

The test will mainly focus on material in Chapters 16 and 17 . However, concepts learned in Chapt 15 will be specially useful in this test. Study your lecture notes, Group quizzes and homework assignments. Expect to solve problems. Test yourselves by doing problems similar to the homework under time constraints. If you understand the concepts fully, you should be able to do these problems within 10-15 minutes. If not, you need to study and practice further to improve your speed and test taking skills.

The following topics are mentioned to help focus (but not limit) your review: Review basic concepts of e
Chapter 16-17 Acid base equilibria:

Know the following: Arrhenius and Bronsted definitions of acids and bases, strength of acids, Buffers. Acid base titrations. Determination of pH at various points in a titration. Indicators, solubility and complex formation equilibria. Chelation.

The following questions are designed to drill you in problem solving for your review. Please don't limit yourself to this review. Read the chapter well and know the core concepts well. Look at problems from different angles.
(Please don't expect an answer key for this guide).

_____ (1) What is the pH of a 0.00010 M HNO₃ solution?

_____ (2) What is the pH of a 0.00010 M NaOH solution?

_____ (3) What is the pH of a solution made up by adding 100. mL of .00010 M HCl to 50.0 mL of 1.0 x 10⁻⁴ M NaOH?

_____ (4) What is the pH of a solution made up by adding 100. mL of 1.0 x 10⁻⁴ M NaOH to 50. mL of .00010 M HCl?

_____ (5) What is [H⁺] in a solution made up by mixing 1.0 mL 1.0 M HCl and 99.0 mL water?

_____ (6) What is the [H⁺] in a solution of 0.10 M HOAc (acetic acid, K_a = 1.8 x 10⁻⁵)?

_____ (7) What is the pH of a solution of 0.10 M NaOAc (K_a = 1.8 x 10⁻⁵M for HOAc)?

_____ (8) What is the pOH of a solution of 0.10 M NH₃ (ammonia, K_b = 1.8x 10⁻⁵ M)?

_____ (9) What is the pH of a solution containing 1.0x10⁻³ M NH₃ and .020M NH₄Cl?

_____ (10) what is the [H⁺] of a solution containing acetic acid and a pH of 3.56?

_____ (11) What is the [OH⁻] of a solution containing a pH of 3.0?

_____ (12) A weak acid has a K_a = 1.0x10⁻⁴. What is its pK_a?

_____ (13) A weak acid has a K_a = 1.0x10⁻⁴. What is the K_b for its conjugate base?

_____ (14) A weak acid has a K_a = 1.0x10⁻⁴. What is the pK_b for its conjugate base?

_____ (15) A diprotic acid, H₂A, has pK's 8.4 and 3.5. What is the K_a of H₂A?

- _____ (16) A diprotic acid, H_2A , has pK 's 8.4 and 3.5. What is the pK_{b1} ?
- _____ (17) A diprotic acid, H_2A , has pK 's 8.4 and 3.5. Write the chemical equilibrium equation and value for K_{b1} .
- _____ (18) A 22.5 mL HCl solution requires 18.5 mL of 0.15 M KOH to reach equivalence. What is $[HCl]_0$?
- _____ (19) A 22.5 mL of H_2SO_4 solution requires 18.5 mL of 0.15 M KOH for complete neutralization. What is $[H_2SO_4]_0$?
- _____ (20) Draw the qualitative pH titration curve for problems (18) and (19). (pK_a for HSO_4^- is 2.0).
- _____ (21) Titration of 0.394g of sulfamic acid takes 20. mL of 0.10 M HCl to reach equivalence. What is the MW of sulfamic a.?
- _____ (22) A diprotic acid, H_2A , has pK 's 8.4 and 3.5. 50.0 mL of 0.10M of the diprotic acid, H_2A , is titrated with 0.20 M NaOH. What is the V_e (i.e. the first equivalence point)?
- _____ (23) A diprotic acid, H_2A , has pK 's 8.4 and 3.5. 50.0 mL of 0.10M of the diprotic acid, H_2A , is titrated with 0.20 M NaOH. What is the pH at the following volumes of NaOH added: 0, 2.0 mL, 12.5 mL, 25.0 mL, 30.0 mL, 37.5 mL, 50.0 mL, 56.0 mL
- _____ (24) A diprotic acid, H_2A , has pK 's 8.4 and 3.5. 50.0 mL of 0.10M of the diprotic acid, H_2A , is titrated with 0.20 M NaOH. Draw the pH titration curve. Below it, show the fractions, α , of the acid present.
- _____ (25) Suppose that the concentration of bromide ions is $7.3 \times 10^{-7} M$ in a solution saturated with AgBr. What is the K_{sp} of AgBr?
- _____ (26) What is the solubility of Ag_2CO_3 ($pK_{sp} = 11.07$) in pure water?
- _____ (27) What is the solubility of Ag_2CO_3 ($pK_{sp} = 11.07$) in 0.10 M K_2CO_3 ?
- _____ (28) What is the solubility of $Ca(OH)_2$ ($pK_{sp} = 5.30$) in pH 13 buffer?
- _____ (29) Go over Example 17-16 to practice K_f equilibria.
- _____ (30) What is the fraction of acetate, α_{OAc^-} , in a 1.0M HOAc -NaOAc buffer whose pH is 4.4? ($pK_a = 4.75$ for HOAc)
- _____ (31) If $[HOAc] = 0.500 M$ in a pH 5.00 acetic acid-sodium acetate buffer, what is $[OAc^-]$?
- _____ (32) Suppose a triprotic zwitterion has the most acid form, H_3A^+ , and pK_a 's of 3.0, 6.0 and 10.0. What is the pH of the following solutions: a) 1.0 M H_3ACl (ie. the chloride salt); b) 1.0 M H_2A ; c) 1.0 M NaHA (ie the sodium salt); d) 1.0 M Na_2A (i.e. the disodium salt); e) its isoelectric point.
- _____ (33) A solution containing a weak monoprotic acid, HX, of unknown K_a is prepared as follows: 50.0 mL of 0.10 M NaOH is added to 20. mL of 0.40M HX resulting in a solution of pH 3.50. What is the K_a of HX?

_____ (34) 1.70 g of a weak base, B ($pK_b = 11.00$) is dissolved in 35.0 mL of 0.20 M HCl, resulting in a pH 2.73 solution. What is the molecular weight of B?

_____ (35) Determine the molar solubility of $PbCl_2$ ($pK_{sp} = 4.77$) in pure water.

_____ (36) Determine the molar solubility of CuCl ($pK_{sp} = 6.76$) in $1.00 \times 10^{-3} M$ NaCl. Use quadratic formula if appropriate. (compare your 2 answers : one with short cut and the other using the quadratic equation).

_____ (37) Determine the molar solubility of $La(OH)_3$ ($pK_{sp} = 18.6$) in pure water.

_____ (38) Determine the molar solubility of $La(OH)_3$ ($pK_{sp} = 18.6$) in a solution buffered at pH 10.60. (Hint what is $[OH^-]$ =?)