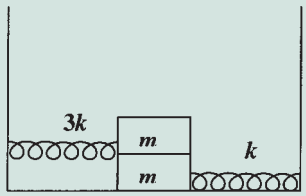
Physics Challenges for Teachers and Students

Harmony and Friction

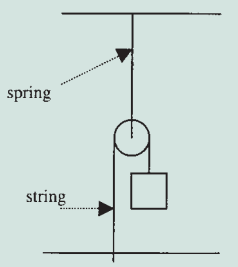
When the system shown in the diagram is in equilibrium, the right spring is stretched by x_1. The coefficient of static friction between the blocks is μ_s; there is no friction between the bottom block and the supporting surface. The force constants of the springs are k and $3k$ (see the diagram). The blocks have equal mass m. Find the maximum amplitude of the oscillations of the system shown in the diagram that does not allow the top block to slide on the bottom.

DOI: 10.1119/1.1639977



Down Under

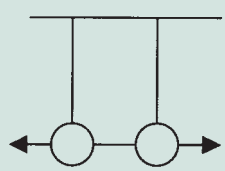
Find the period of low-amplitude vertical vibrations of the system shown. The mass of the block is m. The pulley hangs from the ceiling on a spring with a force constant k. The block hangs from an ideal string.



DOI: 10.1119/1.1639978

Good Vibes

Two simple pendulums of length L each are attached to the ceiling. The small balls attached to the strings have equal masses m. The weights are connected by a very light relaxed rubber band (not a spring) with the force constant k. At a certain moment, each ball is given a light quick push as shown, resulting in equal initial speeds. Find the period T of the ensuing motion.



DOI: 10.1119/1.1639979

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Our October challenges drew many responses from both the United States and abroad. Below are the names of the readers who were first to submit the correct solutions.

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The solutions, as well as the more complete list of contributors, can be found on our website: http://www.aapt.org/tpt. We look forward to your future contributions.

Note to Contributors:

As the number of submissions grows, we request that certain guidelines be observed, in order to facilitate the process more efficiently:
– email solutions as Word files;
– name the file "January04LSimpson" if — for instance — your name is Lisa Simpson, and you are sending the solutions to January 2004 Challenges;
– state your name, hometown, and professional affiliation in the file, not only in the email message.
Many thanks!

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