}}$ (b) $\sqrt{\frac{5k}{2M}}$

(c) $\sqrt{\frac{3k}{2M}}$ (d) $\sqrt{\frac{3k}{M}}$

[2017 : 2 Marks, Set-1]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