

Chemistry 12  
ACID BASE II REVIEW

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Blk: \_\_\_\_\_ Date: \_\_\_\_\_

SHORT ANSWERS:

1. a. Write two equations representing the acidic and basic Hydrolysis of  $\text{NaHSO}_3(\text{s})$ . (2 marks)



b. Use calculations to determine if the solution is acidic or basic. (2 marks)

$K_a(\text{HSO}_3^-) = 1.0 \times 10^{-7}$   $\therefore$  acidic  
 $K_a > K_b$

$K_b(\text{HSO}_3^-) = \frac{1.00 \times 10^{-14}}{K_a(\text{H}_2\text{SO}_3)} = \frac{K_w}{1.5 \times 10^{-2}} = 6.7 \times 10^{-13}$

2. Calculate the pH of 0.550 M  $\text{C}_6\text{H}_5\text{OH}$  (4 marks)

	$\text{C}_6\text{H}_5\text{OH} + \text{H}_2\text{O}$	$\rightleftharpoons$	$\text{C}_6\text{H}_5\text{O}^- + \text{H}_3\text{O}^+$
I	0.550		0
C	-X		+X
E	0.550 - X		X

$\approx 6.550$

$K_a = \frac{X^2}{0.550} \rightarrow 1.3 \times 10^{-10} = \frac{X^2}{6.550}$

$X = \sqrt{(1.3 \times 10^{-10})(6.550)} = \sqrt{8.5 \times 10^{-6}}$

$\text{pH} = -\log(8.5 \times 10^{-6})$   
 $\text{pH} = 5.07$

3. Neutral red, HIn, is an acid-base indicator.  
a. Write an equation to represent the equilibrium of this indicator in water. (1 mark)



b. What colour would this indicator be in 0.1 M NaOH? (1 mark)

$\text{pH} = 14.000 - \text{pOH}$   $\therefore$  it is amber  
 $\text{pH} = -\log(0.1) = 1.0$   
 $\therefore \text{pH} = 14.000 - 1.0 = 13.0$

4. A new indicator "EARL MARRIOTT GREEN" is yellow when  $[\text{H}_3\text{O}^+] > 6.3 \times 10^{-3}$  M and green when  $[\text{H}_3\text{O}^+] < 2.5 \times 10^{-4}$  M. Calculate the pH value at the midpoint of the transition point for this indicator. (2 marks)

$\text{pH} = -\log(6.3 \times 10^{-3}) = 2.20$

$\text{pH} = -\log(2.5 \times 10^{-4}) = 3.60$

$\therefore \text{pH} = \frac{2.20 + 3.60}{2}$   
 $\text{pH} = 2.90$

5. An indicator is often used during acid-base titrations.

a) Define the term *transition point* for an indicator. (1 mark)

When  $[HIn] = [In^-]$

b) Calculate the  $K_a$  value for methyl red. (1 mark)

$$K_a = \frac{[H^+][In^-]}{[HIn]}$$

$$4.8 \times 10^{-6} = \frac{4.8 \times 10^{-6}}{2} = \frac{4.8 \times 10^{-6}}{2} = 2.4 \times 10^{-6}$$

c) A mixture of indicators is made by combining equal amounts of methyl orange and bromothymol blue. Complete the following table, showing the colour of each indicator and the mixture at pH of 5 and pH of 9. (2 marks)

	Colour of Methyl orange	Colour of Bromothymol blue	Combo
pH = 5	yellow	yellow	yellow
pH = 9	yellow	blue	green
Combined Colour			

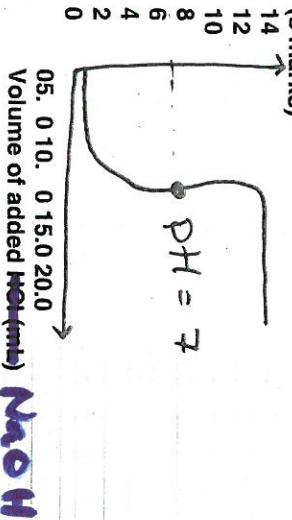
6. Four monoprotic acids of the same concentration are labelled as follows:

Solution	Label	pH
A	$[OH^-] = 5.0 \times 10^{-11} M$	3.70
B	$[H_3O^+] = 0.20 M$	0.70
C	$pOH = 11.30$	2.70
D	$pH = 1.20$	1.20

List the four solutions in order of DECREASING ACIDITY. Use appropriate calculations to support your answer. (4 marks)

