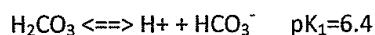
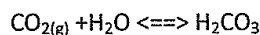


Answer any five of the following six questions. (六題中任選五題作答,滿分 100)

1. The dissolution of carbon dioxide in water:



If the total carbon dioxide concentration is 2.2 mF, what are the concentrations (in mM units) of $[\text{H}_2\text{CO}_3]$, $[\text{HCO}_3^-]$ and $[\text{CO}_3^{2-}]$ at pH 4.0, 6.4, 8.4, 10.3 and 12.5? Please give a quick estimation and explain why. (20%)

pH	Conc. (mM)		
	$[\text{H}_2\text{CO}_3]$	$[\text{HCO}_3^-]$	$[\text{CO}_3^{2-}]$
4.0			
6.3			
8.4			
10.3			
12.5			

2. If the above carbonate system exists in a high saline medium (for example, seawater), the apparent dissociation constants will shift to $\text{p}K_1'=6.0$ and $\text{p}K_2'=9.2$. Try to use concepts related to ionic strength and activity to explain the so-called "pK_a-shifting" phenomenon. (20%)
3. Describe the fundamental concept of chromatography. Also, define the following terms for a separation column with a length L: (20%)
- partition coefficient k'
 - retention time t_R
 - flow speed u and migration speed u_M
 - height equivalent of theoretical plate (HETP)
4. What is ICP-MASS? Brief describe its principle (you may draw diagrams to make it clear). Give some examples to show its application to environmental or clinic chemistry. (20%)
5. Mercury is toxic element. The determination of mercury is largely depending upon a technique called "cold-vapor atomic absorption spectrometry". Use illustrations to describe this technique. (20%)
6. Testing drivers' alcohol is an obligation should any traffic accident take place. What is the method to measure alcohol in driver's breath? If the driver refuses to take breath test, how can we measure alcohol in his blood? (20%)