- Following blood donation, a solution of sodium oxalate is added to remove Ca^{2+} ions (as calcium oxalate, $CaC_2O_4{\cdot}H_2O$, K_{sp} 2.3×10^{-9}), which cause the blood to clot. If the concentration of Ca^{2+} ions in blood is 9.7×10^{-5} g mL^{-1}, and 100.0 mL of 0.1550 M $Na_2C_2O_4$ is added to a 104 mL sample of blood, what will be the concentration (in mol L^{-1}) of Ca^{2+} ions remaining in the blood?

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The amount of Ca^{2+} present in 100.0 mL is 9.7×10^{-3} g. As its molar mass is 40.08 g mol^{-1}, this corresponds to:

number of moles = mass / molar mass =
= (9.7×10^{-3} g) / (40.08 g mol^{-1}) = 2.4×10^{-4} mol

The number of moles of $C_2O_4^{2-}(aq)$ added is:

number of moles = concentration × volume
= (0.1550 mol L^{-1}) × (0.1000 L) = 0.01550 mol

When this is added to the blood, the total volume increases to (100.0 + 104) mL = 204 mL. The concentration of $C_2O_4^{2-}(aq)$ is now:

concentration = number of moles / volume
= (0.01550 mol) / (0.204 L) = 0.0760 mol L^{-1}

For $CaC_2O_4.H_2O(s)$, the solubility product is for the reaction:

$$CaC_2O_4.H(s) \rightleftharpoons Ca^{2+}(aq) + C_2O_4^{2-}(aq) + H_2O(l)$$

$$K_{sp} = [Ca^{2+}(aq)][C_2O_4^{2-}(aq)]$$

The amount of $C_2O_4^{2-}$ is *much* larger than the amount of Ca^{2+} present so precipitation of $CaC_2O_4.H_2O(s)$ does not reduce its concentration significantly. Hence:

$$[Ca^{2+}(aq)] = K_{sp} / [C_2O_4^{2-}(aq)] = (2.3 \times 10^{-9} / 0.0760)\ M = 3.0 \times 10^{-8}\ M$$

Answer: **3.0×10^{-8} M**