SURREY SUPPLEMENT: ACID-BASE EQUILIBRIA

1) A 25.0 mL sample of the weak base trimethylamine, $(CH_3)_3N$, requires 50.0 mL of 0.200 M HCl to reach equivalence. The pK_b of trimethylamine is 4.20, and the titration was carried out at 25°C.

   a) Calculate the pH of the solution at the start of the titration. **[10.75]**
   b) Calculate the pH of the solution when 15.0 mL of the acid solution have been added. **[10.17]**
   c) Calculate the pH at the equivalence point of this titration. **[5.34]**
   d) Calculate the pH when 10.0 mL beyond the equivalence point have been added. **[1.63]**
   e) If you were to select an indicator for the above titration, approximately what should be its pK_a? EXPLAIN YOUR ANSWER. **[choose an indicator with a pK_a = pH at equivalence]**

2) A 10.00 mL sample of 0.3000 M weak acid (HA) is titrated with 0.1000 M NaOH solution. The K_a for HA = 2.0×10^{-4}, and the titration was carried out at 25°C.

   a) Calculate the pH of the solution when no base has been added. **[2.11]**
   b) Calculate how many mL of NaOH solution have been added when the pH = 3.20. **[7.22 mL]**
   c) Calculate the pH when a total of 30.00 mL of NaOH solution have been added. **[8.29]**
   d) Calculate the pH when a total of 40.00 mL of NaOH solution have been added. **[12.30]**
   e) The indicators bromcresol green and thymol blue go through a color change from yellow to blue, however their pK_as are different.
      The pK_a(bromcresol green) = 4.5 and the pK_a(thymol blue) = 8.5
      Which indicator should be used in the above titration so that the end point corresponds with the equivalence point? EXPLAIN YOUR ANSWER. **[choose an indicator with a pK_a = pH at equivalence]**