

CHEM 160 WORKSHEET FOR CHAPTER 14

In the following equation, label each substance as an acid, base, conj. acid or conj. base.



\_\_\_\_\_ acid \_\_\_\_\_ base \_\_\_\_\_ conjugate acid \_\_\_\_\_ conjugate base \_\_\_\_\_

Label each of these as a acid / conjugate base or base/conj. acid or neither.

- A) HCN / CN<sup>-</sup>      B) OH<sup>-</sup> / H<sub>2</sub>O      C) H<sup>+</sup> / HCl      D) OH<sup>-</sup> / HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>  
 Acid/ conj. base      base/conj. acid      neither      neither

Which of the following acids is considered a strong acid?

- A) HF      B) HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>      C) NaOH      D) HNO<sub>3</sub>

Which of the following reactions is a neutralization reaction?

- A)  $2\text{HCl} + \text{Zn} \rightarrow \text{H}_2 + \text{ZnCl}_2$   
 B)  $\text{HNO}_3 + \text{NaOH} \rightarrow \text{H}_2\text{O} + \text{NaNO}_3$   
 C)  $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$   
 D)  $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$

What is the molar concentration of hydroxide ion if the concentration of hydronium ion is  $2.0 \times 10^{-4} \text{ M}$ ?

- A)  $2.0 \times 10^{-4} \text{ M}$       B)  $2.0 \times 10^{-18} \text{ M}$       C)  $5.0 \times 10^{-11} \text{ M}$       D)  $2.0 \times 10^{10} \text{ M}$        $[\text{OH}^-] = 1 \times 10^{-14} / 2.0 \times 10^{-4}$

Which of the following solutions is more acidic?

- A)  $[\text{H}^+] = 1 \times 10^{-7}$       B)  $[\text{H}^+] = 1 \times 10^{-5}$       C)  $[\text{OH}^-] = 1 \times 10^{-7}$       D)  $[\text{OH}^-] = 1 \times 10^{-14}$   
*convert all to  $[\text{H}_3\text{O}^+]$*

Which solution is considered neutral? A) pH = 3      B) pH = 5      C) pH = 7      D) pH = 9

What is the pH of a solution that has  $[\text{H}^+] = 1 \times 10^{-4}$  and  $[\text{OH}^-] = 1 \times 10^{-10}$  ?

- A) pH = 4      B) pH = -4      C) pH = 10      D) pH = -10

$$\text{pH} = -\log [\text{H}_3\text{O}^+] = -\log [1 \times 10^{-4}] = 4$$

Which of the following is NOT a property of bases?

- A) Bases have a slippery feel.  
 B) Bases have a bitter taste.  
 C) Bases turn litmus paper blue.  
 D) Bases dissolve many metals.  
 E) All of the above are properties of bases.

In the following reaction:  $\text{HCO}_3^- (\text{aq}) + \text{H}_2\text{O} (\text{aq}) \rightarrow \text{H}_2\text{CO}_3 (\text{aq}) + \text{OH}^- (\text{aq})$

Base                  acid                  conj. Acid                  conj. base

- A) HCO<sub>3</sub><sup>-</sup> is an acid and H<sub>2</sub>CO<sub>3</sub> is its conjugate base.  
 B) H<sub>2</sub>O is an acid and OH<sup>-</sup> is its conjugate base.  
 C) HCO<sub>3</sub><sup>-</sup> is an acid and OH<sup>-</sup> is its conjugate base.  
 D) H<sub>2</sub>O is an acid and H<sub>2</sub>CO<sub>3</sub> is its conjugate base.  
 E) H<sub>2</sub>O is an acid and HCO<sub>3</sub><sup>-</sup> is its conjugate base.

What is the conjugate base of  $\text{HO}^-$ ? *Loses a  $\text{H}^+$  to form its conjugate base.*

- A)  $\text{O}^{2-}$  B)  $\text{H}_2\text{O}$  C)  $\text{NaOH}$  D)  $\text{OH}^-$  E)  $\text{H}_3\text{O}^+$

Which of the following pairs is *incorrectly* matched?

|    | <u>Compound</u>          | <u>Classification</u> |
|----|--------------------------|-----------------------|
| A) | $\text{HI}$              | strong acid           |
| B) | $\text{Ca}(\text{OH})_2$ | weak base             |
| C) | $\text{HNO}_2$           | weak acid             |
| D) | $\text{NH}_3$            | weak base             |

*This is a strong, not a weak base.*

Which of the following correctly describes an acidic solution

- A.  $\text{pOH} = 4$  B.  $\text{pH} = 9$  C.  $[\text{H}^+] = 1 \times 10^{-5} \text{ M}$  D.  $[\text{OH}^-] = 1 \times 10^{-5} \text{ M}$  E. All describe an acidic solution

If the pH of a solution is 12.5, then the pOH is

- A. 12.5 B. 2.5 C. 1.5 D. -1.5 E. -2.5

$$\text{pOH} = 14 - \text{pH} = 14 - 12.5 = 1.5$$

What is the pH of a solution where  $[\text{H}_3\text{O}^+] = 1 \times 10^{-3}$

- A. 0.001 B. 11 C. -3 D. 14 E. 3

$$\text{pH} = -\log [\text{H}_3\text{O}^+]$$

A solution is considered neutral if

- A.  $\text{pH} = \text{pOH}$  B.  $[\text{H}_3\text{O}^+] = [\text{OH}^-]$  C.  $[\text{OH}^-] = 1 \times 10^{-7} \text{ M}$  D.  $\text{pOH} = 7$  E. A, B, C, D are all correct

A solution where  $[\text{OH}^-] = 1 \times 10^{-4}$  has a  $[\text{H}_3\text{O}^+]$  of

- A.  $1 \times 10^{-4}$  B.  $1 \times 10^4$  C.  $1 \times 10^{14}$  D.  $1 \times 10^{-10}$  E. 10

A 1 M solution of HCl has a \_\_\_\_\_ concentration of  $\text{H}_3\text{O}^+$  A) 0 M B) 0.5 M C) 1 M D) 2 M

A solution where  $[\text{OH}^-] = 1 \times 10^{-5}$  has a pH of

- A. -5 B. 5 C. 10 D. 9 E. -9

$$[\text{H}_3\text{O}^+] = 1 \times 10^{-14} / [\text{OH}^-] = 1 \times 10^{-9}$$
$$\text{pH} = -\log [\text{H}_3\text{O}^+] = 9$$

What is the concentration of the hydroxide ions in a neutral solution?

- A) 0.0 M B)  $1.0 \times 10^{-7} \text{ M}$  C)  $1.0 \times 10^{-1} \text{ M}$  D)  $> 1.0 \times 10^{-7} \text{ M}$  E)  $< 1.0 \times 10^{-7} \text{ M}$

Which solution below is the most acidic? *The lowest pH is most acidic.*

- A)  $\text{pH} = 3.21$  B)  $\text{pH} = 12.49$  C)  $\text{pH} = 7.00$  D)  $\text{pH} = 10.12$  E)  $\text{pH} = 7.93$