#### WASHINGTON LATIN PUBLIC CHARTER SCHOOL CHEMISTRY 2019-20

#### **UNIT 5A PRACTICE TEST – CHEMICAL REACTIONS I: ACIDS AND BASES**

Answer all questions Recommended time = 50 minutes BAHATI NJEMA!

### **SECTION A – OPEN RESPONSE**

1.	Neut	traliz	ation reactions are r	eactions between acids and bases to produce	
	salts	. The	y have a variety of ι	uses, including making different salts.	
	(a) Write balanced symbol equations for the following neutralization				
		read	ctions and name the	salt produced:	
		(i)	Reactants:	magnesium hydroxide and hydrochloric acid	
			Symbol equation:	$Mg(OH)_2 + 2HCI \rightarrow MgCl_2 + 2H_2O$	
			Name of salt:	magnesium chloride	
		(ii)	Reactants:	iron (II) carbonate and sulfuric acid	
			Symbol equation:	$FeCO_3 + H_2SO_4 \rightarrow FeSO_4 + CO_2 + H_2O_4$	
			Name of salt:	iron (II) sulfate	6
	(b)	Stat	e a useful applicatio	on of reaction (a) (i)	
		Mg	(OH) <sub>2</sub> can be consum	ned to neutralize excess stomach acid (HCl)	1
	(c)	The	salt produced in rea	action (a) (ii) is very useful in the treatment of	
		ana	emia. Give brief pra	ctical details of how you would use reaction (a)	
		(ii) t	to obtain a pure soli	d sample of the salt.	
		Mix	the reactants toget	her using excess base	
		Filte	er off the excess bas	e	
		Неа	it the solution remai	ning to evaporate off the water	3
				TOTAL	10

