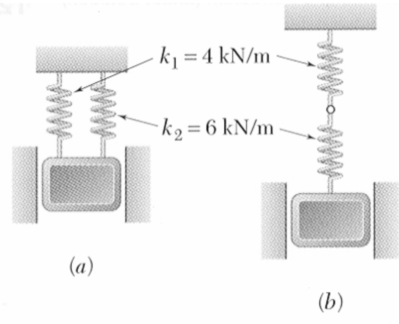
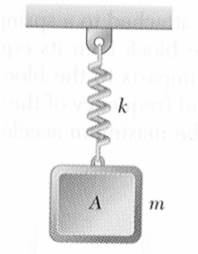
CE222 Spring 2014-2015
Home Exercise #6 (Vibration)

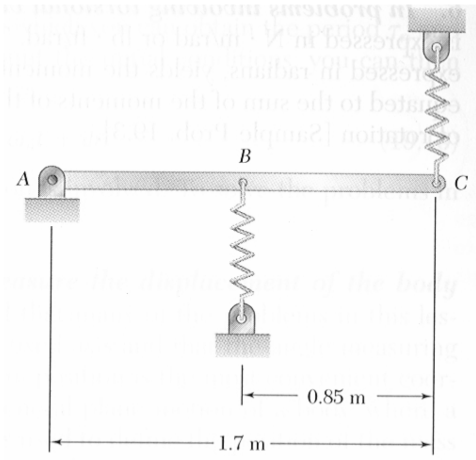
Q1. A 50-kg block moves between vertical guides as shown. The block is pulled 40 mm down from its equilibrium position and released. For each spring arrangement, determine the period of vibration.



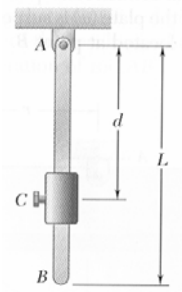
Q2. A 1.4-kg block is supported as shown by a spring of constant k = 400 N/m which can act in tension or compression. The block is in its equilibrium position when it is struck from below by a hammer which imparts the block an upward velocity of 2.5 m/s. Determine (a) the time required for the block to move 60 mm upward, (b) the corresponding velocity and acceleration of the block.



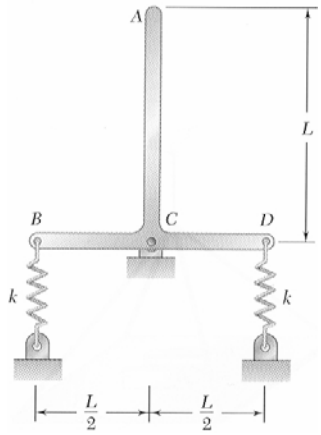
Q3. The 4.5 kg uniform rod AC is attached to springs of constant k = 750 N/m at B and k = 900 N/m at C, which can act in tension or compression. If the end C is depressed slightly and released, determine (a) the frequency of vibration, (b) the amplitude of the motion of point C, knowing that the maximum velocity of that point is 0.8 m/s.



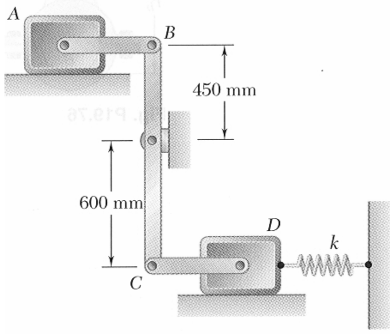
Q4. A small collar of mass 1-kg is rigidly attached to a 3-kg uniform rod length L = 1 m. Determine the period of small oscillations of the rod when (a) d = 1 m, (b) d = 0.7 m.



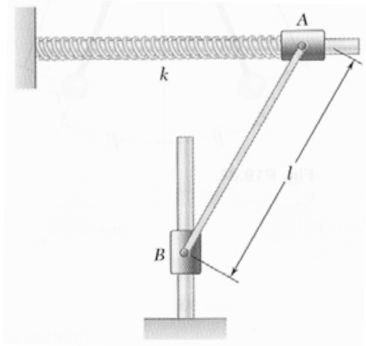
Q5. Two uniform rods, each of mass m = 10 kg and length L = 1 m, are welded together to form the assembly shown. Knowing that the constant of each spring is k = 750 N/m and that end A is given a small displacement and released, determine the frequency of the resulting motion.



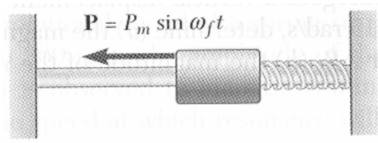
Q6. Two blocks, each of mass 1.5 kg, are attached to links which are pin-connected to bar BC as shown. The masses of the links and bar are negligible, and the blocks can slide without friction. Block D is attached to a spring of constant k = 720 N/m. Knowing that block A is moved 15 mm from its equilibrium position and released, determine the magnitude of the maximum velocity of block D during the resulting motion.



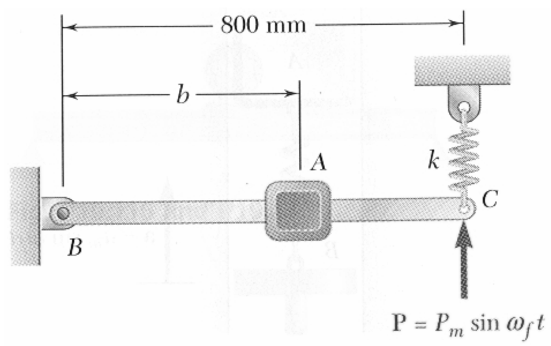
Q7. A slender 10 kg bar AB of length l = 0.6 m is connected to two collars of negligible mass. Collar A is attached to a spring of constant k = 1.5 kN/m can slide on a horizontal rod, while collar B can slide freely on a vertical rod. Knowing that the system is in equilibrium when bar AB is vertical and that collar A is given a small displacement and released, determine the period of the resulting vibrations.



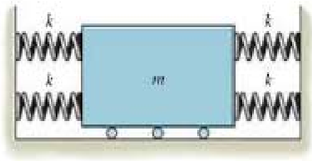
Q8. A 4-kg collar can slide on a frictionless horizontal rod and is attached to a spring of constant 450 N/m. It is acted upon by a periodic force of magnitude $P = P_m \sin\omega_f t$, where P_m =13 N. Determine the amplitude of the motion of the collar if (a) ω_f = 5 rad/s, (b) ω_f = 10 rad/s.



Q9. A small 20-kg block A is attached to the rod BC of negligible mass which is supported at B by a pin and bracket and at C by a spring of constant k = 2 kN/m. The system can move in vertical plane and is in equilibrium when the rod is horizontal. The rod is acted upon at C by a periodic force P of magnitude $P = P_m \sin\omega_f t$, where P_m = 6 N. Knowing that b = 200 mm, determine the range of values of ω_f for which the amplitude of vibration of block A exceeds 3.5 mm.



Q10. Determine the frequency of vibration for the block. The springs are originally compressed Δ .



Q12. The uniform beam is supported at its ends by two springs A and B, each having the same stiffness k. When nothing is supported on the beam, it has a period of vertical vibration of 0.83 s. If a 50-kg mass is placed at its center, the period of vertical vibration is 1.52 s. Compute the stiffness of each spring and the mass of the beam.