B > D > C > A

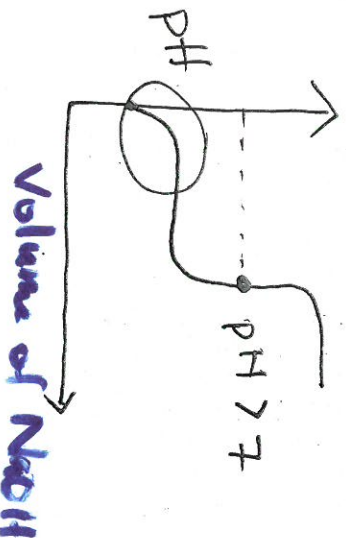
7. a) In the space below, sketch the titration curve for the reaction when 0.10M HCl is added to 10.0mL of 0.10M NaOH. (3 marks)



SN/SB

- b) Describe two changes in the titration curve that would result from

- i) using 0.10M  $CH_3COOH$  in place of the HCl. (2 marks)  
 ii) equivalence pt > 7.

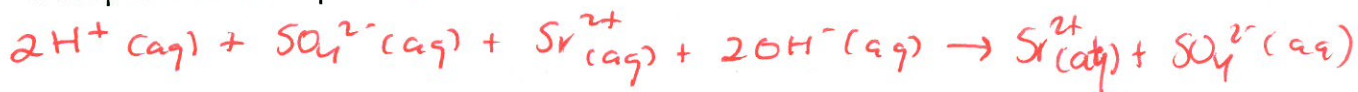


8. Write the formula equation and the net ionic equation for the reaction between 0.1 M  $\text{H}_2\text{SO}_4$  and 0.1 M  $\text{Sr}(\text{OH})_2$ . (3 marks)

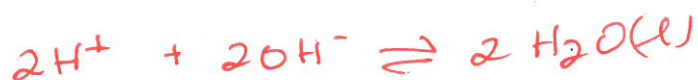
Formula equation:



Complete ionic equation:



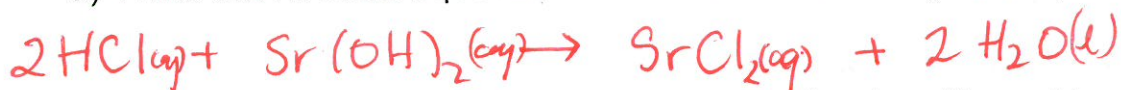
Net ionic equation:



convention:  $2\text{H}_2\text{O}(\text{l}) + 59\text{kJ} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$

9. A 25.0mL sample of  $\text{Sr}(\text{OH})_2$  is titrated with a standardized solution of HCl to the equivalence point. (3 marks)

a) Write the formula equation for the neutralization. (1 mark)



b) Write the net ionic equation for the neutralization. (1 mark)



c) What is meant by the term "standardized" solution? (1 mark)

a solution of known [ ] as it has been prepared with a primary standard.

If HCl is a standard it was standardized with  $\text{Na}_2\text{CO}_3$ .



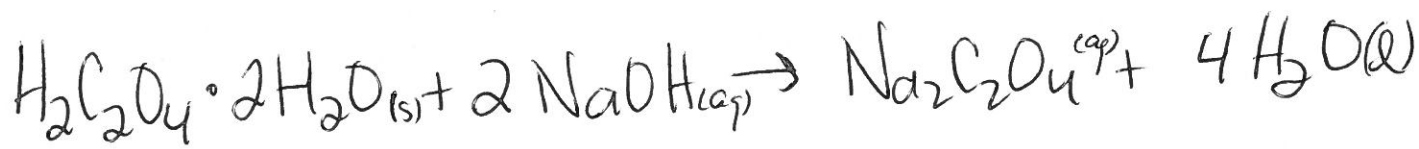
10. A Solution of NaOH(aq) was standardized by titrating it with oxalic acid dihydrate. (126.07 g/mol) as the primary standard. The following data was collected:

mass of acid = 2.56 g

$$\begin{array}{r} 40.15 \text{ mL} \\ - 1.05 \\ \hline 39.10 \text{ mL} \end{array}$$

Initial volume NaOH = 1.05 mL  
 final volume NaOH = 40.15 mL

What is the [NaOH]?



$$2.56 \text{ g} \times \frac{1 \text{ mol H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}}{126.07 \text{ g}} \times \frac{2 \text{ mol NaOH}}{1 \text{ mol H}_2\text{C}_2\text{O}_4} = 4.06 \times 10^{-2} \text{ mol NaOH}$$

$$[\text{NaOH}] = \frac{4.06 \times 10^{-2} \text{ mol NaOH}}{0.03910 \text{ L}}$$

$1.04 \text{ M NaOH}$