

(Please answer each question on a separate sheet of paper.)

1. If you needed to buffer a solution for a particular experiment at pH 8.0, which of the following buffer molecules should you use if your experimental system is more likely to be challenged by acid than by base, MES ($pK_a = 6.1$), DIPSO ($pK_a = 7.6$), EPPS ($pK_a = 8.0$), TAPS ($pK_a = 8.4$), or CABS ($pK_a = 10.7$)? Explain your reasoning using equations and graphs as necessary.
2. Tris(hydroxymethyl)aminomethane (Tris) is a commonly used buffer molecule in biochemistry experiments with an ionizable amine with a pK_b of 5.9 at 25°C.
 - a. Why does Tris have a pK_b of 5.9 when the pK_b of ammonia is closer to 4.7?
 - b. If you had 85.0 mL of 150.0 mM Tris solution of pH 7.5 and added 2.5 mL of 1.0 M NaOH, what would the final pH be?
3. If you wanted to make a buffer solution (pH 7.9) using a molecule with two dissociable protons, with pK_a values of 7.7 and 8.4, what volume of 1.0 M HCl would you need to add to a solution containing 0.350 mole of the fully deprotonated molecule (*e.g.* its disodium salt)? Include all calculations – show your work!