

Take-Home Quiz
Topic 12: Acids, Bases, and pH

Objective:

This is to assess your comprehension of the material we have covered so far and to help prepare you for the exam.

Instructions and Notes:

- Most of the quiz problems are from or adapted from “Exercises” at the end of the chapters in the Chemistry: Atoms First 2e Online Textbook (OpenStax)
- You must *CLEARLY LABEL* all problems and *SHOW ALL WORK* neatly and legibly to receive credit. If the problems do not require calculations/work then you must explain how you got the answer. (can be a few words up to a few sentences or even a few arrows)
- If the problem requires calculations, the answers should be highlighted or boxed.
- Book sections covered: 14.1, 14.2

Submission:

The quiz is usually due ~1 week after we start this section (see our due date schedule). Summer session is due sooner. This should be scanned as a single PDF and submitted online through Canvas. The file cannot be larger than 20 Mb (20,000 kB).

Helpful Tips:

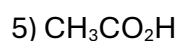
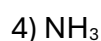
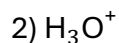
- Start as soon as we’re done with the lecture.
- Refer to the lecture and/or videos (if available).
- Use the corresponding chapter in the book to help you through difficult problems/concepts.
- There are answers and solutions available to the odd numbered problems (book number not quiz number) on the OpenStax website under “Student Resources”. It is not advised to rely on the solutions because you will not have access to the solutions during the exam. Only use the solutions as a last resort. Struggling is good and that is when you are learning the most!
- Work together with your classmates.
- Go to tutoring in the ASTC or MESA, ask your classmates in our Discord room, watch YouTube Videos, come to office hours, etc.
- To ensure your mastery of the material, do the quiz multiple times.

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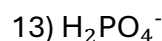
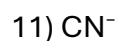
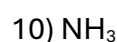
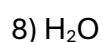
14.1 Brønsted-Lowry Acids and Bases

1) (From Chapter 14.1 #1) Write equations that show NH_3 as both a conjugate acid and a conjugate base.

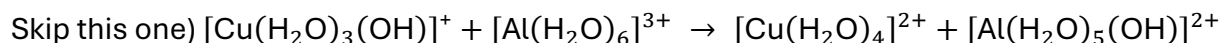
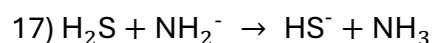
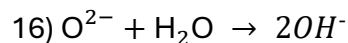
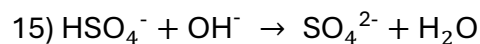
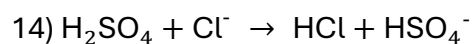
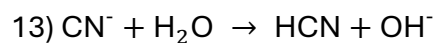
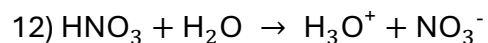
(From Chapter 14.1 #3) Show by suitable net ionic equations that each of the following species can act as a Brønsted-Lowry acid: (i.e. $\text{HCN} \rightarrow \text{H}^+ + \text{CN}^-$)



(From Chapter 14.1 #5) Show by suitable net ionic equations that each of the following species can act as a Brønsted-Lowry base: (i.e. $\text{HS}^- + \text{H}^+ \rightarrow \text{H}_2\text{S}$)

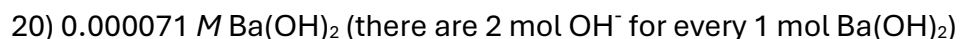
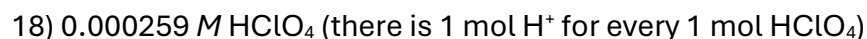


(From Chapter 14.1 #9) Identify and label the Brønsted-Lowry acid, its conjugate base, the Brønsted-Lowry base, and its conjugate acid in each of the following equations:



14.2 pH and pOH

(From Chapter 14.1 #19) Calculate the pH and the pOH of each of the following solutions at 25 °C for which the substances ionize completely: (remember sigfigs)



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(From Chapter 14.1 #18) Calculate the pH and the pOH of each of the following solutions at 25 °C for which the substances ionize completely: (remember sigfigs)

22) 0.200 *M* HCl (there is 1 mol H⁺ for every 1 mol HCl)

23) 0.0143 *M* NaOH (there is 1 mol OH⁻ for every 1 mol NaOH)

24) 3.0 *M* HNO₃ (there is 1 mol H⁺ for every 1 mol HNO₃)

25) 0.0031 *M* Ca(OH)₂ (there are 2 mol OH⁻ for every 1 mol Ca(OH)₂)

26) (From Chapter 14.1 #21) What are the hydronium and hydroxide ion concentrations in a solution whose pH is 6.52? (remember sigfigs)

27) (From Chapter 14.1 #22) Calculate the hydrogen ion concentration and the hydroxide ion concentration in wine from its pH of 3.5. (remember sigfigs)

28) (From Chapter 14.1 #23) Calculate the hydronium ion concentration and the hydroxide ion concentration in lime juice from its pH of 2. (remember sigfigs)

29) (From Chapter 14.1 #24) The hydronium ion concentration in a sample of rainwater is found to be 1.7×10^{-6} *M* at 25 °C. What is the concentration of hydroxide ions in the rainwater? (remember sigfigs)

30) (From Chapter 14.1 #25) The hydroxide ion concentration in household ammonia is 3.2×10^{-3} *M* at 25 °C. What is the concentration of hydronium ions in the solution? (remember sigfigs)