The acidity or alkalinity of a solution can be captured in a single number, by using a logarithmic scale called the pH scale. The acidity of alkalinity of a solution can also be determined by using acid- base indicators. Two common indicators are methyl orange and phenolphthalein. The colors and end-point pH ranges of these indicators is								
show	vn in	the table below	:					
		Indicator	Co	olor 1	End-point pH range	Color 2		
		methyl orange	pi	nk	2.9 - 4.6	yellow		
		phenolphthalein	СС	olorless	8.3 - 10.0	purple		
A sar	mple	e of rainwater wa	is an	alysed an	nd found to have a pl	H of 5.		
(a)	Cal	culate the conce	ntra	tion of H⁺	ions and the concer	ntration of (	OH⁻ ions	
	in t	he sample of rain	nwat	ter. Show	your working.			
	[H⁺	] (in mol/L)		1 x 10 <sup>-5</sup> r	nol/L			
	[OF	H-] (in mol/L)		1 x 10 <sup>-14</sup>	$/(1 \times 10^{-5}) = 1 \times 10^{-9}$	mol/L		3
(b)	A fe	ew drops of meth	nyl o	range and	d phenolphthalein w	ere added		
	sep	parately to two sa	ampl	es of the	rainwater. State the	color show	/n by:	
	me	thyl orange	yell	ow				
	phe	enolphthalein	colo	orless				2
							TOTAL	5
	The susing The solution of the	The acidi using a lo The acidi base indi phenolpl shown in A sample (a) Cal in t [OF (b) A fo sep me phe	The acidity or alkalinity of using a logarithmic scale of The acidity of alkalinity of base indicators. Two comphenolphthalein. The color shown in the table below Indicator methyl orange phenolphthalein A sample of rainwater war (a) Calculate the concer in the sample of rain [H <sup>+</sup> ] (in mol/L) [OH-] (in mol/L) (b) A few drops of method separately to two samethyl orange phenolphthalein	The acidity or alkalinity of a so using a logarithmic scale calle The acidity of alkalinity of a so base indicators. Two common phenolphthalein. The colors a shown in the table below: Indicator Co methyl orange pi phenolphthalein co A sample of rainwater was an (a) Calculate the concentration in the sample of rainwater [H <sup>+</sup> ] (in mol/L) [OH-] (in mol/L) (b) A few drops of methyl of separately to two sample methyl orange yell phenolphthalein color	The acidity or alkalinity of a solution callusing a logarithmic scale called the pHThe acidity of alkalinity of a solution callbase indicators. Two common indicatorphenolphthalein. The colors and end-pshown in the table below:IndicatorColor 1methyl orangepinkphenolphthaleincolorlessA sample of rainwater was analysed and(a)Calculate the concentration of H+in the sample of rainwater. Show[H+] (in mol/L)1 x 10-5 r[OH-] (in mol/L)1 x 10-14(b)A few drops of methyl orange and separately to two samples of the methyl orangemethyl orangeyellowphenolphthaleincolorless	The acidity or alkalinity of a solution can be captured in a susing a logarithmic scale called the pH scale.The acidity of alkalinity of a solution can also be determine base indicators. Two common indicators are methyl orange phenolphthalein. The colors and end-point pH ranges of th shown in the table below:IndicatorColor 1End-point pH range methyl orangeIndicatorColor 1End-point pH range methyl orangeMethyl orangepink2.9 – 4.6phenolphthaleincolorless8.3 – 10.0A sample of rainwater was analysed and found to have a pH (a)Calculate the concentration of H+ ions and the concert in the sample of rainwater. Show your working.[H+] (in mol/L)1 x 10-5 mol/L[OH-] (in mol/L)1 x 10-14 /(1 x 10-5) = 1 x 10-9(b)A few drops of methyl orange and phenolphthalein w separately to two samples of the rainwater. State the methyl orangewethyl orangeyellowphenolphthaleincolorless	The acidity or alkalinity of a solution can be captured in a single numb using a logarithmic scale called the pH scale.The acidity of alkalinity of a solution can also be determined by using a base indicators. Two common indicators are methyl orange and phenolphthalein. The colors and end-point pH ranges of these indicator shown in the table below:IndicatorColor 1End-point pH range 2.9 - 4.6Color 2 yellow phenolphthaleinA sample of rainwater was analysed and found to have a pH of 5.(a)Calculate the concentration of H+ ions and the concentration of Color 11 x 10 <sup>-5</sup> mol/L[H+] (in mol/L)1 x 10 <sup>-14</sup> /(1 x 10 <sup>-5</sup> ) = 1 x 10 <sup>-9</sup> mol/L(b)A few drops of methyl orange and phenolphthalein were added separately to two samples of the rainwater. State the color show methyl orangeyellowwethyl orangeyellowyellowyellowmethyl orangeyellow	The acidity or alkalinity of a solution can be captured in a single number, by using a logarithmic scale called the pH scale.The acidity of alkalinity of a solution can also be determined by using acid- base indicators. Two common indicators are methyl orange and phenolphthalein. The colors and end-point pH ranges of these indicators is shown in the table below:IndicatorColor 1End-point pH range 2.9 - 4.6Color 2methyl orangepink2.9 - 4.6yellowphenolphthaleincolorless8.3 - 10.0purpleA sample of rainwater was analysed and found to have a pH of 5.(a)Calculate the concentration of H+ ions and the concentration of OH- ions in the sample of rainwater. Show your working.[H+](in mol/L)1 x 10^{-5} mol/L[OH-](in mol/L)1 x 10^{-9} mol/L(b)A few drops of methyl orange and phenolphthalein were added separately to two samples of the rainwater. State the color shown by: methyl orangemethyl orangeyellowTOTAL

