

Seven things to do with a barometer

“Describe how to determine the height of a skyscraper with a barometer.”

This was a question on a physics degree at the University of Copenhagen. One student replied . . .

“You tie a long piece of string to the neck of the barometer, then lower the barometer from the roof to the ground. The length of the string plus the length of the barometer will equal the height of the building.”

This highly original answer so incensed the examiner that the student was failed immediately. The student appealed on the grounds that his answer was indisputably correct, and the university appointed an independent arbiter to decide the case. The arbiter judged that the answer was indeed correct, but did not display any noticable knowledge of physics. To resolve the problem, it was decided to call the student in, and allow him six minutes in which to provide a verbal answer, which showed at least a minimal familiarity with the basic principles of physics.

The student sat in silence, forehead creased in thought, until the arbiter reminded him that time was running out. The student replied that he had several extremely relevant answers, but couldnt make his mind up which to use. On being advised to hurry up, the student replies as follows:

“Firstly, you could take the barometer up to the roof of the skyscraper, drop it over the edge, and measure the time it takes to reach the ground. The height of the building can then be worked out from the formula $H = \frac{1}{2}gt^2$. But bad luck on the barometer!

“Or if the sun is shining you could measure the height of the barometer, then set it on end and measure the length of its shadow. Then you measure the length of the skyscrapers shadow, and thereafter it is a simple matter of proportional arithmetic to work out the height of the skyscraper.

“But if you wanted to be highly scientific about it, you could tie a short piece of string to the barometer and swing it like a pendulum, first at ground level and then on the roof of the skyscraper. The height is worked out by the difference in the gravitational restoring force $T = 2\pi\sqrt{\frac{l}{g}}$.

“Or if the skyscraper has an outside emergency staircase, it would be easier to walk up it and mark off the height of the skyscraper in barometer lengths, then add them up.

“If you merely wanted to be boring and orthodox about it, of course, you could use the barometer to measure the air pressure on the roof of the skyscraper and on the ground, and convert the difference in millibars into feet to give the height of the building.”

“But since we are constantly being exhorted to exercise independence of mind and apply scientific methods, undoubtedly the best way would be to knock on the janitor’s door and say to him, “If you would like a nice new barometer, I will give you this one if you tell me the height of this skyscraper.””

The student was Niels Bohr (the only Dane to win the Nobel Prize for Physics).

Andrew Norman
Pembroke College, Cambridge, 2007
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