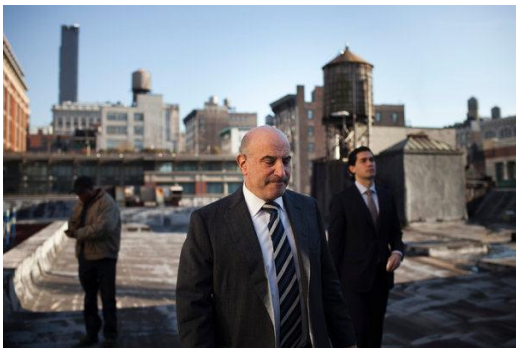
HEAT CONDUCTION & FLUID

PRESSURE DUE TO HEIGHT

Units 20 & 18 Dr. John P. Cise, Professor of Physics, Austin Community College, 1212 Rio Grande St., Austin Tx 78701 jpcise@austincc.edu & NYTimes Dec.18,2012 by Elizabeth Harris

Getting Water to New Yorkers Is a Family Business



Andrew Rosenwach, center, and his son Henry, right, of the Rosenwach Group, one of the three companies that install wooden water tanks in New York City.

INTRODUCTION: Two concepts that will be treated with this article on wood water tanks at the top of high rise buildings in New York City are: Pressure under fluids $\{p = D_{weight\ density}\ h\}$ and Heat(Q) conductivity through surfaces where $Q = k\ A\ \Delta T\ t/L$, k=coefficient of thermal conductivity of material, A = area of surface heat is being conducted through, ΔT = temperature difference across material, L =material thickness, t = time

QUESTIONS: (a) Find the height(h) of water(in inches) that could be supported by 30 psi of water pressure as mentioned in article below? (b)Convert the height in inches found in (a) into feet? (c) If 11.6 ft/floor, find how many floors of water could be supported by 30 psi? (d) If a water tank is on the 20th floor of a building find the water pressure(p) at the first floor just due to height of the water tank? (e)Convert the (110^{o}F -72^{o}F) into ΔC ? (f) Find heat(Q) transferred into a wood water tank of A = 100 m^{2} , 1.5 inches thickness(0.381 m) for 1 hour(3600 s) if ΔC is the value in (e)? (g) Same question as (f) but find heat(Q) transferred if the tank was steel?

HINTS: K_{steel} = 40 J/s m ^{o}K , K_{wood}= 0.17 J/s m ^{o}K ,144 in^{2}/ft^{2} ΔC/ΔF =5/9 , D_{water}= 62.4 lb./ft^{3} , 1728 inch^{3}/ft^{3}, 12 in/ft

ANSWERS: (a)830.8 inch (b) 69.23 ft, (c) 6 floors(as stated in article),(d) 100 psi, (e) 21.11 ^{o}C , (f) Q_{wood}=0.339 X 10^{8} J (g) Q_{steel} = 80 X 10^{8} J Note: Q_{steel} = 236 Q_{wood} , Good for wood

New York is many things: dynamic and dense, artistic and competitive, vivacious and sometimes, particularly in summer, a bit smelly. The list of traits goes on and on, but the word “quaint” isn’t on it. And yet one of the city’s most familiar signposts is a charming, rustic throwback: the wooden water tank. For over a century, **the basic design of these tanks, which are essentially giant wooden barrels, has gone largely unchanged.** Though they look old-fashioned, wooden tanks are still very much in use, even in the city’s new luxury buildings, like the stratospherically expensive condominiums at 15 Central Park West, said David Hochhauser, who owns Isseks along with his brother and sister.(((**Pressure in the city’s pipes will take water up only about half a dozen stories,))) so a building taller than just a few floors requires either a pumping system or a system of tanks, which(((shifts some of the burden to the force of gravity))) for a sprinkler system or, say, tap water.** Water tanks for buildings(((can also be made of steel))), but they are less recognizable because they are mostly enclosed — (((imagine ***how hot a steel vat would get on a rooftop in August, or how quickly it might freeze on a January night***))).