

Not present	Not passing	Barely passing	Passing	Very Good	Excellent	
0	5	6	7	8	10	10 points: Make a spreadsheet, send spreadsheets to Dr. Stone via email. <ol style="list-style-type: none"> 1. Phosphate buffer. Your spreadsheet will calculate the grams of potassium monobasic phosphate (KH_2PO_4) and potassium dibasic phosphate, (K_2HPO_4) that are needed to make the buffer. The spreadsheet should allow for volume, molarity and pH to be variables.
0	15	17	20	22	25	25 points: Theory of Buffers <ol style="list-style-type: none"> 1. There is a complete description of what buffers are and how they work. 2. All relevant equations and concepts are explained. 3. There is a description of how the TAE buffer is used in an experiment. 4. There are complete sentences in well organized paragraphs
0	20	24	28	32	40	40 points: Two SOP, Standard Operating Procedures: <ol style="list-style-type: none"> 1. There are complete, detailed steps for making the TAE buffer 2. There are complete, detailed steps for making the 100 mM pH 7.4 phosphate buffer. 3. Safety precautions that must be observed are included and any warnings from MSDS are included.
0	10	12	14	16	20	20 points: Design an experiment for Gen Chem II students. This experiment will show the buffering capacity (both acid and base) of a phosphate buffer. <ol style="list-style-type: none"> 1. There is a description of the fundamental scientific reason(s) why the experiment is being conducted. (Purpose/Introduction) 2. There is a description of the general type of data that will be collected (show some examples) and how it will be collected. 3. The sample data is neat and organized. 4. The calculations are neat and organized. 5. There are sample calculations for error analysis. 6. There are safety considerations. 7. There are complete sentences in well organized paragraphs.
0	1	2	3	4	5	5 points: There is one source from the refereed literature (2 points) that has been properly cited in the text (1 point) and there is complete bibliographic information in the Reference Section. (2 points) *Primary sources have data that was generated by the authors of the paper.

Instructions:

1. For each buffer that we are making: What is the buffer used for? Why was that buffer chosen for that experiment?
2. **Build a spreadsheet** that allows you to quickly calculate the amount of each reagent needed to make a phosphate buffer, you should be able to input volume, molarity and pH and then your spreadsheet will calculate the amount of each reagent needed.
3. **SOPs: Write detailed instructions** for making the TAE and 100 mM pH phosphate buffers. Write these instructions for someone who has never taken a college chemistry class. Explain everything.
4. How would you test the buffering capacity of your buffer? **Design an experiment** that would determine how much acid or base could be added to your buffer. Give detailed instructions and show the results of your experiment.
5. In your report, fully describe **the theory of buffers** and how they work. Use relevant equations and explain the parts of each equation.