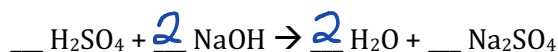
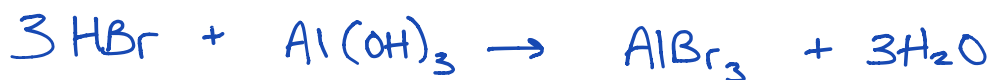


## Titrations

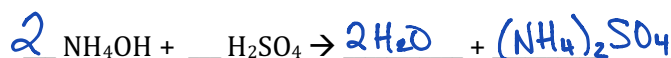
1. Balance the following neutralization equation:



2. Write the balanced equation for the reaction between aluminum hydroxide and hydrobromic acid, HBr, to form aluminum bromide and water.



3. Complete and balance the following equation:



4. If 14.7 mL of 0.102 M NaOH is required to titrate 25.00 mL of a hydrochloric acid, HCl, solution, what is the molarity of the hydrochloric acid?

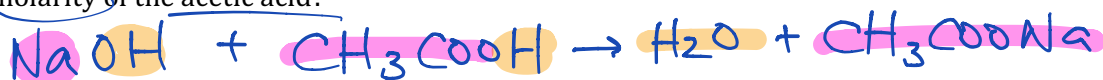


$$14.7 \text{ mL NaOH} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.102 \text{ mol NaOH}}{1 \text{ L}} \times \frac{1 \text{ mol HCl}}{1 \text{ mol NaOH}} = 0.00150 \text{ mol HCl}$$

$$\frac{0.00150 \text{ mol HCl}}{25.00 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = \boxed{0.0600 \text{ M HCl}}$$

3sf

5. If 36.2 mL of 0.152 M NaOH is required to neutralize 25.00 mL of an acetic acid, CH<sub>3</sub>COOH, solution, what is the molarity of the acetic acid?



$$36.2 \text{ mL NaOH} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.152 \text{ mol NaOH}}{1 \text{ L}} \times \frac{1 \text{ mol CH}_3\text{COOH}}{1 \text{ mol NaOH}} = 0.00550 \text{ mol CH}_3\text{COOH}$$

$$\frac{0.00550 \text{ mol CH}_3\text{COOH}}{25.00 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = \boxed{0.220 \text{ M CH}_3\text{COOH}}$$

3sf

6. If 7.3 mL of 1.25 M  $\text{HNO}_3$  is required to neutralize 25.00 mL of a potassium hydroxide solution, what is the molarity of the potassium hydroxide?



$$7.3 \text{ mL } \cancel{\text{HNO}_3} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1.25 \text{ mol } \cancel{\text{HNO}_3}}{1 \text{ L}} \times \frac{1 \text{ mol KOH}}{1 \text{ mol } \cancel{\text{HNO}_3}} = 0.0091 \text{ mol KOH}$$

$$\frac{0.0091 \text{ mol KOH}}{25.00 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = \boxed{0.36 \text{ M HNO}_3}$$

2sf

7. If 8.6 mL of 0.0994 M  $\text{HNO}_3$  is required to neutralize 25.00 mL of a strontium hydroxide solution, what is the molarity of the strontium hydroxide?



$$8.6 \text{ mL } \cancel{\text{HNO}_3} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.0994 \text{ mol } \cancel{\text{HNO}_3}}{1 \text{ L}} \times \frac{1 \text{ mol Sr}(\text{OH})_2}{2 \text{ mol } \cancel{\text{HNO}_3}} = 0.00043 \text{ mol Sr}(\text{OH})_2$$

$$\frac{0.00043 \text{ mol Sr}(\text{OH})_2}{25.00 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = \boxed{0.017 \text{ M Sr}(\text{OH})_2}$$

2sf

8. If 46.2 mL of 2.50 M  $\text{NaOH}$  is required to neutralize 1.54 M phosphoric acid,  $\text{H}_3\text{PO}_4$ , solution, what volume of phosphoric acid was needed to reach the equivalence point?



$$46.2 \text{ mL } \cancel{\text{NaOH}} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{2.50 \text{ mol } \cancel{\text{NaOH}}}{1 \text{ L}} \times \frac{1 \text{ mol H}_3\text{PO}_4}{3 \text{ mol } \cancel{\text{NaOH}}} \times \frac{1 \text{ L H}_3\text{PO}_4}{1.54 \text{ mol H}_3\text{PO}_4} \times \frac{1000 \text{ mL}}{1 \text{ L}} = \boxed{25.0 \text{ mL H}_3\text{PO}_4}$$

3sf