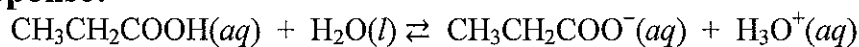


Wkst: Review Unit 10 - FR

1/2

Free Response:

①



Propanoic acid,  $\text{CH}_3\text{CH}_2\text{COOH}$ , is a carboxylic acid that reacts with water according to the equation above. At  $25^\circ\text{C}$  the pH of a 50.0 mL sample of 0.20 M  $\text{CH}_3\text{CH}_2\text{COOH}$  is 2.79.

- Identify a Brønsted-Lowry conjugate acid-base pair in the reaction. Clearly label which is the acid and which is the base.
- Determine the value of  $K_a$  for propanoic acid at  $25^\circ\text{C}$ .
- For each of the following statements, determine whether the statement is true or false. In each case, explain the reasoning that supports your answer.
  - The pH of a solution prepared by mixing the 50.0 mL sample of 0.20 M  $\text{CH}_3\text{CH}_2\text{COOH}$  with a 50.0 mL sample of 0.20 M NaOH is 7.00.
  - If the pH of a hydrochloric acid solution is the same as the pH of a propanoic acid solution, then the molar concentration of the hydrochloric acid solution must be less than the molar concentration of the propanoic acid solution.

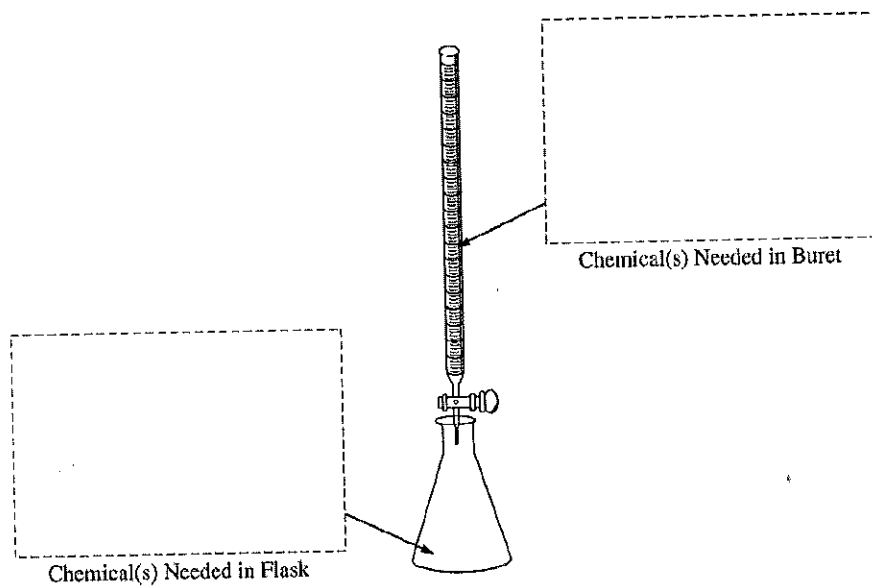
In a separate experiment, a 25.0 mL sample of 0.10 M NaOH is added to a second 50.0 mL sample of 0.20 M  $\text{CH}_3\text{CH}_2\text{COOH}$ .

- Calculate the moles of  $\text{CH}_3\text{CH}_2\text{COOH}$  remaining in the solution.
- Calculate the molar concentration of  $\text{CH}_3\text{CH}_2\text{COO}^-(aq)$  in the solution.
- Calculate the  $[\text{H}_3\text{O}^+]$  and the pH of the solution.

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An experiment is performed to determine the molar mass of an unknown solid monoprotic acid, HA, by titration with a standardized NaOH solution.

- What measurement(s) must be made to determine the number of moles of NaOH used in the titration?
- Write a mathematical expression that can be used to determine the number of moles of NaOH used to reach the endpoint of the titration.
- How can the number of moles of HA consumed in the titration be determined?
- In addition to the measurement(s) made in part (a), what other measurement(s) must be made to determine the molar mass of the acid, HA ?
- Write the mathematical expression that is used to determine the molar mass of HA.
- The following diagram represents the setup for the titration. In the appropriate boxes below, list the chemical(s) needed to perform the titration.



- Explain what effect each of the following would have on the calculated molar mass of HA. Justify your answers.
  - The original solid acid, HA, was not completely dry at the beginning of the experiment.
  - The procedure called for 25 mL of H<sub>2</sub>O in the Erlenmeyer flask, but a student used 35 mL of H<sub>2</sub>O.