

1.76 Practice Problems # 1- Acids & Bases

What is the approximate pH of the following solutions? (no gas exchange)

- 1) 10^{-5} M HCl
- 2) 10^{-4} M HCl
- 3) 10^{-3} M HCl
- 4) 10^{-5} M NaOH
- 5) 10^{-4} M NaOH
- 6) 10^{-3} M NaOH
- 7) 10^{-5} M Phenol (C_6H_5OH) pK_a 10.0
- 8) 10^{-4} M Phenol
- 9) 10^{-3} M Phenol
- 10) 10^{-5} M glycolic acid pK_a 3.8
- 11) $*10^{-4}$ M glycolic acid
- 12) $*10^{-3}$ M glycolic acid
- 13) 10^{-5} M Na-phenolate
- 14) $*10^{-4}$ M Na-phenolate
- 15) $*10^{-3}$ M Na-phenolate

*These problems require a bit more calculation. Hints:

7-9 Phenol is a weak acid. Which way should the pH go when I add a little bit of phenol to pure water? What is the principal component: phenol or phenolate?

10-12 Glycolic acid is a much stronger acid than phenol, but much weaker than HCl...

*11-12 $[H^+] - [OH^-] - [A^-] = 0$ Prove this to yourself using Tableaux, reasoning.
(A^- is the conjugate base of glycolic acid, glycolate. I use HA as an abbreviation for the acid...)

$$[A^-] = \frac{[HA]_T}{\left(1 + \frac{[H^+]}{10^{-pK_a}}\right)}$$

13-15 Na-phenolate is a weaker base than NaOH

*14-15 $[H^+] - [OH^-] + [C_6H_5OH] = 0$ Prove this to yourself too.

16. Chemistry Review

What is the chemical formula of these substances?

For each substance: i) name all of the chemical species formed when the substance is dissolved in water
ii) state whether this substance releases H^+ (decreasing pH), consumes H^+ (increasing pH) or can do both (so the effect on pH is unclear) when it is added to water.

(One of the ideas of this exercise is to teach you to find information on chemicals you may not have heard of before- which books did you look in?)

- a) potassium chloride (salt substitute)
- b) nitric acid (a main ingredient in acid rain)
- c) calcium sulfate (gypsum)
- d) calcium hydroxide (quick lime)
- e) ammonium acetate (buffer, meat preservative)
- f) ammonium nitrate (fertilizer, explosive)
- g) hydrogen sulfide (rotten egg smell)
- h) sodium nitrite (meat preservative)