

- (4) 1. Which one of the following species *cannot* function as a Brønsted-Lowry acid?  
a)  $\text{OH}^{-1}$     b)  $\text{HCO}_3^{-1}$     c)  $\text{H}_2\text{O}$     d)  $\text{CO}$     e)  $\text{NH}_3$
- (4) 2. Which one of the following species *cannot* function as a Brønsted-Lowry base?  
a)  $\text{BH}_3$     b)  $\text{H}_2\text{S}$     c)  $\text{PH}_3$     d)  $\text{N}_3^{-1}$     e)  $\text{NO}_3^{-1}$
- (4) 3. Which one of the following species *cannot* function as a Lewis base?  
a)  $\text{H}^{-1}$     b)  $\text{NH}_3$     c)  $\text{AlH}_3$     d)  $\text{CH}_3^{-1}$     e)  $\text{H}_2\text{Se}$
- (4) 4. Which one of the following species *cannot* function as a Lewis acid?  
a)  $\text{BF}_3$     b)  $\text{AlBr}_3$     c)  $\text{H}^{+1}$     d)  $\text{CH}_3^{+1}$     e)  $\text{CF}_4$
- (4) 5. On the basis of its structure, which one of the following species *cannot* function as either a Lewis acid or a Lewis base?  
a)  $\text{PH}_4^{+1}$     b)  $\text{PH}_3$     c)  $\text{PH}_2^{-1}$     d)  $\text{CH}_3^{+1}$     e)  $\text{CH}_3^{-1}$
- (4) 6. Which one of the following is not a conjugate acid/base pair?  
a)  $\text{H}_2\text{PO}_4^{-1}/\text{H}_3\text{PO}_4$     b)  $\text{OH}^{-1}/\text{O}^{-2}$   
c)  $\text{HN}_3/\text{N}_3^{-1}$     d)  $\text{HSO}_4^{-1}/\text{SO}_3^{-2}$   
e) All of the above choices are conjugate acid/base pairs
- (4) 7. The reaction,  $\text{NH}_4^{+1} + \text{NH}_2^{-1} \longrightarrow 2\text{NH}_3$ , represents:  
a) an Arrhenius acid/base reaction  
b) a Brønsted-Lowry acid/base reaction  
c) a Lewis acid/base reaction  
d) an example of both a) and b)  
e) an example of both b) and c)
- (4) 8. As the ability of an acid to lose protons increases, the ability of its conjugate base to attract protons (increases, decreases, remains the same).



- (6) 14. What mass, in grams, of NaOH is required to react with 20.0 ml of a 0.30M  $\text{H}_3\text{PO}_4$  solution to produce  $\text{Na}_2\text{HPO}_4$ ? Show all work in the space below.
- (7) 15. What is the pH of an aqueous solution at 25°C that is prepared from 175 ml of 0.10M HCl and 125 ml of 0.10M  $\text{Ba}(\text{OH})_2$ ? Assume that volumes are additive. Show all work in the space below.
16. The pH of a 0.02M aqueous solution of weak acid HZ is 5.00 at 25°C.
- (5) a) Determine the acid ionization constant,  $K_a$ , for HZ. Show all work in the space below.
- (2) b) Determine the %-ionization. Show all work in the space below.
- (7) 17. Determine the pH, at 25°C, of a 500 ml aqueous solution that contains 6.90 g of  $\text{NaNO}_2$ .  $K_a$  for  $\text{HNO}_2$  at 25°C is  $4.5 \times 10^{-4}$ . Show all work in the space below.