Strong Acid Titrated by Strong Base

Adding 50.0 mL of 0.100 M NaOH to 50.0 mL of 0.200 M HNO_3

As I should have done for 10.0 mL NaOH addition calculation, will not calculate $[NO_3^{1-}]$ since conjugate base of a strong acid does not react with H_2O.

Using stoichiometry to get rid of all NaOH

$$mol\,OH^{1-}_{add} = (50.0\,mL)\left(\frac{1\,L}{1000\,mL}\right)(0.100\,M\,NaOH)\left(\frac{1\,mol\,OH^{1-}}{1\,mol\,NaOH}\right) = 5.00\times10^{-3}\ mol\,OH^{1-}$$

$$1\,NaOH_{(aq)} + 1\,HNO_{3\,(aq)} \rightarrow 1\,H_2O_{(l)} + 1\,Na_1(NO_3)_{(aq)}$$

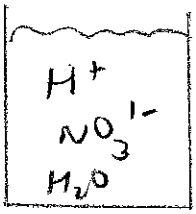
$$mol\,HNO_{3\,left} = mol\,HNO_{3\,I} - mol\,HNO_{3\,con}$$

$$= \left[(50.0\,mL)\left(\frac{1\,L}{1000\,mL}\right)(0.200\,M)\right] - \left[(5.00\times10^{-3}\,mol\,OH^{1-})\left(\frac{1\,mol\,HNO_{3\,con}}{1\,mol\,OH^{1-}}\right)\right]$$

$$= 0.0100\,mol\,HNO_{3\,I} - 5.00\times10^{-3}\,mol\,HNO_{3\,con}$$

$$mol\,HNO_{3\,left} = 5.00\times10^{-3}\,mol\,HNO_3$$

∴ Have enough HNO_3 to react all NaOH, so still strong acid bucket



strong acid bucket

$1\,HNO_3 \rightarrow 1\,H^+ + NO_3^{1-}$ (STOICHIOMETRY)

$$V_{New} = (50.0\,mL + 50.0\,mL) = 100.\,mL\left(\frac{1\,L}{1000\,mL}\right) = 0.100\,L$$

$$mol\,H^+_{left} = (5.00\times10^{-3}\,mol\,HNO_3)\left(\frac{1\,mol\,H^+}{1\,mol\,HNO_3}\right) = 5.00\times10^{-3}\ mol\,H^+$$

$$[H^+] = \frac{5.00\times10^{-3}\,mol\,H^+}{0.100\,L} = 0.050\,M$$

$$pH = -\log[H^+] = -\log(0.050) = -(-1.3010)$$

$$\boxed{pH = 1.301}$$