Question#18865

How much weight can be lifted by a Hydrogen (& also separately for Helium) filled balloon of 10 cubic Meter, at sea level & at a temp. of 20 Degree Centigrade. Pl. describe the inputs used.

Solution:

Let:

$V = 10\,m^3$

$T = 20℃$

$m-?$

$F = mg,\ m = \frac{F}{g}$ were: F – buoyant force

According to the Archimedes' principle:

$F = (\rho_{air} - \rho_{hydrogen})Vg$

Were: ρ_{air} – density of air, $\rho_{hydrogen}$ - density of hydrogen, $g = 9{,}8\ m/s^2$

$\rho_{air} = 1.29\ \text{kg/m}^3$, $\rho_{hydrogen} = 0.09\ \text{kg/m}^3$

$m = \frac{(\rho_{air} - \rho_{hydrogen})Vg}{g} = (\rho_{air} - \rho_{hydrogen})V = (1.29 - 0.09) * 10 = 12\ kg$

Answer: 12 kg.

For Helium: $\rho = 0.178\ \text{kg/m}^3$, $m = (1.29 - 0.178) * 10 = \mathbf{11.12\ kg}$