8. Balloon

We can measure the lift of the ball by attaching a weight $M = 100\,\mathrm{g}$ to it and taking the reading of the scales $F/g = m + M - \rho V = 73.4\,\mathrm{g}$, where $\rho = \mu p_0/RT \approx 1.2\,\mathrm{g/l}$. Hence, $\rho V - M = 27.6\,\mathrm{g}$. So, we need to determine the volume of the ball. To that end, we tighten the rope around the ball as tightly as the fasteners can hold (note that smaller tension values would results in a too small volume decrease, and hence, in a large uncertainty of the final answer). We weight the ball with rope (93.3 g) and subtract the mass of the rope (19.1 g) to find $\rho V' - M = 28.4\,\mathrm{g}$, where V' is the ball volume, when the rope is tightened. Hence, the volume decrease $\Delta V = V - V' = (28.4 - 27.6)/1.2\,\mathrm{l} \approx .67\,\mathrm{l}$. Later, we determine the maximal tension in rope (which can be hold by fasteners) with dynamometer, $T \approx 30\,\mathrm{N}$. We also estimate the average angle $\tan\alpha \approx 1.4$. The radius of the loop is calculated from the measurement of the perimeter, $R \approx 15\,\mathrm{cm}$. According to the given formula, these data correspond to $\Delta p \approx 1900\,\mathrm{Pa}$. Due to gas law, $\dfrac{\Delta p}{p_0} \approx \dfrac{\Delta V}{V}$, hence $V \approx p_0 \dfrac{\Delta V}{\Delta p} \approx 33\,\mathrm{l}$. Therefore, $M = \rho V - 27.6\,\mathrm{g} \approx 12\,\mathrm{g}$.