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- Derive expressions for the equilibrium constants for the complexation of Pb^{2+} (K_1) and of Ca^{2+} (K_2) by $EDTA^{4-}$.

$$\mathbf{Pb^{2+} + EDTA^{4-} \rightleftharpoons [Pb(EDTA)]^{2-}} \quad K_1 = \frac{[\mathbf{Pb(EDTA)^{2-}}]}{[\mathbf{Pb^{2+}}][\mathbf{EDTA^{4-}}]}$$

$$\mathbf{Ca^{2+} + EDTA^{4-} \rightleftharpoons [Ca(EDTA)]^{2-}} \quad K_2 = \frac{[\mathbf{Ca(EDTA)^{2-}}]}{[\mathbf{Ca^{2+}}][\mathbf{EDTA^{4-}}]}$$

Briefly explain why the chelating agent, EDTA, is administered as $[Ca(EDTA)]^{2-}$ to treat lead poisoning and determine which of K_1 or K_2 must be greater for the therapy to be effective.

K_1 must be greater than K_2 for the therapy to be effective.

$[Ca^{2+}]$ is much greater than $[Pb^{2+}]$ in the body, so need $K_1 > K_2$ to form the Pb complex. If EDTA is not administered as the Ca complex, it will strip Ca^{2+} from the body.