

Physics Challenges for Teachers and Students

A Worldwide Problem-Solving Contest



► The Spring in the Winter (F3)

A movable heavy piston is supported by a spring inside a vertical cylindrical container as shown. When all air is pumped out of the container, the piston is in equilibrium as shown in Diagram 1, with only a tiny gap between the piston and the bottom of the container.

When a portion of gas at temperature T is introduced under the piston, the latter rises to a height h as shown in Diagram 2.

What would be the height of the piston above the bottom of the container if the gas is then heated to temperature $2T$? Assume that the piston moves without friction and that the spring obeys Hooke's law.

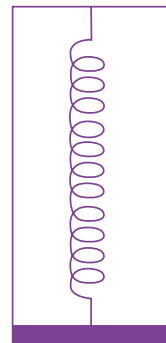


Diagram 1

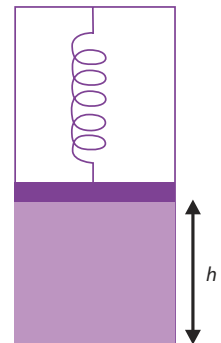


Diagram 2

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Submission Guidelines:

The deadline for submitting solutions to this problem is Feb. 28, 2005.

- only email submissions will be considered;
- email your solutions to Boris Korsunsky at korsunbo@post.harvard.edu;
- please email the solutions as Word files;
- please email *each solution* as a separate file;
- note that each problem, in addition to a very clever title, has a code such as F13. Please name each file as “problem code-first initial-last name.” For instance, “F3DVader” if your name is Darth Vader and you are sending the solution to problem F3;
- please state your name, hometown, and professional affiliation in each file.

We look forward to your (and your students’) participation.

Please send correspondence to:

Boris Korsunsky
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The next Challenge problem will be posted online Feb. 21.