GCSE Physics Calculation Questions Using $p_1V_1 = p_2V_2$

These questions are based on real-life situations involving gases. Use the equation $p_1V_1 = p_2V_2$ and rearrange it where necessary to calculate the missing pressure or volume.

1. A cyclist uses a bicycle pump. Air in the pump has a pressure of 100 kPa and a volume of 60 cm³. The handle is pushed in until the volume is 30 cm³. Calculate the new pressure.
2. A diver releases an air bubble that has a volume of 120 cm³ at a pressure of 200 kPa. As it rises, the pressure falls to 100 kPa. Calculate the new volume.
3. A nurse pulls back the plunger of a syringe. The air inside initially occupies 50 cm³ at 100 kPa and expands to 80 cm³. Calculate the new pressure.
4. A weather balloon contains 2.0 m³ of helium at 120 kPa on the ground. Higher in the atmosphere the pressure falls to 80 kPa. Calculate the new volume.
5. A scuba diver has an air bubble trapped under a rock. The bubble has a volume of 40 cm³ at 500 kPa. It rises until the pressure is 250 kPa. Calculate its new volume.
6. A car piston compresses a gas from 300 cm³ to 100 cm³. The initial pressure is 100 kPa. Calculate the pressure after compression.
7. A hot-air balloon contains 5.0 m³ of gas at 100 kPa. At higher altitude the pressure falls to 25 kPa. Calculate the new volume.
8. An air mattress contains an air pocket of 250 cm³ at 100 kPa. Someone sits on it, increasing the pressure to 250 kPa. Calculate the new volume.
9. A diver observes a 10 cm³ air bubble at a depth where the pressure is 400 kPa. Calculate the bubble's volume when it reaches the surface at 100 kPa.
10. A gas cylinder contains gas occupying 0.50 m³ at 180 kPa. The gas expands to fill a larger container with a volume of 0.90 m³. Calculate the new pressure.

11. A helium balloon has a volume of 3.0 m^3 at sea level where the pressure is 100 kPa. Calculate its volume at a height where the pressure is 50 kPa.
12. A syringe contains 250 cm^3 of air at 160 kPa. The plunger is pushed in until the pressure reaches 400 kPa. Calculate the new volume.
13. An air pocket trapped inside a submarine occupies 0.75 m^3 at 300 kPa. As the submarine rises, the pressure decreases to 120 kPa. Calculate the new volume.
14. A Formula 1 car's pneumatic valve system contains gas at 2.4×10^5 Pa occupying 0.20 m^3. The gas is compressed to 0.12 m^3. Calculate the final pressure.
15. A laboratory gas sample occupies 8.0×10^{-3} m^3 at a pressure of 3.0×10^5 Pa. The pressure is increased to 4.8×10^5 Pa. Calculate the new volume.
16. A deep-sea research vehicle observes a gas bubble with a volume of 2.5×10^{-4} m^3 at a pressure of 5.0×10^5 Pa. Calculate the volume when the bubble rises to a region where the pressure is 1.0×10^5 Pa.
17. A space simulation chamber contains a gas occupying 0.015 m^3 at a pressure of 1.2×10^6 Pa. The pressure is reduced to 3.0×10^5 Pa. Calculate the final volume.