

How to Use the Helium Regulator and Garden Hose to Inflate a 1200g Balloon Using the Pressure Difference Method

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1. Unscrew and remove the pressure valve knob from the regulator. This must be done before connecting the regulator to the tank otherwise you risk an accidental expulsion of helium. FYI, unscrewing the pressure valve knob disconnects the flow of helium through the regulator.
2. Make sure the valve on the tank is shut and not leaking or cracked.
3. Connect the regulator to the tank in the same manner the hose is normally connected to the tank.
4. Open, or unscrew, the valve on the tank to allow the helium to flow out of the tank and into the regulator. **IT IS CRUCIAL THAT YOU NOTE THE PRESSURE READING ON THE REGULATOR AT THIS POINT** because this will be your starting pressure. For the full tank we used at Huntsville for this experiment we measured a pressure of **2650 psi/18100 kPa**.
5. Securely connect the hose to the balloon.
6. Once everything is ready and in place, slowly and carefully screw-in the pressure valve knob onto the helium regulator. The flow of helium should start. The more you screw-in the valve the higher the flow rate of the helium. Adjust it to the desired flow rate and monitor the balloon and helium regulator as the balloon inflates.
7. For our experiment, we attached the lift-off weight to gauge how much helium is required to adequately fill the balloon. Once the balloon lifted from the ground, we stopped the flow of helium by unscrewing and completely removing the pressure valve knob from the regulator. We noted the final pressure as **1500 psi/10500 kPa**.
8. Therefore the ΔP required to fully inflate a 1200g balloon is **2650-1500 = 1150 psi**, or **18100-10500 = 7600 kPa**.
9. Note: According to the numbers above, each helium tank should give us about 2.3 balloons. To inflate a balloon from a tank with less than 1150 psi of helium, simply note the initial tank pressure and express all the helium into the balloon. Note the final pressure and calculate the ΔP of helium that was expressed into the balloon. Subtract that ΔP from 1150 psi to get the additional ΔP of helium that will be required from the new tank. Connect the regulator to the new helium tank taking in mind the precautions outlined above, and note the initial pressure. Subtract the remaining ΔP from this initial pressure and continue inflating the balloon until you reach the final pressure calculated from the new tank initial pressure – remaining ΔP .
10. We can assume this relationship to be valid based on the assumption that the temperature remains constant, i.e. $PV=nRT$, hence for a given ΔV that we require to inflate the balloon, there will be a $\Delta P = nRT/\Delta V$, assuming the temperature to be constant.
11. Remember to store the pressure valve knob in a safe place for the next launch.