

Your science teacher has assigned you the task of building a water barometer. You have learned that the pressure of the atmosphere can vary by as much as 5% from 1 standard atmosphere as the weather changes.

(a) What minimum height must your barometer have?

(b) One stormy day the TV weather person says, "The barometric pressure this afternoon is a low 29.55 inches." What is the height of the water in your barometer?

Solution

We know, that the **1 atmosphere=101 325 Pa**.

a) The pressure of 1.05 atm is equal to pressure of water column, which has height

$$h = \frac{p}{g\rho}$$

$$\rho = 1000 \frac{kg}{m^3}$$

$$g = 9.8 \frac{m}{s^2}$$

$$p = 1.05 * 101300 Pa$$

$$h = 10.85m$$

Answer:

Barometer must have minimum height $h = 10.85m$

b) We have, that the mercury (the density of mercury is $\rho_m = 13600 \frac{kg}{m^3}$) in barometer

has height $h_m = 29.95inches = 76.07cm = 0.7607m$

It is equal pressure $p = g\rho_m h_m = 101390Pa$

It is equal pressure of water column, which has height $h_w = \frac{p}{g\rho} = 10.36m$.

Answer:

The height of water is

$$h_w = 10.36m$$