

## Chapter 16 Worksheet 3 (acid strength factors and predicting the direction of acid-base reactions)

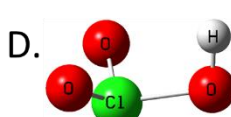
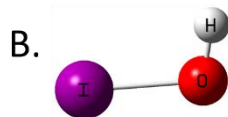
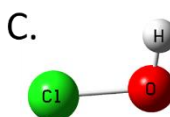
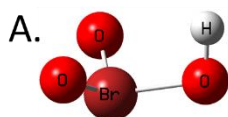
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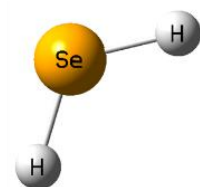
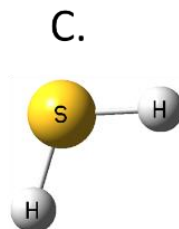
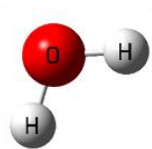
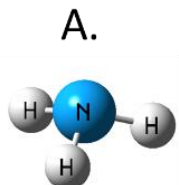
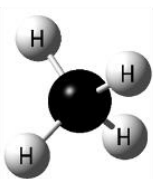
Instructions:

- Please enter your first and last name as it appears on the eLC roster (do not use a nickname).
- Your UGA myID is a combination of letters and numbers (example: mine is sre13137). **Do not use your 81x number.**
- If you do not have a printer, type your answers in the then upload the worksheet template to Gradescope by Monday, November 2 at 11:59 pm. Write your work on separate sheets of paper, convert to a PDF and upload to eLC.
- If you have a printer download the worksheet, convert it to a PDF and upload to Gradescope by Monday, November 2 at 11:59 pm. You do not need to upload anything to eLC.

1. Which of these oxoacids would you expect to be the most acidic?



2. Which compound do you expect to be most acidic?

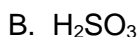
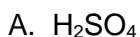


3. Which is the stronger acid? Explain.

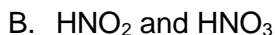


- A.  $\text{H}_2\text{O}$  is the stronger acid because  $\text{HO}^-$  is **more** stable than  $\text{HS}^-$ .  
B.  $\text{H}_2\text{O}$  is the stronger acid because  $\text{HO}^-$  is **less** stable than  $\text{HS}^-$ .  
C.  $\text{H}_2\text{S}$  is the stronger acid because  $\text{HS}^-$  is **more** stable than  $\text{HO}^-$ .  
D.  $\text{H}_2\text{S}$  is the stronger acid because  $\text{HS}^-$  is **less** stable than  $\text{HO}^-$ .  
E. It's impossible to predict acid strength without  $\text{pK}_a$  data.

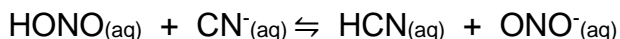
4. Identify the stronger acid in each of the following pairs.



5. Which pair has the stronger acid listed first?



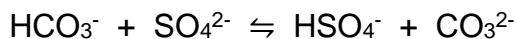
6. The equilibrium constant for the reaction is  $1.1 \times 10^6 \text{ M}$ .



This value indicates that

- A.  $\text{CN}^-$  is a stronger base than  $\text{ONO}^-$   
B.  $\text{HCN}$  is a stronger acid than  $\text{HONO}$   
C. The conjugate base of  $\text{HONO}$  is  $\text{ONO}^-$   
D. The conjugate acid of  $\text{CN}^-$  is  $\text{HCN}$

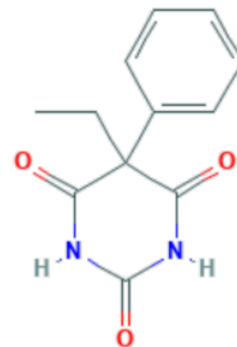
7. When mixing equal amounts of reactants and products, does this reaction proceed to the (A) left or to the (B) right? (Hint: you may find the table of Relative Strengths of Acid-Base Pairs from lecture 2 useful).



8. Which of these acids has the strongest conjugate base?

- A. acetic acid,  $K_a = 1.8 \times 10^{-5}$   
B. nitrous acid,  $K_a = 4.5 \times 10^{-4}$   
C. dihydrogen phosphate ion,  $K_a = 6.2 \times 10^{-8}$   
D. hydrocyanic acid,  $K_a = 4.0 \times 10^{-10}$   
E. benzoic acid,  $K_a = 6.3 \times 10^{-5}$

9. Phenobarbital has a  $pK_a = 7.4$ . Compared to a  $1.0 \times 10^{-3}$  M solution,  $1.0 \times 10^{-4}$  M phenobarbital will have a \_\_\_\_\_ (higher, lower) pH and a \_\_\_\_\_ (higher, lower) percent ionization.

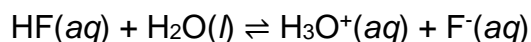


10. In order for the reaction  $A^- + H_2CO_3 \rightleftharpoons HA + HCO_3^-$  to have an equilibrium constant

$K_c < 1$ , the  $K_a$  of HA must be \_\_\_\_\_ (greater, less) than the  $K_a$  of  $H_2CO_3$ .

11. The acid strength of an oxoacid having the general formula  $H_nYO_m$  increases as the electronegativity of Y \_\_\_\_\_ and as the oxidation number of Y \_\_\_\_\_.

12. The equilibrium constant for the reaction below has the value  $K_a = 3.5 \times 10^{-4}$ . In this reaction the stronger Brønsted-Lowry acid is \_\_\_\_\_ and the weaker Brønsted-Lowry acid is \_\_\_\_\_.



13. A 0.50 M solution of a weak acid HA has the same pH as a 0.075 M solution of HCl. Calculate the  $K_a$  for HA.

14. Normal rainfall has a concentration of  $\text{OH}^-$  that is  $3.99 \times 10^{-9}$ . The concentration of  $\text{H}_3\text{O}^+$  in normal rainfall is

☐

- A. greater than  $3.99 \times 10^{-9}$ , and the rain is acidic.
- B. greater than  $3.99 \times 10^{-9}$ , and the rain is basic.
- C. less than  $3.99 \times 10^{-9}$ , and the rain is acidic.
- D. less than  $3.99 \times 10^{-9}$ , and the rain is basic.