**Quiz 2**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. In the pH Indicators experiment, what substance are you boiling in water to extract the indicator (2 points)?

Red cabbage

1. Consider the reaction at equilibrium: CO (g) + Cl2 (g) $⇌$ COCl2 (g)

Predict whether the reaction will shift left, shift right, or remain unchanged if (4 points)

|  |  |  |
| --- | --- | --- |
|  | change | Shift (left, right, unchanged) |
|  | Add COCl2 | Left |
|  | Add Cl2 | Right  |
|  | Add Ne gas | Unchanged  |
|  | Reduce the volume of the container | Right  |

1. The AIDS drug zalcitabine (also know as ddC) is a weak base with a chemical formula of C9H13N3O3 and a pKb of 9.8 (14 points).
	1. What is the Kb value?

$$K\_{b}=10^{-pK\_{b}}=10^{-9.8}=1.584893192×10^{-10}≈2×10^{-10}$$

* 1. The initial concentration of zalcitabine is 2.65 × 10-3 M. Calculate the equilibrium concentrations.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | C9H13N3O3 (aq) +  | H2O (l) $⇌$ | C9H13N3O3H+ (aq) | OH- (aq) |
| I | 2.65 × 10-3 M | ∞ | 0 M | ~ 0M |
| C | -x  |  | +x | +x |
| E | 2.65 × 10-3 M – x =2.65 × 10-3 M – 6.5 × 10-7 M =2.65 × 10-3 M |  | x = 6 × 10-7 M | x = 6 × 10-7 Mx = 6 × 10-7 M + 1 × 10-7 M = 7 × 10-7 M |

$$K\_{b}=\frac{\left[C\_{9}H\_{13}N\_{3}O\_{3}H^{+}\right][OH^{-}]}{[C\_{9}H\_{13}N\_{3}O\_{3}]}$$

$$K\_{b}=1.584893192×10^{-10}=\frac{(x)(x)}{(2.65×10^{-3} M-x)}$$

$$K\_{b}=1.584893192×10^{-10}=\frac{x^{2}}{(2.65×10^{-3} M)}$$

$$x=6.48071520746×10^{-7} M≈6×10^{-7}$$

Check x is small approximation

$$\frac{6×10^{-7} M}{2.65×10^{-3} M}×100=0.03\%\ll 5\%$$

* 1. What percentage of the base is protonated in an aqueous solution of zalcitabine solution?

 $\%protonation=\frac{[BH^{+}]}{[B]}×100=\frac{6×10^{-7} M}{2.65×10^{-3} M}×100=0.03\%$