**Dougherty Valley HS AP Chemistry**

**WORKSHEET #7**

**Acid Base – Study Questions Chemistry of Acids and Bases**

**Name: Date: Period: Seat #:**

Show all work for each question, box your final answer

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| [1] For the following aqueous equilibria, designate the Brønsted-Lowry conjugate acid-base pairs and establish the weaker side: | | | | |
| [a] | | **NH3(aq) +H2O(*l*) ⇔ NH4+(aq) + OH−(aq)** | | |
| Brønsted-Lowry conjugate acid: | | | Brønsted-Lowry conjugate base: | Weaker side: |
| [b] | | **HCN(aq) + H2O(*l*) ⇔ H3O+(aq) + CN−(aq)** | | |
| Brønsted-Lowry conjugate acid: | | | Brønsted-Lowry conjugate base: | Weaker side: |
| [c] | **NH4+(aq) + CO32−(aq) ⇔ NH3(aq) + HCO3− (aq)** | | | |
| Brønsted-Lowry conjugate acid: | | | Brønsted-Lowry conjugate base: | Weaker side: |

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| [2] Complete the Brønsted-Lowry equilibria, label the components acid or base, and pair up the conjugate acid-base pairs: |
| HSO4− + H2O ⇔ |
| NH3 + H2O ⇔ |
| CN− + H2O ⇔ |
| H− + H2O ⇔ |
| HClO4 + H2O ⇔ |

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| [3] Of the following acids,  [i] HNO3 (aq) + H2O(*l*) ⇔ H3O+ (aq) + NO3− (aq) **Ka = very large**  [ii] HSO4− (aq) + H2O(*l*) ⇔ H3O+ (aq) + SO42− (aq) **Ka = 1.2 x 10−2**  [iii] HCN (aq) + H2O(*l*) ⇔ H3O+ (aq) + CN− (aq) **Ka = 4.0 x 10−10**  [iv] H2CO3 (aq) + H2O(*l*) ⇔ H3O+ (aq) + HCO3− (aq) **Ka = 4.2 x 10−7**  [v] NH4+ (aq) + H2O(*l*) ⇔ H3O+ (aq) + NH3 (aq) **Ka = 5.6 x 10−10**  [vi] HF (aq) + H2O(*l*) ⇔ H3O+ (aq) + F− (aq) **Ka = 7.2 x 10−4**  **Determine**: | |
| [a] The strongest acid |  |
| [b] The acid that produces the lowest concentration of hydronium ions per mole of acid |  |
| [c] The acid with the strongest conjugate base |  |
| [d] The diprotic acid |  |
| [e] The strong acid |  |
| [f] The acid with the weakest conjugate base |  |

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| [4] What is the pH of |
| a. 0.0010 M HCl solution? 3.0 |
| b. 0.15 M KOH solution? 13.2 |
| c. 10-8 M HNO3 solution? 6.96 |

[5] Complete the table for each aqueous solution at 25°C. State whether the solutions are acidic or basic.

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| [H3O+] | [OH−] | pH | pOH | Acidic or Basic |
| 2.0 x 10-5 |  |  |  |  |
|  |  | 6.25 |  |  |
|  | 5.6 x 10-2 |  |  |  |
|  |  |  | 9.20 |  |
| 8.7 x 10-10 |  |  |  |  |

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| [6] If the pH of a sample of rainwater is 4.62, what is the hydronium ion concentration [H3O+] and the hydroxide ion concentration [OH−] in the rainwater? ([H3O+] = 2.4E-5, [OH−] = 4.2E-10) |

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| [7] Hydroxylamine is a weak base with a Kb = 6.6 x 10−9. What is the pH of a 0.36 M solution of hydroxylamine in water at 25°C?  9.69 |

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| [8] Which of the following salts, when dissolved in water to produce 0.10 M solutions, would have the lowest pH? | |
| a. sodium acetate | d. magnesium nitrate |
| b. potassium chloride | e. potassium cyanide |
| c. sodium bisulfate | **Explain why:** |

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| [9a] Cyanic acid HOCN has a Ka = 3.5 x 10−4, what is the Kb for the cyanate ion OCN−? Kb = 2.86 x 10-11 |
| [b] Phenol is a relatively weak acid, Ka = 1.3 x 10−10. How does the strength of its conjugate base compare with the strength of ammonia (Kb = 1.8 x 10-5), the acetate ion (Kb = 5.55 x 10-10), and sodium hydroxide? |