

Titration and Precision Rubric

	Level 4	Level 3	Level 2	Level 1	Level 0
Q1. NaOH concentration (1 point) Report NaOH molar concentrations for all the runs performed in the lab with the correct number of significant figures	The table is complete, and the data is reported with the correct number of significant figures (1 point) .	All the data is included and there is one error in the significant figures (0.75 points) .	All the data is included, there are two errors in the significant figures (0.5 points) .	All the data is included, there are two errors in the significant figures (0.25 points) .	The table is not filled or there are more than three errors in significant figures (0 points) .
Q2a). SD and RSD (4 points) Report SD and RSD in the table below as well as your calculated average molar concentration and M_{NaOH} +/- SD with the correct units and correct number of significant figures.	All the values are reported with the correct units and correct number of significant figures. (4 points)	One incorrect item from Level 4 (3 points)	Two incorrect items from Level 4 (2 points)	Three incorrect items from Level 4 (1 points)	More than three incorrect items from Level 4 (0 points)

<p>Q2b). (4 points)</p> <ul style="list-style-type: none"> • Explain what your SD and RSD tell you about the uncertainty and precision of your titration. • Did you have to adjust the number of significant figures in your average M_{NaOH} based on the calculated SD? Please explain why. • Was your titration precision based on reproducibility smaller or the same as the 	<p>The answers to all four questions are given and are valid. (4 points)</p>	<p>One of the answers is missing (3 points)</p> <p>OR</p> <p>One of the answers is invalid (3 points)</p>	<p>Two of the answers are missing (2 points)</p> <p>OR</p> <p>Two answers are invalid (2 points)</p> <p>OR</p> <p>One answer is missing, and one is invalid (2 points)</p>	<p>Three answers are missing (1 point)</p> <p>OR</p> <p>Three answers are invalid (1 point)</p> <p>OR</p> <p>There is a combination of invalid and missing answers adding up to 3 items (1 point)</p>	<p>All four answers are invalid (0 point)</p>
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precision based
solely on the
reading error
from your
glassware and
balance

precision? Look
at the significant
figures for your
average molar
concentration
based solely on
the measured
values and
compare to
average $M_{\text{NaOH}} \pm$
SD.

- What can you tell
about the
accuracy of your
titration?

<p>Q3. Further use of NaOH solution based on precision (1 point)</p> <p>Based on the results of your titration, would you feel confident to further use your NaOH solution to titrate an unknown acid to get a high precision result? Justify your answer in 1-2 sentences.</p>	<p>The answer is</p> <ul style="list-style-type: none"> - justified -Justification is valid - justification does not exceed 1-2 sentences. <p>(1 point)</p>		<p>One item from Level 4 is missing (0.5 points)</p>		<p>Two items are missing from Level 4 (0 points)</p>
<p>Q4. ICE table (4 points)</p> <p>If you dissolved 0.181 mg of KHP in exactly 30.0 mL of water and measured the pH of this solution before starting the titration, what would the pH value be?</p> <p><i>Instructions:</i></p> <ul style="list-style-type: none"> • Write the dissociation reaction. 	<p>The instructions are followed precisely.</p> <p>The following items are present and correct:</p> <ul style="list-style-type: none"> - Dissociation reaction - The ICE table is set up based on the reaction - $[H_3O^+]$ is calculated, and 	<p>One item from Level 4 is missing or incorrect (3 points)</p>	<p>Two items from Level 4 are missing or incorrect (2 points)</p>	<p>Three items from Level 4 are missing or incorrect (1 point)</p>	<p>More than three items from Level 4 are missing or incorrect (1 point)</p>

<ul style="list-style-type: none"> Set up the ICE table based on your reaction Calculate $[H_3O^+]$ and show your calculations. Show your calculations for pH value and report it with the correct number of significant figures. 	<p>calculation are shown</p> <ul style="list-style-type: none"> Calculation for the pH value is shown and the pH sig figs are correct 				
<p>Q5.</p> <p>Explain what is happening to the KHP dissociation reaction as you keep titrating KHP with NaOH. Consider which of the reactions is reversible and which is not? (2 points)</p>	<p>The explanation is valid, complete and based on the reversibility and irreversibility of the reactions happening during the titration (2 points)</p>	<p>The explanation is valid, but not fully complete. (1.5 points)</p>	<p>The explanation is not completely valid (1 point)</p> <p>OR</p> <p>Reversibility/irreversibility is not addressed (1 point)</p>	<p>The explanation is neither completely valid nor fully complete (0.5 points)</p>	<p>The explanation is invalid (0 points)</p>

<p>Q6. (4 points)</p> <p>Will the experimental M_B calculated by <i>Student A</i> be higher or lower than the true M_B value? Explain in no more than 5 sentences.</p>	<p>The explanation is concise and completely valid. The sentence limit is respected. (4 points)</p>	<p>The explanation is not completely concise (3 points)</p> <p>OR</p> <p>Not completely valid (3 points)</p> <p>OR</p> <p>The sentence limit is not respected but does not exceed 7-10 sentences (3 points)</p>	<p>Only half of the explanation is valid. (2 points)</p> <p>OR</p> <p>The sentence limit exceeds 10 sentences (2 points)</p>	<p>Only one half of the explanation is valid, and the other half is not completely valid.</p> <p>OR</p> <p>The sentence limit exceeds 15 sentences (1 point)</p>	<p>The explanation is completely invalid (0 point)</p>
<p>Data Sheet (3 points)</p>	<p>Data sheet is complete, no information is missing. The TA signature is present. The data sheet is submitted on time (3 points).</p>	<p>Data sheet is mostly complete, but some data is missing (up to 10-20%). The TA signature is present. The data sheet is</p>	<p>Data sheet is partially complete, up to 30% of data is missing. The TA signature is present. The data sheet is submitted on time (1 point).</p>	<p>Data sheet is partially complete, up to 50% of data is missing. The TA signature is present. The data sheet is submitted on time (0.5 points).</p>	<p>Data sheet is incomplete (more than 50% of data is missing), or it is not submitted or submitted after the last deadline, or it is not signed</p>

		submitted on time (2 points) .			by the TA (0 points) .
Personalized procedure (2 points)	The procedure is complete or mostly complete and personalized. The TA signature is present. (2 points)		The procedure is missing up to 50% of the steps. The TA signature is present. (1 point)		The procedure is copied directly from the manual, or the procedure is not submitted, or submitted past the last deadline, or it is not signed by the TA (0 points) .
Total # points:	25 points				