3.	Nitri	c acic	d, HNO₃, is	a strong acid. Nitrous acid, HNO <sub>2</sub> , is a weak acid.	
	Both	acid	s are neut	ralized by calcium oxide according to the following	
	equations: Nitric acid: $2HNO_3 + CaO \rightarrow Ca(NO_3)_2 + H_2O$ Nitrous acid: $2HNO_2 + CaO \rightarrow Ca(NO_2)_2 + H_2O$				
	(a)	Expl	ain the dif	ference between a strong acid and a weak acid.	
		Stro	ng acid fu	lly dissociates in water to give H⁺ ions	
		Wea	ak acid slig	htly dissociates in water to give H⁺ ions	2
	(b)	Writ	te ionic eq	uations to show what happens to nitric acid and nitrous	
		acid	in water:		
		nitri	c acid	$HNO_3 \rightarrow H^+ + NO_3^-$	
		nitro	ous acid	$HNO_2 \rightleftharpoons H^+ + NO_2^-$	3
	(c)	Rub	i poured 5	0 mL of 1 mol/L nitric acid into a boiling tube.	
		She	then adde	d CaO powder gradually to the boiling tube until the acid	b
		had	been com	pletely neutralized.	
		She	then repe	ated the experiment with 50 mL of 1 mol/L nitrous acid.	
		(i)	Calculate	the maximum mass of CaO which would dissolve in the	
			nitric acio	d solution.	
			moles of	$HNO_3 = 50/1000 \times 1 = 0.05$	
			moles of	CaO = 0.05/2 = 0.025	
			mass of C	CaO = 0.025 x 56.1 = 1.4 g	
		(ii)	State one	e similarity Rubi would observe when repeating the	
			experime	ent using the nitrous acid solution.	
			Both acid	Is would dissolve the same amount of CaO	
		(iii)	State one	e difference Rubi would observe when repeating the	5
			experime	ent using the nitrous acid solution.	
			The stror	ng acid (HNO <sub>3</sub> ) would dissolve the CaO much faster	
	TOTAL				

## **SECTION B – MULTIPLE CHOICE**

# Do not answer these questions on this document. Click on the answer sheet provided at the end of the questions.

4.	Wher	When aluminium carbonate reacts with hydrochloric acid, the formula of the				
	salt p	salt produced is				
	А	H <sub>2</sub> CO <sub>3</sub>				
	В	Cl <sub>2</sub> CO <sub>3</sub>				
	С	Al <sub>3</sub> Cl				
	D	AICI <sub>3</sub>				
	Е	AIH <sub>3</sub>				
			1			

5.	Ammonium nitrate is a dangerous explosive and an important fertilizer.				
	lt car	It can be easily prepared in a neutralization reaction by mixing			
	Α	NH <sub>3</sub> and HNO <sub>3</sub>			
	В	HCl and CuO			
	С	HNO <sub>3</sub> and Ca(NO <sub>3</sub> ) <sub>2</sub>			
	D	NH <sub>3</sub> and NaOH			
	E	H <sub>2</sub> SO <sub>4</sub> and HNO <sub>3</sub>			
	•	•	1		

6.	Amm	onia is a weak base. In an aqueous solution of ammonia, approximately				
	1% of	1% of ammonia molecules react with water to form OH <sup>-</sup> ions.				
	The p	H of 0.1 mol/L ammonia solution is approximately				
	А	2				
	В	3				
	С	11				
	D	12				
	E	13				
	•	2				

7.	Whic	Which of the following solutions has the lowest pH?			
	А	0.001 mol/L HCl			
	В	0.001 mol/L NaOH			
	С	pure water			
	D	a solution containing 1 x $10^{-12}$ mol/L H <sup>+</sup> ions			
	Ε	a solution containing 1 x 10 <sup>-12</sup> mol/L OH <sup>-</sup> ions			
			2		

## Questions 8 – 10

25 mL of standard solution of sodium carbonate (0.5 mol/L) was placed in a conical flask. Two drops of methyl orange indicator were added and a solution of sulfuric acid (of unknown concentration) was gradually added from a burette. When 18.3 mL of the sulfuric acid had been added, the indicator changed color.

8.	The f	The formula of the salt produced in this reaction is:				
	А	NaSO <sub>4</sub>				
	В	Na <sub>2</sub> SO <sub>4</sub>				
	С	H <sub>2</sub> SO <sub>4</sub>				
	D	Na <sub>2</sub> CO <sub>3</sub>				
	Е	K <sub>2</sub> SO <sub>4</sub>				
			1			

9.	At the	At the equivalence point of this titration, the indicator will change from			
	А	orange to yellow			
	В	pink to yellow			
	С	yellow to orange			
	D	yellow to pink			
	E	orange to pink			
			1		

10.	The n	The molarity of the sulfuric acid used in this titration is				
	А	0.34 mol/L				
	В	0.68 mol/L				
	С	1.37 mol/L				
	D	3.4 mol/L				
	E	6.83 mol/L				
			2			