Gas clouds in interstellar space are acted upon by external pressure and their own gravity, and would otherwise collapse, but if they are hot enough, they can remain stable for a long time. That seems to be the case for objects called Bok Globules.

This photo of Thackeray's Globule (IC-2944) taken by the Hubble Space Telescope may be a stable dark cloud containing 10 times the mass of our sun at a temperature of less than 100 K.

A gas sphere with a radius, R, a mass, M, and a temperature, T, is subject to an external pressure, P so that

$$P = \frac{3MkT}{4\pi R^3 \mu m} - \frac{3GM^2}{20\pi R^4}$$

where k, G and μ are constants.

Problem 1 - At what minimum radius will the cloud start to collapse for a given mass and temperature?

Problem 1 - The problem states that the mass and temperature are held constant, so the only free variable is R. For complicated equations, it is always a good idea to group all constants together and define new constants. You can later replace the new constants by the old ones. Let's define $A = (3MkT/4\pi\mu m)$ and $B=(3GM^2/20\pi)$, then the equation becomes $P = AR^{-3} - BR^{-4}$. To find the extremum, we calculate dP/dR and set this equal to zero. This gives us $dP/dR = A(-3)R^{-4} - B(-4)R^{-5} = 0$. This leads to R = 4 B/3 A which upon substituting back for the definitions of A and B gives us

$$R_c = \frac{12G\mu m}{45kT}$$