Chapter 8 – Old quiz and exam questions

6. A monoprotic weak acid (HA) is titrated with sodium hydroxide. In the middle of the buffer region, will the resulting solution be acidic, basic, or neutral?

a) acidic
b) basic
c) neutral
d) more information is needed

Questions 10-11. Consider the dissociation of the salt barium phosphate in water.

10. If $K_{sp} = 3.8 \times 10^{-35}$, then what is the solubility for barium phosphate in water?

a) 0.0 mol/L
b) $9.1 \times 10^{-4}$ mol/L
c) $6.2 \times 10^{-39}$ mol/L
d) $5.1 \times 10^{-4}$ mol/L
e) none of these

11. If solid $\text{(NH}_4\text{)}_3\text{PO}_4$ is added to the barium phosphate solution at a constant temperature, what will happen? Assume that the volume of added $\text{(NH}_4\text{)}_3\text{PO}_4$ is negligible.

a) Solubility increases, $K_{sp}$ increases
b) Solubility increases, $K_{sp}$ does not change
c) Solubility decreases, $K_{sp}$ does not change
d) Solubility decreases, $K_{sp}$ decreases
e) none of these

14. Which of the following mixtures results in the formation of a buffer?

I. 10 mL of 1.0 M HNO$_3$ mixed with 10 mL of 1.0 M NaNO$_3$
II. 10 mL of 1.0 M NaHCO$_3$ mixed with 12 mL of 1.0 M Na$_2$CO$_3$
III. 10 mL of 1.0 M HCN mixed with 8 mL of 1.0 M NaOH

a) I. only
b) II. only
c) I. and II.
d) II. and III.
e) I., II., and III.
15. Which of the following solutions will be the best buffer at a pH of 4.74? (\(K_a\) for \(\text{HCC}_2\text{H}_3\text{O}_2\) is \(1.8 \times 10^{-5}\); \(K_b\) for \(\text{NH}_3\) is \(1.8 \times 10^{-5}\).)

a) 0.10 M \(\text{NH}_3\) and 0.10 M \(\text{NH}_4\text{Cl}\)  
b) 3.0 M \(\text{HCC}_2\text{H}_3\text{O}_2\) and 3.0 M \(\text{NH}_4\text{Cl}\)  
c) 0.10 M \(\text{HCC}_2\text{H}_3\text{O}_2\) and 0.10 M \(\text{NaC}_2\text{H}_3\text{O}_2\)  
d) 3.0 M \(\text{HCC}_2\text{H}_3\text{O}_2\) and 3.0 M \(\text{NaC}_2\text{H}_3\text{O}_2\)  
e) 3.0 M \(\text{HCC}_2\text{H}_3\text{O}_2\) and 3.0 M \(\text{NH}_3\)

18. Calculate the pH of a solution made by mixing 15 mL of 1.0 M HF with 12 mL of 1.0 M NaF at 25°C. Assume that the volumes are additive.

a) 9.0  
b) 3.2  
c) 3.0  
d) 7.0  
e) none of these

32. How many mmoles of HCl must be added to 140.0 mL of a 0.20 M solution of \(\text{CH}_3\text{NH}_2\) (a weak base with \(pK_b = 3.36\)) to give a buffer having a pH of 11.30?

a) 28 mmol  
b) 0.22 mmol  
c) 5.0 mmol  
d) 4.8 mmol  
e) 0.44 mmol

33. A 50.0 mL sample of buffer solution was prepared in which \([\text{NaCN}] = 1.6\) M and \([\text{HCN}] = 1.2\) M. To this buffer solution, 12.0 mL of 1.0 M NaOH was added. What is the pH of the solution after adding the NaOH?

a) 9.5  
b) 9.2  
c) 4.5  
d) 7.0  
e) none of these

37. A 50 mL sample of 1.9 M hydrocyanic acid (HCN) is titrated with 1.9 M NaOH. What is the pH at the equivalence point in the titration?

a) 7.0  
b) 9.2  
c) 11.1  
d) 2.9  
e) 11.6
20. Consider a solution of 2.0 M HCN and 1.0 M NaCN. Which of the following statements is true?
   a) The solution is not a buffer because [HCN] is not equal to [CN\textsuperscript{-}].
   b) The pH will be below 7.00 because the concentration of the acid is greater than that of the base.
   c) [OH\textsuperscript{-}] > [H\textsuperscript{+}]
   d) The buffer will be more resistant to pH changes from addition of strong acid than of strong base.
   e) All of the above are false.

21. If 25 mL of 0.75 M HCl are added to 100 mL of 0.25 M NaOH, what is the final pH?
   a) 12.7
   b) 12.8
   c) 1.30
   d) 1.20
   e) 7.00

22. A 50.0-mL sample of 0.10 M HNO\textsubscript{2} is titrated with 0.10 M NaOH. What is the pH after 25.0 mL of NaOH have been added?
   a) 7.00
   b) 1.00
   c) 12.50
   d) 3.34
   e) 2.48

26. When 20 mL of 0.1 M Ba(OH)\textsubscript{2} is added to 40 mL of 0.1 M weak acid (HA) what is the pH of the solution?
   a) pH < 7
   b) pH = 7
   c) pH > 7
   d) pH = pK\textsubscript{a}
   e) None of these

29. Consider a 100.0 mL of buffer solution that is 0.50 M CH\textsubscript{3}COOH and 0.50 M NaCH\textsubscript{3}COO. What is the pH of the solution after 10.0 mL of 1.0 M NaOH is added.
   a) 4.75
   b) 4.93
   c) 4.57
   d) 4.67
   e) 7.0
30. A 100 mL sample of 0.10 M HCl is mixed with 50 mL of 0.10 M NH₃. What is the resulting pH?
   a) 12.52  
   b) 3.87  
   c) 1.30  
   d) 7.85  
   e) 1.48  

31. The following plot show the pH curves for the titrations of various acids, HA, by 0.10 M NaOH. At the start of the titration, all of the acids were 50.0 mL of 0.10 M HA.

   ![](image)

Which pH curve corresponds to an acid with $K_a = 2 \times 10^{-6}$?

a) a  
   b) b  
   c) c  
   d) d  
   e) e