Solution Stoichiometry – Acid-Base (4)

(1) * A 10.00 mL of $Ca(OH)_2$ solution is neutralized by 23.30 mL of 0.02000 M HNO_3. What is the molarity of $Ca(OH)_2$?

$$Ca(OH)_2 + 2HNO_3 \longrightarrow Ca(NO_3)_2 + H_2O$$

10.00×10^{-3} L ; ? M — 23.30×10^{-3} L ; 0.02000 M

Strategy → mol HNO_3 → mol $Ca(OH)_2$ → molarity.

$$23.30 \times 10^{-3}\,L \times 0.02000\,\frac{mol\ HNO_3}{L} \times \frac{1\ mol\ Ca(OH)_2}{2\ mol\ HNO_3} \times \frac{1}{10.00 \times 10^{-3}\,L}$$

$$= \boxed{0.0233\ M\ Ca(OH)_2}$$

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(2) * 15.00 mL of H_2SO_4 is neutralized by 32.44 mL of 0.00986 M NaOH. What is the molarity of H_2SO_4? And what is the molarity of Na_2SO_4 formed?

$$H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$$

15.00×10^{-3} L ; 32.44×10^{-3} L × 0.00986 M

0.00031984

3.199×10^{-4} mol.

$$3.199 \times 10^{-4}\ mol\ NaOH \times \frac{1\ mol\ H_2SO_4}{2\ mol\ NaOH} \times \frac{1}{15.00 \times 10^{-3}\,L} = \boxed{0.01066\ M}$$

Molarity of Na_2SO_4: mol NaOH → mol Na_2SO_4 → mol, using total V.

$$3.199 \times 10^{-4}\ mol\ NaOH \times \frac{1\ mol\ Na_2SO_4}{2\ mol\ NaOH} \times \frac{1}{(15.00 \times 10^{-3} + 32.44 \times 10^{-3})\,L}$$

0.047442

$$= \boxed{3.371 \times 10^{-3}\ M}$$