

- The solubility of nitrogen in water at 25 °C and 1.0 atm is 0.018 g L⁻¹. What is its solubility at 0.50 atm and 25 °C?

The equilibrium of interest is $\text{N}_2(\text{g}) \rightleftharpoons \text{N}_2(\text{aq})$ with equilibrium constant:

$$K = \frac{[\text{N}_2(\text{aq})]}{[\text{N}_2(\text{g})]}$$

From the perfect gas law, $PV = nRT$ or concentration = $\frac{n}{V} = \frac{P}{RT}$.

As a result, doubling the pressure doubles the concentration of $\text{N}_2(\text{g})$. As the temperature is unchanged, the equilibrium constant does not change and so $[\text{N}_2(\text{aq})]$ must halve to ensure that K_p is constant.

The solubility is thus halved to $\frac{1}{2} \times 0.018 = 0.009 \text{ g L}^{-1}$

Answer: **0.009 g L⁻¹**