Name: Key

Blk:____ Date:_____

Chemistry 12
ACID BASE II REVIEW

SHORT ANSWERS:

1.a. Write two equations representing the acidic and basic **Hydrolysis** of $NaHSO_3(s)$. (2 marks)

$NaHSO_3 \rightarrow Na^+ + HSO_3^-$

$HSO_3^- + H_2O(\ell) \rightleftharpoons H_2SO_3 + OH^-$

$HSO_3^- + H_2O(\ell) \rightleftharpoons SO_3^{2-} + H_3O^+$

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

$K_a(HSO_3^-) = 1.0 \times 10^{-7}$ ∴ acidic $K_a > K_b$

$K_b(HSO_3^-) = \frac{1.00\times10^{-14}}{K_a(H_2SO_3)} = \frac{K_w}{1.5\times10^{-2}} = 6.7\times10^{-13}$

2. Calculate the **pH** of 0.550 M C_6H_5OH (4 marks)

	C_6H_5OH	+ $H_2O(\ell)$ ⇌	$C_6H_5O^-$	+ H_3O^+
I	0.550		∅	∅
C	$-x$		$+x$	$+x$
E	$0.550-x$		x	x
	$\cong 0.550$			

$K_a = \frac{x^2}{0.550} \rightarrow 1.3\times10^{-10} = \frac{x^2}{0.550}$

$\sqrt{(1.3\times10^{-10})(0.550)} = \sqrt{x^2}$

8.5×10^{-6}

$pH = -\log(8.5\times10^{-6})$

$\boxed{pH = 5.07}$

3. Neutral red, HIn, is an acid-base indicator.

a. Write an equation to represent the equilibrium of this indicator in water.(1 mark)

$HIn + H_2O(\ell) \rightleftharpoons In^- + H_3O^+$

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

$pH = 14.000 - pOH$

$pOH = -\log(0.1) =$

$\therefore pH = 14.000 - 1.0 = 13.0$

∴ it is amber

4. A new indicator "EARL MARRIOT GREEN" is yellow when $[H_3O^+] > 6.3\times10^{-3}$ M and green when $[H_3O^+] < 2.5\times10^{-4}$ M. Calculate the **pH** value at the **midpoint** of the transition point for this indicator. (2 marks)

$pH = -\log(6.3\times10^{-3})$

$= 2.20$

$pH = -\log(2.5\times10^{-4})$

$= 3.60$

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

$\boxed{pH = 2.90}$

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)**

Ka = antilog (-midpoint)

$\frac{4.8 + 6.0}{2}$ = antilog(-5.4)

$\Rightarrow 4 \times 10^{-6}$

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

pH=5

	Colour of Methyl orange	Colour of Bromthymol 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:

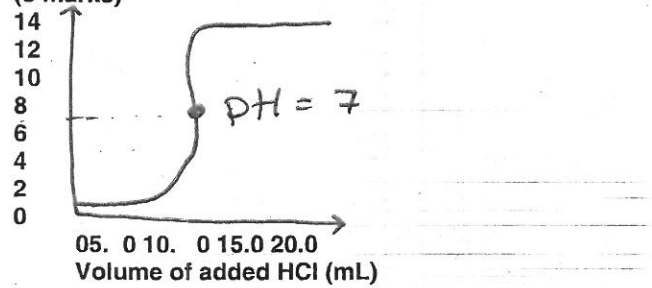
Solution	Label	pH
A	$[OH^-] = 5.0 \times 10^{-11}$ M	3.70
B	$[H_3O^+] = 0.20$ M	0.70
C	pOH = 11.30	2.70
D	pH = 1.20	1.20

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)

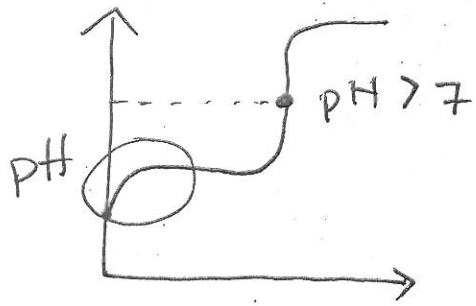
SA/SB



b) Describe two changes in the titration curve that would result from using 0.10M CH_3COOH in place of the HCl . (2 marks)

i) equivalence pt > 7.

ii)



8. Write the formula equation and the net ionic equation for the reaction between 0.1 M H_2SO_4 and 0.1 M $Sr(OH)_2$. **(3 marks)**

Formula equation:

$H_2SO_4(aq) + Sr(OH)_2(aq) \longrightarrow SrSO_4(aq) + 2H_2O(l)$

Complete ionic equation:

$2H^+(aq) + SO_4^{2-}(aq) + Sr^{2+}(aq) + 2OH^-(aq) \rightarrow Sr^{2+}(aq) + SO_4^{2-}(aq) + 2H_2O(l)$

Net ionic equation:

$2H^+ + 2OH^- \rightleftharpoons 2H_2O(l)$

convention: $2H_2O(l) + 59kJ \rightleftharpoons H_3O^+ + OH^-$

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

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

$2HCl(aq) + Sr(OH)_2(aq) \longrightarrow SrCl_2(aq) + 2H_2O(l)$

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

$2H_2O(l) + 59kJ \rightleftharpoons H_3O^+ + OH^-$

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 Na_2CO_3.

10. A Sdution 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

Initial volume NaOH = 1.05 mL

final volume NaOH = 40.15 mL

40.15 mL − 1.05 = 39.10 mL

What is the [NaOH]?

$$H_2C_2O_4 \cdot 2H_2O_{(s)} + 2\,NaOH_{(aq)} \rightarrow Na_2C_2O_4^{(aq)} + 4\,H_2O_{(l)}$$

$$2.56\,g \times \frac{1\,mol\,H_2C_2O_4 \cdot 2H_2O}{126.07\,g} \times \frac{2\,mol\,NaOH}{1\,mol\,H_2C_2O_4} = 4.06 \times 10^{-2}\,mol\,NaOH$$

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

1.04 M NaOH