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

$$P = \frac{3 M k T}{4 \pi R^3 \mu m} - \frac{3 G M^2}{20 \pi R^4}$$

where $k$, $G$ and $\mu$ 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 $A = \frac{3MkT}{4\pi\mu m}$ and $B = \frac{3GM^2}{20\pi}$, then the equation becomes $P = AR^{-3} - BR^{-4}$. To find the extremum, we calculate $\frac{dP}{dR}$ and set this equal to zero. This gives us $\frac{dP}{dR} = A(-3)R^{-4} - B(-4)R^{-5} = 0$. This leads to $R = \frac{4B}{3A}$ which upon substituting back for the definitions of A and B gives us

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