1. (5 pts) 250 mL of 0.2 M acetic acid (HOAc) reacts with 250 mL of 0.2 M NaOH. What is the pH of the resulting solution? \( \text{pK}_a (\text{HOAc}) = 5 \)

2. (5 pts) Identify whether the following 1:1 solutions will be acid, basic, or neutral:
   a) NaOAc/HOAc (pK\(_a\) = 4.7)
   b) NH\(_3\)/NH\(_4\)NO\(_3\) (pK\(_a\) = 9.3)
   c) NaCl/KNO\(_3\)
   d) H\(_3\)PO\(_4\)/NaH\(_2\)PO\(_4\) (pK\(_a\) = 2.1)
   e) CH\(_3\)NH\(_2\)/CH\(_3\)NH\(_3\)Cl (pK\(_a\) = 10.6)

3. (3 pts) What is the approximate pH of a colorless solution that turns yellow if a small amount of methyl yellow, or alizarin yellow is added to it, but turns pink if phenolphthalein is added. See Table 1 for information about indicators. Circle your answer.

   a) 0 to 1     b) 4 to 5     c) 7 to 8     d) 9 to 10     e) 13 to 14

4. (2 pts) Which indicator (see Table 1) would work best to indicate the equivalence point for the titration curve shown to the right (circle answer):

   a) methyl violet     b) methyl red     c) thymol blue
   d) phenolphthalein   e) alizarin yellow
5. (3 pts) What is the pH of a 0.01 M solution of NaHCO$_3$? $pK_b = 4$. Clearly show all your work.

6. (4 pts) Consider the following list of salts:

A) CsNO$_3$      B) TiCl$_4$      C) Na(SH)      D) KF
E) Ca(OH)$_2$    F) Ti(ClO$_4$)$_4$  G) [HN(CH$_3$)$_3$]Cl   H) LiHCO$_3$
I) NaPF$_6$     J) RbBr

Which salts will generate **acidic** solutions? ________________
Which salts will generate **basic** solutions? ________________
Which salts will generate **neutral** solutions? ________________

7. (4 pts) What is the pH if 500 mL of 0.2 M HCl is added to 500 mL of 0.2 M ammonia (NH$_3$, $pK_b = 5$) (clearly show all your work)

8. (4 pts) What is the pH of the following 0.5 $M$ aqueous solutions containing equal amounts of the two components shown (find $pK_{a/b}$ or $K_{a/b}$ values in your textbook appendix or lecture notes):

a) NH$_4$Cl + NH$_3$

b) HNO$_2$ + KNO$_2$

c) H$_2$S + CsHS

d) C$_5$H$_4$N (pyridine) + [C$_5$H$_4$NH]Br