Acid-Base Titration

Name : _____

1. Can I titrate a solution of unknown concentration with another solution of unknown concentration and still get a meaningful answer? Explain your answer in a few sentences.

2. Explain the difference between an endpoint and an equivalence point in atitration.

3. How many moles of LiOH are needed to neutralize 2.0 moles of H_2SO_4 exactly?

4. How many moles of H_2SO_4 are needed to neutralize 5.0 moles of NaOH?

5. 13.45 mL of 0.200 M NaOH is required to titrate 25.0 mL of a solution known to have HCl. Calculate the original concentration of HCl.

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Answers

1. Can I titrate a solution of unknown concentration with another solution of unknown concentration and still get a meaningful answer? Explain your answer in a few sentences.

   You cannot do a titration without knowing the molarity of at least one of the substances because you would then be solving one equation with two unknowns (the unknowns being M1 and M2)

2. Explain the difference between an endpoint and an equivalence point in atitration.

   Endpoint: When you stop doing the titration (usually, this is determined by a color change in an indicator or an indication of pH = 7.0 on an electronic pH probe).

   Equivalence point: When the solution is precisely neutralized.

   The equivalence point and the endpoint are not precisely the same because indicators do not change color at exactly 7 pH and pH probes are not infinitely accurate. Generally, you can measure the effectiveness of a titration by the closeness of the endpoint to the equivalence point.

3. How many moles of LiOH are needed to neutralize 2.0 moles of H_2SO_4 exactly?

   $$H_2SO_4 + 2\ LiOH \longrightarrow Li_2SO_4 + 2\ H_2O$$

   1.0 mole of H_2SO_4 can be neutralized by 2 moles of LiOH.

   Therefore, 2.0 moles of H_2SO_4 can be neutralized by 4.0 moles of LiOH.

4. How many moles of H_2SO_4 are needed to neutralize 5.0 moles of NaOH?

   $$H_2SO_4 + 2\ NaOH \longrightarrow NasSO_4 + 2\ H_2O$$

   5.0 moles of H_2SO_4 can be neutralized by $\frac{1}{2} \times 5 = 2.5$ moles of NaOH

   Therefore, 2.0 moles of H_2SO_4 can be neutralized by 4.0 moles of LiOH.

5. 13.45 mL of 0.200 M NaOH is required to titrate 25.0 mL of a solution known to have HCl. Calculate the original concentration of HCl.

   $$HCl + NaOH \longrightarrow NaCl + H_2O$$

   $$\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2} \Rightarrow \frac{M_1(25\ mL)}{1} = \frac{(0.2\ M)(13.45\ mL)}{1} \Rightarrow M_1 = 0.108\ M$$