

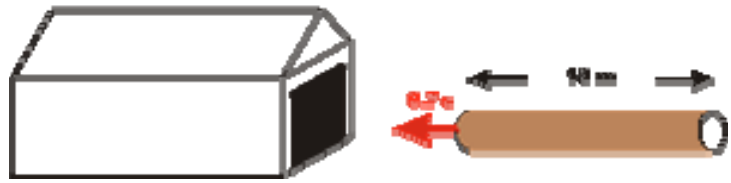
## PHY100S – The Magic of Physics Homework #6

This homework assignment is due in the Drop Box for your tutor by 5 PM on Monday March 6.

### QUESTION 1

We have a 25 m long pole and a 20 m long barn, both as measured at rest relative to the pole and the barn. We will assume the back wall of the barn is very very strong

If the pole is moving towards the barn at 70% of the speed of light, its length will be contracted to about 18 m. Thus it clearly fits in the barn, and we can slam the door shut (and run!).



But if we are riding along with the pole, its length is not contracted and is 25 m long. But the barn is contracted and is now about 14 m long. Clearly the pole does not fit in the barn.

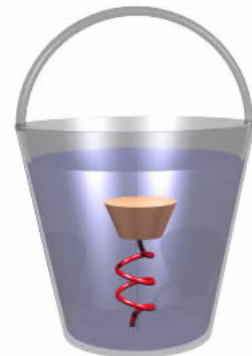


Does the pole fit in the barn or not? Does the door slam shut or not? Explain.

### QUESTION 2

A bucket of water has a spring soldered to the bottom, as shown. A cork is attached the spring, and is therefore suspended under the surface of the water.

You are on top of the CN tower, holding the bucket, and step off. While falling towards the ground, do you see the cork move towards the top of the water, towards the bottom of the bucket, or stay where it is relative to the bucket and the water? Explain.



In thinking about this question, you may find it helpful to recall a realization due to Archimedes: the buoyant force that causes some objects to float is equal to the weight of the displaced water. It is reported that Archimedes had this insight while in the bath, and caused him to get so excited that he ran naked down the streets of Syracuse in Sicily shouting “Eureka! I’ve found it!”