

PSC 1222 — Basic Chemistry for Laboratory Practice 2009/10  
Home Assignment

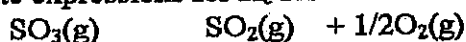
Please write the answers in a separate sheets of paper.

1. At 400°C, a student starts with pure HI at a concentration of 0.22 M. Some of the HI dissociates to form I<sub>2</sub> and H<sub>2</sub>. At equilibrium, the concentration of I<sub>2</sub> is 0.020 M.

- What is [I<sub>2</sub>]?
- What is [HI]?
- What is the value of the equilibrium constant at 400°C?
- What will happen if some I<sub>2</sub> is withdrawn from the system?
- What will happen if some I<sub>2</sub> is added to the system?



2. (i) Write expressions for K<sub>c</sub> for the following system.



- (ii) Write the corresponding balanced chemical equation for the expression for K<sub>c</sub>.

$$K_c = \frac{[\text{NH}_3]^4 \times [\text{O}_2]^5}{[\text{NO}]^4 \times [\text{H}_2\text{O}]^6}$$

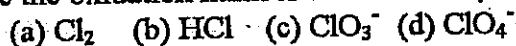
3. The concentration of a NaOH solution is 0.020 M.

- What is the concentration of H<sup>+</sup> ions?
- What is the pH of the solution?
- A 25.0 mL of this solution was titrated with H<sub>2</sub>SO<sub>4</sub> and the end point reading was 20.00 mL. What is the concentration of H<sub>2</sub>SO<sub>4</sub>?

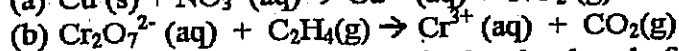
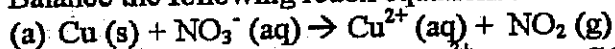
4. Arrange the following compounds each having a concentration of 0.2 M in the order of decreasing pH. Explain your answer.



5. (i) Give the oxidation number of chlorine in,



- (ii) Balance the following redox equations for reactions in the acidic medium.



- (iii) Identify the species that is oxidised and reduced of each equation.

- (iv) Identify the oxidizing and the reducing agent in each equation.

THE OPEN UNIVERSITY OF SRI LANKA

Certificate course for Laboratory Technology 2009/2010

PSC 1222 – Basic Chemistry for Laboratory Practice

Answer guide for Home assignment

1.		$2 \text{ HI} \rightleftharpoons \text{H}_2 + \text{I}_2$	
	Stoichiometry	2	1      1
	Initial concentration	0.22 M	-      -
	Equilibrium concentration		0.020 M

(i)  $[\text{H}_2] = [\text{I}_2] = 0.020 \text{ M}$

- (ii) No of moles of HI required to give 1 mol of  $\text{H}_2$  = 2 moles  
 " " " " " 0.02 mol of  $\text{H}_2$  =  $2 \times 0.02 \text{ mol}$   
 = 0.04 mol  
 " " " " " HI remained in equilibrium =  $0.22 - 0.04 \text{ mol}$   
 = 0.18 mol  
 Concentration of HI = 0.18 M

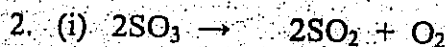
(iii) 
$$K_c = \frac{[\text{H}_2][\text{I}_2]}{[\text{HI}]}$$

$$= \frac{(0.02 \text{ M} \times 0.02 \text{ M})}{0.18 \text{ M}}$$

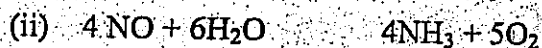
$$= 0.01 \text{ M}$$

(iv) More and more HI will be decomposed. As a result  $[\text{HI}]$  will reduced and  $[\text{H}_2]$  will be increased.

(v) More and more HI will be formed with the reaction of  $\text{I}_2$ . As a result  $[\text{HI}]$  will be increased and  $[\text{H}_2]$  will be reduced.



$$K_c = \frac{[\text{SO}_2]^2[\text{O}_2]}{[\text{SO}_3]^2}$$



$$K_w = [\text{H}^+][\text{OH}^-]$$

$$10^{-14} = [\text{H}^+] 0.02$$

$$[\text{H}^+] = 0.5 \times 10^{-12} \text{ M}$$

(ii)  $\text{pH} = -\log[\text{H}^+]$

$$\text{pH} = -\log(0.5 \times 10^{-12})$$

$$\text{pH} = 12.3010$$



2                      1

$$\text{No. of moles of NaOH in 25 ml} = (0.02/1000) \times 25 \text{ mol}$$

$$\begin{aligned} \text{,, ,, ,, H}_2\text{SO}_4 \text{ required} &= (1/2) \times (0.02/1000) \times 25 \text{ mol} \\ &= 0.25 / 1000 \end{aligned}$$

$$\begin{aligned} \text{Concentration of H}_2\text{SO}_4 &= (0.25/1000) \times (1000/20) \\ &= 0.0125 \text{ M} \end{aligned}$$

4.  $H_2SO_4$  and  $HNO_3$  are strong acids. One mole of  $H_2SO_4$  gives 2 moles of  $H^+$  while  $HNO_3$  gives only one mole of  $H^+$ . Therefore,  $H_2SO_4$  is more acidic than  $HNO_3$ .

Acetic acid ( $CH_3COOH$ ) is a weak acid so less acidic.

$pH = -\log [H^+]$ . Therefore, pH decreases when  $[H^+]$  increases.

$KOH$  and  $Ca(OH)_2$  are strongly basic. One mole of  $Ca(OH)_2$  gives 2 moles of  $OH^-$  while  $KOH$  gives only one mole of  $OH^-$ . Therefore,  $Ca(OH)_2$  is basic than  $KOH$ .

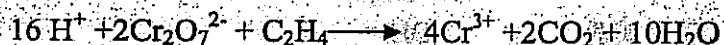
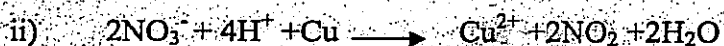
$pOH = -\log [OH^-]$ . Therefore, higher the amount of  $OH^-$ , lower the pOH value.

$pH = 14 - pOH$ . Therefore, pH increases with decreasing pOH.

The order of decreasing pH is,

$Ca(OH)_2$ ,  $KOH$ ,  $CH_3COOH$ ,  $HNO_3$ ,  $H_2SO_4$

5. i) a) 0 b) -1 c) +5 d) +7



iii) oxidized species      a) Cu                      b)  $C_2H_4$

Reduced species          a)  $NO_3^-$                       b)  $Cr_2O_7^{2-}$

iv) Oxidizing agent        a)  $NO_3^-$                       b)  $Cr_2O_7^{2-}$

reducing agent            a) Cu                          b)  $C_2H_4$

