During snowfalls, most children are excited by the accumulating snow, while many parents may worry if the weight of the snow will eventually cause their roofs to collapse. Although a small amount of snow weighs next to nothing, a few feet can weigh many pounds. How much snow is too much for the average roof on a house? Engineers estimate that 65 pounds per square foot (320 kg/m²) is the average amount that a standard wood-framed roof can hold before it collapses. Dry snow has a density of about 50 kg/m³ while wet snow has a density of 200 kg/m³.

**Problem 1** - Two houses are covered with a blanket of snow. House A has dry snow to a depth of 1 meter, and House B has a roof covered with wet snow to a depth of \( \frac{1}{2} \) meter. Which house is at greater risk of roof collapse?

**Problem 2** - A snow storm of wet snow began at 6:00 am and continued steadily all day at a rate of 20 cm/hour. At what time will the snow accumulating on the roof reach the critical load for roof collapse?

Space Math http://spacemath.gsfc.nasa.gov
**Problem 1** - Two houses are covered with a blanket of snow. House A has dry snow to a depth of 1 meter, and House B has a roof covered with wet snow to a depth of ½ meter. Which house is at greater risk of roof collapse?

Answer: House A has 1 meter of dry snow covering every square meter of surface, so the mass of this snow on the roof is $50 \text{ kg/m}^3 \times 1 \text{ meter} = 50 \text{ kg/m}^2$. House B has wet snow to a depth of 1/2 meter so the mass is $200 \text{ kg/m}^3 \times 1/2 \text{ meter} = 100 \text{ kg/m}^2$. **House B is at greater risk even though it appears to have much less snow cover.**

**Problem 2** - A snow storm of wet snow began at 6:00 am and continued steadily all day at a rate of 20 cm/hour. At what time will the snow accumulating on the roof reach the critical load for roof collapse?

Answer: The wet snow density is 200 kg/m$^3$. It is accumulating at a rate of 0.2 meters/hour. To reach 320 kg/m$^2$, which engineers say is the critical loading for roof collapse, you need to accumulate a thickness of $320/200 = 1.6$ meters. At a rate of 0.2 meters/hour this will take about $1.6$ meters x (1 hour/0.2 meters) = 8 hours, so by about **2:00 pm**, the roof might collapse.