Acid-Base Rubric

	Level 4	**Level 3**	**Level 2**	**Level 1**	**Level 0**
Q1. The table (1 point) Please fill in the table below 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)**.
Q2. Calculate and report K_a and pK_a for HBB (**4 points**) Using your data in the eq. 9 from the Background Information of the Lab Manual, calculate the K_a and pK_a **for** HBB. Please show your calculations and report your answers with the correct number of significant figures**.**	The calculations are shown for both K_a and pK_a. The significant figures are reported correctly for all the values present. (**4 points**)	The calculations are shown for both K_a and pK_a, but there is one error in the significant figures (**3 points**) OR There is one error in the calculations (**3 points**) OR	Two errors in sig figs (**2 points**) OR One error in sig figs and the calculations for conversion to pKa is not present. (**2 points**)	Three errors in the sig figs (**1 points**)	Calculations are not presents or completely wrong (**0 points**)

		The calculation for conversion to pKa is not present. (**3 points**)			
Q3. Absolute and relative (%) errors. (4 points) To estimate how much your experimentally determined value differs from the literature *p*Ka value for HBB (pK_a=7.10), calculate absolute and relative % errors.	Both absolute and relative % errors are calculated and reported correctly (**4 points**)**.**	Both absolute and relative % errors are calculated and reported correctly **BUT** There are minor errors, for example, the relative % error is not reported with the correct number of significant figures or there is a mistake in the calculation (**3 points**).	Only one error is calculated and reported correctly (**2point**)	Only one error is reported and calculated correctly and there are minor errors in calculations or relative % error is not reported with the correct number of significant figures (**1 point**)**.**	Both absolute and relative % errors are calculated and reported incorrectly (**0 points**)

Q4. (**3 points**) Explain which of the three solutions (yellow, green or blue) we are using to study the HBB ⇆ BB^-equilibrium and why in no more than 5 sentences. Please include the absorbance spectra for all three species on one graph that you have acquired in the lab.	The explanation is clear and valid and written in students' own words. The explanation contains no more than 5 sentences. The graph is included. (**3 points**)	The explanation is almost valid and contains no more than 5 sentences. The graph is included. (**2.5 points**)	The explanation is somewhat valid and contains no more than 5 sentences. (**1.5 points**) OR The explanation is valid, but contains more than 7 and less than 10 sentences (**1.5 points**) OR The graph is not included (**1.5 points**)	The explanation is somewhat valid and contains no more than 5 sentences. (**0.5 points**) OR The explanation is valid, but contains more than 7 and less than 10 sentences (**0.5 points**)	The explanation is completely invalid (**0 points**) OR It is not an original student's work (**0 points**) OR Has => than 10 sentences)
Q5 a) (**2 points**) Explain why we are using a buffered solution of BB^-Na^+ to study the equilibrium and not a solution of either BB^-Na^+ or HBB in	The explanation is valid, complete and written in students' own words. The sentence limit is respected (**2 points**)	The explanation is valid, but not fully complete. (**1.5 points**)	The explanation is not completely valid (**1 point**) **OR**	The explanation is neither completely valid nor fully complete (**0.5 points**)	The explanation is invalid (**0 points**) OR

water. No more than 5 sentences.					Has => than 10 sentences (**0 points**) OR The explanation provided in not an original students' work (**0 points**)
Q5 b) (**2 points**) Calculate the pH of the phosphate buffer you prepared and compare to the measured value of the buffered bromothymol blue solution. Show your calculations Report with the correct number of sig figs	The calculation is present and correct. The significant figures are reported correctly. The comparison to the measured value is given as well as the explanation. The explanation is valid. **(2 points**)	There is one error in sig figs OR a small error in the calculations. BUT the comparison and the explanation are present and valid (**1.5 points**)	The calculation is not present, but the value is reported correctly, and the comparison and the explanation are present and valid (**1 point**) OR Calculation is present and it is correct. There are no errors in sig figs, but the comparison and	The calculation is present but mostly incorrect. The comparison and the explanation are present but mostly invalid (**0.5 points**)	Both calculations are explanations are incorrect (**0 points**)

			explanation are missing (**1 point**)		
Q6. (4 points) In the previous experiment you titrated NaOH with KHP using phenolphthalein (color change at between pH 8-9.6) as an indicator. Would bromothymol blue (color change between pH 6-7.6) be a suitable indicator for this titration. Please explain via analysis of pH at the titration's equivalence point and the titration products at equivalence point in no more than 5-7 sentences. Write an equation for the main acid-base equilibrium at the equivalence point.	The explanation is valid, complete and written in students' own words. The sentence limit is respected (- 1 point for each extra sentence). The equation for the main equilibrium at the equivalence point is included The explanation is given through the analysis of the titration products at the equivalence point. (**4 points**)	One error or omission from Level 4. (**3 points**)	Two errors or omissions from Level 4. (**2 points**)	Three errors or omissions from Level 4. (**1 point**)	The explanation is invalid (**0 points**) OR Has => 10 sentences (**0 points**) OR The explanation provided in not an original students' work (**0 points**)

Data Sheet (**3 points**)	Data sheet is complete, no information is missing. The TA signature is present. The data sheet is submitted on time **(3 points)**.	Data sheet is mostly complete, but some data is missing (up to 10-20%). The TA signature is present. The data sheet is submitted on time **(2 points)**.	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)**.	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)**.	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 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**				