AP Chemistry Daily Videos

4.6 Introduction to Titrations

Video #1

1. Draw and label the titration setup. Provide a definition for any terms you aren't familiar with.

2. What is the purpose of doing a titration?

3. What is the difference between the endpoint and the equivalence point.

4. Try the following problems before the teacher completes it. How did you do and what errors did you make?

Potassium sorbate, $KC_6H_7O_2$ (molar mass 150. g/mol) is commonly added to diet soft drinks as a preservative. A stock solution of $KC_6H_7O_2(aq)$ of known concentration must be prepared. A student titrates 45.00 mL of the stock solution with 1.25 M HCl(*aq*)

a. Write the net-ionic equation for the reaction between $KC_6H_7O_2$(aq) and HCl(aq).

b. A total of 29.95 mL of 1.25 *M* HCl(*aq*) is required to reach the equivalence point. Calculate $[KC_6H_7O_2]$ in the stock solution.

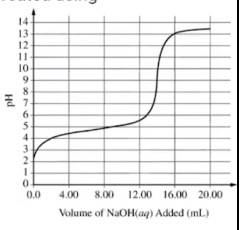
5. **Try the following problems before the teacher completes it. How did you do and what errors did you make?**

In a separate experimental procedure, the student titrates 10.0 mL of the 2.000 M $HC_2H_3O_2(aq)$ with an NaOH(aq) solution of unknown concentration. The student monitors the pH during the titration. The following titration curve was created using the experimental data presented in the table.

c. Write the balanced net ionic equation for the reaction that occurs when $HC_2H_3O_2(aq)$ and NaOH(aq) are combined.

d. Calculate the molar concentration of the NaOH(aq) solution.

Volume of NaOH(aq) Added (mL)	pH
0.00	2.23
2.00	3.99
4.00	4.37
6.00	4.65
8.00	4.90
10.00	5.17
12.00	5.55
14.00	9.35
16.00	13.04
18.00	13.31
20.00	13.46



Video #2

1. **Besides acid/base reactions. What other reactions can you do titrations on?**

2. **Review this problem with the instructor and write down any errors you make.**

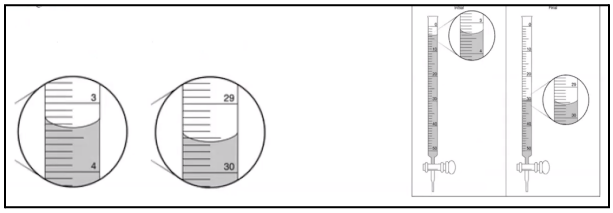
$$6\ H^+(aq) + 2\ MnO_4^-(aq) + 5\ H_2C_2O_4(aq) \rightarrow 10\ CO_2(g) + 8\ H_2O(l) + 2\ Mn^{2+}(aq)$$

A student dissolved a **0.139 g** sample of oxalic acid, $H_2C_2O_4$, in water in an Erlenmeyer flask. Then the student titrated the $H_2C_2O_4$ solution in the flask with a solution of $KMnO_4$, which has a dark purple color. The balanced chemical equation for the reaction that occurred during the titration is shown above.

(b) The student used a **50.0 mL** buret to add the $KMnO_4(aq)$ to the $H_2C_2O_4(aq)$ until a faint lavender color was observed in the flask, an indication that the end point of the titration had been reached. The initial and final volume readings of the solution in the buret are shown below. Write down the initial reading and the final reading and use them to determine the volume of $KMnO_4(aq)$ that was added during the titration.

(c) Given that the concentration of $KMnO_4(aq)$ was **0.0235** M, calculate the number of moles of MnO_4^- ions that completely reacted with the $H_2C_2O_4$.

(d) The student proposes to perform another titration using a **0.139 g** sample of $H_2C_2O_4$, but this time using **0.00143** M $KMnO_4(aq)$ in the buret. Would this titrant concentration be a reasonable choice to use if the student followed the same procedure and used the same equipment as before? Justify your response.



3. **Try the following problems before the teacher completes it. How did you do and what errors did you make?**

$$2\ MnO_4^-(aq) + 5\ H_2O_2(aq) + 6\ H^+(aq) \rightarrow 2\ Mn^{2+}(aq) + 5\ O_2(g) + 8\ H_2O(l)$$

A student was given the task of determining the molarity of an unknown concentration of $H_2O_2(aq)$. She analyzed a 10.0 mL sample of $H_2O_2(aq)$ by titrating it with 0.0330 M $KMnO_4$, which has a dark purple color. The balanced chemical equation for the reaction that occurred during the titration is shown above.

A total of 10.69 mL of 0.0330 M $KMnO_4$ was required to reach the equivalence point.

a) Calculate the number of moles of MnO_4^- that reacted completely with the H_2O_2.

b) Calculate the $[H_2O_2]$ in the solution.