**Acids & Bases Practice Worksheet**

1. Describe what occurs when water ionizes (“self-ionization of water”). Include an equation and an explanation.
2. What are the molar concentrations of [H+] and [OH-] in pure water at 25 ̊C?

1. What is the ion-product constant, Kw? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What is pH a measure of? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What is the equation used for finding pH? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What is the equation that relates to pH and pOH? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| 1. Find [H+] for solutions having the following [OH-] value. Then, find pH

 a) [OH-] = 1 x 10-13 [H+] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pH = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b) [OH-] = 2.7 x 10-4 [H+] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pH = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ c) [OH-] = 1 x 10-3 [H+] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pH = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ d) [OH-] = 6.3 x 10-10 [H+] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pH = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_1. Calculate [OH-] of a solution when its [H+] has the following values. Then, find pOH

 a) [H+] = 1 x 10-1 [OH-] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pOH = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b) [H+] = 3.6 x 10-5 [OH-] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pOH = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ c) [H+] = 1 x 10-2 [OH-] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pOH = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ d) [H+] = 7.8 x 10-8 [OH-] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pOH = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |

1. Complete the following table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | [H+] | [OH-] | pH | pOH | Acid, Base, or Neutral |
| a | 1.0 x 10-3 | 1.0 x 10-11 | 3 | 11 | acidic |
| b |  | 1.0 x 10-5 |  |  |  |
| c |  |  | 10.00 |  |  |
| d |  |  |  | 6.00 |  |
| e | 0.010 |  |  |  |  |
| f |  | 0.0000010 |  |  |  |
| g |  |  | 4.00 |  |  |
| h |  |  |  | 7.00 |  |
| i | 3.2 x 10-3 |  |  |  |  |
| j |  | 1.8 x 10-14 |  |  |  |
| k |  |  | 10.23 |  |  |
| l |  |  |  | 6.78 |  |
| m | 0.0050 |  |  |  |  |
| n |  | 0.0050 |  |  |  |

1. What would be the pH of each of the following:

 a) 0.0010 M HCl \_\_\_\_ g) 0.024 M HCl \_\_\_\_

 b) 0.0010 M HNO3 \_\_\_\_ h) 0.075 M KOH \_\_\_\_

 c) 0.010 M NaOH \_\_\_\_ i) 0.000034 M HCl \_\_\_\_

 d) 0.0035 M HCl \_\_\_\_ j) 1.0 M KOH \_\_\_\_

 e) 1.0 M HBr \_\_\_\_ k) 0.00012 M KOH \_\_\_\_

 f) 0.000000000001M HCl l) 12 M HCl \_\_\_\_

**ANSWER KEY**

1. Describe what occurs when water ionizes (“self-ionization of water”). Include an equation and an explanation.

 **H20 H+ + OH-**

1. What are the molar concentrations of [H+] and [OH-] in pure water at 25 ̊C?

 **1 x 10-7 M**

1. What is the ion-product constant, Kw? **Kw = [H+][OH-] = 1 x 10-14**
2. What is pH a measure of? **[H+]**
3. What is the equation used for finding pH? **pH = - log10 [H+]**
4. What is the equation that relates to pH and pOH? **pH + pOH 🡪 14**

|  |  |
| --- | --- |
| 1. Find [H+] for solutions having the following [OH-] value. Then, find pH

 a) [OH-] = 1 x 10-13 [H+] = **1 x 10-1** pH = **1** b) [OH-] = 2.7 x 10-4 [H+] = **3.7 x 10-11** pH = **10.4** c) [OH-] = 1 x 10-3 [H+] = **1 x 10-11** pH = **11** d) [OH-] = 6.3 x 10-10 [H+] = **1.6 x 10-5** pH = **4.8**1. Calculate [OH-] of a solution when its [H+] has the following values. Then, find pOH

 a) [H+] = 1 x 10-1 [OH-] = **1 x 10-13** pOH = **13** pH = 1 b) [H+] = 3.6 x 10-5 [OH-] = **2.8 x 10-10** pOH = **9.6** pH = 4.4 c) [H+] = 1 x 10-2 [OH-] = **1 x 10-12** pOH = **12** pH = 2 d) [H+] = 7.8 x 10-8 [OH-] = 1.**28 x 10-07** pOH = **7.02** pH = 6.98 |  |

1. Complete the following table:

**Kw = [H+][OH-] = 1 x 10-14  pH = - log10 [H+] pH + pOH 🡪 14**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | [H+] | [OH-] | pH | pOH | Acid, Base, or Neutral |
| a | 1.0 x 10-3 | 1.0 x 10-11 | 3 | 11 | acidic |
| b | **1.0 x 10-9** | 1.0 x 10-5 | **9** | **5** | **basic** |
| c | **1.0 x 10-10** | **1.0 x 10-4** | 10.00 | **4** | **basic** |
| d | **1.0 x 10-8** | **1.0 x 10-6** | **8** | 6.00 | **basic** |
| e | 0.010 | **1.0 x 10-12** | **2** | **12** | **acidic** |
| f | **1.0 x 10-8** | 0.0000010 | **8** | **6** | **basic** |
| g | **1.0 x 10-4** | **1.0 x 10-10** | 4.00 | **10** | **acidic** |
| h | **1.0 x 10-7** | **1.0 x 10-7** | **7** | 7.00 | **neutral** |
| i | 3.2 x 10-3 | **3.1 x 10-12** | **2.5** | **11.5** | **acidic** |
| j | **5.6 x 10-1** | 1.8 x 10-14 | **0.255** | **13.745** | **acidic** |
| k | **5.89 x 10-11** | **1.7 x 10-4** | 10.23 | **3.77** | **basic** |
| l | **6.03 x 10-8** | **1.66 x 10-7** | **7.22** | 6.78 | **Neutral/basic** |
| m | 0.0050 | **2.0 x 10-12** | **2.3** | **11.7** | **acidic** |
| n | **2.0 x 10-12** | 0.005 | **11.7** | **2.3** | **basic** |

1. What would be the pH of each of the following:

**Kw = [H+][OH-] = 1 x 10-14  pH = - log10 [H+] pH + pOH 🡪 14**

 a) 0.0010 M HCl (**1.0 x 10-3** M) = **3** g) 0.024 M HCl (**2.4 x 10-2** M) = **1.62**

 b) 0.0010 M HNO3 (**1.0 x 10-3** M) = **3** h) 0.075 M K**OH** (**7.5 x 10-2** M) = **12.88**

 c) 0.010 M Na**OH** (**1.0 x 10-2** M) = **12** i) 0.000034 M HCl (**3.4 x 10-5** M) = **4.47** d) 0.0035 M HCl (**3.5 x 10-3** M) = **2.46** j) 1.0 M K**OH** = **14**

 e) 1.0 M HBr = **0** k) 0.00012 M K**OH** (**1.2 x 10-4** M) = **10.1** f) 0.000000000001M HCl (1 **x 10-12** M) = **12** l) 12 M HCl = **-1.08** (enrichment)