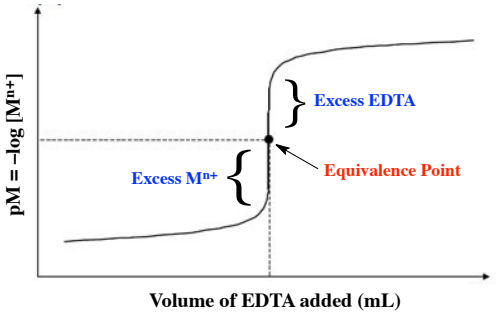
CONCEPT: EDTA TITRATION CURVES

The following can be used as the roadmap for determining the p[M^{n+}] for a metal-EDTA Titration.

$$M^{n+} + EDTA \rightleftharpoons MY^{n-4} \qquad K_f' = \alpha_{Y^{4-}} K_f = \frac{[MY^{n-4}]}{[M^{n+}][EDTA]}$$



Equivalence Volume (V_e)

The titration of 50.0 mL of 0.100 M Ba^{2+} (buffered to 9.00) with 0.050 M EDTA

Before Equivalence Point

The titration of 50.0 mL of 0.100 M Ba^{2+} (buffered to 9.00) with 80.0 mL of 0.050 M EDTA

$$M^{n+} = \underbrace{\left(\frac{V_e - V_{EDTA}}{V_e}\right)}_{\text{Fraction of } M^{n+} \text{ remaining}} [M^{n+}]_0 \underbrace{\left(\frac{V_{\text{Initial } M^{n+}}}{V_{Solution}}\right)}_{\text{Dilution Factor}}$$

At Equivalence Point

The titration of 50.0 mL of 0.100 M Ba^{2+} (buffered to 9.00) with 100.0 mL of 0.050 M EDTA

$$[MY^{n-4}] = [M^{n+}]_0 \underbrace{\left(\frac{V_{\text{Initial } M^{n+}}}{V_{Solution}}\right)}_{\text{Dilution Factor}}$$

	M^{n+}	+	EDTA	$\rightleftharpoons$	MY^{n-4}
Initial	–		–		$[MY^{n-4}]$
Change	+ x		+ x		– x
Equilibrium	+ x		+ x		$[MY^{n-4}] - x$

$$M^{n+} + EDTA \rightarrow MY^{n-4} \qquad K_f' = \alpha_{Y^{4-}} K_f \qquad K_f' = \frac{[MY^{n-4}] - x}{[M^{n+}][EDTA]} \therefore K_f' = \frac{[MY^{2-}] - x}{x^2} \therefore x = [M^{n+}] \therefore p[M^{n+}]$$

After Equivalence Point

The titration of 50.0 mL of 0.100 M Ba^{2+} (buffered to 9.00) with 112.0 mL of 0.050 M EDTA

$$[EDTA] = [EDTA]_0 \left(\frac{V_{\text{Excess EDTA}}}{V_{Solution}}\right) \qquad [MY^{n-4}] = [M^{n+}]_0 \left(\frac{V_{\text{Initial } M^{n+}}}{V_{Solution}}\right) \qquad K_f' = \frac{[MY^{n-4}]}{[M^{n+}][EDTA]}$$

PRACTICE: EDTA TITRATION CURVES CALCULATIONS 1

EXAMPLE: Calculate the pMn^{3+} for the titration of 30.0 mL of 0.0100 M EDTA with 50.0 mL of 0.0200 M $MnPO_4$ at pH = 10.00.

PRACTICE: Calculate the pNi^{2+} for the titration of 50.0 mL of 0.120 M EDTA with 15.0 mL of 0.100 M $NiCl_2$ at pH = 8.22.