Chemistry of Aqueous Gases: Acid Rain

1. Given that formaldehyde dissolves in water (K_H = 1.7 M atm^{-1}) and reacts to form a hydrate (K_{eq} = 2 x 10^3), calculate the total concentration of formaldehyde in rainwater if its atmospheric concentration 6 x 10^9 molec cm^{-3} (0.22 ppb$_v$).

*[Answer: Total (**CH$_2$O**) = 0.75 µM]*

2. Calculate the pH of natural rainwater in equilibrium with CO_2 at an atmospheric concentration of 380 ppm$_v$.

$K_H = 0.039$ M atm^{-1}
$K_{a1} = 4.5$ x 10^{-7}
$K_{a2} = 4.7$ x 10^{-11}

[Answer: pH = 5.60]

3. Calculate the pH of natural rainwater in equilibrium with **SO$_2$** at an atmospheric concentration of 5.0 ppb$_v$.

$K_H = 5.4$ M atm^{-1}
$K_{a1} = 1.7$ x 10^{-2}
$K_{a2} = 6.4$ x 10^{-8}

[Answer: pH = 4.57]